

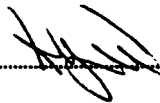
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Business Process Document

The installation and upgrading of escalators and passenger conveyors

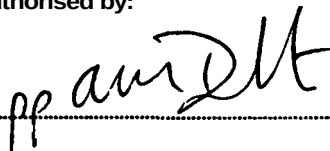
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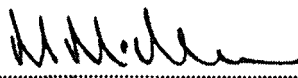
K. Lydford, Head of Electrification & Plant Engineering

Authorised by:



A. McNaughton, Chief Engineer

Accepted for issue by:



M. McManus, National Standards Manager

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2	April 2006	Re-issued as a SAF3 Business Process Document

Implementation

1 April 2006

Compliance

This Network Rail specification is mandatory and must be complied with by Network Rail and its contractors from 1 April 2006

When this specification is implemented, it is permissible for all projects, which have formally completed GRIP Level 4 to continue to comply with the Issue of any relevant Network Rail standards current when GRIP Level 4 was reached and not to comply with requirements contained herein unless the head of electrification and plant has stipulated otherwise in the accompanying briefing note.

Where the head of electrification and plant has specified that all projects will comply with the requirements, specific authority not to comply can be sought in the usual manner using the appropriate non-compliance authority processes described in Network Rail standard, [NR/SP/STP/045](#) *Managing the process for non-compliance authority* (formerly RT/LS/P/045).

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I Purpose

The Specification has been developed to ensure that escalators and passenger conveyors are suitable for the public service application associated with stations and large volumes of passenger flow. In all cases equipment is specified and rated suitable for a minimum 25 years service in compliance with the remit from Network Rail.

2 Scope

This document applies to Network Rail's infrastructure and leased property portfolio.

3 Reference documentation

BS EN 115	Safety rules for the construction and installation of escalators and passenger conveyors
BS EN 294	Safety of machinery. Safety distances to prevent danger zones being reached by the upper limbs
BS EN 316	Wood fibreboards. Definition, classification and symbols
BS EN 60276	Definitions and nomenclature for carbon brushes, brush-holders, commutators and slip-rings
BS EN 60529	Degrees of protection provided by enclosures (IP Code)
BS EN 60617-3	Graphical symbols for diagrams – Part 3: conductors and connecting devices
BS EN 60898	Specification for overcurrent protection for household and similar installations
BS EN 60947-2	Low-voltage switchgear and controlgear
BS EN ISO 1461	Hot dip galvanized coatings on fabricated iron and steel articles – specifications and test methods
BS EN ISO 9000 series	Quality management and quality assurance standards
BS 88	Specification for cartridge fuses for voltages up to and including 1000 V a.c. and 1500 V d.c.
BS 228	Specification for short-pitch transmission precision roller chains and chain wheels
BS 921	Specification. Rubber mats for electrical purposes
BS 1486-4	Specification for hydraulic grease nipples
BS 4293	Specification for residual current-operated circuit-breakers
BS 4999-147	Specification for rotating electrical machinery. General data. Dimensions of brushes and brush holders for electrical machines
IEC 136	
BS 4568	Specification for steel conduit and fittings with metric threads of ISO form for electrical installations. Steel conduit, bends and couplers
BS 4570	Specification for fusion welding of steel castings
BS 4678-1	Cable trunking. Steel surface trunking

BS 4999	General requirements for rotating electrical machines
BS 5000 Index	Rotating electrical machines of particular types or for particular applications
BS 5135	Specification for arc welding of carbon and carbon manganese steels
BS 5493	Code of practice for protective coating of iron and steel structures against corrosion
BS 5499-5	Graphical symbols and signs - safety signs, including fire safety signs - Part 5: Signs with specific safety meanings
BS 5655-1	Safety rules for the construction and installation of electric lifts
BS 6211	Specification for operator's controls for earth-moving machinery: crawler tractors and crawler loaders
BS 6217	Guide to graphical symbols for use on electrical equipment
BS 6221	Printed wiring boards
BS 7671	Requirements for electrical installations. IEE Wiring Regulations. Sixteenth edition
PD 5304	Safe use of machinery

4 Definitions

Angle of inclination	Angle to the horizontal for the moving steps, pallets or belts.
Combs	The fixed parts at the landings which mesh with the moving steps, pallets or belts.
Handrail	Moving part which serves as a handhold for passengers.
Steps/Pallets	The moving sections providing a level surface for passengers to stand during travel. The top sections mesh with the fixed combs at the landings.
Belts	Continuous belt used on passenger conveyors providing the surface for passengers to stand during travel. The top profile meshes with the fixed combs at the landings.
Step Band Radius	The radius of the truss and step chain at the points where the steps form and where the steps level out.
Capacity. (theoretical)	Passengers than can theoretically be transported in a one hour period.
Balustrade.	Panels to either side of the escalator or passenger conveyor.

Balustrade Skirting Newel	The panels adjacent to the step edges. The end of the handrail on either landing where the handrail returns.
Compact Escalator/ Passenger conveyor	Where the machinery is integral with the escalator structure. Access to the machinery is generally gained from the motor box and return station floor panels.
Remote Type Escalator/ Passenger conveyor	Generally where the machinery and electrical control equipment is positioned in a dedicated machine room. Access for maintenance is generally gained from beneath the escalator and in theory specific maintenance operations can be undertaken with the machine stopped but avoiding further obstruction to travelling passengers.
Operational Brake.	The main brake which brings the escalator/passenger conveyor to rest under normal and emergency stops.
Auxiliary Brake.	A second brake that is designed to hold the escalator/passenger conveyor at rest with an out of balance load.
Step Band Locking Device.	A mechanical lock which engages with the step band drive sprocket or the step band chain to prevent movement of the step band under full load conditions. Electrical interlock to the control circuit.

5 Initial planning

5.1 Basic standards

For new installations the advised minimum step width and speed shall be enforced. However for modernisations and replacements the overall restraints resultant from existing load points, available width and angle of inclination may restrict the design of the replacement installations.

Escalators shall provide the following basic standards where practical:

Step width	1000mm
Contract speed	0.5 to 0.65 metres per second
Angle of inclination	30° to the horizontal.

Passenger conveyors shall provide the following basic standards where practical:

Pallet width	1000mm (1400mm where used with self help trolleys)
Contract speed	0.5 to 0.65 metres per second
Angle of inclination	up to 5° from the horizontal.
Length	maximum of 25000mm.

Note: If longer distances are required then two or more passenger conveyors shall be provided, separated by refuge areas a minimum of 2500mm in length by 2000mm in width.

5.2 Environment

Initial planning shall also address the environment in which the escalator or passenger conveyor will operate. Total exposure to the effects of weather shall be avoided. Where the application requires the escalator/passenger conveyor to access external areas a canopy shall be provided. In this case the equipment shall additionally be provided with the necessary protection to ensure satisfactory operation and issues such as approach surfaces being of a non slip finish shall be clearly specified. The recommendation is for approach surfaces to have a Slip Resistance Value (SRV) between 55 and 75, even when wet.

5.3 Prohibited use

Escalators shall not be used for the transportation of push chairs, luggage trolleys, baggage carts or similar.

Where passenger conveyors are considered for the transportation of push chairs, luggage trolleys, baggage carts or similar a safe method of use shall be fully documented. Special provisions will additionally be required from the manufacturer to allow full C.E. marking on completion.

5.4 Changes in level – provision of lifts

Where practical, changes in level shall be provided with automatic passenger lift(s) for the use of passengers with small children, pushchairs, trolleys etc. and for use by disabled persons.

5.5 Instructions for use

Instructions for the safe use of escalators shall be provided, located out of the line of travel to avoid congestion as passengers slow or stop to read them. They shall however be sufficiently close to the escalator or passenger conveyor to enable passengers to recognise the relationship.

5.6 Meeting the needs of disabled passengers

Where practical the following facilities shall be provided for all escalators and passenger conveyors:

- a) Adequate clear signs on the approach.
- b) Clear information on the direction of travel.
- c) Adequate general lighting on all approach and exit areas.
- d) (200 lux minimum at horizontal floor level)
- e) Comb lights.
- f) Understep lighting where steps change level.
- g) The horizontal and vertical edges to the nosings of all steps to be finished yellow.
- h) The step combs are to be finished yellow.
- i) The handrails are to include for colour contrast dots or similar.
- j) The approach route flooring shall contrast with the surrounding floor in both texture and colour.
- k) Clear approach of 10m to assist with safe use and viewing of information signs.

5.6.1 Information signs for disabled passengers

Information signs shall be provided in the following format:

- a) 25mm sans serif font, in a mixture of upper and lower case,
- b) text to contrast with the sign background, which shall contrast against the local background,
- c) explanatory pictograms are additionally to be provided,
- d) where practical all to be sited between 1400mm and 1700mm above finished floor level,
- e) where not practical a site specific risk assessment is to be undertaken.

The direction of travel shall be indicated in highly visible signs at a lower height. Consideration shall be given to the provision of tactile signs where practical.

5.7 Sub surface stations

5.7.1 Legislation

The legislative requirements of The Fire Precautions (Sub-Surface Railway Station) Regulations shall be applied at all sub surface stations.

5.7.2 Linear heat detector

All escalators and passenger conveyors shall include a linear heat detector.

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5.7.3 Water sprinkler

The requirement for an internal water sprinkler system, installed within the escalator truss, shall be avoided as false activation can result in extensive damage to the major components.

For each installation a site specific risk assessment shall be submitted to the Network Rail Fire Advisor for approval.

5.7.4 Machine rooms

All machine rooms shall include smoke detectors.

5.7.5 Materials

The material used for balustrades, decking, skirting and all walked surfaces, plus all display panels, notices and advertisements shall offer adequate resistance to the spread of flame over the surface of the material and shall if ignited have a reasonable rate of heat release. This shall additionally apply to all materials used beneath the escalators or passenger conveyors.

6 Testing and commissioning - dynamic testing

In all cases completed escalators and passenger conveyors shall be witness tested at the manufacturers works prior to despatch to site.

All units shall be further witness tested on site, including load and brake tests.

The completed test sheets shall be signed by the contractor and copies shall be incorporated within the maintenance manuals.

To allow future comparison of performance the following additional performance criteria shall be recorded and incorporated within the maintenance manuals:

- a) Step speed in both directions,
- b) Handrail speeds in both directions,
- c) Brake stopping distance, unloaded in both directions,
- d) Brake stopping distance, full loaded, in both directions.
- e) Running currents, fully loaded and unloaded,
- f) Starting currents, fully loaded and unloaded,
- g) Standby speed, if applicable with energy saving features.
- h) Running currents while on standby speed.

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7 Performance and equipment requirements for compact and remote drive escalators level and inclined passenger conveyors

7.1 Preamble

This Specification forms the Standard requirements for Escalators of the 'Compact' and 'Remote' drive types and for passenger conveyors, both level and inclined.

The equipment shall provide full compliance with [BS EN 115](#) Safety rules for the construction and installation of escalators and passenger conveyors.

All designs shall be based on the equipment being used for Public Service Duties as further covered.

Wiring associated with the Linear Heat Detectors shall be terminated in a suitably protected connection box for interfacing with the fire detection, alarm and extinguishing system.

7.2 Supporting structure

All truss members shall be galvanised.

The truss design shall allow ready removal of the upper drive assembly and lower carriage without the necessity of extensive dismantling.

An indicator plate shall be fitted at the top and bottom landings of each truss to indicate the centre line of the escalator and a plate indicating all imposed support loadings.

The truss shall normally be designed to support at each extreme end. The design shall be such that final levelling adjustment to match floor finishes is available together with resilient mountings to minimise transmission of noise and vibration to the building structure.

Loadings of the mid span support shall be included on the indicator plate fitted at the top and bottom landings of each truss.

The linear heat detectors shall be located in the most effective position for efficient operation while minimising the risk of accidental damage.

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7.3 Steps

7.3.1 Step unit

Each step unit shall be a one piece die cast aluminium alloy construction with integral step treads. The casting shall incorporate a groove pattern on the riser face which shall intermesh with the leading edge of the following step tread. The nosing shall incorporate a homogeneous yellow plastic/nylon material insert, or similar identification, extending for 35mm on both the horizontal and vertical faces. Renewal shall be practical without the requirement to remove the step.

7.3.2 Landings

At the landings the steps shall be guided in such a way that the front edges of the steps leaving the comb and the rear edges entering the comb are restrained horizontally for the full tread width as specified in Schedule I. The vertical difference in level between two consecutive horizontal steps within the landings shall not exceed 4mm and should not normally exceed 2mm.

7.3.3 Under tread illumination

Under tread lighting illumination shall be of sufficient intensity to be clearly seen between the steps as they start to form from or form to the horizontal. The luminaires shall meet the protection requirements of [BS EN 60529](#) Classification IP. 33 (internal installations) or Classification IP. 65 (external installations).

7.3.4 Step dimensions

The step height shall not exceed 0.21m.

The step width shall not be less than 1000mm on escalators and passenger conveyors and not less than 1400mm on passenger conveyors where used with self help trolleys.

7.3.5 Step supports

On escalators each step shall be supported on four wheels, the minimum dimensions of which shall be 100mm dia x 20mm face width. However, preference will be given to larger size wheels where design permits. Wheels shall incorporate the following:

- a) Oil resistant, non-distorting, synthetic compound tyres fitted to die cast aluminium hubs.
- b) The hubs shall be fitted with sealed for life bearings.

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On passenger conveyors it is common for the 'steps' or 'pallets' to be supported on stub axles to the rear edge and on the preceding 'step' or 'pallet' to the front edge. This is acceptable subject to compliance with the minimum wheel dimensions.

7.3.6 Step chain/wheel arrangement

The step chain/wheel arrangement shall be designed such that step chain wheels are located outside the chain links and are easily replaced without dismantling any of the drive chain. Step connections to the chain shall be similarly designed using stub axles or similar arrangements. For high rise escalators, alternative arrangements may be submitted for approval. All attachment devices shall be suitably secured using Set Screws with locking washer or self locking nuts.

7.4 Step drive chain

The following applies to all passenger conveyors and escalators up to 18m rise. Above 18m rise then specialist advice shall be obtained.

Each chain shall be of precision roller type manufacture and of 'Matched' lengths. Chains shall be pre-stretched where necessary.

Each chain shall have a minimum Factor of Safety of 5:1. The Tenderer shall indicate in Schedule 2 the Factor of Safety of the chains offered.

The minimum pitch of the Chain shall be 133mm. The maximum bearing pressure on the step chain links and pins shall be 200kg/cm² based on a step loading of 120kg per step. Proof calculations of the maximum bearing pressure shall be provided by the Tenderer.

The chain shall be 'green' in design and shall not require further lubrication once installed.

The chain shall be driven from the main drive or an independent motor.

7.5 Step chain tensioning device

A step chain tensioning device shall be incorporated to maintain the step chains at the correct tension and shall be incorporated in the lower return station assembly within the truss. The design shall allow for the maximum allowable chain elongation.

- a) The device shall be designed using springs in compression only, and shall be fitted with a fixed measuring plate and moving pointers to indicate the original chain positions and subsequent parallel adjustment. Indication shall also be provided to show when maximum allowable elongation has been reached.