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इलेक्ट्रिक कृषि ट्रैक्टर – परीक्षण संहिता

Draft **Indian Standard**

ELECTRIC AGRICULTURAL TRACTORS — TEST CODE

ICS 65.060.10

Agricultural Machinery and Equipment Sectional Committee, FAD 11	Last date for Comments: **16 February 2025**

FOREWORD

(*Formal clause will be added later*)

An electric agricultural tractor is a type of agricultural tractor that uses electric motor/s powered by a battery pack, rather than a traditional diesel engine, for propulsion and other operations. Electric tractor technology has evolved significantly in recent years with advancements in battery technology, electric motors, and power electronics enabling the development of efficient and powerful electric tractors. These tractors offer a sustainable alternative to traditional diesel-powered tractors, with benefits including reduced emissions, lower operating costs, and improved performance.

However, as the adoption of electric tractors grows, there is a pressing need to establish standardized testing protocols to ensure their safety, reliability, and performance. Therefore, for testing these electric tractors, the standard is being brought out.

In the preparation of this standard, assistance has been derived from the following:

a) IS 5994 : 2022 "Agricultural tractors — Test code (*fourth revision*)"
b) Automotive Industry Standards for electric vehicles (*see* Annex G).

In reporting the result of a test or analysis made in accordance with this standard, if the final value, observed or calculated, is to be rounded off, it shall be done in accordance with IS 2 : 2022 'Rules for rounding off numerical values (*second revision*).

Draft ***Indian Standard***

ELECTRIC AGRICULTURAL TRACTORS — TEST CODE

1 SCOPE

This standard covers the terminology, general guidelines and tests to be conducted on electric agricultural tractors (hereinafter called as electric tractor). It includes method of testing of PTO power, drawbar power, belt and pulley test, vibration measurement, specification check and inspection of components/assemblies.

2 REFERENCES

The standards listed below contain provisions which, through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards listed below. In case the standards are to be referred in this clause, they are to be listed as follows:

IS No.	*Title*
IS 4905 : 2015/ISO 24153 : 2009	Random sampling and randomization Procedures (*first revision*)
IS 4931 (Part 1) : 2024	Agricultural Tractors — Rear-Mounted Power Take-off Types 1, 2, 3 and 4 Part 1 General Specifications, Safety Requirements, Dimensions for Master Shield and Clearance Zone (ISO 500-1 : 2014, MOD) (*fourth revision*)
IS 4931 (Part 2) : 2024	Agricultural Tractors — Rear-Mounted Power Take-off Types 1, 2,3 and 4 Part 2 Narrow-Track Tractors, Dimensions for Master Shield and Clearance Zone (ISO 500-2 : 2004, MOD) (*fourth revision*)
IS 4931 (Part 3) : 2024 ISO 500-3:2014	Agricultural tractors – Rear-mounted power take-off type 1, 2, 3, and 4 – Part 3 : Main PTO dimensions and spline dimensions, location of PTO (*fourth revision*)
IS 5994 : 2022	Agricultural tractors — Test code (*fourth revision*)
IS 9253: 2013	Agricultural wheeled tractors — Field performance and haulage tests — Guidelines (*third revision*)
IS 10743 : 1983	Method for determination of centre of gravity of agricultural tractors
IS 11442: 1996/IS0 5721: 1989	Agricultural tractors — Operator's field of vision — Test procedures
IS 11859 : 2023 / ISO 789-3 : 2015	Agricultural tractors — Test procedures — Turning and clearance diameters (*second revision*)
IS 12061 : 1994	Agricultural tractors — Braking performance — Method of test (*first revision*)
IS 12036 : 1995	Agricultural Tractors – Test Procedures – Power Tests For Power Take-Off (first revision)

IS 12180 (Part 1) : 2024 ISO 5131:2015	Tractors for agriculture and forestry — Noise measurement — Method of test Part 1 Noise at the operator's position – Survey method (Second Revision)
IS 12180 (Part 2) : 2024 ISO 7216:2015	Tractors for agriculture and forestry — Noise measurement — Method of test part 2 noise emitted when in motion (Second Revision)
FAD 11 (25051) F	Hydraulic power and lifting capacity of agricultural tractors — Methods of Test (*first revision* of IS 12224)
IS 12226 : 1995	Agricultural Tractors – Power Tests for Drawbar – Test Procedure (*first revision)*
IS 12239 (Part 1): 2018/ISO 4254-1: 2013	Guide for safety and comfort of operator of Agricultural Tractors and power tillers: Part 1 General requirements (*second revision*)
IS 12239 (Part 2): 1999	Tractors and machinery for agriculture and forestry — Technical means for ensuring safety: Part 2 Tractors (*first revision*)
IS 14272 : 2011	Automotive vehicles — Types — Terminology (*first revision*)
ISO 23316-1 : 2022	Tractors and machinery for agriculture and forestry — Electrical high-power interface 700 V DC / 480 V AC
AIS-038 (Rev 2) : 2020	Specific Requirements for Electric Power Train of Vehicles
AIS-041(Rev 1) : 2015	Electric Power Train Vehicles — Measurement of Net Power
AIS-049 (Rev 1) : 2016	Electric Power Train Vehicles — CMVR Type Approval for Electric Power Train Vehicles
AIS 168 : 2021	Specific Requirements for A6 and A7 Category Electric Power Train Agricultural Tractors

NOTE — AIS Standards for electric vehicles provided in Annex G for guidance may also be referred by the testing authority during testing electric tractors if required.

3 TERMINOLOGY

For the purpose of this standard, the following definitions in addition to those given in IS 9939, IS 14272 and ISO 23316-1 shall apply. The definitions related to electric vehicle/tractor given in AIS-049, AIS-038 and AIS 168 are also applicable.

3.1 Pure Electric Agricultural Tractor (A7) — An agricultural tractor powered by a system consisting of one or more electric energy device including solar energy storage devices, one or more electric power conditioning devices and one or more electric machines that convert stored electric energy to mechanical energy delivered at the wheels for propulsion of the vehicle (*see* IS 14272).

3.2 Electric Agricultural Tractor — An agricultural tractor that operate using electric power sourced from direct current (DC) or alternating current (AC) through electric energy devices (here referred as batteries). These tractors can be utilized for various farm operations, including traction, stationary tasks, and transportation.

3.3 Kilowatt-hour (kWh) — A unit of energy used to measure the amount of electrical energy.

NOTE — In the context of electric tractor, it is typically used to describe the capacity of the battery of electric tractor i.e., how much energy it can store?

3.4 Kilowatt (kW) — A unit of power used to measure the rate at which electrical energy is used or produced.

NOTE — For electric tractors, kW is usually used in two contexts (1) the power output of the motor (how fast the tractor can use energy to drive?) and the charging power (how fast the battery of tractor battery can be charged?). The higher the kW rating, the more powerful the tractor.

3.5 Energy Consumption — The total amount of electrical energy required in performing farm operations, drawbar and PTO tests at various load and is measured in kilowatt hours (kWh).

3.6 Power — The rate at which energy is consumed and expressed in W or kW. Power is obtained in electrical system by multiplying voltage and current.

3.7 Voltage — Electromotive force (EMF) or the difference in potential between two points measured in volts.

3.8 Current — The flow rate of electricity (electrons flow per second through a given conductor) and it describes volume. It is measured in ampere.

3.9 Average Power — The power that is either utilized or generated over a specific period of time throughout a certain type of operation.

3.10 Instantaneous Power — Measured for a given instant of time and measured with help of a power vs time graph.

3.11 Peak Power — The maximum value of power measured at any instant of time.

3.12 Nominal Motor speed — The speed set for operation at nominal voltage and nominal torque at natural ambient temperature.

3.13 Nominal Torque — The torque generated for operation at nominal voltage and nominal current at natural ambient temperature.

3.14 Nominal Voltage — The battery system voltage which is applied from battery to inverter.

3.15 Nominal current — The current expected from normal use of an electronic device.

3.16 Rated Motor speed —The maximum speed at which a motor is normally operated.

3.17 Rechargeable Electrical Energy Storage System (REESS) — Provides electric energy for electrical propulsion.

3.18 Components of Electric Tractors (*see* Fig. 1)

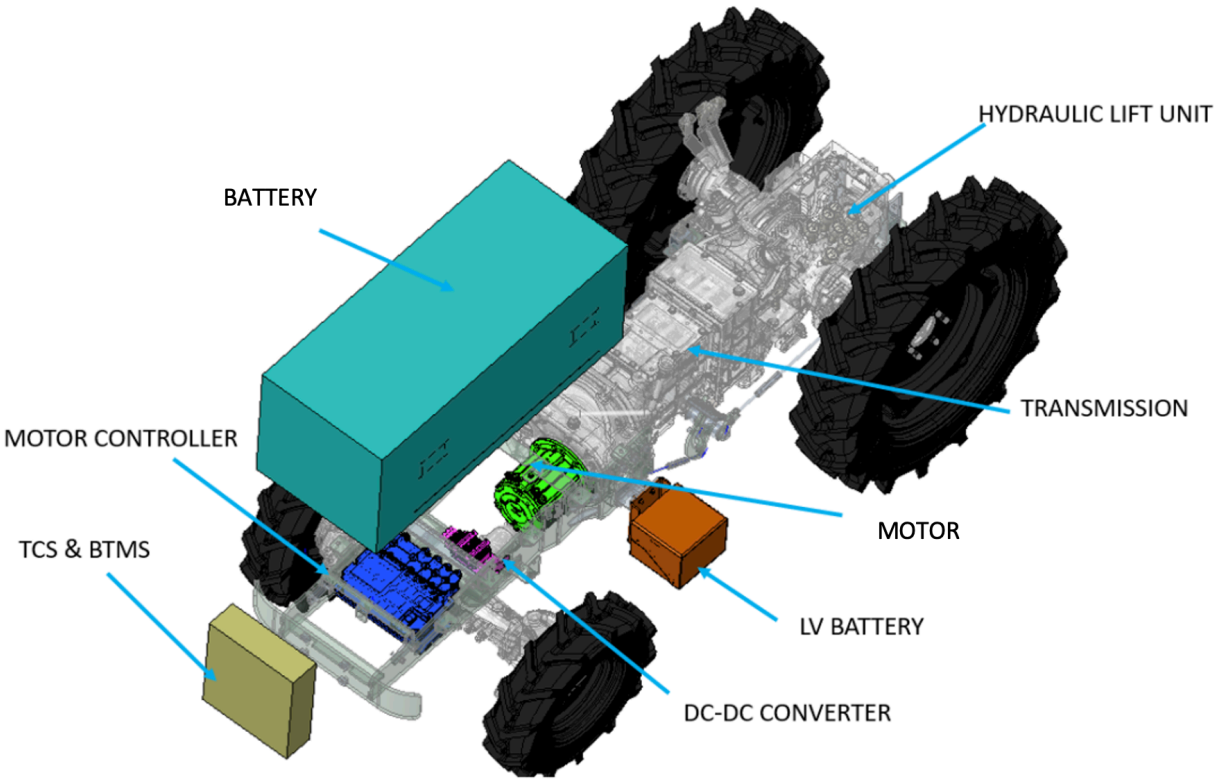

FIG. 1 MAJOR COMPONENTS OF ELECTRIC TRACTOR

3.18.1 *Battery* — Rechargeable energy storage device that supplies power to the electric motor very quickly, giving electric tractors high performance & rapid torque.

3.18.2 *Motor* — An electric motor used for propulsion of electric tractor including PTO shaft, Hydraulic pump and any other drive systems.

NOTE — Manufacturer may provide separate motors for propulsion, PTO drive, hydraulic pump, etc.

3.18.3 *Motor Controller* — Device(s) that can coordinate in a predetermined manner the performance of an electric motor(s) of electric tractor.

3.18.4 *DC-to-DC Converter* — A type of electric power converter consisting of an electronic circuit or electromechanical device that converts a source of direct current (DC) from one voltage level to another.

3.18.5 *AC-to-DC Convertor* — An electrical device that converts alternating current (AC) into direct current (DC).

3.18.6 *Invertor* — An electrical device that converts direct current (DC) into alternating current (AC).

3.18.7 *LV Battery* — Low voltage battery.

3.18.8 *Traction Cooling System (TCS)* — A system that manages the temperature of the motor during operation.

3.18.9 *Battery Thermal Management System (BTMS)* — A system that manages the temperature of the battery pack.

3.19 Charger — Power converter that performs the necessary functions for charging a battery.

3.19.1 *Off-board Charger* **—** Charger connected to the premises wiring of the AC supply network (mains) and designed to operate entirely off the vehicle. In this case, direct current electrical power is delivered to the vehicle.

3.19.2 *On-board Charger* **—** Charger mounted on the vehicle and designed to operate only on the vehicle.

3.20 State of Charge — The available electrical charge in a tested device expressed as a percentage of its rated capacity.

3.21 State of Health of a Battery — A measure used to assess the overall condition and performance capability of a battery relative to its condition when it was new.

3.22 C-Rate — The constant current of the tested-device, which takes 1/n hours to charge or discharge the tested-device between 0 per cent of the state of charge and 100 per cent of the state of charge.

3.23 Depth of Discharge — A measure used to describe the extent to which a battery has been discharged relative to its total capacity.

3.24 Wheelbase — The horizontal distance between the front and the rear wheels in the same plane measured at the centre of their ground contact.

3.25 Electric Tractor Mass

3.25.1 *Basic Electric Tractor Mass* (*Unladen Electric Tractor)* – Mass of the electric tractor in working conditions with its battery, motor & controller etc.

> NOTE — Optional front and rear weights (ballast), tyre ballast, the electric tractor operator, mounted implements, equipment or any specialized components are not included.

3.25.2 *Ballasted Electric Tractor Mass* (*Laden Electric Tractor)* — Any mass that can be added or removed from an electric tractor for the purpose of changing traction and stability of electric tractor.

3.26 Maximum Drawbar Pull — The maximum horizontal drawbar pull, at a drawbar height recommended by the manufacturer, corresponding up to 15 per cent wheels slip on standard concrete test track for wheel electric tractors and up to 7 per cent track slip for track laying electric tractors on earthen test track which a tractor is able to sustain in the line of its longitudinal axis.

3.27 Specific Current Drawn — The amount of current drawn per unit of work. It will be measured during tests and expressed in A/kW The power at tractor PTO (kW) will be recorded for the purpose during the test.

3.28 Drawbar Power — Power obtained at the drawbar with the motor control in the position recommended by the electric tractor manufacturer for drawbar work and the electric tractor moving on a horizontal surface with the drawbar pull applied horizontally.

3.29 PTO Power — Power obtained at the main power-take-off with the motor control in position recommended by the electric tractor manufacturer for PTO work, the electric tractor being

stationary. The mechanical power generated by a Power Take-Off (PTO) mechanism is used to drive implements and machinery attached to it.

3.30 Tyre Rolling Radius — The effective radius corresponding to the average distance travelled by the electrical tractor in one rotation of wheels (that is, this distance divided by 2л) when the electrical tractor is driven without drawbar load at a speed of approximately 2 km/h.

4 GENERAL GUIDELINES AND REQUIREMENTS

4.1 Specification Sheet

The electric tractor manufacturer/applicant shall supply the specification of the electric tractor consisting of the items/parameters listed in the specimen report given in Annex A, as well as any other information required by the testing authority to carry out the tests. The manufacturer/applicant should also supply all literature, operational, maintenance and service manual, and parts catalogues.

4.2 Conditions for Checking of Dimensions

4.2.1 The electric tractor shall be without any wear on tyres when placed on a firm horizontal surface.

4.2.2 Unless otherwise stated by the manufacturer/applicant, the electric tractor shall be stationary with its wheels and components in the positions they would be, if the electric tractor was travelling in a straight line.

4.2.3 The pressure in pneumatic tyres shall be adjusted to the value recommended by the electric tractor manufacturer for field work.

4.3 Selection

The electric tractor, if under production, should be selected at random (*see* IS 4905) from the production line complete with its standard accessories and in a condition as generally offered for sale. The electric tractor shall be new and should not be given any special treatment or preparation for test. The method of selection should be reported in the proforma given in Annex B.

4.4 Running-In

4.4.1 The manufacturer/applicant shall run-in the electric tractor before the test, under his/her responsibility and in accordance with his/her usual instructions. The running-in shall be carried out in collaboration with the testing authority. If this procedure is impracticable due to the electric tractor being an imported model, the testing authority may itself run-in the electric tractor in accordance with the procedure prescribed or agreed to with the manufacturer/applicant.

4.4.2 The place and duration of the running-in shall be reported in the proforma given in Annex B.

4.5 Servicing and Preliminary Setting after Running-In

4.5.1 After completion of running-in, servicing and preliminary settings should be done according to the printed literature supplied by the manufacturer/applicant or as per declaration of the manufacturer for electric tractor. The following may be carried out, wherever applicable:

a) Change of hydraulic and transmission oil;
b) Change of transmission/ hydraulic oil filters;
c) Greasing/oiling of all the lubricating points;
d) Tightening the nuts and bolts;
e) Checking and adjusting the tension of belts and chains;
j) Checking and adjustment of safety devices (as per clause **5.0** of AIS 168), if any; and
k) Any other checking or adjustment recommended by the manufacturer after the running-in period and included in the printed literature of the electric tractor.

4.5.2 The manufacturer/applicant may ~~make~~ carry out calibration of system and other adjustments during the period the electric tractor is prepared for tests. These adjustments should conform to the values specified by the manufacturer/applicant for agricultural use in the printed literature/specification sheet or declaration submitted by manufacturer during testing. No adjustment shall be made, unless it is recommended in the literature/declaration submitted to the testing authority. All the parts replaced shall be reported in the test report.

4.6 Ballasting

The ballast mass, which are commercially available and approved by the manufacturer for use in agriculture, may be fitted. For wheeled electric tractors, liquid ballast in the tyres may also be used. The overall static load on each tyre (including liquid ballast in the tyres and 75 kg mass added to the tractor to represent the driver), and the inflation pressures shall be within the limits specified by the tyre manufacturer or load limit of axle, whichever is lower. Measure the inflation pressure of the tyre with the tyre valve in the lowest position.

NOTE — In case of electrical tractors provided with a device for transfer of implement load to tractor, the ballasting including weight transfer shall not exceed the load limits specified by the electric tractor/tyre manufacturer.

4.6.1 *Requirements of Ballast Mass*

a) Each ballast mass shall bear the manufacturer's mark and a statement of their mass in kg to an accuracy of ± 5 percent.
b) Front ballast masses which require frequent removal and fitment shall leave a safety clearance of at least 25 mm all around the grab handles.
c) The method of locating the ballast mass shall be such that any inadvertent separation is avoided (e.g., in the event of tractor roll over).
d) Access to front coupling device may be limited when using a front ballast mass.

4.7 Repairs and Adjustments during Tests

All repairs and adjustments made during the tests shall be reported, together with comments on any practical defects or shortcomings in Annex B. This shall-not include those maintenance jobs and adjustments which are performed in conformity with the manufacturer's recommendations or any accidental damage.

4.8 Lubricants

The lubricants used for the test shall comply with the manufacturer's specification and be identified by tradename, type and viscosity class. If different lubricants are used, precise information shall be given as to where they are used (motor, transmission, etc).

If the lubricant conforms to other national or International Standards, a specific reference to these shall be given.

4.9 Battery Charging

Battery installed in the electric tractor shall be charged as per manufacturer's recommendation provided on charging and use of charger.

4.10 MEASURING TOLERANCES

The measuring apparatus shall be capable of measuring the following parameters as per tolerances indicated below:

a) Rotational speeds, rev/min ± 0.5 percent
b) Time, s ± 0.2 s
c) Distance, m or mm ± 0.5 percent
d) Force, N and torque, Nm ± 1.0 percent
e) Mass, kg ± 0.5 percent
f) Atmospheric pressure, kPa ± 0.2 kPa
g) Tyre pressure, kPa ± 5 percent
h) Hydraulic pressure, kPa ± 2.0 percent
i) Wet and dry bulb thermometers, ºC ± 0.5 ºC
j) Current, Amp ± 1 percent
k) Voltage, V ± 1 percent

4.11 Ancillary Equipment

For all tests, accessories such as the hydraulic lift pump or air compressor, etc., may only be disconnected if it is practicable for the operator to do so as normal practice in work, in accordance with the operator's manual and without using tools, except as otherwise specified for a particular test. If not, they shall remain connected and operate at minimum load.

If the electric tractor is equipped with devices that create variable parasitic power losses such as a variable speed cooling fan, intermittent hydraulic or electrical demands, etc, the device shall not be disconnected or altered for test purposes. If it is practical for the operator to disconnect the device as outlined by the operator's manual, it may be disconnected for test purposes, in which case this shall be recorded in the test report.

Power variations during tests caused by these devices exceeding ± 5 percent shall be recorded in the test report in terms of per cent variation from the mean.

4.12 Operating Conditions

No corrections to the measured values of torque or power shall be made for atmospheric conditions or other factors. Atmospheric pressure shall not be less than 96.6 kPa. If this is not possible because of altitude; voltage, current drawn, surface temperature of cable (connecting battery to the controller/motor), electric motor and controller ~~t~~at different loading conditions may have to be used, details of which shall be included in the report.

Operating conditions may be provided by the manufacturer. These shall be attained at each load setting before beginning of test measurements.

4.13 Current Drawn

Main battery current (A) and voltage (V) consumption shall be measured with suitable devices. Motor(s) current shall also be measured with a suitable device.

The power consumption instrumentation can be set up to measure current & voltage with the motor and battery (power) pack as the electric tractor moves/ under testing. Efforts shall be made to limit the temperature variations throughout the tests.

In case of drawbar performance test, the current drawn shall be measured when the tractor traverses a straight track for a distance of 100 m.

4.14 Declaration of Power and Labelling of Electric Tractors

4.14.1. *Declaration of Power*

4.14.1.1 The power declared by the manufacturer shall be the value obtained at the power take off of the tractor after conducting the test given under **5.2.2.1** of this standard.

In case there are separate motors used for drive and for PTO, both ratings for nominal and max power shall be declared.

4.14.1.2 The unit of power shall be kilowatt (kW). The addition of the equivalent metric horsepower (hp) in parentheses is permitted.

4.14.1.3 The declared power shall be the value rounded off to the nearest first decimal place with the fineness of 0.5.

4.14.1.4 The specific current drawn corresponding to the power obtained under **5.2.2.1** of this standard shall be declared by the manufacturer.

4.14.1.5 The unit of specific current drawn shall be A/kW.

4.14.1.6 The declared specific current drawn shall be the value rounded off to the nearest first decimal place with the fineness of 0.5.

4.14.2 *Labelling*

4.14.2.1 The labelling plate shall be of adequate size and thickness. It must be placed in a clearly visible and accessible position by a method such as riveting or hammering or stamping, in such a way that it cannot be obliterated or deteriorate.

The location of the labelling plate shall be on the permanent structural member preferably on the left-hand side, such as bonnet/ bonnet scuttle assembly/ mudguard (on outside), motor and battery support frame and front axle support etc., when viewed from the operator's seat of the electric tractor.

4.14.2.2 Amongst other details, the name plate shall include the following prominently

Name of manufacturer and trade-mark, If any		
Make[1]/Model/Brand of Electric Tractor		Month and Year of manufacture (In MM/YY format)
Battery serial number Make and Model	Motor (multiple) serial number Make[1] and Model	Chassis serial number
Battery Capacity, (Ah) Rated Voltage (V)	Maximum Motor power kW (hp) Max PTO Power, kW(hp)	Specific Current Drawn for Max PTO Power (A/ kW)
NOTE — Make shall include the details of country of origin as well.		

4.14.2.3 The writing/punching on the labelling plate shall be legible. The size of letters and figures on the labelling plate shall not be less than 5 mm.

4.14.2.4 Declaration of power and labeling of electric tractors shall be in line with the existing Central Motor Vehicles Rules (CMVR) amended time to time.

5 TESTS

Various tests to be conducted on an electric tractor are given in Table 1. The implementing authority shall decide about the tests and their frequency to be carried out during initial commercial and batch testing (*see* **3.1** of **IS 5994**).

Table 1 Tests to be Conducted on Electric Tractor

Sl No.	Tests	Clause/Reference Standard	Remarks
(1)	(2)	(3)	(4)
i)	Checking of the specification	*see* **5.1**	
ii)	PTO performance	*see* **5.2**	
iii)	Belt-pulley performance	*see* **5.3**	
iv)	Drawbar performance	*see* **5.4**	
vi)	Vibration measurement	*see* **5.5**	
vii)	Component/ assembly inspection	*see* **5.6**	
viii)	Test for hydraulic power and lifting capacity	IS 12224	
ix)	Turning ability & steering effort	IS 11859	

x)	Centre of gravity	IS 10743	
	Operator's field of vision	IS 11442	
xi)	Brake test	IS 12061	
xii)	Noise measurement		
	At operators position	IS 12180 (Part 1)	
	At bystanders position	IS 12180 (Part 2)	
xiii)	Safety	IS 12239 (Part 1) IS 12239 (Part 2) AIS 168	
xiv)	Field test	3 of IS 9253	
xv)	Haulage test	4 of IS 9253	
xvi)	Special characteristic		If required by the manufacturer and with the mutual agreement of manufacturer and testing station Supplementary measurements to determine any special characteristics of the tractor may be carried out depending on requirements.
xvii)	Electro Magnetic Compatibility (EMC) Test	*see* **8.0** of AIS 168	Relevant test certificate to be submitted by Applicant during submission of Electric Tractor for Testing

5.1 Checking of Specifications

5.1.1 The information given by the manufacturer/applicant in the specification sheet (*see* Annex A) shall be verified by the testing authority and reported. Details of the components and assemblies which do not conform to the relevant Indian Standards shall also be reported. The adequacy or otherwise of the literature shall be indicated.

5.1.2 While checking the dimensions, the conditions laid down in **4.2** shall be followed.

5.1.3 *Load platforms of Electric Tractors* (*if fitted*)

5.1.3.1 *Load platform*

A platform attached to the structure in front or rear of the tractor for the carriage of agricultural produce/material, implements, equipment and tools. The manufacturer shall specify safe load carrying capacity for such load platform on the labeling plate of load platform.

5.1.3.2 *Requirements*

a) The centre of gravity of the tractor with load~~ed~~ (as specified) platform shall be situated between the axles.
b) The dimensions of the platform shall be such that:
   1) The length does not exceed 1.4 times the front or rear track of the electric tractor, whichever is the larger.

2) The width does not exceed the maximum overall width of the electric tractor without platform.
3) Adequate side protection shall be provided to prevent falling off goods loaded on load platform.
4) The platform shall be laid out symmetrically in relation to the longitudinal median plane of the electric tractor.
5) The height of the upper most point of load platform above the ground shall be not more than 1500 mm.
6) The load platform shall be attached to the tractor in such a way as to avoid any risk of accidental detachment.

c) The type of platform and the way it is attached shall be such that, with a normal load, the driver's field of vision remains adequate, and the various mandatory lighting and light-signaling devices may continue to fulfill their proper function.

5.2 Power Take-Off (PTO) Test

5.2.1 General

Tests shall be carried out at one or more PTO shafts as specified by the manufacturer on all electric tractors having a PTO as specified in IS 4931 (Part 1, Part 2 and Part 3). The tests shall include power take-off capable of transmitting the full power of the motor if such a PTO is available.

The various tests shall normally be carried out continuously.

The angle of the connection of the shaft connecting the PTO to the dynamometer shall not exceed 2°.

5.2.2 Test at Natural Ambient Condition

The surrounding temperature shall be maintained within 27 ± 7 °C during the entire test.

5.2.2.1 *Maximum power absolute*

Operate the electric tractor at the motor speed where maximum power occurs for a period of 1 h subsequent after reaching a stabilized running condition. Measure the power, equivalent motor torque, electricity consumption and temperature of connected wires to motor controller.

The maximum power quoted in the test report shall be the average of at least six readings made at regular intervals of 10 min during the 1 h period. If the power varies by more than ± 2 percent from the average, repeat the test. If the variation continues, report the deviation.

5.2.2.2 *Maximum power at rated motor speed (optional)*

If maximum power does not occur at rated motor speed, an optional additional 30 minutes test should be carried out using the procedure stated in **5.2.2.1**.

5.2.2.3 *Varying speed at full load*

Measure the power, equivalent motor torque and electricity consumption as a function of speed at full power at approximately 10 per cent speed increments. The minimum speeds at which

measurements are made shall be at the speed of ~~maximum torque~~ continuous torque and, if possible, 15 per cent below that speed.

5.2.2.4 *Varying load tests*

Measure the power, speed and current consumption at the values listed below of torque with the, governor control set for maximum power, firstly, at the rated motor speed and secondly, at the standard speed appropriate to the design of the PTO that is either (540 ± 10) rev/min or (1000 ± 25) rev/min [*see* IS 4931 (Part 1, 2, and 3)]:

a) The torque corresponding to maximum power available at rated motor speed and at standard PTO speed;

b) 85 per cent of the torque obtained in (a);

c) 75 per cent of the torque obtained in (b);

d) 50 per cent of the torque obtained in (b);

e) 25 per cent of the torque obtained in (b); and

f) Unloaded [with the dynamometer disconnected if the residual torque is greater than 5 per cent of the torque defined in (b)].

5.2.2.5 *Presentation of results*

The data in **5.1** shall be reported in, tabular form for each test condition. If also presented in graphical form (which is optional), the following, covering the full range of motor speeds tested, shall be included:

- Power as a function of speed and time;
- Equivalent motor torque as a function of speed;
- Current drawn
- Specific current drawn as a function of power.
- Report the no-load maximum motor speed.

5.2.2.8 *Additional measurements*

In addition to the performance measurements specified above, report the following:

a) Ambient air temperature at a representative point: this is taken to be approximately 2 m in front or to the side of the tractor, and approximately 1.5 m above the ground.
b) Motor body temperature (in the case of an air cooled Motor, measure the temperature of the motor block at representative points);
c) Controller temperature;
d) Temperature of Connected wire to controller
e) Battery pack temperature;
f) Atmospheric temperature;
g) Atmospheric pressure;
h) Relative air humidity;
j) Motor blower inlet temperature;
k) Motor blower outlet temperature;

l) Controller surface temperature;
m) REESS blower inlet temperature; and
n) REESS body temperature

5.2.3 *Test at High Ambient Temperature*

The test given under **5.2.2.1**, **5.2.2.2**, and **5.2.2.3** shall be conducted under high ambient temperature of (43 ± 2) °C. The power, torque and current drawn shall be reported. The observations given under **5.2.2.4** shall also be reported.

5.2.4 *Statement of Power Rating*

The power rating of the electric tractor shall be stated as the maximum power measured at a PTO capable of transmitting the full power of the motor. If the tractor is not fitted with a PTO capable of transmitting the full power of the motor, the power measured at other PTO points may be used, but shall be clearly identified in the test report. In case of PTO powered by a separate motor, power obtained on PTO shall be mentioned accordingly.

NOTE — If there are no PTO points capable of transmitting the full power of the motor, the power rating of the tractor is stated as the power measured at the drawbar (see IS 12226).

5.2.5 The data shall be recorded in accordance with Annex C.

5.3 Belt or Pulley Shaft Tests (Optional)

At the manufacturer's request, the power available at the belt or pulley shaft of electric tractors, if fitted, may be measured.

Connect the tractor pulley to that of the dynamometer by a flexible belt having appropriate power and torque transmission characteristics. Belt slip when calculated from the following formula; shall not exceed 2 percent and tension necessary to prevent this shall be as small as possible.

Belt slip shall be determined by the following formula:

$$\frac{100\ (n_0 - n_1)}{n_0}$$

where
n_0 – is the number of revolutions per minute of the driven pulley without slip; and

n_1 – is the number of revolutions per minute of the driven pulley under load.

All the provisions for tests at the main PTO with the exception of those at standard PTO speed and for tractors unable to transmit the motor power at the PTO shall apply to the belt or pulley shaft.

If the rated motor speed does not correspond to a standard belt speed, measure the performance of the motor at the speed corresponding to the standard belt speed of (15.75 ± 0.25) m/s.

5.4 Test Procedure for Drawbar Performance Test

5.4.1 *General*

Measure the drawbar performance of the electric tractor on one of the following surfaces:

a) *For wheeled or rubber track electric tractors* – a clean, horizontal and dry concrete or tarmacadam surface containing a minimum number of joints;

b) *For steel track-laying electric tractors* – flat, dry and horizontal mown or grazed grassland or in a horizontal surface having equally good adhesion characteristics; and

c) A moving surface (rotating drum or treadmill), providing results are comparable to those obtained on the above surfaces.

State the type of surface in the report, if a rotating drum is used, report the diameter of the drum.

Do not make the test in gears in which the forward speed exceeds the safety limits of the test equipment.

The line of pull shall be horizontal. The height of the drawbar shall remain fixed in relation to the electric tractor and shall be such that the electric tractor can be controlled at all times during the test. For wheeled electric tractors, the following formula applies.

$$H_{\text{Max}} \leq \frac{0.8 \times W \times Z}{F}$$

where

W is the static load exerted by the front wheels on the ground, in newton
Z is the wheelbase, in millimetres,
F is the drawbar pull, in newton, and
H is the static height of the line of pull above the ground, in millimetre

At the beginning of the drawbar test, the weight of tyre or rubber track tread bards, measured at the centreline of the tyres or tracks, shall be at least 65 per cent of their height when new. This height shall be measured using the technique and equipment specified in Annex D.

The atmospheric temperature at the test track shall be 25 ºC ± 15 ºC.

In the case of electric tractors having driving wheels not mechanically locked together, the revolutions of each wheel should be separately recorded and the slip calculated for each wheel. If the results for each wheel differ by more than 5 per cent, they should be checked and separately reported.

Slip of the driving wheels or tracks shall be determined by the following formula

$$\frac{100\ (N_1 - N_0)}{N_1}$$

where

N_1 is the sum of the revolutions of all driving wheels or tracks for a given distance, and

N_0 is the sum of the revolutions of all driving wheels or tracks for the same distance when the tractor is driven without drawbar load at a speed of approximately 3.5 km/h

The slip of wheels or rubber tracks shall not exceed 15 per cent and that of steel tracks shall not exceed 7 per cent.

5.4.2 *Transmission Characteristic Test*

Measure the maximum drawbar power, if possible, in available gears as per manufacturer's recommendations that in which maximum pull can be developed, without exceeding the slip limits in **5.4.1**, and that in which maximum power can be produced up to the gear closest to, but not exceeding 12 km/h. The results shall include drawbar power, pull, speed, slip, current drawn and atmospheric conditions. Any noticeable wheel hop should be noted in the report, with corresponding slip values at which it occurred. For steel track laying electric tractors, report the maximum drawbar pull as a foot note beneath the table giving drawbar performance figures if the maximum pull occurs above 7 percent slip.

If the electric tractor has a torque converter which can be locked out by the driver, carry out the test both with the torque converter in operation and with it locked out.

If the electric tractor has a step less variable transmission, carry out the test at available transmission ratios approximately equally spaced but including that at which maximum power is obtained. Produce tables showing drawbar power, speed, wheel or track slip, and specific current drawn as a function of drawbar pull.

5.4.3 *Varying Drawbar Pull and Speed at Full Load*

If the electric tractor is not fitted with a power take-off capable of transmitting full motor power, the drawbar power and speed shall be measured as a function of drawbar pull at full load. Operate the tractor, ballasted as for the tests in **4.6**, at the speed ratio giving maximum drawbar power. Increase the drawbar pull until maximum drawbar power is generated, and then increase the drawbar pull further, to reduce the motor speed in approximately 10 per cent intervals using the speed at maximum power as 100 per cent until either the drawbar pull reaches its maximum value, or the slip limits in **5.4.1** or some other limiting condition specified by the manufacturer is reached. For each increment of drawbar pull, record speed, drawbar power, wheel or track slip, motor speed, voltage, current, temperature of connected wire to controller, and atmospheric conditions.

If the electric tractor has a torque converter which can be locked out by the driver, carry out the test both with the torque converter in operation and with it locked out.

If the electric tractor changes the gear ratio setting automatically with increasing drawbar pull, end the test at the first automatic ratio change.

5.4.4 *Five Hour Test*

For wheeled electric tractors, ballasted in accordance with **4.6**, Two and half hour test given in **5.4.4.1** shall be conducted followed by another Two and half hour given in **5.4.4.2** with a minimum

time interval*. For track laying tractors, the test given at **5.4.4.1** shall be conducted for 5 hours instead of 2.5 hours.

*Recharging of battery can be done as per manufacturers specification between the two tests prescribed in **5.4.4.1** & **5.4.4.2**.

5.4.4.1 *Two and half hour test at 75 percent of the pull at maximum power*

The ballasted wheeled electric tractor shall be operated for 2.5 hour in a gear normally used for agricultural work, such as ploughing. The drawbar pull shall be 75 per cent of the pull at maximum power in that gear. Values of the voltage, power, speed, slip, current drawn, and temperature of connected wire to controller, and transmission oil, and atmospheric conditions (temperature, pressure and relative humidity) shall be reported.

If the electric tractor is fitted with torque converter which can be 'locked out' by the driver, the test shall be carried out with the torque converter in operation, within the limitations specified by the manufacturer in his published instructions. If the limiting conditions for operation of the torque converter are reached, the test shall be completed with the torque converter 'locked out'. The respective durations of the two parts of the test shall be noted in the test report and the corresponding current drawn shall be separately reported. For four wheel drive tractors, test with four wheel drive engaged shall be carried out.

5.4.4.2 *Two and half hour test at the drawbar pull coinciding with 15 per cent wheel slip*

The ballasted wheeled electric tractor shall be operated for 2.5 hours at the drawbar pull giving 15 per cent wheel slip measured during the test specified in **5.4.2**. The gear used shall be the fastest gear in which the required pull can be obtained when the electric motor is operating at required voltage and current. If necessary, supplementary ballast may be added to reduce the wear of the tyres and to facilitate control of the electric tractor. The drawbar pull, speed, voltage and current drawn, temperature of connected wire to controller and atmospheric conditions (temperature, pressure and relative humidity) shall be reported.

If the electric tractor is fitted with torque converter which can be 'locked out' by the driver, the test shall be carried out with the torque converter in operation, within the limitations specified by the manufacturer in his published instructions. If the limiting conditions for operation of the torque converter are reached, the test shall be completed with the torque converter 'locked out'. The respective durations of the two parts of the test shall be noted in the test report. For four wheel drive tractors, test with four wheel drive engaged shall be carried out.

NOTE — If the electric tractor does not develop sufficient power to reach the drawbar pull coinciding with 15 per cent wheel slip measured during the test specified in **5.4.2** the test shall be carried out at the maximum drawbar pull.

5.4.5 The data shall be recorded in accordance with Annex E.

5.5 Vibration Measurement

5.5.1 The amplitude of mechanical vibration of assemblies and components of the electric tractor, which are functionally important, shall be measured with the help of suitable vibration measuring device.

5.5.2 *Test Requirement*

The electric tractor shall be parked on a level concrete surface and operated at rated speed at no-load and at load corresponding to 85 percent of maximum PTO power. The maximum horizontal displacement (HD) and vertical displacement (VD) in microns shall be measured by mounting the measuring device in related positions. Inflation pressure of tyres shall be as given in **4.2.3**.

5.5.3 The data shall be recorded in accordance with Annex F.

5.6 Component/Assembly Inspection

5.6.1 The battery, transmission, brakes, front axles, motor and motor controller shall be partially dismantled after conducting all the tests. The following measurement/observations shall be made and reported.

5.6.1.1 *Clutch*

The clutch shall-be opened and inspected for condition of the clutch-release bearing, pilot bearing, springs and fingers. Clutch friction plate wear should be determined by measuring the thickness. The clutch housing shall be inspected for the entry of dust, mud, water and oil.

5.6.1.2 *Gear box*

The top cover of the gear box shall be opened and inspected for visual damage to the gear teeth.

5.6.1.3 *Brakes*

The brake housing shall be opened and inspected for the entry of dust, mud, water and oil. The wear of brake lining shall be determined by measuring the thickness.

5.6.1.4 *Front axle*

The king pin and stub axle shall be dismantled and inspected for the entry of dust, mud, water and oil. Clearances between king pin and bushes as well as between centre pin and bush shall be measured. The condition of thrust bearings, bearings for stub axle and seals for stub axle as well as kingpins shall also be examined for entry of dust. For track-laying tractors, wear of sprocket, pin, grouser plate and idler shall be inspected.

5.6.2 Any other relevant data of electric tractors shall be recorded as per IS 5994.

6 REPORTING THE RESULTS

The test results of electric tractor shall be reported on the basis of the standards referred in this test code for testing of electric tractors**.**

ANNEX A

(*Clause* 4.1 and 5.1)

SPECIFICATION SHEET FOR ELECTRICAL TRACTORS

A-1 ELECTRIC TRACTOR

a) Name and address of the manufacturer
b) Name and address of the applicant for test
c) Make/Type/Model/Brand
d) Serial number
e) Year of manufacture

A-2 BATTERY

a) Type/make/model
b) Serial number
c) Battery charging speed (manufacturer's recommended setting)
d) Details of battery

BATTERY	Detailed Specifications
1. Battery Capacity, (Ah) 2. Nominal voltage, (V) 3. Upper Cut off Voltage, (V) 4. Nominal discharge current, (A) 5. Maximum discharge current, (A) 6. Cycle life 7. Depth of discharge (percent) 8. Weight, (kg) 9. IP Class 10. Cell type 11. Number of cells 12. In case of pack, no. of battery modules per pack 13. Operating Temperature conditions, (°C) 14. Cooling system for battery 15. Warranty, years 16. Battery designation/identification 17. Battery Energy, kWh 18. Internal resistance, of battery if less than <= 5mΩ 19. Recommendation for mounting and clamping for vibration and shock test. 20. Any relevant information from battery manufacturer	

A3 BATTERY CHARGER

Battery Charger	Specifications
1. Model and make 2. Power rating, kW/ W 3. Battery pack type 4. Charging voltage, V 5. Charging current, A 6. Charge profile	

7. Mains operating range, °C 8. Input power factor 9. LED/LCD Indications 10. Audio Indication (Buzzer) 11. Reserve battery protection 12. Mains over current protection, A 13. Cooling system; Type 14. Thermal System; Type 15. Thermal protection, °C 16. Charger operating temperature, °C 17. Battery Cable length, m 18. Mains cable length, m 19. Warranty, years 20. Weight, kg 21. Enclosure, if any	

A-4 ELECTRIC MOTOR

Motor	Specifications
1. Type of motor (e.g. Asynchronous AC Induction, Synchronous Permanent Magnet AC, BLDC, SRM etc.) 2. Make 3. Number of Phases 4. Maximum Power (kw @ xxxx rpm) 5. Maximum torque (Nm @ xxxx rpm) 6. Cooling System (Liquid /Air / Naturally air cooled) 7. Type (winding/excitation) 8. Maximum net power and / or maximum 30 minutes power (kW) as per AIS 041 (Rev 1) :2015 as amended and revised from time to time 9. Motor rated speed, rpm 10. Rated torque, Nm 11. Power rating, kW 12. Maximum voltage, V 13. Maximum current, A 14. Rated voltage and current, V and A 15. Shaft dimensions, mm 16. Power harness 17. Type of insulating material used 18. Operating Temperature, °C 19. IEC protection class 20. Conduits provided Yes / No 21. Cable size (DC side), mm^2 22. Cable size (AC side), mm^2 23. Electrical circuit diagram and Layout 24. Warranty, years 25. Motor Speed	

Maximum Speed at No Load, rev/min	*Low Idle Speed, rev/min*	*Speed at Max Torque, rev/min*	*Rated speed, rev/min*		
			For PTO Use	For Drawbar Use	Other If Any
(1)	(2)	(3)	(4)	(5)	(6)

A-5 CONTROLLER

Controller	Specifications
1. Power rating, kW 2. Voltage Range, V 3. Overload Protection device, if any 4. Polarity Protection device, if any 5. Full power temperature range, °C 6. Operating temperature range, °C 7. Frequency of operation, h 8. Standby battery current, A 9. Cable size, mm^2 10. IEC protection class	

A-6 COOLING SYSTEM FOR BATTERY, CONTROLLER AND MOTOR

A-7 LUBRICATING SYSTEM

a) Type
b) Filters
   1) Type
   2) Number
c) Oil capacity, litres
d) Oil changing period, hours
e) Pump
   1) Type
   2) Capacity at rated speed, l/min (at____ºC)
   3) Pressure release setting, kPa (kgf/cm^2)

A-8 ELECTRICAL SYSTEM

a) Starting system

   1) Make/type
   2) Aid for cold starting
   3) Any other device provided for easy starting

4) Method of drive

b) Battery, if additional

1) Make/type
2) Number
3) Capacity of range
4) Location

c) Detail of lights:

Description	*Height Above Ground of Centre mm*	*Size, mm*	*Distance from Centre of the Beam to Outside Edge of Tractor at Standard Rear Track Setting, mm*
(1)	(2)	(3)	(4)
Headlights			
Sidelights			
Rear lights			
Reflectors			
Plough Light			

d) Switches-Main light and other (Type and Position)
e) Horn-type and location
f) Details of other electrical accessories
g) Thermal System, if any

A-9 INSTRUMENT PANEL DETAILS

A-10 TRANSMISSION SYSTEM

a) Clutch
1) Make/Type
2) Size
3) Number of friction plate
4) Method of operation
5) Friction plate
i) Type
ii) Material

b) Gear box

1) Make/Type

2) Oil capacity, liters

3) Oil changing period, hours

4) Number of speeds

i) Forward

ii) Reverse

5) Nominal speed:

Movement	*Gear Number*	*Number of Motor Revolutions for One Revolution of Driving Wheel or Sprocket*	*Nominal Speed at Rated Motor Speed when Fitted with..... Size Tyre, at an Inflation Pressure of.....and Rolling Radius of .... km/h*
(1)	(2)	(3)	(4)
Forward	1 2 3 etc		
Reverse	1 2 etc		

c) Rear axle and final drive

1) Make/Type
2) Differential lock
   i) Type
   ii) Method of operation

3) Reduction in final drive

4) Oil capacity of final drive, litres

5) Oil changing period, hours

d) Details of transmission if used other than those given in (a), (b) and (c) above

A-11 POWER TAKE-OFF (PTO) SHAFT

a) Location
b) Number of splines
c) Speed, rev/min
d) Size, mm

e) Standard to which it conforms
f) Height above ground, mm
g) Motor speed at standard PTO speed, rev/min
h) Direction of rotation (viewed from driving end)
j) PTO speed at rated motor speed, rev/min
k) Details of other PTO, if any

A-12 THREE POINT LINKAGE

a) Upper hitch points

    1) Diameter of hitch pin hole
    2) Width of-ball

b) Lower hitch points

    1) Diameter of hitch pin hole
    2) Width of-ball

c) Lateral distance from lower hitch point to centre line of tractor
d) Lateral movement of lower hitch point
e) Distance from end of power take-off to centre of lower hitch point (lower links in horizontal position)
f) Transport height
g) Power range
h) Leveling adjustment range
j) Lower hitch point height
k) Zone of clearance around each hitch point spherical radius

A-13 POWER LIFT

a) Make/Type
b) No. and Type of cylinders
c) Type of linkage lock for transport
d) Make and type of pump
e) Location and drive
f) Number and type of filters
g) Lifting capacity, kN (kgf)

    1) At lower links
    2) At standard frame

h) Oil change period
j) Hydraulic oil capacity (litre)
k) Provision for external tapping
m) Details of control levers
n) Method of draft sensing

A-14 DRAWBAR (LINKAGE DRAWBAR/SWINGING DRAWBAR)

a) Type
b) Location
c) Height above ground level, mm

    1) Maximum
    2) Minimum

d) Method of changing position
e) Distance from rear axle, mm
f) Position relative to PTO shaft, mm
g) Lateral adjustment to either side, mm
h) Pivot position relative to rear wheel or centre of sprocket, mm
j) Standard to which it conforms

A-15 TOWING HITCH (FRONT/ REAR)

a) Type
b) Height above ground level, mm
c) Type of adjustment
d) Distance of hitch point (mm)

    1) From rear axle centre
    2) From PTO shaft end

A-16 STEERING

a) Make/Type
b) Location
c) Method of operation
d) Diameter of control wheel, mm
e) Steering housing oil capacity, liters

A-17 BRAKES

a) Service brake

    1) Make/Type
    2) Location
    3) Area of liners, cm^2
    4) Material of liners
    5) Method of operation

b) Parking brake

    1) Make/Type
    2) Method of operation

A-18 WHEEL EQUIPMENT

a) Steering wheel

1) Make
2) Number
3) Size
4) Type of tyre
5) Ply rating
6) Maximum permissible loading capacity of each tyre at ...kPa (kgf/cm^2) pressure, kN (kgf)
7) Recommended inflation pressure, kPa (kgf/cm^2)
   i) For field work
   ii) For transport
8) Track width, mm
9) Method of changing track width

b) Driving Wheel

1) Make
2) Number
3) Size
4) Type of tyre
5) Ply rating
6) Maximum permissible loading capacity of each tyre at…….kPa (kgf/cm^2) pressure
7) Recommended inflation pressure, kPa (kgf/cm^2)
   i) For field work
   ii) For transport
8) Track width, mm
9) Method of changing track width, range and number of steps

c) Wheel base, mm
d) Method of changing wheel base, if any and range

A-19 TRACK-LAYING EQUIPMENT

a) Track Plate
1) Type
2) Number
3) Width, mm
4) Surface hardness and depth of hardness
5) Grouser height, mm
6) Track pitch, mm
7) Size of pins, mm
8) Track gauge, mm
9) Length of track in ground contact, mm
10) Nominal pressure, kPa (kgf/cm^2)
11) Method of track tensioning

12) Type of links

b) Driving Sprockets
   1) Pitch circle diameter, mm
   2) Number of teeth
   3) Face width, mm

c) Type of Suspension

d) Idler Wheel

   1) Diameter, mm
   2) Face width, mm
   3) Method of fixing
   4) Lubrication

e) Carrier Rollers

   1) Number
   2) Diameter
   3) Surface hardness
   4) Depth of hardness
   5) Type of bearing
   6) Service schedule

f) Track Rollers

   1) Number
   2) Diameter, mm
   3) Surface hardness
   4) Depth of hardness
   5) Type of bearing
   6) Service schedule

A-20 BALLAST

Re-write as under:

Particulars	*Ballast Mass as Used (kg)*				
	Front C.I. Weight on			Rear Weight	
i) During drawbar performance test	Water	Wheel	Axle	Water	C.I. Weight on Wheel
ii) During field performance test					
a) Dry land					
b) Wet land					
iii) During haulage test					

A-21 SEAT

a) Make/type
b) Type of suspension
c) Type of damping
d) Range of adjustment, mm

1) Vertical
2) Lateral
3) Horizontal

A-22 MASS OF ELECTRIC TRACTOR (TRACTOR WITHOUT DRIVER BUT WITH LUBRICANT, BATTERY AND COOLANT FULL)

Condition	*Mass of tractor, kg*		
	Front	Rear	Total
(1)	(2)	(3)	(4)
Without ballast			
With commercial ballast			
With ballast			
i) During drawbar performance test			
ii) During field performance test			
iii) During haulage test			

A-23 OVERALL DIMENSIONS

Condition	*Length, mm*	*Width, mm*	*Height, mm*	*Ground Clearance, mm*
(1)	(2)	(3)	(4)	(5)
Without Ballast				
With Commercial Blast				

A-24 OPTIONAL FEATURES, IF ANY FOR ACCESSORIES PROVIDED

A-25 LUBRICANTS RECOMMENDED

a) Lubricants

Sl No. (1)	*Location* (2)	*Type* (3)	*Grade* (4)
i) Transmission			
ii) Final drive			
iii) Steering gear			
iv) Hydraulic			

b) Number of external lubricating points

1) Oiling
2) Greasing

A-26 ADDITIONAL INFORMATION

a) Whether the electric tractor is suitable for

1) Belt pulley work and if so maximum power rating
2) Puddling (if suitable for puddling indicate features, such as water sealing, etc., provided)

b) Recommended acceleration setting for:

1) Field operation
2) Belt pulley work
3) Puddling
4) Road haulage

c) Standard accessories and fittings
d) Optional accessories and fittings
e) Safety features, if any
f) Any special feature of the tractor

NOTES

1 Delete the parameters ~~items~~ not applicable to a electric tractor.
2 Add any additional details, of the electric tractor, if present.
3 Conformity or otherwise of a component, assembly or item with the relevant Indian Standard/AIS should be stated, wherever applicable.

ANNEX B

(*Clauses* 4.3, 4.4.2 and 4.7)

PROFORMA FOR SELECTION, RUNNING-IN AND REPAIRS

a) Name of the manufacturer	e) Method of selection
b) Address	f) Place of running-in
c) Submitted for test by	g) Duration and schedule of running-in
	Repairs and adjustments made during
d) Selected by	h) running in

ANNEX C

(*Clause* 5.2.5)

SPECIMEN TEST REPORT FOR POWER TAKE-OFF TEST

Date & location of test:

Type of dynamometer:

Power (KW)	**Speed (rpm)**		**Electricity**		**Consumption**	
	motor	PTO	Current (A)	Voltage (V)	Specific current consumption (A/ PTO kW)	Power (KW)
Maximum power absolute						
Rated motor speed with varying load						
a)						
b)						
c)						
d)						
e)						
Varying speed at full load (**5.2.2.3**)						
Standard speed with varying loads						
a)						
b)						
c)						
d)						
e)						
f)						

No-load at recommended maximum motor speed:

Equivalent motor shaft torque, Nm:

Maximum equivalent motor shaft torque .....at …… motor speed

Mean atmospheric conditions:

Temperature at air intake: . . . . . .

Relative humidity ……
Ambient temperature . . . . . .

Pressure……..

Maximum temperature of coolant

....

.....

Motor Surface Temperature: .....

ANNEX D

(*Clause* 5.4.1)

DRAW TESTS – MEASUREMENT OF TYRE TREAD AND TRACK

The height of the tyre or rubber track tread bard (*see* **5.1**) shall be measured by use of a 3-point gauge. Each gauge leg shall terminate in a hemispherical tip of radius 5 mm. The gauge shall be placed astride the tread bar and perpendicular to the direction of the tread bar as close to the centerline of the tyre or rubber track as possible. Two legs of the gauge shall be positioned at the base of the tread bar (at the point of tangency between the tyre carcass and the radius joining the tread bar to the carcass.) The third point of the gauge shall be in the centre of the tread bar.

The tread bar height shall be the difference in elevation between the two outside legs of the gauge and the centre point. The tread bar height measured in this manner shall be taken and averaged for a minimum of four equally spaced locations round the periphery of the tyre. It shall be compared to similar data on a new tyre of the same make, size, type, and inflation pressure.

ANNEX E

SPECIMEN TEST REPORT FOR DRAWBAR PERFORMANCE TEST

(*Clause* 5.4.5)

G-1 VARYING DRAWBAR PULL AND SPEED

Drawbar pull, KN					
Speed, km/h					
Drawbar power, kW					
Motor speed, rpm					
Wheel or track slip					

Maximum drawbar pull (track laying tractors only)

Maximum: …….KN Track slip: ……percent

DRAWBAR TEST

Date of test: …….

Type of surface (or drum diameter): ……

Height of drawbar above ground: …….....

Gear	Drawbar Power	Drawbar Pull	Speed	Motor Speed	Slip of Wheels	Electricity Consumption				Temperature				Atmospheric Conditions			Max Sustained Pull
										Motor Blower Inlet and outlet	Trans oil	Motor coil and controller	Battery, etc	Temp.	RH	Press.	
	(kW)	(kN)	(km/h)	(rpm)	(percent)	(A)	(V)	(A/Drawbar kW)	(Battery Power kW)	(°C)	(°C)	(°C)	(°C)	(°C)	(percent)	(kPa)	(kN)
Maximum Power at rated motor speed																	
1																	
2																	
3																	

ANNEX F

(*Clause* 5.5.3)

VIBRATION MEASUREMENT

1) Date and location of test
2) Type of accelerometer
3) Test data

Measuring Points	*At No-Load*		*Vibration, Micron At Load Corresponding to 85 percent of Maximum PTO Power*	
	HD	VD	HD	VD
(1)	(2)	(3)	(4)	(5)
i) Foot rest, left				
ii) Foot rest, right				
iv) Steering wheel				
v) Seat, back				
vi) Seat, bottom				
vii) Mud-guard, left				
viii) Mud-guard, right				
ix) Head light, left				
x) Head light, right				
xi) Battery base, centre				
xii) Tail light, right				
xiii) Ploughing light				
xiv) Gear shifting lever				
xv) Accelerator lever, foot				
xvi) Accelerator lever, hand				
xvii) Brake pedal, left				
xviii) Brake pedal, right				
xix) Clutch pedal				
xx) Hydraulic control lever				
xxi) PTO engaging lever				
xxii) Differential lock lever				
xxiii) If a helper's seat is provided on mud-guard				

ANNEX G

(*Foreword*)

LIST OF RELEVANT AIS STANDARDS

No.	Title
AIS-038 (Rev 2) : 2020	Specific Requirements for Electric Power Train of Vehicles
AIS-039 (Rev 1) : 2015	Electric Power Train Vehicles – Measurement of Electrical Energy Consumption
AIS-040 (Rev 1) : 2015	Electric Power Train Vehicles- Method of Measuring the Range
AIS-041(Rev 1) : 2015	Electric Power Train Vehicles - Measurement of Net Power
AIS-174/D1	Specific Requirements for Electric Power Train Construction Equipment Vehicles
AIS-156 : 2020	Specific Requirements for L Category Electric Power Train Vehicles