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Electro-Pneumatic Train Stops

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About This Standard

This Specification describes the general requirements for Electro-pneumatic Train Stops to be manufactured and supplied to Australian Rail Track Corporation or contractors to Australian Rail Track Corporation.

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Contents

1. Introduction

This Specification describes the general requirements for Electro-pneumatic Train Stops to be manufactured and supplied to Australian Rail Track Corporation or contractors to Australian Rail Track Corporation.

2. Applicable Documents

2.1. Australian Standards

This Specification refers to the following Australian Standards:

- AS 1831/1985 : Iron Castings-Spheroidal or nodular graphite cast iron

2.2. ARTC Specifications

- SCP 15 Installation of Trackside Equipment

3. Definitions

For the purpose of this specification, the following definitions shall apply:

Train Stop

A mechanism so constructed and arranged that its operation in conjunction with a trip arm mounted on the leading car of a suburban and inter-urban train will automatically result in the application of the train brakes.

Trip Arm

That portion of the track apparatus of the automatic train stop to which the train apparatus of such systems is directly responsive.

Circuit Controller

A device for opening and closing electric circuits to be operated through a separate crank movement operated by a driving pin mounted on the trip arm.

Centralising Spring

A device provided to ensure that in the event of a breakage of any part of the trip arm the circuit controller is moved to a neutral position, thus eliminating any possibility of a false indication.

Trip Arm Return Spring

A device provided to return the trip arm to the normal (raised) position when the mechanism is de-energized.

Safety Latch

A device associated with the operating crank inside the case provided to prevent the train stop arm being depressed externally by illegal operation.

Air Motor

That portion of the train stop consisting of a piston and cylinder in which compressed

air is submitted to operate the piston rod which drives the trip arm.

Electric Magnet Valve

A device, electrically controlled, which by its action in opening or closing an aperture, permits or prevents the passage of compressed air into the air motor.

Left Hand Side of Track

The left side of the track in the direction of running.

Rated Voltage

The value of the voltage marked on the magnet valve and intended to be applied to its terminals.

4. Scope

This specification applies to electro-pneumatic train stops operated by compressed air, which is admitted to a cylinder through an electrically controlled magnet valve.

The operating mechanism is to consist essentially of an air motor to drive the trip arm to the clear position when air pressure has been applied, a spring mechanism to raise the arm to the trip position when pressure is released and a magnet valve, all of which are required to be housed in the same mechanism case.

A circuit controller carrying contacts for the control of external circuits and fitted with a centralising spring should also be incorporated in the mechanism.

5. Operation of the Magnet Valve and Train Stop Mechanism

Compressed air to the train stop motor cylinder is to be controlled by a magnet valve located in the train stop case. When the magnet valve is energised compressed air must be admitted to the air motor cylinder and operate the piston rod connected to a lever on the trip arm shaft. Thus the trip arm will be driven down into the "lowered/position". The action of driving the trip arm down must also compress a return spring, which is to be attached to the arm shaft through a lever.

When the magnet valve is de-energized it shall cut off the air supply and vent the motor cylinder to atmosphere, external to the case. The return spring must then decompress and return the arm to the raised (normal) position within 1.5 seconds.

A system of links and levers should be used to connect the trip arm to the circuit controller, so that in the event of a link becoming disconnected or the arm being broken, the circuit controller is moved to and retained in the neutral position by a centring spring.

The trip arm is to be proved in its two positions by the circuit controller. A lever in the mechanism shall be provided to lock the trip arm in the normal or raised position to prevent it being lowered by external pressure.

A fracture point is not required to be provided in the trip arm. The complete mechanism is to be suitable for fixing on the left hand side of the track only in the direction of running. All parts are to be made easily removable for replacement purposes.

6. Rated Voltage and Air Pressure

The rated voltage for the magnet valve shall be 50V DC +/- 20%. Air pressure will be in the range of 350KPA to 550KPA.

7. Case

The mechanism including the controlling magnet valve and circuit controller shall be enclosed in a strong metallic weatherproof case, designed for mounting on two sleepers only.

The case shall be provided with a hinged cover preferably capable of being flat when open and shall be equipped with suitable fastenings to enable the cover to be secured and padlocked. The cover shall be sufficiently strong and rigid, when closed, to support a 90Kg load over 2500 sq mm at the centre of the cover without permanent deformation or deflection exceeding 3mm.

The case should be divided into two compartments. One of these compartments is to serve as a reservoir for lubricating oil (if the train stop is of the “wet sump” type) and should house the operating cylinder and associated parts. The second compartment, which is to be completely free of oil, is to house the circuit controller and magnet valve, the latter being located towards the end of the case.

Maximum and minimum oil levels should be clearly marked in the compartments used as a reservoir for oil.

Means for readily draining accumulation of oil or water shall be provided. The design shall be such as to minimise condensation in the mechanism.

When the arm is in the raised position, it should lie against a stop, cast on the casing, the purpose of which is to absorb any shock carried by its engagement with a trip cock on a train without throwing undue strain on the operating mechanism.

The case shall not be more than 540mm wide at the furthest point measured from the centre line of the trip arm. Refer to Specification SCP 15.

Separate cable and air supply entries, as shown in sketch details A and B attached, shall be provided at the end of the case in which the magnet valve is housed. The exit for the exhaust air should be located at the side of the case adjacent to the track at the end at which the magnet valve is located and should also conform to the arrangement shown in sketch detail "B".

The cable entry, air supply entry and exhaust and all other openings are to be suitably plugged for transit.

A ventilator of a type which will not permit foreign matter to enter the case should be provided. The arm is to be made from spheroidal graphite cast iron to AS 1831/400-250-12.

8. Position of Train Stop Relative to Rail and Sleepers

Specification SCP 15 details the position of the train stop mechanism case and the train stop trip arm in the lowered and raised positions with tolerances. The minimum structure gauge must not be infringed by any portion of the equipment except the arm in the raised position.

The train stop arm shall be adjustable in the raised position.

Adjustments shall be such that the dimensions shown on Specification SCP 15 are not exceeded.

9. Method of Fixing

Train stops may be mounted directly onto 250 x 150 timber sleepers spaced at 600 +/- 25mm centres and secured with 4x20mm coach screws. No part of the train stop shall project below the top of the sleepers.

Alternatively, the train stop may be mounted to a steel bracket which is, in turn, mounted to two concrete sleepers spaced at 600+/-25 mm centres.

10. Circuit Controller

The mechanism is to be housed in a separate, fully sealed, readily removable case. The sides of the case, except for that portion in which the self-lubricating bearing for the shaft is located, which should be metal, shall be sufficiently transparent for the contacts to be clearly visible for inspection.

The movement shall be so fixed that there is a minimum clearance of 12mm between the case and all moving parts. The transparent sides of the case shall be of material which shall be permanently transparent, tough, self extinguishing and non hygroscopic and shall be unaffected by changes in temperature between -10^{o}C and +80^{o}C.

All parts of the circuit controller shall be free from tendency to distortion, which would affect its operation under service conditions.

The contacts are to be operated to their various positions by a cam, the latter being operated by the trip arm proving mechanism through a suitable linkage.

The top of the case, on which the terminals are to be fitted should be detachable, similar to the type provided on detachable top relays. It shall be of tough, incombustible, non-hygroscopic insulating material which will not soften when heated to a temperature of 100C. The terminals shall be fastened in such a way that they cannot turn or become loose in service.

Four independent proving contacts, two for the "lowered" and two for the "raised" position of the trip arm are to be provided.

The contact fingers shall meet the fixed contact surfaces uniformly and shall make a wiping contact. Contact elements shall be so secured that they will not shift or become loose in service.

Material used in affixing contact elements shall not cause corrosion.

Each current carrying part shall be designed to carry 3 amperes continuously.

The circuit controller to be provided with a centering spring to ensure that in the event of breakage of any part of the trip mechanism including the arm, the circuit controller will assume the neutral position.

The circuit controller case should be provided with two emergency stops for limiting the stroke of the operating arm. It should be ensured that the arm reaches these stops without obstruction from the internal mechanism.

11. Lubrication

A self lubricating system with an oil sump and oil pump should be provided for lubrication of the bearings. Oil is to be circulated to the mechanism by a pump housed on the base of the main reservoir, for which it collects oil. Its operation is to be controlled by the operation of the mechanism and oil is to be pumped at each stroke of the trip arm.

Oil is to be drawn into the pump when the trip arm is lowered and on its return stroke, oil is to be circulated, the pump being spring loaded to return slowly when the trip arm is raised.

Check valves are to be incorporated in the oiling system to prevent air being drawn into the system when applied to the cylinder.

The quantity of oil reaching each point is to be controlled by metering valves. Points to be lubricated should include all bearings and bearing surfaces (except those in the circuit controller section of the mechanism) the piston and cylinder interior and the piston rod where it enters the cylinder. A valve to prevent the escape of air will be necessary at the cylinder lubricating point.

The oil filter of the pump should be located clear of any sediment forming on the floor of the sump.

Copper tube situated inside the case which carries the air supply from the magnet valve to the air cylinder at the other end should be rigidly supported at not less than four points along its length.

Those moving parts which cannot be lubricated by oil e.g. in the dry compartment, are to be fitted with bearings which require no lubrication. Carbon steel is not to be used in these locations.

Alternatively,

Train stops shall employ self-lubricating bearings or materials where contact between moving or moving and stationary parts occurs. These bearings or materials shall be such that no additional lubrication to any part of the train stop is required at less than six (6) month intervals under any operating condition except full immersion in water.

12. Wiring

Internal wiring shall be carried out in 0.6/1KV V75 grade PVC permanently and restrained, such that it is double insulated from the case and prevented from fouling moving parts. The wiring shall be impervious to the effects of lubricants and moisture.

The conductors of the internal wiring shall be adequately insulated and shall be tinned copper, stranded conductors terminating on studs.

A diagram of connections shall be attached securely and conspicuously to the inner face of the cover of the case and protected from the effects of lubricants and moisture.

13. Terminals

Terminals shall be 1/4" Whitworth in and shall be spaced not less than 25mm apart between centres or shall be 2BA spaced at not less than 20 mm.

Terminals shall be marked for identification purposes in accordance with the diagram

of connections.

14. Performance

The magnet valve shall be capable of operating between the limits of +/- 20% of the rated voltage. The train stop shall operate satisfactorily at pressures between 350 and 550 kpa. The operating time shall not exceed 1 second.

15. Insulation

A surface leakage distance of not less than 20mm shall be provided between any exposed current carrying parts and other metallic parts insulated therefrom.

An air clearance of not less than 12mm shall be provided any exposed current-carrying part and other metallic parts. In the case of terminals, there shall be no possibility of nuts unscrewed to the point of removal coming into contact with other metallic parts.

16. Voltage Tests

16.1. High Voltage Test

- The insulation of the assembled machine shall withstand, for one minute, a test voltage of 2000 volts R.M.S applied between all parts of electric circuits and other metallic parts insulated therefrom.

- The test voltage shall be alternating of approximately sine-wave form and of any frequency between 25 and 100 cycles per second.

16.2. Insulation Resistance Test.

This test shall be made immediately after the applied high voltage test and at a potential of approximately 1000 volts D.C. The insulation resistance shall be measured between all insulated circuits and earth. The minimum value for the completely wired machine shall be not less than 100 megohms.

The tests specified in sub-clauses 16.1 and 16.2 shall be made on the assembled machine at the manufacturers works.

17. Ambient Conditions

The train stop shall be suitable for the environmental (including vibration) conditions listed for Category F equipment in Specification SPS 02 -Environmental conditions.

18. Uneven Mounting

To cater for the possibility of the sleepers on which the train stop is mounted being misaligned horizontally, train stops must be capable of operating at the voltage and pressure limits set out, without bearing stiffness or binding and without failure or permanent deformation of the case or any other part of sealing, under the following conditions:

Test train stops shall be placed in a jig or other means used to twist the case so that a straight line passing through the under surface of the two front mounting feet is displaced by not less than 1.5 degrees relative to a similar line passing through the mounting surface of the two rear feet.

19. Finish

All ferrous metal parts, except SG parts, shall be hot-dip galvanised or equally protected against corrosion, then finish painted in the colour specified. SG iron parts shall be primed and painted (except on working surfaces) with suitable paints which are oil and grease resistant and will not flake into the lubricant. Aluminium parts shall preferably be anodised.

The case and shall be finished in semi-gloss or gloss mid-grey and the cover and face of the trip arm in gloss white.

20. Marking

A nameplate giving the manufacturer's name, the type and the serial number shall be attached to the train stop in a conspicuous position.

A plate shall be fixed on the solenoid valve bearing following information:

- Serial number
- Rated D.C. voltage
- Resistance of Coil

21. Shipping and Storage

Each train stop shall be suitably prepared before packing and shipping to ensure that all parts are protected against deterioration whilst the machine is in storage prior to installation.