

5.2 Inspection and Maintenance of Railways

5.2.1 Inspection and Maintenance of Civil Structures

(1) Types of Civil Structure

1) Functional Classification

Earth Roadbed

Bridges ((River) Bridges, Overbridges, Road Overbridges, Other)

Tunnels (Mountain, Under Road, Under River, Undersea, Other)

Other (Passenger Platforms, Retaining Walls, Revetments, Wayside (Drainage) Channels, Cross Drains, etc.)

2) Classification by Structural Material

Earth Structures

Concrete Structures

Steel Structures

Steel and Concrete Structures

Other (Wood, Synthetic Resin, etc.)

3) Classification by Structural Form (Bridges)

Girder Structures (Simple Girder, Continuous Girder, etc.)

Rigid Frame Structures (Viaducts, Box Culverts)

Other (Suspension Bridges, Arches, etc.)

4) Classification by Construction Method (Tunnels)

Mountain Method (Mainly Upper Arch)

Shield Method (Mainly Circular Section)

Open Cut Method (Mainly Rectangular Section)

Other (Sinking, etc.)

Above are indicated the major classifications.

(2) Features of Civil Structures on Railways in Manila

- 1) PNR railways mainly consist of earth structures (bare surface), but steel bridges are adopted on some river crossings.
- 2) Urban railway lines (Line 1, Line 2, Line 3) mainly consist of concrete structures (girder viaducts, bridge substructure), but earth structures are adopted for rolling stock depots, steel bridges are adopted on some river crossings, and open cut tunnels are adopted in station sections. Moreover, on Line 3, earth structures (bare surface) are frequently adopted between stations.

(3) Features of Disturbance According to Type of Structure

1) Earth Structure

Earth structures are largely divided into bankings, cuttings and bare surfaces, however, since most of the earth structures of railways in Metro Manila are bare surface, features shall be described for this.

In the case of bare surface, as is also true with banking and cutting, track irregularity caused by roadbed sinkage and liquefaction is a major problem. And, concerning subgrade and roadbed underneath ballast, as is again true with banking and cutting, roadbed strengthening to withstand train loads is necessary and, in addition to selecting the appropriate roadbed material, in cases where ground strength cannot be expected from subgrade, ground strengthening measures such as ground improvement, etc. must be carried out in advance. Furthermore, even if good quality materials are used for subgrade and roadbed, if roadbed drainage is poor, since track irregularity arising from infiltration of sediment into the subgrade and liquefaction of the roadbed is apt to occur, it is necessary to constantly maintain roadbed drainage in good condition and thus reduce the amount of track maintenance.

2) Concrete Structures

Concrete structures are commonly used in railway civil structures such as bridge superstructures (girders), substructures (abuts, piers) and retaining walls, etc., and use of such structures has been increasing in recent years due to problems of noise, etc.

Speaking from the viewpoint of structural management, since concrete structures adopt material which is prone to cracking (concrete), disturbance of such structures is commonly found as a result of discovery of cracks. It is almost impossible to

completely prevent cracking in concrete structures, and numerous cracks are apt to occur in sections which are structurally subject to tensile force (under sides midway between girder spans, etc.). However, when such cracks occur in structures, rainwater and harmful gases infiltrate the structures in question and cause corrosion, and this corrosion leads to degradation and disturbance of the structures and further reduce structural durability.

Therefore, when designing concrete structures, concerning sections which are subject to the operation of tensile force, it is important to make sure that cracking only occurs to the extent which leads to an allowable degree of rainwater and harmful gas infiltration. In the area of management too, it is necessary to monitor sections which are prone to tensile force to make sure that cracking does not advance beyond the allowable level. Moreover, in cases where advanced cracking is found in sections prone to tensile force and cases where cracking is found to have occurred in sections subject to other forces (contraction, sheathing), it is possible that some kind of disturbance (displacement, sinkage, etc.) has occurred in girder bodies, substructures or foundations, or retaining wall bodies or foundations, etc., and it is necessary to take appropriate steps including measurement of displacement volume and examination of causes and countermeasures.

Moreover, although not problems which have an immediate impact on train safety, as disturbance items which can be visually checked in concrete structures and which may lead to structural degradation in future, the degradation and peeling of concrete and corrosion of reinforcing bars and steel can be raised.

3) Foundation Structures (including concrete retaining walls)

Foundations are broadly divided into spread foundations, pile foundations and others (caisson). Since foundations are buried underground, it is near impossible to directly check disturbance by eye. Therefore, disturbance is indirectly confirmed through measuring the following items in abuts, piers, girders and sheathing walls, etc.

Subsidence and uneven subsidence

Tilting

Movement

Irregularity

Abnormal stress, cracking

The following can be pointed to as causes of these problems:

Roadbed subsidence and movement

Reduced strength of foundations or reduction of ground bearing capacity

Furthermore, external factors which are generated as a result of the above are as follows:

Overloading of banking occurs on weak roadbed or beside lines.

Groundwater level is lowered as a result of groundwater pumping.

Foundations are constructed on unstable slopes containing risk of landslide.

Construction works are executed near to lines.

Strength of foundations is reduced due to structural deterioration.

Ground bearing force is lowered as a result of subgrade sinkage and adjoining pit excavation

In addition to measuring manifestations of disturbance in management of foundation structures, when ascertaining causes, it is necessary to grasp changes over time in areas around structures.

4) Steel Bridges

Major types and causes of disturbance in steel bridges are as follows.

Cracking

Cracks are divided into those which can be observed by naked eye and those which cannot be observed visually, for example, cracks which occur in welded sections. Cracks which occur in the main members of steel bridges not only carry the risk of reducing girder strength, they also carry the possibility of rapidly spreading through total sections. Moreover, when cracks progress and split secondary members too, overall girder stability and load distribution deteriorate and this leads to negative impact such as increased vibration of girders when trains pass, etc.

The following items can be pointed to as causes of cracking: stress arising from repeated load, structural faults in member sections, etc.,

concentrated stress and residual stress arising from poor work on welded sections.

Corrosion

Corrosion is the most common form of disturbance in steel bridges. Once corrosion occurs, the section in question does not dry out so easily and this leads to further progression of the corrosion. Cracking is also caused by corrosion in some cases.

Iron is inherently prone to oxidation and this occurs when the surface of iron comes into contact with moisture, oxygen or acid. Moreover, if the surface of iron is tainted due to attachment by dirt, smoke or salt, the iron becomes less responsive to drying due to saturated condensation of moisture in the atmosphere and rust progresses as a result. Therefore, when corrosion is discovered, it is necessary to implement immediate countermeasures such as recoating, etc.

Deformation

Deformation of girders is caused by clashes with automobiles or vessels and dropping of objects from overbridges, etc. Moreover, thermal deformation of girders is sometimes caused by fires on lines. When this deformation occurs on the compression side or in compression members of girders, since train loads cause the deformation to increase and damage the safety of girders, it is necessary to rectify the deformation.

Support Displacement

Displacement of girder supports occurs when sinkage, tilting or horizontal displacement of abuts and piers take place. Girder deformation and alteration of stress conditions occur in line with this, and if structures continue to be used in this condition, deformation of all girder members will be induced as a result.

Abrasion and Looseness

Abrasion of truss moving shoe and sliding shoe sliding parts, and looseness which frequently occurs in rivets and high tensile bolts, lead to changes in girder stress conditions and increased vibration and flexure of girders, and over time they trigger a variety of adverse impacts.

5) Open Cut Tunnels

Major types and causes of disturbance in tunnels are as follows.

Cracking

Some cracks are caused by the drying contraction of lining concrete, while others appear as a result of tunnel lining deformation caused by the action of load on tunnels (biased pressure or changes in load conditions, etc.). If cracking is allowed to progress, it eventually leads to peeling and separation of lining surfaces and destruction of tunnels. Moreover, on sections of concentrated stress or lining joints, etc., irregularity is apt to occur. In the same way as with general concrete structures, it is necessary to monitor the progress of cracking.

Since there is little or no allowance between the outer sides of rolling stock and inner sides of tunnels, separation of concrete and displacement of tunnel bodies immediately have an impact on train operating safety, and therefore it is necessary to practice caution.

Water Leakage

If leaking water inside tunnels is properly collected and drained away, it does not have a major impact on tunnels. However, constructing a tunnel triggers the same phenomena which occur when digging a large-scale well. In urban areas where open cut tunnels are constructed, since such works lower the groundwater level, they also sometimes lead to ground subsidence and parching.

Moreover, in cases where leakage increases in tunnels which are normally hardly affected by leakage because of low surrounding groundwater level, since raising of the groundwater level leads to tunnel floating, it is necessary to examine the issue of tunnel stability in tunnels which have a thin earth covering.

Sediment Flow Behind Lining Surfaces

Flow of sediment behind lining inside tunnels leads to the occurrence of gaps in the ground around tunnels and this not only leads to changes in load conditions working on tunnels and adverse impact on tunnel bodies themselves, but since it also triggers deformation in nearby houses, etc. and leads to major problems, it is necessary to take immediate countermeasures.

Corrosion of Track Materials

On sections of extreme water leakage in tunnels on electrified sections (for example, cases where water containing impurities is always lying on rails), electric corrosion leads to corrosion of rails and fasteners and it is necessary to carry out replacement of materials more frequently than normal.

This brings to an end the description of types and manifestations of disturbance in railways.

(4) Control and Inspection Flow in Civil Structures

1) Maintenance Procedure

Maintenance of civil structures is carried out based on the following thinking upon first gaining a full understanding of the characteristics of the structures in question.

Implement inspections which enable disturbance to be discovered quickly.

Gain an early understanding of the degree of progression of the disturbance in question.

Make as accurate an estimation of the time when disturbance occurred as possible.

Correctly judge the cause and future progression of the disturbance based on its form and position, and arrive at a proper judgment of integrity.

Where necessary, compile a detailed inspection plan.

Implement appropriate steps based on correct understanding of the method and effect of the steps in question.

In particular, even though disturbances and faults in the foundations of bridges, etc. cannot be directly identified, since these often have a major impact on main structure functions and require drastic countermeasures, initial minor disturbances must be gauged as early as possible to allow appropriate measures to be taken in time.

2) Inspection Procedure

Below is given an example inspection procedure.

Compilation of Inspection Plan

Since structural disturbances take a wide range of forms, determine inspection frequency and measurement methods, etc. based on careful consideration of the type, location, size and importance of the structure in question.

Data Collection and Appearance Inspection

The main data to be collected are as follows.

a) History of the structure

Year of construction, changes in carried load, past record of earthquake and fire damage, etc., changes in environmental conditions, past maintenance and repair history, conditions of use under girders (in cases of bridges), geological data

b) Design documents and works records

Design drawings, design calculation sheets, strength, used materials and material quality, allowable stress, works records

c) Inspection records

Past inspection records (subsidence, tilting, cracking, rust, drainage conditions, etc.), disturbance drawings, follow-up drawings of disturbance, riverbed alteration (in cases of river bridges), etc.

Visual Inspection

Carry out necessary inspection for cracking, etc.

Dynamic Inspection

Measure vibrations and sinkage, etc. which occur in structures when trains pass by, and confirm any disturbances.

Materials Strength Inspection

The Schmidt hammer test is a method for measuring concrete strength, and where necessary, strength testing is carried out on samples obtained through boring cores, etc.

Integrity Judgment

Judgment of integrity is made based on the above results, and countermeasures are examined if problems are found to exist.

(5) Inspection and Maintenance Standards for Civil Engineering Structures and Tracks

1) Track maintenance standards

Definition: gauge, cross level, longitudinal level, alignment, (torsion), others

Maintenance standard values: limit values, target values and so forth of gauge, cross level, longitudinal level, alignment, (torsion), and other irregularities

2) Track inspection standards

Definition: patrol inspection, track maintenance inspection, material inspection, others

Inspection cycle: cycles of respective inspections

Inspection method: inspection items, inspection points, system of reporting inspection results

3) Building (civil engineering structures) maintenance standards

Definition: building, civil engineering structures, rolling stock, others

Construction gauge: basic construction gauge; construction gauge expansion; margin outside of construction gauge

Building design: permissible stress of materials, permissible volume of displacement

4) Building (civil engineering structures) inspection standards

Definition: inspection objects, inspection classification

Inspection cycle: regular inspection, non-regular inspection

Treatment after inspection: data recording; reporting; judgment on necessity of construction works

5.2.2 Inspection and Maintenance of Electric Power Facilities and Operational Safety Facilities

(1) Basic Policy of Facility Maintenance

In executing facility maintenance, it is essential to clarify the plans, methods, and procedures of work, so as to enhance work efficiency.

(2) Definition of Words

- 1) The word “maintenance” means: to maintain functions of facilities in good conditions; to restore lost functions of facilities; and to improve and reinforce facilities so as to enhance their reliability. The contents of “maintenance” consist of “inspection” and “repairs”.
- 2) The word “inspection” means: to inspect and measure the degree of deterioration of facilities as well as the changes in their situations for preventive treatment; to judge the necessity of treatment for maintaining the facility functions in normal and stable conditions; and to execute repairs when necessary.
- 3) The word “repairs” means to mend, replace, and adjust facilities which are defective or presumed to be defective.

(3) Recording of maintenance

Dates and results of each facility maintenance should be recorded after its execution, in order to clarify its situation.

(4) Kinds of inspection

1) Overall inspection of facilities

Overall inspection of facilities in action: functional inspection; and visual check by the five senses concerning general situations and environmental conditions and the like of facilities

2) Detailed inspection of facilities

Detailed inspection of facilities (conducted at specified intervals) entailing suspension of their operation)

3) Non-regular inspection

Inspection extraordinarily conducted depending upon the need

- When facilities have been newly installed, remodeled, or repaired
- When the use of facilities is suspended and resumed
- When an abnormality has been detected in facilities, or when there is a possibility of occurrence of an abnormality

(5) Execution of Inspection

It is essential to establish the contents and cycles of inspection by kind of facilities (substation facilities, catenary facilities, signal facilities, etc.) and by kind of devices (transformer, rectifier, trolley wire, interlocking device, etc.)

The contents of the above should be utilized as the “maintenance standards” of facilities.

(6) Arrangement and Custody of Drawings and Data Books

The drawings and data books necessary for facility maintenance should always be properly arranged and kept in custody.

(7) Adequate Administration of Measurement Devices

The measurement devices used for facilities maintenance should always be kept in good conditions.

(8) Adequate administration of emergency materials and spare parts

Emergency materials and spare parts should always be stored in good conditions at specified places, so that they can be put into use at any time.

(9) Standardization of maintenance work

Efforts should be made to standardize facility maintenance work in order to ensure efficient work execution.

5.2.3 Inspection and Maintenance of Rolling Stock

(1) Inspection Items and Inspection Methods for Rolling Stock for Ordinary Railway Applications

- 1) Inspection items and inspection methods to be employed for inspecting rolling stock, other than those used only for shunting, that are specified by the semi-overhaul and general inspection guideline as “rolling stock for general railway applications” shall be as described in tables appended to this publication. These Appendixes list the inspection items and inspection methods by the type of rolling stock as shown below. The inspector should consult the appropriate Appendix indicated to the right of each rolling stock type:

Table 5.2.1

Type	Appendix
Electric locomotives and electric cars	1
Internal combustion locomotives and internal combustion rail cars	2
Passenger cars, freight cars, and baggage cars	3

- 2) Notwithstanding the above, in consideration of the design and frequency of usage of the particular type of rolling stock, some of the specified inspection items and inspection methods may be omitted from the inspection provided that they do not involve critical parts of critical rolling stock components.

3) Inspection Items and Inspection Methods for Rolling Stock Other Than for Ordinary Railway Applications

Inspection items and inspection methods for rolling stock other than for ordinary railway applications as specified by the critical element inspection and general inspection guidelines shall be determined, depending on the design and frequency of usage of the particular rolling stock, and in accordance with the provisions specified above.

4) Meaning of Rolling Stock Maintenance Terms

Inspection: Inspection and associated repairs.

Measurement: Taking of measurements by means of measuring instruments, or using standard rulers, voltage, markings or other means to determine whether or not a certain value is within specified acceptable limits.

Damage inspection: Inspection by ultrasonic, magnetic or invasive techniques.

5) Ultrasonic Damage Inspection

Ultrasonic damage inspection of wheel axles of rolling stock must be performed at each of the following times:

Prior to use of a new product, either newly developed or purchased

At each general inspection

As required

(2) When to Start Counting Time to Next Inspection

For periodic inspections of the condition and functioning of rolling stock, counting should begin immediately after the completion date of the preceding inspection. For a semi-overhaul or general inspection, counting should proceed from the month subsequent to the month the preceding inspection is completed.

(3) Method of inspection

The following methods are available:

- 1) Visual: Conformance judged by sight
- 2) Auditory: Conformance judged by hearing
- 3) Olfactory: Conformance judged by odor
- 4) Tactile: Conformance judged by hand touch.
- 5) Tapping: Conformance judged through tapping on a surface and listening to sound from the surface or sensing the resistance of the tapping tool or vibrations by hand placed on the surface.
- 6) Operation: Conformance judged by control devices
- 7) Measurement: Conformance judged by measurement
- 8) Conduction: Conformance judged by making devices conductive
- 9) As mounted: Inspection made with devices in place
- 10) Dismounted: Where a device is inaccessible due to, for example, adjacent equipment, the device must be dismantled from the rolling stock for inspection
- 11) Overhauled as mounted: Some parts of a device are overhauled as the device is mounted on the rolling stock
- 12) Dismounted and overhauled: The device is dismantled and then overhauled

ATTACHMENT 1

INSPECTION ITEMS AND INSPECTION METHODS FOR ELECTRIC LOCOMOTIVES AND ELECTRIC CARS

1. Individual Inspections

Item(s) to be inspected			Points to be inspected	Method of inspection
1. Drive units	(1) Trucks	1) Truck frame and swing bolster	<ul style="list-style-type: none"> a. Check for cracked, damaged, deformed or loosened truck frames or swinging bolsters. b. Check for damaged, worn or loosened wear plates. Check condition of sliding portions. c. Check for cracked, damaged, worn or deformed main motor mounts and gearboxes. d. Check for cracked, damaged or leaking air chambers. e. Check for worn, cracked, damaged, deteriorated or loosened swinging bolster suspenders, and suspender support bars, pins and bushings. 	Damage inspection
		2) Center plate and side bearings	<ul style="list-style-type: none"> a. Check for cracks, damage, wear and looseness. b. Check for damaged or worn wear plates and for loosened dust guards. c. Check oil level. d. Check for worn, cracked or bent center pins in trucks. e. Neither central plate nor side bearing is equipped with a bolster-less truck. 	
		3) Traction device	<ul style="list-style-type: none"> a. Check the traction device body, its frame and traction plate springs for cracks, damage, deformation and looseness. b. Check for damaged, worn or loosened rubber stoppers (for horizontal traction) or friction plates. c. Check for cracked, damaged or worn pins. d. No traction device is equipped with a central plate truck. 	Damage inspection
		4) Axle box and axle suspension	<ul style="list-style-type: none"> a. Roller bearing <ul style="list-style-type: none"> i. Check oil level. ii. Check rollers, inner and outer rings, and cages for wear, deformation, cracks, peeling, damage or improper fitting. iii. Check for cracked, damaged, or loosened wheel axle nuts, keys and snap rings. 	

Item(s) to be inspected			Points to be inspected	Method of inspection
			b. Axle box suspension <ul style="list-style-type: none"> i. Check links, flat springs, axle box horns and guide tubes for cracks, damage, wear or looseness. ii. Check for cracked, peeled, damaged, deteriorated, or loosened rubber parts. iii. Check axle guard stand-bys for cracks, damage, deterioration or looseness. 	Damage inspection
		5) Wheels and axles	a. Check for damaged, worn or loosened tires, cores or snap rings. b. Check wheel diameter, flange height and thickness, wheel diameter differences and back gauge. c. Check for damaged axles and cracked or damaged wheel treads.	Measurement Damage inspection
		6) Springs	a. Check for cracked, damaged, worn, deformed or loosened springs and spring washers. b. Check air springs for cracks, damage, wear, deformation, deterioration, leakage and looseness. c. Check for damaged, leaking or loosened height control valves or differential pressure regulating valves. d. Check oil dampers for oil leakage, or cracked, damaged, worn or loosened damper mounts. e. Check for cracked, damaged, deformed, deteriorated, or loosened rubber parts.	
		7) Lifeguard	a. Check for cracks, damage, deformation or looseness. b. Check height.	Measurement
	(2) Driving unit	1) Gear and gearbox	a. Check for cracked, deformed, worn, nicked, damaged, loosened or improperly meshed gears. b. Check for damaged, deformed, leaking or loosened gearboxes and lids. c. Check oil gauges and magnetic plugs for damage. Check oil level. d. Check roller bearings for wear, damage or improper gap. e. Check for cracked, damaged, deteriorated, deformed or loosened shock-absorbing rubber parts.	

Item(s) to be inspected			Points to be inspected	Method of inspection
		2) Flexible joint	a. Check joints, cushion rubber and balancing springs for cracks, damage, wear, deformation or looseness. b. Check for oil leakage. Check amount of oil. c. Check shaft and gears for proper key-groove fitting and tapered surface fitting.	
		3) Grounding device	a. Check boxes and collector rings for damage, wear, cracks or looseness. b. Check condition of brushes. c. Check springs for cracks, breakage or deformation and for proper spring pressure.	
		4) Tachometer generator	a. Check damaged or loosened boxes, insulation and lead wires. b. Check operation. c. Check insulation characteristics.	Insulation resistance test
2. Main Circuit Equipment (including Control Equipment)	(1) Power collection device	1) Pantograph and accessories	a. Check under frame, main shaft, frame pipe, pantograph shoe and contact slider strips for cracks, burning, damage, deformation, corrosion, wear or looseness. b. Check pins and pinholes and bearings for wear, damage or looseness. c. Check cylinders, air lines and rubber hoses for corrosion, leakage or looseness. d. Check insulators and other insulating devices for damage or soiling. Also check clearance between live parts and ventilator. e. Check for damaged or loosened connection boxes. f. Inspect solenoid valves and switches as described in the “General Electrical Equipment” section. g. Check to make sure that the pantograph may be raised and lowered and check insulation characteristics.	Measurement
		2) Current collector shoe, its supporting device and beam	a. Check for worn or damaged shoes. b. Check movable sections for proper operation and secure installation. c. Check for damaged supporting devices and for worn, partially worn or loosened shaft bolts and supporting sections. d. Check for worn or corroded springs, cylinders and push rods, and worn or loosened shock- absorbing rubber parts. e. Check for damaged, cracked, worn, deformed, or corroded beams, and for worn or loosened shock-absorbing rubber parts. f. Check insulation characteristics.	Insulation resistance test

Item(s) to be inspected			Points to be inspected	Method of inspection
		3) Main conductor and fuse	a. Check for damaged insulating shields and terminals. Check main conductors, braided copper wires and lead wires for proper cross-sections and secure installation. b. Check for damaged or loosened conduits and conductor supporting fixtures. c. Check for damaged or loosened boxes and fuses, and abnormal packing. d. Measure insulation.	Insulation resistance test
	(2) Main motor	1) Rotor (including armature)	a. Check for damaged, worn or deformed shafts and fans. b. Check armatures for damaged, contaminated or discolored commutation surfaces. c. Check for worn, contaminated or loosened armature brushes.	Armature layer short test Measurement
		2) Frame, field, lid and bearing	a. Check for damaged, contaminated or deformed frames and field coils, shorted coils, and damaged or loosened cores. b. Check for broken conductors, damaged shielding and cracked terminals. c. Check for damaged or contaminated fans, and damaged, worn, deformed or loosened end-lids, frames and bearing inlets. d. Check for damaged, worn or improperly fit bearings. e. Check amount of oil.	Check amount of oil
		3) Terminal box	a. Check for box damage, soiling or looseness. b. Check for damaged lead wires, and damaged, contaminated or improperly contacting terminals.	
		4) Assembly testing	a. Check relative locations of all parts, and condition of the assembled component. b. Check insulation characteristics. c. Check rotary operation.	Measurement Insulation resistance test Dielectric endurance test

Item(s) to be inspected			Points to be inspected	Method of inspection
	(3) Devices in control circuit	1) Line breaker and main contactor	a. Check for damaged boxes. Check condition of chain locks and lead wires. b. Check for cracked, damaged, contaminated, deteriorated or leaking insulation and insulating joints in air line. c. Check for cracked, damaged, contaminated or loosened spark-extinguisher coils, arc boxes, and arc guides. d. Check movable sections and their joints and slide areas for damage or wear. e. Check for damaged or worn contacts, fingers and contact markers. Make sure of their proper contact, security, contact pressure, wiping action, and clearance. f. Check springs, terminals, crossover passages, and braided copper wires for damaged or loose wires. g. Check synchronization of the main and sub contactor sections. h. Check struts and operating beams for cracks, damage or looseness. i. Check for damaged, fouled or rusted magnets, and for damaged spring- or lever-contacts or dust covers. j. Inspect solenoid valves and cylinders as described in the "General Electrical Equipment" section.	Measurement
		2) Master controller	a. Check terminals, lead wires, braided copper wires, and check lids for damage or looseness. b. Check operation and functioning of all parts.	
		3) Semiconductor for main circuit	a. Check for damaged boxes. Check condition of chain locks and lead wires and check to make sure they have been securely installed. b. Check semiconductors and insulation for damage, soiling and deterioration. c. Check for contaminated or deformed cooling devices.	
		4) Controller	a. Check characteristics. b. Check for to make sure that the controller has been securely installed. Check condition of plugs and lead wires. c. Check for damaged, contaminated, deformed or loosened card frame units.	
	(4) Main transformer and its accessories	1) Main transformer	a. Check for soiled or damaged insulators. b. Check for oil leakage. c. Check insulation characteristics.	Insulation resistance test and dielectric endurance test (Oil insulation test should be added at oil change.)

Item(s) to be inspected			Points to be inspected	Method of inspection
		2) Main rectifier	a. Check for soiled or damaged insulators. b. Check for oil leakage. c. Check insulation characteristics. d. Check performance of elements.	Insulation resistance test and dielectric endurance test (Oil insulation test should be added at oil change.) Reverse flow current test and test of voltage that being shared among elements.
		3) Reactor and filter	a. Check for soiling and damage. b. Check insulation characteristics.	Insulation resistance test and dielectric endurance test
		4) Tap changer	a. Check for damage. b. Check switching. c. Check operating time. d. Check insulation characteristics.	Measurement Insulation resistance test Dielectric endurance test
3. Brake System	(1) Basic brake system	1) Levers and rods	a. Check for worn, cracked or deformed levers and rods. b. Check movable and sliding sections for damage or wear. c. Check brake discs for cracks, wear, or looseness.	
		2) Brake cylinder and brake diaphragm	a. Check cylinder interior, pistons, and rubber bellows for damage, cracks or wear. b. Check oil level.	
		3) Automatic clearance controller	a. Check for damage, wear, and deformation. b. Check for proper operation.	
	(2) Hand brake system		a. Check movable and sliding sections for damage or wear. b. Check for proper operation.	
	(3) Air brake controller	1) Brake valve, brake control, control valve, relay valve, car operator valve, direct solenoid control, electro-pneumatic control, readout changeover, and device to respond to load changing	a. Check movable and sliding sections for damage or wear. b. Check for proper contact between valve and valve seat, and for damaged springs. c. Check for damaged, deteriorated or deformed diaphragms and packing. d. All electrical components are to be inspected in accordance with the directions given in the General Electric Controller Guidelines.	

Item(s) to be inspected			Points to be inspected	Method of inspection
	(4) Air brake receiver		a. Check for damaged or loosened boxes. b. Check for damaged or broken plugs and connecting wires. c. Check operations and adjusted values. d. Inspect semiconductors as described in the “Electrical Equipment” section. e. Inspect reset switches as described in the “General Electrical Equipment” section. f. Inspect printed circuit cards as described in the “Control Equipment” section.	
	(5) Emergency brake switch		a. Check for damaged or loosened boxes and lids. b. Check for cracked, damaged, contaminated, deteriorated or loosened insulation. c. Check for damaged or loosened terminals and lead wires. d. Check contacts and contact fingers for damage, wear, soiling, improper contact or looseness. e. Check switching operation.	
	(6) Pressure sensor		a. Check for damaged or loose sensors. b. Check operations and adjusted values.	
4. General Electrical Equipment	(1) Auxiliary power supply unit and motor	1) Motor generator and blower	a. Motors shall be inspected as described in the “Main Motor” section. b. Check for damaged rectifiers and condensers. c. Check generator output characteristics.	Measuring of voltages and frequencies generated by the generator
		2) Power converter and stationary inverter	a. Check for fouled or damaged insulation. b. Check for coolant leakage. c. Check for looseness. d. Check insulation characteristics of parts, other than semiconductors. e. Check output characteristics.	Insulation resistance test and dielectric endurance test Measuring of the generated voltages and frequencies
		3) Battery and charger	a. Check for corroded, damaged or loosened batteries, jumper cables and terminals. Check for fluid leakage. b. Check weight and volume of battery fluid. c. Check charger for proper operation and secure installation.	
	(2) Relay, solenoid valve, and wiring	1) Auxiliary resistor, fuse, and switch	a. Check for damaged, discolored or deformed resistors. b. Check for fouled or damaged contact surfaces. c. Check for looseness.	

Item(s) to be inspected			Points to be inspected	Method of inspection
		2) Contactor and relay	a. Check for fouled or damaged insulation. b. Check movable and sliding sections for damage. c. Check all parts for looseness. d. Check for proper operation.	
		3) Solenoid valve	a. Check for broken or burned coils. b. Check for proper contact between valves and valve seats and check for lifted valves. c. Check all parts for looseness. d. Check for proper operation.	
		4) Arrester	a. Check for damaged or fouled insulators. b. Check for looseness.	
		5) Wiring, conduit, and optical fiber	a. Check wires, joint boxes, and other accessories for damage and looseness. b. Check insulation characteristics. c. Check for damaged, contaminated, deteriorated or loosened optical fibers and connectors.	Insulation characteristics should be determined by insulation resistance test.
		6) Air compressor controller	a. Check for damaged or loosened boxes and chain locks. Check condition of lead wires. b. Check for damaged or deteriorated semiconductors and insulation. c. Check condenser for soiling, oil leakage and deformation. d. Check cooling fins for soiling and deformation. e. Check input/output characteristics of pressure sensors. f. Semiconductors should be inspected as described in the "Control Equipment" section.	
	(3) DC/DC converter	1) Box	a. Check appearance. Check for deformed or loosened covers. b. Check for clogging in covers for areas partly opened, and mesh covers. c. Check for deteriorated packing. d. Check wires and insulation for evidence of overheating, discoloration, or soiling.	

Item(s) to be inspected			Points to be inspected	Method of inspection
		2) Semiconductor unit	a. Check appearance. Check panels for deformation, discoloration, and looseness. b. Check cooling fan areas for soiling. c. Check condenser appearance. Check terminals. d. Check resister appearance. e. Check semiconductor elements. f. Check gate drive, pulse transformer, and base drive unit for loosened bolts.	
		3) Resister unit	a. Check fins for soiling. b. Check terminals. c. Check for discoloration and deformation by visual observation.	
		4) Control box	a. Check appearance and lead wires. Check for loosened parts. b. Check printed circuit boards for deformation, discoloration or corrosion. c. Check electrolytic condenser for secure installation and loosened terminals. d. Check connector connections. e. Check card frame units for damage, soiling or deformation. f. Change batteries regularly.	
		5) Switch	a. Check for loosened plugs. b. Check for loosened terminals.	
		6) Units	a. Check power surge detection unit, voltage detection unit, and no-load resistive control unit for soiling, and loosened terminals and screws.	
		7) Reactor and condenser	a. Check for looseness. b. Check for evidence of overheat. c. Check for odor.	
		8) Filter condenser	a. Check for looseness. b. Check insulators.	
		9) Fuse	Check for damage, discoloration, and looseness.	Resistance measurement

Item(s) to be inspected			Points to be inspected	Method of inspection
		10) Electromagnetic contactor	<ul style="list-style-type: none"> a. Check for loosened or damaged springs, terminals, crossover passages, and braided copper wires. b. Check for damaged or worn contacts, fingers or contact markers. Make sure of their proper contact, security, contact pressure, wiping action, and clearance. c. Check terminals of live parts for loosened bolts. d. Check for cracked, damaged or deteriorated insulations. e. Check spark extinguisher coils, cores, and ceramic/steel plates for cracks, damage and looseness. f. Check movable section for worn pins and their holes. Check joints and sliding sections and see if they are installed rigidly. g. Check synchronization of the main and sub contactors. 	<p>Contact pressure measurement</p> <p>Measurement of spacing between contacts</p>
		11) High-speed circuit breaker	<ul style="list-style-type: none"> a. Check box for damage. Check condition of chain locks and lead wires. b. Check insulation for cracks, damage or deterioration. c. Check spark extinguisher coils, cores, and ceramic/steel plates for cracks, damage or looseness. d. Check arc box and arc guide for damage, soiling, burning or looseness. e. Check movable section for worn pins and pin holes. Check joints and sliding sections. f. Check for damaged or worn contacts, fingers or contact markers. Make sure of their proper contact, security, contact pressure, wiping action, and clearance. g. Check springs, terminals, crossover passages, and braided copper wires for damage or looseness. h. Check synchronization of main and sub contactors. i. Check struts and operating beams for cracks and looseness. j. Check for damaged, fouled or rusted magnets, damaged spring- or lever-contacts and dust covers. k. Check operating voltage and current. 	<p>Measurement of spacing between contacts</p> <p>Measurement of resistance of electromagnetic coils</p>

Item(s) to be inspected			Points to be inspected	Method of inspection
		12) Receiver/transmitter box	a. Check box for damage. Check insulation for damage, soiling, deterioration or looseness. b. Check for damaged, cracked, broken or loosened terminals, crossover passages and braided copper wires. c. Check for broken, short-circuited or discolored coils. Check coil insulation. d. Check arc box and arc guide for damage and looseness. e. Check spark extinguisher coil for damage, discoloration or looseness. Check spark extinguishing performance. f. Check for damaged, worn or loosened contacts. Check contact pressure and wiping action. g. Check movable section for proper operation, adjusted values and operation. h. Check operating voltage and operating current.	
5. General Pneumatic Equipment	(1) Air compressor and accessories	1) Air compressor	a. Inspect motors as described in the "Main Motor" section. b. Check crank chamber, cylinder and piston for damage. c. Check for proper contact between valves and valve seats and check for lifted valves. d. Check power transmission system for damage. e. Check amount of oil, and air and oil tightness. f. Check operation.	
		2) Pressure governor and air pressure switch	a. Check body of each device and its parts for cracks, damage, soiling, degradation, and looseness. b. Check for damaged or worn valves. Check contact between valve and valve seat. c. Check operation.	
		3) Safety valve	Check contact between valve and valve seat.	
		4) Dehumidifier	a. Check for deteriorated desiccant. b. Inspect solenoid valves as described in the "General Electrical Equipment" section. c. Inspect discharge valves as described below in the "supply valve and pressure reduction valve" section.	
	(2) Valves, air tank and air lines	1) Supply valve and pressure reduction valve	a. Check valve-seat contact. Check for damaged springs. b. Check for damaged, deteriorated or deformed diaphragms and packing. c. Check operation.	
		2) Air tank	a. Check tank body and protective fittings for corrosion and looseness.	

Item(s) to be inspected			Points to be inspected	Method of inspection
		3) Air lines and hoses	a. Check air pipe, hose and dust filters for damage and looseness. b. Check cocks for proper open/close operation and installation.	
6. Chassis and Interior	(1) Underframe		a. Check beams and lifting beams for damage, deformation, cracks and corrosion.	
	(2) Car interior and exterior		a. Check roof, floor, exterior surface, interior surface and inter-car plates for damage and corrosion. b. Check windows, shades, passenger seats, sliding doors, manually-operated doors and other fittings for damage and check to make sure that everything is properly installed.	
	(3) Roof		a. Check roof paint or cloth roofing for damage and deterioration. b. Check roof plates, footplates and gutters for corrosion, water leakage and looseness. c. Check current collectors, air conditioners and ventilators for damaged, corroded or loosened bases. Check their insulation characteristics.	Insulation resistance test
	(4) Automatic door closers (including safety device for door closing)		a. Check door engines, belts, arms, links, rollers and sliding devices for damage, wear, deformation and looseness. b. Solenoid valves, door closing switches and safety devices for door closing should be inspected in accordance with the inspection specifications for relay, solenoid valve and wiring given in the "General Electrical Equipment" section. c. Check for air/oil leakage from the door closing devices and air line. d. Check open/close operations.	
	(5) Lighting		a. Check for damaged or loosened bulbs and lighting systems. b. Inspect contactors as described in the specifications for relay contactors and relays in the "General Electrical Equipment" section.	
	(6) Window wiper		a. Check for damaged wiper bodies and loosened wipers. b. Check operation. c. Check for damaged or loosened cylinders and motors. d. Check for damaged or loosened washer tanks and pump motors.	
7. Other Equipment	(1) Signals, intercoms and public address systems	1) Signaling devices (including whistling and emergency notification devices)	Check all devices for damage, soiling and looseness.	

Item(s) to be inspected			Points to be inspected	Method of inspection
		2) Telephone and on-train announcing devices (including security communication facilities)	Check all devices for damage, soiling and loosening.	
	(2) Display units		Check for damaged or loosened bulbs and lighting systems.	
	(3) Instrumentation		a. Check for damaged or loosened instruments. b. Check pressure gauge operation. c. Check speed meter operation. d. Check operation of electric instruments (voltmeters, ammeters, etc.).	Pressure gauge test Speed meter test
	(4) Couplers	1) Automatic coupling device, tight lock coupler, rod type coupler, semi-permanent coupler	a. Check coupler bodies, knuckles, anchorages, and pin holes for cracks, deformation and wear. b. Check coupling operation and coupler heights.	Coupler Measure height
		2) Buffer	Check for damage, deformation and looseness.	
		3) Shank	Check for damage, deformation and looseness.	
		4) Air line couplers	Check for damaged or deteriorated hoses and packing.	
		5) Wire coupler	a. Check for damaged or loosened connecting plugs and plug holders. b. Check for broken jumper cables and damaged shielding. c. Check insulation characteristics.	Insulation resistance test
	(5) Automatic train stop devices (ATS) (including automatic train controller, train selection device and automatic train operation device)	1) On-board coil and receiving device	Check for damage, soiling and looseness.	
		2) Speed detecting device (including tachometer generator)	Check for damaged or loosened parts.	

Item(s) to be inspected			Points to be inspected	Method of inspection
		3) ATS device (receiving, speed checking, logic and power supply sections)	Check for damaged or loosened parts.	
	(6) Emergency braking and emergency train protection devices	1) Emergency braking device (dead-man device and FB device)	Check for damaged or loosened parts.	
		2) Emergency train protection device (TE device)	Check for damaged or loosened parts.	
	(7) Cooler	1) Unit cooler's main frame, cover and adiabatic material	a. Check for secure installation. b. Check main frames and covers for cracks and damage. c. Check adiabatic and packing for peeling, deterioration and damage. d. Check insulating base and anti-vibration rubber for damage and deterioration. e. Check for clogged drainpipes and holes.	
		2) Main circuit board	a. Check for soiling, damage and looseness. b. Check for proper operation of temperature display setter. c. Check insulation characteristics. d. Circuit breakers are to be inspected as described in the "General Electrical Equipment" section.	Insulation resistance measurement
		3) Temperature and humidity sensors	Check for soiling, damage and looseness.	
		4) Filter	a. Check for soiling, damage and looseness. b. Check for clogging in filter. c. Check operation and function. d. Check insulation characteristics.	Insulation resistance measurement
		5) Contactor fuse box	a. Check box and insulation for soiling, damage and looseness. b. Contactors and fuses are to be inspected as described in the "General Electrical Equipment" section.	
		6) Air pressure switch	To be inspected as described in the "General Electrical Equipment".	
		7) Air conditioner operating switch	a. Check for soiling, damage and looseness. b. Check operation.	

Item(s) to be inspected			Points to be inspected	Method of inspection
		8) Freezing cycle	a. Check electric compressor for secure installation. b. Check outdoor and indoor heat exchangers for damaged, contaminated or loosened fins, copper tubes and frames. c. Check piping, copper tubes and soldered areas for damage, cracks and soiling.	
		9) Inverter	Check as per the specifications in the “General Electrical Equipment” section.	
		10) Air conditioner control box	a. Check for soiling, damage and looseness. b. Check dust guard packing for cracks, deformation, discoloration, deterioration and peeling. c. Check operation.	
		11) Outdoor and indoor blowers	a. Check for rigid blower installation. b. Check for damaged or contaminated vanes. c. Check condition of motor.	

2. General Inspection of Electric Locomotives and Electric Cars

Points to be inspected	Method of inspection
(1) Check to make sure that all systems and devices are properly installed.	Measure height
(2) Check height of lifeguards and sanders.	
(3) Check operation of power collection devices.	
(4) Check control and protection functions of devices in control circuits.	Insulation resistance and dielectric endurance tests
(5) Check insulation characteristics of electrical circuits other than those using batteries and semiconductors.	
(6) Check brake operation.	
(7) Check for air leakage from pneumatic brake controllers and ordinary pneumatic devices.	Measure leakage
(8) Check air compressor capacity and operation of related equipment (e.g., pressure controllers and safety valves).	Check operation
(9) Check angle of inclination of car.	Measure angle of inclination
(10) Check operation of automatic door closers.	Measure height Operational characteristics measurement
(11) Check operation of lights.	
(12) Check operation of signals, intercoms and public address systems.	
(13) Check operation of displays.	
(14) Check height of couplers.	
(15) Check operation of automatic braking system and related devices.	Measure height Operational characteristics measurement
(16) Check operation of emergency braking and emergency protection system.	

3 Test Operation of Electric Locomotives and Electric Cars

Points to be inspected	Method of inspection
(1) Starting, acceleration and deceleration	
(2) Operation of braking system	
(3) Creaking, screeching, and vibration	
(4) Meter and gauge readings	
(5) Operation of automatic train operation devices	
(6) Condition of systems and equipment after test operation	
1) Main motor bearings	
2) Devices in main circuits	
3) Overheating or leaking of oil in axle bearings	

ATTACHMENT 2

INSPECTION ITEMS AND INSPECTION METHODS FOR INTERNAL COMBUSTION LOCOMOTIVES AND INTERNAL COMBUSTION RAILCARS

Item(s) to be inspected			Points to be inspected	Method of inspection
1. Running Device	(1) Truck	1) Truck frame and swing bolster	a. Check for deformed, cracked or corroded frames, swing bolsters and balancing beams. b. Check for damaged or worn sliding sections. c. Check swing bolsters for damaged or worn suspenders and pins. d. Check for damaged air chambers. e. Check for damaged or worn support rods in the reversing gears and decelerators.	
		2) Center plate and side bearings	a. Check for damaged or worn friction surfaces. b. Check oil level.	
		3) Axle box and axle suspension	a. Check for damaged, worn, discolored bearings. Check clearances. b. Check to make sure that there is enough lubricant and that the lubricant is in good condition. c. Check clearance between axle box and axle box guard.	Measure clearance
		4) Wheel and axle	a. Check for damaged wheel treads. b. Check wheel shape, wheel diameter or tire thickness, flange thickness and height, and back gauge. c. Check for damaged axles.	Diameter or thickness measurement Axle damage inspection
		5) Buffer	a. Check for damaged, worn or deformed springs. b. Check operation and oil leakage from oil dampers. c. Inspect height regulating valves for air springs and differential pressure regulating valves as described by the specifications for valves in the "General Pneumatic Equipment" section.	
		6) Lifeguard	Check for damaged, deformed or loosened lifeguard body.	
		7) Sanding device	a. Check for damaged, worn, deformed or loosened sanding device body. b. Inspect solenoid valves as described by the specifications for solenoid valves in the "General Electrical Equipment" section.	

Item(s) to be inspected			Points to be inspected	Method of inspection
2 Power Generating Devices	(1) Main body	1) Crank chamber	a. Check main body for damage, deformation and wear. b. Check for loosened stud bolts and improper threads. c. Check for damaged crankshafts or cam bearings. d. Check clearances on crankshaft spindle bearings and camshaft bearings. e. Check for damaged or worn cylinder linings. f. Check protruding sections of cylinder lining.	Measure clearance Dimensional measurement
		2) Crankshaft	a. Check for damage, wear and deformation. b. Check for damaged, worn or deformed vibration absorbing joints and gears.	Shaft damage inspection
		3) Piston	a. Check for damage and wear. b. Check for loosened piston rings.	Piston damage inspection
		4) Connecting rods	a. Check for damage, wear and deformation. b. Check connecting rod bearings for wear, looseness and improper contact. c. Check for worn or loosened small-end bushings. d. Check clearance of large ends of connecting rod bearings.	Measure clearance
	(2) Ventilator	5) Cylinder heads	a. Check cylinders, pre-combustion chamber and nozzle holes for damage, wear or deformation. b. Check for damaged, worn or deformed valve parts. c. Check contacts between valves and valve seats.	Cylinder head damage inspection
		6) Dynamic valves	a. Check for damaged, worn or deformed parts. b. Check all contact surfaces. c. Check valve clearance.	Camshaft damage inspection
		7) Timing gears	a. Check timing gear chamber for damage or loosened timing gears. b. Check for damaged, worn or loosened gears, shafts or bearings.	
		1) Ventilator manifold	a. Check for damage, corrosion and looseness. b. Check for damaged or loosened intercoolers.	
		2) Supercharger		

ATTACHMENT 2

INSPECTION AND MAINTENANCE OF INTERNAL COMBUSTION LOCOMOTIVES AND INTERNAL COMBUSTION RAIL CARS

1. Individual Inspections

Item(s) to be inspected			Points to be inspected	Method of inspection
1. Drive units	(1) Trucks	1) Truck frame and swing bolster	a. Check for deformed, cracked, or corroded truck frames or swing bolsters. b. Check for damaged or worn moving parts. c. Check for damaged or worn swinging bolster suspenders or swinging bolster pins. d. Check for cracks in the air chamber. e. Check for damage or wear in the reverser or decelerator supports.	
		2) Center plate and side bearings	a. Check for damage or wear to contact surface. b. Check the amount of lubricant.	
		3) Axle box and axle suspension	a. Check for wear, damage, or discoloration of axle bearings and check distance between axles and axle bearings. b. Check amount of and condition of lubricant. c. Check distance between axle box guard and axle box.	Measure distance
		4) Wheels and axles	a. Check for damage to the wheel bases. b. Check shape of wheels: – Diameter of wheels and thickness of tires – Thickness and height of flanges – Buck gauge c. Check for damage to axles.	Measure diameter and thickness Axle damage inspection
		5) Shock absorbers	a. Check for damaged, worn, or deformed springs. b. Check for oil damper leakage and check operation of oil damper. c. Inspection of air pressure spring height valves and differential air pressure valves is to be performed in accordance with directions for inspection of valves under General pneumatic equipment.	
		6) Lifeguard	Check for damage, deformation or looseness.	
		7) Sander	a. Check for damage, wear, or deformation and check to make sure sander is installed properly. b. Inspection of electromagnetic valves is to be performed in accordance with guidelines for inspection of electromagnetic values.	

Item(s) to be inspected			Points to be inspected	Method of inspection
2. Drive train	(1) Engine	1) Crank chamber	a. Check crank chamber for wear, damage, or deformation. b. Check for bent built-in bolts and check condition of screws. c. Check for] damage to crank bearings or cam bearings. d. Check distance between main crank axle and cam shaft bearings. e. Check for damaged or worn cylinder linings. f. Measure distance of protrusion of cylinder linings.	Measure distance Measure dimensions
		2) Crank axles	a. Check for wear, damage, or deformation. b. Check for damaged, worn, or deformed gears or shock absorber joints.	Axle damage inspection
		3) Pistons	a. Check for damage or wear. b. Check to make sure that piston rings are properly attached.	Piston damage inspection
		4) Connecting rods.	a. Check for wear, damage, or deformation. b. Check for wear to connecting rod bearings and check whether they come into contact and are attached properly. c. Check for worn or loosened small-end bushings. d. Check clearance of large ends of connecting rod bearings.	Measure clearance
		5) Cylinder heads	a. Check cylinders, pre-combustion chamber and nozzle holes for damage, wear or deformation. b. Check for damaged, worn or deformed valve parts. c. Check contacts between valves and valve seats.	Cylinder head damage inspection
		6) Dynamic valves	a. Check for damaged, worn or deformed parts. b. Check all contact surfaces. c. Check valve clearance.	Cam shaft damage inspection
		7) Timing gears	a. Check timing gear chamber for damage or loosened timing gears. b. Check for damaged, worn or loosened gears, shafts or bearings.	
	(2) Ventilator	1) Ventilator manifold	a. Check for damage or corrosion and check to make sure manifold is installed properly. b. Check gears, shafts, and bearings for damage or wear and check to make sure they are installed properly.	
		2) Supercharger	a. Check flywheels, shafts, and bearings for damage, wear, or deformation. b. Check supercharger and chamber for damage or deformation.	
		3) Damper and exhaust pipes	Check all parts for damage, corrosion, or deformation, and check to make sure they are installed properly.	
		4) Air filters and air intake vents	a. Check all parts for wear, damage, or deformation. b. Check cutoff for soiling or damage.	

Item(s) to be inspected			Points to be inspected	Method of inspection
	(3) Fuel system	1) Fuel tank, fuel lines, and filter	a. Check fuel tank and fuel lines for corrosion or damage. b. Check filter to see if it is dirty or damaged. c. Check oil level meter to see if it is soiled or damaged. d. Check high-pressure fuel lines for damage or deformation. e. Check all parts for fuel or oil leakage.	
		2) Fuel injection pump	a. Check fuel injection pump for wear, damage, or deformation. b. Check fuel supply pump for damage or wear; check operation of fuel supply pump. c. Check rack drive linker for damage or wear.	
		3) Fuel injection valve	a. Check nozzles and holders for damage or wear. b. Check operation of nozzles and check to make sure that fuel is sprayed properly from nozzles.	
	(4) Fuel control system	1) Speed control unit	a. Check for damage or leaking. b. Check operation.	
		2) Fuel controller	Check for damage or leaking.	
		3) Spark advance system	Check for damage.	
		4) Fuel injection pump drive system	a. Check for damage. b. Check injection time.	
	(5) Oil system	1) Oil lines, valves, and filters	a. Check oil system and gears, shafts, and bearings for damage. b. Check operation.	
		2) Oil pump	a. Check oil system and gears, shafts, and bearings for damage. b. Check operation.	
		3) Oil cooling system	Check for leaking, soiling, or damage.	
	(6) Cooling system	1) Tank, lines, valves, and filters	a. Check tank, lines, and valves for damage or corrosion. b. Check to see if filters are soiled or damaged. c. Check water level meter to see if it is soiled or damaged. d. Check all parts for water leakage.	
		2) Water pump	Check flywheels, gears, shafts, and bearings for damage or wear and check to make sure they are installed properly.	
		3) Fan	a. Check flywheels, shafts, and bearings for damage or wear and check to make sure they are installed properly. b. Check drive shaft, joints, and bearings for damage or wear and check to make sure they are installed properly. c. Check fluid joints and static hydraulic pump for damage or wear and check to make sure they are installed properly. d. Check operation of hydraulic pump.	

Item(s) to be inspected			Points to be inspected	Method of inspection
		4) Radiator	Check for leakage, corrosion, or deformation and check to make sure radiator is installed properly.	
		5) Pre-combustion chamber	a. Check all parts for damage or leakage and check to make sure they are installed properly. b. Check operation.	
	(7) Drive system	Drive system	a. Check to make sure that engine may be started and stopped. b. Check all parts for creaking, vibration, overheating, or leakage. c. Check ventilator, fuel system, fuel control system, oil system, cooling system, and electrical system to make sure that everything is installed and operating properly. d. Operation characteristics.	Load test and fuel control test
3. Drive train system	(1) Liquid transmission		a. Check system, flywheels, and guide flywheels for damage or deformation. b. Check clutch and free wheels for damage or corrosion. c. Check gears, shafts, and bearings for damage or wear. d. Check lines, valves, and filters for damage. e. Check input/output joints for damage or corrosion. f. Check all parts for leakage.	
	(2) Drive shaft		Check shaft, spline, and cross-shaped joints for damage or deformation.	Damage inspection (applies only to spline shaft)
	(3) Reverser and decelerator		a. Check main unit and gears, shafts, and bearings for damage or corrosion. b. Check operation of reverser. c. Check all parts for leakage.	
4. Brakes	(1) Main brakes	1) Levers, rods, etc.	a. Check levers and rods for cracking, wear, or deformation. b. Check moving parts and parts which come into contact with other parts for damage or wear. c. Check brake disks for cracks or wear and check to make sure brake disks are attached properly.	
		2) Brake cylinders (includes brake diaphragms)	a. Check cylinder interior, pistons, and rubber bellows for damage, cracks or wear. b. Check oil level.	
		3) Automatic clearance controller	a. Check all parts for damage, wear, or deformation. b. Check operation.	
	(2) Manual brakes		a. Check moving parts and parts which come into contact with other parts for damage or wear. b. Check operation.	

Item(s) to be inspected			Points to be inspected	Method of inspection
	(3) Air brake controller	1) Brake valves	a. Check moving parts and parts which come into contact with other parts for damage or wear. b. Check contacts between valves and valve seats and check for damaged springs. c. Check for damaged, worn or deformed diaphragms and packing. d. All electrical components are to be inspected in accordance with the directions given in the section on electric controllers.	
		2) Control valves (includes relay and conductor valves)	see above	
		3) Electric air controller	see above	
		4) Load response system	see above	
5. General electrical equipment	(1) Controllers	Main controller, control circuit switch, switches, etc.	a. Check moving parts and parts which come into contact with other parts for damage or wear. b. Check contacts, filaments, and edges for damage or corrosion. c. Check insulation for soiling or damage. d. Check all parts to make sure they are installed properly.	
	(2) Power unit and motor	1) Engine and related equipment	a. Check all parts for damage or wear. b. Check to make sure that engine may be started and stopped. c. Check all parts for creaking, vibration, overheating, or leakage. d. Check ventilator, fuel system, fuel control system, oil system, cooling system, and electrical system to make sure that everything is installed properly.	
		2) Electric power generator	a. Check all parts for damage. b. Check operation. c. Check insulation characteristics.	Insulation and resistance test; insulation endurance test
		3) Energization controller	Check all parts for damage and check to make sure they are installed properly.	
		4) Electric motors (includes starting generator) and charging generators	a. Check for damage and check to make sure that everything is installed properly. b. Check operation. c. Check insulation characteristics.	Insulation and resistance test
		5) Charger	a. Check to make sure charger is installed properly. b. Check operation.	
		6) Batteries	a. Check batteries, wires, and terminals for damage, corrosion, or leakage and check to make sure that they are installed properly. b. Check weight and volume of battery fluid.	

Item(s) to be inspected			Points to be inspected	Method of inspection
	(3) Relays, solenoid valves, and wires	1) Fuses and switches	a. Check contacts for soiling or damage. b. Check to make sure fuses and switches are installed properly.	
		2) Relays and contacts	a. Check insulation for soiling or damage. b. Check moving parts and contacts for damage. c. Check all parts to make sure they are installed properly. d. Check operation.	
		3) Solenoid valves and electronic solenoids	a. Check coils for shorted wires or burning. b. Check for proper contact between valves and valve seats and check for lifted valves. c. Check all parts to make sure they are installed properly. d. Check operation.	
		4) Wiring	a. Check wiring, wiring boxes, and other related equipment for damage and check to make sure everything has been installed properly and connected. b. Check insulation characteristics.	Insulation and resistance test
6. General pneumatic equipment	(1) Air compressor and related equipment	1) Air compressor	a. Check crank chamber, cylinders, and pistons for damage. b. Check for proper contact between valves and valve seats and check for lifted valves. c. Check motor for damage. d. Check oil level and check for water or air leakage. e. Check operation.	
		2) Air pressure controller and air pressure switches	Inspection is to be performed in accordance with the section on brakes (i.e., air brake controllers).	
		3) Safety valves	Check for proper contact between valves and valve seats.	
		4) Dehumidifier	a. Check for any changes in the moisture absorbent. b. Safety valves are to be inspected in accordance with the directions given in the section on solenoid valves under General electrical equipment. c. Exhaust valves are to be inspected in accordance with the directions given in the following item on valves.	
	(2) Valves, air tank, and air lines	1) Supply valves and pressure reduction valves	a. Check for proper contact between valves and valve seats and check for spring damage. b. Check for damaged, worn or deformed diaphragms and packing. c. Check operation.	

Item(s) to be inspected			Points to be inspected	Method of inspection
		2) Other valves	a. All other valves are to be inspected in accordance with the directions given in the item above on valves. b. Electrical components are to be inspected in accordance with the directions given for relays, solenoid valves, and wiring under General electrical equipment.	
		3) Air tank	Check tank and protective fittings for corrosion and check to make sure they are installed properly.	
		4) Air lines	a. Check air lines, hoses, and dust filters for damage and check to make sure they are installed properly. b. Check to make sure that cocks may be opened and closed and check to make sure they are installed properly.	
7. Chassis and interior	(1) Underframe		Check beams and lifting beams for damage, deformation, cracks or corrosion.	
	(2) Car interior and exterior		a. Check roof, floor, exterior surface, interior surface and inter-car plates for damage and corrosion. b. Check windows, shades, passenger seats, sliding doors, manually-operated doors and other fittings for damage and check to make sure that everything is installed properly. c. Check paint for soiling or peeling.	
	(3) Roof		a. Check roof paint for soiling, wear, or peeling. b. Check covers and containers of footplates, fans, and air conditioners and heaters for damage and corrosion and check to make sure they are installed properly.	
	(4) Automatic door closers (including door closing safety devices)		a. Check door closers, belts, arms, links, rollers, and glides for damage, corrosion, or deformation and check to make sure everything is installed properly. b. Electrical components of solenoid valves, door-closing switches, and door safety devices are to be inspected in accordance with the directions given for relays, solenoid valves, and wires under General electrical equipment. c. Check for oil or water leaks in door closers and air lines. d. Check to make sure doors may be opened and closed properly.	
	(5) Lighting		a. Check for damaged lights or light fixtures and check to make sure lights and light fixtures are installed properly. b. Contacts are to be inspected in accordance with the directions given for relays and contacts under General electrical equipment.	

Item(s) to be inspected			Points to be inspected	Method of inspection
8. Other equipment	(1) Signals, intercoms and public address systems	1) Signals (includes whistles and emergency address systems)	Check all parts for damage or soiling and check to make sure they are installed properly.	
		2) Intercom and public address system (includes safety communications systems)	Check all parts for damage and check to make sure they are installed properly.	
	(2) Displays		Check for damaged lights or light fixtures and check to make sure lights and light fixtures are installed properly.	
	(3) Gauges and meters		a. Check for damage and check to make sure that everything is installed properly. b. Check operation of pressure gauges. c. Check operation of speedometer. d. Check operation of electrical gauges and meters (voltage meter, current meter, etc.).	Measure pressure Measure speed
	(4) Couplers	1) Automated couplers (includes rod couplers)	a. Check for cracks, wear, or deformation of couplers, latches, joints, or pins. b. Check internal distance between elbow and arm protector. c. Check operation.	Measure internal distance
		2) Shock absorbers	Check frame, shock absorber springs, auxiliary panels, and auxiliary panel guards for damage, wear, or deformation and check to make sure that everything is installed properly.	
		3) Shanks	Check for damage, wear, or deformation and check to make sure shanks are installed properly.	
		4) Air line couplers	Check hoses and packing for damage or deterioration.	
		5) Wiring couplers	a. Check couplers, insulation, and jumper wires for soiling or damage. b. Check operation.	
	(5) Automatic braking system	1) Brake handle	Check all parts for damage and check to make sure they are installed properly.	
		2) Receiver	Check all parts for damage and check to make sure they are installed properly.	

Item(s) to be inspected		Points to be inspected	Method of inspection
	(6) Emergency braking and emergency protection system	1) Emergency braking system (includes dead-man brake and emergency brakes)	Check all parts for damage and check to make sure they are installed properly.
		2) Emergency protection system (TE)	Check all parts for damage and check to make sure they are installed properly.

2. General Inspection of Electric Locomotives and Electric Cars

Points to be inspected	Method of inspection
(1) Check to make sure that all systems and devices are installed properly.	
(2) Check height of lifeguards and sanders.	Measure height
(3) Check that engine may be started and that engine operates properly.	
(4) Check operation of brakes.	
(5) Check insulation characteristics of electrical circuits other than those using batteries and semiconductors.	Insulation and resistance test; insulation endurance test
(6) Check for air leakage from pneumatic brake controllers and ordinary pneumatic devices.	Measure leakage
(7) Check air compressor capacity and operation of related equipment (e.g., pressure controllers and safety valves).	Measure capacity and check operation
(8) Check angle of inclination of car.	Measure angle of inclination
(9) Check operation of automatic door closers.	Measure angle of inclination
(10) Check operation of lights.	
(11) Check operation of signals, intercoms and public address systems.	
(12) Check operation of displays.	
(13) Check height of couplers.	Measure height
(14) Check operation of automatic braking system and related devices.	Check operation and monitor functioning
(15) Check operation of emergency braking and emergency protection system.	

3. Test Operation of Electric Locomotives and Electric Cars

Points to be inspected	Method of inspection
(1) Starting, acceleration and deceleration (2) Condition of engine when in operation (3) Operation of braking system (4) Creaking, screeching, and vibration (5) Meter and gauge readings (6) Condition of systems and equipment after test operation <ul style="list-style-type: none"> a. Engine leaks b. Overheating or leaking of oil in axle bearings 	

ATTACHMENT 3

PASSENGER CARS, FREIGHT CARS, AND BAGGAGE CARS

Item(s) to be inspected			Points to be inspected	Method of inspection
1. Drive units	(1) Trucks	1) Truck frame and swing bolster	a. Check for deformed, cracked, or corroded truck frames swing bolsters, or supports. b. Check for damage or wear to contact surface. c. Check for damage or corrosion of swing bolsters or swing bolster pins. d. Check for damage to air chamber.	
		2) Center plate and side bearings	a. Check for damage or wear to the contact surface. b. Check the amount of lubricant.	
		3) Axle box and axle suspension	a. Check for wear, damage, or discoloration of axle bearings and check distance between axles and axle bearings. b. Check amount of and condition of lubricant. c. Check distance between axle box guard and axle box.	Measure distance
		4) Wheels and axles	a. Check for damage to the wheel bases. b. Check shape of wheels: <ul style="list-style-type: none"> – Diameter of wheels and thickness of tires – Thickness and height of flanges – Buck gauge c. Check for damage to axles.	Check shape Axle damage inspection

Item(s) to be inspected			Points to be inspected	Method of inspection
		5) Shock absorbers	a. Check for damaged, worn, or deformed springs. b. Check for oil damper leakage and check operation of oil damper. c. Inspection of air pressure spring height valves and differential air pressure valves is to be performed in accordance with directions for inspection of valves under General pneumatic equipment.	
2. Brakes	(1) Main brakes	1) Levers, rods, etc.	a. Check levers and rods for cracking, wear, or deformation. b. Check moving parts and parts which come into contact with other parts for damage or wear.	
		2) Brake cylinders (includes brake diaphragms)	a. Check cylinder interior, pistons, and rubber bellows for damage, cracks or wear. b. Check oil level.	
		3) Automatic clearance controller	a. Check all parts for damage, wear, or deformation. b. Check operation.	
	(2) Manual brakes		a. Check moving parts and parts which come into contact with other parts for damage or wear. b. Check operation.	
	(3) Air brake controller	1) Control valves (includes relay and conductor valves)	a. Check moving parts and parts which come into contact with other parts for damage or wear. b. Check contacts between valves and valve seats and check for damaged springs. c. Check for damaged, worn or deformed diaphragms and packing.	
		2) Load response system	see above	
3. General electrical equipment	(1) Power unit and motor	1) Drive shaft power generator	a. Check all parts for damage and check to make sure that everything is installed properly. b. Check operation. c. Check insulation characteristics.	Insulation and resistance test
		2) Engine and related equipment	a. Check all parts for damage or wear. b. Check to make sure that engine may be started and stopped. c. Check all parts for creaking, vibration, overheating, or leakage. d. Check ventilator, fuel system, fuel control system, oil system, cooling system, and electrical system to make sure that everything is installed properly. e. Check operation.	
		3) Electric power generator and fans	a. Check all parts for damage. b. Check operation. c. Check insulation characteristics.	Insulation and resistance test; insulation endurance test

Item(s) to be inspected			Points to be inspected	Method of inspection
		4) Energization controller	Check all parts for damage and check to make sure they are installed properly.	
		5) Auxiliary transformer	a. Check to make sure that auxiliary transformer is installed properly. b. Check insulation characteristics.	Insulation and resistance test; insulation endurance test
		6) Rectifiers (includes chargers)	a. Check all parts for damage. b. Check operation. c. Check insulation characteristics.	Insulation and resistance test
		7) Batteries	a. Check batteries, wires, and terminals for damage, corrosion, or leakage and check to make sure that they are installed properly. b. Check weight and volume of battery fluid.	
4. General pneumatic equipment	(1) Air compressor and related equipment	1) Air compressor	a. Motors are to be inspected in accordance with the directions given under General electrical equipment and under Motor power generators and Motor fans. b. Check all parts for damage or wear. c. Check oil level and check for oil or air leaks. d. Check operation.	
		2) Air pressure controller and safety valves	a. Check all parts for damage or wear. b. Check operation.	
	(2) Valves, air tank, and air lines	1) Supply valves and pressure reduction valves	a. Check for proper contact between valves and valve seats and check for spring damage. b. Check for damaged, worn or deformed diaphragms and packing. c. Check operation.	
		2) Other valves	a. All other valves are to be inspected in accordance with the directions given in the item above on valves. b. Electrical components are to be inspected in accordance with the directions given for relays, solenoid valves, and wiring under General electrical equipment.	
		3) Air tank	Check tank and protective fittings for corrosion and check to make sure they are installed properly.	
		4) Air lines	a. Check air lines, hoses, and dust filters for damage and check to make sure they are installed properly. b. Check to make sure that cocks may be opened and closed and check to make sure they are installed properly.	
5. Chassis and interior	(1) Underframe		Check beams and lifting beams for damage, deformation, cracks or corrosion.	

Item(s) to be inspected			Points to be inspected	Method of inspection
	(2) Car interior and exterior		<ul style="list-style-type: none"> a. Check roof, floor, exterior surface, interior surface and inter-car plates for damage and corrosion. b. Check windows, shades, passenger seats, sliding doors, manually-operated doors and other fittings for damage and check to make sure that everything is installed properly. c. Check sliding doors, fan doors, opening doors, and latches for damage and check to make sure that everything is installed properly. d. Check paint for soiling or peeling. e. Check tank and other fixtures for damage or corrosion and check to make sure they are installed properly. 	
	(3) Roof		<ul style="list-style-type: none"> a. Check roof paint for soiling, wear, or peeling. b. Check covers and containers of fans, and air conditioners and heaters for damage and corrosion and check to make sure they are installed properly. 	
	(4) Automatic door closers (including door closing safety devices)		<ul style="list-style-type: none"> a. Check door closers, arms, links, rollers, and glides for damage, corrosion, or deformation and check to make sure everything is installed properly. b. Electrical components of solenoid valves, door-closing switches, and door safety devices are to be inspected in accordance with the directions given for relays, solenoid valves, and wires under General electrical equipment. c. Check for oil or water leaks in door closers and air lines. d. Check to make sure doors may be opened and closed properly. 	
	(5) Lighting		<ul style="list-style-type: none"> a. Check for damaged lights or light fixtures and check to make sure lights and light fixtures are installed properly. b. Contacts are to be inspected in accordance with the directions given for relays and contacts under General electrical equipment. 	
6. Other equipment	(1) Signals, intercoms and public address systems	1) Signals (includes emergency address systems)	Check all parts for damage or soiling and check to make sure they are installed properly.	
		2) Intercom and public address system	Check all parts for damage and check to make sure they are installed properly.	
	(2) Displays		Check for damaged lights or light fixtures and check to make sure lights and light fixtures are installed properly.	
	(3) Gauges and meters		<ul style="list-style-type: none"> a. Check for damage and check to make sure that everything is installed properly. b. Check operation of pressure gauges. d. Check operation of electrical gauges and meters (voltage meter, current meter, etc.). 	Check operation of pressure gauges

Item(s) to be inspected			Points to be inspected	Method of inspection
	(4) Couplers	1) Automated couplers (includes rod couplers)	a. Check for cracks, wear, or deformation of couplers, latches, joints, or pins. b. Check internal distance between elbow and arm protector. c. Check operation.	Measure internal distance
		2) Shock absorbers	Check frame, shock absorber springs, auxiliary panels, and auxiliary panel guards for damage, wear, or deformation and check to make sure that everything is installed properly.	
		3) Shanks	Check for damage, wear, or deformation and check to make sure shanks are installed properly.	
		4) Air line couplers	Check hoses and packing for damage or deterioration.	
		5) Wiring couplers	a. Check couplers, insulation, and jumper wires for soiling or damage. b. Check operation.	
	(5) Container emergency device		Check all parts for damage, wear, or deformation and check to make sure that all parts are installed properly.	

2. General Inspection of Electric Locomotives and Electric Cars

Points to be inspected	Method of inspection
(1) Check to make sure that all systems and devices are properly installed.	Measure leakage
(2) Check for air leakage from pneumatic brake controllers and ordinary pneumatic devices.	
(3) Check operation of brakes.	
(4) Check insulation characteristics of electrical circuits other than those using batteries and semiconductors.	Insulation and resistance test; insulation endurance test
(5) Check angle of inclination of car and side bearing clearance.	
(6) Check operation of automatic door closers.	
(7) Check operation of lights.	Measure angle of inclination
(8) Check operation of signals, intercoms and public address systems.	
(9) Check operation of displays.	
(13) Check height of couplers.	Measure height

3. Test operation of electric locomotives and electric cars

Points to be inspected	Method of inspection
(1) Creaking, screeching, and vibration	
(2) Overheating of axle bearings and leaking of oil from axle bearings after test operation	

5.3 Japanese Voluntary National Standards of Railway Sectors

(1) Track General

E1001	Glossary of terms for permanent way
E1101	Rails
E1102	Fish plates for rails
E1103	Light rails
E1104	Fish plates for light rails
E1107	Fish bolts and nuts
E1108	Rail spikes
E1109	Railway track screw spike
E1110	Tie plates
E1111	Anti-creepers
E1115	Spring washers for fish plates
E1116	Compromise fish plates for rails
E1117	Resilient sleeper pads for shock-absorbing
E1118	Rail fastenings for prestressed concrete sleeper
E1120	Heat hardend rails
E1122	Compromise rails
E1123	End hardend rails
E1125	Glued insulated rails
E1126	Elastic joint
E1201	Pretensioning type prestressed concrete sleepers
E1202	Post-tensioning type prestressed concrete sleepers
E1301	Turnout number
E1303	Railway turnouts and crossing
E1304	Dimension of turnouts and crossings
E1305	Railway's switches – Shape and dimensions
E1306	Railway crossings – Shape and dimensions
E1307	Guards for turnouts and crossings- Shape and dimensions
E1311	Railway – Turnouts and crossings – Vocabulary
E1501	Spike hammers
E1505	Single ended wrenches for track service
E1507	Track gauges

(2) Electric Contact Line and Substation

E2001	Overhead contact lines – Fittings – vocabulary
E2002	Overhead contact lines – Fittings – Test methods

E2101	Hard drawn grooved trolley wires
E2102	Hard drawn copper round trolley wires
E2201	Overhead contact lines - Fittings
E2219	Overhead contact lines - Section insulators
E2220	Overhead contact lines – Connecting sleeves of stranded conductors
E2301	Insulator for electric overhead line

(3) Signalling and Safety Appliance

E3001	Test methods for electric point machines
E3002	Electro – pneumatic points machines- Test methods
E3003	Testing methods for railway signal relay
E3004	Inspection of relay interlocking machines
E3005	Test methods for frequency shift type automatic train stop
E3006	Test methods for commercial frequency track circuit type automatic train stop
E3007	Test methods for continuous induction type automatic train control
E3011	Lettered symbols for railway signaling
E3012	Graphical symbols for railway signaling
E3013	Glossary of terms for railway signaling
E3014	Parts for railway signal – Vibration test methods
E3015	Parts for railway signal – Shock test methods
E3016	Performance test methods for motor-operated barriers
E3017	Parts for railway signaling – Waterproof test methods
E3018	Railway signaling equipment – Impedance bonds – Test methods
E3019	High and low temperature testing methods for parts of railway signaling
E3020	Change of temperature testing method for parts of railway signalling
E3021	Insulation resistance and withstand voltage testing methods of parts for railway signaling
E3022	Testing methods of permissible interference values for track circuit device
E3023	Insulating materials of insulated rail joint – test methods
E3031	General rules of colour identification and registering means for railway signal relay
E3101	Instrument cases for railway signaling
E3101	Instrument cases for railway signaling
E3103	650 VA track and signal lamp transformers
E3104	Railway signal – Connecting terminals
E3301	Point indicators
E3302	Point indicator lights

E3303	Lenses, filters, reflectors and semi-sealed units for railway signals
E3304	Multiple light type color light signals
E3305	Temporary signals
E3307	Train and car stop indicators
E3308	Car stop marker
E3309	Railway- Calling-on signals
E3310	Way side repeating signals
E3311	Route indicators
E3313	Position light shunting signals
E3351	Gauge ties for railway signaling
E3601	Rail bonds
E3602	Signal bonds
E3603	Impedance bonds
E3604	Lead wires for impedance bonds
E3701	Railway crossing equipment – Safety colour code
E3702	Out of order indicators for level crossing signal
E3703	Train proceeding direction indicator
E3704	Operating switch for obstruction warning device of level crossing

(4) Rolling Stock General

E4001	Railway rolling stock – Vocabulary
E4010	Symbols for railway rolling stock and railway rolling stock parts
E4011	Measuring methods for mass of railway rolling stock
E4014	Test methods for insulation resistance and withstand voltage of railway rolling stock
E4015	Measuring methods for air conditioning and heating temperature of railway rolling stock
E4016	Illuminance for railway rolling stock – Recommended levels and measuring methods
E4017	Railway rolling stock – Graphical symbols for electrical apparatus
E4018	Railway rolling stock – Measuring methods of leakage magnetic field
E4021	Railway rolling stock – Test methods inside noise
E4022	Railway rolling stock – Test methods for waterproof
E4023	Vibration characteristics of railway rolling stock – Measuring methods
E4024	Railway rolling stock – Test methods of ventilation
E4031	Railway rolling stock parts – Test methods for vibration
E4032	Railway rolling stock parts – Test methods for shock

E4034	Railway rolling stock parts – Test methods of resistibility for moisture and rainfall
E4035	Railway rolling stock – High and low temperature test methods of parts
E4036	Railway rolling stock component parts – General rules for dust test
E4041	General rules for the inspection of electric railcar on completion of construction
E4042	General rules for the inspection of electric locomotives on completion of construction
E4043	General rules for the inspection of diesel railcar on completion of construction
E4044	General rules for the inspection of diesel locomotives on completion of construction
E4045	Freight cars – General requirements for the inspection on completion of construction
E4046	General rules for the inspection of passenger car on completion of construction
E4047	Design methods of arc welded joints for railway rolling stock
E4048	Railway rolling stock – Spot welded joints of mild steel – Design methods
E4049	Welded joints of stainless steel for railway rolling stock – Design methods
E4050	Welded joints off aluminum alloy for railway rolling stock – Design methods
E4101	Drain cocks for railway rolling stock
E4102	Angle cocks for railway rolling stock
E4103	Cut-out cocks for railway rolling stock
E4105	Three-way cocks for railway rolling stock
E4106	Railway rolling stock – Screwed type pipe fittings
E4111	Clevis pins with head for railway rolling stock
E4112	Steel bushes and sintered metallic bushes for railway rolling stock
E4113	Railway rolling stock – Split cotters
E4115	Magnet valves for railway rolling stock
E4116	Pneumatic window wipers for railway rolling stock
E4117	Leveling valves for railway rolling stock
E4118	Bourdon tube pressure gauges for railway rolling stock
E4119	Polyurethane bushes for railway rolling stock
E4201	Railway rolling stock – Automatic couplers
E4202	Jumper couplers
E4203	Railway rolling stock – Tight lock couplers
E4202	Jumper couplers

E4203	Railway rolling stock – Tight lock couplers
E4204	Rubber draft gears for railway rolling stock
E4205	Oil dampers for railway rolling stock
E4206	Spring rigging for railway rolling stock
E4207	Truck frames for railway rolling stock – General rules for design
E4208	Test methods of static load for track frames and truck bolsters of railway rolling stock
E4301	Air hose couplings
E4302	Dummy hose couplings
E4303	Packing rubbers for hose couplings
E4306	Conductor's valves for railway rolling stock
E4307	Air reservoirs for railway rolling stock
E4308	Railway rolling stock – Air filters
E4309	Composition brake shoes for railway rolling stock
E4310	Sintered metallic filter elements for railway rolling stock
E4501	Railway rolling stock – Design methods for strength of axles
E4502	Axles for railway rolling stock
E4504	Wheel sets for railway rolling stock
E4603	Electric speedometer equipment for railway rolling stock
E4704	Grease seals for railway rolling stock
E4710	Railway rolling stock – Rubber vibration isolators – General requirement
E4901	DC fuses for railway rolling stock
E4902	Knife switches for railway rolling stock

(5) Motive Power (Rolling Stock)

E5001	Methods of test for line breakers of railway rolling stock
E5002	Air compressors for railway rolling stock – Test methods
E5003	Test methods for direct current surge arresters of railway rolling stock
E5004	Control equipment for electric rolling stock- Test methods
E5005	Railway rolling stock – High speed circuit breaker – Test methods
E5006	General rules for tests of electronic equipment used on railway rolling stock
E5007	Test methods of traction transformers for railway rolling stock
E5008	Main rectifiers for railway rolling stock – Test methods
E5009	Traction reactors of railway rolling stock – Test methods
E5301	Railway rolling stock – Radiator element – Inspection methods
E5302	Propeller shafts for railway rolling stock
E5303	Test methods for diesel engines of railway rolling stock
E5401	Carbon steel tyres for railway rolling stock

E5402	Solid rolled wheels for railway rolling stock
E5501	Air whistles for railway rolling stock
E6001	DC electric railcar – Wire code & symbol
E6002	General rules for performance of electric railcars for commuter use
E6003	General rules for design of driving cabs of electric commuter cars
E6004	Electric rolling stock- General rules for performance tests
E6005	Railway rolling stock – Automatic train control and automatic train stop device on board – Test methods
E6101	Methods of test for DC traction motors of railway rolling stock
E6102	AC traction motors of railway rolling stock – Test methods
E6201	General rules of choppers for electric rolling stock
E6202	Electromagnetic relays for railway rolling stock – General requirement
E6301	Contact strips for pantograph
E6302	Pantographs of railway rolling stock – Inspection methods
E6401	Ohmic resistors for railway rolling stock
E6501	Door engines for railway rolling stock
E6502	Door close switches for railway rolling stock
E6601	Railway rolling stock – Auxiliary rotating electrical – Test methods
E6602	Cooling unit apparatus for electric cars
E6801	Jumper cables for railway rolling stock

(6) Railway Carriage and Wagons

E7101	Tank cars
E7102	Design methods for tanks of tank cars
E7103	Electric railcars for commuter use – General requirement for design of bodies
E7104	Seats for passengers of railway rolling stock
E7105	Test methods static load for body structures of railway rolling stock
E7501	Railway rolling stock – Cast iron brake shoes
E7701	Safety valves for high pressure gas tank car tanks