Engineering Specification
Signals
Equipment Specification

RailCorp

Engineering Specification

SPG 1602

HIGH VOLTAGE IMPULSE TRACK CIRCUITS

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Document control

Version	Date	Summary of change
1.0	September 2005	Replaced *SC 07 42 00 00 SP High Voltage Impulse Track Circuits*
1.1	May 2010	Application of TMA 400 format

Contents

1 Scope and Application

This Specification provides for the manufacture, supply and delivery of railway track circuit equipment specifically designed to maintain train shunt over points, sidings and yards in general.

The ordering details shall be set out in the accompanying enquiry. Where this Specification forms part of a general specification for signalling works the enquiry shall be supplied by the Contractor.

Where a track plan accompanies an enquiry, it will show to scale the area required to be track circuited and indicate wayside signals, points, stations and road level crossings. In such cases, the enquiry calls for a quantity of track circuit sets sufficient to meet the signalling requirements of the area, plus spares. Although specific quantities and distances are indicated, it will be permissible to offer track circuits capable of operating over reduced or increased distances, providing the total quantity is adjusted accordingly and the proposed allocation to the area required to be track circuited is shown. Such departures must be clearly set out as part of the initial offer.

While it is not a requirement that transmitters and receivers can be located in a number of central locations this feature will be considered favourably.

Track circuits shall be supplied in complete sets.

Supply of prototype equipment will be required where such equipment has not been previously used by the Principal. The cost of supply, transport, testing and recovering the equipment shall be borne by the supplier, whether the equipment is accepted for service or not.

The cost of design changes arising from prototype testing or otherwise must be borne by the manufacturer unless specifically agreed in writing by the Principal.

The cost of damage in transit up to the agreed point of delivery must be borne by the supplier.

Where equipment has not been previously used by the Principal full details of use and approval by other rail Authorities should be provided with offers.

2 Applicable Standards

The equipment is required for the continuous detection of trains and constitutes a vital part of the signalling system. The highest possible standards of design, construction, components and workmanship are imperative.

The relevant Australian Standard Specifications, or in their absence British Standard Specifications relating to design, manufacture and testing of the track circuit are deemed to form part of this Specification.

In matters where conflict exists, this Specification shall take precedence.

3 Conditions of Operation

3.1 Safety of Operation

The track circuit shall operate with a minimum train shunt of 0.2 ohms over the entire track circuit.

Broken rail protection is required under all circumstances except in the case of the traction rail of a single rail track circuit.

Adjacent track circuits shall be able to be set to opposite polarities in order to detect a failure of the separating block joints.

The whole of the equipment, including all cables and connections throughout, must fail to safety; i.e. if any one component or any part of the equipment fails in whatever mode, open circuit, short circuit or an intermediate condition, the track circuit itself and/or one or other of the two adjacent track circuits must show occupied immediately and permanently whether it is occupied or not.

3.2 Pulse Generation and Detection

3.2.1 Pulse Shape

The pulse generated by the transmitter shall be asymmetrical, consisting for example, of a high voltage, short duration "high" pulse, followed by a low voltage, longer duration "low" pulse. This asymmetry shall be such that adjacent track circuits may be adjusted to have opposite polarities to detect block joint failure.

The typical voltage of the "high" pulse delivered to track shall be 120V with a maximum of 200V, in order to efficiently break through any rust and scale on the rail surface.

The track circuit shall be immune to chopper locomotive interference.

3.2.2 Transmitter

The transmitter shall produce the "high", "low" pulse sequence at least twice each second, and the output relay shall de-energize within one second of a shunt being applied to the track.

Failure of the transmitter to switch properly shall not produce any output capable of energizing the receiver.

The power consumption of the transmitter shall not exceed 60 watts.

The capability of being fed from a battery backup supply is desirable although under normal circumstances duplicated 120V +/- 15% 50Hz. A.C. power supplies will be provided.

3.2.3 Receiver

It is preferred that the receiver be a passive device and, under no circumstances shall any form of latched memory device be used to keep the output relay energised between receipt of pulses.

"High" and "low" pulse segments shall be detected separately.

The receiver circuits shall be such that with distortion, or complete absence of one or both of the pulse segments the output relay is de-energized.

3.2.4 Electrification Requirements

The track circuit shall be capable of correct operation in 1500V D.C. and 25KV A.C. electrification. The traction conditions will be nominated in the accompanying specification.

3.2.5 D.C. Traction Conditions

Traction is supplied at 1500V D.C.derived from 12 and 6 phase 50Hz rectifiers. Rectifier ripple is in accordance with B.S.S. 1698, negative to earth, both rails normally partaking in traction return, with a nominal rating of 1000 amps per rail.

3.2.6 A.C. Traction Conditions

Various areas are being designed such that they are compatible with future electrification at 25KV 50Hz A.C.

3.2.7 Overhead Spark Gap Arrestors

Overhead masts are not insulated from earth and are connected to rail by means of a spark gap. This spark gap although normally open circuit may become short circuit due to electrical storms or general deterioration and remain so. Such a condition will not be readily detected and allowance shall be made in the design or recommended method of installation of the track circuit to guarantee that the equipment will detect a train with one or more spark gaps broken down to earth.

3.2.8 Miscellaneous

Provision must be made for building and bridge structure and electrolysis protection connections.

Both single and double rail track circuit configurations are required to operate over a minimum length of 50m to a maximum length of 500m for single rail and 1000m for double rail track circuits. The quantity of each type required will be detailed in the accompanying enquiry.

3.3 Non Electrified Areas

The need exists for a short pulse track circuit over points in non-electrified areas. In addition, single line section tracks may be nominated as requiring a long pulse type track circuit of several kilometres in length.

3.4 Environmental

Ambient temperatures: -10 degrees to 50 degrees C. Ambient temperature indoors: 0 degrees C to 70 degrees C. Maximum solar radiation: 10.7 watts per square metre of exposed surface. Allowance has been made in this figure for the sun's altitude at the place of use. It shall be considered that the whole of the heat will be absorbed as outdoor equipment will not necessarily be kept painted or free of airborne industrial fallout. If sunshades are required this shall be stated and designs submitted. Relative humidity: maximum 90% at 50 degrees C. Severe lightning storms can be expected at frequent intervals and suitable circuitry and protection must be provided.

3.5 Miscellaneous

3.5.1 General

Rails are 55kg/metre (approx) flat bottom, 1.43 metres between running faces, 1.5 metres between centres. Power supply is 120 volts +/- 15% A.C. 50Hz +/- 2%. Power supply at opposite ends of track circuits may not be in phase or synchronous.

Ballast resistance unless otherwise specified is 1.5 ohms/km.

Receiver output is to be capable of operating a 24 or 50 volt signalling relay to *British Railways Board Specification 930*. Direct interconnection between transmitter and

adjacent receiver for the purpose of controlling the transmitter without an interposing relay (cut track operation) is not required.

3.5.2 Adjustment

The procedure for setting up and subsequent adjustments must be simplified as far as possible. A single voltage value at the receiver input must be established as a track circuit adjustment criterion.

3.5.3 Miscellaneous

All output terminations, cables etc., shall be able to withstand open circuits and short circuits without damage to the equipment.

A slow to energize facility shall be provided whereby each receiver would delay the pick-up of its output relay for 1.0 second after it itself has been energised from the track.

All track circuit equipment sets are to be supplied complete with mounting racks and all other necessary equipment including wiring lugs for plugboards.

3.6 Additional Requirements

Cases mounted outdoors to be lockable (sample padlock can be supplied on request) and insulated from rails and earth.

All semi-conductors to be silicon.

All printed wiring boards to be mounted vertically.

All outdoor equipment to be completely weatherproof.

Indoor equipment to be capable of being mounted in close proximity.

Internal wiring to be flexible.

Steady voltages greater than 120v not to appear in equipment.

If equipment is mounted at track level, special precautions against vibration must be taken.

Crimp joints are preferred to soldered joints.

Wiring to be colour coded.

All modules, cases and pluggable sections to be clearly, permanently and unambiguously identifiable in English.

4 Information To Be Supplied

4.1 With Offer

a) Complete drawings, electrical and mechanical; inscriptions in English.

b) Limitations in regard to lead length and resistances.

c) What type of shielding, if any, is required for leads and cables.

d) Track lengths obtainable.

e) Description of operation in English.

f) Adjustment instructions in English.

g) Dimensions of all items of equipment.

h) Electrical characteristics of cables.

i) Maximum lengths of cables.

j) Maximum and minimum train shunts obtainable.

k) Proposed arrangements for manufacturer's servicing and stocking of spare components.

l) Effect on operation and on train shunt of change of ballast resistance due to wet whether.

m) Effect on train shunt of accidental structure spark gap breakdown as a function of structure earth resistance.

n) Any special test equipment required.

4.2 Prior to Delivery

Maintainer’s instructions in English and drawings with inscriptions in English. This information shall be in the form of masters reproducible by the dyeline process. The Authority undertakes to issue information only to those personnel who by reason of their duties are required to have use of it but will not be liable of unauthorised disclosure.

Installation drawings and instruction in English.

Shadow drawings of printed circuit cards and assemblies showing the locations of components.

List of all components used including ferrite cores showing code number and manufacturer of equivalents readily available in Australia. Failing this, complete characteristics must be supplied. In the case of inductors and transformers, winding data to be supplied.