3 Power supply

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Chapter 6　Power Supply Equipment

Section 6 Contact line facilities

Article 44　Installation, etc. of Contact Lines, etc.

1-1 Contact lines shall be installed by the overhead single-line system or overhead double-line system. However, for ordinary railways in underground type structure, elevated type structure, and those on dedicated sites where people cannot easily enter, the third-rail method may be adopted, and for suspended type railways, straddled type railways, guide-rail type railways, and levitation railways, the rigid double-line system may be employed.

1-2 The auto-transformers (excluding those installed at substations) of the 2×25kV (AT) feeding system, and the apparatuses and wires belonging to those, shall be installed in such a manner that people cannot easily touch them.

1-3　The installation method for wires designed to supply electricity from substations to auto-transformers (except for contact lines and feeders. Hereinafter, referred to as "Auxiliary feeders") shall be subject to the rules on the installation method for AC overhead feeders.

1-4　The auxiliary feeders shall not be connected to any other load facilities except the auto-transformers

1-5　The installation method for AT feeding circuit protective wires shall be subject to the rules on the installation method for AC negative feeders.

1-6　For the supports of overhead contact lines and feeder lines located over a platform, the footstep fittings to be used by the handling persons for going up and down shall not be installed at less than 1.8m above the platform, except when any of the following items applies:

(1) When a support so structured as to be able to accommodate footstep fittings inside is installed.

(2) When a support is provided with a device designed to prevent climbing.

(3) When a fence, enclosure, etc. is provided around the support, so that none other than the handling persons can enter.

(4) When no one can climb a top by the platform shelter, etc.

1-7　Third-rails shall be installed in accordance with the following rules:

(1) Third-rails shall be provided with guard equipments to prevent people from touching them easily, and the gap between the third-rails and the guard equipment (limited to top guard plates) shall be 75mm or more.

(2) At a station, third-rails shall be installed on the other side of the platform. However, this rule does not apply in the case where there is an inevitable reason because of the structure of the station, and top guard plates and front guard plates are provided, or where passengers are not likely to suffer electric shock due to the presence of a platform door or other facilities.

1-8　The plus conductor lines of the rigid double-line system of the straddled type railways, guide-rail type railways, and levitation railways shall be installed on the other side of the platform at their stations. However, this rule does not apply in the case where top guard plates and front guard plates are provided, or where passengers are not likely to suffer electric shock due to the presence of a platform door or other facilities.

1-9 Feeders (excluding overhead feeders. The same in 1-9) in long tunnels (tunnels constructed in the underground of urban areas with length exceeding 1.5km each, tunnels constructed in other locations than the underground of urban areas, with length exceeding 2km each, and tunnels in which stations are located with station-to-station distance (referred to as the platform-end distance) or distance between the tunnel end and the platform end of the nearest station exceeding 1km. The same in 1-11) must be installed in accordance with the following rules:

(1) The wires to be employed shall be cables consistent with the voltage to be used.

(2) The feeders shall be provided with any of the flame-resistant measures listed below:

a) The cables with flame-resistant or self-extinguishing flame-retardant coverings shall be employed.

b) The cables shall be covered with a flame-resistant or self-extinguishing flame-retardant tape, sheet, paint that prevents spread of fire, or other material similar to those.

c) The cables shall be installed accommodated inside flame-resistant or self-extinguishing flame-retardant pipes or troughs.

1-10 "Flame-resistance" and "Self-extinguishing flame-fire retardancy" as mentioned in 1-9 (2) shall be specified as of bellows

(1) Flame-resistance

Products manufactured from flame-resistant materials specified under Article 2, No. 9, of the Building Standards Law or those with performance equal to or better than those.

(2) Self-extinguishing flame-fire retardancy

a. In the case of the coverings of wires, or tapes, sheets, paints that prevent spread of fire, and other products similar to those:

The products shall pass the flame-resistance test specified in Annexed Table No. 21, Appendix No. 1, of the Ministerial Ordinance establishing the technical standards of electrical appliances (Ministerial Ordinance No. 85 of the Ministry of Trade and Industry, 1962), or shall have performance equal to or better than those.

b. In the case of pipes and troughs:

The products shall pass the flame-resistance test specified in Annexed Table No. 24, Appendix No. 2, of the Ministerial Ordinance establishing the technical standards of electrical appliances, or shall have performance equal to or better than those.

1-11 In the cases where feeders (excluding overhead feeders. Referred to as "Feeders" in 1-11) laid in a long tunnel come close to or cross other feeders, transmission/distribution lines, weak-current lines, etc., or water pipings, the separation distance shall be equal to or larger than the values indicated further below, except when any of the following items applies:

(1) When sturdy fire-resistant partitions are provided between feeders and other feeders, transmission/distribution lines, weak-current lines, etc., or water pipings.

(2) In the case where feeders come close to or cross weak-current lines, etc. and where the said feeders are accommodated inside a strong flame-resistant or self-extinguishing flame-retardant pipe or trough, and the said pipe or trough is so installed that it will not come into direct contact

with the said weak-current lines, etc.

(3) In the case where feeders come close to or cross weak-current lines, etc., and where the said weak-current lines, etc., are fiber-optic cables covered with flame-resistant or self-extinguishing flame-retardant material, or fiber-optic cables accommodated inside a flame-resistant or self-extinguishing flame-retardant pipe or trough.

(4) In the case where feeders come close to or cross weak-current lines, etc., and where the said feeders are of low voltage, and the said weak-current lines, etc. are provided with the flame-resistant measure conforming to 1-9 (2).

(5) In the case where feeders come close to or cross weak-current lines, etc., and where the high-voltage or extra-high-voltage feeders are so installed that they will not come into direct contact with weak-current lines, etc. that are provided with the flame-resistant measure conforming to 1-9 (2).

(6) In the case where feeders come close to or cross a water piping, and where the said feeders are accommodated inside a strong flame-resistant or self-extinguishing flame-retardant pipe or trough.

(7) In the case where feeders come close to or cross other feeders or transmission/distribution lines, and where either of the following rules applies in each case:

a. When the feeders have self-extinguishing flame-retardant coverings.

b. When the feeders are accommodated inside a strong self-extinguishing flame-retardant pipe or trough.

(8) In the case where feeders come close to or cross other feeders or transmission/distribution lines, and where either of them have flame-resistant coverings.

(9) In the case where feeders come close to or cross other feeders or transmission/distribution lines, and where either of them are accommodated inside a strong flame-resistant pipe or trough.

other wire, water piping / Feeder	Feeder laid inside tunnel, etc.			Transmission/ distribution line laid inside tunnel, etc.	Weak-current line, etc., laid inside tunnel, etc.		Water piping laid inside tunnel, etc.
	Extra-high-voltage	High-voltage	Low-voltage		Ordinary cases	When less than 170kV is involved and the consent of the administrator of weak-current lines, etc. is obtained.	
Extra-high-voltage		0.15	0.15	0.15	0.15	0.1	0.15
High-voltage	0.15		0.15	0.15	0.15	0.1	0.15
Low-voltage	0.15	0.15		0.15	Must not touch	Must not touch	Must not touch

1-12 "Flame-resistance" and "Self-extinguishing flame-fire retardancy" as mentioned in 1-11 shall respectively be as specified below:

(1) Flame-resistance

Flame-resistant materials of Article 2, No. 9, of the Building Standards Law, or those with performance equal to or better than those.

(2) Self-extinguishing flame-fire retardancy

1) In the case of coverings of feeders or transmission/distribution lines

These coverings shall pass the combustion test of IEEE Std. 383-1974, or shall have performance equal to or better than those.

2) In the case of coverings of fiber-optic cables

These coverings shall pass the flame-resistance test of Annexed Table No. 21, Appendix No. 1, of the Ministerial Ordinance establishing the technical standards of electrical appliances.

3) In the case of pipes or troughs

These articles shall pass the flame-resistance test of Annexed Table No. 24, Appendix No. 2, of the Ministerial Ordinance establishing the technical standards of electrical appliances, or shall have performance equal to or better than those. However, pipes that are commercialized as double pipes shall pass the test of 1. (4), Appendix No. 2, of the Ministerial Ordinance establishing the technical standards of electrical appliances.

2-1 The height above rail top of overhead single-line system contact lines of ordinary railways (excluding high speed railways) shall be 5m as the standard, but not less than 4.4m at D.C., not less than 4.57m at A.C., or not less than 4.8m when the contact lines are installed over a level crossing road. Besides, the height in each case shall be one that results from adding 400mm to the maximum of the heights of cars traveling with their power collection devices folded down, or larger. However, in the cases indicated in (1) and (2) below, the height may be reduced to the respective specified values:

(1) When any of the following applies (excluding locations corresponding to (2) below). Height resulting from adding 400mm to the maximum of the height of cars traveling with their power collection devices folded down.

1) Railways where people cannot enter, such as those mainly in underground type structure, elevated type structure, etc.

2) Tunnels, overbridges, bridges, platform shelter eaves, and other places where structures similar to those are located, and locations adjacent to those.

(2) In the case of the location specified in (1) 2) , and besides, a level crossing road, the DC overhead contact lines shall be at a height of 4.65m or more, and besides, a height resulting from adding 400mm to the maximum of the heights of cars traveling with their power collection devices folded down.

(3) In any of the following cases, "400mm" specified in 2-1 may be reduced down to 250mm (150mm, if such a measure is taken that load current is not cut off with pantographs on a DC overhead contact line).

1) When the two mentioned below are provided:

(a) Device that allows communication with substation or power supply dispatcher office from the inside

of any train or car.

(b) Interlinked circuit breaker located on the feeding side of a substation and capable of stopping the feeding of the substation that feeds power to the feeding area.

2) When such an automatic circuit-breaker or failuer selective device is provided on the feeding side of a substation as can detect current that flows through the feeding circuit of the said substation when the overhead electric lines are arc-grounded (hereinafter, referred to as "failure current") and stop the said feeding.

3) When such an automatic circuit-breaker, or failure selecting device, and interlinked circuit breaker is provided on the feeding side of a substation as can detect fault current at any of the substations feeding the feeding area and stop the feeding of all the substations feeding the said feeding area.

2-2 When AC overhead contact lines are laid over a level crossing road with vehicular traffic, a beam or span wire shall be provided on both sides of the lines and above the road, and a danger marking shall be posted on them.

2-3 The height above the road surface of the beam or span wire mentioned in 2-2 shall be of a value that results from subtracting 50cm (30cm, if a beam in copper lattice structure or a beam having strength equal to or larger than that is used) from the height above the rail top of the contact lines.

2-4 The height of overhead feeders shall conform to the following standards:

(1) When overhead feeders cross a railway or track, they shall be at 5.5m or more above the rail top.

(2) When overhead feeders cross a road (excluding level crossing roads), they shall be at 6m or more above the road surface.

(3) When overhead feeders cross a level crossing road, their height above the level crossing road surface shall be that of the contact lines (5m, if that height is less than 5m) or higher.

(4) When overhead feeders are installed above a pedestrian bridge or platform, the following rules shall be complied with, except when a roof or other protective facility is installed between the overhead feeders and the pedestrian bridge or platform.

1) If they are AC feeders (excluding negative feeders. The same as standard 6-3, 6-4, 6-6, and 6-7 relating to regulation 6, Standard 8-2 relating to regulation 8), they shall be at 5m or more above the foot walk surface or platform surface.

2) If they are overhead feeders whose standard voltage is 1,500VDC or AC overhead negative feeders, they shall be at 4m or more above the foot walk surface or platform surface (3.5m, if cables or insulated wires for high voltage (meaning a voltage of 750VDC, or over 600VAC up to 7,000VAC. The same hereinafter) (hereinafter referred to as "Insulated high-voltage wires") are employed).

3) If they are overhead feeders whose standard voltage is 750VDC or 600VDC, they shall be at 3.5m or more above the foot walk surface or platform surface (3m, if cables or insulated high-voltage wires are employed).

(5) In the cases except for 2-4 (1) through (4), the height shall be 5m or more above the ground surface. However, when the feeders are installed inside a tunnel, overbridge, or at a location where structures similar to those exist, and when there is an absolutely necessary reason, their height may be reduced down to 3.5m above the ground surface.

2-5 The height of contact lines of high speed railways shall be 5m as the standard, but not less than 4.8m.

2-6 The height above the ground surface of rigid double-line system conductor lines of the straddled type railways and levitation railways shall be 5m or more. However, if the conductor lines are installed at other locations than road sites, and are provided with underside guard plates, their height may be reduced to below 5m, but not less than 3.5m. If guard fences are provided to block people from entering the dedicated site and, besides, guard plates are provided on all sides or guard plates are provided at other parts than the power collection surface of the plus conductor lines, and besides, such a measure is adopted as may prevent people from approaching easily when voltage is applied, then their height may be less than 3.5m.

3-1 The contact lines at the main line of the overhead single-line system (excluding those of overhead rigid conductor system) shall be grooved hard-drawn copper wires with nominal cross-sectional area of 85mm2 or more (with nominal cross-sectional area of 110mm2 or more on high speed railways) conforming to the standards of the Japanese Industrial Standard "Hard-drawn copper grooved contact wires," or their equivalent.

3-2 The suspension method for overhead single-line system contact lines shall be the catenary system, except when any of the following rules applies to other railways than high speed railways:

(1) When the conductor lines are suspended by the overhead rigid conductor system in a section where trains travel at a speed of 90km/h or less (130km/h or less, if conductor lines and pantographs applicable to high-speed run are employed).

(2) When the contact lines are suspended by the direct suspension method that is engineered to give the contact lines a tension of 9.8kN or larger by means of an automatic tension adjusting device, and also to hardly allow the power collection device to lose contact at the support points of the contact lines, in a section where trains travel at a speed of 85km/h or less.

(3) When the contact lines are suspended by the direct suspension method that is engineered to give the contact lines such a tension as limits the maximum sag to 50mm or less with respect to a support point spacing of 15m, in a section where trains travel at a speed of 65km/h or less and the support points of the contact lines are spaced at an interval of 15m or less.

(4) When the contact lines are suspended by the direct suspension method in a section where trains travel at a speed of 50km/h or less.

3-3 When contact lines are suspended by the catenary system, they shall be installed in accordance with the following rules:

(1) The suspension system shall be consistent with the operation speed of trains.

(2) Droppers shall be spaced at an interval of 5m as the standard.

(3) The contact lines and catenary wires shall be provided with tensioning devices (automatic tensioning devices on the overhead contact lines of high speed railways main line) at an appropriate interval.

3-4 The conductor lines of the overhead rigid conductor system and third-rails or rigid double-line system shall be installed in accordance with the following rules:

(1) The support points shall be spaced at an interval of 7m or less for the conductor lines of the overhead rigid conductor system, or 5m or less for the conductor lines of the rigid double-line system and third-rails.

(2) Expansion joints and anchor shall be placed at an appropriate interval.

(3) Each end shall be provided with a ramp, etc., and so structured as not to hinder the sliding motion of collectors.

3-5 Deviation of the conact lines of the overhead single-line system shall be covered within 250mm (within 300mm on high speed railways) from the center plane of the track vertical to the rail surface in a section where pantographs are used as power collection devices, except in the following cases:

(1) When the deviation of two of the four contact lines is covered within 250mm in a division of double-contact wires contact lines, such as, those of the twin simple-catenary system, and is not likely to adversely affect the power collection devices.

(2) When the power collection devices are not likely to be dislocated from the contact lines in a division of three-rail track contact lines, and the deviation is not likely to adversely affect the power collection devices.

3-6 The gradient of the contact lines of the overhead single-line system shall be 5/1000 in the case where the contact lines are suspended by the catenary system or overhead rigid conductor system in a section where trains travel at a speed over 50km/h, or 15/1000 in other cases (3/1000 or less on high speed railways regardless of its speed). However, contact lines on the side track may have a gradient of 20/1000 or less (15/1000 or less on high speed railways).

3-7 Supports for the contact lines of the overhead single-line system or overhead double-line system shall be installed in accordance with the following rules:

(1) The distance from one support to another shall be 45m (60m, if the structure specified in 3-2 (2) is adopted) when the contact lines are suspended by the direct suspension method, or 60m when the contact lines are suspended by the simple catenary system, or 80m or less when the contact lines are suspended by the compound catenary system.

(2) Supports for contact lines shall be installed with the following safety factors against the predictable maximum wind pressure load, tensions, etc. arising from the contact lines, and so forth:

1) For wooden masts, 3 or more against breaking load at the time of new installation.

2) For concrete masts, 2 or more against breaking load.

3) For metal masts, metal towers, beams and brackets, 1 or more against the permissible stress of the material.

(3) The depth of embedment of wooden masts or concrete masts shall be 1/6 or more of their overall length, and the masts shall be provided with strong guy anchors at locations of soft ground. However, this rule does not apply when concrete or its equivalent is used for their foundations, and besides, a safety factor of 2 or more is adopted against pull-up force, compressive force and overturning moment arising from the supports.

(4) For the foundations of metal masts or metal towers, a safety factor of 2 or more shall, respectively,

be adopted against pull-up force, compressive force and overturning moment arising from the supports.

(5) If the support at a curved part is a single mast, stay shall be provided, except when a safety factor of 2 or more is adopted for the foundation.

3-8 For the messenger wires and main span wires laid by the catenary system and for the main span wires laid by the direct suspension method, a safety factor of 2.5 or more shall be adopted against tensile force.

3-9 Stays shall be installed in accordance with the following rules:

(1) A safety factor of 2.5 or more shall be adopted for tensile force.

(2) When stranded wires are employed, these shall consist of three or more wires stranded. However, except when stays are provided for wooden posts, their underground parts and parts up to 30cm above the ground shall consist of galvanized iron bars or bars of any other material having strength and durability equal to or better than those, and these bars shall be attached to stay blocks, etc.

(3) The wires shall be metal wires of 2mm or more in diameter and with tensile strength of 690N per square mm or more.

(4) When stays are likely to touch overhead lines, they shall be protected to avoid trouble to others due to contact.

(5) The stays to be provided for a concrete post or metal post shall not share a strength equivalent to one half or more of the strength against maximum wind pressure load to be possessed by that concrete post or metal post in accordance with the provision of 3-7 (2).

(6) The stays to be provided for a metal tower shall not share the strength to be possessed by that metal tower in accordance with the provisions of 3-7 (2) and (4) .

4-1 When contact lines with different standard voltages, etc. are installed, a dead section, etc. shall be provided to prevent contact fault due to an electric confusion.

5-1 The railway companies shall establish the standard voltages for contact lines.

5-2 The standard voltages of contact lines established in 5-1 shall be maintained at values necessary to secure the operation of trains.

5-3 The table below gives the standard voltages of contact lines, by way of example, according to the types of railways.

Type of railways	Installation methods	Standard voltage of contact lines
Ordinary railway	Overhead single-line method	1,500VDC 25,000VAC, single-phase(same as high speed railways)
	Third rail	750VDC
Suspended type railway, straddled type railway, and levitation type railway	Rigid double-line system	1,500VDC following
Guide-rail type railway	Rigid double-line system	750VDC following 600VAC following, three-phase
	Overhead single-line system	1,500VDC following

Article 45 Approach or Crossing of Overhead Contact Lines, etc.

6-1 The distance of separation of the power-applied portions of overhead contact lines or overhead feeders from other electric lines, structures, etc. (excluding 2. through 5.) shall be of the value specified in the table , or larger. However, in the cases listed in (1) through (4) below, values larger than those established in each case may be adopted. (table abbreviation)

(1) When the power-applied portions of DC overhead contact lines, or overhead feeders or AC overhead negative feeders are accommodated in protective gear, the distance of separation of the power-applied portions of the overhead contact lines or overhead feeders from signals, signs, and other similar structures shall be 0.6m.

(2) When DC overhead feeders or AC overhead negative feeders are accommodated in protective gear, the distance of separation between the overhead feeders and a level crossing barrier having insulating property shall be 0.2m.

(3) When high voltage insulated wires are used for overhead feeders with standard voltage of 1,500VDC, or AC overhead negative feeders, or when low voltage insulated (meaning a voltage of less than 750VDC or 600VAC) wires (hereinafter referred to as "Low voltage insulated wires) (meaning vinyl chloride-insulated wires for outdoor use, 600V vinyl chloride-insulated wires, 600V polyethylene-insulated wires, 600V fluororesin-insulated wires, 600V rubber-insulated wires, and vinyl chloride-insulated wires for lead-in. The same hereinafter) are accommodated in protective gear for overhead feeders with standard voltage of 750VDC, 600VDC or 600VAC three-phase, the distance of separation between the overhead feeders and a level crossing barrier having insulating property shall be 0.1m.

(4) The distance of separation between overhead feeders using the wires of 6-1 (3) and the nearby vegetation shall be so secured that they will not come into contact with each other due to the prevailing wind, winds produced by railway cars running by, and so forth. However, this rule does not apply when the feeders are installed in accordance with the following rules:

1) When the feeders in question are accommodated in protective gear, and that protective gear is provided with an abrasion layer laid over an abrasion detection layer with dielectric strength and abrasion resistance, and so structured as to cover the wires to avoid the risk of contact from the outside.

2) When the feeders in question consist of wires that are provided with an abrasion detection layer with dielectric strength and abrasion resistance over insulated wires, and further provided with an

abrasion layer covering the insulated wires in uniform thickness.

6-2 The insulation distance between the power-applied portion of a DC overhead contact line or overhead feeder and an overbridge, tunnel, bridge, etc. (referred to as "Overbridges, etc." in connection with detailed explanation 6) or platform shelter shall be 0.25m or more. However, if it is absolutely necessary for a structural reason of an overbridge, etc. that separation distance may be reduced to 0.07m.

6-3 The insulation distance between the power-applied portion of an AC overhead contact line or overhead feeder and a station building, signal handling office, platform shelter, signal, or other similar structure shall be 1.5m or more. However, if it is absolutely necessary in light of the situation ruling at the facility, that separation distance may be reduced to 1.2m (0.3m for a platform shelter whose metal part is grounded and whose necessary parts from the viewpoint of safety are provided with a danger marking).

6-4 The insulation distance between the power-applied portion of an AC overhead contact line or overhead feeder and an overbridge shall be 0.3m or more. However, if it is absolutely necessary for a structural reason of the overbridge, etc. that separation distance may be reduced to 0.25m.

6-5 The insulation distance between an AC overhead negative feeder and an overbridge, etc. shall be 0.15m or more. However, if it is absolutely necessary for a structural reason of the overbridge, etc. that separation distance may be reduced to 0.07m.

6-6 AC overhead contact lines or overhead feeders shall not be installed crossing high-voltage or low-voltage overhead transmission and distribution lines (hereinafter referred to as "Overhead transmission/distribution lines." Those installed outside the railway dedicated site are excluded. The same hereinafter.), overhead weak-current lines (hereinafter referred to as "Overhead weak-current lines." Those installed outside the railway dedicated site are excluded. The same hereinafter), or overhead fiber-optic cables (hereinafter referred to as "Overhead optical cables." Those installed outside the dedicated site are excluded. The same hereinafter.) (Hereinafter referred to as "Overhead weak-current lines, etc."). However, this rule does not apply, if it is absolutely necessary in light of the situation ruling at the facility, etc., and when the high-voltage or low-voltage overhead transmission/distribution lines or overhead weak-current lines, etc. are installed in accordance with the following rules:

(1) Cables or hard-drawn copper stranded wires with cross-sectional area of 38mm2 or more, or wires with tensile strength of 14.51kN or more, shall be employed for the high-voltage overhead transmission/distribution lines.

(2) Cables shall be employed for the low-voltage overhead transmission/distribution lines.

(3) Polyethylene-insulated vinyl chloride-covered communication cables shall be employed for the overhead weak-current lines.

(4) The distance from one support to another of overhead transmission/distribution lines or overhead weak-current lines, etc. shall be 60m when wooden posts are used for the supports, or 120m or less when concrete posts or metal posts are used.

(5) The separation distance between the power-applied portions of overhead contact lines or overhead feeders and overhead transmission/distribution lines or overhead weak-current lines, etc. shall be 2m or more. However, when the overhead feeders are cables, the separation distance may be 0.5m or more, or when they are insulated wires for extra-high voltage (meaning a voltage exceeding 7,000V. The same hereinafter.) (Hereinafter referred to as "Insulated extra-high-voltage wires), the separation distance may be 1m or more.

6-7 AC overhead contact lines or overhead feeders shall not be installed crossing a cableway. However, this rule does not apply, if it is absolutely necessary in light of the situation ruling at the facility, etc. and those lines are installed in accordance with the following rules:

(1) The insulation distance between the power-applied portions of the overhead contact lines or overhead feeders and the cableway shall be 2m or more. However, when the overhead feeders are cables, the separation distance may be 0.5m or more, or when they are insulated extra-high-voltage wires, the separation distance may be 1m or more.

(2) A sturdy protective facility shall be provided over the power-applied portions of the overhead contact lines or overhead feeders, and besides, its metal parts shall be grounded.

Article 46 Insulation Division of Contact Lines

7-1 The electric contact lines shall not be divided in the sections listed further below. However, this rule does not apply when a section switch is provided at the part to be divided and maintained permanently closed, and a proper measure is adopted preventing trains from approaching that part as the said section switch is opened in the case of an accident, etc.

(1) Sections in which electric locomotives or electric cars stop regularly.

(2) Area within the distance from a home signal, starting signal, or block signal, that results from adding 50m to the distances between the train head and the last power collection devices of traveling trains.

(3) In a section in which the cab signal system is executed or section in which operation is carried out using an equipment that secures distance between trains (limited to the automatic train control equipment), the area within the distances between the train head and the last power collection devices of traveling trains from the leading end of the signal indication section (section in which

control information is displayed for the equipment that secures separation distance between trains. The same in 7-1 (3)) toward the outside of the leading end of that section, and the area within the distance in which trains can stop upon receipt of a signal instructing to stop, issued inward from the leading end of that signal indication section.

(4) In a section in which operation is carried out using automatic train control equipment that secures separation distance between trains (limited to the automatic train control equipment), the area within the distances between the train head and the last power collection devices of traveling trains from the leading end of a section which the trains, etc. displayed by the control information of the automatic train control equipment can be allowed to enter, toward the outside of the trailing end of that section.

7-2 Notwithstanding the provisions of 7-1. above, division shall be able to made also in the sections listed in7- 1 (2) through (4), in the case where it is inevitably necessary for a technical reason, the part where the contact line is to be divided is permanently left open, and a proper measure is adopted preventing troubles from occurring if an electric car stops at that part.

Article 47 Prevention of Problems under Overbridges, etc.

8-1 In the cases where overhead contact lines or feeder lines are installed under overbridges, road bridges, or other facilities similar to those, and they are likely to cause harm to people, etc., facilities designed to prevent troubles shall be provided.

8-2 In the case where AC overhead contact lines or overhead feeders are installed under overbridges, road bridges or other facilities similar to those, the following rules shall be complied with, in addition to the provision of 8-1:

(1) Metal parts, such as bridge girders, shall be grounded.

(2) Danger markings shall be posted at the necessary parts from the viewpoint of safety.

8-3 If the power-applied portion of a DC overhead contact line is supported by the steel members of a platform shelter, bridge, etc., insulators having sufficient insulating efficiency shall be installed and other necessary safety measures shall be adopted to avoid hazards due to the possible intrusion of high voltage.

Article 48 Installation of Return Current Rails

9-1 The joints of return current rails shall be electrically connected with a bonding agent, etc.

9-2 The joints of the return current rails of DC contact lines shall have an electric resistance equivalent to less than 5m as converted into rail length.

10-1 If it is likely that people, etc., are exposed to hazards due to the potential difference produced between return current rails and ground, at a location of public traffic, such as a level crossing, cross walk, etc., the rails laid at that part shall be isolated from the other rails, or that part shall be paved.

Article 49 Lightning protection

11-1 Lightning protection such as arrestors shall be installed on contact lines, and feeder lines at or

in the vicinity of the following locations, except where the likelihood of lightning damage is considered negligible.

(1)DC contact lines or feeder lines in each section with electrical separation

(2)Primary side of auto-transformer

(3)Incoming and outgoing terminals for overhead feeder lines at a substation or switching station

12-1 Where a high voltage line is joined to a extra high voltage line by means of a transformer (other than transformers fitted with earthed metallic short proof plates and feeding transformers. The same in 12-1 and 12-2), a lightning arrestor or discharge device with a maximum voltage of three times the operating voltage shall be fitted to the high voltage line at the electrode nearest the transformer terminal. Discharge devices must be earthed.

12-2 Where a high voltage or extra high voltage line is joined to a low voltage line by means of a transformer, the neutral point on the low voltage side of the transformer shall be earthed. If the low voltage line is 300 V or less and the neutral point of the transformer cannot be earthed properly, then the earth may be connected to a terminal on the low voltage side of the transformer instead.

Section 2 Equipment at Substation

Article 51 Facilities at substations

14-1 Substations shall be fitted with a fence, wall or other barrier designed to prevent entry by unauthorized persons, as well as appropriate warning signs at the entrance, except where the topography of the site is deemed sufficient to prevent access.

15-1 Substations shall be fitted with the following safety equipment as appropriate.

(1) Substations shall be fitted with automatic circuit breakers to protect transformation equipment on high voltage and/or extra high voltage AC lines

(2) Substations and switching stations shall be fitted with automatic circuit breaker on the feeding side to protect against accident current in feeder lines (except in relation to a switching station protected by an automatic circuit breaker at the substation)

(3) Substations and distribution stations shall be fitted with overload protectors

(4) Substation shall be fitted with power source failure protectors

(5) DC substations shall be fitted with the following protection devices for semiconductor rectifiers on feeder lines:

1) Device overheat protector

2) Cooling mechanism failure protector

3) Abnormal voltage protector

(6) Substations shall be fitted with overheat protection devices for receiver transformers and feeding transformers (excepting external excited cooling systems rated at 3,000 kVA or less)

15-2 The automatic circuit breaker fitted to the feeder line in accordance with the provisions of 15-1 (2) above shall be an automatic rapid-response cut-out type with selectable operating current and abnormal current or automatic circuit breaker with equivalent performance, except on railways operating under a load that can readily be shut off in the event of abnormal current flow.

17-1 Monitored substations and switching stations (hereafter referred to as monitored substations) shall conform to the following standards.

(1) They shall be provided with a control room with permanent monitoring staff

(2) The control room shall be located close to the relevant authorities to enable immediate response in the event of an alarm

(3) The building shall be constructed to fire-proof or fire-resistant design standards

(4) Provision for manual operation and manual shutdown shall be provided

(5) Substations (other than fully outdoor substations) shall be fitted with automatic circuit breakers on the receiver side designed to operate in the event of fire, and/or warning devices in the control room

17-2 The control room described in 17-1(1) above shall be provided with the following equipment.

(1) A display indicating whether the monitored substation is operating or stopped

(2) An alarm to indicate when the automatic circuit breaker has shut off the main circuit of the monitored substation

(3) A device that can be used to prevent the automatic circuit breaker from shutting on the line in the event of the warning in (2) above (except where the control room has a device capable of displaying the cause of the warning in (2) above)

(4) Equipment for shutting down operation of the monitored substation

(5) A device for preventing operation via the control room when the monitored substation is under manual control

(6) A device for detecting or providing warning of failure in the monitoring and control equipment of the monitored substation

Article 52 Installation of electrical equipment and switchboards

18-1 2×25kV(AT) feeding systems auto-transformers (except where installed at a substation) located in the vicinity of residential properties shall be fitted with protective barriers and fire-fighting equipment.

18-2 Oil-filled equipment at substations shall be shielded behind a suitable barrier or partition or located well away from other equipment and facilities in order to prevent the spread of fire.

18-3 Switches, distribution boards ,and electrical equipment located outdoors with exposed live components shall be designed to keep person from contacting live components.

18-4 Switches, automatic circuit breakers, lightning arresters and equivalent devices which operate at voltages over 600 V and up to 7,000 V and generate an arc shall be located 1 m or more away from flammable substances, or which operate at over 7,000 V and generate an arc shall be located 2 m or more away from them(or devices operating at up to 35,000 V and generate an arc, only where the arc is not considered a fire risk in terms of length and direction shall be located 1 m or more away from them), except where separated by a barrier of fire-proof material.

Article 53　Protection of electrical equipment

19-1 2×25kV(AT) feeding systems auto-transformers with capacity in excess of 2,000 kVA (except where installed at a substation) shall be fitted with a switching mechanism which can be controlled from the substation or control room. Where the autotransformer is located close to the relevant authorities to enable immediate response, the remote control functionality may be omitted from the switching mechanism.

19-2　Electric lines and associated electrical equipment shall be fitted with protective devices such as safety cut-outs or fuses to shut off abnormal current flow caused by grounding and shorting faults, where considered necessary for safety reasons.

Article 54　Insulation of electric lines

20-1　Electric lines and electrical equipment must conform to the testing procedures and standards outlined in the table below, except in the case of AC feeder lines employing cable that have successfully passed a dielectric strength test between the core and the ground (for multi-core cable, between the cores and between the cores and the ground) involving the continuous application of the DC voltage specified below over a period of ten minutes.

(1) For neutral point grounded extra high voltage with maximum operating voltage over 60,000V, 220% of the maximum operating voltage (or 150,000 V if the maximum operating voltage is less than 150,000 V)

(2) For all other extra high voltage transmission lines, 250% of the maximum operating voltage (or 21,000 V if the maximum operating voltage is less than 21,000 V)

(3) For high voltage lines, 300% of the maximum operating voltage

Type of line/equipment		Test method
Single phase AC contact lines and feeder lines (excluding negative feeder lines)		Continuous application of AC voltage at 125% of the maximum operating voltage between the line and the ground (for multi-core cable, between the cores and between the cores and the ground) over a period of ten minutes
Low voltage three phase AC contact lines and feeder lines		Continuous application of 150% of the maximum operating voltage between the line and the ground (for multi-core cable, between the cores and between the cores and the ground) over a period of ten minutes
DC feeder lines		Continuous application of 150% of the maximum operating voltage between the line and the ground (for multi-core cable, between the cores and between the cores, and the ground) over a period of ten minutes
Bus bar or other electrical devices	Over 60,000V	Where connected to a neutral point grounded electric line, continuous application of AC voltage at 110% of the maximum operating voltage (or 75,000 V if the maximum operating voltage is less than 75,000 V), or where connected to a neutral point non-grounded electric line, continuous application of AC voltage at 125% of the maximum operating voltage, between the active section and the ground over a period of ten minutes

	Over 7,000V and up to 60,000 V	Continuous application of AC voltage at 125% of the maximum operating voltage (or 10,500 V where the maximum operating voltage is less than 10,500 V) between the active section and the ground over a period of ten minutes
	Up to 7,000V	Continuous application of AC voltage at 150% of the maximum operating voltage (or 500 V for electrical devices with an operating voltage of less than 500 V) between the active section and the ground over a period of ten minutes. Not required where bus bar operating voltage is less than 600 V
Rectifiers		Continuous application of AC voltage at 100% of the maximum operating voltage on the DC side (or 500 V where the maximum operating voltage is less than 500 V)between the active section and the outer casing over a period of ten minutes
Transformers	Over 60,000 V	Where connected to a neutral point grounded electric line, continuous application of AC voltage at 110% of the maximum operating voltage (or 75,000 V if the maximum operating voltage is less than 75,000 V), or where connected to a neutral point non-grounded electric line, continuous application of AC voltage at 125% of the maximum operating voltage, between different sets of windings, between the windings and the iron core, and between the windings and the ground, over a period of ten minutes
	Over 7,000 V and up to 60,000 V	Continuous application of AC voltage at 125% of the maximum operating voltage (or 10,500 V where the maximum operating voltage is less than 10,500 V) between different sets of windings, between the windings and the iron core and between the windings and the ground, over a period of ten minutes
	Up to 7,000 V	Continuous application of AC voltage at 150% of the maximum operating voltage (or 500 V where the maximum operating voltage is less than 500 V) between different sets of windings, between the windings and the iron core and between the windings and the ground, over a period of ten minutes

20-2 Insulation resistance between a DC contact line and the ground shall be sufficient to restrict leakage current at the normal operating voltage to a maximum of 10 mA per km of contact lines, or 100 mA where the contact line is supported via an overhead rigid conductor system or a rigid double line or third rail configuration is used.

20-3 Where the dielectric strength of a extra high voltage electric line has been measured in accordance with the procedure outlined in Section 3.1 Check Method of Dielectric Strength for Extra High Voltage Electric Lines of JESC E 7001 (Japan Electrotechnical Standards and Codes Committee, 1998) regarding the measurement of dielectric strength of electric lines, the stipulations of item 20-1 above shall not apply.

20-4 Where the dielectric strength of a transformer electric lines has been measured in accordance with the procedure outlined in Section 3.2 Check Method of Dielectric Strength for Transformer Electric Lines of JESC E 7001 (Japan Electrotechnical Standards and Codes Committee, 1998) regarding the measurement of dielectric strength of electric lines, the stipulations of item 20-1 above shall not apply.

20-5 Where the dielectric strength of an appliance or apparatus electric lines has been measured in accordance with the procedure outlined in Section 3.3 Check Method of Dielectric Strength for Appliance/Apparatus Electric Lines of JESC E 7001 (Japan Electrotechnical Standards and Codes Committee, 1998) regarding the measurement of dielectric strength of electric lines, the stipulations of item 20-1 above shall not apply

Article 55 Grounding of Electrical Equipment

21-1 The metal fittings used between insulators and supports, or supports on an AC overhead contact line shall be grounded, except in the following cases.

(1) The negative side of the insulators (only sections that are insulated from the supports) is connected to the negative feeder line

(2) The metal fittings between insulators and supports or the negative side of the insulators are connected to an AT protection line

(3) The metal fittings between insulators and supports are connected to the negative feeder line or an AT protection line through a suitable discharge gap

21-2 The cable messenger wire, the metal portions of the conduit or duct housing the cable, the metallic sheath around the cable, and other metal accessories, connection boxes and protection devices shall be properly grounded, except in the case of:

(1) Corrosion protected cable;

(2) A low voltage overhead line employing cable, where the messenger wire employs insulated wire or other wire with equivalent or better insulation properties;

(3) Connection boxes constructed in accordance with proviso21-3;

21-3 The steel frame and metallic outer casing of electrical equipment and the iron core of a transformer not enclosed in outer casing shall be grounded, except in the case of:

(1) Steel frame and/or metallic outer casing which is surrounded with insulating material;

(2) A instrument transformer not enclosed in outer casing which is surrounded with insulating material and which is installed in an inaccessible location;

(3) High or low voltage electrical equipment which is installed on insulated poles or equivalent that are inaccessible to unauthorized personnel;

21-4 The grounding resistance associated with grounding in accordance with the stipulations of item 21-1 above shall be at a level that can be automatically cut off at the substation in the event of a grounding fault.

21-5 The maximum grounding resistance of the associated lightning arrester shall be up to 30 Ω. If the grounding electrode of the lightning arrester is located in 1 m from the grounding electrode of the transformer, the maximum grounding resistance shall be up to 10Ω.

21-6 For grounding in accordance with the stipulations of item 6-7 (2) of the Detailed Explanation for Technical Regulation for Article 6, item 8-2 (1) of the Detailed Explanation for Technical Regulation for Article 8, the maximum grounding resistance shall be up to 100 Ω .

Article 99 Inspection and monitoring of the contact lines on the main line

26-1 The main line and contact lines installed on the main line shall be inspected according to the condition of the line and that of train operation so that they are maintained in a condition that enables vehicles to run safely at a designated speed. The frequency, timing and methods of inspection shall be determined to the condition of the lines.

27-1 If disasters that hinder train operation on the main line may occur, the tracks involved shall be inspected, and the operation speed shall be restricted as required or the operation of the tracks or sections thereof shall be suspended temporarily. In addition, track monitoring systems, restricted train speeds, etc. shall be determined in advance according to the magnitude of expected disasters.

Article 101 Records

30-1 Records of regular inspections of power supply equipment and records of their remodeling, modification and repair shall be kept for predetermined periods.

[Notifications concerning regular inspections of power supply facilities]

(Regular inspections of power supply equipment)

Regular inspections of power supply equipment must be carried out for each of the places of installation specified in the left column of the table below according to the types of equipment specified in the middle column and at intervals that do not exceed the periods specified in the right column.

Places of installation	Types of equipment	Period
Railways other than the high speed railways and high speed railways (train depots only)	Contact lines; transformation equipments used for train operation; devices that protect substations' equipment, electric lines, etc. when irregularities occur; and other types of important power supply equipment	One year
	Power supply equipment other than those listed above	Two years
High speed railways (excluding train depots)	Devices that protect substations' equipment, electric lines, etc. when irregularities occur (power circuit breakers on the feeder's side only)	Three months
	Contact lines (connection points, sectioning devices, overhead crossings and feeding branches only)	Six months
	Power supply equipment other than those listed in the two cells above	One year

2 Notwithstanding the provision of the preceding paragraph, the period set forth in the paragraph can be extended for the items listed in the following items:

(1) Power supply equipment whose spare devices have functions of operating automatically or

working otherwise if the equipment fails or may have failed

(2) Equipment that is electronized, or is sealed ,and maintains certain functions if replaced regularly and whose functions last longer than the period stipulated in the preceding paragraph

(3) Structures that support feeder lines, contact lines, etc.

Remarks

If the condition of power supply equipment is constantly monitored using constant monitoring equipment and is regularly reported to dispatcher office, etc. with respect to certain items, such electric equipment shall be considered to undergo regular inspections with respect to such items.

4 Signaling and Telecommunications

Table of Contents

Chapter 1 General rules

Purpose

This detailed explanation for signal and telecommunication system (hereinafter referred to as the " explanation ") stipulates the function to construct, remodel and improve railway operation security system as well as maintenance services therefor, thereby aiming at contributing to safe, punctual and rapid transport.

Definition of terms

The meaning of the term used in these implementation criteria is as follows.

1. The "section between two stations" is the section between the home signals of adjacent two stations.
2. The "block section" is part of a track sectioned with a departure signal and a home signal, with a departure signal and a block signal, with two adjacent block signals or with a block signal and a home signal.
3. The "duplicated section" is the part of a protected section in a route from which the part up to the next route is excluded.
4. The "outside the signal" is the direction into which the signal aspect is directed.
5. The "inside the signal" is the direction protected by the signal.
6. The "interlocking device" is a device to set interlocking conditions between signals that are apprehended to disturb the route, between a signal and points in the route, or between signals, points and train detection device, to prevent collision between trains and ensure the safety of train operation.
7. The "automatic train stop system" is a system having a function to automatically stop a train outside a signal indicating a stop aspect in case braking operation is not performed on the train approaching the signal, or when the train speed is higher than the specified speed at a specified position (hereinafter referred to as "ATS").
8. The "automatic train control system" is a system having a function to continuously indicate a signal aspect for the allowable train speed on the train to reflect the distance up to the preceding train and track conditions and automatically decelerate or stop the train according to the signal aspect (hereinafter referred to as "ATC").
9. The "cab signal" is a signal to continuously display the information required for train operation on the train in sections under the cab signal system.
10. The "centralized train control system" is a system for a train operation center to set routes at stations along the entire sections in the area under its control and make it possible to centralize monitoring and controlling all trains in the sections in the area.

11. The "remote control system" is a system for a parent station to remotely control the interlocking system at the adjacent stations.
12. The "safety margin for overrun" is a distance set as a margin inside the section into which entry is prohibited to protect trains against overrun.
13. The "train detection system" is a system to correctly detect trains without affected from outside.

Scope of application

The construction, remodeling, improvement and maintenance services for railway operation and security systems shall be as per the prescriptions in this guideline and those in the law.
Matters not specified in this guideline shall be dealt with as per the rules set forth separately.

Chapter 7 Signal and telecommunication system

Article 56 Block guaranteeing system

Article 56-1 Function of block system

1. Railway operators shall install block devices and a system to ensure the safety of train operation according to the method of train operation.
2. The block system shall ensure the safety of train operation in relevant sections and control exchanges of necessary tablets and signal aspects.
3. The block system in single-track sections shall lock the departure signal for the relevant section to prevent the entry of trains running in the opposite direction into the section where a train exists.

Article 56-2 Categories of block system

Block systems shall be as per the following.

1. Tablet block system (non-automatic system)
2. Semi-automatic block system
3. Automatic block system
4. Train interval guaranteeing system

Article 56-3 Tablet block system (non-automatic system)

1. A set of tablet block devices, bells and dedicated telephones shall be equipped at the stations at the ends of a block system.
2. The tablet block system shall be designed so that tablets housed in a block device cannot be

taken out unless the device is handled jointly by the stations at the ends of the relevant block section.

3. The tablet block system shall be designed so that the stations at the ends of a block system cannot take out two or more tablets at the same time.
4. The tablet block system shall be designed so that another tablet cannot be taken out unless the tablet that has already been taken out is returned to the relevant block device.
5. The tablet block system shall be designed so that tablets of different types cannot be stored in a tablet block device.
6. The tablets used for a block section shall be of a different type from those used for the adjacent block sections.

Article 56-4 Semi-automatic block system

1. The stations at the ends of a semi-automatic block section shall be equipped with lamps to indicate the existence of a train in the block section, a pair of interlocked block levers, departure signals interlocked with the block levers, bells and dedicated telephones.
2. The stations at the ends of a semi-automatic block section shall be equipped with devices to detect the entry/exit of a train into/from the section and automatically display and stick a stop aspect at departure signals when a train has entered the section or the block system has failed.
3. The pair of block levers shall be kept locked during the period from the entry of a train into the block section to its exit there from.

Article 56-5 Automatic block system

1. The automatic block system shall automatically control the aspects of home, departure and block signals when a train is detected by the train detection system set in the area protected by these signals and indicate a stop aspect on the relevant signals in the following cases.
    a. A train exists in the block or duplicated section.
    b. A point in the block or duplicated section is not cleared into the authorized route.
    c. A train on other tracks interferes with the block or duplicated section at points or crossings,
    d. The block system has failed.
2. When an inside signal has changed its aspect, the automatic block system shall indicate corresponding aspects on the signals behind.

Article 56-6 Train interval guaranteeing system

The train interval guaranteeing system shall make trains receive the information on the position

and speed of the preceding train and run by keeping an appropriate interval with the preceding train. It shall satisfy the following conditions.

1. The ground equipment of the train interval guaranteeing system shall continuously output control information for trains on the operation speed according to track conditions and the position of preceding train, in case one exists.
2. The equipment on the train shall:
    a. Cross-check the train speed and the speed specified by the control information referred to in the paragraph 1.
    b. Apply brakes to automatically decelerate the train down to the speed instructed by the control information in the section specified by the control information.
3. The length of the section specified by the control information referred to in the paragraph "a" shall be equal to or longer than the distance within which the train that has entered the section can decelerate or stop while running at the speed specified by the control information.

Article 57 Signal indication system

Note: The system is not prescribed in the technical criteria in Vietnam.

Article 57-1 Categories of fixed signal

Fixed signals shall be as per the following. See the reference materials I and II in the operation explanation for the aspects of color light signals and semaphore signals in Japan and Vietnam

1. Fixed color light signal
    a. Home signals (including the yard home signal and protection signal)
    b. Departure signal (including the yard departure signal, protection signal and the signal simultaneously used for shunting as a shunting signal)
    c. Shunting signal (including the shunting/protection signal and hump signal)
    d. Block signal (including the signal at the block separating points)
    e. Call-on signal
    f. Relay signal
    g. Distance signal

    Other than these signals, there are special signals and route indicators. The backside of a color light signal shall be black in color.
2. Fixed semaphore signal
    (1) Home signal
    (2) Departure signal
    (3) Relay signal

(4) Distance signal

Article 57-2 Cab signal

The cab signal shall correctly receive the control information sent from the ground equipment and continuously display it.

Article 57-3 Performance of fixed signal

Signals and indicators shall be visible from the point the distance specified below away in the daytime on fine days.

1. Home signal and block signal ····· 800 m or over
2. Departure signal on the main line, yard signal, distance signal and hump signal ···· 400 m or over
3. Departure signal on side tracks, yard signal, shunting signal, call-in signal and others ····· 200 m or over
4. Where the above visibility distance cannot be guaranteed for home signals or block signals due to topographical conditions, or the existence of obstacles or curves, it can be reduced to 400 mm, or 200 m under inevitable special conditions.

Article 57-4 Position of two or more fixed signals

Where two or more fixed signals are to be installed at the same position, the following rules shall be observed.

1. Where two or more fixed signals are to be installed in parallel on the left side of tracks, the signal for the leftmost track shall be installed on the leftmost side in the signal array, with the signals for other tracks installed toward the right side at the position of the corresponding tracks.

   Where two or more fixed signals are to be installed in parallel on the right side of the tracks, the signal for the leftmost track shall be installed on the leftmost side in the signal array, with the signals for other tracks installed toward the right side at the position of the corresponding tracks.
2. In the paragraph 1, the signal for the most important track shall be installed at a position higher than those of other signals.

Article 57-5 Installation of departure signal for two or more routes

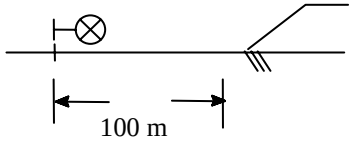
Where there are two or more routes from a track, a departure signal shall be installed for each route. In the case of a departure route where no non-stop trains run, however, a departure signal attached with route indicators can be used in common for two or more routes.

Article 57-6 Installation of home signal

1. A home signal shall be installed at the following position, except where a speed restriction signal is installed at the outside block signal when the home signal indicates a stop aspect or where a device is installed to automatically stop trains linked with the signal aspect of the

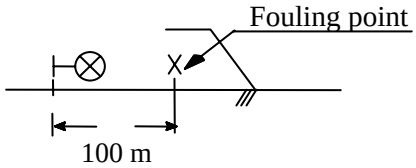
home signal at a position 3.5 m or over distant outside the fouling point related to a trailing point or a crossing between tracks.

(1) A position 100 m or over distant from the tongue rail of the trailing point (except the one for safety side tracks) existing at the outermost position in the section to be protected by the home signal



A position 100 m or over distant outside the tongue rail of the point

(2) A position 100 m or over distant from the fouling point related to a trailing point or a crossing between tracks existing at the outermost position in the section to be protected by the home signal



A position 100 m or over outside a fouling point

(3) A position 100 m or over outside the train stopping section

2. The separation distance in the paragraph 1 can be reduced to the distance specified in the right-hand side column for the maximum train speed between stations in the left-hand side column of the following Table where it is inevitable due to topographical conditions or for other reasons.

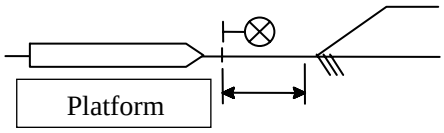
Train maximum speed between stations (km/h)	Separation distance (m)
Less than 65	
65 to less than 85	
85 to less than 100	

Article 57-7 Installation of departure signal

A departure signal shall be installed at the following position.

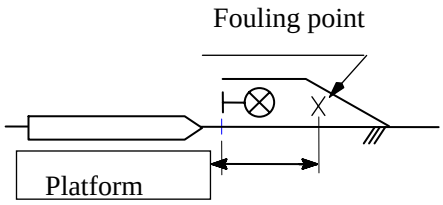
(1) Forward from the train stop position

(2) Outside the tongue rail of the trailing point existing at the outermost position in the section to be protected by the departure signal



A position outside the tongue rail of the point

(3) A position outside the fouling point related to the trailing point or the crossing between tracks existing at the outermost position in the section to be protected by the home signal, provided that the position shall be 3.5 m or over outside the fouling point related to the trailing point or the crossing between tracks.



A position 3.5 m or over outside the fouling point

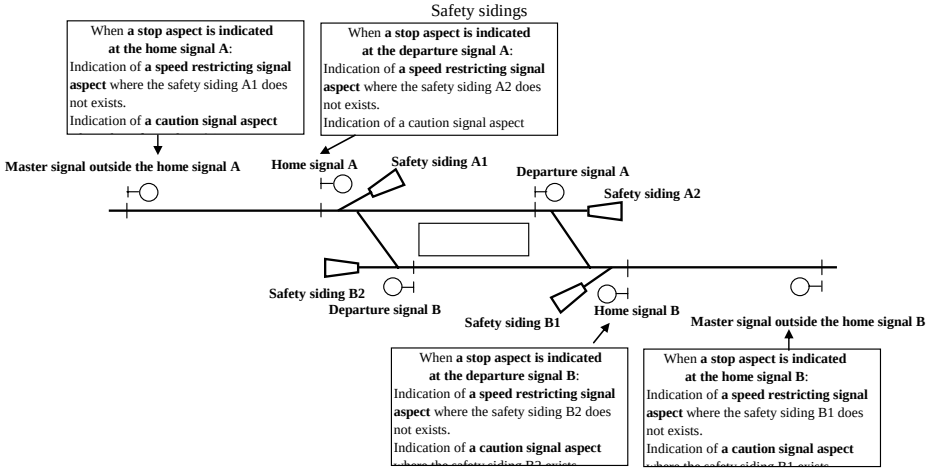
Article 57-8 Indication of the speed restriction signal at the master signal outside the home or departure signal

A speed restriction signal indicating device shall be attached to the master signal outside the home or departure signal located at the starting point of a section where interference between trains is apprehended to occur due to overrun when a train enters or exits from the station, except where a device is installed to automatically stop trains linked with the said home or departure signal or in one of the following cases.

(1) A safety siding exists inside the home or departure signal at the starting point of the said section.

(2) A section at a length of 100 m or over exists from the home or departure signal at the starting point of the said section to the fouling point or the tongue rail of the trailing

point (except that for the safety siding).



Article 57-9 Installation of block signal

Block signals shall be installed at the starting point of block sections, except where a home or departure signal exists at the position.

Article 57-10 Installation of call-in signal

Call-in signals shall be installed at the position of home or departure signal at a height lower than that of the signal.

Article 57-11 Installation of shunting signal

A shunting signal shall be installed at each route where shunting is implemented, except where two or more routes exist from a track in one of the following cases.

a. Branching points between tracks for which conditions to guarantee the safety of train operation are the same.

b. A route indicator is attached to the shunting signal.

Article 57-12 Installation of distance signal

A distance signal shall be installed where a visibility distance is not guaranteed for a length of 800 m or over for the home or passing signal under the semi-automatic or tablet block system. The visibility distance shall be as per the following where a distance signal is installed.

1. The sum of the visibility distances for a distance, home and passing signals shall be 800 m or over.

2. The visibility distance for a distance, home or passing signal shall be 400 m or over.
3. Where the visibility distance specified in the paragraph 1 and 2 is not guaranteed due to topographical conditions or for other reasons, it may be reduced to 200 m, provided that the distance between the distance signal and home or passing signal is 1,000 m or over.

Article 57-13 Installation of relay signal

1. Relay signals shall be installed outside the home, departure and block signals where a visibility distance longer than that required for approaching trains to decelerate or stop according to the aspect of relevant signals is not guaranteed due to topographical conditions or for other reasons under automatic block system.
2. Relay signals shall be installed to make the distance from the point where they are visible to the home, departure or block signal longer than the brake distance of the train approaching to the relevant signal.

Article 57-14 Installation of route indicator

Route indicators shall be installed on the pole of the departure or shunting signal at a height lower than that of the signal.

Article 57-15 Installation of special signal

A special signal (or a shut-off signal) shall be installed where there is an obstacle at unexpected places on the track to compromise the safety of train operation.

Article 57-16 Installation of sign

The following signs shall be installed where necessary.

1. Home sign
2. Departure sign.

Article 58 Interlocking system

Article 58-1 Categories of interlocking system

The categories of interlocking equipment are as per the following.

1. Mechanical interlocking system
2. Electrical interlocking system including the following.
   a. Electrical relay interlocking system (wholly of the relay type)
   b. Electronic interlocking system

Article 58-2 Function of interlocking system

1. The signal interlocking system shall be installed on the main line or at the places where a siding track that interferes with the main line crosses or branches from it.
2. The interlocking system installed in the station yard shall be in conformity with the following except in the case where trains are operated under the train interval guaranteeing system.
   a. Master signals (including cab signals and shunting signs) shall be interlocked with each other where their route and the safety margin for overrun or part thereof are in common use or where the route and the safety margin for overrun cross each other at grade.
   b. Master signals (including cab signals and shunting signs) shall be interlocked with the points in their route and safety margin for overrun.
3. The interlocking system where trains are operated under the train interval guaranteeing system shall be in conformity with the following.
   a. The interlocking system shall interlock the control information for different routes issued according to the open/close status of the routes where all or part of the routes are in common use or cross each other at grade.
   b. The interlocking system shall interlock the points in the route (except those normally locked) with the control information issued according to the open/close status of the route.
4. The points on the main line and on siding tracks (except those in the shunting yards) shall mechanically be locked as an interlocking system.

Article 58-3 Function of the centralized train control system

1. The centralized train control system (hereinafter referred to as "CTC") and the remote control system (hereinafter referred to as "RC") shall display the following information on the display units at the center and shall be able to set routes for trains or rolling stock exiting from stations.
   a. Position of the trains on the main line
   b. The open/close status of the routes on the main line.
2. A device to issue an alarm when the route setting system has failed shall be installed at the center for CTC and RC that automatically set routes.

Article 59 Automatic train stop (ATS) system and automatic train control (ATC) system

Article 59-1 Installation of automatic train stop and automatic train control systems

The automatic train stop or automatic train control system shall be installed to automatically decelerate or stop trains according the signal aspect under the automatic block system, except in the following cases.

1. Two or more trains are not operated simultaneously on a section not connected with other sections.
2. A siding track exists to prevent collision between trains due to overrun or erroneous departure at train crossing stations in single-track sections where the section between stations constitutes a block section.
3. Measures have been taken to prevent collision between trains due to overrun in single-track sections where the signal aspect does not indicate the blocking status between stations.

Article 59-2 Function of automatic train stop system in double-track sections

The automatic train stop system installed in accordance with Article 59-1 in double-track sections shall have a fundamental function in conformity with one of the following.

1. The system shall automatically stop trains outside the master signal in case brakes are not applied at the specified point when the master signal indicates a stop aspect.
2. The system shall automatically stop trains outside the master signal in case train speed exceeds the specified speed at the specified point when the master signal indicates a stop aspect.

Article 59-3 Function of automatic train stop system in single-track sections

The automatic train stop system installed in accordance with Article 59-1 in single-track sections shall have a fundamental function in conformity with one of the following.

(1) The system shall be in conformity with the paragraph (1) or (2), Article 59-2.

(2) The system shall automatically stop trains before the outermost fouling point in the section protected by the departure signal when it indicates a stop aspect.

Article 59-4 Installation of automatic train stop or automatic train control system at speed restricted places

The automatic train stop or automatic train control system shall be installed to automatically decelerate or stop trains safely before the speed restricted point or the stop indicated point in the following sections under the automatic block system.

a. Curve speed restricted sections

b. Turnout speed restricted sections

c. Sections where speed is restricted due to the existence of structures

d. Track end sections

e. Non-closed level crossing approach sections

f. Gradient speed restricted section

However, the above prescriptions "a" to "f" do not apply in the following cases "a" and "b."

a. Train operation in sections where passengers are not transported.

b. Non-regular operation of rolling stock when measures have been taken to prevent accident due to delayed brake application or oblivion by the driver when two or more drivers are onboard the driving cab.

Article 59-5 Function of automatic train control system

The automatic train control system installed in accordance with Article 59-1 shall be in conformity with the following.

1. The ground device shall continuously output the control information for trains to instruct train speed according to the interval with the preceding train on the route and track conditions.
2. The device on the train shall cross-check the train speed with the speed instructed by the control information and automatically apply brakes to decelerate the train speed down to the speed instructed by the control information.
3. A cab signal shall be installed in the driving cab to continuously indicate the allowable operation speed in accordance with the control information obtained by receiving ATC track circuit signals.

Article 59-6 Signal control at automatic feeding section switching points of high-speed railways

1. Automatic switching devices shall be installed at the feeding section posts of high-speed railways to transmit the ATC control information indicating a stop aspect to outside track circuits adjacent to the track circuit that controls the automatic switching device in the following cases.

a. Voltage is not applied to the feeding section inside the changeover catenary wires.

b. An inappropriate power source is used to apply voltage to changeover catenray wires.

2. In the cases of the above paragraphs "a" and "b," a route for entry, departure, block or shunting shall not be established in case an automatic changeover device is installed at the

feeding section post.

Article 59-7 Installation of temporary speed restriction signal

The automatic train control system of high-speed railways shall be equipped with a temporary speed restriction signal device, which changes the control information indicated for the main line between stations into one that instructs an operation speed lower than that instructed by the original control information.

Article 60 Automatic train operation system

1. Railways under the automatic train control system shall be equipped with a system to perform automatic train operation (hereinafter referred to as the "automatic train operation system").
2. The automatic train operation system shall be in conformity with the following.
   a. Trains shall not be able to start unless their boarding/alighting doors have been closed and the safety of boarding/alighting passengers has been confirmed.
   b. Train speed shall smoothly be controlled with the target speed set lower than that instructed by the control information of the automatic train control system.
   c. Trains shall smoothly be stopped at a specified position.
   d. The automatic train operation mode shall be cancelled when brakes are not applied.

Article 61 Train detecting system

Article 61-1 Function of track circuit

The train detecting system relying on track circuits shall be in conformity with the following.

1. Trains shall be detected when rails are short-circuited with the wheel-sets of trains or rolling stock.
2. The system shall be of the type of closed electricity circuit.
3. Obstacles shall not occur on the track circuit due to the current and return current in the adjacent track circuits or other external currents.
4. The sectioning point at the starting point of the section protected by the master signal shall be at the position of the signal. In case it is not possible to satisfy the above requirement for inevitable reasons, the sectioning point can be set within a distance to ensure safety before or after the signal.
5. The sectioning point at the starting point of the section protected by the master signal shall not be placed in the following section.

a. Where a turnout exists: the section from its tip on the tongue rail side to a point 3.5m outside its trailing side
b. Where a track crossing exists: the section between the fouling points added with a distance of 3.5m on each side.

Article 61-2 Installation of cross bond

Cross bonds to connect rails shall be installed not to interfere with the function of tracks.

Article 61-3 Dead section

In track circuits, sections where the track circuit does not function when short-circuited by the wheel-sets of trains or rolling stock (hereinafter referred to as the "dead sections") shall not be set in principle. In case one is set for inevitable reasons, measures shall be taken to ensure the safety of trains running on the section.

Article 61-4 Train detection system without track circuits

The train detection system without track circuits shall be in conformity with the following.

1. The system shall not be obstructed by the inductive noise of catenary wires or electric equipment on rolling stock
2. The system shall not detect trains in other sections.

Article 62 Security and telecommunication equipment

The railway telecommunication system shall effectively support the management and operation of railways and provide passengers with effective services.

Article 62-1 Installation of telecommunication circuits dedicated to operation

Dedicated security and telecommunication circuits shall be installed between power dispatching center and operation dispatching center, between power dispatching center and substations (other than monitored substations), between operation dispatching center and principal stations and between stations where the block procedures or the direction of train operation is consulted with each other.

In station yards and railway facilities in their vicinity, security and telecommunication circuits shall be installed between stations and operation field units, maintenance units, disaster prevention centers and rolling stock dispatch centers.

Article 62-2 Radio telecommunication equipment

1. Dedicated security and telecommunication radio circuits shall be installed between trains and the operation dispatching center of high-speed and semi-high-speed railways (hereinafter referred to as "high-speed railways").
2. The protection radio equipment of normal railways shall be able to transmit signals from trains to other trains within a distance of about 1km (longer than the distance within which trains can stop).
3. The train crew radio telephones shall enable communications between stations and operation dispatching center and trains and between the head and tail of a train in the vicinity of stations,
4. At stations where shunting of rolling stock is performed without using train radio or train crew radio telephones, communication shall be possible between the train crew, stations and the staff on the ground.
5. At stations where shunting of rolling stock is performed by using shunting signs, a loud voice telephone system (talk-back system) shall be installed in principle along with portable radio and portable telephone systems.

Article 62-3 Satellite and mobile telecommunication systems

The latest technologies of satellite and mobile telecommunication systems shall be introduced into high-speed railways to provide communication services and implement correct and high-speed data transmission.

Article 62-4 Transmission characteristics and quality of telecommunication circuits

1. High-speed railways shall be installed with high-quality optic fiber transmission circuits at 622 Mb/s to 10 Gb/s transmission speeds.
2. Normal railways shall be installed with optic fiber transmission circuits at 622 Mb/s to 2.5 Gb/s transmission speeds in addition to conventional bare wire and metallic wire circuits where necessary.

Article 62-5 Telecommunication circuits

Railways other than high-speed railways shall use bare wire, metallic wire and optic fiber transmission systems where necessary depending on line conditions.

Article 62-6 Information exchange system in railway businesses

To correctly and efficiently implement information exchanges in railway companies:

- High-speed railways shall introduce the conference and television telephone systems at a

speed of 1,920 kb/s or over.

- Normal railways shall introduce the conference and television telephone systems at a speed of 384 kb/s or over.

Article 62-7 Switching system

The digital electronic switching system shall be introduced into the circuits related to the public telephone and data exchange systems except where an existing switching system is in operation

Article 62-8 Synchronized clock system

1. The railway transmission network shall compose a real-time clock system for comprehensive simultaneous control.
2. The above clock system shall be composed of a precise primary clock, relays and plural secondary clocks that are controlled by the signal issued by the primary clock.

Article 62-9 Passenger information system

To provide railway users with effective passenger services and encourage the use of railways, railway stations shall have dedicated telecommunication circuits equivalent to security telecommunication circuits to quickly and correctly transmit the information on the status of train operation, train departure and arrival at stations and reservation of seats.

Article 63 Overhead telecommunication line facilities

Article 63-1 Height of overhead telecommunication lines

The height of overhead telecommunication lines shall be in conformity with the following.

1. 2.5 m or over in fields and on hills
2. 3 m or over in station yards
3. 4.5 m or over on roads crossing railway tracks
4. 7.5 m or over vertically on or crossing railway lines.
5. Supports shall be installed at a point more than their height distant from the shoulder of foundation level.

Article 63-2 Connection of telephones to overhead telecommunication lines

Security devices shall be installed for cross protection against other telecommunication lines or prevention of the damage due to lightning strokes at the point where telephones to be connected with overhead telecommunication lines are installed.

Article 64 Level crossing security equipment

Article 64-1 Categories and installation of level crossing security equipment

1. Mechanical level crossings stationed with a crossing watchman shall be installed with the following level crossing security equipment, with a signal to indicate the open/close status of the level crossing for trains equipped where necessary.

    Crossing barriers, warning signals on the road, alarm issuing devices, marks, fences and crossing walkway lines

2. Level crossings not stationed with a crossing watchman shall be installed with the following level crossing security equipment, with obstacle detection devices and barrier close signals equipped where necessary.

    a. Level crossings equipped with automatic barriers: Automatic barriers, automatic level crossing warning signals, marks, fences and crossing walkway lines

    b. Level crossing without barriers: Automatic crossing warning signals, marks, fences and crossing walkway lines

    c. Level crossings with marks alone: Fences and crossing walkway lines

Article 64-2 Standards on the installation of automatic level crossing warning signals

Automatic level crossing warning signals shall be installed as per the following.

1. The warning signal shall issue alarms for pedestrians on both sides of the level crossing.
2. The warning signal, where installed on one side of the level crossing, shall be installed on the right side of the road, or at the center or on the left side when inevitable due to site conditions.
3. The warning signal can be installed on both sides of the road where necessary.
4. Two or more red flashing lamps shall be installed.
5. The red flash lamps shall be visible at a distance of 100 m or over.
6. Warning marks (cross marks) shall be installed.
7. The level crossing warning signals installed in sections having two or more tracks shall be attached with a train moving direction indicator.

Article 64-3 Function of automatic level crossing warning signal

Level crossing warning signals shall function as per the following.

1. The signal shall automatically start operation when a train has approached.
2. The time from the start to the end of the operation shall not obstruct the passage of pedestrians.
3. The standard time from the start of the operation to the arrival of the train shall be 60

seconds.

4. The signal shall start canceling the warning after the train has passed.
5. The warning starting point shall be controlled by a continuous closure of an electric circuit or a train detection system. The warning ending point shall be controlled by a continuous opening of an electric circuit or a train detection system.

Article 64-4 Standards on the installation of mechanical level crossing security equipment

1. Level crossings stationed with a crossing watcher shall be equipped with manual crossing barriers and warning signals, or warning signals only where the volume of traffic is extremely small or installation of barriers is technically difficult.
2. Barriers shall completely shut off the tracks from both sides.
3. The warning signal shall have two or more red lamps that flash alternately when in operation.
4. The time from the start to the end of warning shall be as per the following.
   a. Where automatic warning signals and non-automatic crossing barriers are installed: 90 seconds as a standard.
   b. Where non-automatic warning signals (electric or petroleum lamps) are installed: 120 seconds as a standard.
5. Procedures when a crossing barrier or a crossing warning signal has failed:
   Post a railway employee at the crossing to give caution to pedestrians or take other appropriate measures.

Chapter 9 Maintenance of facilities and rolling stock

Article 102 Maintenance of signal and telecommunication equipment

Article 102-1 Definition of terms

The meaning of the terms used in this clause is as follows.

1. The term "maintenance" is to efficiently maintain the function of equipment and precisely recover the lost function thereof when necessary.
2. The term "maintenance services" is the replacement, repair, adjustment, supply and other services implemented to recover the stable state when the equipment has lost its function or is apprehended to lose the normal and stable state.
3. The term "inspection" is to investigate the degree of deterioration or changed conditions of equipment, judge whether maintenance services are required to maintain its function it the normal and stable state and implement maintenance services at the same time when

necessary.

Article 102-2 Categories of maintenance

The categories of maintenance are as follows.

1. Preventive maintenance

   The preventive maintenance is to detect that the equipment is apprehended to lose its function by effective methods and implement maintenance services in advance mainly for equipment that will seriously affect train operation and passenger services if the function has been lost.

2. Breakdown maintenance

   The breakdown maintenance is the maintenance services implemented in principle after its function has been lost for equipment that will not seriously affect train operation or passenger services even if the function has been lost.

Article 102-3 Maintenance of signal and telecommunication equipment

The signal and telecommunication equipment shall be maintained in a state to correctly function by appropriately implementing inspection and monitoring the state by an equipment monitoring system. In case a component has failed, it shall immediately be repaired to recover its normal state.

Article 102 Implementation of inspection

1. Inspection shall be implemented as per the inspection schedule specified by control organizations.
2. In case the inspection in accordance with the above paragraph "a" can not be implemented due to bad weathers or for other reasons, the inspection can be postponed until it becomes possible.

Article 102-5 Inspection of newly constructed facilities

Newly constructed, remodeled or repaired facilities shall be used after their operation, function and safety have been checked through inspection.

Article 102-6 Procedures after abnormality has been found through inspection

When it is apprehended in inspection that the equipment will lose the normal and stable function, appropriate measures shall be taken for recovery, adjustment, replacement or suspension of operation as emergency services.

Article 102-7 Records

The results of inspection for newly constructed, remodeled and repaired equipment shall be kept for five years together with the records and the date of inspection.

Article 102-8 Procedures at a disaster or an accident

1. When a disaster or an accident has occurred on equipment, immediately investigate the cause and recover its function. In case an erroneous signal accident has occurred, however, due to a cause related to equipment or when so suspected, immediately suspend the use of the equipment and keep its status unchanged.
2. Specify the range of the suspension of equipment until it recovers its function after a disaster or an accident has occurred.
3. After a disaster or an accident or when equipment is used for train operation after suspension of operation, inspect it to confirm its operation, function and safety in advance.

Article 102-9 Filing of figures, tables and statistic data

File the figures, tables and statistic date required for the maintenance of equipment.

Article 102-10 Equipment requiring care

Keep under vigilance the equipment requiring care for prevention of injury or for other reasons. Improve and make it thoroughly known among those concerned.

Article 102-11 Changes in the environment

Grasp the changes in the environment of equipment for management and make efforts to prevent accidents.

Article 102-12 Inspection tools

Inspect and keep instruments, tools, protectors and power equipment under proper conditions.

Article 102-13 Standby machines and materials for emergency use

Specify the place to store standby machines and materials for emergency use and keep them under proper conditions.

Additional rules and reference materials

Additional rule 1 Special flash signals

There are following two types of special flash signals.

(1) Rotating type

(2) Blinking type

(See Figs. 38-1 and 38-2 for reference.)

The signal aspects indicated by special flash signals shall be visible from a point 800 m or over distant in the daytime on fine days.

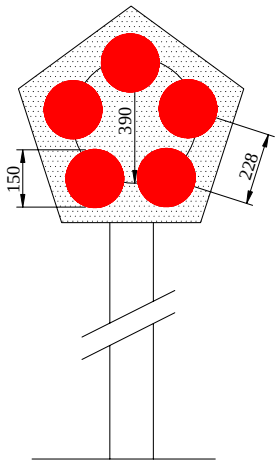


Fig. 38-1
Rotating type

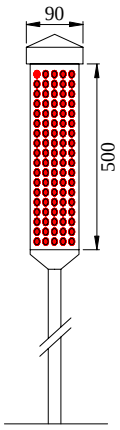
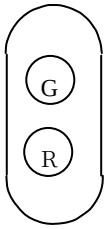
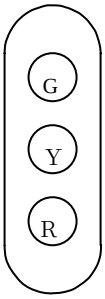
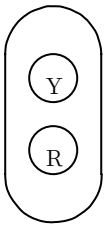
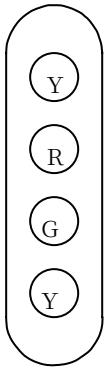
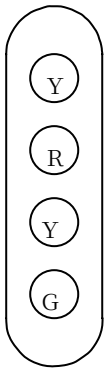
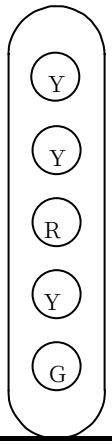


Fig. 38-2
Blinking type

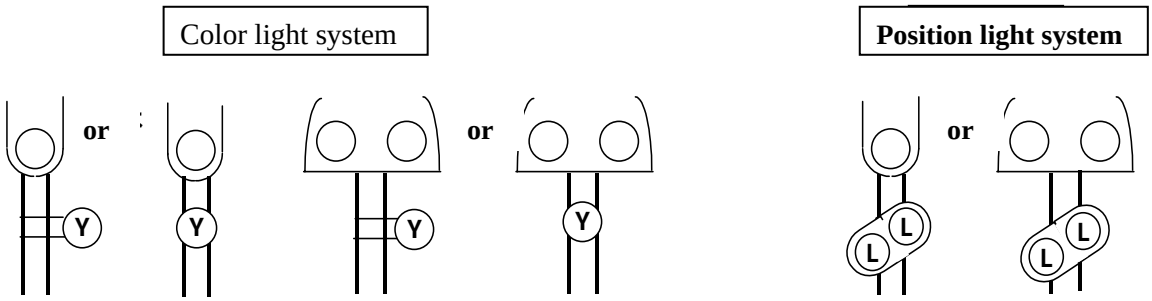
Reference material 1 Color light signal

1. Home, departure and block signals shall indicate the following aspects.

Types of home, departure and block signals

Two-position color light signal	Three-position color light signal				
Stop and proceed aspects	Stop, caution and proceed aspects	Stop and caution aspects	Stop, speed restriction, caution and proceed aspects	Stop, caution, speed reduction and proceed aspects	Stop, speed restriction, caution, speed reduction and proceed aspects
					

2. Call-in signals shall have the following configurations and dimensions and indicate the specified aspects.

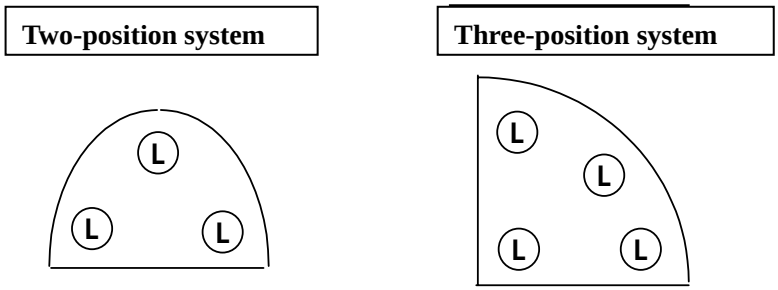


Remarks

1. Y represents a yellow lamp. L shall be a color distinguishable from white or other colors.
2. Lamps shall be 90 mm or over in diameter.
3. The center distance between the lamps of color light signal shall be 250 mm or over (150 mm or over in tunnel).

3. The center distance between the lamp of call-in signal and the lowest lamp of home signal shall be 600 mm or over.
4. The center distance between the lamp of call-in signal and the lowest lamp of shunting signal shall be 250 mm or over.

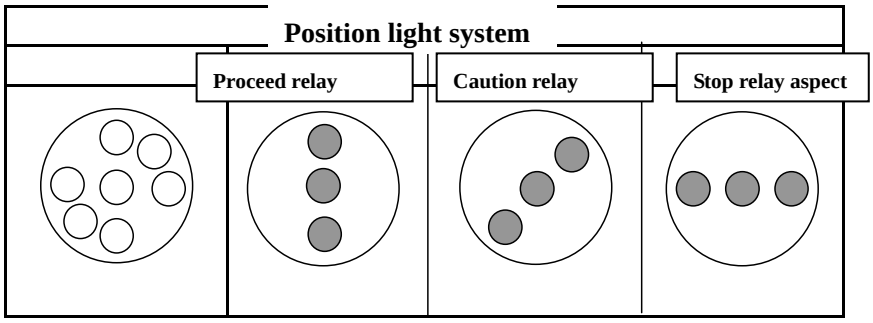
5. Shunting signals and signs shall have the following configurations and dimensions and indicate the aspects specified below.



Remarks

1. For shunting signals, use white lamps distinguishable from other lamps of color light signal.
2. Shunting signs shall have purple lamps and the same mechanism as that of shunting signals.
3. Shunting signals of the position light system attached with a shunting signal identification lamp can be used in common with a shunting sign.
4. The lamps shall be 90 mm or over (60 mm or over in tunnel) in diameter.
5. The center distance between the lamps of color light signal shall be 250 mm or over (150 mm or over in tunnel).

6. Relay signals shall have the following configurations and dimensions and indicate the aspects specified below.



Remarks

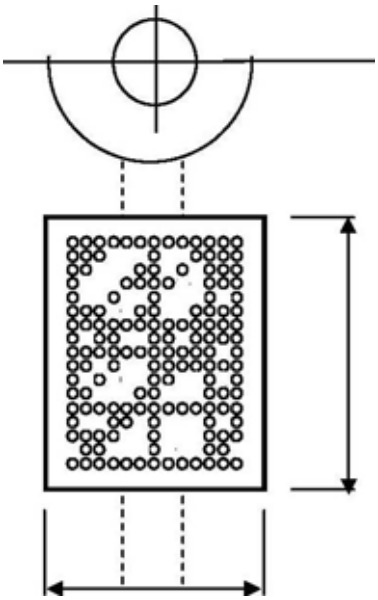
1. G, Y and R represent green, orange-yellow and red, respectively. L shall be a lamp distinguishable from other lamps of color light signal.
2. Lamps shall be 100 mm or over in diameter with color light signals and 90 mm or over (40 mm or over in tunnel) in diameter with position light signals.

3 The center distance between lamps shall be 200 mm or over (180 mm or over in

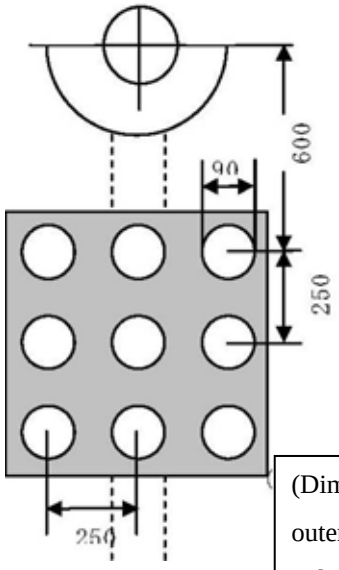
tunnel) with color light signals and 250 mm or over (150 mm or over in tunnel) in diameter with position light signals.

7. Route indicators shall have the configurations and dimensions specified in the following drawings.

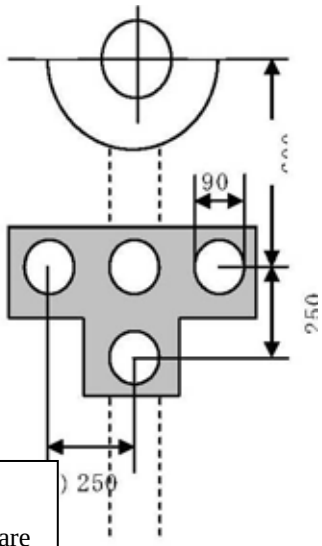
For multiple routes



For three routes



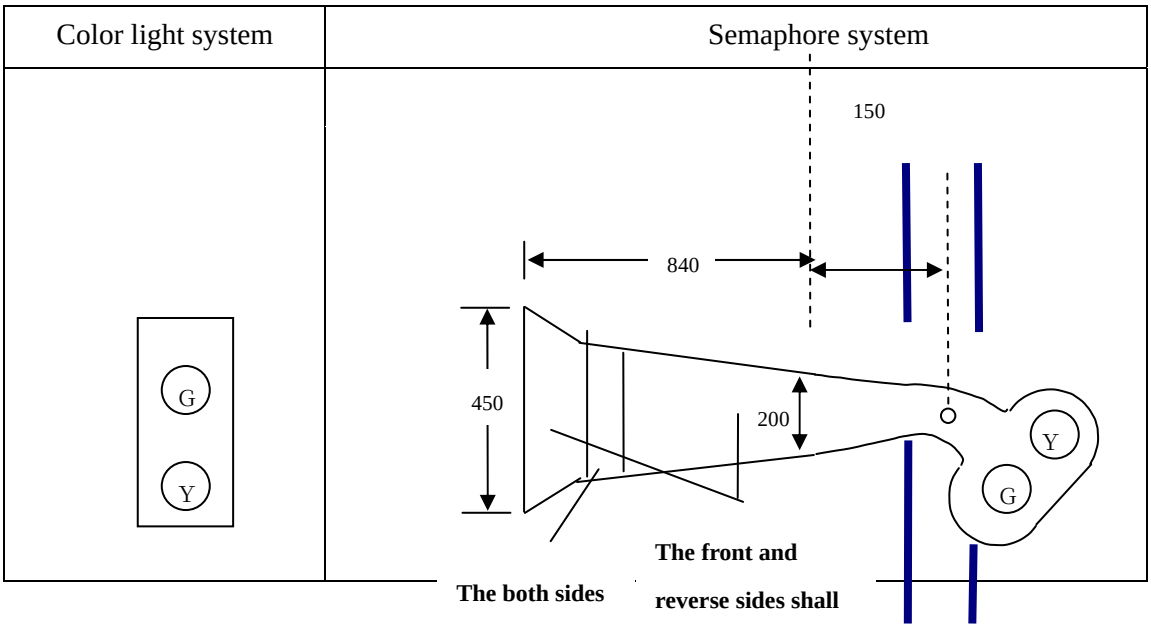
For two routes



(Dimensions of the outer configuration are only for reference.)

Reference material 2 Semaphore signal

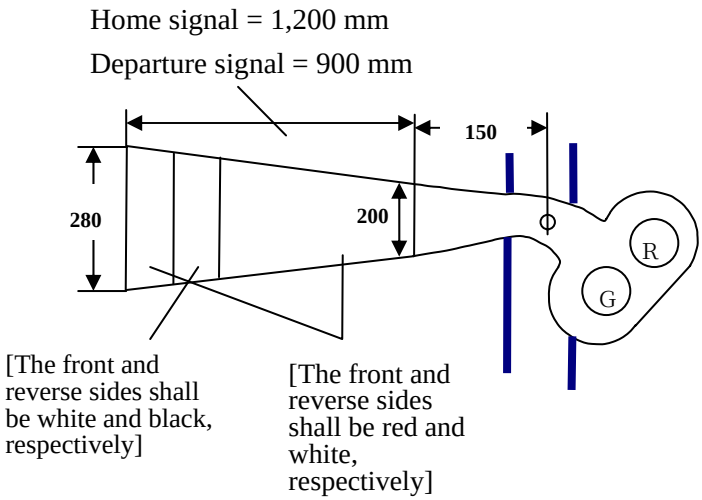
1. Passing signals shall have the following configurations and dimensions and indicate the aspects specified below.



Remarks

1. The dimensions are in millimeters.
2. G and Y represent green and orange-yellow, respectively.
3. Lamps shall be 100 mm or over in diameter.
4. The center distance between lamps shall be 200 mm or over (180 mm or over in tunnel).

2. Semaphore home and departure signals shall have the following configurations and dimensions and indicate the specified aspects.



Two-position semaphore signal

Remarks

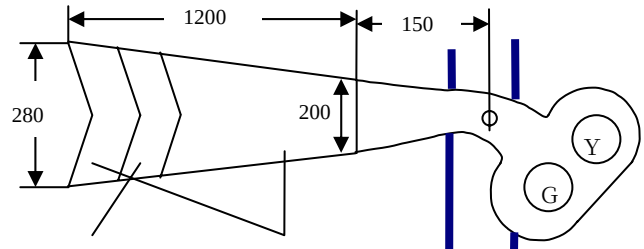
1. The dimensions are in millimeters.
2. G, Y and R represent green, orange-yellow and red, respectively.
3. Lamps shall be 100 mm or over in diameter.
4. The center distance between lamps shall be 200 mm or over (180 mm or over in tunnel).

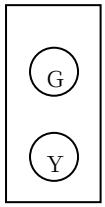
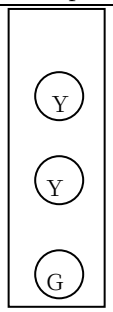
3. Distant signals shall have the following configurations and dimensions and indicate the specified aspects.

Remarks

1. The dimensions are in millimeters.

2. G and Y represent green and orange-yellow, respectively.

<table>
<tr><td colspan="2">Color light system</td><td>Semaphore system</td></tr>
<tr><td>Caution and proceed aspects</td><td>Caution, speed reduction and proceed aspects</td><td rowspan="2"> 

The front and reverse sides shall be white and black,
The front and reverse sides shall be yellow and white,</td></tr>
<tr><td> 
</td><td> 
</td></tr>
</table>

3. Lamps shall be 100 mm or over in diameter.

4. The center distance between lamps shall be 200 mm or over (180 mm or over in tunnel).

Reference material 3 Operation of ATS

1. Block system and rear-end collision

The ATS system is used to prevent rear-end collisions specific to railways. Fig**.** 1 shows the geometrical relation between the block signal and the ground coil of the ATS-S system.

Down 2 (yellow)

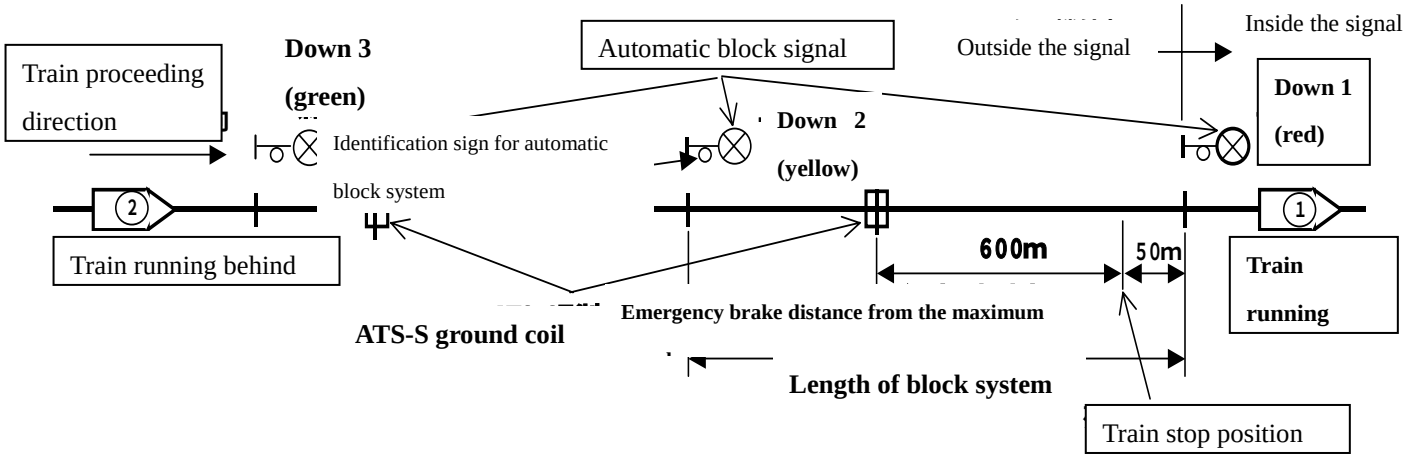


Fig. 1 Geometrical relation between the block signal and the ground coil of the ATS-S

When the train running ahead (1) is at the position specified in Fig., the signal aspect and the method of train operation are as follows.

- Indication of the "down 1" signal: Stop (red) aspect ... The train stops at the position 50 m outside the signal.
- Indication of the "down 2" signal: Caution (yellow) aspect ... The train can proceed inside the signal at 45 km/h.
- Indication of the "down 2" signal: Proceed (green) aspect ... The train can proceed inside the signal without speed restriction.

The train is normally supposed to decelerate to 45 km/h or lower when the train running behind has passed the "down 2" signal, enter the "down 2 block section", acknowledge the "red" aspect of the "down 1" signal at a visibility distance of 600 m and apply service brakes to stop at the specified position.

In case the driver fails the above manipulation, the automatic train stop (ATS) system is installed as a backup means at the position indicated in the Fig. When the train passes a ground coil of the ATS system, the pickup coil on the train issues a warning notice. If the driver does

not perform a warning notice acknowledging manipulation, the emergency brake is automatically applied to prevent a rear-end collision.

2. Background of the introduction of ATS-S system

In the railways of JR companies, there are electrified and non-electrified sections, installed with automatic or non-automatic signals of the color light or semaphore system, where a variety of trains are operated, such as steam, electric or diesel locomotive-hauled trains, DMUs, EMUs and freight trains. Under the circumstances, the ATS-S system made its debut as a system featuring a simple structure and easiness of adjustment without affecting nearby equipment, which is applicable across the country irrelevant of gourd facilities or systems.

The ground coil of this system functions linked with signals, in that it controls the ATS function with a built-in electric circuit in the case of automatic and semi-automatic signals and with a circuit controller installed under an arm in the case of semaphore (non-automatic) system.

The warning is issued only at the point where the ground coil is installed, after which changes in the signal aspect cannot be reflected in the operation by the driver on the train. The operation after a warning acknowledging manipulation or brake application solely depend on the caution of the driver. This does not perfectly guarantee the eradication of rear-end collisions due to the erroneous operation by the driver.

3. Composition and operation of the ATS-S system.

The ATS system is composed of ground coils and pickup coils. See Fig. 2 for the geometrical relation in between.

The ground coil is a tank circuit having Q at 110 to 170 and a resonance frequency of 130 kHz. This tank circuit is short-circuited not to function as a resonance circuit except when the related signal indicates a "stop" aspect. The pickup coil is normally composed of part of an oscillator whose return circuit is drawn out as a pickup coil and installed at a position on the car underfloor to face the ground coil.

When the pickup coil faces a ground coil, the pulling effect of the resonance circuit modulates the resonance frequency from 105 kHz to 130 kHz, which drops a relay on the car. In relation to this phenomenon, the function of the system is summarized as follows.

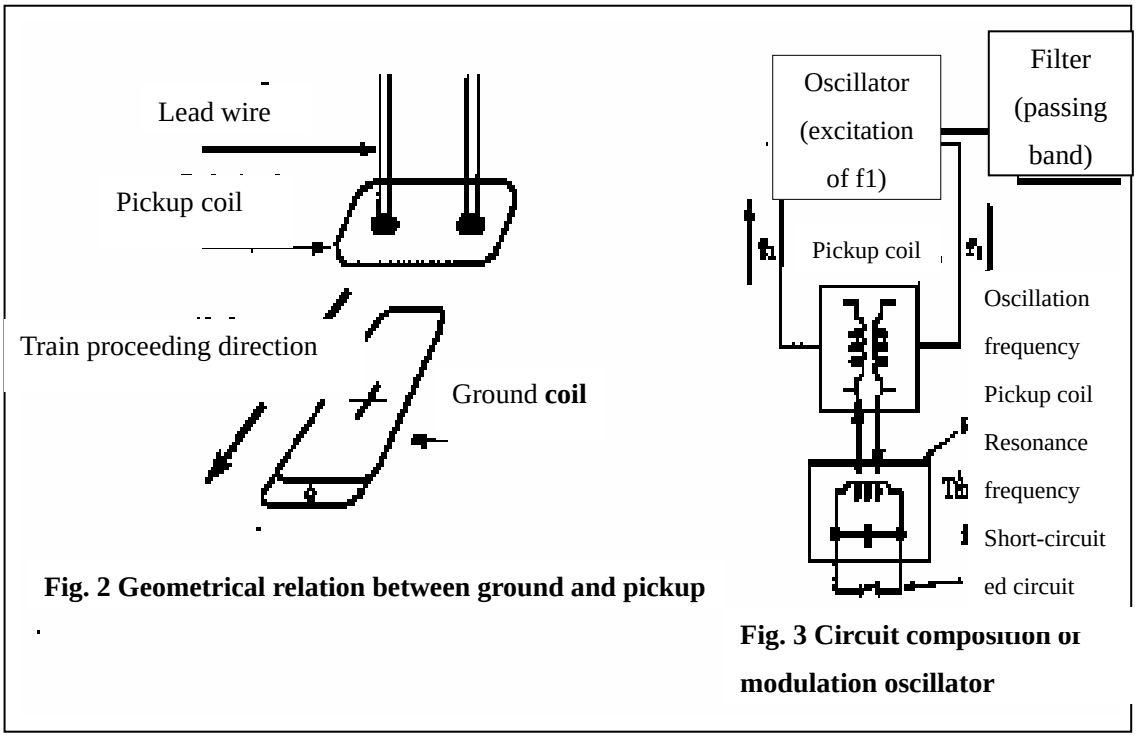


Fig. 2 Geometrical relation between ground and pickup

Fig. 3 Circuit composition of modulation oscillator

The status of the train changes thereafter as follows depending on whether the onboard devices are manipulated appropriately by the driver.

Setting the brake handle at the lapping position within five seconds → Cancellation of the intervention by the system → Return to the normal state

No manipulations for more than five seconds → Application of emergency brake → Setting the brake handle at the emergency position → Train stop → Cancellation of the intervention by the system → Return to the normal state

The maximum train speed responded to by the ATS-S system is 130 km/h. Fig**.** 4 and 5 are photos to show the installation of ATS ground coil and that of ground coils used for speed check, respectively.

Fig. 4 ATS-S ground coil

Fig. 5 Ground coils having the speed check function

4. ATS-P type

(1) Outline

There have been ATS systems having the following problems from the viewpoint of security and operation efficiency.

After an acknowledging manipulation, the system does not function, thereby increasing the danger of rear-end collision (improved by the ATS-SN type and thereafter)

After issuing a warning, the system is indifferent of changes in the signal aspect to a severer speed restriction side.

The system does not instruct speed restriction or slowdown where signals do not exit.

To eliminate these drawbacks, the ATS-P type (hereinafter referred to as "ATS-P") uses a "transponder" system of the digital signal type to armor ground coils with more information.

(2) Operation of ATS-P

When the signal indicates a stop aspect, the system makes the equipment on the train generate a speed check pattern corresponding to the distance from the ground coil to the stop position, or the digitized information on the distance up to the stop position and running speed at different positions continuously thereto, with the running distance from the pattern generating point calculated by counting the number of pulses generated by a tachometer-generator linked with the rotation of wheels. Fig**.** 6 conceptually shows the operation of ATS-P. The train is required to decelerate in accordance with the pattern. When the speed exceeds the pattern, the maximum service brake is applied to confine the operation speed in the area lower than the pattern in Fig.6

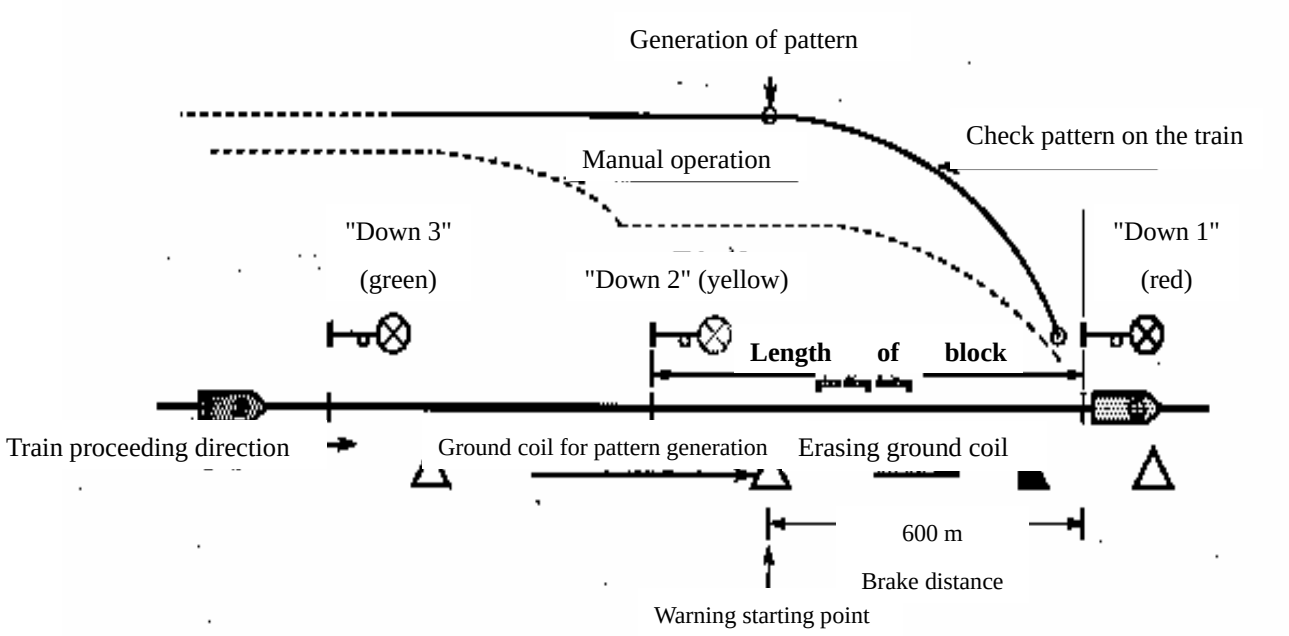


Fig. 6 Speed check pattern and operation

When the signal aspect has changed to a speed restriction relaxing side, the pattern is erased by the pattern erasing ground coil to allow advancing the notch. For a home signal, normally six erasing ground coils are installed. The maximum train speed responded to by the ATS-P system is 160 km/h.

(3) Categories of ground coil

There are structurally two categories of ATS-P ground coil, power-source type and non-power-source type.

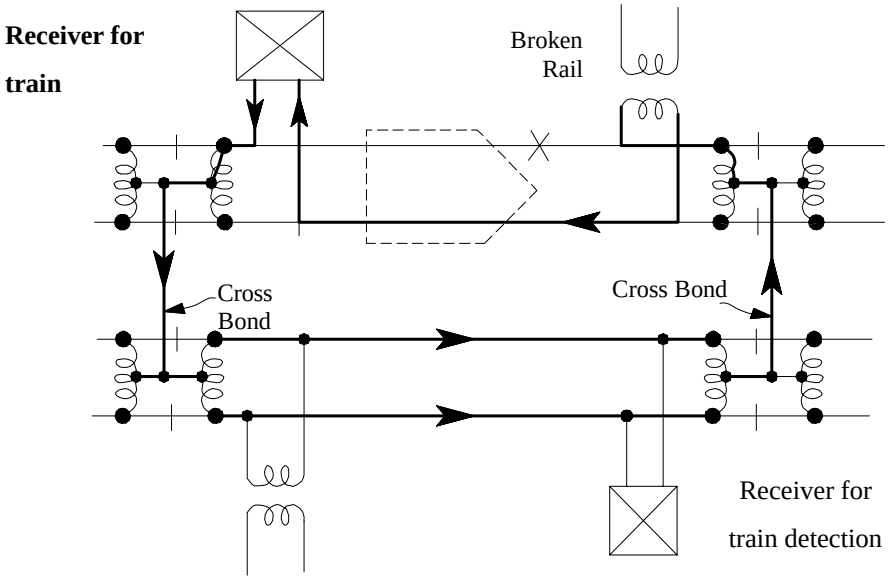
◇ Power-source type: Installed at positions to be controlled by signals and the interlocking system

◇ Non-power-source type: Installed at positions between stations where information shall be sent to trains

The non-power-source type ground coil, which is specific to the "transponder" system, receives the 245 kHz wave normally transmitted from the pickup coil of a train to start operation with the wave as a power source and transmits information at 1.7 MHz to the train. This ground coil can be set at positions where speed restriction is required, independently of the position of signal.

Reference material 4 Cross bond circuit and Cases of train detection systems without track circuits

An example of cross bond circuit



Examples of train detection system without track circuits

Category	Outline of the principle of train detection
Wheel axle detection system	A transmitting coil and a receiving coil are installed to sandwich the rail, with the latter supplied with power at a certain level or over through the electromagnetic coupling with the former. When a wheel passes between the two coils, the electromagnetic coupling in between weakens to reduce the power received by the receiving coil. This works to detect the passage of the wheel. To count the number of entries and exits of trains to/from a section, a transmitting coil and a receiving coil are installed at the ends of the section, which add or subtract the numbers of wheels passing these coils.
Cross induction wire system	Induction wires are installed inside, outside or to the side of the gauge at certain intervals. Trains are equipped with two coils, one for train entry detection and the other for train exit detection. These coils on the train, which face the cross induction wires on the ground, normally transmit an electromagnetic wave. This wave is received by the cross induction wires on the ground to detect the entry and exit of trains. The cross induction wires on the ground are normally fed with a current to check their soundness and that of other equipment on the ground.

Reference material 5　Transmission characteristics of telecommunication equipment.

<table>
<tr><th colspan="2">Types of railway</th><th>Request for communication system (such as transmission, switched service, etc.)</th><th>Remark</th></tr>
<tr><td rowspan="4">National railway</td><td>High speed railway
200-350 km/h</td><td>Tokaido shinkansen;
optical communication:600 Mbps
error rate performance:$<1\times10^{-11}$</td><td rowspan="2">Somewhere else,
2.4Gbps for motion picture</td></tr>
<tr><td>Bound high speed railway
150-200 km/h</td><td>train radio system(tohoku/joetsu shinkansen):LCX
error rate performance:$<1\times10^{-4}$</td></tr>
<tr><td>1st level railway
100-150 km/h</td><td rowspan="3">JR EAST(TOKYO METROPOLITAN DISTRICT);
optical communication:100 Mbps</td><td rowspan="3"></td></tr>
<tr><td>2nd level railway
60-100 km/h</td></tr>
<tr><td>3rd level railway
-60 km/h</td></tr>
<tr><td colspan="2">Urban railway</td><td>Tsukuba express;
optical communication:150 Mbps
error rate performance:$<1\times10^{-11}$</td><td>Somewhere else,
1Gbps for multimedia</td></tr>
</table>

5 Rolling stock

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Chapter 8 : Rolling Stock

Chapter 9 : Rolling Stock Maintenance

CHAPTER 8 Rolling Stock

Section 1 : General

Article 2 Terminology

1. The terminological descriptions of fundamental terms are shown in article 2 of the technical regulation in addition the terms for rolling stock are explained as below.

(1) The rolling stock means all type car and vehicle of locomotive, passenger car, freight car and any special car which run a main line, including any vehicle which run a main line temporarily such as a shunting locomotive or like.

However, the vehicles/cars running on a main line concerned shall be not applied, only if a track possession is carried out.

(2) “Electric car" means a passenger electric vehicle (electric motor vehicle and trailer vehicle) and an electric motored freight car (electric motor car and trailer car).

(3) “An internal combustion engine car” means an internal combustion car for passenger and an internal combustion freight car.

(4) "Train" means the organized cars/vehicles for operating on a track, such as locomotive coupled with freight wagons or passenger coach, electric multiple unit train, internal combustion engine cars/ diesel cars, single locomotive/ internal combustion engine car.

(5) “Diesel multi unit (DMU)” means the train composed by diesel cars.

(6) “Electric multi unit (EMU)” means the train composed with some electric motor cars and trailers.

(7) “Locomotive” means an electric locomotive, an internal combustion locomotive/diesel locomotive, and a steam locomotive.

(8) “Traction motor car” means the car which has a power generating unit.

(9) "Passenger car" means a passenger electric car, an internal combustion car for passengers, coach (coach is mainly towed by a locomotive and it is used for the transportation of passengers, that is presented as coach.) and including such car that has not only a passenger room but also a baggage room.

(10) “Freight car" means an electric motored freight car, an internal combustion freight car, and a freight car (it is mainly hauled by a locomotive and is used for the transportation of cargos, that is presented as freight car.) and a baggage car (that is used mainly for a transportation of baggage and parcel/goods, that is presented as baggage car.).

(11) "Special car" means a track inspection car, an electric inspection car, a wreck tool car, and others which have special structures or special facilities.

(12) "Special edition car" means passenger coach that having a fundamental performance as a common passenger car, but being applied a special specification for the facility in its passenger room in order to use for special purpose.

(13) "The rolling stock for a wheelchair" means that can be free at entrance and exit of a wheelchair for any handicapped passenger and also can be stay in.

(14) "Rigid wheel base" means the horizontal distance between the axle centers of front side wheel and behind side wheel, those wheels are composed into one frame of the bogie which dose not kinked toward the horizontal direction (including a bogie frame) and those wheels have not the lateral allowance and the steering function.

(15) "Total wheel base" means the horizontal distance of the axle centers in both end at front and behind of a bogie. (Fig.1)

(16) “Distance between bogie centers” means a horizontal distance between the rotation centers of bogies in both ends of a car.

(17) “Tare mass”; Total mass of the rolling stock that has full amount of fuel for engine and fuel system, lubricant, coolant and facilities provided for the operation service without mass of passenger, crews and materials or goods. (The mass of crews, passengers and any goods are not included into the mass.)

(18) “Loaded mass”; Total mass of rolling stock having full amount of fuel for engine and fuel system, lubricant and coolant and facilities provided for the operation service with equivalent mass of passenger and crew and maximum amount of luggage or baggage. Mass of a single passenger and crew can be calculated by 55 kg per person

(19) "Passenger capacity" means number of seats or beds for passengers. However, in case there are standing spaces, it means the sum of the number of seats and the number of standing spaces.

(20) “Brake ratio”; Ratio between total value of working force against brake shoe (cast-iron) and mass of car. Non-cast iron brake shoe shall be converted into cast-iron brake shoe in friction coefficient of braking. Loaded brake ration is for loaded and un-loaded brake ration is for tare mass of rolling stock.

(21) “Inspection” means inspections of rolling stock and the parts concerned, and also repairs accompanied with inspections.

(22) “Interval of inspection” means the schedule of the interval when the respective inspection should be carried out according to the inspection type concerned.

(23) “Personnel”; means those who carry out inspections of rolling stocks and repair works accordingly.

2. Other than terminologies mentioned in the previous clause, technical terms in these criteria is referred to meanings in Vietnam Railway Law and Vietnam railway technical regulations.

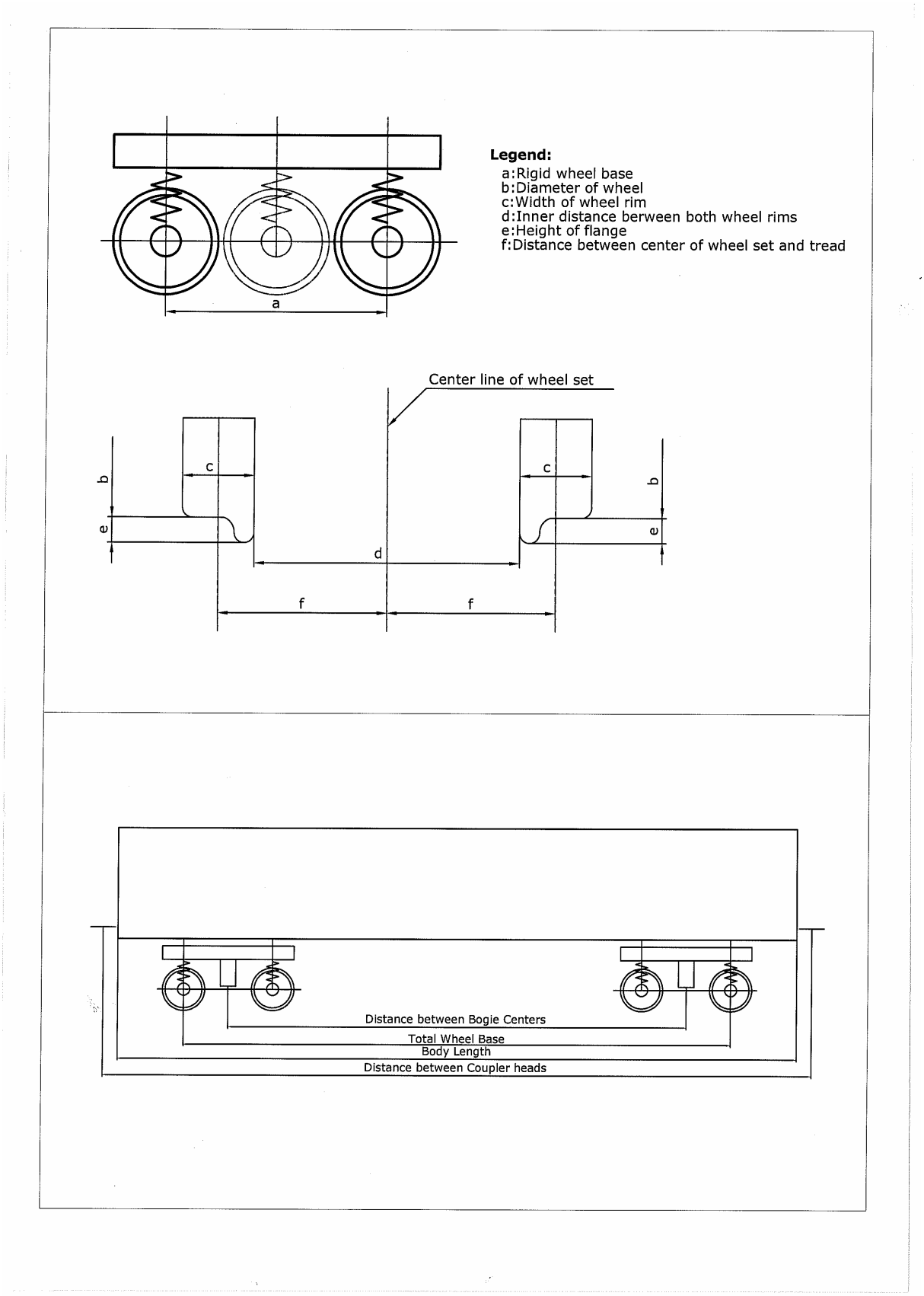


Fig 1 (Article 2)

Section 2 : Rolling Stock Gauge

Article 68 Rolling Stock Gauge

Rolling stock shall not exceed the rolling stock gauge under the conditions mentioned below.

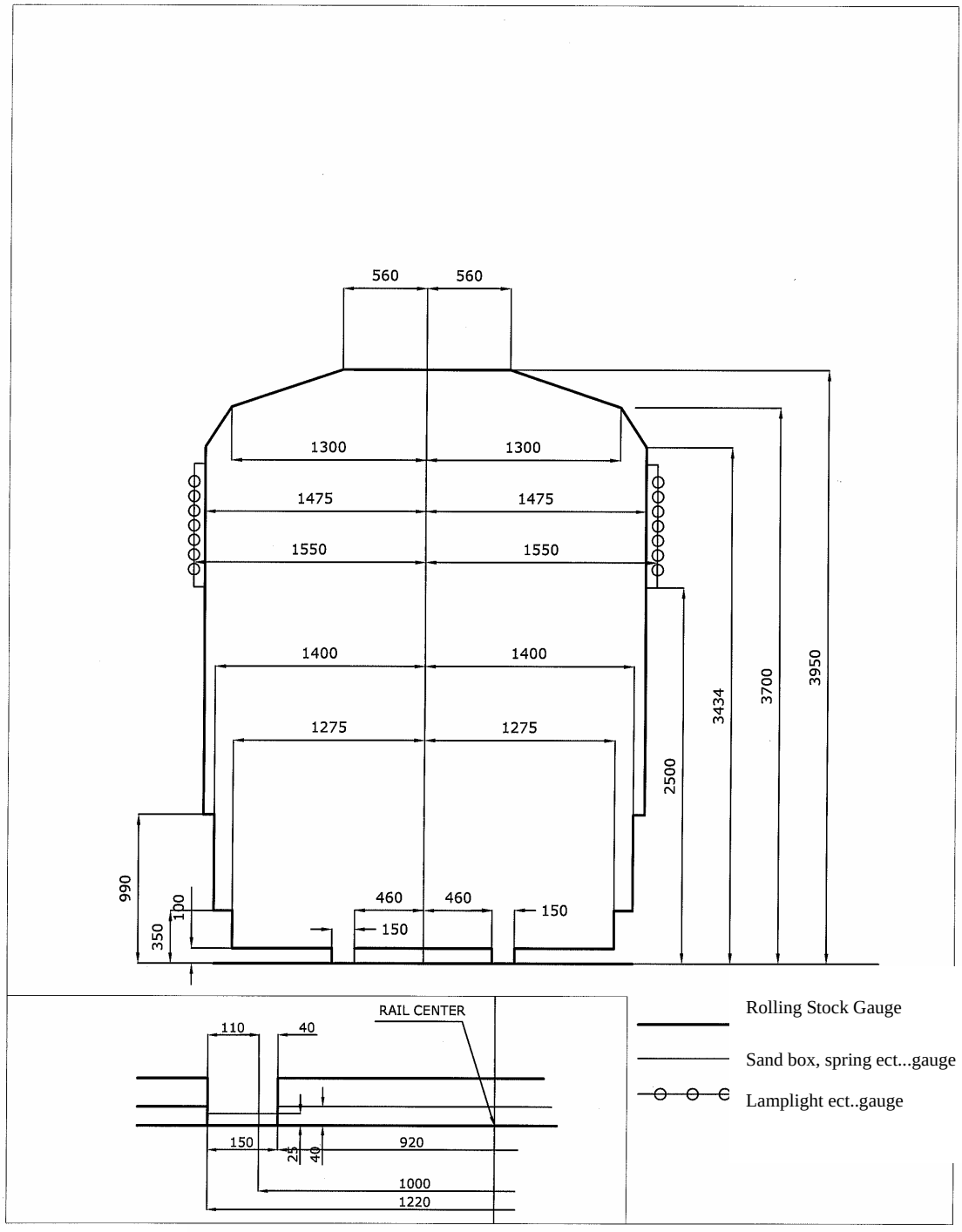
(1) In the condition that rolling stock stops on the level and straight track and centerline of the carbody and the bogie tally to centerline of the track whether the wheel is worn out or not.

(2) In the conditions that rolling stock is loaded by the maximum capacity load.

(3) In the condition that carbody or bogie are not inclined by deviated load due to passenger or cargo.

Article 68-2

1. Rolling stock gauge at the straight section shall be as follows.
   (1) Rolling stock gauge in ordinary railway: (Fig.2)
   (2) Rolling stock gauge of high speed railway: (Fig.3)
2. Notwithstanding the previous clause, the following parts or devices of rolling stock may exceed the gauge by each item concerned as provided in principle as follows.
   (1) Wheel, rail lubricator and track measuring device
   Condition; All inside construction gauge
   (2) Rail guard (Pilot)
   Condition; Springy part within the construction gauge
   (3) Doors including plug door, swing door of non-covered wagon, emergency door and the like
   Condition; Case under being opened
   (4) Rail measuring wheel, rail crack detector, and construction clearance measuring machine
   Condition; Case under operation within the construction gauge
   (5) Crane and the other concerned
   Condition; Case under operation
   (6) Supporting device for passenger getting on and off
   Condition; Case under operation
3. Rolling stock clearance in curve section shall be calculated by adding relative value on each side related to the clearance at straight section in consideration of deviation carbody. And moreover, carbody shall be considered to be inclined due to the cant concerned.

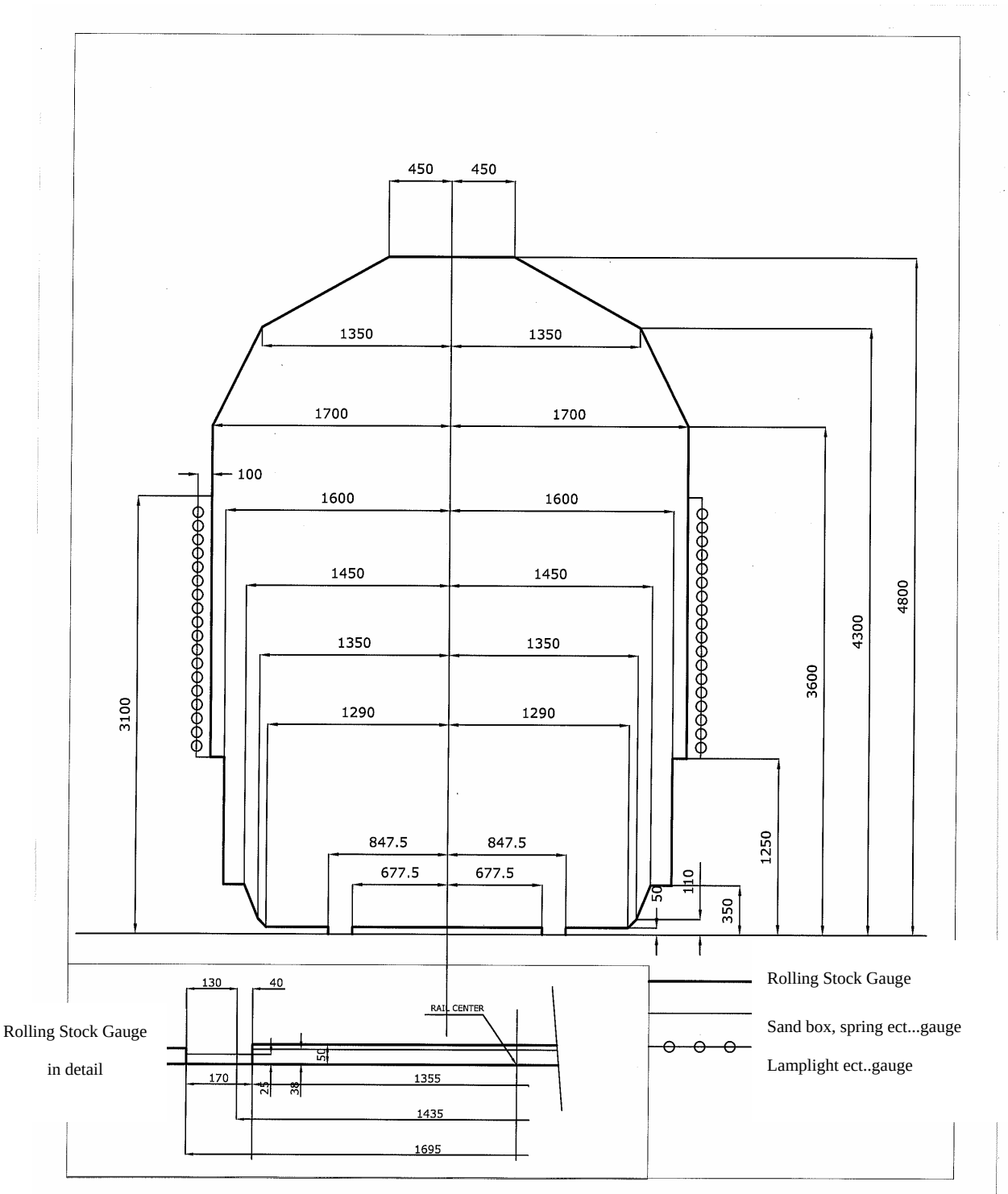


Rolling Stock Gauge

in detail

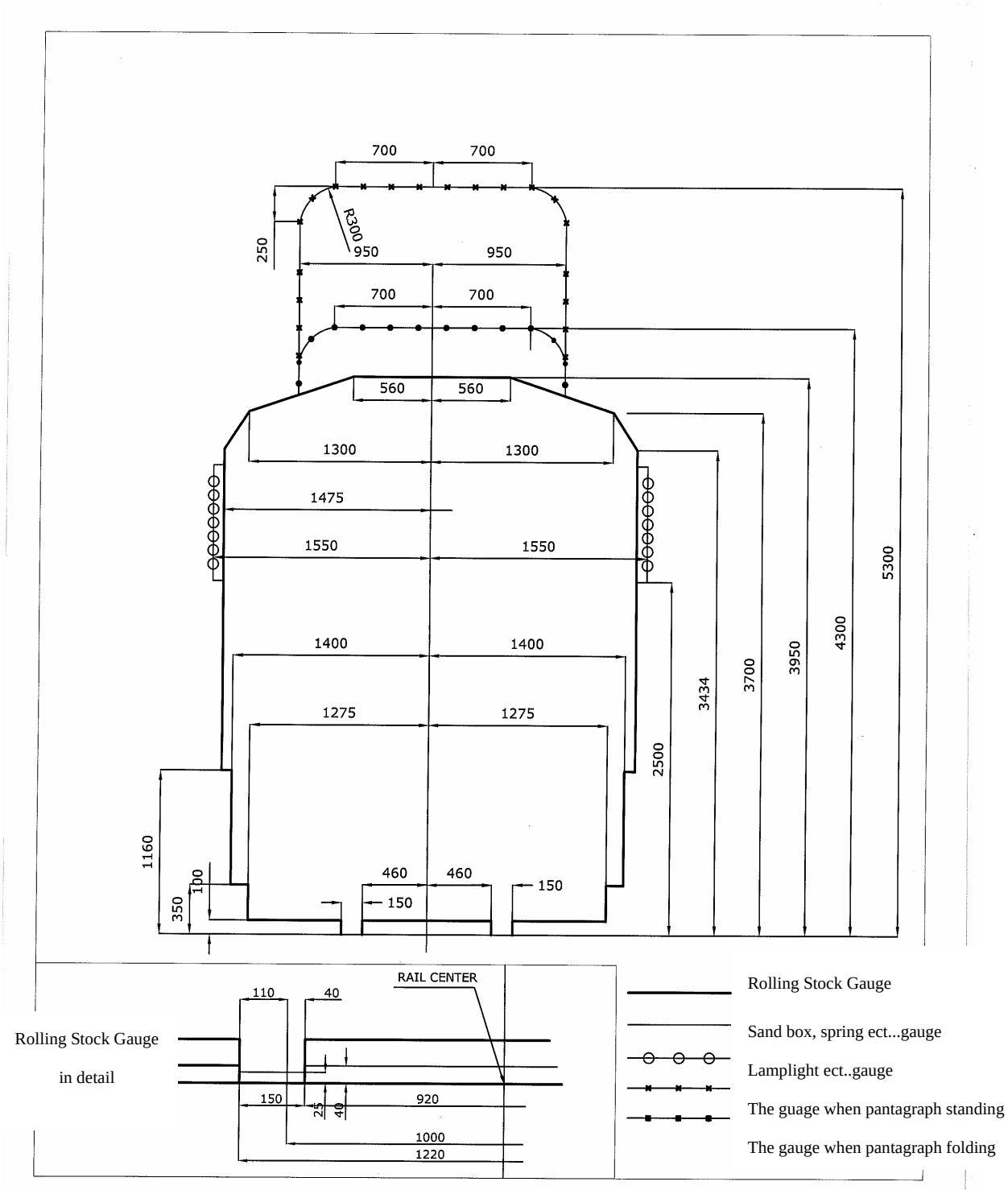
NON ELECTRIFIED LINE
STANDARD RAILWAY (1000 m)
ROLLING STOCK GAUGE

Fig. 2-1 (Article 68-2)



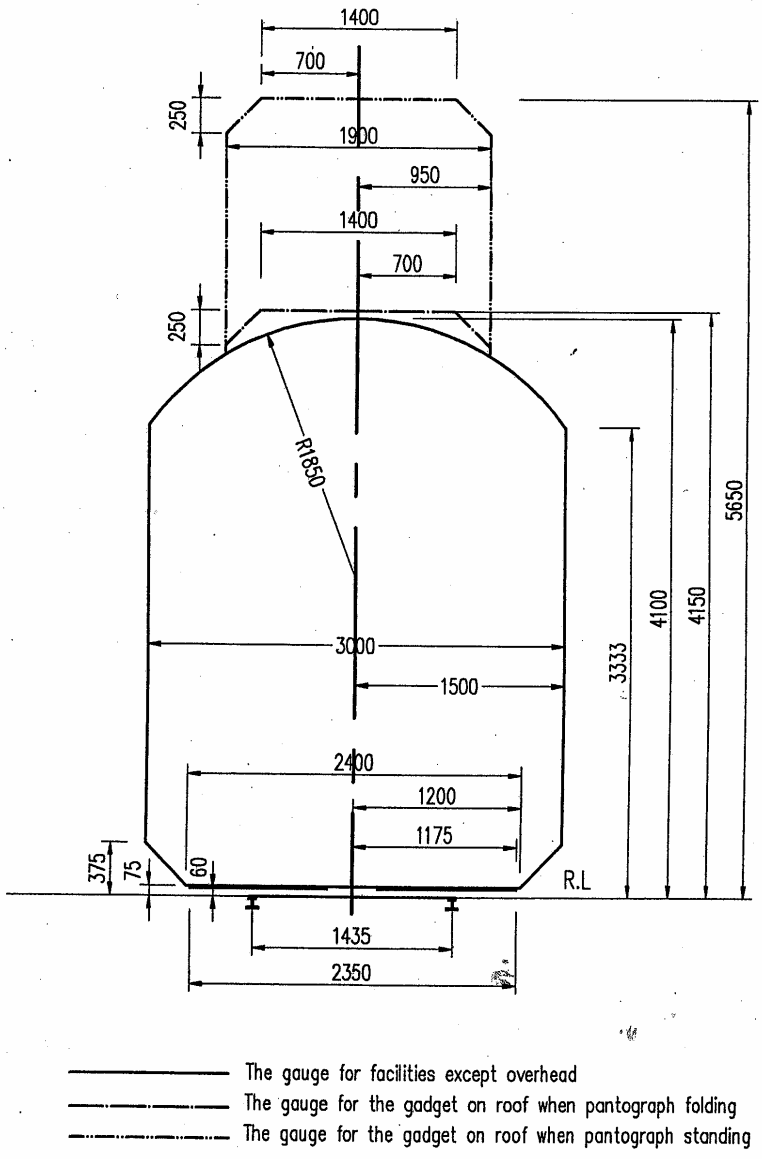
NON ELECTRIFIED LINE
STANDARD RAILWAY (1435 m)
ROLLING STOCK GAUGE

Fig. 2-2 (Article 68-2)



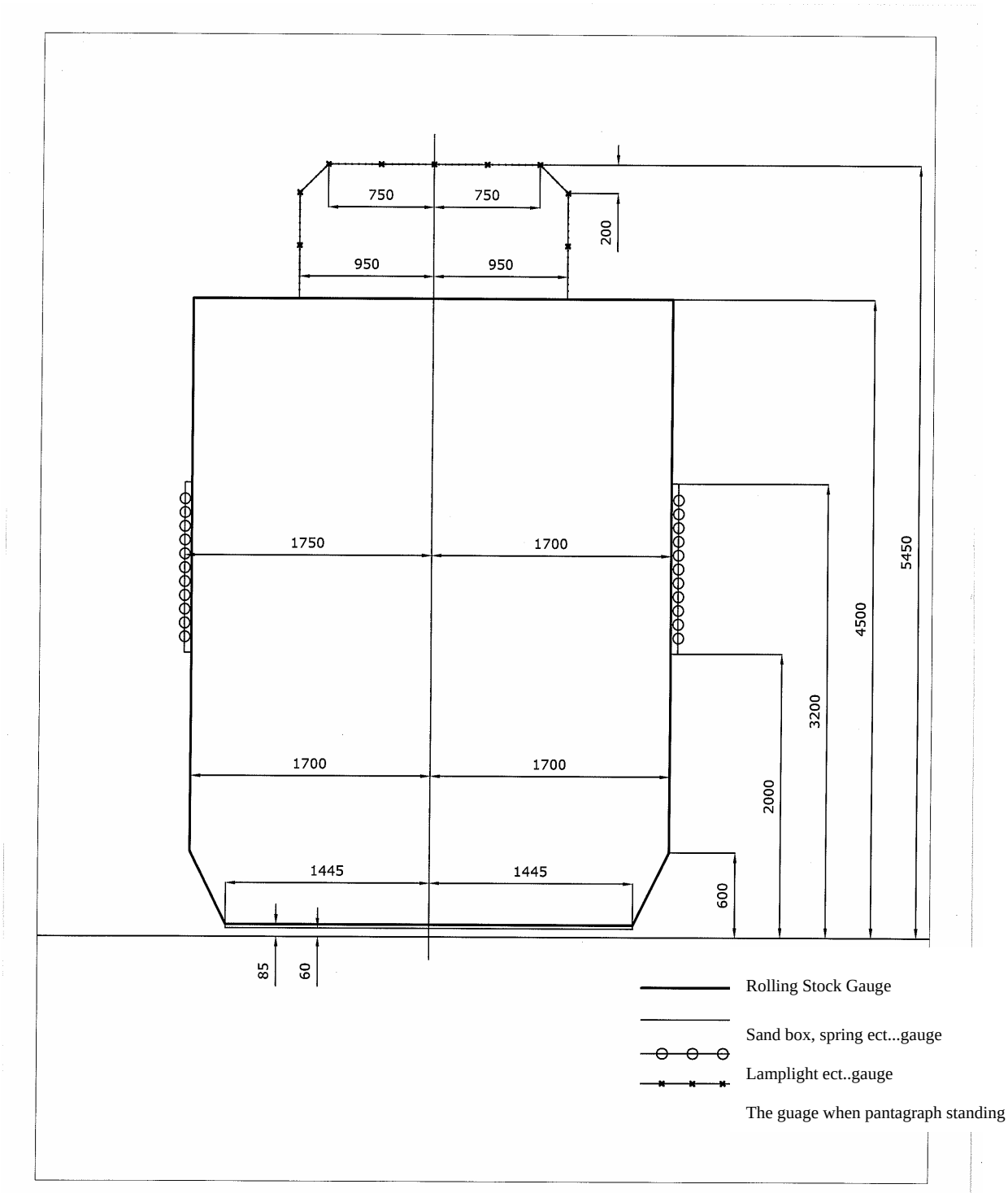
ELECTRIFIED LINE
STANDARD RAILWAY (1000 m)
ROLLING STOCK GAUGE

Fig. 2-3 (Article 68-2)



ELECTRIFIED LINE
ORDINERY RAILWAY(1435mm)
ROLLING STOCK GAUGE

Fig.2-4(Article68-2)



ELECTRIFIED LINE
HIGH SPEED RAILWAY (1435 m)
ROLLING STOCK GAUGE

Fig. 3 (Article 68-2)

Section 3 Mass of Rolling Stock

Article 69 Mass of Rolling Stock

Rolling stock shall not impose heavier burden on track and structure beyond the capacity.

Article 70 Stability

1. Rolling stock shall be operated in safety and stability under the track condition and other predictable operation condition.
2. A passenger car shall set the ratio of static load unbalance between pair wheels (a ratio between a wheel load of unloaded condition and a half of axle load) into 0.9 or more and 1.1 or less for the car using in 1000mm gauge, and set it into 0.85 or more and 1.15 or less in 1435mm gauge. Furthermore the structure of bogie could be easily adjusted of the ratio of static load unbalance between pair wheels. However, this shall not be applied, if it is conformed to the criteria being defined independently such as the national railway specification.
3. A Rolling stock shall be such structure which is not overturning even though it stops on the track of a curve installed a cant.

Section 4 Running Gear of Rolling Stock

Article 71 Running Gear

1. Running Gear shall has strong and solid structure enough to secure the running safety and stability against severe hunting motion.
2. Arrangement and the mounting structure of wheel axle and other structure of installments shall conform to the followings.
   (1) The structure shall pass through turnout, derailment prevention rail and other guardrail without any damage.
   (2) Dimension of wheelbase and wheel and axle of rolling stock shall conform to each one indicated in the following table.

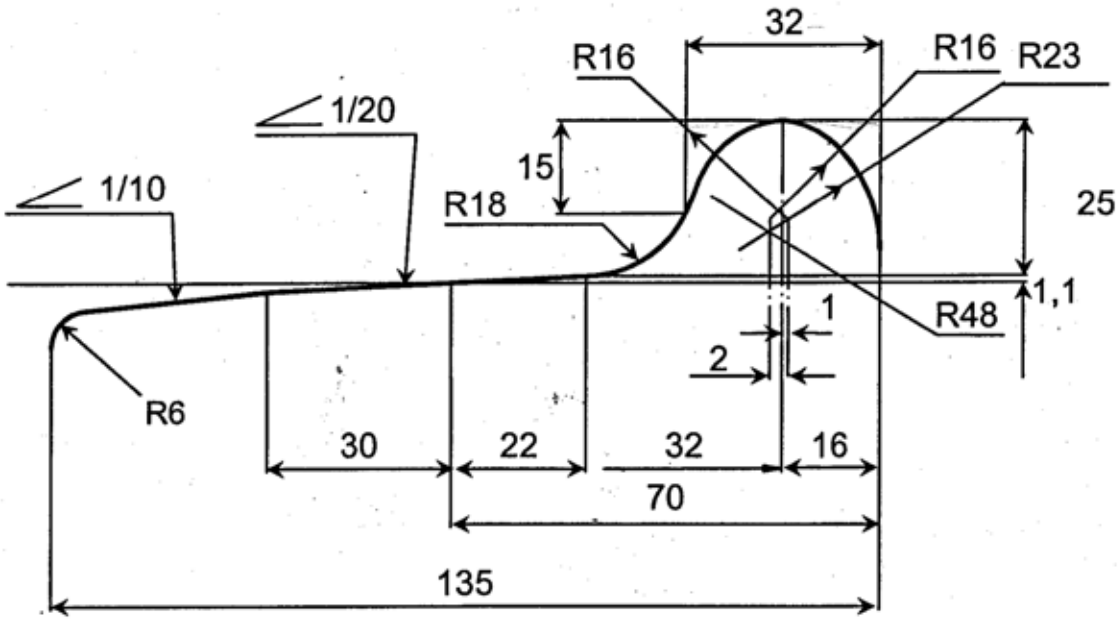
Table71.1 Running Gear

Description	Ordinary Railway		High Speed Railway
	1000mm	1435mm	1435mm
a. Wheel Base	4300mm or less		3500mm less
b. Wheel Diameter	680mm more		730mm more
c. Rim width of wheel	120mm - 150mm		-
d. Inner distance between both wheel rims	921mm – 927mm	1350mm 1356mm	1358mm 1363mm
e. Height of Flange	25mm – 35mm		
Limiting curve condition for Rolling Stock	R=75 m	R=100m	200m radius curve with 5mm gauge-widening

(Fig.4)

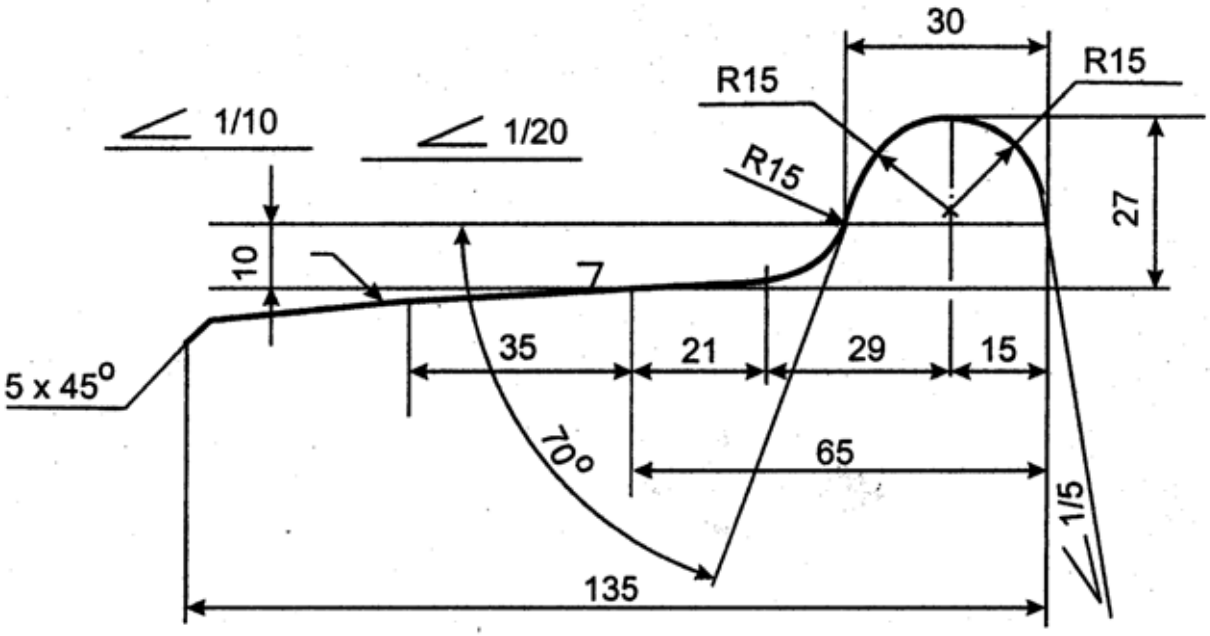
Wheels dimension of rolling stock that is less than 680 mm shall be applied to other legal regulation

3. Suspension system with air spring shall conform to the followings.
   (1) It shall be provided with adequate capacity of air chamber.
   (2) It shall support car body safely even though the mechanism does not work as spring due to air leakage.
4. A car at the most front of train shall be provided with rail guard (pilot), which shall conform to the following criteria.
   (1) Rail guard (pilot) shall be provided some clearance between the lower end and the top of rail in order to remove an obstacle on the rail.
   (2) Rail guard (pilot) mentioned above includes cowcatcher and other structure to drive away obstacle on the rail.



WHEEL PROFILE (GAUGE 1000mm)

VIET NAM RAILWAY



WHEEL PROFILE (GAUGE 1435mm)

VIET NAM RAILWAY

Fig. 4-1 (Article 71)

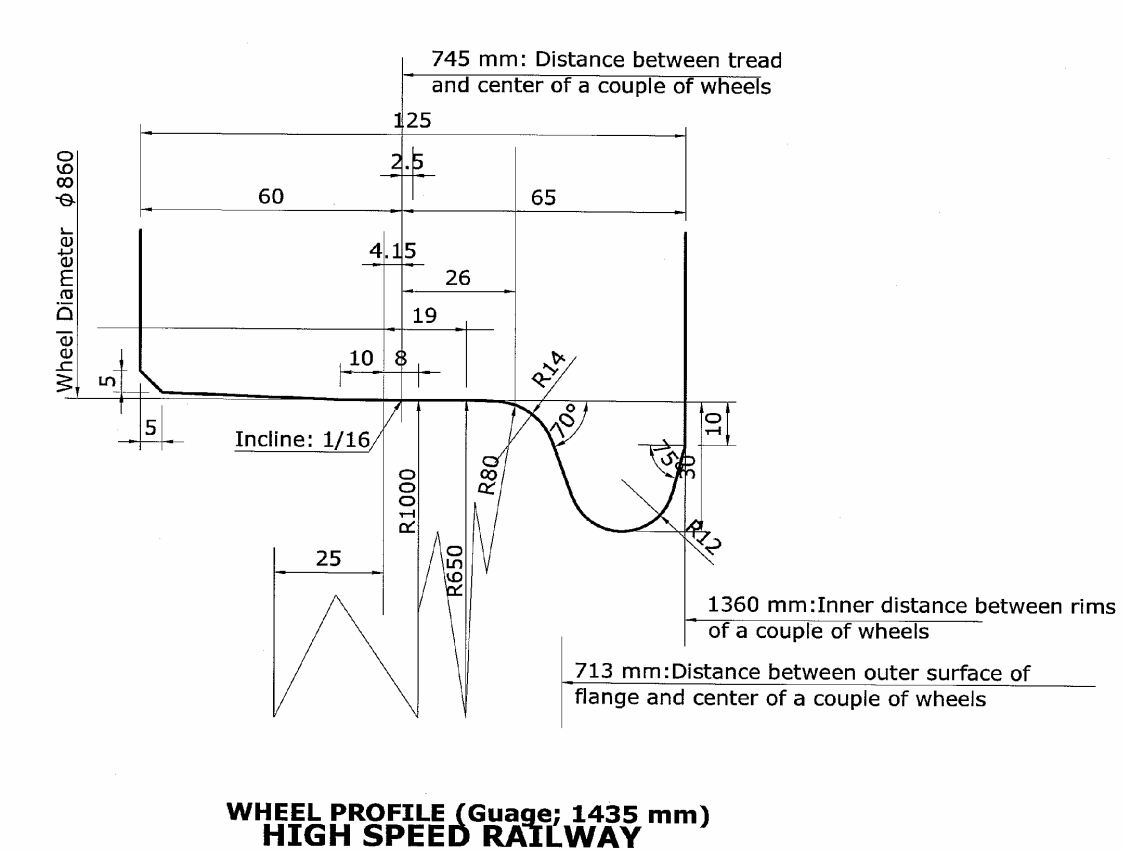


Fig. 4-2 (Article 71)

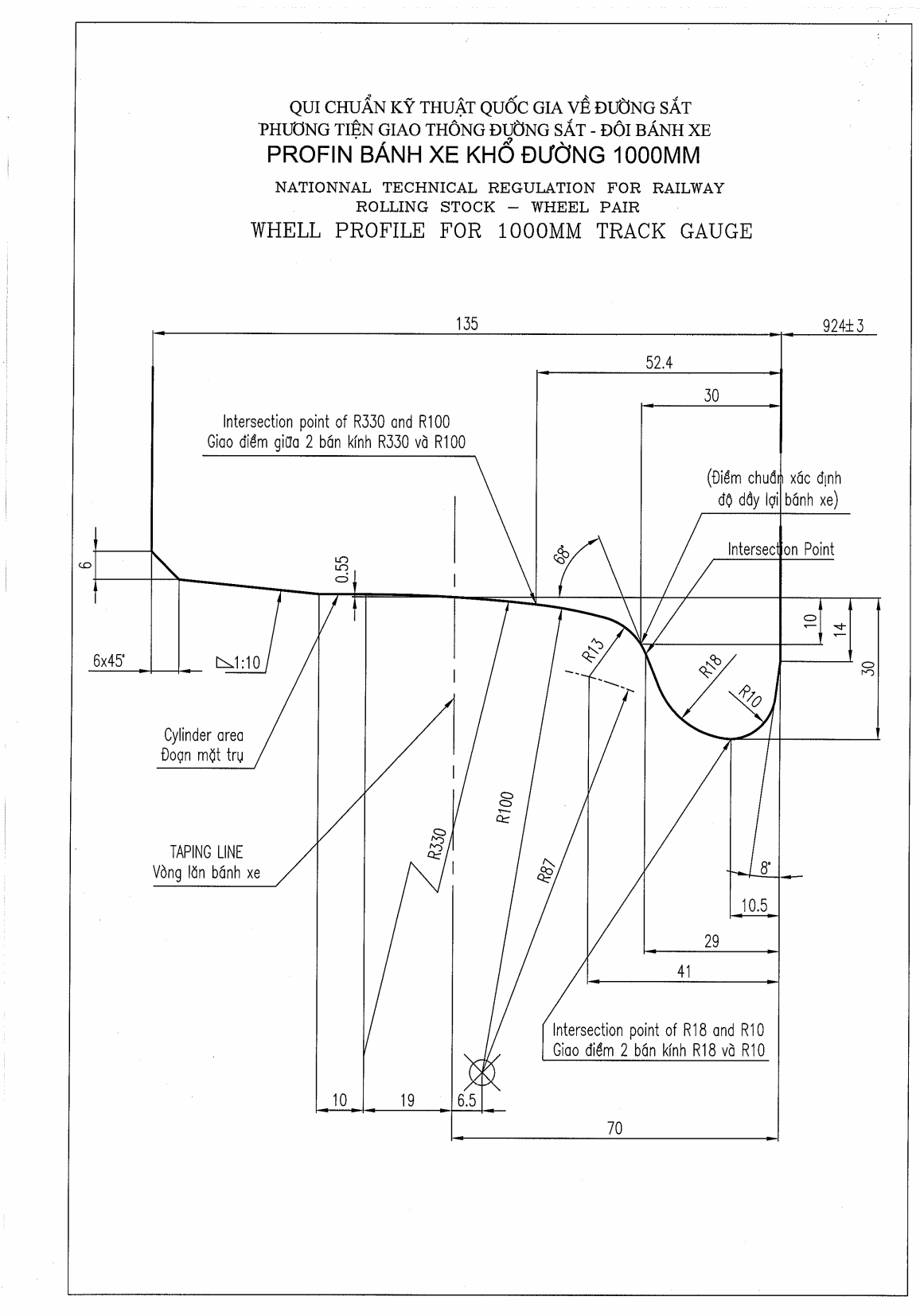


Fig. 4-3 (Article 71)

Article 72 Propulsion system

1. Propulsion system, power collecting system, power transmission system, and auxiliary equipment concerned shall conform to the ground facilities and withstand operation.
2. Electric devices and wire of rolling stock shall conform to the followings.
   (1) Any electric shock and fire shall not be caused by dielectric breakdown and the like.
   (2) Devices shall be protected against any person so as not to treat without permission.
   (3) Inductive disturbance shall not cause any trouble on other electric circuit that is provided for railway facilities and rolling stock.
   (4) Electric wire shall conform to the followings.
      a. Wiring that might be damaged by sliding or vibrating motion shall be protected.
      b. Protector and lead-in/ out wiring of devices shall be protected structurally against rainwater infiltration.
      c. Wirings used for different voltage shall not be installed in a single and the same protecting pipe or duct. When insulator used for the highest voltage wiring or the insulating capacity are used for other lower voltage wiring too, all the wirings can be protected structurally by a single, however.
3. Power collecting system of electric car or locomotive (hereafter; electric rolling stock) shall conform to the followings.
   (1) Mount of the system shall be insulated.
   (2) The system shall follow overhead contact line adequately to collect electricity.
   (3) Pantograph shall be pushed up by springs kinetic force or compressed air.
   (4) Pantograph shall be pulled down by remote control from driver cabin of electric car formed in a train.
   (5) Collecting system by third rail contact line shall follow the previous items in consideration about voltage to be used.
4. Main circuit of electric rolling stock shall be provided with the following equipment.
   (1) Surge arrester at position electrically not far off from the power collection equipment
   (2) Automatic breaker or manual releasing device at a position electrically close to power collection equipment
   However, these equipments can be omitted in case of rolling stock supplied electricity through the other rolling stock provided with automatic breaker and releasing device.
   (3) Emergency ground switch shall be provided at the place near pantograph in case of railway with alternative current electrification.
   (4) Electric rolling stock which is operated connecting some sections with different electric system or different voltage shall be provided with device at place near collecting system so as to protect electric equipment while entering to different sections.
   (5) Device which protects collecting system against dropping down before main circuit being cut out. Dropping down some out of more than one pantograph are connected by bus line shall be excluded from the mentioned above, however.

5. Electric circuit shall be provided with following equipment in the supply side.

(1) Fuse or breaker that has the same performance as the fuse. However, these equipments can be omitted in case of rolling stock supplied electricity from the other rolling stock provided with the fuse or breaker.

(2) Contactor at power source circuit of power converter, or motor generator, static Inverter, motor of air compressor and the like. However, this shall be excluded for power source of motor for air compressor and the like, which is supplied power from other power source with the breaker

6. Engine of rolling stock shall conform to the followings.

(1) Fuel tank and piping shall have structure protected against leakage by vibration or shock and the like.

(2) Inlet or air bleeder of fuel tank shall have structure protected against vibration and shall be isolated from opening of exhaust pipe and devices that may generate arc and besides shall not be opened in the cabin.

(3) Exhaust piping shall not be installed inside cabin. However, protected piping shall be able to be installed inside cabin.

7. Engine shall be provided with the following equipment.

(1) Equipment that can stop engine in case of excessively lower lubricant pressure

(2) Equipment that can stop engine or release load from the engine in case of cooling water overheated.

(3) Drain plug and oil pot at the lower part of silencer

(4) Indicator that warns crew in cabin against exhaust pipe overheated

(5) Automatic extinguisher in power supply car

Article 72-2 Equipment of steam locomotive

Engine of steam locomotive shall be provided with the following equipment in addition to the previous articles.

(1) More than 2 water feeders and 2 safety valves which work independently on boiler

(2) 2 independent water level indicators on boiler

(3) Melting plug on ceiling of fire chamber

(4) Pressure gauge indicating maximum operation pressure

(5) All stay of fire chamber shall be checked damage from outside excepting for stay on top of the chamber

(6) Equipment that protect sparks and cinder against scattering on smoke chamber and ash tray

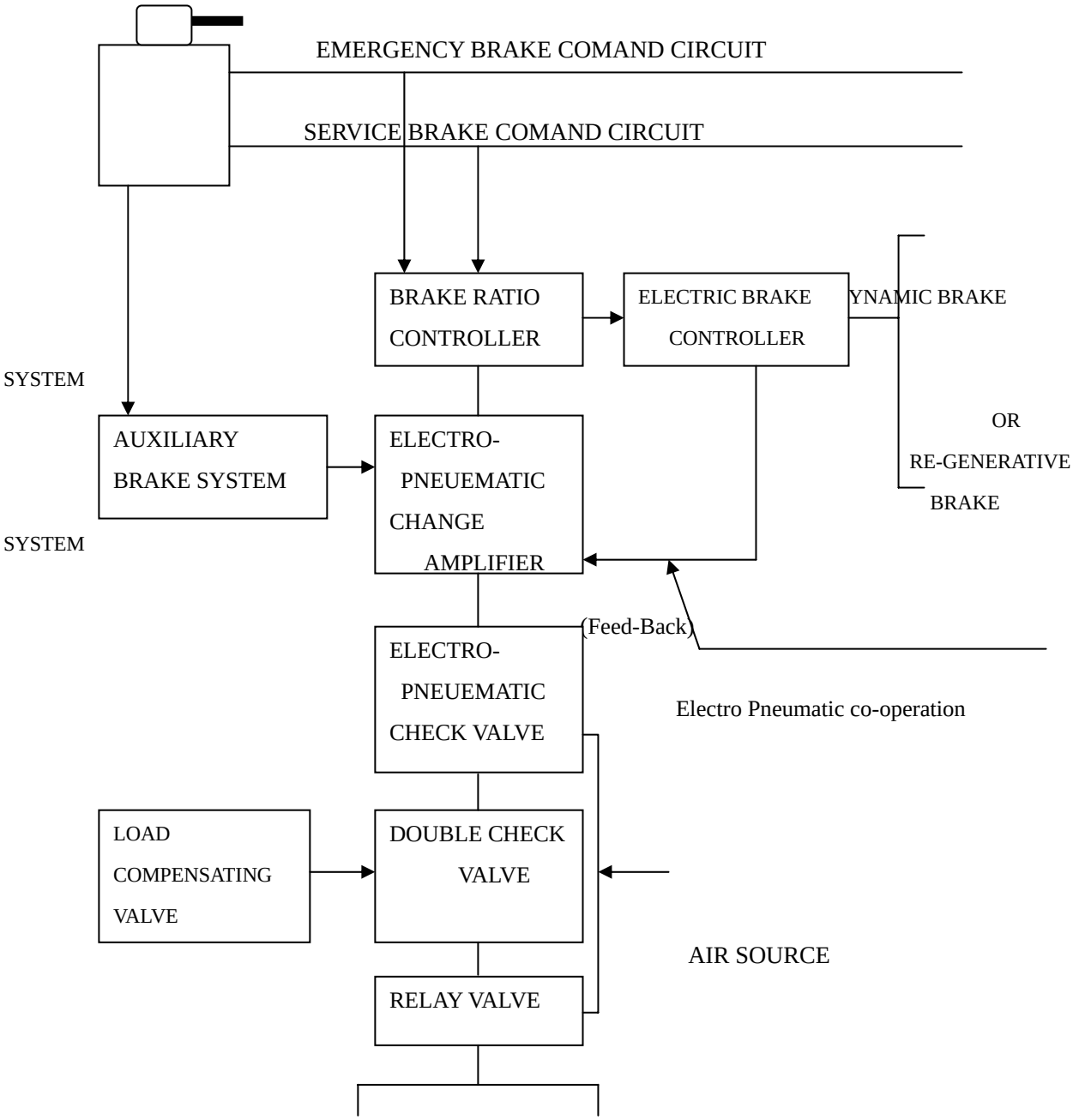
Article 73 Brake system

Rolling stock shall be provided with brake system conforming to each type:

(1) It shall be equipped with a service brake system that works in emergency to stop the running cars quickly as well as in normal operation. In case of electric car of high speed railway,

however, 2 or more brake command control systems that work independently shall be provided. (Fig.5)

ELECTRIC COMMAND AIR BRAKE SYSTEM WITH ELECTRIC BRAKE



AUXILIARY BRAKE SYSTEM: Brake system that works from BRAKE CONTROLLER directly in case of breakdown of other brake systems.

Fig. 5 (Article 73)

(2) Parking brake for preventing car rolling while being parked

(3) Security brake for stopping train when service brake system fails

Table73.1 Brake system

Description of Rolling Stock		Description of Brake System		
		Service	Parking	Safety
Locomotive	Diesel	P	P	
	Electric	P	P	
Passenger Electric / Diesel Car		P	P	P
Passenger Coach		P	P	
Freight Wagon		P	P	
Car for special use		P		

P: To be provided

However, some rolling stock which is categorized in multiple, more than one type shall be provided with brake systems conforming to all types.

2 Notwithstanding the previous provision, parking brake may not be provided for rolling stock conforming following criteria.

(1) Rolling stock that can be prevented rolling at parking by security brake system.

(2) Freight car that can be prevented rolling at parking by parking brake system equipped in another car which is coupled permanently

3. Device, piping and function and shall not be caused troubles due to vibration and impact or the like.

4. Function of service brake system shall be conformed to the following criteria. Service brake system can;

(1) decelerate and stop running rolling stock and keep rolling stock stopped

(2) It shall be capable of stopping rolling stock running on the flat line at the maximum speed within a distance conforming to ground facilities condition by applying service brake at its maximum performance.

(3) Work braking force on all wheels of rolling stock excluding leading wheel, trailing wheel of locomotive and wheel for lightening axle load and some wheel of special usage.

(4) Braking force of ordinary railway rolling stock shall be indicated by loaded brake ratio and as shown in the following table:

Table73.2 Loaded Brake Ratio

Description of rolling stock	Loaded Brake Ratio
Locomotive	70/100
Electric/ Diesel car	70/100
Passenger car	70/100
Freight car	25/100
Special car	25/100

However, rolling stock categorized in multiple functions shall be conformed to each value.

(5) Braking force of high speed railway rolling stock shall be indicated in deceleration ratio at level and straight track as shown in the following table.

Table73.3 Deceleration

Speed Range (km/h)	Deceleration (km/h/s)	Deceleration (m/s^2)
Over 230km	1.5	0,41
160 – 230	1.9	0,52
110 – 160	2.5	0,69
70 - 110	3.1	0,86
Less than 70	3.4	0,94

Loaded braking ratio (LBR): Proportion of total braking force to the car weight with load

This shall be obtained by the following calculation.

LBR: Loaded braking ration = $A/B \times C$

A: Braking force (kN) = $a \times b \times p \times k \times f$

a: Area of brake cylinder (m^2)

b: Number of brake cylinder

p: Air pressure in brake cylinder (k Pa)

k: Lever ratio

f: Mechanical efficiency

B: Weight of car (kN) = $(W + L) \times g$

W: Tare weight (t)

L: Load (t)

g: Gravity acceleration (m/s^2)

C: Conversion ratio of brake shoe material

This value shall be calculated from friction coefficient compared between base brake shoe (for example, cast iron) and brake shoe used actually.

(6) Regarding locomotive provided with two driver cabins at both ends, the locomotive may start structurally only in case of the brake system to be functioned in a manned driver side cabin.

(7) Brake system activated by air pressure as power source for braking shall be as follows.

a. Air reservoir shall have capacity to accumulate air pressure enough to activate barking.

b. Lower air pressure in main air reservoir or piping shall enable structurally rolling stock not to start.

c. Power supply condition for braking shall be indicated in driver cabin.

d. Devices and piping between the final air reservoir; as power source for braking and brake cylinder shall be installed inside bogie width including bolster link and other strong parts installed in bogie structure. However, piping in cabin or devices and piping protected by strong material shall be excluded.

e. In case of the utmost front car with driver cabin in a train, devices and piping between the final air reservoir; as power source for braking and brake cylinder shall be installed inside the front structure of body frame. However, piping protected by strong material shall be excluded.

(8) Brake system activated by hydraulic operation as power source for braking shall be as follows.

a. Accumulator shall have capacity to accumulate oil pressure enough to activate barking.

b. Lower oil pressure shall enable structurally rolling stock not to start.

c. Power supply condition for braking shall be indicated in driver cabin.

d. .Devices and piping between the final accumulator as power source for braking and brake cylinder shall be installed within bogie width including bolster link and other strong parts installed in bogie structure. However, piping in cabin or devices and piping protected by strong material shall be excluded.

e. In case of the utmost front car with driver cabin in a train, devices and piping between the final oil accumulator as power source for braking and brake cylinder shall be installed inside the front structure of body frame. However, piping protected by strong material shall be excluded.

5. Function of parking brake system shall be as follows.

(1) In order to prevent car rolling while parked, the capacity shall be the same as those of hand brake and side brake equipment or more.

(2) Braking force shall be calculated by brake ratio. And the ratio according as the brake description shall be over the each value indicated in the table below:

However, rolling stock shall be provided with scotch block in order to prevent rolling in case of brake ratio 5/100 or less of hand brake system.

Table 73.4 Brake Ratio

Description of brake equipment	Non-loaded brake ratio	Loaded brake ration	Calculation
Hand Brake	20%	—	Operating the steering wheel in case of one hand handle is 294 Newton and the both hands handle is 441 Newton, brake leverage makes 1200 or less.
Hand Brake (Steam Locomotive)	5%	—	
Spring brake	20%	—	

6. Function of safety brake shall be as follows.
   (1) It shall activate braking force independently from service brake system and enable rolling stock stopped and shall be able to maintain rolling stock stopped for time long to be needed.
   (2) Braking force shall be calculated by brake ratio, and the non-loaded brake ratio shall be over 70/100.
   (3) In case of brake system using air pressure as power source for braking, besides mentions in the a), c) and d) of Item 7 Clause 4, devices and piping between the final air reservoir as power source for braking force and brake cylinder shall be independent from other pneumatic devices and piping as possible as they can.
   (4) In case of brake system using hydraulic pressure as power source for braking, besides mentions in the a), d) and e) of Item 7 Clause 4, devices and piping between the final accumulator as power source for braking force and brake cylinder shall be independent from other hydraulic devices and piping as possible as they can.
7. Brake system of rolling stock coupled ordinarily with other car in a train formation shall be provided with continuous braking function.
   (1) Service brake system of all cars coupled in a train formation shall be controlled directly from the driver cabin.
   (2) Splitting car from a train formation shall activate braking force automatically.
   (3) Car equipped with pneumatic brake system shall be connected through main reservoir piping or brake piping (in case of car without main reservoir piping)
8. Electric or diesel car with double driver cabins at the both ends, which runs as a single shall be structured as follows besides mentions up to the previous clauses.
   (1) Service brake system and safety brake system shall be provided with double piping circuits

independently to each other between power source for braking force and brake cylinder whether it is pneumatic or hydraulic.

(2) Air reservoir or oil accumulator and check valve of safety brake system shall be doubled structurally in the system and braking function in either front or rear bogie shall be secured by arranging check valves in right and left side.

Section 5　Body Structure and Devices

Article 74　Body Structure

1. Body shall be structured strongly enough to withstand long operation.
2. A part coupling cars regularly with each other shall be provided with facility to protect passenger walking through there normally from his falling down.

   However, where there is no possibility that any passenger may fall, under the condition of protective facilities along the platform or suchlike, this regulation shall not be applied.

Article 75　Structure for lightening remarkable noise

1. Rolling stock in high speed railway shall be provided with structure lightening noise remarkably caused by power collecting system, aerodynamic sound and due to infrastructure while high speed operation, that is, improving pantograph, smoothing body surface, lighting car weight and the like.
2. Notwithstanding the previous clause, track inspection car, electric inspection car which are operated in the same speed as commercial train while commercial operation shall be considered about noise lightening measures within range so as not affect against correct inspection items.

Article 76　Structure of crew's cabin

1. Structure of crew cabin shall conform to the followings. However, crew cabin of a car for special purpose shall be excluded from this article. Crew cabin shall be;
   (1) Separated from passenger cabin and shall be locked mechanically or electrically.
   (2) Provided with doorstep. However, it may be excluded if crew can enter the crew cabin through passenger cabin with ease.
   (3) Provided with inward-open door or slide door at the doorstep on body side.
   (4) Provided with hinged door opening toward crew cabin or both ways if doorway mentioned in (1) is also used as emergency door for passenger.
2. Windows of crew cabin shall conform to the followings:
   (1) Front window of driver seat shall be wide view enough for the driver to look out track condition and so and wiper.
   (2) The front window shall secure drivers view and be provided with glass which cannot be broken through even though window glass is damaged by something flying.
   (3) Window on both sides of the cabin shall be provided in order to ease driver to operate a train.
   (4) Side windows on both sides or one side window of car to be used by conductor shall be able to be opened.
   (5) Windows of crew cabin shall be safety glass or same performance.

Article 77　Structure of Passenger cabin

1. Structure of passenger cabin shall conform to the followings

(1) Windows shall be as follows.

a. Window shall not be able to open outward.

b. With regard to windows that passenger can open, height of the bottom line from the floor level shall ber 800 mm or more high at the back or side of seat, and 1200 mm or more high at the aisle.

c. Windows shall be provided with safety glass or the same function as the safety glass and more.

(2) Opening dimension of window shall be as follows. (Fig.6)

a. Car[*1] running in section with narrower distance[*2] between both track centers and car running in section with narrower clearance[*3] between rolling stock and construction gauges shall follows the table below.

*1: Excluding rolling stock having the maximum body width less than the distance between both track centers reduced by 600 mm.

*2: The distance between center lines both tracks < Maximum width of rolling stock gauge + 600 mm

*3: The clearance at the side of rolling stock is less than 400 mm.

Table77.1 Opening dimension of window

	Height from the floor level	Opening dimension of window	
		Car running in section with narrower distance between track centers	Car running in section with narrower clearance between construction and rolling stock gauge
Window facing side or back of seat	800 mm or more Less than1200 mm	200 mm	150 mm
Window facing standing seat or aisle	1200 mm or more Less than1400 mm	200 mm	150 mm

b. Regarding the car running in section with narrower distance between track centers in a, the car provided with protect bar on windows shall be excluded in the previous point. However, the protect bar shall be installed at the outer side of windows and distance between center of the protect bar and bottom line of the opening shall be within the limits between 150 and 200 mm.

c. Regarding the car running in section with narrower clearance between construction and rolling stock gauges in a, the car provided with protect bar on windows shall be 250 mm in the opening dimension. However, the protect bar shall be installed at the outer side of windows and distance between center of the protect bar and bottom line of the opening shall be within the limits between 100 and 150 mm.

(3) Passenger capacity shall be calculated by followings.

a. Seating passenger capacity is number of seat in case of the seat which is clearly divided by something like partition. In case of long seat that can not be divided, number that the width of seat should be divided by 450 mm.

b. Total essential standing passenger capacity shall be calculated from floor space, divided by the rank of the following table. However, the floor space shall be excluded by seat space area with 250mm width from the edge and other space with effective width, 550mm or more and under effective height, 1900mm or more besides.

Table77.2 Number of passengers a square meter

Rank	Number of passengers a square meter
A	4
B	6
C	8

(4) Ventilating performance in passenger cabin shall be as follows.

a. Natural ventilation shall be available enough, provided that sum of opening area of windows and doorway is over 1/20 of area of the said car's passenger cabin floor the said car. The area of floor can be calculated by inner length and width of the cabin.

b. Notwithstanding the previous item a., car with motor-driven ventilation volume required for 1 person is 13 m^3 per hour (A rank). However, ventilation volume of car, which is prohibited to accept passenger exceeding over the capacity can be calculated by provided passenger capacity.

c. Notwithstanding the previous items a and b, combination with natural and motor-driven ventilation system shall be provided with capacity complemented by each system.

(5) Lighting in passenger cabin shall be as follows.

a. It shall maintain brightness enough at night and in tunnel.

b. It shall maintain brightness enough to secure safety even in emergency.

(6) Aisle shall be as follows.

a. Passenger car shall be provided with pathway from doorway to seat.

b. It shall be provided with some handrail for passenger to be able to walk in safety and easy.

c. It shall be provided with essential width over 550 mm wide and the lower part 800 mm high or less from the floor is over 450 mm wide.

d. Notwithstanding the previous item c, if a space for wheelchair is provided, a single pathway or more between the space and doorway, and lavatory shall be over 800 mm wide so as to be suitable for wheelchair passing.

e. Essential height of aisle shall be over 1800 mm high.

(7) Passenger car shall be provided with appropriate number of seat for passenger. However, it shall be excluded for passenger car such as dining car or the like which is not provided with

number of passenger capacity.

(8) It shall be provided straps and handrails for standing capacity.

(9) Lavatory shall be as follows.

a. Passenger car shall be provided with lavatories if necessary.

b. Muck tank shall be provided.

(10) One lavatory per every car shall be provided for physically handicapped passenger on wheelchair at least.

(11) Lavatory for physical handicapped passenger on wheelchair shall be provided with structure and facilities for him or her to move and handle easily

2. Rolling stock for wheelchair shall be;

(1) Easy for a physical handicapped passenger on wheelchair to go in and out and to stay

(2) Provided with handrail and the like.

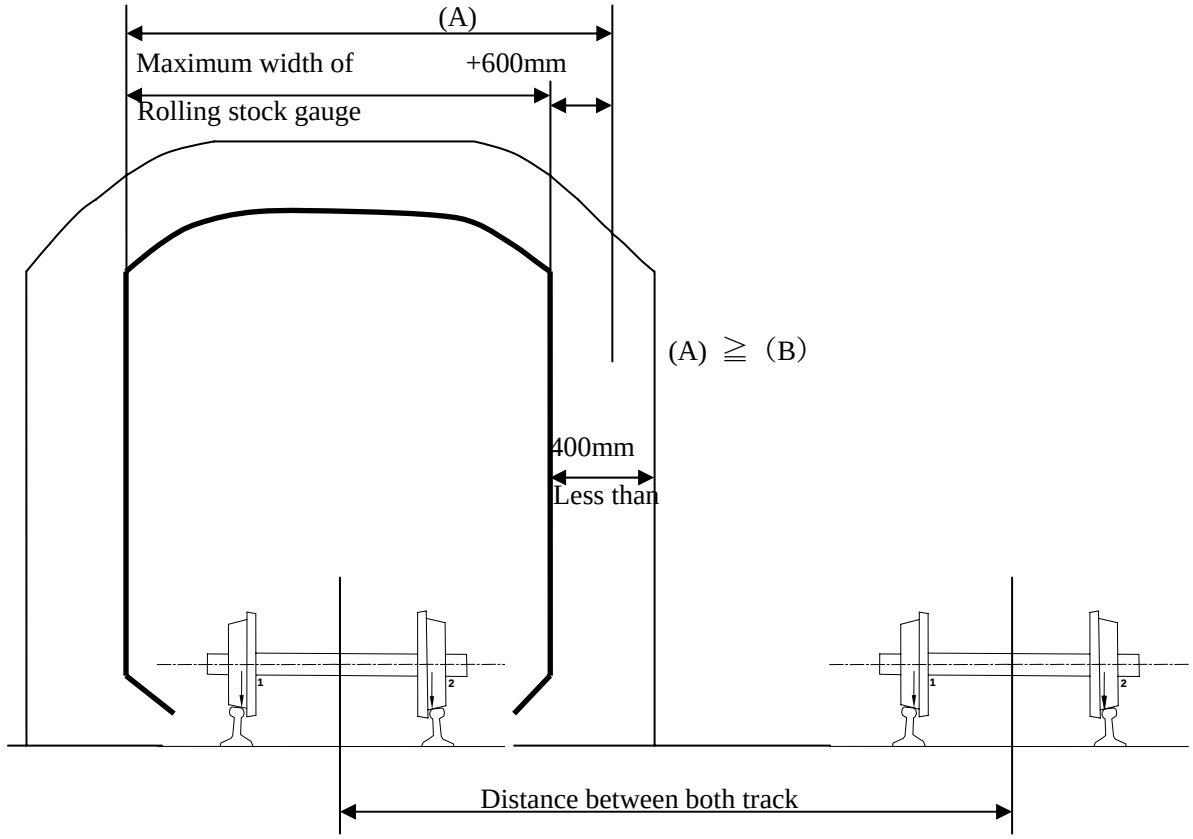
(3) Provided with non-slip floor.

(4) Provided with floor without difference.

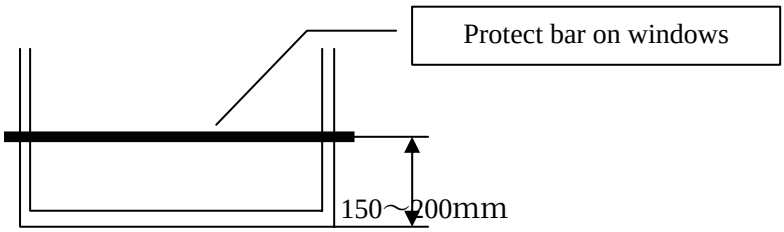
(5) Provided with indication for wheelchair space

(6) Seat provided for physical handicapped passenger with wheelchair shall be provided with area enough for him or her to get in and out.

(2)



(2) b.（ narrower distance between track centers ）



(2) c.（ narrower clearance between construction and rolling stock gauge ）

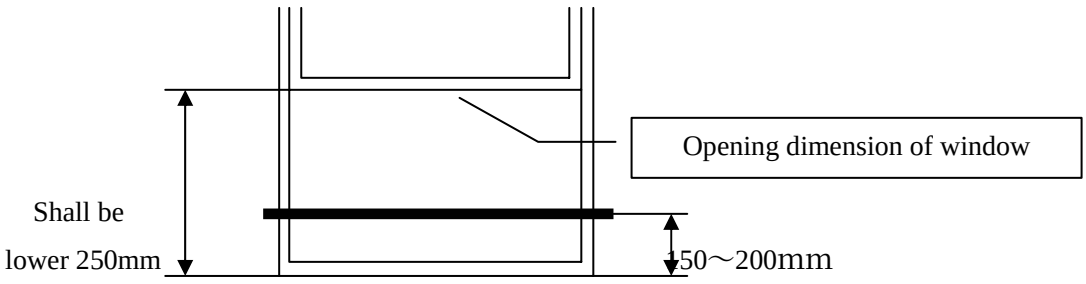


Fig 6 (Article77)

Article 78 Doorway structure for passenger

1. Doorway structure of passenger car shall be structured as follows.

   Doorway shall be;

   (1) Provided at both sides of a body.

   (2) Structured for wheelchair passing through smoothly in the said doorway located at the nearest position to a wheelchair place.

   (3) Structured by the essential width over 660 mm. However, rolling stock for wheelchair shall be over 800 mm wide essentially.

   (4) Structured by the essential height over 1800 mm high.

   (5) Provided with as narrow crevice as possible between end of the floor or step and platform within the limits for car running in safety.

   (6) Provided with as small grade difference as possible between the floor or step and platform.

   (7) Provided with non-slip floor or step.

   (8) Provided with step in case of that the said floor is over 380 mm higher from top of platform in the tare weight condition.

   (9) Provided with handrail or the like in case of doorway equipped with step mentioned above.

   (10) Provided with facility announcing moving side of the door by chime or voice. However, this shall be excluded by personnel announcing it.

2. End of floor in passenger car shall be provided with color tone different from the surroundings in order to make people recognize easily the appearances.

3. It shall be possible to secure the safe and smooth boarding/deboarding of passengers from passenger doorway. In case of automatic opening door system is provided at the doorway, the structure shall be conformed to the followings.

   (1) Operated and checked the motion simultaneously by a train crew or personnel.

   (2) Provided with electric or mechanic lock system.

   (3) Provided with a system that never let door open even by releasing the lock mentioned in the previous Item (2) and control system concerned while car running.

   (4) Provided with a system that let train start only after all the door closed completely. However, this shall not apply to passenger rooms if the crew confirms directly that the doors are closed.

   (5) Provided with a control system to ease door-moving speed just before the stopper in order to secure passenger safety.

   (6) Provided with indicating lamplight that can be switched on automatically by door opening. The lamplight shall be;

      a. Installed on both upper sides of car.

      b. Red light.

      c. Recognizable clearly from other lightings.

   (7) Provided with device that can be handled by hand inside and outside of the car. And the inside device shall be handled by passenger easily.

   (8) The inside device mentioned in the previous shall be indicated by notification about the

location and handling manner in order that passenger can recognize it easily.

(9) The notification mentioned in the previous shall not be indicated in car that runs exclusively in narrow clearance between construction and rolling stock gauges, less than 400 mm at body side especially in underground line. However, this shall be excluded if there is an especially additional notification saying that it is possible for passenger to handle the device only by instruction from conductor in case of train that runs through from other line.

Article 79 Structure of Gang doorway and gangway

Passenger car shall be provided with gang doorways and gangways more than one each. However, this shall be excluded by a car being operated exclusively as a single car.

2. Notwithstanding the previous clause, passenger cars designed to run underground or through long length tunnels (referred to as “passenger cars of subway type”) shall be provided with 2 gangway doors and 2 gangways. The cars of both ends of a train, those connected to exclusively locomotives and other specially arranged cars (that is; 1. a passenger train that is made up of trains of two or more cars and provided with a security staff who is to guide and assist passengers to evacuate from the train in emergency (referred to as “a security staff“ hereafter) in every one of the coupled train; 2. a passenger train that is provided with a security staff in any one of the coupled trains and equipped with an emergency alarm device which comes with a device to enable conversation between the passenger and the security staff in every one of the coupled cars) shall be provided with one gangway door and one gangway.
3. The very front or very rear car of a train that runs in a section with narrow clearance between rolling stock and construction gauges shall be provided with two gang doorways over 600 mm wide and two gangway over 600 mm wide essentially.
4. Gangway structure shall be;
   (1) Essentially over 550 mm wide.
   (2) Essentially over 1800 mm high.
   (3) Provided with hood and walk board without grade difference in order that passenger can walk in safety.
   (4) Provided with slide door except for gangway at the end of very front car or very rear car of a train.
5. Gangways at the end of very front car and very rear car of a train formation shall be provided with a door regularly locked.
6. Door mentioned in the previous clause shall confirm to followings.
   (1) Hinged door shall be kept opened at a coupled end.
   (2) The door shall not be opened by passenger’s careless action.

Article 80 Fire exit structure

1. Passenger cabin with only single emergency route to other car or outside shall be provided a fire exit for passenger to escape easily. However, this is excluded by a compartment.
2. Fire exist structure shall conform to the followings.
   (1) Fire exit shall be provided essentially with over 400 mm wide and over 1200 mm high.
   (2) There shall not be any projection and difference at the fire exit and the surroundings
   (3) Outward hinged door or slide door including plug door shall be provided.
   (4) The door shall be shut securely and opened by manual from inside and outside in emergency and shall not be closed by its own weight again.
   (5) The door shall be opened easily from inside without key and any other special tools.
   (6) Notification about location and handling manner of the fire exit shall be provided on its surface or the surrounding place in order to come easily into passenger view.
   (7) Location of the fire exit shall be indicated by green lamplight.
   (8) Passenger car with fire exits shall be provided with lamplights that are automatically turned on by the door opening at both upper sides of car body, and the lamplight shall be recognized easily in other lamps excluding lamplight of emergency information system and emergency stop system.

Article 81 Coupling system

Coupling system excluding articulated bogie shall conform to the followings.

Coupling system shall be;

   (1) Strong and stiff enough to withstand the operation.
   (2) Keeping connection between 2 cars even under vibration or shock.
   (3) Connected automatically each other car by sticking both couplers. However, this may be excluded regularly coupled cars and special coupling equipment used for rescuing works.
   (4) Provided with draft gear function.

2. Coupling system provided with air coupling system shall never be caused air-leak by vibration or shock.
3. Coupling system provided with electric coupling system that never be caused short-circuit by rainwater, vibration and shock.

Article 82 Rolling stock structure for transporting special cargo

Tank wagon and other freight car for transporting special cargo shall be structured for preventing any disaster caused by the cargo concerned. Structure of tank shall be as follows.

   (1) Tank body shall be installed rigidly on the car body frame and then within the front and the end beam so as not to be moved or damaged while transporting.
   (2) Structure of tank to transport dangerous liquid that is only noninflammable liquid, acid, oxidized erosive materials and volatile toxic materials shall be as follows.
      a) Body steel plate shall be 9 mm thick or more, steel panel shall be 12 mm thick or more

and cover steel plate of manhole and inlet shall be 6 mm thick or more.

b) Projected valve, inlet and the accessories concerned shall be provided with some protector to prevent them from damaged.

c) A tank for transporting dangerous liquid, which may cause some fire due to static electricity, shall be provided with earthing device.

Article 83 Facilities of driver cabin

Driver cabin of the utmost front car of a train formation shall be provided with following facility and equipment.

(1) Handling device of control system

(2) Handling device of service brake system

(3) Handling device of safety brake system if required

(4) Transmission and receiving device of signing or communication system if required

(5) Speed meter

(6) Indicator of on-board signaling system if the car runs in a line required the system if necessary. (incase electric car)

(7) Handling device to pull down pantograph in car with it

(8) Handling device of emergency ground switch, which is provided in a train concerned

(9) Transmission and receiving device of safety information system, which is provided in the car

(10) Alarm device or transmission device of alarm signal emitting system in a train that runs in line (exceeding shunting locomotive) with radio system of special warning system.

(11) Whistle system

(12) Air pressure gauge that indicates pressure of main reservoir pipe and brake pipe and brake cylinder.

(13) Handling device of front marked light

(14) A device which inform the abnormality of the turn of the wheel in the rolling stock in high speed railway.

(15) The pressure gauge which display the maximum allowable working pressure of the boiler in the steam locomotive.

(16) Handling device of wiper

2. Driver cabin of the utmost front car of passenger train shall be provided with the followings in addition to devices and equipments in the previous clause:

(1) Receiving device of emergency information system or indicating device of emergency stop system in a car provided with the said systems.

(2) Indicating device of warning a fire exit door opened in a car provided with the said fire exit.

(3) Lamplight device of indicating door opened in doorway for passenger

However, driver cabin of locomotive is excluded.

3. Speed meter provided in item (5) clause 1 shall conform to the *industrial criteria* or the same performance as the technical Criteria or more.
4. Air pressure gauge mentioned in item (12) of clause 1 shall indicate starting and releasing pressure of air governor concerned. However, this shall be excluded in digital pressure gauge scanning the pressure in certain interval.
5. Speed meter mentioned in item (5) and (12) of clause 1 shall be provided with self luminescence or luminous paint on the pointers and the face of the gauge.
6. Car running in line with automatic train stop system or automatic train control system, automatic train operation system shall be provided with on-board system that conforms to the followings. (Fig.7) (Fig.8)

(1) Control device and indicator showing the working condition of the said system in driver cabin

(2) Releasing switch of on-board device, which hall be located for the crew so as not to treat in his normal situation or be covered with something like a glass panel for preventing him to easily operate.

7. A switch to bring the train to an emergency operation (at a speed of 25km/h or lower) in case the automatic train control system (ATC) does not work.

ATS

(AUTOMATIC TRAIN STOP SYSTEM)

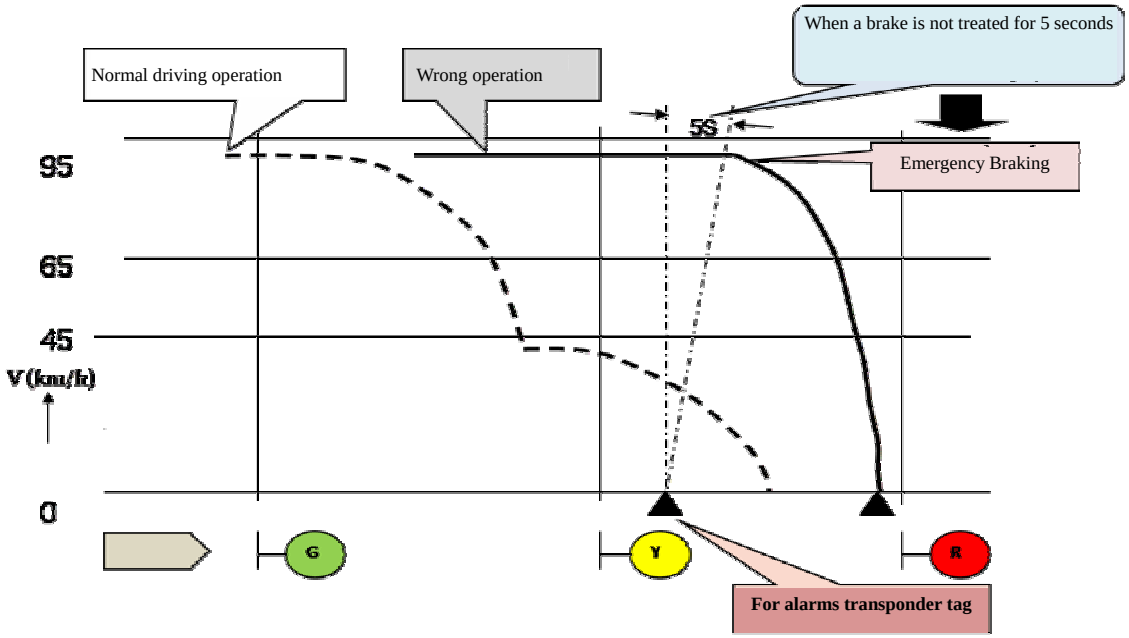
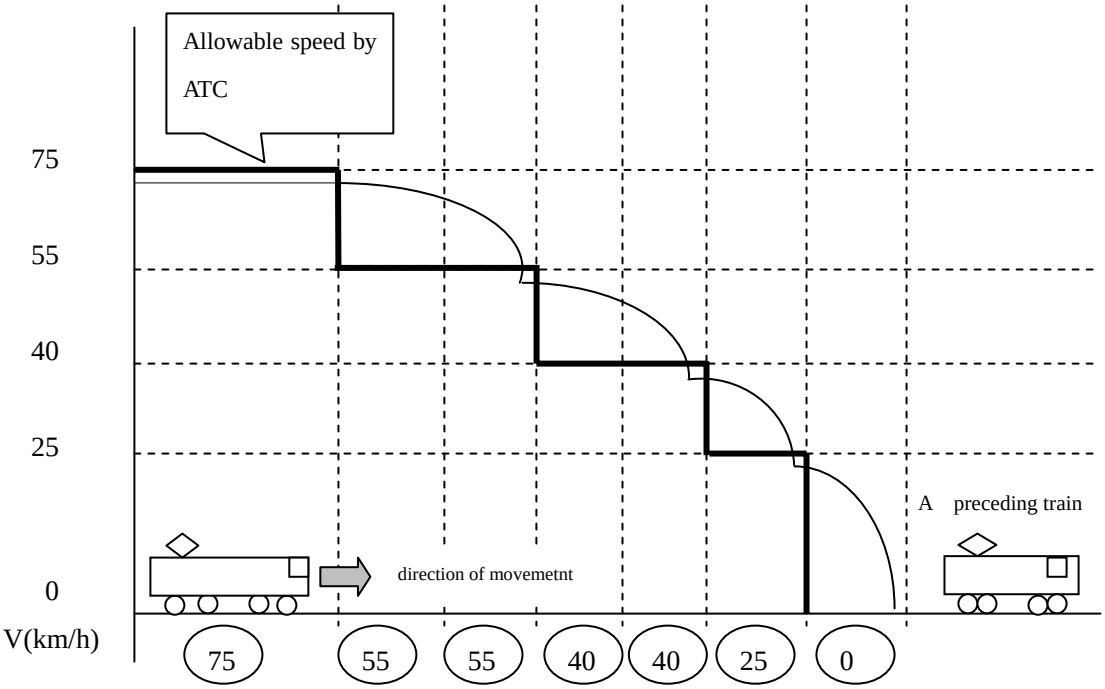


Fig. 7 (Article 83)

ATC（Automatic Train Control System）

(Multistep control System ATC)



ATC（AUTOMATIC TRAIN CONTROL SYSTEM）

(One step brake control A T C)

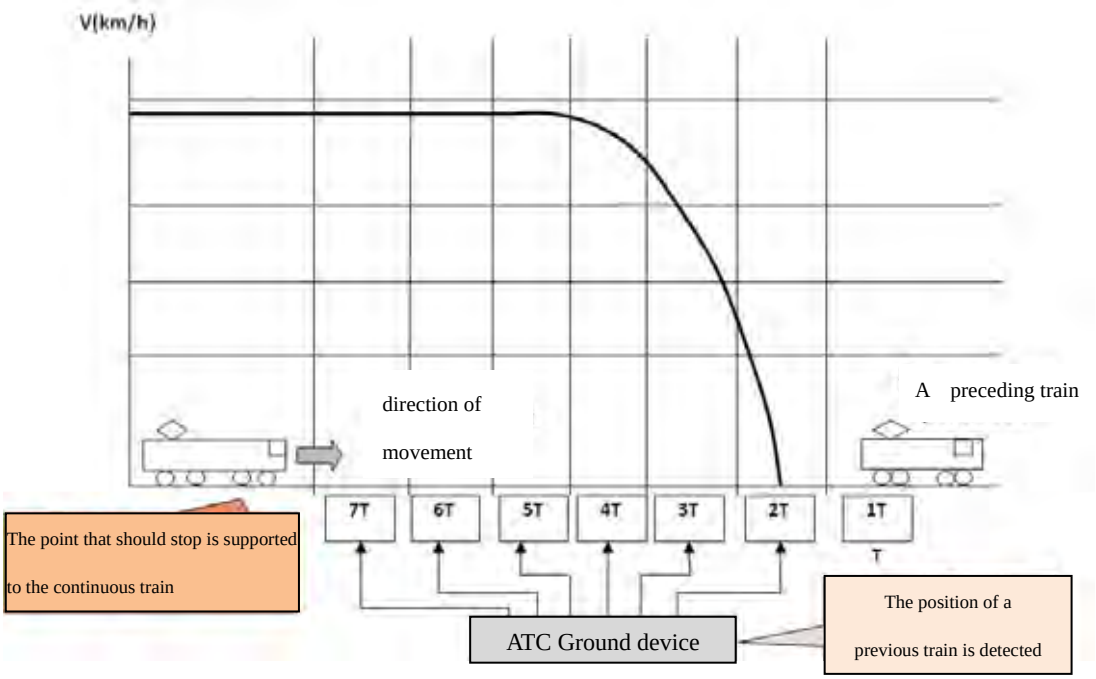


Fig. 8 (Article 83)

ATO（AUTOMATIC TRAIN OPERATION SYSTEM）

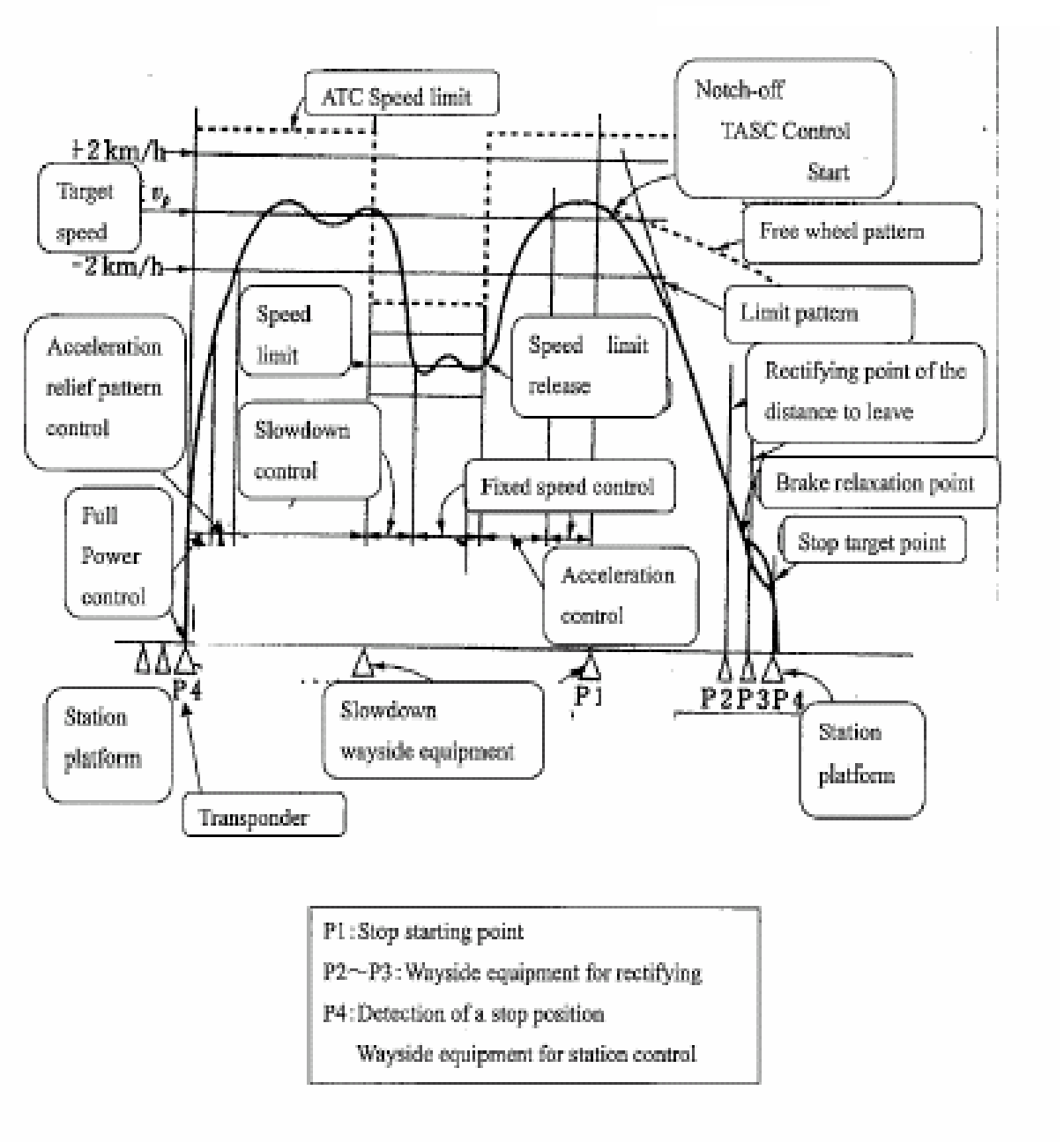


Fig. 9 (Article 83)

Article 83-2 Facilities of conductor cabin

1. Conductor cabin shall be provided with the followings.
   (1) Handling device of service brake system only for stopping a train in emergency.
   (2) Devices mentioned in item (4), clause 1 of the previous article.
2. Conductor cabin (use with crew cabin) shall be provided with the followings in addition to the previous clause.
   (1) Transmitting device of public announcing system in the car concerned
   (2) Handling device of automatic door closing system in the car concerned
   (3) Devices mentioned in item (1), (2) of clause 2 in the previous article.

Article 84 Internal pressure vessels and other pressure supply sources and accessory devices

1. Pressured air reservoirs and other auxiliary equipment of rolling stock shall conform to the followings.
   (1) Relief valve shall be installed on the main air reservoir concerned or on the piping connected with it at the close point.
   (2) Main air reservoir shall be provided with drain cock or automatic drain device. A reservoir supplied pressure air from air compressor with air dryer shall be provided with drain plug
   (3) Drain cock mentioned in the previous clause shall be protected against impact caused by something flying while running.
   (4) Pressured air reservoir and the connecting pipe shall be installed so as not to be damaged by vibration or shock.
   (5) Air reservoir shall be installed at the place to be checked easily.
   (6) Air compressor shall be installed with an air governor. However, the air governor shall not be installed on all compressors that are connected with piping each other.
2. Accumulator and the auxiliary equipment concerned shall conform to the followings.
   (1) Relief valve shall be installed on the accumulator or on the piping connected with it at the close point.
   (2) Accumulator and the connecting pipe shall be installed so as not to be damaged by vibration or shock.
   (3) Accumulator shall be installed at the place to be checked easily.
   (4) Hydraulic pump shall be installed with a governor.

Article 85 Auxiliary equipment of rolling stock

A train that can start by conductor’s sign shall be provided with the followings signing devices:
   (1) Transmitting and receiving sign shall be available mutually only among crews.
   (2) Receiving sign shall not be able to be cut easily by receiving crew.
   However, this shall be excluded in case of that a train can start by signing device on platform.

Article 85-2

1. Passenger car shall be provided with communication device including radio system that conforms to the followings. However, this shall be excluded for a single car operated exclusively or a train operated by a single crew.
   (1) Transmitting nand receiving (hereafter called as communication) shall be available only among crews. However, this shall be excluded for a system that can give crews precedence (priority) over other people even though the said system has a function to communicate with others.
   (2) The function mentioned in the previous item shall not be decontrolled only by a receiving crew.
2. Front of the very front car of a train formation excluding freight car shall be provided with whistle or the like which has volume enough to give people warning.
3. Passenger cars shall be provided with public announcing system that a crew can announce guide to passenger all over the train. However, this shall be excluded for a single car operated exclusively (excluding a train operated by a single crew)
4. Passenger car shall be equipped with emergency alarm device that meets the standards specified in each of the following paragraphs. However, this shall not apply to the train with emergency stopping device and a train set of one or two cars (a single car in case of one-man operation).
   (1) Passenger cabin with emergency information system shall be provided with transmitter of the said system. However, this shall be excluded for passenger car with crew cabin and, which can make passenger easy to contact crew.
   (2) The emergency information system shall be notified the location and the handling manner at the said system or the surroundings so as to make passenger to recognize easily.
   (3) Function of the system shall not be decontrolled manually.
   (4) Car with emergency information system shall be provided with lamplight that can be turned on automatically by the said system working. However, this shall be excluded for a case of that working location can be recognized at the driver or crew cabins.
   (5) The lamplight mentioned in the previous item shall be installed at the upper both sides of car and the lamplight shall be recognized easily in other lamps excluding lamplight that is turned on automatically by fire exit door opening or emergency train stop system working.
5. Passenger car to be equipped with emergency stopping device shall meet the standards specified in each of the following paragraphs.
   (1) Passenger cabin with emergency train stop system shall be provided with control device of the said system. However, this shall be excluded for passenger car with crew cabin and, which can make passenger easy to contact crew.
   (2) The emergency train stop system shall be notified the location and the handling manner at the said system or the surroundings so as to make passenger to recognize easily.
   (3) Function of the system shall not be decontrolled manually.
   (4) Car with emergency train stop system shall be provided with lamplight that can be turned on

automatically by the said system working. However, this shall be excluded for a case of that working location can be recognized at the driver or crew cabins.

(5) The lamplight mentioned in the previous item shall be installed at the upper both sides of car and the lamplight shall be recognized easily in other lamps excluding lamplight that is turned on automatically by fire exit door opening or emergency information system working.

6. Marked lamp or signal lamp shall conform to the followings.

(1) Front marked lamps at the front of car with driver cabin shall be white lamp and arranged symmetrically with respect to the centerline of carbody.

(2) The front marked lamp mentioned in the previous clause shall be recognized from a long way off at night and be reduced illumination or set down ray of the light.

(3) Rear mark equipped at the very rear car of a train shall be red color lamplight or red reflector, which can be seen or reflected enough by front marked lamp of the following train. However, in case of car of high speed railway, 2 red color lamplights or more shall be provided at symmetrical point with respect to carbody center line.

(4) Front marked lamp and rear mark at the same face of a car shall be distinguished easily one from the other.

7. Passenger car shall be provided with on-board information system in passenger cabin, which shows name of next station, destination or train code as visual information for passenger.

8. Body side of passenger car shall be provided with destination information board showing destination and train description. However, this shall be excluded for train whose destination or train description are very clear.

9. Rolling stock shall be provided with a facility to be loaded with articles needed for operation works. These articles shall be provided by other criteria.

Article 85-3 Guard Iron

Equipment that can remove obstacles shall be provided at the front of car with driver cabin.

Article 86 Rolling Stock Markings

Rolling stock shall be provided with mark for indentification and management on the body.

Section 6 Fire Prevention of Rolling Stock

Article 87 Fire Prevention of rolling stock

Fireproof criteria concerning rolling stock material preventing fire shall conform to Criteria shown as following:

Table87.1 Examination standard

Description	Burning				Burned			
	Ignition	Flame	Smoke	Force of flame	Flame	Ash	Carbonization	Deformation
Non Combustible	No	No	Few	-	-	-	Discoloration is 100 mm long or less	100 mm or less on the surface
High Fire Retardancy	No	No	Few	-	-	-	Shall not reach to top of the piece.	150 mm or less
	Exist	Exist	Few	Weak	No	No	30 mm long or less	
Incombustible	Exist	Exist	Normal		No	No	Shall reach to top of the piece	Overall or hole eaten by fire

Flame does not spread over top of the piece

Remarks:
Dimension of Carbonization and deformation shall be major axis of the size.
Case of extraordinary flame shall be judged by one step down.

<table>
<tr><th rowspan="2">Description</th><th colspan="4">Burning</th><th colspan="4">Burned</th></tr>
<tr><th>Ignition</th><th>Flame</th><th>Smoke</th><th>Force of flame</th><th>Flame</th><th>Ash</th><th>Carbonization</th><th>Deformation</th></tr>
<tr><td>Non Combustible</td><td>No</td><td>No</td><td>Few</td><td>-</td><td>-</td><td>-</td><td>Discoloration is 100 mm long or less
  </td><td>100 mm or less on the surface</td></tr>
<tr><td rowspan="2">High Fire Retardancy</td><td>No</td><td>No</td><td>Few</td><td>-</td><td>-</td><td>-</td><td>Shall not reach to top of the piece.
  </td><td rowspan="2">150 mm or less</td></tr>
<tr><td>Exist</td><td>Exist</td><td>Few</td><td>Weak</td><td>No</td><td>No</td><td>30 mm long or less
  </td></tr>
<tr><td>Incombustible</td><td>Exist</td><td>Exist</td><td>Normal</td><td></td><td>No</td><td>No</td><td>Shall reach to top of the piece
  </td><td>Overall or hole eaten by fire</td></tr>
</table>

Fig. 10 (Article 87)

Article 87-2

Fire prevention concerning electrical wiring and devices shall conform to the followings.

(1) Wiring to be connected or close to devices which might generate arc or heat shall be covered very flameproof materials including noninflammable materials.

(2) Wiring excepting for ones mentioned in the previous clause shall be covered with flameproof

materials including the very flameproof or noninflammable materials.

(3) Electric devices which might generate arc or heat shall be installed at a place isolated from wall or provided with noninflammable plate at the said place in a place near to the wall and the like.

(4) Engine of diesel traction type of rolling stock shall be installed at a place isolated from wall or provided with noninflammable plate at the said place in a place near to the wall and the like.

(5) Regarding the exhaust piping mentioned in the previous, it shall be provided with noninflammable plate between the said installment and body in order to prevent spreading fire on the body even though the chimney was damaged.

Article 87-3

1. Fire prevention of body of passenger car shall conform to the followings.

(1) A roof should be made of metal or other materials that have an equal or greater quality of fireproofing. (Roof means the top of the car body and upper part from the gutters or creasings. When the gutters or creasings are situated within 1/3 of the car width from the center of the car, it is the area covering 1/3 of the car width to both sides from the center of the car body.) In case a part of the roof is joined with the end plate, it will be regarded as the end plate and the standards should be applied accordingly.. (Fig.11)

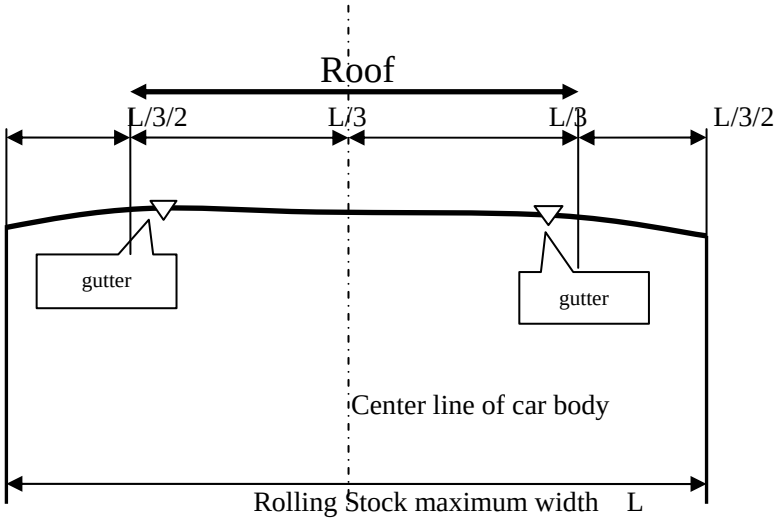


Fig. 11 (Article 87-3)

(2) Roof of electric car that runs under direct current electric section shall be as follows.

a. Roof shall be covered with fireproofing materials.

b. Equipments and metal fittings on roof shall be isolated from body structure at the mount or the surface shall be covered with flameproof insulator.

(3) Ceiling, exterior and interior panel shall be produced with noninflammable material or be covered by noninflammable material on the surface. A material that is not noninflammable

can be utilized by being inserted between metals or something noninflammable insulators.

(4) Ceiling, exterior and interior panel shall be able to be painted only by noninflammable materials. In case of multiplex painting, the last paint layer shall be noninflammable at least.

(5) Carpet on the floor shall be provided with fireproofing material.

(6) The floor shall not be invaded with smoke or flame.

(7) Underside of floor shall be produced or covered with metal on the surface. Metal panel of floor underside that is for controlling heat generated by equipments installed under floor shall be regarded as underside.

(8) Hood of gangway shall be noninflammable.

(9) Sunblind shall be fireproofing materials.

(10) Cover fabric and stuffing of passenger seat shall be noninflammable.

(11) Electric heated under passenger seat shall be protected with noninflammable panel between electric heater and seat.

2. Notwithstanding the previous clause only concerning item (3), passenger car that runs chiefly in underground and high speed railway shall be provided with noninflammable materials on the ceiling, exterior and interior panels.

3. Besides the previous clause, passenger car that runs chiefly in underground or high speed conform to the followings.

(1) Heat insulator and sound proofing material shall be noninflammable.

(2) Stuffing material under carpet shall be the very fireproofing material. Stuffing in keystone structure and stuffing between both metal plates and stuffing between carpet and metal structure are included in this category.

(3) Floor plate shall be noninflammable metal products or have the same performance as the metal or higher.

(4) Paint material on the surface of underside of floor shall be noninflammable.

(5) Equipment boxes installed underside of floor shall be noninflammable excluding cover of relay device and the like. However, fireproofing material can be used only for the boxes to be insulated due to the unavoidable reason.

4. Materials used for specific car shall conform to the followings besides the previous clause.

(1) Finishing material of floor shall be fireproofing.

(2) Seat or the like shall be structured by fireproofing materials.

(3) Wood that is used for floor and other facilities shall be fire-proof processed or covered by metal film or the like.

(4) The shoji frame of a window should be a thing of nonflammability, such as metal, and shoji paper is fireproofing.

Article 88 Fire Alarm System

Sleeping car and specific car shall be provided with fire alarm system detecting automatically fire by heat or smoke caused by the fire.

Article 89 Auxiliary Power Source Facility

Facility and equipment mentioned in table below shall be activated by battery for a while regularly even under main electric power failed due to breakdown of generator or power from overhead contact line.

Table89.1 Facility and equipment

Description	Facility and equipment
Propulsion (Article 72)	- Indicator of temperature of exhaust system overheated
Brake system (Article 73)	- Brake system using electricity
Passenger cabin structure (Article 77)	- Motor-driven ventilating system - lightings including emergency lamp
Doorway for passenger (Article 78)	- Automatic door engine - Indicator of door opening for passenger
Emergency exit structure (Article 80)	- Notification of location and handling manual
Driver cabin facility (Article 83)	- Indicator of on-board signal - Indicator and releasing switch of automatic train stop system, automatic train control system, automatic train operation system. - Indicator of fire exist opening - Indicator of door system (Open or close condition)
Auxiliary equipment of rolling stock (Article 85)	- Sign device - Whistle - Communication device - Public announcing - Emergency communication system, location of emergency stop system and notification of handling manual - Indicator or light of emergency communication system and stop system
On-board devices for one man operation (Article 90)	- Emergency stop system - On-Board system of safety communication system

2. Battery mentioned in the previous clause shall be provided with capacity that can activate and hold device function to be used for 30 minutes or so in emergency. Regarding to the brake system, a train shall be able to be stopped by a braking once or more.

   However, driven ventilator of electric car of high speed railway can be excluded from equipment used in emergency in case of the followings.

   (1) Total opening area of doorway with slide door which can be provided with protection of passenger falling is more than 1/20 of total area of passenger cabin floor.

   (2) Regarding calculation of opening area of doorway with slide door mentioned in the previous clause, the total opening area can be calculated by including opening area of the next cars only which are coupled with each other through the gangways. However, total opening area of cars

coupled permanently in a train must be 1/20 or more of total floor area of passenger cabin in a train.

Section 7 Other Equipment

Article 90 Car Facility of a train by one-man driving

Rolling stock of a train by one-man driving shall be provided with followings.

(1) Car of a train by one-man driving shall be provided by from Article 66 to the previous article except for article 83-2.

(2) The very front car of a passenger train shall be provided with a transmitter of public announcing system and handling device for automatic door engine system of passenger doorway at the driver cabin.

(3) The device mentioned in the previous item shall be handled easily by the driver at his position.

(4) Handling device of automatic door system shall be located at the position where the driver can recognize passenger condition at station through mirror. Instead of the mirror, however, window at side of car shall be provided at position where the driver can check passenger getting and off.

(5) The driving cabin shall be provided with followings.

a. Device that can stop a train immediately in case of that the crew cannot operate due to some disease. The said device shall not be able to be released by manual. However, this shall be excluded for a train without passenger, which is operated by automatic train control system exclusively in underground and elevated track.

b. Device that can inform automatically about emergency device work to station or operation dispatching center in case of an underground train provided with the system stopping a train immediately in emergency.

c. Driver cabin of the very front car shall be provided with on-board device of safety communication system that can communicate between the train and station or operation dispatching center. However, this shall be excluded for case of communication system through facility on the ground.

(6) On-board device of the safety communication system mentioned in the previous point c, shall not be able to be released by manual and not be combined with public announcing system and emergency information system.

CHAPTER 9 ROLLING STOCK MAINTENANCE

Section 4 Rolling Stock

Article 106 Rolling Stock Maintenance

This criteria is established based on the provisions from Article 106 to Article 110 of the Ministerial Regulation specifying the technical regulations concerning railway and aims for rolling stock maintenance in the condition in which it can be operated safely.

Article 106-2 Application

In accordance with kind of rolling stock, description, interval of inspection and points to be inspected, test run and notation, record shall be provided in this criteria.

Article 106-3 Training and Education

1.The personnel who inspects and repairs rolling stock shall be educated and trained to acquire knowledge and skills required for carrying out inspection work. The practical education method shall be prepared in advance.

2 When it is necessary for railway operator to entrust rolling stock repair work to a third party, the management of the entrusting party shall implement education and training of required knowledge and skills for the personnel who carry out the entrusted work.

Article 108 Train Inspection

Description of rolling stock inspection shall be as follows:

(1) ”Daily Inspection”; means that in accordance with operation condition, filling up or replacing consumable goods with new ones and checking visually operation condition of power collection system, running gears, electric devices, brake equipment and body.

(2) “Periodic Inspection”; means condition/function inspection and general inspection and repairing, replacing damageable parts.

Article 109 Periodic inspection of Rolling Stock

1. Rolling stock shall be inspected periodically within a period which does not exceed time indicated for each type of rolling stock in “Rolling stock inspection and repair method” , provided that some pars which can be operated exceeding the period indicated in “Rolling stock inspection and repair method” due to the anti-wear and durable function.
2. In case of rolling stock can not be inspected in the provided by article 108 due to unavoidable case such like disaster or the like, the rolling stock shall be able to operate only to the first place or facility, where

it can be inspected.

Article 109-2 Inspection Item

Inspection period, item, method of the dailya inspection and the periodic inspection shall be provided in “Rolling stock inspection and repair method”.

However, some parts excluding critical equipment can be left out from the inspection item in the “Rolling stock inspection and repair method”under consideration of structure and function of rolling stock concerned.

Article 109 -3 Inspection of suspended rolling stock

1. In case of suspending rolling stock for operation, all means needed to protect parts against damaged with careful consideration about deterioration of strength and function which might be caused by corrosion, deformation, electrical deterioration of rolling stock occurred in the period and to maintain rolling stock for opening next operation.
2. Regarding rolling stock suspended from operation, the suspended period shall not be calculated in inspection interval despite inspection interval provided in **Article 109**. However, the un-counted period shall be limited at the tem provided as follows in regard to description of inspection.
   (1) Consideration/ Function Inspection: 2 months
   (2) Semi General Inspection (Critical parts): 2 years
   (3) General Inspection: 4 years

Article 109-4 Test Run

Test run shall be carried out after inspection in the following case.

(1) Newly produced or purchased

(2)Provisions in “Rolling stock inspection and repair method”

(3) Other if necessary

Article 109-5 Calculation of periodic inspection date

The next inspection date shall be counted from the day following the inspection completion. In addition, duration of the inspections below general inspection shall no be counted in period between 2 general inspections.

Article 110 Inspection records

When the rolling stock inspection is carried out, the inspection date and result shall be recorded and the records shall be securely stored until the next general inspection to be completed.

Article 110-2 Inspection notation

When the general inspection is completed, the inspection date shall be indicated on the locomotive concerned.

Supplement 1: Temporary Measure

These Criteria shall not be applied to rolling stock that has been introduced and operated actually railways in the Vietnam before the date of the enforcement.

Supplement 2: Inspection period and inspection items in Japan shall be introduced in the appendix.

PERIODICAL INSPECTION INTERVAL OF ROLLING STOCK

Description	Interval (Period)		
	Condition/Function Check	Semi-General Inspection (Critical Part Inspection)	General Inspection
Non Rail Electric Car	30 days	1 year	3 years
Steam Locomotive	40 days	1 year	4 years
Freight Wagon	90 days	2.5 years	5 years
Electric Car of Suspended /Straddled /Guided Railway	90 days	3 years or 4 years in case of the first inspection after newly produced	6 years or 7 years in case of the first inspection after newly produced
Internal Combustion Locomotive/ Railcar	90 days	Shorter period of 4 years or 500000 km	8 years
Electric car	90 days	Shorter period of 4 years or 600000 km	8 years
Electric Car of High Speed Railway	Shorter period of 30 days or less than 300000km	Shorter period of 1.5 year or less than 600000km and 2.5 years in case of the first inspection after newly produced	Shorter period of 3 year or less than 1200000km and 4 years in case of the first inspection after newly produced
Freight car of High Speed Railway	90 days	2.5 years	5 years

1. “Condition/Function Check means a periodical inspection for checking condition or function during operation.
2. “Semi-General Inspection (Critical Part Inspection)” means a periodical inspection for power generator, running gear, brake system and other important equipments.
3. “General Inspection” means a periodical inspection of overall general of rolling stock.

APPENDIX 1
ELECTRIC LOCOMOTIVES AND ELECTRIC CARS

1. Individual Inspections

Item(s) to be inspected			Points to be inspected	Method of inspection
1. Drive units	(1)Bogie	1) Bogie frame and swing bolster	a. Check for cracked, damaged, deformed or loosened bogie 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	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 bogies. e. Neither central plate nor side bearing is equipped with a bolster-less bogie.	

Item(s) to be inspected			Points to be inspected	Method of inspection
		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) Spring and 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 and Snowplow	a. Check for cracks, damage, deformation or looseness. b. Check height.	Measurement

Item(s) to be inspected			Points to be inspected	Method of inspection
		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.	
	(2) Driving unit	1) Gear	a. Check for cracked, deformed, worn, nicked, damaged b. Check for gear meshing condition	
		2) Gear Box	a. 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.	
		3) Coupler	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.	

Item(s) to be inspected			Points to be inspected	Method of inspection
		4) 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.	
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 h. Check insulation characteristics.	Measurement Insulation resistance test

Item(s) to be inspected			Points to be inspected	Method of inspection
		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.	Measurement Insulation resistance test
	(2)	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

Item(s) to be inspected			Points to be inspected	Method of inspection
		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) 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

Item(s) to be inspected			Points to be inspected	Method of inspection
		Cam shaft and the control mechanism	a. Check for damage, worn and installation of cam, cam shaft and star wheel b. Check for damage and worn of movable and sliding parts c. Check for damage, worn, contact pressure and installation of contactor, finger and tip d. Check for damage of bearing e. Check for soiling and damage of insulation f. Check for function of magnetic valve and cylinder g. Check driving motor function h. Check function of each part i Function: - Wiping motion of contactor and finger - Interlocking motion between main and sub contacting devices - Intermittent motion by rotating and stopping	

Item(s) to be inspected			Points to be inspected	Method of inspection
		Reverser and Changer	a. Check for damage, worn and installation of cam, cam shaft and star wheel b. Check for damage and worn of movable and sliding parts c. Check for damage, worn, contact pressure and installation of contactor, finger and tip d. Check for soiling and damage of insulation e. Check for function of magnetic valve and cylinder f. Check function of each parts g. Function: - Wiping motion of contactor and finger - Interlocking motion between main and sub contacting devices - Changing motion	
		4) Master controller	a. Check for damage, worn of movable and sliding parts b. Check for damage, worn, contact pressure and installation of contactor, finger and tip c. Check for soiling and damage of isulation d. Check operation and function of all parts	
		5) Main resister (Resister for field)	a. Check for soiling, damage and deterioration of insulation b. Check for damage, discolored, deformation and installation of resister body and the joint c. Check for insulation characteristic	Insulation resister test

Item(s) to be inspected			Points to be inspected	Method of inspection
		6) Contactor and Relay	a. Check for soiling and damage of insulation b. Check for damage of movable and contacting parts c. Check installation of each part d. Check the function	
		7)Semiconductor for main circuit	a. Check for soiling and damage of semiconductor element, insulation and radiator fan b. Check installation of each part	
		8) Controller of main circuit semiconductor	a. Check for soiling and damage of semiconductor element b. Check installation of each part	
		9) Reactor and filter	a. Check for soiling and damage of each part b. Check installation	
	(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.)
		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.

Item(s) to be inspected			Points to be inspected	Method of inspection
		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) Foundation 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.	

Item(s) to be inspected			Points to be inspected	Method of inspection
	(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.	
		2) Control valves (includes relay and conductor valves)	see above	
		3) Electric air controller	see above	
		4) Load compensating device	a. Check for damaged or loose sensors. b. Check operations and adjusted values.	
4. General Electrical Equipment	(1)	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

Item(s) to be inspected			Points to be inspected	Method of inspection
		2) Power converter and static 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	a. Check for damaged, discolored or deformed resistors. b. Check for installation	
		2) Fuse and switch	b. Check for soiling and damage of contact surfaces. c. Check for installation	
		3) 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.	
		4) 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.	

Item(s) to be inspected			Points to be inspected	Method of inspection
		5) Arrester	a. Check for damaged or fouled insulators. b. Check for looseness.	
		6) Wiring, conduit, and optical fiber	a. Check wires, joint boxes, and other accessories for damage and looseness. b. Check insulation characteristics.	Insulation characteristics should be determined by insulation resistance test.
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.	

Item(s) to be inspected			Points to be inspected	Method of inspection
		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) Other valve	a. See above b. Check electric part as described in the "Relay, solenoid valve, and wiring" of the "General Electrical Equipment" section	
		3) Air tank	a. Check tank body and protective fittings for corrosion and looseness.	
		4) 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. Body and Interior	(1)Under frame		a. Check beams and lifting beams for damage, deformation, cracks and corrosion.	

Item(s) to be inspected			Points to be inspected	Method of inspection
	(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. c. Check paint damage	
	(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.	
	(4)Door engine (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.	

Item(s) to be inspected			Points to be inspected	Method of inspection
	(5)		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.	
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.	
		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

Item(s) to be inspected			Points to be inspected	Method of inspection
	(4)	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 pipe coupler	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) Safety devices (including automatic train stop system ,controller, train selection device and automatic train operation device)	1) On-board coil and receiving device	Check for damage, soiling and looseness.	If necessary

Item(s) to be inspected			Points to be inspected	Method of inspection
		2) Speed detecting device (including tachometer generator)	Check for damaged or loosened parts.	
		3) Substance (Receiver, speed check part, logic part and power supply part)	Check for damaged or loosened parts.	
	(6) Emergency braking and emergency train protection devices	1) Emergency braking device (dead-man device and EB device)	Check for damaged or loosened parts.	EB: Emergency Brake
		2) Emergency protection system (TE)	Check all parts for damage and check to make sure they are installed properly.	TE: One Touch Operative Emergency Devices
	(8) Operation Data Recording Device		Check for damaged or loosened parts.	If necessary

Item(s) to be inspected			Points to be inspected	Method of inspection
(Reference)	**(8)Air Conditioner**	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".	

Item(s) to be inspected			Points to be inspected	Method of inspection
		7) Air conditioner operating switch	a. Check for soiling, damage and looseness. b. Check operation.	
		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

Points to be inspected	Method of inspection
(1) Check to make sure that all systems and devices are properly installed. (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. (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. (8) Check air compressor capacity and operation of related equipment (e.g., pressure controllers and safety valves). (9) Check angle of inclination of car. (10) Check operation of automatic door closers. (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. (16) Check operation of emergency braking and emergency protection system. (17) Check static wheel load (only Electric car)	Measure height Insulation resistance and dielectric endurance tests Measure leakage Check operation Measure angle of inclination Measure height Operational characteristics measurement Measure wheel load

3 Check points of Test run

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) Traction motor bearings 2) Devices in main circuits 3) Overheating or leaking of oil in axle bearings (7) Data recorder condition	

APPENDIX 2
DIESEL HYDRAULIC LOCOMOTIVES AND CARS

1. Individual Inspections

Item(s) to be inspected			Points to be inspected	Method of inspection
1. Drive units	(1)Bogies	1) Bogie frame and swing bolster	a. Check for deformed, cracked, or corroded bogie 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

Item(s) to be inspected			Points to be inspected	Method of inspection
		5) Spring and 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 and snowplow	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.	
2. Traction system	**(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 shaft	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

Item(s) to be inspected			Points to be inspected	Method of 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 gear device	a. Check timing gear chamber for damage or loosened timing gears. b. Check for damaged, worn or loosened gears, shafts or bearings.	
	(2) Intake	1) Intake 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.	

Item(s) to be inspected			Points to be inspected	Method of inspection
		4) Air filters and air intake vents	a. Check all parts for wear, damage, or deformation. b. Check cutoff for soiling or damage.	
	(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) Governor	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.	

Item(s) to be inspected			Points to be inspected	Method of inspection
	(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.	
		4) Radiator	Check for leakage, corrosion, or deformation and check to make sure radiator is installed properly.	
		5) Pre-heater	a. Check all parts for damage or leakage and check to make sure they are installed properly. b. Check operation.	
	(7)Drive	Drive system	a. Check to make sure that engine may be	Load test and fuel

Item(s) to be inspected			Points to be inspected	Method of inspection
	system		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.	control test
3. Transmission system	(1) Hydraulic 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) Propeller shaft		Check shaft, spline, and cross-shaped joints for damage or deformation.	Damage inspection (applies only to spline shaft)
	(3) Reverser and reduction gear		a. Check main unit and gears, shafts, and bearings for damage or corrosion. b. Check operation of reverser. c. Check all parts for leakage.	

Item(s) to be inspected			Points to be inspected	Method of inspection
4. Brakes	**(1) Foundation brake system**	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)Hand 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) 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.	

Item(s) to be inspected			Points to be inspected	Method of inspection
		2) Control valves (includes relay and conductor valves)	see above	
		3) Electric air controller	see above	
		4) Load compensating 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) Excitation controller	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
		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.	
	(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.	

Item(s) to be inspected			Points to be inspected	Method of inspection
		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 Cequipment	**(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 pipes	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. Body and interior	(1)Under frame		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 soling, 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) Door		a. Check door closers, belts, arms, links, rollers, and glides for damage, corrosion, or	

Item(s) to be inspected			Points to be inspected	Method of inspection
	engine (including door closing safety devices)		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.	
8. Other equipment	(1)	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.	

Item(s) to be inspected			Points to be inspected	Method of inspection
	(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.	TE: One Touch Operative Emergency Devices

2. General Inspection

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.	
(16) Check static wheel load (Only Diesel railcar)	

3. Check points of Test Run

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	
a. Engine leaks	
b. Overheating or leaking of oil in axle bearings	

APPENDIX 3
PASSENGER CARS, FREIGHT CARS, AND BAGGAGE CARS

1. Individual Inspections

Item(s) to be inspected			Points to be inspected	Method of inspection
1. Drive units	**(1) Bogies**	1) Bogie frame and swing bolster	a. Check for deformed, cracked, or corroded bogie 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: – 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
		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.	

Item(s) to be inspected			Points to be inspected	Method of inspection
2. Brakes	**(1) Foundation brake system**	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 diaphrags ms)	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)Hand 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 compensating device	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

Item(s) to be inspected			Points to be inspected	Method of inspection
		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
		4) Excitation 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.	
	(2) 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.	

Item(s) to be inspected			Points to be inspected	Method of inspection
			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
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.	

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 pipes	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. Body and interior	**(1) Under frame**		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 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.	

Item(s) to be inspected			Points to be inspected	Method of inspection
	(3)Roof		a. Check roof paint for soling, 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 engines (including door closing safety devices)		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		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.	

Item(s) to be inspected			Points to be inspected	Method of inspection
		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		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
	(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

Points to be inspected	Method of inspection
(1) Check to make sure that all systems and devices are properly installed.	
(2) Check for air leakage from pneumatic brake controllers and ordinary pneumatic devices.	Measure leakage
(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.	Measure angle of inclination
(6) Check operation of automatic door closers.	
(7) Check operation of lights.	
(8) Check operation of signals, intercoms and public address systems.	
(9) Check operation of displays.	
(10) Check height of couplers.	Measure height
(11) Check static wheel load	

3. Check points of Test Run

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	

APPENDIX 4
STEAM LOCOMOTIVE

1. Individual Inspections

Item(s) to be inspected			Points to be inspected	Method of inspection
1. Drive units/Body	(1) Main Frame		a. Check for abrasion, crack, damage, or loosened part b. Check for crack or loosened of boiler support and pedestal, end beam, lateral stay. c. Check for crack, damage, worn or deformation of axle box stay. d. Check for crack, damage or leaking air chambers. e. Check for difference between center lines of cylinders at both sides.	Measurement
	(2) Intermediate Buffer		a. Check for cracks, damage, wear and looseness of seat and stopper of buffer. b. Check for damage or worn of wear plates and head. c. Check for worn and crack or deformation intermediate pull bar.	
	(3) Bogie Frame		a. Check for crack, deformation and loosened of frame and accessories.	
	(4) Center Pin		a. Check for worn, crack and clearance of center pin and center pin guide of leading bogie.	
	(5) Center Plate and Side support		a. Check for damage, worn of sliding surface. b. Check for lubricant volume	
	(6) Righting Device		a. Check for worn, crack of Roller, roller frame, swing bolster, bolster guide and guide bar	
	(7)		a. Check for worn, crack of axle box, box	

Item(s) to be inspected			Points to be inspected	Method of inspection
	Axle box of Driving Wheel		wedge, wedge bolt and oil pan b. Check for installation condition of driving wheel c. Check for clearance between bearing plate and journal	Measurement
	(8) Axle Box and Pedestal Guide		a. Check for damage, worn, colored and gap between bearings b. Check for dirtiness and amount of lubricant c. Check for gap between stay and axle box	Measurement
	(9) Axle and Wheel		a. Check for damage to the wheel bases. b. Check profile of wheels: – Diameter of wheels and thickness of tires – Thickness and height of flanges – Back gauge c. Check for damage of axles.	
	(10) Spring System		a. Check for damage, worn and deformation of spring b. Check for worn and deformation of spring hanger, equalizer beam, spring seat and spring mount c. Check for worn and deformation of pin and bushing d. Check for damage of hanger pin of bolster	
	(11) Lifeguard		a. Check for cracks, damage, deformation or looseness.	
	(12) Sander		a. Check for damage, wear, or deformation and check to make sure sander is installed properly.	
	(13) Rail water Sprayer		a. Check for water leakage of cock, pipe and joint	
	(14) Frame		a. Check for deformation. worn, crack and loosened of frame	

Item(s) to be inspected			Points to be inspected	Method of inspection
	(15) Water Tank of Tender		a. Check for corrosion, crack and leakage of tank	
2. Power System	**(1) Boiler and equipment**	1) Fire Chamber	a. Check for corrosion, crack, swelling and scale of outer plate, rear plate, ceiling plate and piping sheet of fire chamber b. Check for corrosion, crack and swelled of plate joint. c. Check for crack and deformation of bottom frame d. Check for leakage and damage of arched pipe	
		2) Stay	a. Check for leakage and damage b. Check for block and damage of check hole	
		3) Heat Exchanging (Smoke) Pipe	a. Check for corrosion, crack and leakage	Water Pressure Check
		4) Melting Plug	a. Check for worn and leakage of screw	
		5) Flushing Plug	a. Check for leakage of screw	
		6) Boiler Body	a. Check for corrosion, crack and leakage of body b. Check for corrosion, crack and leakage of steam pipe	
		7) Smoke Chamber	a. Check for damage, deformation and corrosion of front plate, door and body of smoke chamber b. Check for fixing condition of door c. Check for leakage of inserting of exhaust pipe and main steam pipe	

Item(s) to be inspected			Points to be inspected	Method of inspection
			d. Check for loosened of exhaust pipe opening e. Check for corrosion and damage of spark protector and reflector f. Check for damage of blower pipe and opening g. Check for loosened, crack and leakage of superheated vapor pipe plate and main steam pipe h. Check for corrosion, crack and leakage of superheated vapor pipe	Water pressure test
		8) Governor Valve	a. Check for worn, sliding, gap, lift and opening condition of body, main valve and sub valve b. Check for worn and leakage at fitting of connecting rod. c. Check for lifting movement of valve	
		9) Safety Valve	a. Check for worn, crack and gap between body and valve b. Check for worn and damage of tip of push rod	
		10) Water Supply Valve and Overflow Valve	a. Check for worn and damage of body and valve	
		11) Injector	a. Check for worn and damage of body, steam valve, check valve, nozzle and cock	
		12) Water Valve and Cock	a. Check for worn and crack of body and valve	
		13) Indicator	a. Check for worn and damage of upper cock, bottom cock, drain cock and plug b. Check for dirtiness of glass cylinder	

Item(s) to be inspected			Points to be inspected	Method of inspection
		14) Stud bolt	a. Check for damage, loosened, worn and leakage	
		15) Stoker Door	a. Check for damage and deformation of stoker frame, door hinge b. Check for damage of each accessory	
		16) Grillage	a. Check for damage and deformation	
		17) Ash Box	a. Check for damage, deformation and fixing b. Check for condition of ash disposer	
			a. Check for condition of plate and leakage of heat exchanging pipe, stay, base frame and other accessory installation	Water pressure test
	(2) Cylinder and Auxiliary Equipment	1) Cylinder	a. Check for loosened and crack of body b. Check for damage of inner sleeve and loosened of bushing c. Check for loosened, worn and crack of cover	
		2) Bypass Valve	a. Check for worn and crack of cylinder and piston b. Check for worn and swelling of spring and piston ring	
		3) Bypass Cock	a. Check for worn, crack and fitting between cylinder and piston	
		4) Cylinder Safety Valve	a. Check for worn and crack of valve body and valve b. Check for worn and damage of tip of spindle c. Check for damage of spring	
		5) Cylinder Drain Valve	a. Check for worn, crack and opening movement of body and valve	
		6) Air Valve	a. Check for worn and crack of body and valve b. Check for damage of cover and steel net	

Item(s) to be inspected			Points to be inspected	Method of inspection
		7) Piston	a. Check for gap, worn, deformation and damage of piton bar and piston body b. Check for contact fitting between taper of piston bar and cock c. Check for crack, worn and deformation of lead bar support, plain bearing and wedge	
		8) Steam Chamber	a. Check for worn and damage of valve seat and inner surface of bushing b. Check for loosened of cover	
		9) Oil Pump	a. Check for worn and damage of body, sliding sleeve and crankshaft b. Check for worn and damage of lubricating valve, plunger and piston c. Check for damage of gear box, gear and adjusting screw and check valve d. Check for damage of driving unit	
		10) lubricator	a. Check for damage of steam check valve, oil control valve and oil nozzle	
	3. Valve System	1) Slide Valve and Piston	a. Check for worn and crack of sliding valve, strip and equalizing plate b. Check for worn crack and gap between valve frame and spindle c. Check for spindle condition and gap between body and steam chamber bushing d. Check for worn, damage and deformation of piston valve and spindle e. Check for gap between piston and ring f. Check for loosened of stop screw for ring	

Item(s) to be inspected			Points to be inspected	Method of inspection
		2) Link System	a. Check for worn and deformation of valve spindle crosshead and slider b. Check for worn and deformation of governor ring and slider c. Check for worn and deformation of turning crank d. Check for worn and deformation of reverser screw and slider e. Check for worn, damage and deformation of eccentric bar, link bar, reversing bar, spindle f. Check for worn and damage of bushing of eccentric bar g. Check for condition of bolt h. Check for worn and damage of pin	
3. Traction System	**(1) Crosshead**		a. Check for worn and crack of body, slider and crosshead pin b. Check for gap between sliding head and sliding bar of crosshead c. Check for fitting between crosshead pin hole and pin taper, between wedge and bushing d. Check for status condition of crosshead	
	(2) Sliding Bar		a. Check for damage and worn of body b. Check for crack of sliding bar support c. Check for status condition of sliding bar	
	(3) Main Crank Shaft		a. Check for deformation and crack of body b. Check for worn of fitting of support c. Check for fitting condition of frame and wedge	
	(4) Connecting Rod		a. Check for deformation and crack of body b. Check for worn between fitting hole of connecting end	

Item(s) to be inspected			Points to be inspected	Method of inspection
	(5) Knuckle Pin		a. Check for deformation and damage of body b. Check for fitting between knuckle pin hole of connecting rod, taper of elbow pin and wedge	
	(6) Crank Pin		a. Check for loosened, worn, damage and deformation of body b. Check for eccentric worn of crank pin	Measurement Measurement
4. Brake System	**(1) Foundation brake system**	1) Levers and rods	a. Check for worn, crack or deformation levers and rods. b. Check movable and sliding part for damage or wear.	
		2) Brake Cylinder and brake diaphragm	a. Check for damage, crack and worn of inside of cylinder and pistons b. Check for lubricant volume	
	(2) Hand brake system		a. Check for damage and worn of movable and sliding part b. Check for proper function	
	(3) Air Brake System	1) Brake Valve	a. Check for damage and worn of movable and sliding part b. Check for contact between valve and valve seat and damage of spring or the like c. Check for damage, deterioration, deformation of diaphragm and packing	
		2) Air Compressor	a. Check for worn and damage of steam cylinder, air cylinder and piston. b. Check for gap between cylinder and piston c. Check for worn and damage of steam chamber. Steam valve, reverser valve, reverser bar and air valve	

Item(s) to be inspected			Points to be inspected	Method of inspection
		3) Pressure Governor	a. Check for damage and worn of movable and sliding part	
		4) Steam Supply Valve and Reducing Valve	a. Check for damage and worn of movable and sliding part	
		5) Distributing Valve	a. Check for damage and worn of movable and sliding part	
		6) Air Tank	a. Check for corrosion and installation of body and safety attachment	
		7) Air Piping	a. Check for damage, and installation of air piping, hose and filter c. Check for oil opening motion and installation of cock	
	(2) Steam Brake System		a. Check for worn, crack of inside of cylinder, piston, piston ring and piston bar and damage of spring b. Check for leakage and worn of valve and the seat of brake valve	
5. Other Device	**(1)Whistle System**		a. Check for damage, dirtiness and installation of parts	
	(2)Indicators		a. Check for damage, dirtiness and installation of parts	
	(3)Gauges and meters		a. Check for damage and installation b) Check for function of pressure gauge c. Check for function of speed meter d. Check for function of voltage meter	 Measurement Measurement
	(4)Couplers	1)Automatic coupling device	a. Check for cracks, deformation and worn of coupler body, knuckles, anchorages, and pin b. Check for distance between elbow and stay	Measurement

Item(s) to be inspected			Points to be inspected	Method of inspection
			c. Check for function	
		2)Buffer	a. Check for damage, worn, deformation and installation of frame, draft spring, follower plate and guide	
		3)Shank guide	a. Check for damage, worn, deformation and installation	
		4)Air pipe coupler	a. Check for damage and deterioration of hoses and packing.	
		5) Water supply hose	a. Check for damage and deterioration of hoses and packing	
	(5) Lighting System		a. Check for worn or damage of turbine frame, shaft, bearing, governor, piston valve, valve b. Check for worn and damage of generator frame, cover, bearing, armature and field coil c. Check for worn, damage and loosened of brush, brush holder and commutator d. Check for rotation characteristic e. Check for dirtiness, damage and installation of lighting, lens, reflector, plug support and switch f. Check for damage and installation of wiring, connection box and other devices g. Check for insulation characteristic	Rotation test Insulation resistance test
	(6) Operation Recorder		a. Check for damage and installation	

2. General Inspection

Points to be inspected	Method of inspection
(1) Check for Installation of devices	
(2) Check for tilting of body	Measurement
(3) Check for height of pilot, sanding pipe and water spray	Measurement
(4) Check for device condition under operation	
- Function of boiler safety valve and cylinder safety valve	
- Installation of injector and leakage of piping	
- Temperature and function of injector	
- Function of bypass valve	
- leakage of air piston of bypass valve	
- Installation of reverser	
- Leakage of cylinder and steam chamber	
(5) Check for leakage of air brake control system	Measurement
(6) Check for function of brake system	
(7) Check for capacity of air compressor and function of governor	
(8) Check for function of whistle	
(9) Check for function of indicators	
(10) Check for insulation characteristic of electric circuits excepting	Insulation resistance test
for circuits with battery and semi-conductor	Measurement
(11) Check for height of coupler	
(12) Check for lighting system	

3 Check points of Test run

Points to be inspected	Method of inspection
(1) Check for condition of starting, acceleration and deceleration	
(2) Check for cut-off condition	
(3) Check for combustion condition, blowing condition and steam	
pressure condition under operation	
(4) Check for leakage of piston packing	
(5) Check for function of brake system	
(6) Check for abnormal noise and rolling	
(7) Check for indication of meters	
(8) Check for heating or leakage of bearing and sliding parts	
(9) Check for function of operation recorder	

REF 1-1: DEVIATION OF ROLLING STOCK

Rolling stock deviates toward outside at the both corner of the end and toward inside at the body center from the track while the rolling stock passes a curve section. The deviation can be estimated by the rough calculation as follows and the **Fig. ref-1.**

1. Deviation toward inside (W_1)

W_1 can be gained from triangle △PQO and the following formula.

$$(R - W_1)^2 = (R - d)^2 - (L_1 / 2)^2 \quad -----(f-1)$$

$$d = R - \sqrt{\{R^2 - (L_0 / 2)^2\}} \quad --------(f-2)$$

$$W_1 = R - \sqrt{\{(R - d)^2 - (L_1 / 2)^2\}} \quad --------(f-1-1)$$

2. Deviation toward outside (W_2)

W_2 can be also gained from triangle △STO and the following formula.

$$W_2 = \sqrt{\{(R + B/2 - W_1)^2 + (L_2 / 2)^2\}} - R - B/2 \quad --------(f-2)$$

L_0: Fix wheel base

L_1: Distance between both centers of bogies

L_2: Length of body

B: Body width

R: Radius of curve

W_1: Deviation toward inside

W_2: Deviation toward outside

d: Deviation inside bogie due to the double axle

3. Rough Calculation of Deviation

Formula (f-1-1) can be transformed by (f-2) as follows;

$$W_1 = R - \sqrt{R^2 - (L_0^2 + L_1^2)^2 / 4} \quad --------(f-4)$$

f-4 can be transformed by

$$(L_0^2 + L_1^2)^2 / 4 = m^2$$

and then,

$$W_1 = R - \left(R^2 - m^2\right)^{1/2} \quad \text{--------(f-5)}$$

f-5 can be further arranged by R;

$$W_1 = R\left[1 - \left\{1 - \left(m/R\right)^2\right\}^{1/2}\right] \quad \text{--------(f-6)}$$

In the formula,f-6 $\left\{1 - \left(m/R\right)^2\right\}^{1/2}$ is processed by Maclaurin expansion, and very small item less than fourth power items is neglected;

$$W_1 = R\left[1 - \left\{1 - 1/2\left(m/R\right)^2\right\}\right] \quad \text{--------(f-7)}$$

f-7 can be transformed again by m, and the rough calculation formula shall be as follow.

$$W_1 = \frac{L_0^2 + L_1^2}{8R}$$

Therefore, deviation W_1 shall be limited within clearance of rolling stock gauge at curve section. Generally, since deviation toward outside (W_2) is far less than W_1, the deviation of rolling stock at the curve is regulated by the W_1. Equipment mounted at roof top of rolling stock shall be also checked in this formula. Cant at curve section shall be considered in this calculation.

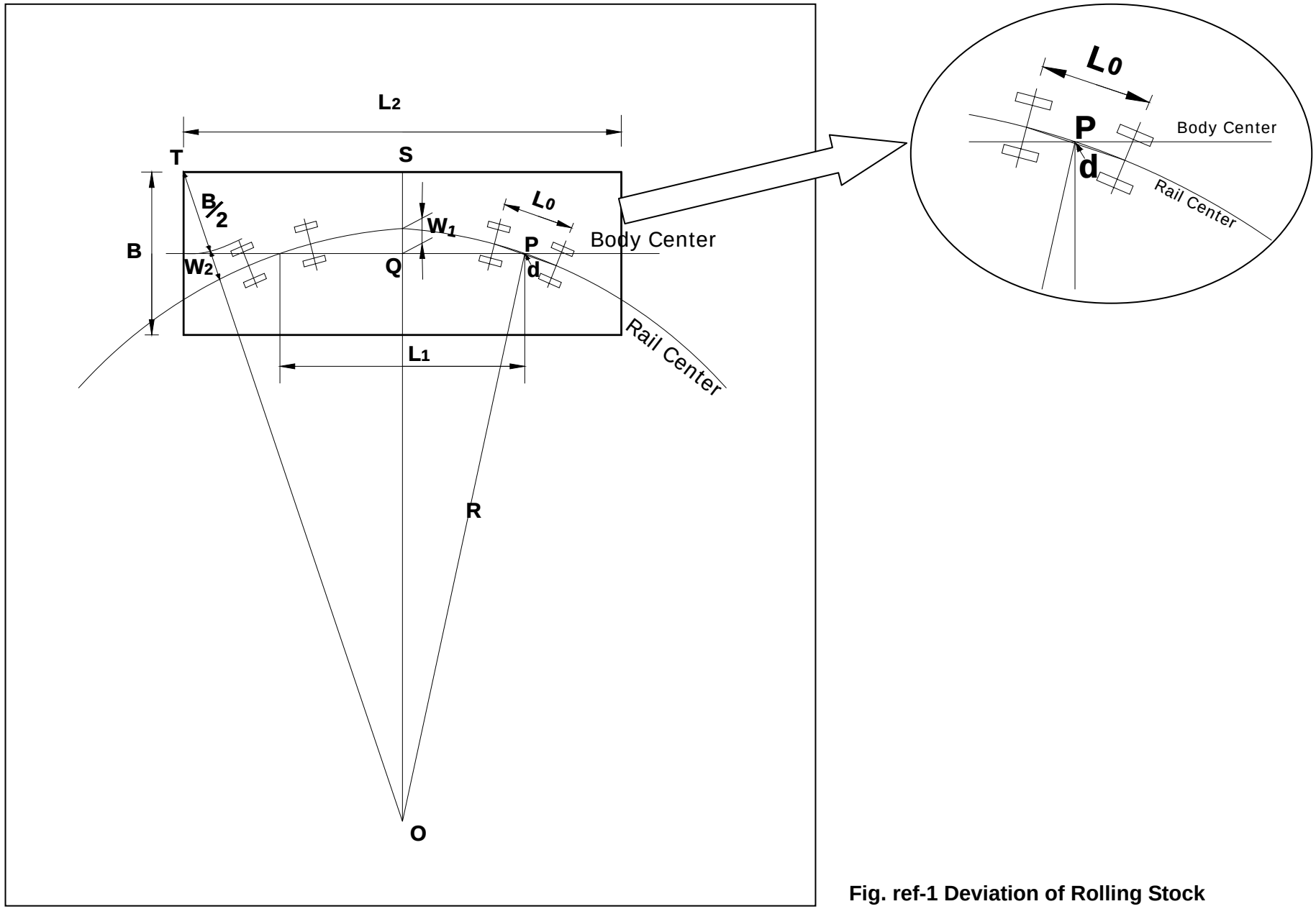


Fig. ref-1 Deviation of Rolling Stock

REF 1-2: MASS OF ROLLING STOCK

(Weight limit against track and Bridge)

1. Rolling stock shall not cause any harmful effect to track and bridge by the load in excess of the capacity of track and bridge concerned.
2. Mass of a wheel set of rolling stock load shall be 18 ton or less at the stopping. However, rolling stock such like locomotive shall be filled with fuel, water and lubricant.
3. Mass a wheel set of rolling stock excluding locomotive shall be 14 ton or less per one wheel set at the stopping.
4. Mass of rolling stock excluding locomotive shall be 5 ton or less in average per every 1 m in the distance between both couplers.

(Case of High speed railway)

Under construction

REF 1-3 STABILITY

(Wind velocity limit against downfall)

1. Wind velocity limit shall be 30 m/s or more. (This regulation shall be provided by the operation rules)

2. Calculation formula shall be as follows. (**Fig. ref-3**)

(1) Calculation; Downfall index (D)

$$D = \frac{h_G}{b_W}\left(\frac{V^2}{Rg} - \frac{C}{2bw}\right) + \frac{h_G}{b_W}\left(1 - \frac{\mu h_{GT}}{1+\mu h_G}\right)\alpha y + \frac{h_{BC} \bullet \rho \mu^2 S C_D}{2bwmg}$$

m_B : Half mass of body (kg)

m_T: Mass of bogie (kg) (Including mass of wheel and axle)

Y_W: Wind pressure force (N)

Y_V: Inertia force caused by vibration of body (N)

h_{GB}: Gravity center height of body from the rail (m)

h_{GT}: Gravity center height of bogie from the rail (m)

R : Radius of curve (m)

g: gravitational acceleration (9.8 m/s^2)

V: Running velocity (m/s)

E: Distance between gravity center of body and wind pressure force center (m)

θ: Cant (rad) $\tan\theta = C/G$ (C: Cant (m), G: Gauge (m))

h_{G^*} : Effective height of gravity center of rolling stock on spring of bogie (= 1.25 h_G (m))

h_{BC^*} : Effective height of wind pressure center of rolling stock on spring of bogie (= 1.25 h_{BC} (m))

2bw: Distance between wheel contact (= Inner distance between rims + width of rim: (m))

m: Half mass of rolling stock (= m_B + m_T+ 2m_W (kg))

μ: Mass ratio between bogie and body (=(m_B + 2m_W)/ m_B (kg))

αy: Lateral vibration acceleration at gravity center of body (G)

ρ : Air density (=0.125 (kg· s^2/m^4)

u: Wind velocity (m/s)

S: Half of side projection are of body (m^2)

C_D: Resistance ratio of body against lateral wind (= 1.0)

(2) Judgment

- Downfall Index shall be between 1.0 and 0.8 at all speed from 0 km/h to maximum at the curve section concerned.

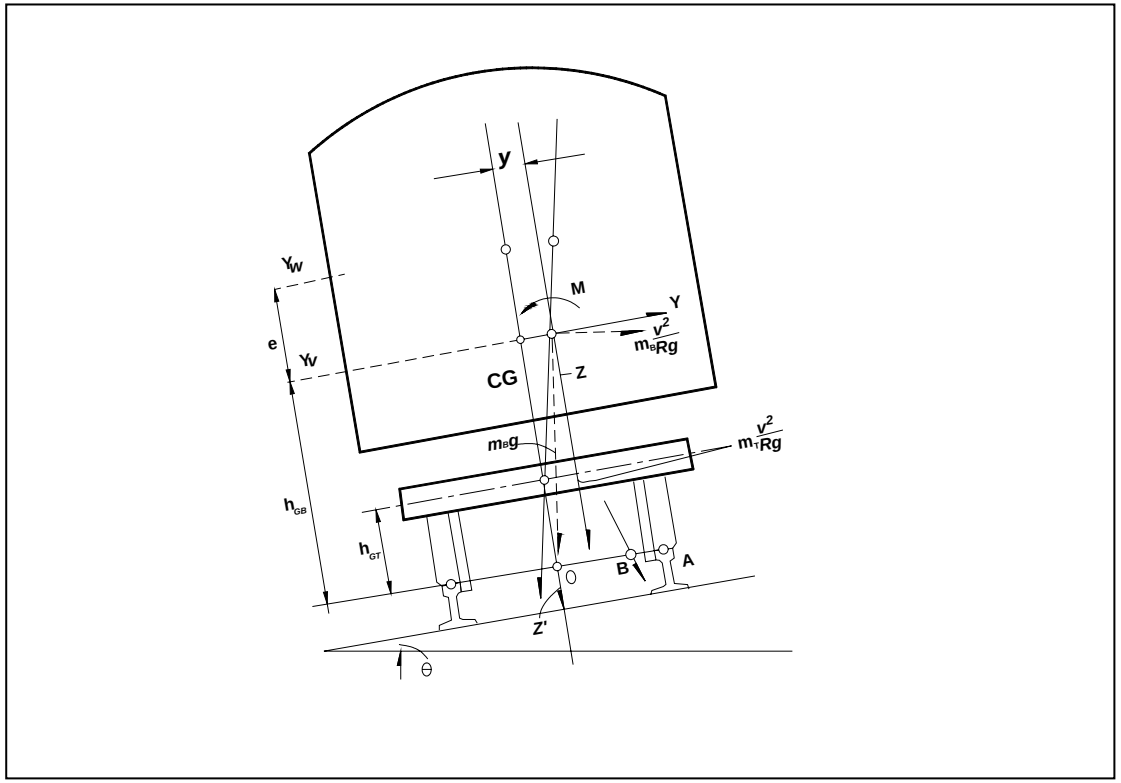


Fig. ref-3.1 Stability of Rolling Stock

(Static Wheel weight Ratio :SWR)

(1) Static wheel weight ratio of rolling stock for passenger shall be 0.85 -1.15 in tare weight of body.

$$SWR = \frac{W_1}{(W_1 + W_2)/2} \qquad \text{OR} \qquad SWR = \frac{W_2}{(W_1 + W_2)/2}$$

(2) The structure shall be easy to adjust wheel weight ratio.

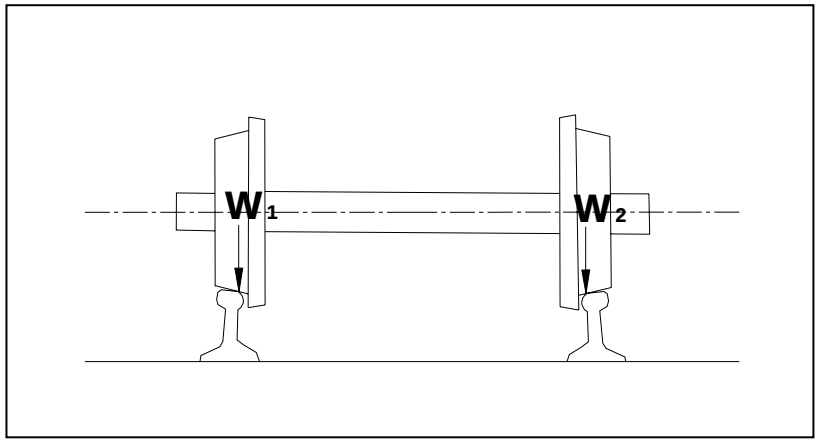


Fig. ref-3.2 Static Wheel Weight Ratio

(Running stability)

Running stability shall be judged by following criteria.

Description	Criterion
Derailment Ratio (Q/P)	Less than and including 0.8
Wheel unloading ratio	Up to 80% of static wheel weight (1 revolution more)

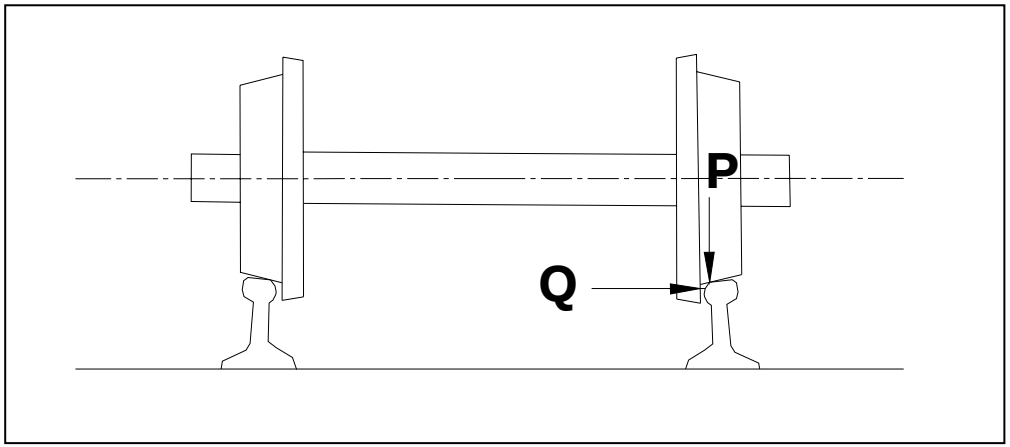


Fig.ref-4 Dynamic Ratio of wheel weight

REF 1-4 STRENGTH OF BODY

(Safety Criterion against crash at level crossing)

(1) Body structure shall be strong enough to withstand operation.

Strength of car body may be referred to the followings.

- *JIS E 7103 (Electric railcar for commuter use – General requirement for design of bodies)*
- *JIS E 7105 (Test methods for static load of body structures of railway rolling stock)*

JIS: Japan Industrial Standard

(2) Body to be installed with equipment shall not be resonated within the bound up to the design maximum speed.

Description	Crash condition	Requirement
Commuter Type or Line with few level crossing	- Train speed: 60 km/h - Train weight: train with passenger capacity - Road vehicle weight: 40 t	- Reinforced front structure - Strength of the front structure Section Modulus (Zy) Zy= 1.58 $\times 10^5$ (mm^3)
Limit Express Type or line with level crossing	- Train speed: 70 km/h - Train weight: train with passenger capacity - Road vehicle weight: 40 t	- Impact absorbing structure against 10 G to driver and passenger

(Body structure strength)
Strength of body structure shall be simulated by the followings.

Load	Description		Definition	Load Standard	Remarks
Vertical Load	Tare Load		Mass of Body structure	Car weight without bogie, equipment and facilities	Distributed load
	Passenger Load		Passenger weight	- Passenger Commuter type: 55 kg/person Limited express type: 60 kg/person - Maximum load Commuter type: Capacity ×250% Limited express type: Capacity ×200%	Distributed load
	Equipment Load		Equipment weight	Weight concerned	Concentrated load
	Vertical inertia force		Inertia force generated by running vibration	- Coil spring bogie Inertia mass ×0.3 - Air spring bogie Inertia mass ×0.1	
Back and forth load	End Load	Hauling load	Pulling force	- Car with tight lock coupler: 343 kN - Car of High Speed Railway: 490kN - Other Car: 686 kN - Locomotive: 784 kN - Freight wagon: 784 kN	
		Compression load	Compressing force	- Car with tight lock coupler: 490 kN - Car of High Speed Railway: 980kN - Other Car: 980 kN - Locomotive: 980 kN - Freight wagon: 980 kN	
	Impact load		Load by impact	(Car weight + Passenger Load)×0.3	
Inner pressure load of car body				Pressure in cabin: 8.0 kPa	High speed Railway

Reference: *JIS E 7105 ((Test methods for static load of body structures of railway rolling stock)*

REF 1-5 BOGIE STRUCTURE

(Bogie strength)

Running Gear including bogie, suspension system and rail guard (pilot) installed on bogie shall has strong and solid structure enough to secure the running safety and stability against considering hunting motion.

Reference: *JIS E 4206(spring rigging for railway rolling stock)*

JIS E 4207(Truck frames for railway rolling stock – General rules for design)

JIS E 4208 (Test methods of static load for truck frames and truck bolsters if railway rolling stock)

JIS E 4501(Railway rolling stock – Design methods for strength of axles)

JIS E 4502-2(Axles for railway rolling stock – Dimensional requirements)

REF 1-6 COUNPLING DEVICE

(Profile Coupler)

1. Profile of automatic Coupler shall conform to the **Fig. ref 6-1**.
2. Profile of tight lock coupler shall conform to the **Fig. ref 6-2**.

(Height of coupler)

1. Center of coupling device shall be 880 mm high from the top of rail.

(Strength of coupler)

1. Tensile breaking load shall be as follows.

Description	Tensile Breaking Load
Automatic Coupler	980 kN
Tight Lock Coupler	588 kN

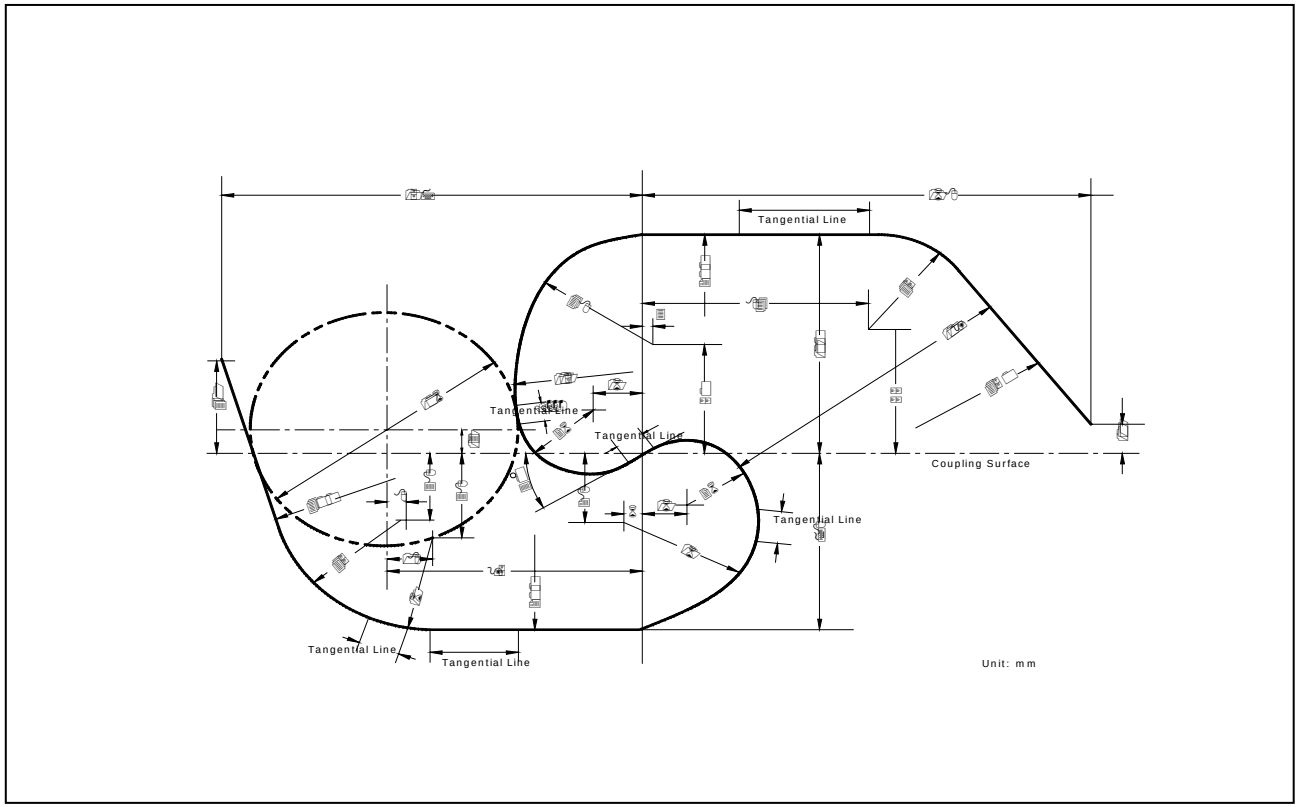


Fig. ref 6-1 Profile of Automatic Coupler

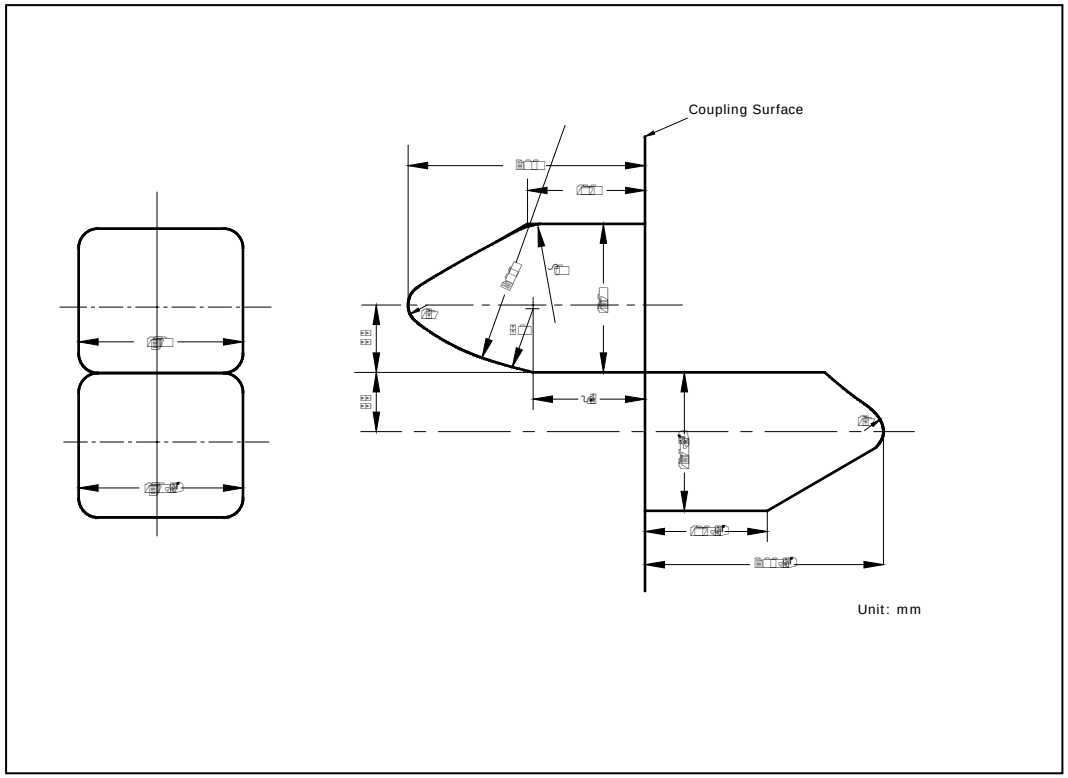


Fig. ref 6-2.1 Profile of Tight Coupler

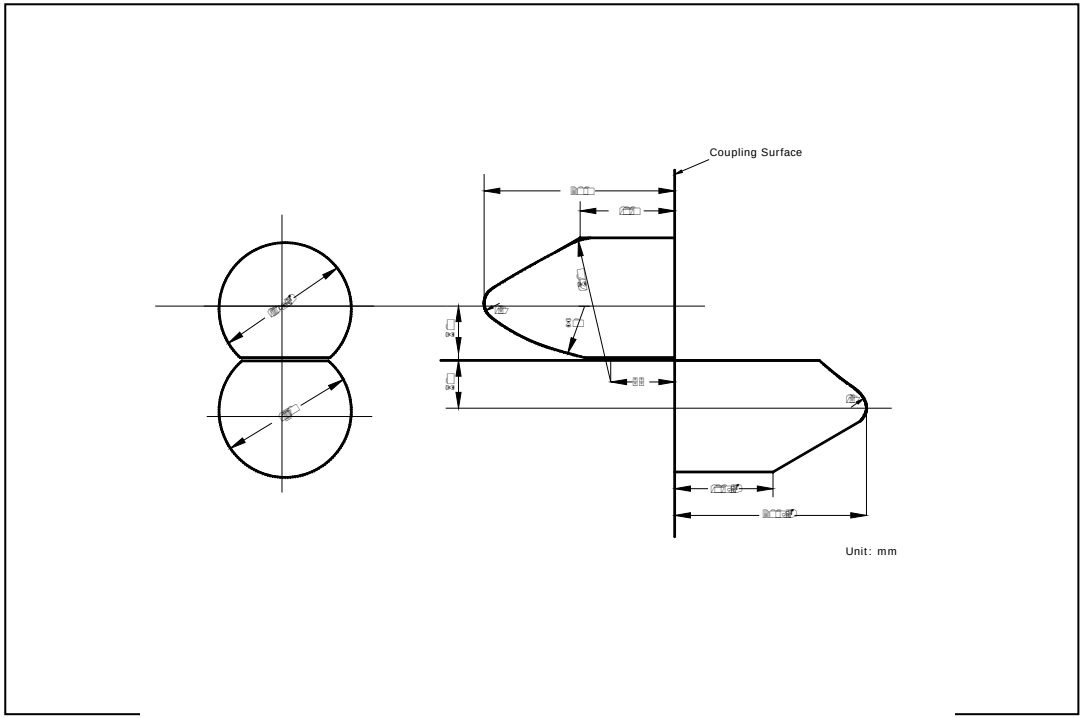


Fig. ref 6-2.2 Profile of Tight Coupler(High Speed Railway)

(Air Coupler)

3. Air Coupler Profile shall conform to the **Fig. ref 6-3**

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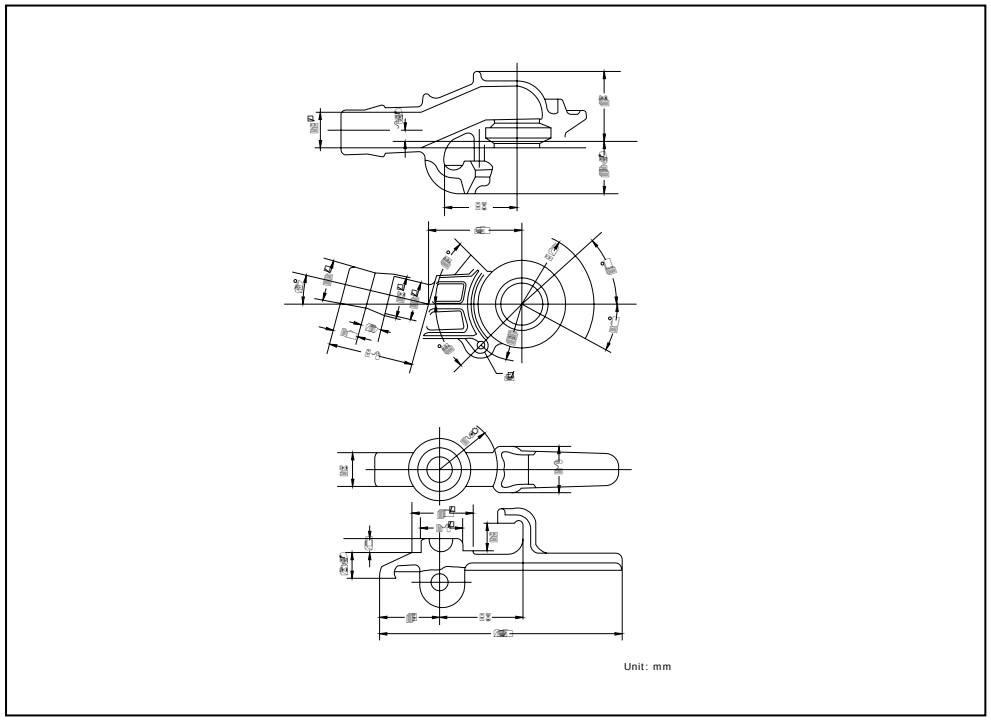


Fig. ref 6-3 Profile of Air Coupler

REF 1-7 BRAKE SYSTEM

(Function of Brake System of Standard Railway with maximum speed 150km/h or less)

1. Running train shall be decelerated, stopped and maintained to stop by service braking

   On – 5 ‰ downward section, running train at the maximum speed shall be stopped by emergency braking within distance regulated by the ground safety installation.

   Stopping train running at the maximum speed within distance conforming capacity of ground facilities on level section by the maximum force of service braking

2. Distance regulated by the ground safety installation means 600 m or less. (see Figure below)
3.
4. All wheel of rolling stock shall be provided with braking function. However, some wheel of special use shall be excluded.
5.
6. Braking force shall be provided with brake ratio by following values in the table. Transmission coefficient of force is defined by 100/100.

Description	Loaded Braking Ratio
Locomotive	70/100
Electric and diesel car	70/100
Passenger coach	70/100
Freight wagon	25/100
Specific car	25/100

7. Braking ratio indicated in table above shall be calculated by following formula.

(a) Tread Brake case

1) Brake force: B1 (kN)

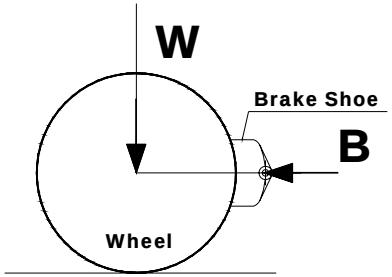
$B1 = \pi/4 \cdot D^2 \cdot \delta \cdot n \cdot P$

2) Loaded mass of rolling stock: W (kN)

W= Weight of rolling stock (t) ·9.8 (m/s^2)

3) Friction coefficient ratio (Cast iron conversion ratio) =μ1/μ2

4) Loaded braking ratio = B1/W·μ1/μ2·100



(b) Disc Brake

1) Brake force: B2 (kN)

$B2 = \pi/4 \cdot D^2 \cdot \delta \cdot n \cdot P$

2) Loaded mass of rolling stock: W (kN)

W= Weight of rolling stock (t) ·9.8 (m/s^2)

3) Disc ratio (Tread brake conversion) = r/R

Friction coefficient ratio (Cast iron ratio) =μ1/μ2

4) Loaded braking ratio = B2/W·r/R·μ1/μ2·100

D: Diameter of Cylinder (m)

δ : Lever ratio

n: Number of Cylinder

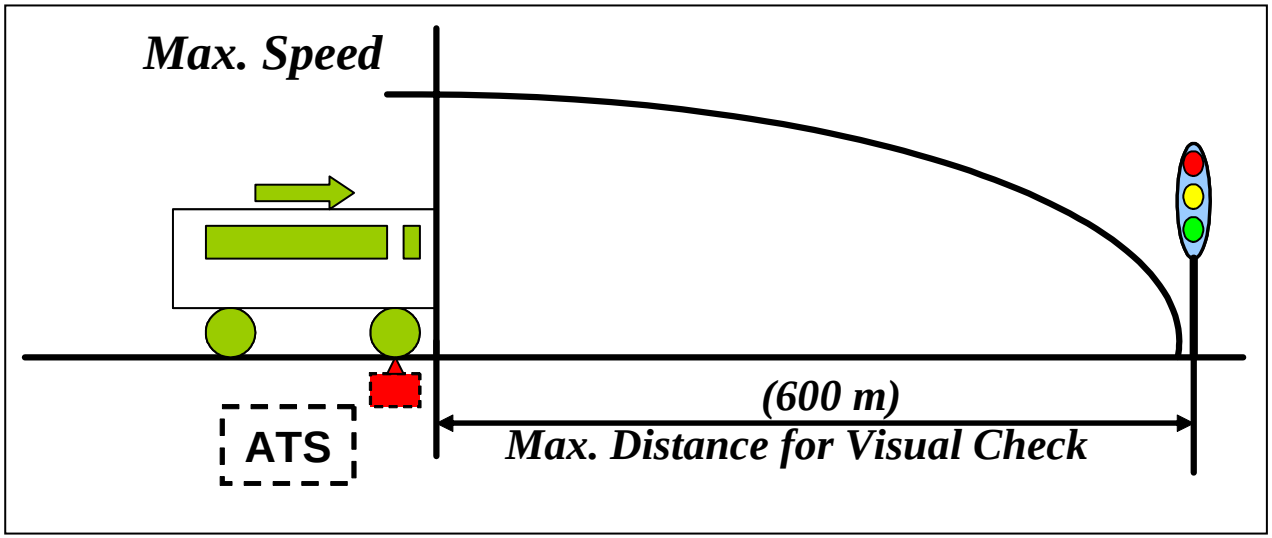
P: Cylinder Pressure (kPa)

r: Essential radius of disc (mm)

R: Radius of wheel (mm)

μ1: Friction coefficient of composite brake shoe

μ2: Friction coefficient of cast iron shoe (0.15)



All kinds of trains must stop within 600 m from the maximum speed because ground safety facility is fixed for any train.

(Function of Brake System of High Speed Railway with maximum speed 200km/h or more)

Braking function of high speed railway rolling stock with tare at level section shall be provided by deceleration at level as follows.

peed Range (km/h)	Deceleration (km/h/s)
Over 230	1.5
160 – 230	1.9
110 – 160	2.5
70 – 110	3.1
Less than 70	3.4

REF 1-8 FIRE PROTECTION

1. Fire Protection

(1) Fire protection for electric cable and devices

Description	Protection Measure	
1. Electric Cable	Cable installed near or connected with device that may generate arc or heat	Covered with high fire retardancy
	Others	Covered with Incombustible material
2. Electric Equipment	Equipment that may generate arc or heat	Installed apart from floor or wall and with heat insulation plate with incombustibility
3. Internal Combustion Engine		Installed apart from floor or wall and with heat insulation plate with incombustibility
		Installed with heat insulation plate between exhaust duct and body even under deteriorated condition of exhaust.

(2) Fire Protection on Passenger Car

<table>
<tr><td colspan="2">Part of Rolling Stock</td><td>General Railway</td><td>Subway / High Speed Railway</td><td colspan="2">Special Railway</td></tr>
<tr><td rowspan="4">Roof</td><td rowspan="2">Roof</td><td colspan="2" rowspan="2">Non-Combustible material which is equivalent to steel</td><td>Non-Combustible material</td><td>- Mono-Rail
- Guide Railway</td></tr>
<tr><td>Incombustible material equivalent to steel</td><td>- Non Track way
- Rope way</td></tr>
<tr><td>Roof surface</td><td colspan="3">Covered with incombustible material, only for passenger car with overhead contact line.</td><td></td></tr>
<tr><td>Equipment or device mounted on roof</td><td colspan="3">Mounting support shall be insulated against body and the surface shall be covered with incombustible material</td><td></td></tr>
<tr><td rowspan="2">Outer Panel</td><td>End panel</td><td>Incombustible material /or finished with non-combustible paint</td><td colspan="2">Non-Combustible material/ finished with non-combustible paint</td><td></td></tr>
<tr><td>Other Panel</td><td rowspan="3">Non-Combustible material or covered with non-combustible material/ finished with non-combustible paint</td><td colspan="2">Non-Combustible material/ finished with non-combustible paint</td><td></td></tr>
<tr><td rowspan="2">Passenger Cabin</td><td>Ceilings</td><td>Non-Combustible</td><td>Non-Combustible/ Non-Combustible Pait</td><td></td></tr>
<tr><td>Inner Panel</td><td colspan="2">Non-Combustible</td><td></td></tr>
<tr><td colspan="2">Heat Insulator and sound proof panel</td><td></td><td colspan="2">Non-Combustible</td><td></td></tr>
<tr><td rowspan="5">Floor</td><td>Floor</td><td colspan="3">Protected against smoke or fire</td><td></td></tr>
<tr><td>Carpet</td><td colspan="3">Incombustible</td><td></td></tr>
<tr><td>Pad under carpet</td><td></td><td colspan="2">High fire retardancy</td><td></td></tr>
<tr><td>Floor panel</td><td>Non-Combustible /covered with steel panel</td><td>Non-Combustible material equivalent to steel</td><td>Covered with Non-Combustible Paint</td><td></td></tr>
<tr><td>Under floor</td><td>Non-combustible material or covered with steel</td><td>Non-combustible material or covered with steel and besides finished with non-combustible paint</td><td>Covered with Non-Combustible Paint</td><td></td></tr>
<tr><td colspan="2">Under Floor Equipment</td><td></td><td colspan="2">Non-Combustible or incombustible material due to electric insulation</td><td></td></tr>
<tr><td rowspan="3">Seat</td><td>Cover</td><td colspan="3">Incombustible</td><td></td></tr>
<tr><td>Padding</td><td></td><td colspan="2">Incombustible</td><td></td></tr>
<tr><td>With heater under seat</td><td></td><td colspan="2">Installed heat insulator between seat and heater</td><td></td></tr>
<tr><td>Shade</td><td></td><td colspan="3">Incombustible</td><td></td></tr>
<tr><td>Gangway bellows</td><td></td><td></td><td colspan="2">Incombustible</td><td></td></tr>
</table>

Fireproof criteria concerning rolling stock material preventing fire shall conform to the followings and **Fig. ref .8**.

2. Structure of test method:

(1) Fuel container;

a. Metal product of 17.5 φ, 7.1 mm depth and 0.8 mm thick

b. This shall be supported by material with low thermal conductivity like cork so as that bottom line of the container is set at the position 24.5 mm from surface of the test piece.

c. Pure ethyl alcohol 0.5 cc shall be burned in this container

(2) Test piece of non metal material:

a. Size 182 mm wide and 257 mm long

b. Process for testing

Test piece shall be dried for 5 days and more at place 1 meter high from floor in a room with breath but without direct sunlight.

(3) Condition of laboratory

a. Temperature: 15 – 30 C

b. Relative humidity: 60 – 75%

c. Any breeze shall be prohibited.

3 Flameproof judgments

Material shall be judged under burning and after burned.

(1) Burning

It shall be judged by observing the ignition, fire, smoke and force of the flames.

(2) After burned

It shall be judged by observing flame, ash, carbonization, and deformation.

JUDGEMENT

Description	Burning				Burned			
	Ignition	Flame	Smoke	Force of flame	Flame	Ash	Carbonization	Deformation
Non Combustible	No	No	Few	-	-	-	Discoloration is 100 mm long or less	100 mm or less on the surface
High Fire Retardancy	No	No	Few	-	-	-	Shall not reach to top of the piece.	150 mm or less
	Exist	Exist	Few	Weak	No	No	30 mm long or less	
Incombustible	Exist	Exist	Normal	Flame does not spread over top of the piece	No	No	Shall reach to top of the piece	Overall or hole eaten by fire

Remarks:
Dimension of Carbonization and deformation shall be major axis of the size.
Case of extraordinary flame shall be judged by one step down.

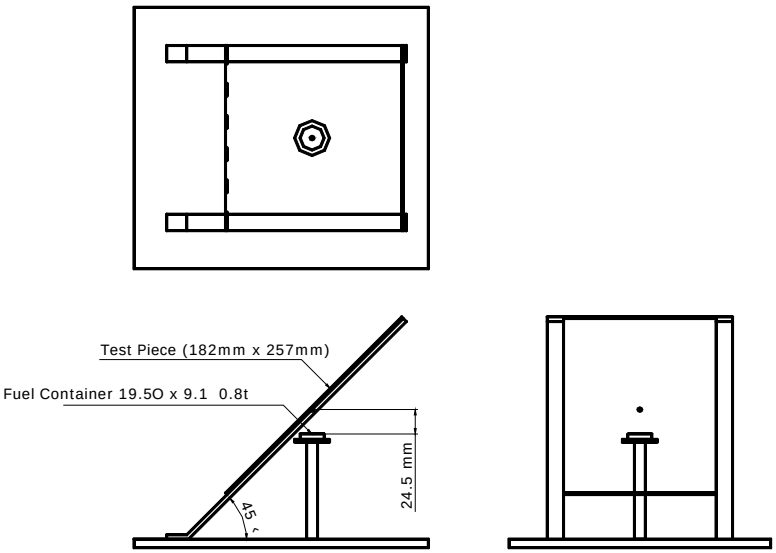
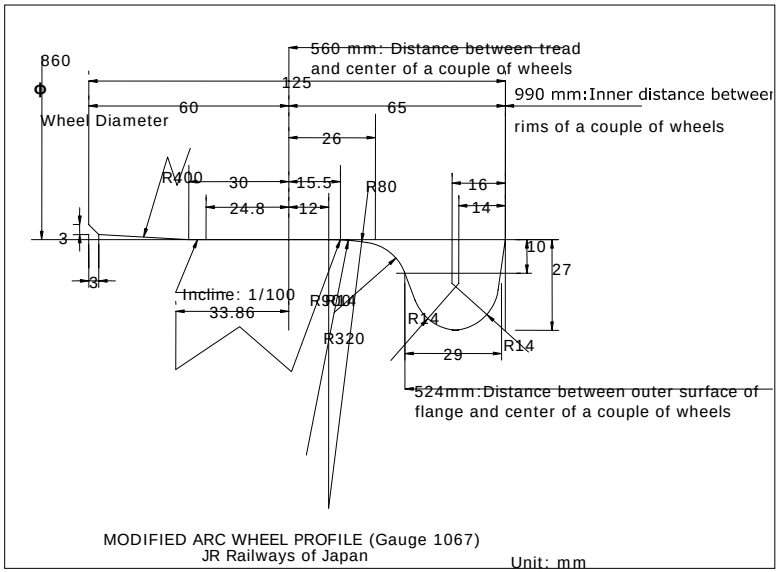
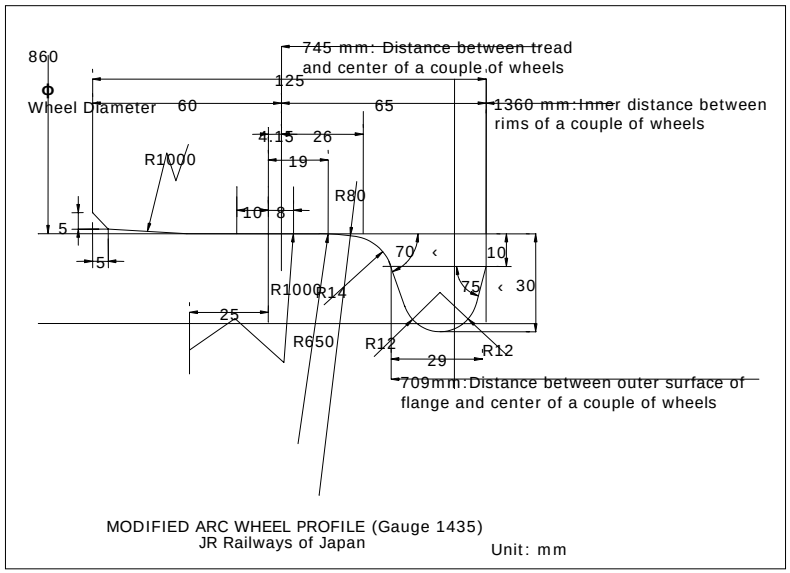


Fig. ref-8 Flameproof Test Stand

REF 1-9 MODIFIED ARC WHEEL PROFILE

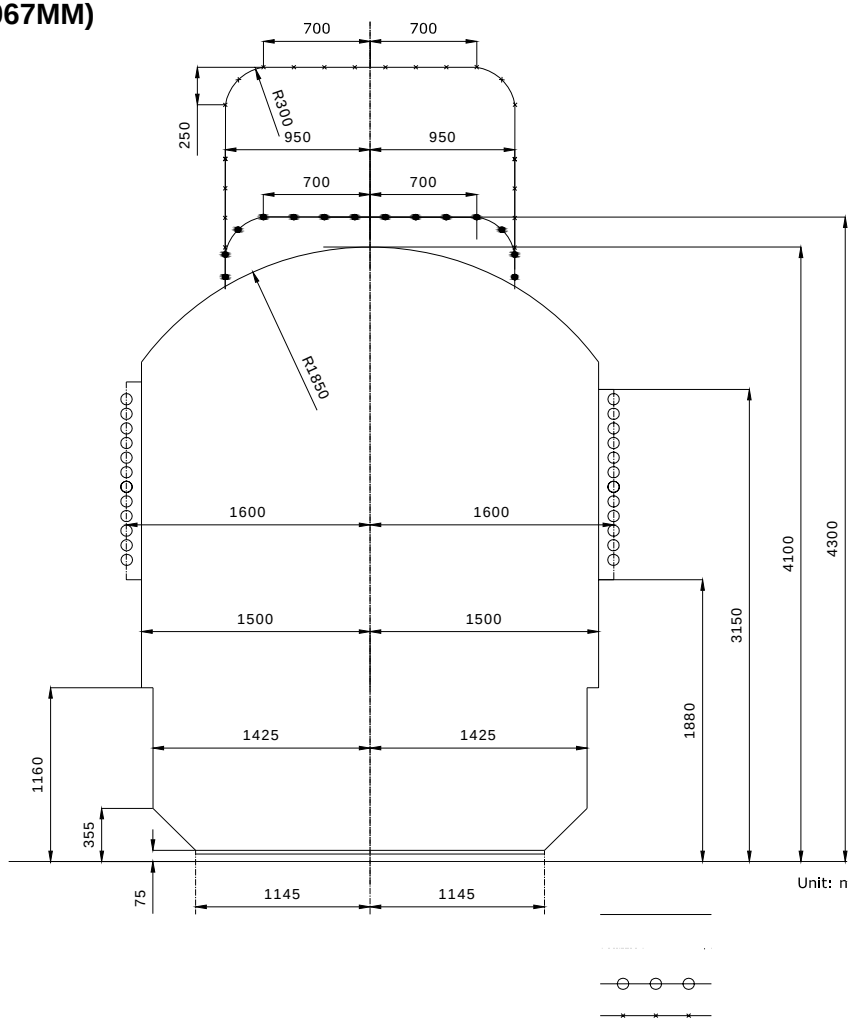


MODIFIED ARC WHEEL PROFILE (Gauge 1067)
JR Railways of Japan
Unit: mm



MODIFIED ARC WHEEL PROFILE (Gauge 1435)
JR Railways of Japan
Unit: mm

REF 1-10 ROLLING STOCK GAUGE (1067MM)



ROLLING STOCK GUAGE (1067)
JR Railways of Japan

REF 1-11 RUNNING GEAR

(Running Gear)

(2) Dimension of wheelbase and wheel and axle of rolling stock shall conform to each one indicated in the following table .

Description	Ordinary Railway 1067mm
a. Wheel Base	4300mm less
b. Wheel Diameter	680mm more
c. Rim width of wheel	120mm more 150mm less
d. Inner distance between both wheel rims	989mm more 994mm less
e. Height of Flange	25mm more 35mm less
f. Distance between centers of wheel set and tread	
Limiting curve condition for Rolling stock	100 m radius curve with 15 mm gauge-widening (However,100m radius curve without gauge widening for rolling stock with 2 axle bogies)

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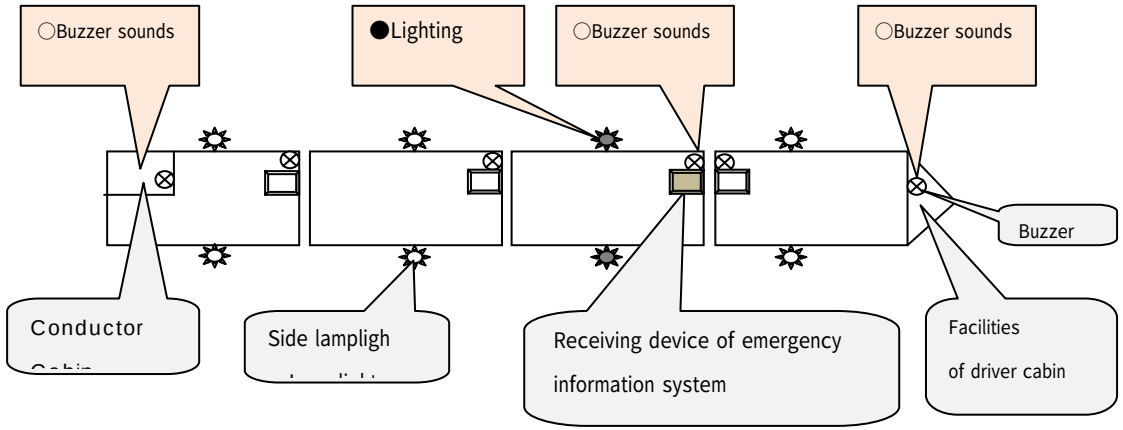
REF 1-12 EMERGENCY INFORMATION SYSTEM



Receiving device of emergency information system

REF 4 APPROVAL PROCEDURE

The Railway Law (No.35/2005/QH11) provides that rolling stock shall be certificated technically in article 38. Following shows some procedure for approval.

(Approval of rolling stock)

Railway operator shall be approved of rolling stock by the Government when the operator wants to operate rolling stock for railway service.

Operator shall be approved of rolling stock by the Government when the operator wants to change structure of rolling stock that has been already approved. However, light change can be excluded.

(Approval Procedure)

Article 1: (Method of approval of rolling stock)
The confirmation shall be done on the documents and drawings about the said rolling stock and the operation section, or territory to be submitted by the operator.

Article 2: (Request of approval of rolling stock)
Operator must submit application for approval of rolling stock following procedure as mentioned below.
(1) Name of representative, name and address of operator
(2) Operation section or territory for rolling stock to be approved
(3) Type of rolling stock and code name
(4) Structure and equipment (shown in the table as follows)

Equipment		Structure	
1	General	1	Tare weight
		2	Passenger capacity
			(Passenger capacity or maximum number of passenger in case of cable way)
		3	Unit area in cabin per passenger (square meter) for seating and standing passenger each

		4	Maximum load
		5	Maximum speed in design
		6	Dimension and measurement related with rolling stock clearance
			(This shall be shown by drawings, plan, elevation, cross section and end view.)
		7	Major equipment arrangement
			(This shall be shown by drawings.)
		8	Fire countermeasures
2	Running Gear	1	Material and structure of bogie (Shown by drawings)
		2	Material and structure of wheel and axle (Shown by drawings)
		3	Spring characteristics of supporting system (Excluded locomotive)
		4	Material and structure of guide steering system (only for guide rail type) (Shown by drawings)
		5	Material and structure of steering system (only for non-track electric car) (Shown by drawings)
		6	Maglev system (*Omitted*)
3	Traction System	1	Type and output of power source (Shown by drawings)
		2	System of traction
		3	Control system
		4	Traction characteristic (Shown by drawings)
4	Brake system	1	Type and structure of brake system in service brake, parking brake, security brake (Shown by drawings)
		2	Braking ratio in service brake, parking brake, security brake)
		3	Device and location of air piping and oil piping (Shown by drawings)
		4	Piping of air reservoir, actuator and auxiliary equipment (shown by drawings)
		5	Capacity of air compressor or oil pump
		6	Air pressure regulated by governor or safety valve
5	Electric system	1	Electric circuit (Shown by drawings)
	(Excluded devices	2	Type, voltage and output of generator

	unrelated to safety operation)	3	Voltage and capacity of battery
6	Coupling system	1	Type of coupler
		2	Type of draft gear
7	Operation safety system	1	Type, function and structure of onboard device of automatic train stop system, automatic train control system
			and automatic train operation system (Shown by drawings)
		2	Type, function and structure of onboard device of communication system (Shown by drawings)
		3	Frequency and type of transmission of onboard train radio system
8	Other equipment		Material of window glass and the proper equipment
(Remarks)			
Each item mentioned in column "structure" can be omitted by the notification as follows;			
Item is,			
1) the same as that of which the operator has already operated under approval.			
2) the same as that of which other operator has already operated under approval.			
3) the same as that of which Minister of MLIT has already announced the specification.			

6 Train Operation

Table of Contents

Chapter 2　The official in charge

Article 9　To guarantee operating safety

Persons engaging in the work of driving (hereinafter “officials”) shall observe the following regulations and canons on safety faithfully.

1. The officials shall fully understand the regulations on the conduct of driving.
2. The officials shall observe the regulations on the conduct of driving faithfully and precisely.
3. The officials shall endeavor to be well versed in the conduct of driving and in case a question arises about the way of conduct, the conduct thought to be the safest shall be taken.
4. In working, the officials shall be in close contact with the persons concerned, discuss correct arrangements with them and cooperate mutually.
5. In working, the officials shall make necessary confirmation meticulously and refrain from working on unsupported assumption.
6. The officials shall be well aware of the times of operating trains related to their work.
7. The employees shall always ensure accuracy of a timepiece used on business.
8. The officials shall make effort to prevent accidents in cooperation with others and do their best lest damage should be done to passengers and the general public.
9.. If an accident occurs, the officials shall judge the situation calmly, and particularly when a human life is exposed to danger, they shall do everything in their power for lifesaving.

Article 12　To have theoretical and practical training for an official in charge

1. The officials engaging in the work of driving are listed in the following items..

(1) “The officials directly involved in driving trains”

a. The staff provided in Article 46 of the Vietnamese Railway Law (hereinafter “the Law);

b. The officials on board for train protection, brake operation or signaling as needed for train operation;

c. An official who deals with singly directs or supervises work directly related to the train operation in maintenance or construction of railway tracks, electric railway tracks, safety device and so forth.

(2) “The officials engaging in the maintenance of facilities and rolling stock and similar work to it”

a. The officials engaging in maintenance service for structures and railway tracks;

b. The officials engaging in maintenance service for electric equipment and safety devices for driving;

c. The officials engaging in inspection and repair of rolling stock;

d. The officials who personally switch apparatuses of electric equipment.

2. The officials as provided in 1(1) shall fulfill the requirements set forth in Article 46 paragraph 2 of the Law and shall have to accomplish their work on their own responsibilities as stipulated in Article 34 paragraph 3.

3. Railway operators shall educate and train the officials periodically and confirm that they have necessary knowledge and skill.

(1) Implementation guidelines shall set forth types of such education and training, teachers and trainers, persons to be educated/trained, and other necessary matters concerning the education/training.

(2) Education and training shall be conducted regularly according to an established annual schedule.

(3) In addition to those who are assigned to a new work, education and training shall cover persons transferred to a new location even for the same types of work as before and education and training on rolling stock, railway tracks, security equipment for driving and the manners of driving in the newly-assigned location shall be given as occasion demands.

(4) Education and training for a crew member who drives a motive power unit for familiarization when assigned to a new line (including the case where new transport service is opened) shall be conducted as follows.

a. To give basic knowledge of the motive power unit and educate on matters concerning track equipment and electric equipment;

b. To carry out a study tour and practical training for driving in the section concerned. The frequency of driving practices shall be increased or decreased appropriately in consideration of the section in which the person will work, the length of railway track, and complicatedness of signal indication.

c. Driving practice shall be carried out in the same operating mode as that of trains in service (in a condition of service to be applied once a new transport business is opened). Hereinafter the same applies. Nevertheless, if some interference with the existing section in service is foreseen in the case of opening a new service on an extended line, for example, practice should be carried out in the form of operation which resembles as much as possible that of the trains in service.

4. For a train driver and an assistant train driver among the officials provided in 1(1) a, and the officials of 1(1) b, a system enabling appropriate supervision, such as requesting them to report or giving them instructions on matters necessary for the operation before getting on board, while in driving and at some other suitable time, must be established.

Article 13 To have a crewman who drives a power car on board, and so on

The phrase “cases where there is no problem with safe driving without a crewman on board owing to the structure and the like of facilities and rolling stock” in a proviso of Paragraph 1 shall apply when each of the conditions mentioned below is satisfied, and at the same time, it shall be conformed to the standards set forth in Subparagraph 3 of Article37 (Platform), Article 89（Devices for automatic operation）, and Paragraph 2 of Article ※(equipment of cars of a train or the like in which a driver of motive power unit is singly on duty)

(1) The railway is constructed in such a way that people cannot easily enter the tracks and there is no possibility of the passage of the train being impeded as a result of, for example, rocks falling onto the track. Note that, however, this shall not apply to a case where a device capable of detecting anything that is likely to impede the progress of the train and stop a train automatically is equipped or where some other measures that do not impede the safe running of the train are taken.

(2) The railway is of a structure or in a form that requires no protection of train against adjacent tracks. Note that, however, this shall not apply to a case where a device capable of detecting anything that is likely to impede the progress of the train and stop a train automatically is equipped.

(3) The railway permits passengers to be readily evacuated in an emergency

Chapter 10 Operation

Section 1 Loading Limits, etc.

Article 111 Vehicle loading limits, etc.

1. Anything that exceeds a maximum load indicated on the car shall not be loaded.

2. In case an outsized cargo is transported, the route shall be checked in advance for any obstacle and necessary measures shall be taken to ensure safety.

Article 112 Indication when hazardous materials are loaded

The indication of a car loaded with a hazardous material shall tell, in addition to the name of the material, its description allowing one to know its properties easily so as to contribute to the selection of appropriate means in an emergency.

Article113 Hazard control for vehicles loaded with hazardous materials

1. Hazardous material for transport shall be handled in conformity with the Law No. 102 (Transport of Hazardous Cargo).

2. Hazardous material shall be loaded in cars or the like of sealed construction (including those which are equipped with tanks containers, etc. Hereinafter the same applies.)

3. When a car loaded with hazardous material is connected to a train, a certain interposition car shall be connected in consideration of possible effect on passengers and crew members, as stipulated in the detailed explanation of Article 114.

4. In parking a car loaded with hazoudous material, or loading and unloading of it, if it is feared that a surrounding area is exposed to danger, a step for risk prevention, such as moving it onto the furthest railway track, shall be taken.

5. Harzardous material is as provided in Chapter 5 of the Guideline for Enforcing the Vietnamese Railway Law (Cabinet Order No. 109/2006/ND-CP)

Section 2 Train Operation

Article 114 Maximum number of vehicles to be coupled, etc.

1. When a train is composed, the number of cars to be connected shall not exceed the fixed traction number. In case the maximum number of connectable cars needs to be reduced in order to limit the length of train due to the effective length of the railway tracks in a station, more cars than the reduced number shall not be connected.

2. Any passenger train shall not be longer than the effective length of the platform of station. Nevertheless, this rule shall not apply to cases where only a very limited number of passengers

get on or off the train at the platform and it is unavoidable for the operation of trains on condition that the measures are taken such as announcement and guiding to protect passengers from falling down.

3. When a car loaded only with hazard material (excluding a car of sealed construction or the like) is connected to a train, a necessary interposition car shall be connected in consideration of possible effect on passengers and crew member.

Article 115 Train brakes

1. A train shall be put in a condition in which a continuous brake works on all the shafts. This rule does not apply, however, in the cases listed in the following subparagraphs and in which no risk of interfering safe operation of the train is found.

(1) A train comprising only locomotives, each of which is manned by an official who drives a motive power unit, and a work train, a rescue train, or a train manned by an official who is capable of taking a safety measure to stop the train or a separated car or to prevent a car from wheel movement.

(2) A train of which the continuous brakes (brakes provided in Paragraph 7 of the detailed explanation for Article 73) do not work on some of its cars, which is connected with such cars in a middle portion thereof, and of which the brakes are used in the foremost and the rearmost cars.

(3) A train with a damaged car on which a continuous brake does not work or a special car (limited to those which are unable to be connected in a middle portion of the train) coupled to the front or the rear thereof and on which an official in charge of keeping watch on such a car or is so arranged that the car should not be separated.

2. A procedure for the brake test of train shall be established in accordance with the condition at the time when the train is composed, when the composition is changed, or when the driver changes the operating position.

Article 116 Train braking force

1. For the braking force of a train, certain criteria including the ratio in number of axle of cars on which prescribed braking force is exerted to the axle of all the cars composing the train shall be established and it shall be arranged so that a quick judgment is possible.

2. The ratio in Paragraph 1 should be standardized as 100, and in case the ratio needs to be reduced to a level below 100 due to a brake failure or connection of a special car, etc., alternative new ratio shall be set in accordance with a standard gradient of the railway track and a speed.

3. If the number of braked axles is less than the established ratio, an operation controller’s

instruction shall be requested.

(For reference) **Examples in Japanese railways**

Rate of brake a axle / Train composition	100	Minimum 80 and less than 100	Minimum60 and less than 80	Minimum40 and Less than 60
Train composed of cars with maximum speed of 130km/h	130km/h	120km/h		
Train composed of cars with maximum speed of 120km/h	120km/h	105km/h		
Train composed of cars with maximum speed of 110km/h	110km/h	100km/h		
Train composed of cars with maximum speed of 100km/h	100km/h	90km/h		
Train composed of cars with maximum speed of 95km/h	95km/h	85km/h		
Train composed of cars with maximum speed of 85km/h	85km/h	75km/h		
Train composed of cars with maximum speed of 75km/h	75km/h	70km/h		
Train composed of cars with a speed of 65km/h or lower	65km/h	65km/h	60km/h	60km/h

Note: A train of cars of different may speeds should take the lowest speed to apply.

Article 117 Operation of the main line outside station

1. The phrase “the time of shunting” referred to in the proviso of Article 117 is limited to the shunting for which a necessary area must be extended to the outside of the station for unavoidable reasons like the condition of facilities of the station.

2. Boundary between the inside and the outside of a station shall be defined as follows.

(1) In the case of railway tracks for trains to enter a station which is in a double-track section or railway tracks in a station in a single-track section;

The outermost home signal ,a home indicator or a ground signal or marks indicating the

station area;

(2) In the case of railway tracks for trains to depart from a station which is in a double-track section.

Marks indicating the station area (On high speed railways, the outermost stopping limit indicator).

Article 118　Train working time

1. When the state of trains in service is examined or operation adjustment is carried out, stations not covered by such work shall be allowed not to fix the schedule of train operation.

2. Whenever operation adjustment is needed, an instruction of a person in charge of operation adjustment shall be asked for instructions.

Article 119　Prevention of accidents at train departure

In consideration of actual conditions of platforms or train operations in a station, railway operators shall establish procedure for on-the-spot action to prevent a train from leaving a platform with a passenger caught in the train doors or an inclined cargo remains inclined.

Article 120　Safety assurance between trains

1. Cases where a train is run by “the block system” provided in Paragraph 1 item 1 of the Article 120 shall be as follows.

(1) The main track shall be divided into block sections;

(2) The main track within a station is allowed not to be a block section;

(3) Except the following cases, more than one train shall not be run simultaneously in one block section.

①When a train is divided and run in a block section;

②When a train is guided into a block section in which another train already exists;

③When a train follows a train that running by a block system, and it runs by the method of using a device to maintain intervals between trains or by the method that an official who drives the motive power unit operates in consideration of visibility ahead and other requirements for safe operation of train (hereinafter “the method of relying on a motive power unit drive’s full attention”)

(4) Types of block systems normally used for running a train are listed below.

①For double-track operation

- Automatic block system

②For single-track operation

(a) Automatic block system

(b) Semiautomatic block system

(d) Tablet block system

(5) Under the automatic block system , the following shall be observed.

①For blocking, a device prescribed under Paragraph 1 and Paragraph 3 of Article 56 shall be used;

②In a single-track section, before starting a train from a station equipped with a starting signal, the direction of running shall be decided on upon consultation with the station ahead which is equipped with a starting signal. However, this does not apply to operation by remote control.

(6) Under the semiautomatic system, the following shall be observed.

①For blocking, a device and an electric bell set forth in Paragraphs 1 and 3 of Article 56 as well as a specified telephone shall be used.

②When a train is driven into a block section, approval of the station ahead shall be received in advance. When the station gives approval, it shall be confirmed that the block section is free of train.

(7) Under the tablet block system, the following shall be observed.

①For blocking, a device set forth in Paragraphs 1 of Article 56 shall be used；

②The tablet of an adjoining block section shall be of a different type；

③A tablet once used for a train operation shall not be used again before it is once put in a tablet blocker. This does not apply, however, when a train crosses another or returns in a short time (within 10 minutes or so) according to a train operating chart.

④A driver who operates a train shall carry on board the tablet of the block section.

⑤A official who adjusts a tablet shall be appointed beforehand.

⑥ (6)②shall applies mutatis mutandis.

(8) Despite (4), for running a train on a line on which more than one train is not operated simultaneously throughout the line, procedure of such operation shall be established.

2. In case a train is operated by the “Use of a device to secure an interval between trains,” as prescribed in the Item 2, Paragraph 1 of Article 120, a device prescribed in Paragraph 2 and 3, of Article 56 shall be used.

3. An operation “relying on a motive power unit driver’s full attention” prescribed in Item 3, Paragraph 1 of Article 120 shall be performed only when the “block system” operation or the operation “by the use of a device to secure an interval between trains” is not possible in cases as follows:

(1) A train stops following the stop signal of a block signal and it starts again despite the indication of the stop signal. (Referred to as “non-blocking operation with full attention” hereafter) As the device to keep the distance between trains fails to work, the train is

operated by some other system. (Referred to as “emergency operation” hereafter)

(2) It is impossible to operate a train neither by “block system” nor “use of a device to secure an interval between trains” due to some device failures in a double track section and a necessity arises to dispatch trains to the same direction in a certain time intervals from a station. (Referred to as “special time interval method” hereafter)

(3) In case of operation “relying on a motive power unit driver’s full attention,” the following shall be observed.

① Other than high-speed railways

(A) Non-block operation with full attention or emergency operation

(a) The motive power unit driver shall drive at the speed that will allow the train to stop within the distance he could see ahead.

(b) When an operation system is changed, the train shall restart in one minute after the train stopped.

(c) When a train gets too closer to the preceding train, it should stop immediately and start again in one minute after the preceding train gets moving.

(B) Operation by special time interval method

(a) The motive power unit driver shall drive at the speed that will allow the train to stop within the distance he could see ahead.

(b) Trains to run in the same direction shall be operated with a certain intervals of distance with each other.

(C) Use of a device that limits the acceleration

When driving by the operation system of (A) or (B), make use of the device like an automatic train stop device that will prevent the train from accelerating beyond a certain speed if available.

②High speed railway

(a) The motive power unit driver shall drive at the speed that will allow the train to stop within the distance he could see ahead.

(b) Trains to run in the same direction shall be operated with a certain intervals of distance with each other.

4. In case a device normally used for blocking or a device to maintain intervals between trains becomes unable to be used for failure or some other reason and at the same time a train is operated under the block system, the following shall be observed.

(1) Any of the block systems cited in 1(4) or of the following systems

① For double track operation:

(a) Communication system

(b) Command-type

(c) Detection system

② For single track operation:

(a) Pilot and telephone system

(b) Pilot and dispatching system

(c) Pilot and detection system

(d) Pilot system

(2) In case, due to a problem on a railway track or the like, more than one adjacent station allowing trains to pass each other are divided into more than one block section and at the same time trains are operated under a block system, the instruction system shall be used for such sections.

(3) In the operation under the communication system, the following shall be observed.

①For blocking, a section between stations shall be taken as one block section and in the stations at both ends of the block section, telephones shall be designated and a communication system register shall be used. In the case of using a device capable of confirming whether there is a train or not in a block section, the use of communication system register may be omitted.

②In the communication system register, approval of blocking, train arrival and departure and release of blocking shall be recorded.

③Before entering a train into a block section, approval shall be obtained from the station at the other end. In giving such approval, it shall be ascertained that the section is free of a trains, etc.

(4) In the operation under the command-type, the following shall be observed.

①For blocking, a section between stations shall be taken as one block section and a person in charge of operation adjustment shall carry out blocking by using a train radio device.

②Before entering a train into a block section, a directive shall be received from the person in charge of operation adjustment. The person in charge of operation adjustment shall give a direction only after confirming that the block section is free of a trains, etc.

(5) In the operation under the detection system, the following shall be observed.

❶For blocking, a section between stations shall be taken as one block section and a device which automatically detects the existence of a train, etc. in the section shall be used.

②Before entering a train into a block section, the stations at both ends of the section shall confirm by the device prescribed in ❶ above that the block section is free of a trains, etc.

(6) In the operation under the instructional pilot and telephone system, the following shall be observed.

①For blocking, a section between stations shall be taken as one block section and the stations at both ends of the section shall designate a pilot for the section and telephones and

make pilot cards ready for use.

②The pilot shall be appointed upon consultation between the stations at both ends of the block section and the name of the pilot shall be put on record.

③The pilot shall wear a red armband.

④In a pilot card, the names of stations on both ends of the block section, the date of issuance, and the number of the train to carry the card shall be entered. A pilot card once used for a train operation shall not be used for another train operation.

⑤A pilot card shall be issued by the pilot when two or more trains are successively driven in the same direction. In this case, the first train shall carry the pilot card and the last train shall carry the pilot

⑥The pilot card shall be handed personally by the pilot of the block section to an official who drives the motive power unit.

⑦ A train in operation shall either have a pilot of the block section on board or carry a pilot card.

⑧When, in a double-track section, train service is stopped on one of the tracks and the pilot and telephone system is carried out, for trains running in the same direction as in the double-track operation, the method of using a device to maintain intervals between trains, the automatic block system or the cab signal block system may be used in combination.

⑨(3)③shall applies.

(7) In the operation under the Pilot and dispatching system, the following shall be observed.

①For blocking, a section between stations shall be taken as one block section, for which one instructor shall be chosen, and a person in charge of operation adjustment shall use a train, radio device. In this case, the stations at both ends of the block section shall have the pilot card.

②A pilot shall be appointed and his or her name shall be put on record.

③(4)②and (6)③ through ⑧ shall apply.

(8) In the operation under the pilot and detection system, the following shall be observed.

①For blocking, a section between stations shall be taken as one block section, for which one pilot shall be chosen, and the stations at both ends of the block section shall use a device which automatically detects that there is not a train, etc. in the block system. In this case, the stations at both ends of the block section shall have the pilot cards.

②(5)2 and 6② through ⑧ shall apply.

(9) In the operation under the pilot system, the following shall be observed.

①For blocking, one pilot shall be chosen for one block section.

② A train in operation shall have the pilot of the block section on board.

③(6)③ shall applies.

(10) In case the Pilot and telephone system, the Pilot and dispatching system, the pilot and detection system and the pilot system is carried out, for a line section including a section for which the use of a pilot is difficult, it is possible to use a pilot card in place of a pilot if such a section is identified beforehand. In this case, one pilot card shall be used for one block section and one meant for an adjacent section shall be of a different type.

5. In case “a method used in the case of running a rescue train or the case of running another work train in a section in which another work train already exists” as set out in Paragraph 2 is established separately, it shall be called “the messenger system” and the following shall be observed.

(1) A train as the object of rescue or a train ahead shall not move from the position on which it stops and indicate to the rescue train or any other work train the limit for it to stop.

(2) In addition to (1), the following shall be observed.

① One messenger shall be chosen for a section in which the system is carried out;

② The messenger shall wear a white armband.

③ When the train is driven, the messenger shall ride together.;

④ Once the train is started, another train shall be allowed to enter the section only after the arrival of the messenger at the station is confirmed.

(3) In carrying out the messenger system, for a line section including a section in which using a messenger is difficult, a message voucher may be used in place of a messenger if the section is specified in advance. In this case, one message voucher shall be used for each of sections in which the messenger system is carried out.

6. The blocking when the block system is carried out or the matters provided in 5(2) for the messenger system shall be taken care of by the operation adjustment officer or the station master concerned (or in case some person other than the station master is appointed, that person).

7. In case the methods are changed from that of using a device to maintain intervals between trains to blocking, or a block system is changed to another block system or returned to a predetermined method, careful consideration shall be given to ensure the safety of the first train after such a change and necessary rules for handling such a case shall be established.

8. The following cases shall be handled each time in accordance with a directive of a person in charge of operation adjustment.

A case where the method of train operation is changed temporarily or a block section is changed temporarily and a case where these are returned to the predetermined ones.

Article 121　Train driving position

1. “Cases where there is no possibility of interfering with safe driving of a train” in the proviso of Article 121 include the following.

(1) When a railway track, electric railway track or a train car has same problems.

(2) When a work train or a rescue train is operated;

(3) When a train is run between a station and a sidetrack branched off in the middle of the main track outside the station;

(4) When a train turns back in a turn-back type station;

(5) When a train is operated for testing a facility or train cars;

(6) When train is operated in a particular section specified beforehand.

2. For applying the provisions of (4) and (6) of Paragraph 1, railway operators shall specify the station name or the section.

Article 122　Train running speeds

For driving a train, the maximum speed shall be fixed in accordance with the conditions of the railway tracks and the electric railway tracks, the performance of the cars, and the system of train protection. Besides, in the following cases, the speed limits provided respectively shall be observed.

(1) Speed limits fixed according to the method of driving:

① Other than high speed railways

(a) 25km/h maximum; when a train is operated in any other position than the front of a train.

(b) 25km/h maximum; when a train is operated backward.

(c) 45km/h maximum; when a locomotive with a tender runs backwards turned (only when coupling to the very front of a train),

(d) 25km/h; at the max when a train started in a certain interval of time following a preceding train, and a train change its operation method to that of relying on a motive power unit driver’s full attention after such cases as a train operated with a block system is stopped by a stop signal, or a train operated by using a device to keep an interval between trains is stopped by controlling device.

(e) The actual implementation of each of the above items from (a) to (d) shall be done under the direction of an operation adjustment officer.

② High speed railways

(a) 45km/h maximum; when a train is operated in any other position than the front of a train. This rule does not apply, however, to driving using a device to maintain intervals between trains.

(b) 45km/h maximum; when a train is operated backward (excluding a case where backward

operation is scheduled and the case of (a).

(c) 45km/h maximum; when a train is operated by method of relying on a motive power unit driver's full attention.

(2) Speed limits fixed according to the conditions of signals:

(a)Alarm signal

25km/h maximum or below a speed suitable for stopping on arrival/departure lines designated in advance.

(b) Caution signal

A speed suitable for stopping at the indication point of the next stop signal (if there is no indication of stop signal, a stop position) or below a speed suitable for passing an indication point of the next alarm signal at a pre- determined speed;

(c) Reduced speed signal

A speed suitable for passing the indication point of the next caution signal or alarm signal at a prescribed speed or below a speed suitable for stopping at the indication point of the next stop signal (if there is no indication of stop signal, a stop position);

(d) Call-on signal

15km/h maximum

(e) Slow-speed signal

A specified speed or less

(f) The case of using a cab signal system

Below a speed indicated by figures (excluding 0). (If indicated by other means than figures, below a speed fixed separately)

(3) The case of using a wayside signal

45km/h maximum

Article 123 Train backward operation

Trains must not be operated backward except when some trouble arises with a railway tracks or rolling stock, when it an operation of trains or relief trains or when it is a test run for facilities or rolling stock and at the same time, any of the following applies.

(1) When a backward operation is scheduled;

(2) When instructed by a person in charge of operation adjustment or by a person responsible for blocking in a station behind;

(3) When the reversing is very slight and it is so arranged that the succeeding train is stopped at a point at an appropriate distance outwardly from the range of the reversing.

Article 124 Simultaneous entry or departure of trains

In case a system capable of automatically stopping a train such as ATC (automatic train control) or ATS (automatic train stop) (limited to those which have a speed verification function) is installed and when a safety siding is provided, it shall be considered that there is no risk of trains interfering with each other's courses due to overrun.

Article 125 Train protection

1. Train protection shall be done in the following cases.

(1) When a derailment of a train, etc. interferes with the course of a train running on an adjacent track.

(2) When a problem which causes the need of stopping trains arises on a railway track, an electric railway track or some other places.

2. Train protection shall be done at an appropriate distance outwardly from the place where a problem arises, by indicating stop signal on a main signal, a cab signal, a temporary hand signal or an accident warning signal or by using an emergency ground switch.

3. In case the train protection is supposed to be done by an official on board, the train shall have an official to do the job on board during operation.

4. In case a train protection measure using a portable signal apparatus is taken, the officials concerned, the type of the signal apparatus which they will carry with them or is always provided, and others shall be specified beforehand.

5. In the event a portable fusee and a protection radio are usable, a stop signal shall be indicated to the train.

6. Stop signal indication by a portable fusee and a portable obstruction warning signal shall be on a spot more than 800m apart outwardly from the place where a problem arises.

Article 126 Track possession

1. The closure of a railway track shall be carried out as instructed by a person in charge of operation adjustment or a person in charge of blocking of a station.

2. When maintenance of a railway track, etc. is carried out without closing the railway track, or a trolley is used, care must be taken so as not to interfere with the operation of train, etc.

Article 127 Prevention of train disaster

1. Preventive measures against disaster caused by weather conditions

When there is a risk of disaster caused to a train due to meteorological conditions or a terrestrial phenomenon, temporary suspension of train operation, restrictions on a train speed and other measures should be taken, and procedure of carrying out such measures, sections to be

covered and other details have to be decided on beforehand.

2. Disaster preventive measures when a fire outbreaks on a train in railway of subway type construction

For the prevention of disaster, safety of passengers and prompt evacuation when a fire breaks in a train which is running underground, the following rules shall be stipulated beforehand. In this case, if individual handling is required because of the conditions of facilities, etc., such handling shall be specified.

(1) In the event a fire outbreaks on a running train, the train shall be driven to the next station or out of the tunnel in principle;

(2) The relevant trains shall be stopped at their nearest stations and shall be kept there.

(3) In the event a train on fire stops at a station or a station is on fire, trains approaching the station shall not be stopped at the station in principle.

Section 3 Vehicle operation

Article 128 Shunting

1. Shunting of train cars shall be carried out as follows.

(1) "The method of shunting by cues or other safe methods" shall employ any of the following. Nevertheless, shunting free of a risk of interfering with other railway tracks and simple shunting as a routine can be carried out by the method that a motive power unit driver considering the visibility ahead and other conditions necessary for safe operation of cars.

①Method using a device for automatic operation of train cars

②Method using signals

③Method using cues

④Method using signs

⑤Method using a radio device

(2) Shunting by the method using cues or signs shall be carried out after confirming that there is no obstacle ahead before starting operation of train cars.

(3) Kick off shunting shall not be made unless the cars are capable of braking to a certain degree. Those cars with passengers, explosives or cargo with a potential risk of hazard when affected by kick off shunting shall not be exposed to any form of kick off shunting.

(4) In case a train car is shunted on the main line by manual operation, it shall be kept under observation.

(5) Except the following cases, shunting which interferes with the main line outside a station in the direction from which a train approaches shall not be carried out.

① In a section in which a block system is carried out as discussed between stations at both ends of the block section, when approval of blocking is not given;

② In a section in which a block system using one evidence or one designated official is carried out, when the evidence or the designated person exists in the station;

③ In a case where an action to suspend train operation is taken or there is some inevitable reason, and at the same time sufficient protective measures are taken for the direction from which a train approaches.

(6) The speed of shunting shall be as follows. Nevertheless, this rule does not apply to the shunting using an automatic train control device.

① Other than high speed railways

(a) 45km/h maximum for shunting by a shunting signal (excluding the shunting using a call-on signal or a case where a train passes facing a point that is not chain-locked.

(b) 25km/h maximum for other shunting than (a),

② High speed railways

45km/h maximum

2. The shunting of a train shall be performed in the same way as that of a train car.

Article 129 Parking of vehicles

"Necessary steps" in parking train cars means establishing a system to prevent the train from its self-movement by its own motive power and also its non-self-movement due to a slope or natural force such as strong wind. They include stationing a watcher to pull the key out of the brake controller, clamping a hand brake and side brake, placing a hand-scotch, etc., to prevent self-movement of the train.

Section 4 Railway Signals

Article 130 Relationship between railway signals and operation

The types of railway signals are listed below.

(1) Signals refer to the means which indicate conditions/instructions for driver of a train or rolling stock in a certain in section, by means of shapes, colors, sounds, etc.

(2) Signs refer to the means which are used by driving-related officials to communicate each other by means of shapes, colors, sounds, etc.

(3) Indicators refer to the means which provide necessary information indicating positions of objects, directions, conditions, etc., by means of shapes, colors, etc.

Article 131 Indication of stop signal

1. A train, etc. must stop before the end of the stopping position whenever a signal indicates a stop. This "before the end of the stopping position" means "not exceeding the stop signal (in case of a cab signal , it shall be before an indicator that shows the limit for a train to stop, etc.)

or before the protected area of the indicating signal.

2. When a train, etc. stops at a stop signal, it shall not restart before;

(1) a proceed signal turns on; or

(2) being instructed to proceed; or

(3) being guided a shunting cue; or

(4) being instructed to do a non-blocking operation: or

(5) being emergency instructed to do an operation.

Article 132 Inaccurate signal indication

"A signal of the maximum restriction on the operation of train, etc." means a stop signal as a main signal and a cab signal and as a subsidiary signal, it means a signal that warns a train of a stop signal of the main signal or a repeating signal of a stop signal ahead.

Article 133 Prohibition of dual-purpose use of signals

1. "Cases where it causes no hindrance to the safe operation of a train, etc." in the prohibition of dual-purpose distance use of signals are as listed below.

(1) When a distant signal, a repeating signal or a signal with a route indicator and a cab signal are used for two or more railway tracks concurrently;

(2) A signal provided on a junction point of adjacent railway tracks which are identical in the conditions concerning driving safety is used for two or more railway tracks concurrently;

(3) When a cab signal is used also as a signal for a train or shunting rolling stock;

(4) When a wayside signal is used also as a signal for a train or shunting rolling stock;

(5) When a shunting signal (including a wayside signal) is used also as a route clear indicator.

2. When a signal is used concurrently for two or more purposes, it should be so indicated that its purposes are easily understood as required.

Article 134 Conditions for clear aspect signals

Only when there is no problem with the route of a train, etc., a clear signal can be indicated at the protected section concerned or a clear signal by a hand signal ca be indicated.

Article 135 Other matters concerning signal aspect

1. Regarding the signal-related matters, some new provisions have been added to what are presently in effect in Vietnam railway.

2. "Types of signals and their indication systems and conditions" shall be as shown below.

(1) For a signal to which different indication systems are applied between day and night, the day system shall be used from sunrise to sunset and the night system from sunset to sunrise.

Nevertheless, in the case of a line in which two or more trains might be operated simultaneously between stations, the night system shall be used even between sunrise and sunset if it is difficult to recognize the indication by the day system on account of a weather condition, a tunnel or the like.

(2) Fixed signals (those which are installed in fixed places on the ground and indicate signals) shall be classified as follows.

① Main signals

② Subsidiary signals

③ Signal appendix

(3)The main signals shall be classified as follows.

①Home signal: Indicates a signal to a train entering a station;

②Starting signal: Indicates a signal to a train leaving a station;

③Block signal: Indicates a signal to a train entering a block section;

④Call-on signal: Indicates a signal to a train, etc. which is guided and goes beyond the signal;

⑤Shunting signal: Indicates a signal to a train, etc. to be shunted.

⑥Wayside signal: Indicates a signal to a train entering or leaving a station as a substitute for a cab signal in case it failed, and to a train being shunted as a shunting signal where a shunting signal is not installed.

(4) Subsidiary signals shall be classified as follows.

① Distant signal: Subordinates to a home signal and indicates to a train what will be indicated on a following principal signal;

②Passing signal: Subordinates to a starting signal and indicates to a train entering a station what will be indicated on a following principal signal, telling whether it can pass the station.

③Repeating signal: Subordinates to a home signal, a starting signal or a block signal and relays a signal to be indicated on a following principal signal.

(5) Signal appendix is of the following type and it shall be used after specifying an indication system.

① Route indicator: In case a signal of a home signal, a starting signal or a call-on signal is used in common for tracks branching to two or more lines in its protection area, this indicates the route for a train, etc., to take as a subsidiary to that signal.

(6) Types of signals and indication systems of signals of a cab signal (which gives signal indication from the driver’s cabin of a train, etc.) shall be as shown in the following table.

Type of signal	Indication system
Stop signal	A code representing a stop or a light with letter(s) or a red light
proceed signal	A code representing a speed or figures (except 0) or a color light except a red one.

(7) Types and indication systems of main signals shall be as shown in the following table.

①Home signal, starting signal and block signal

Type of signal	Indication System			
	3 position system	2 position system		
	Color light system	Color light system	Mechanical semaphore system	
			Daytime	night
Stop signal	Red light	Red light	Arm horizontal	Red light
Alarm signal	Top, orange light; Bottom, orange light	Top, orange light; Bottom, orange light		
Caution signal	Orange light	Orange light		
Reduced speed signal	Orange light or Orange light and green light	Orange light or Orange light and green light		
Proceed signal	Green light	Green light	Arm to lower left at 45°	green light
Proceed signal (for starting on branch line	Top, green light; bottom, green light	Top, green light; bottom, green light		

②Call-on signal

Type of signal	Indication system	
	Color light system	Position light system
Call-on signal	Orange light or white light	Position of light to lower left at 45°

Remarks: Call-on signal shall indicate the above aspect on the conditions that the principal signal indicates a stop signal for main signal.

③Shunting signal and wayside signal

Type of signal	Indication system			
	3-position system		2-position system	
	Color light system	Position light system	Color light system	Position light system
Stop signal	Red light	Horizontal position of lights	Red light or purple light	Horizontal position of light
Caution signal	Orange light	Position of light to lower left at 45°		
Proceed signal	Green light	Vertical position of light	Green light, orange light or white light	Position of light to 45°lower left at 45°

(8) Types of signals and indication systems of a subsidiary signal shall be as shown in the following table.

① Distant signal

Type of signal		Indication system			
		When signal of principal signal is of 3- position system	When signal of principal signal is of 2-position system		
		Color light system	Color light system	Semaphore system	
				Daytime	Night
When principal signal indicates stop signal	Caution signal	Orange light	Orange light	Arm horizontal	Orange light
When principal signal indicates alarm signal or caution signal	Reduced speed signal or proceed signal	Top, orange light; bottom, green light, or green light	Top, orange light; bottom, green light		
When principal signal indicates proceed signal	Proceed signal	Green light	Green light	Arm to lower left at 45°	Green light

②Passing signal

Type of signal		Indication system		
		When principal signal is of 2-position system		
		Color light system	Semaphore system	
			Daytime	Night time
When a principal signal indicates stop signal	Alert signal	Orange light	Arm horizontal	Orange light
When principal signal indicates proceed signal	Proceed signal	Green light	Arm to lower left at 45°	Green light

③Repeating signal

Type of signal		Indication system	
		Color light system	Position light system
When principal signal indicates stop signal	Stop repeating signal	Red light	Horizontal 2 position of white light
When principal signal indicates alarm signal	Restriction repeating signal	Top, orange light; bottom, orange light	Position light to lower left at 45°
When principal signal indicates caution signal		Orange light	
When principal signal indicates reduced speed signal		Top, orange light; bottom, green light	
When principal signal indicates proceed signal	Proceed repeating signal	Green light	Vertical position of light

Remarks: Lights in the position light system shall be made free of the risk of being mistaken for a white light or a signal of any other color light systems.

(9) A temporary signal shall be provided temporarily to indicate signals in case a train, etc. is unable to run at a prescribed speed due to a track obstruction or some other reason. Types of temporary signals and their indication systems shall be as shown in the following.

①Types of temporary signals

(a) Slow-speed signal: Indicates a slow-speed signal to a train, etc. entering a section that requires driving at a reduced speed;

(b) Slow-speed warning signal: Subordinates to a slow-speed signal and indicates a warning of slow-speed signal to a train, etc.;

(c) Slow-speed release signal: Indicates a slow-speed release signal to a train, etc. which leaves a section requiring driving at a reduced speed.

② In case a slow-speed signal requires trains to slow down, the speed shall be indicated.

③ Temporary signal shall be used only after fixing their indication systems.

(10) Hand signals shall indicate a signal when a signal is unable to be used or not installed. Their types and indication systems shall be as shown in the following.

①Types of hand signals

(a) Substitute hand signal: For use as a substitute when a home signal, a starting signal, a cab signal or a device for maintaining intervals between trains (limited to those which are used for trains entering or leaving a station) is unable to be used;

(b) Passing hand signal: To be used for a train passing a station when a passing signal is unable to be used;

(c) Temporary hand signal: To be used as occasion demands besides (a) and (b).

② Types and indication systems of hand signals shall be as shown in the following table.

(a) Substitute hand signal

Type of signal	Indication system	
	Daytime	Night
Stop signal	Red flag	Red light
Proceed signal	Green flag or orange flag	Green light

(b) Passing hand signal

Type of signal	Indication system	
	Daytime	Night
Proceed signal	Green flag or orange flag	Green light

(c) Temporary hand signal

Type of signal	Indication system	
	Daytime	Night time
Stop signal	A red flag or a red light. If neither a red flag nor a red light is available, however, an object other than a green flag shall be waved around in a circle by an arm raised high.	Red light. If red light is not available, however, any other light than green light shall be waved around in a circle..
Slow-speed signal	An opened orange flag shall be hoisted high above the head, or folded green flags shall be crossed high above the head. If orange flags are not available, extend both arms to right and left and move up and down slowly.	Flashing green light
Proceed signal	A green flag or a green light. If neither a green flag nor green light is available, raise an arm high.	Green light

Remarks: The green flag is not used in the Vietnam railways at present.

③A flag or a light used for hand signals shall be identifiable at a distance of 400m minimum.

④When a train is to pass a station while a passing signal is unable to be used, a passing hand signal shall indicate a proceed signal in the protection area of a home signal.

⑤The substitute apparatus for hand signal listed below can be used in place of hand signals.

Type of signal	Indication system
Stop signal	Red light
Slow-speed signal	Flashing green light
Proceed signal	Green light

(11) A special signal shall be indicated when the need of stopping a train arises in an unexpected place. Special signals have the following types and indication systems.

①Types of special signals

(a) Fusee signal: Stops a train by a flame.

(b) Accident warning flashing signal: Stops a train by a light

(c) Accident warning signal: Stops a train by a warning sound

(d) Detonating signal: Stops a train by an explosive sound

(e) Obstruction warning signal: Stops a train by a light

②Special signals shall give only a stop signal by the following indication systems.

(a) Fusee signal: Red flame from a fusee.

(b) Accident warning flashing signal: Flashing red light

(c) Accident warning signal: Warning sound via radio communication

(d) Detonating signal: Explosive sound from detonator

(e) Obstruction warning signal: Lighting of red light (In case a cutoff signal is indicated, however, a red light is lighted on a obstruction notice signal.)

③The indication of special signal shall be identifiable at a distance which allows a train to stop before reaching the point of obstruction.

(12) Requirements for signal indication shall be as follows.

① A alarm signal shall be indicated on the following signals.

(a) A home signal, a starting signal or a block signal, in case there is a risk of trains causing some trouble each other due to overrunning when they enter or leave station. (excluding a case where a safety siding is provided)

(b) A signal before a home signal, when the home signal indicates a stop signal, and either the distance between the signal and point that lies the closest to the signal in the protection area or the stopping distance is short.

② A alarm signal may be indicated on the following signals in addition to the ones cited in ①.

(a) The signal closest to the protection area of a terminating track in a station when prevention of overrunning of a train entering the station is required.

(b) A three-position system signaler in approach of a signal which indicates a stop signal.

③ A caution signal shall be indicated on the following signals.

(a) The three-position system signal closest to the stopping position (except those which indicate an alarm signal) of a terminating track in a station;

(b) A distance signal and a passing signal which subordinate to a signal indicating a stop signal.

④ Besides the ones shown in ③, a caution signal may be indicated on a three-position system signal in approach of a signal which indicates a stop signal or a alarm signal.

⑤A reduced speed signal shall be indicated on a distance signal which subordinates to a home signal indicating an alarm signal or a caution signal.

⑥Besides the one cited in ⑤, a reduced speed signal may be indicated on a three-position system signal in approach of signal which indicates an alarm signal or a caution signal.

⑦A proceed signal may be indicated on a three-position system signal in approach of signal which indicates a caution signal and a reduced speed signal.

⑧A home signal, a starting signal and a block signal in a section in which the automatic block system is carried out by a three-position system signal may be exempted from the provisions of ① through ⑦.

⑨If a certain speed is fixed for the indication of a caution signal, a shunting signal installed in a section in which shunting is carried out by a three-position system may be exempted from the provisions of ③ and ④.

(13) A signal indicated by a main signal (excluding the type which indicates to a train or the like at a stop) shall allow a train approaching the signal to confirm it at a distance at which the train can decelerate or stop according to a signal indicated by the signal. This rule does not

apply, however, to a case where the distance at which the train can confirm such a signal is not long enough but has a subordinate signal indicating a signal and when added with the confirmation distance of the principal signal, the subordinate signal's confirmation distance exceeds a distance enabling a train approaching the principal signal to decelerate or stop according to a signal indicated by the subordinate signal.

3. Signals shall be dealt with as follows.

(1) When a signal denoting proceeding is indicated, the following shall be observed.

① On sight of the indication of a stop repeating signal, a driver shall move the train forward in anticipation of the indication of a stop signal on the principal signal of which the confirmation distance is short;

② On sight of the indication of an alarm signal, a driver shall move the train forward in anticipation of the indication of a stop signal or a stop position and shortness of an allowable distance for overrunning;

③On sight of the indication of a caution signal, a driver shall move the train forward in anticipation of the indication of a stop signal or an alarm signal on the next signal or a stop position;.

④On sight of the indication of a reduced speed signal, a driver shall move the train forward in anticipation of the indication of an alarm signal or a caution signal on the next signaler;

⑤On sight of the indication of a restriction repeating signal, a driver shall move the train in anticipation of an alarm signal, a caution signal or a reduced speed signal on a principal signal of which the confirmation distance is short;

⑥On sight of the indication of a proceed signal, a driver shall move the train forward at a lower speed than a fixed speed (lower than a displayed speed in the case of a proceed signal on a cab signal);

⑦On sight of the indication of a proceed repeating signal, a driver shall move the train forward in anticipation of the indication of a proceed signal on a principal signal of which the confirmation distance is short;

⑧On sight of the indication of a call-on signal, a driver shall move the train forward in anticipation of a train or the like on the course;

⑨A home signal, a starting signal and a block signal in a section in which the automatic block system is carried out by a three-position system signal may be exempted from the provisions of ②through ④；

⑩A shunting signal in a section in which shunting is carried out by a three-position system shunting signal may be exempted from ③ if a certain speed is fixed for the indication of a caution signal.

(2) When a signal is indicated by a temporary signal, the following shall be observed.

①On sight of the indication of a slow speed signal, a driver shall move the train forward at a lower speed than the prescribed one;

②On sight of the indication of a slow speed warning signal, a driver shall move the train forward in anticipation of subsequent indication of a slow-speed signal;

③On sight of the indication of a slow speed release signal, a driver may cease to proceed at a reduced speed once the train gets over the point of the indication

(3) Signals shall be handled as set forth in the following

①When a signal is indicated on a three-position signal, the following shall be observed.

(a) A proceed signal shall not be indicated before a caution signal or a reduced speed signal is indicated on a signal in protection area thereof;

(b) A reduced speed signal shall not be indicated before an alarm signal or a caution signal is indicated on a signal in protection area thereof.

②A starting signal (excluding one installed in a section to which the automatic block system is applied) shall indicate a proceed signal only after blocking of the section;

③A call-on signal shall not be indicated before a train, etc. to be guided stops in protection of a home signal or a shunting signal. This rule does not apply, however, when the equivalent level of safety is assured in indicating a call-on signal as the case of indicating a call-on signal after a train, etc. stops;

④A distant signal shall not indicate a proceed signal before the indication of a proceed signal on a principal signal, and a reduced speed signal before the indication of an alarm signal or a caution signal on the principal signal;

⑤A passing signal shall not indicate a proceed signal before a proceed signal is indicated on the principal signal and on a home signaler installed on the same point;

⑥A repeating signal shall not indicate a proceed repeating signal before a proceed signal is indicated on the principal signal, and a restriction repeating signal before an alarm signal, a caution signal or a reduced speed signal is indicated;

⑦A route indicator shall not indicate a route before a signal to denote proceeding is indicated on a signal to which the indicator subordinates;

⑧A preliminary route indicator shall not indicate a notice of route before its attached signal and the next signal indicate a proceeding signal.

⑨A person who handles a fixed signal shall be an official in charge of operation adjustment or a station master (if any person other than the station master is appointed, the appointed person).

(4) A temporary signal and hand signals of a slow-speed signal and a proceed signal shall be indicated only after the persons concerned are informed of such indication.

(5) When a train enters or leaves a station in a case where the use of a device for maintaining

intervals between trains, a home signal, a starting signal or a cab signal is not possible on account of mechanical trouble or the like, a substitute hand signal shall be indicated. A substitute hand signal may not be used, however, when a person in charge of operation adjustment or a station master (if any person other than the station master is appointed, the appointed person) gives instructions necessary for proceeding upon confirmation of the condition of the route in question, or when a starting signal does not work in case of carrying out any block system other than the automatic block system or the semiautomatic block system and a point in a protected area is a trailing point with a point sign or is a spring point.

4. Train signal (Train indicator in Japan)

(1) Each train shall display a train signal. The systems of showing signal shall be as follows.

(a) Other than high speed railways

Type of signal	Method of display	
	Daytime	Night time
Head signal	One or more white light on the front of the foremost car of a train (It is allowable to show no signal during daytime).	
Tail signal	One or more red light or red disc on the back of the rearmost car of a train	Two or more red lights or red discs on the back of the rearmost car of a train。

Train signal in case of backward operation shall remain the same as they had been before the backward operation started. A head signal shall be displayed in addition to a tail signal on the front side of a train in backward operation at night if possible.

(b) High speed railways

Type of signal	Method of display
Head signal	White light on the front of the foremost car of a train
Tail signal	Red light on the back of the rearmost car of a train (white light in the case of train to be driven backward)

(2) On a motive power unit for use in shunting, a shunting motive power unit signal shall be shown. This does not apply to the case when a train signal is indicated.

Article 137　Sign and indicators

1. Signs and indicators shall be used after classifying their types and indication systems. The signs and indicators in the following cases shall be handled according to the rules specified respectively.

(1) Signs

① A starting sign shall be given when necessary at the start of train;

② A whistle sign shall be given for the following purposes

(a) To warn against danger;

(b) To attract attention;

(c) To inform an approach of train;

(d) To inform emergency accident

③ A shunting sign shall be given in case a sign is used for shunting of rolling stock.

(2) Indicators

① The following indicators shall be shown, on railway tracks in a section in which trains are operated by the method of using a device to maintain intervals between train, except when wayside signals are provided.

(a) A home indicator on a track for trains entering a station

(b) A starting indicator on a track for trains leaving a station

② A shunting indicator shall be shown, on a track on which indicator is used for shunting.

③ A point indicator shall be shown, on a point that requires the indication of opening route.

④ A train stop indicator shall be installed, if it is necessary to indicate a stopping limit for train on a track without a starting signal or a track for which a starting signal cannot be installed on a prescribed point.

⑤ A car stop indicator shall be installed, on a place that requires an indication of a stopping limit for rolling stock.

⑥ A car stop marker shall be installed, on a track that requires an indication of a track termination.

⑦ A contact wire terminal indicator shall be installed on a track that requires an indication of a contact line termination.

⑧A whistle board shall be posted in an appropriate spot, at a railroad crossing without a barrier or a level crossing signal, which is considered to be difficult for passers-by to know the approach of a train, etc.

2. As for signs and indicators which have different display systems in daytime and night time, it shall apply item 1 paragraph 2 of the detailed explanation of Article 135. Here, “signals” shall be read as “signs and indicator.

Reference Material 1

Substitute block systems

1. General description of substitute block systems

In the event it becomes impossible to carry out the regular block system on account of failure of a blocking device, a signaler or the like, some other system is carried out in place of the regular block system; it is called “a substitute block system.”

Any substitute system is the same as the regular one with respect to the basic block mechanism of preventing trains from colliding with each other by having one block section occupied by one train.

2. Substitute block systems

The types of following substitute block systems are as listed below.

(1) For double track operation

Communication system

Command-type

Detection system

(2) For single-track operation

Pilot and telephone system

Pilot and dispatching system

Pilot and detection system

Pilot system

3. Examples of substitute block systems carried out

3.1 For double- track operation

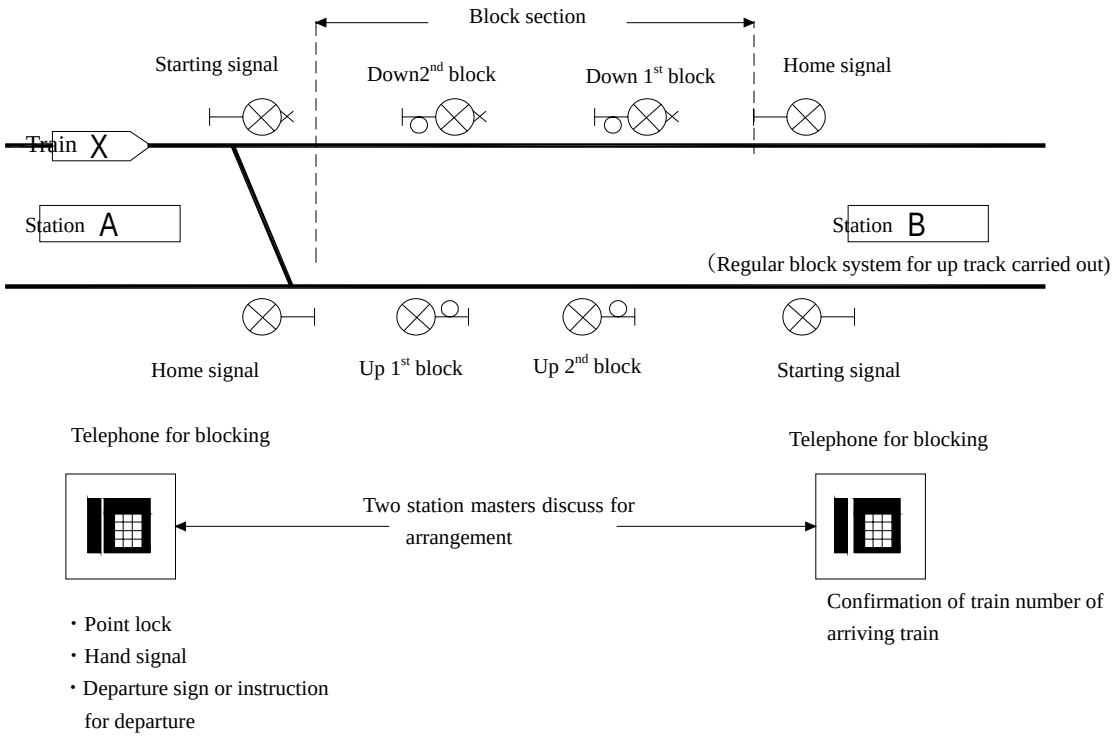
3.1.1 Communication system

(1) This is carried out when double- track operation is possible but the regular block system is unable to be carried out on either one of the up or down tracks in a double-track section.

(2) In this system, by the station masters of stations on both ends make sure of no trains between the stations and start trains one by one using the telephones and communication record books designated for blocking by the station masters.

【Example of communication system】

The train X leaves the station A when the starting signal for down track does not work as well as most of the block signals for down tracks between stations A and B.



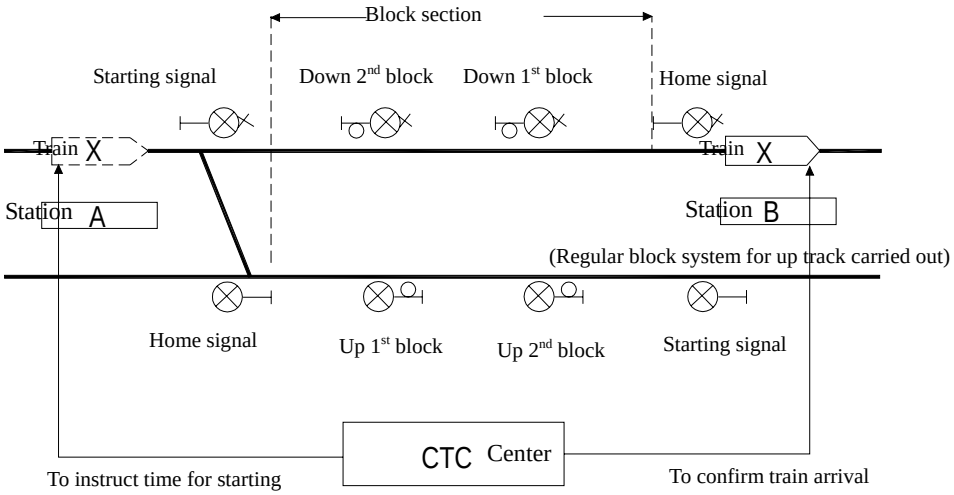
3.1.2 Command-type

(1) This is carried out when double-track operation is possible but the regular block system is unable to be carried out on either one of the up or down tracks in a two-track section and basically the same as 3.1.1 but is used for a CTC controlled section or the like.

(2) In this system, a CTC dispatcher makes sure of no train in the block section and between the stations and start trains one by one using a device displaying the condition of train operation, a radio, etc.

【Example of directive system 】

The train X leaves the station A when the starting signal for down track does not work as well as most of the block signals for down tracks between stations A and B.



・Point lock
・Hand signal

3.1.3 Detection system

(1) Basically, like 3.1.1and 3.1.2 above, this system is carried out when double -track operation is possible but the regular block system is unable to be carried out on either one of the up or down track in a two-track section. However, this is carried out in case such devices as the one that displays the conditions of train operation or communication equipment to talk any time with a dispatcher are unable to be used in an ATC section.

(2) Detectors installed in the stations on both ends of the block section automatically detect that there is no train, etc. in the block section.

3.2 Single-track operation

3.2.1. Pilot and telephone system

(1) The pilot and telephone system is carried out when operation on one track in a double -track section suspended or when the regular block system is unable to be used in a single-track section.

(2) Practically, it is carried out in the same way as the communication system for a double-track operation, that is, the station masters of stations on both ends make sure of no trains between the stations and start train one by one using telephones and communication

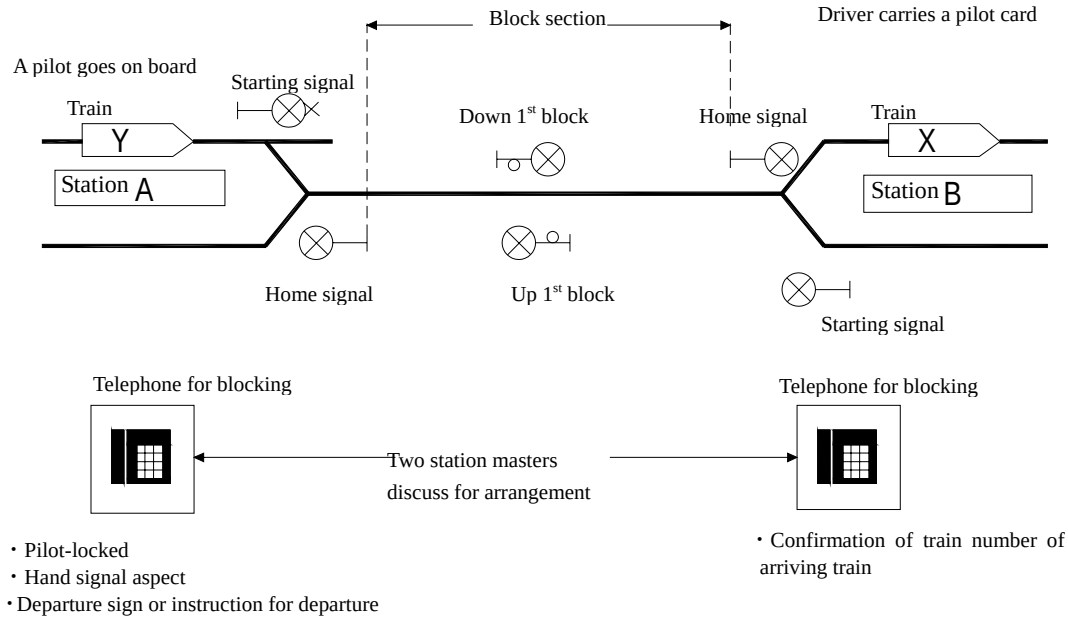
record books designated for blocking by the station masters.

(3) In this system, it is so arranged that a train is safe from colliding against a train from an opposite direction by having a pilot appointed to be on board a train as a proof of safety of the block section. This is the conspicuous difference from the communication system.

(4) When some trains start successively from the station with a pilot in the same direction, every driver of the preceding trains shall have a “pilot card” and the last train shall have the pilot aboard .The drivers shall be handed the “pilot card” directly from the pilot as the fact that having a pilot serves to insure the safety of the trains against the trains from the opposite direction.

【Example of instructional communication system carried out】

After the train X leaves the station A , the train Y is started consecutively.



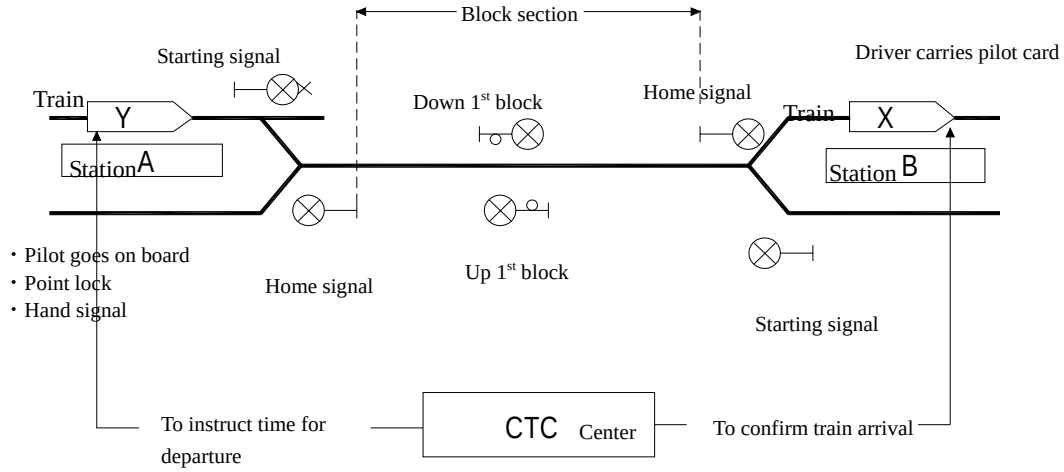
3.2.2 Pilot and dispatching system

The pilot and dispatching system is the single-track version of the command-type. In this system is a CTC dispatcher makes sure of no trains in block section by using a device which

displays the conditions of train operation and the radio. Practice of the “pilot” is the same as pilot and telephone system.

【Example of instructional directive system carried out】

The train X leaves the station A followed by the train Y successively.



3.2.3 Pilot and detection system

(1) The pilot and detection system is the single-track version of the detection system. Like the detection system of double track an automatic detector observes the train’s existence in a block section.

(2) Practice of the ”pilot card” and the “pilot” is exactly the same as that of 3.2.1 and 3.2.2 above.

3.2.4 Pilot system

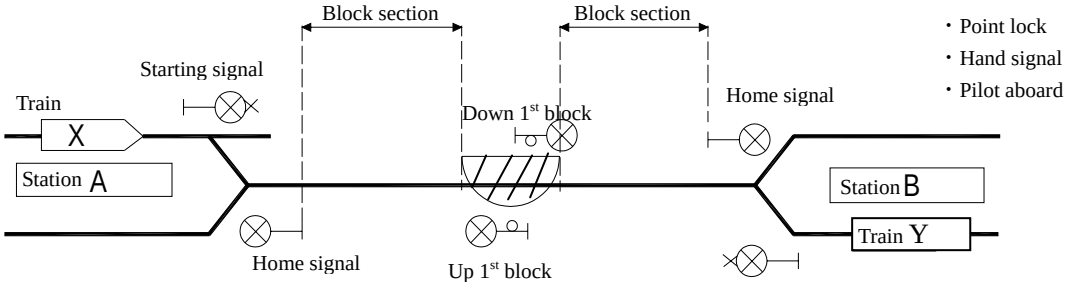
(1) The pilot system is a substitute block system carried out when a section between two stations is divided into two or more on account of a disaster or for some other reasons.

(2) It is similar to the pilot and telephone system and the pilot and dispatching in that one pilot system is appointed for a block section and gets him aboard a train. As shown in the following example, however, “a pilot card” is unusable as two or more trains are never operated at the

same time in this system.

【Example of pilot system carried on】

Trains shuttle back and forth between a section and the site of landslide which happened some where between A and B.

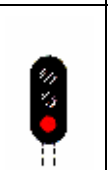
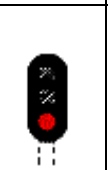
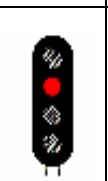
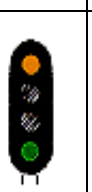
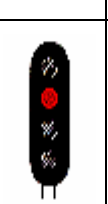
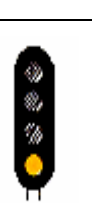
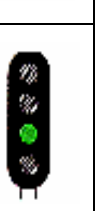
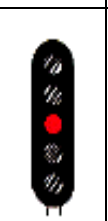
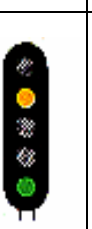
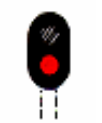


・Point lock
・Hand signal
・Pilot aboard

Reference Material 2　　Indication systems of signals, indicators, etc.

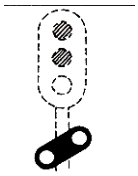
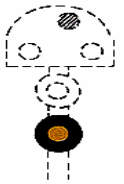
(Example of Japanese System)

Material-1　Indication system of home signal, starting signal and block signal

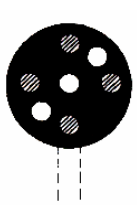
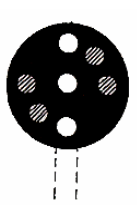
Type of Signal			Stop signal	Alarm signal	Caution signal	Reduced speed signal	Proceed signal	Remarks
Indication system	Three-position system	Color light system						Two aspect signal(limited to home signal)
								Two-aspect signal (limited to starting signal and home signal having a function of starting signal)
								Three-aspect
								Four-aspect
								
								Five-aspect
	Two-position system							Limited to the home and starting signal
		Semaphore system						

Material-2 Indication system of call-on signal, repeating signal and distant signal

2-1 Call-on Signal

Type of signal		Calling-on signal
Indication system	Position light system	
	Color light system	

2-2 Repeating signal

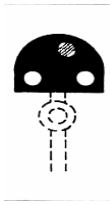
Type of signal		Stop repeating signal	Restriction repeating signal	Proceed repeating signal
Aspect of the master signal		▪ Stop signal	▪ Alarm signal ▪ Caution signal ▪ Reduced speed signal	▪ Proceed signal
Indication system	Position light system			

2-3 Distant signal

Type of signal			Caution signal	Reduced speed signal	Proceed signal
Aspect of the principal signal			▪ Stop signal	▪ Alarm signal ▪ Caution signal	▪ Proceed signal
Indication system	Principal signal of three-position	Color light signal			
	Principal signal of two-position				

Material-3 Shunting Signal

3-1 Indicate system of the shunting signal

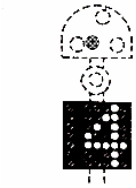
Type of signal			Stop signal	Proceed signal
Indication system	Two-position system	Position light system		

3-2 Indication system of shunting signal appendix (route indicator)

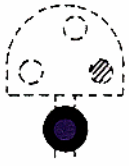
(1) Three-route indicator

Direction of open route		Route is open to the left from the center	Route is open to the center	Route is open to the right from the center
Indication system	Position light system			

(2) For multiple route

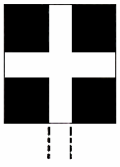
Direction of open route		Route is open to the direction shown by a number or an English character
Indication system	Position light system	

3-3 Indication of shunting signal indicator



Note: This is attached to a shunting signal to show that it is a shunting signal when the light is on.

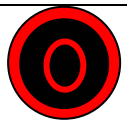
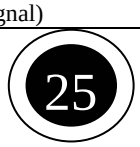
3-4 Car stop indicator



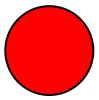
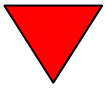
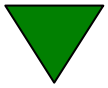
Note: Light or a reflective material is used.

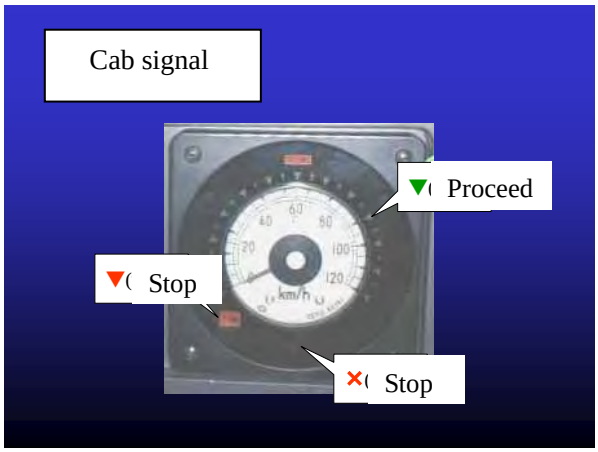
Material-4 Indication systems of cab signal

4-1 Speed signal system (The system of indicating a proceed signal as a speed signal showing a speed at which a train can proceed)

Type of signal	Stop signal		Speed signal (proceed signal)
Indication system			 （Example）
Remarks	・Indicated to prohibit a train from entering the route ・Indicated when a train needs to stop immediately.	Indicated when a train needs to be stopped before the end of the route.	The above exemplifies the speed signal allowing a train to move forward at a speed of 25km/h or low. (It is called the 25 signal.)

4-2 Speed information system (The system of indicating a speed allowable for moving forward as control information, in addition to a proceed signal)

Type of signal	Stop signal		Proceed signal	Control information
Indication system				A speed allowable for proceeing is indicated by orange light on a speed meter.
				A speed allowable for proceed is indicated by the position of proceed signal on a speed meter.
Remarks	・Indicated to prohibit a train from entering the route. ・Indicated when a train needs to stop immediately.	Indicated when a train needs to stop before the end of the route.		

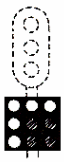


Material-5 Indication systems of signal appendix (route indicator)

① For 2 route

Direction of open route		When route is open to the left	When route is open to the right
Indication system	Position light system		

② For 3 route

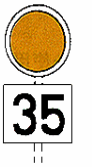
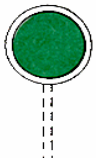
Direction of open route		Route is open to the left from the center	Route is open to the center	Route is open to the right from the center
Indication system	Position light system			

③ For multiple route

Direction of open route		Route is open in the direction shown by a figure or an English character
Indication system	Position light system	

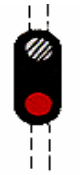
Note: The above example shows that the route is open to the track No.4.

Material-6 Indication systems of temporary signal

Name of signal	Slow-speed warning signal	Slow-speed signal	Slow-speed release signal
Type of signal	Warning of a slow speed signal	Slow-speed signal	Slow-speed release signal
Indication system			

Note 1: The figures on the bottom of the slow-speed warning signal and the slow-speed signal show, as an example, that the speed is to be as show as 35km/h or low..
2: High visibility even at night must be ensured.
3: The white portions of the slow-speed warning signal may be orange in color.

Material-7 Substitute apparatus for hand signal

Type of signal	Stop signal	Proceed signal
Indication system		

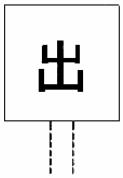
Material-8 Indicators

8-1 ATC system home indicator and starting indicator

(1) Home indicator

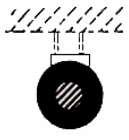
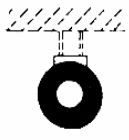
Note 1: In case there are multiple home rote, the respective route are shown by figures on the top.
Note 2: A reflective material is used.

(2) Starting indicator

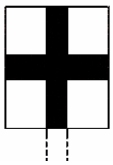


Note 1: In case there are multiple starting route, the respective route are shown by figures on the top.
Note 2: A reflective material is used.

8-2 Repeater of starting signal

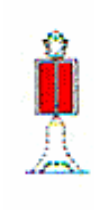
Indication system	When stop signal is indicated on starting signal	When proceed signal is indicated on starting signal
		

8-3 Train stop indicator



Note: A light or a reflective material is used.

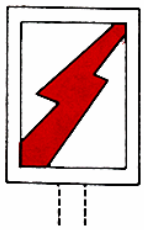
8-4 Point indicator

Type of indicator		Ordinary point indicator		Spring point indicator		Derailment point indicator	
Indication system	Direction of opening of point	In usual position	In reverse position	In usual position	In reverse position	When opened in the direction that derails a train	When opened in the Direction that does not derail a train i
	Daytime						
	Night time						

Note: Derail point indicator may be used also for lifting type point.

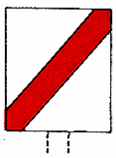
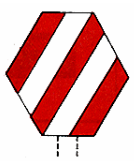
Material-9 Indicators for overhead line

9-1 Contact wire terminal indicator



Note: A light or a reflective material is used

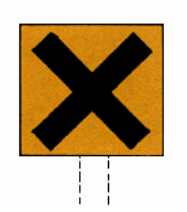
9-2 Dead section indicator of catenary

Indication system	For AC use	For AC/DC use
		

Note: A light or a reflective material is used

Material-10 Other Indicators

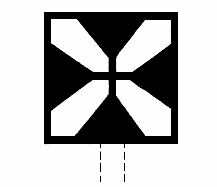
10-1 Whistle board



Note: Reflective material is used

.

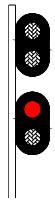
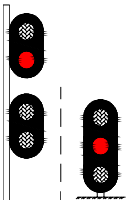
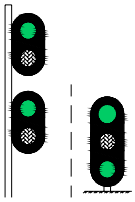
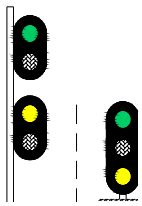
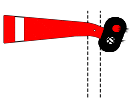
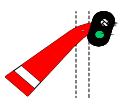
10-2 Car stop marker



Reference Material 3

Indication systems of signals, indicators, etc. of Vietnamese Railways

Material-1 Indication systems of home signal, starting signal and block signal

Type of Signal		Stop signal	Alarm signal	Caution signal	Reduced speed signal	Proceed signal	Remarks
Indication system	Color light system						Home signal Combinations of 2-asepect signals
							Starting signal (Automatic section) 3-aspect signal
							Starting signal (Semi-automatic section) 2-aspect signal
							Starting signal (Semi-automatic section; for starting from branch lines)
							For starting from yard
	Semaphore system						Home signal, Starting signal

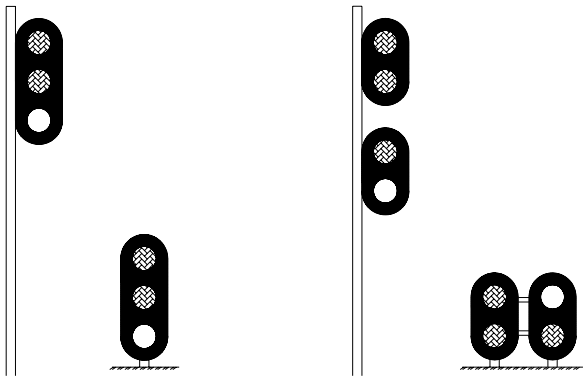
Note: In the Vietnam Railways, all the aspects except for stop signal are called “Proceed” although the speed is reduced according to the respective signal aspects.

Material-2　Call-on Signal and Shunting Signal

2-1. Call-on Signal

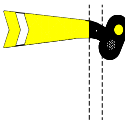
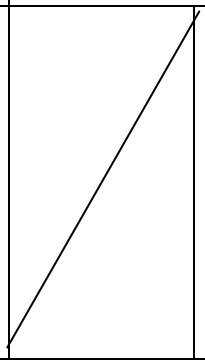
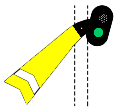
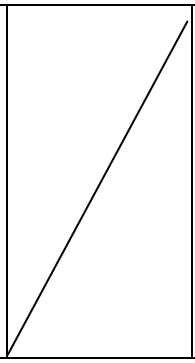
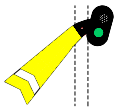
Type of signal		Call-on signal
Indication system	Color light system	

2-2. Shunting Signal

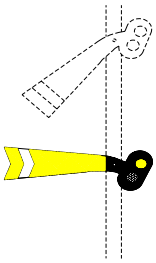
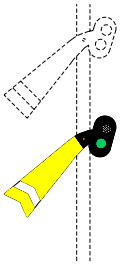
Type of signal		Proceed signal
Indication system	Color light system	

Material-3 Indication system of distant signal and passing signal

3-1. Distant signal

			Indication of approaching signal	Caution	Proceed			
			Indication of main signal	Stop signal	Alarm signal	Caution signal	Reduced speed signal	Proceed ssignal
Indication system	When central-position signal is of 2-position type	Color light system						
		Semaphore system						

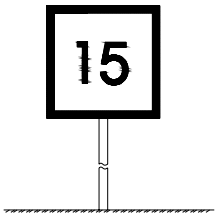
3-2. Passing signal

	Pass with caution	Proceed and pass
Semaphore system		

Material-4 Main Indicators

1 Slow-speed warning indicator

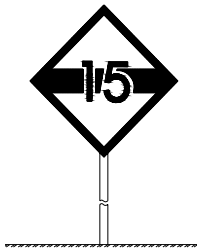
・Installed on the point of giving warning of slow speed.



Note: Yellow ground, black-framed, with the back in white.

2 Slow-speed indicator

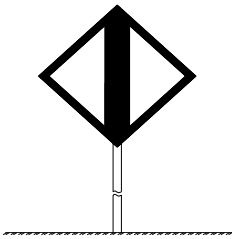
・Installed before a slow-speed point.



Note: Black letters on white ground with a black line, black-framed

3 Slow-speed release indicator

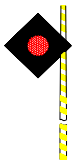
・Installed at the end of a slow-speed.



Note: Black line on white ground, black-framed

4 Obstruction warning signal

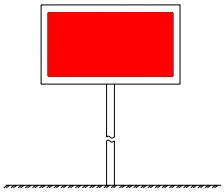
・Used to stop a train urgently for in a problem with a railway crossing or the like.



Note: For stopping a train, it turns on a red light.

5 Stop-movement signal

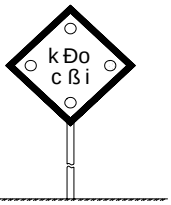
・For train protection from construction work or obstruction.



Note: Red ground, white-framed.

6 Whistle board

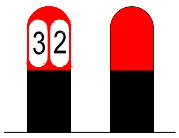
・Installed in place in need of giving a warning to railway crossings, bridges, etc. of an approaching train.



Note: Black letters on white ground, black-framed.

7 Clearance post of tracks

・Dimensional limit for rolling stocks not to interfere with other railway tracks at a divergence or crossing point.



Note: Half top in red and half bottom in black, track numbers in black on white ground.

8 Passenger train stop position marker

・Installed so that passengers can get on and off a train smoothly at a station.

Note: Red letter on white ground, circled in red.

Reference Material 4

Driver license system for train operation in Japan

Flow of Acquisition of Driver License

Ministerial ordinance relevant to driver license

- No crew drive any power car without driver license
- Driver license is given to those who passed driver license examination
- Those who are 20 years old or more are eligible for the exam
- Examinees need to pass the exam of four items ; 1.Medicine aptitude, 2. Driving aptitude, 3. Paper test, 4. Skill test

Railway operator (JR east etc.)

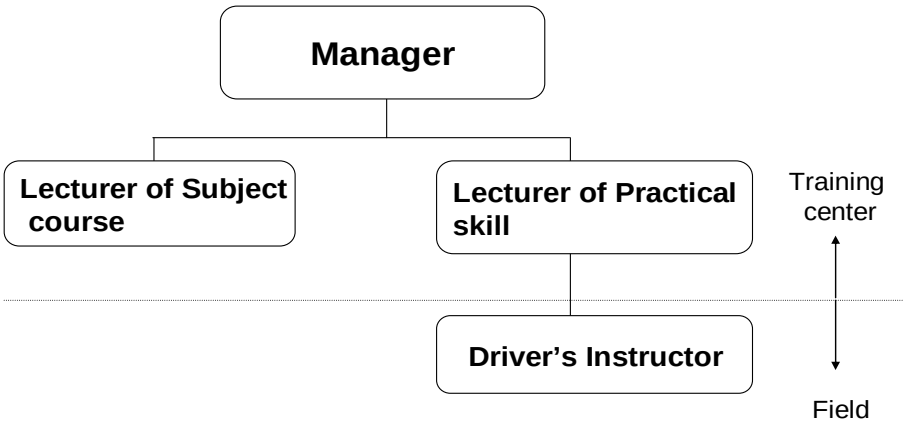
- Obtain authorization of driver license training center from the Minister of Land, Infrastructure and Transport
- Qualification of examination：Experience as a station staff for one year and as a conductor for two years or more
- Examination to enroll training center: The successful applicants who passed 1 and 2 of the ministerial ordinance take the paper test
- 568 hours (four months) of academic subject followed by 515 hours (four months) of the practical skills for those who passed the subject exam

Apply for a driver license　　Issue a driver license

The successful applicant in practical skill exam → MLIT → Announce by a railway operator to a driver

Lecture of Driver License Course

The name, brief resume and present duty of a qualified lecturer are notified to MLIT



Courses and hours of each subject

Courses		Hours (DC electric railcar)
General of railway		24
Railcar	Control system	116
	Brake ・ Bogie	56
Operating regulation		112
Signal ・Track	Signal ・ Communication	32
	Track	10
Railway electricity		40
Operating theory		60
Check & Repair for rolling stock		18
Safety for work		10
Sub total		478
Moral education		8
Site survey ・ Exercise		47
Preservation & Gymnastics		15
Midterm exam ・ Final exam		20
Sub total		90
Total		568

Contents of practical skill

Courses		Hours	Contents
Basic course		15	System of command and direction, Standard of work, Bylaw of Depot, Operation regulations, Explanations and site survey of training line
Driving training	Basic	30	Status of line, How to confirm signal, Handling of equipment at the time of coming-in, coming-out and operation
	First term	128	Handling of standard notch, of break and of ATS(ATC), Operation of trains of each type, Transfer, Succeed of work, Shuttle operation, Operation of coupling and decoupling at a station, Shunting operation Stations, duties and signals that need special attention
	Second term	182	Sense of running speed, Eye measurement distance, Responding to call-on signal, Catch-up operation, Operation of congested trains Operation under some particular conditions such as: ・Pushing operation ・Backward operation ・Released ATS (or ATC) ・Changed block system ・Conductor's valve in use, ・Bad weather ・Overrun ・Emergency buzzer going on ・Disrupted train schedule Knowing the operation route of one's own line in emergency
	Comprehen-sive training	100	Repetitive training of above program
Inspection before departure from depot		10	Inspection before departure and arrival
Emergency measure		50	Measures to take in case of railway accident ・Procedure ・Train protection ・Handling of fatal/injury accident ・Handling of transportation trouble ・Guiding passengers to safety Measures to take in case of vehicle breakdown Measures to take in case of overhead line failure Measures to take in case safety device failure
Total		515	