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Category 2 Standard

S2552

Point Heating Systems

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Contents

1	Purpose	3
2	Scope	3
3	Requirements	3
3.1	Functional Requirements	3
3.2	System Architecture Requirements	4
3.3	Electrical Supply Arrangements	5
3.4	Trackside Installations	6
3.5	Local equipment for the point heating system	7
3.6	Performance Requirements	8
3.7	Operational Requirements	9
3.8	Environmental Requirements	9
3.9	EMC Requirements	9
3.10	Energy Efficiency Requirements	9
3.11	Labelling	9
3.12	Design, Installation, Testing, Commissioning and Maintenance	10
3.13	Operations and Maintenance	11
3.14	Approvals	11
3.15	Identification and traceability	12
3.16	Documentation	12
4	Responsibilities	13
4.1	Asset Engineer	13
4.2	Asset Steward	13
4.3	Head of Signalling Engineering	13
4.4	Head of Power Engineering	13
4.5	E&M Engineer	14
4.6	Design Authority	14
4.7	Designer	14
4.8	Suppliers	14
4.9	Tester	14
5	Supporting information	14
5.1	Background	14
5.2	Safety considerations	15
6	References	15
6.1	References	15
6.2	Abbreviations	16
6.3	Definitions	17
6.4	Person accountable for the document	17
6.5	Document history	17
7.0	Attachments	17
7.1	Typical High Level Schematic of Point Heater System	18
7.2	Typical Schematic of Point Heater System (with expanded trackside detail)	19

1 Purpose

The purpose of this standard is to define the requirements for point heating systems to be used on London Underground (LU) infrastructure. The purpose of point heating is to prevent point failures due to adverse weather conditions, with particular regard to temperature, precipitation (rain, sleet and snow).

2 Scope

This standard applies to all new point heating systems installed on London Underground infrastructure, and states the mandatory requirements for the design, installation, testing and maintenance of these signalling assets.

3 Requirements

3.1 Functional Requirements

- 3.1.1 Point heating systems shall be capable of heating point installations (actuating systems and associated rails), so that point systems operate reliably within the range of environmental conditions prescribed within this standard. This shall include credible rates of change of these conditions within this range.
- 3.1.2 The point heating systems shall be capable of operating in both Automatic and Manual modes.
- 3.1.3 In Automatic mode, the system shall continuously sense and process the environmental conditions and apply heating to rails and point actuation equipment to meet the Operational Requirements stated in 3.7.
- 3.1.4 In Manual Mode, heating shall be applied to the rails, irrespective of the prevailing environmental conditions, except as noted in 3.7.2. Manual Mode shall be selectable both locally and remotely.
- 3.1.5 The point heating system shall provide a Test Function, which shall switch the heating on for a sufficient period of time to establish that point heaters are working correctly, and afterwards automatically switch off. The Test Function shall be selectable both locally and remotely.

Note: Existing systems switch on for a period of 30 minutes to allow the system to stabilise.
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- 3.1.6 When the point heating system is in Manual or Test mode, the automatic environmental sensing shall continue to comply with Operational Requirements by requesting for heating to be applied, thereby achieving a seamless reversion to automatic mode when the Manual and Test modes are deselected.
- 3.1.7 Point heating systems shall provide local indications and displays indicating:
 - a) The status of incoming power supplies;
 - b) The status of point heating controls
 - Mode: Automatic, Manual, and Test

- Heating ON or OFF;
- c) Whether precipitation (rain, sleet or snow) has been detected;
- d) rail temperatures in the heated and unheated areas;

Note: Point heating systems typically make use of temperature sensors attached to rails in the vicinity of the points. There are usually two sensors, one attached to a portion of the unheated rail (the “cold rail sensor”) and the other to a portion of the same rail that is subjected to heating (the “hot rail sensor”). These sensors may be used to support the control of the point heating system.

- e) Health status of individual point ends indicating whether they are working within the normal operating band.

3.1.8 Point Heating Systems shall provide remote monitoring. The information collected by monitoring equipment at the local (field) end shall be made available to a remote location by means of a secure data transmission system. The specific requirements for data communication between the remote and local monitoring equipment (protocols, data rates, physical interfaces etc.) shall be defined in the procurement specification. The requirements for the dissemination or sharing of this centralised data, held at the remote location, are not within the scope of this standard.

Note: Access to remote monitoring information may be required by a number of different parties. The information for a particular point end will be held at one remote location and users will obtain information from this centrally held data base.

3.2 System Architecture Requirements

3.2.1 The point heating system shall comprise the following sub-systems:

- a) Power Equipment to supply and electrically isolate the point heating system;
- b) Isolating transformers to provide power via double wound insulating earth free secondary windings to heating elements at each point end;
- c) The trackside heating components, typically including connection boxes, plug couplers, heating strips/blankets/cartridges, temperature sensors, clips for securing the heating elements, wires, cables and insulated heat retaining shields;
- d) Environmental monitoring and control equipment to process temperature and precipitation (rain, sleet and snow) measurements made by external sensors. These sensors shall be located at positions that accurately represent the weather conditions to which the points are exposed;

Note: Temperature and precipitation sensors must be located where they can accurately monitor the rail/weather conditions. When determining the precise location of sensors, care should be taken to avoid positions where higher temperatures may be detected due to the effects of direct sunlight, or lower temperatures due to evaporative cooling (wind chill). Also, consideration should be given to the possible effects of sheltering from rain/sleet/snow.

- e) Equipment to provide remote control of the Manual Mode and Test Function;
- f) Equipment Status and Condition Monitoring equipment to record the hours of heating, and to determine whether the various parts of the system are healthy or failed. This equipment shall provide local indications of the status of the monitored functions and have the capability to provide the same information for onward transmission to a remote diagnostic system or data terminal.

3.3 Electrical Supply Arrangements

- 3.3.1 The power supply for the control and monitoring equipment, and the point heating elements, shall be provided from a source agreed by London Underground's Head of Power Engineering. This supply shall be either 230V 50Hz single or 400V 50Hz three phase. The choice of supply arrangement shall be determined by the number of point ends to be heated and by what is most appropriate to London Underground to meet the power demands at a particular location.

Note: Typical installations involving 3 or less point ends have generally been powered from single phase supplies, but each new installation must be assessed individually to ensure that all LU's needs are best met.

- 3.3.2 The electrical arrangements shall enable isolation and protection of both personnel who may come into direct contact with the point heating system, and the point heating system itself from electrical damage.
- 3.3.3 The isolating transformers that provide power to the heating elements shall be housed within a kiosk/cubicle.
- 3.3.4 Isolating transformers shall be dedicated to the heating elements for each point end. Each isolating transformer shall be 230V primary and two independent earth free 110V secondary windings (230V /110V, 110V). In addition, the secondary windings shall be provided with tappings to facilitate adjustment of the voltage at the point of connection to the heating elements to 110V (+ 10%).

Note: Providing power via earth free secondary windings reduces the risk of unwanted electrical connections between running rails and adjacent train detection systems.

- 3.3.5 Double pole isolation devices shall be provided at/in the enclosure of the isolating transformers to enable any equipment connected to the secondary windings to be fully isolated from the supply.
- 3.3.6 In addition to protecting against any hazards that may arise from the AC power arrangements provided to the heating elements and point heating control system, the protection devices shall also provide protection against DC traction hazards that could conduct into the point heating system under credible failure conditions.

Note 1: Personnel working on or in the vicinity of the trackside components of the point heater system may be exposed to electrical hazards. Therefore, it is imperative that the design makes provision for protection devices for each secondary circuit to isolate the heating elements and associated wiring in the event of them being damaged or exposed to high DC currents due to traction faults. To meet this requirement, RCBO (Residual Current Breaker with Overcurrent) devices have been used in existing arrangements to provide both isolation and protection.

Note 2: DC traction voltage under fault conditions may rise to circa 890V.

- 3.3.7 Heating elements attached to stock and associated switch rails on each side of the point end layout shall be supplied with power from separate transformer windings to avoid any direct electrical connections between train detection systems.

Note: Unwanted electrical connections between rails in the vicinity of the point heating system may give rise to hazards, such as loss of train detection caused by 'run round paths' between sections of the train detection system. Such hazards could introduce risks to the safe operation of the signalling system.

- 3.3.8 Where the train detection system requires insulation within the rodding of the point system, the electrical supply to the heating blanket shall be designed to avoid the hazards described in 3.3.7.

Note: Where insulation is installed in the rodding of the point system, it is normal practice for the point actuator to be located on the continuous rail side of the insulation. In such situations, the heating blanket is supplied from the secondary winding that supplies power to the heating elements attached to the continuous switch and stock rails.

3.4 Trackside Installations

- 3.4.1 All trackside components, equipment and cables shall be designed to operate reliably in the harsh trackside environment, and be approved by London Underground for the application. In addition, the IP rating for equipment enclosures, such as kiosks, cubicles and boxes shall be approved by London Underground for the application.

Note: Consideration should be given to robust and ruggedised construction of:

- boxes
- kiosks/cubicles
- cables
- connectors
- plug couplers