WHITE PAPER

York EMC Services

The Detail Behind Depots

The Implications of Fixed Installations on Depots

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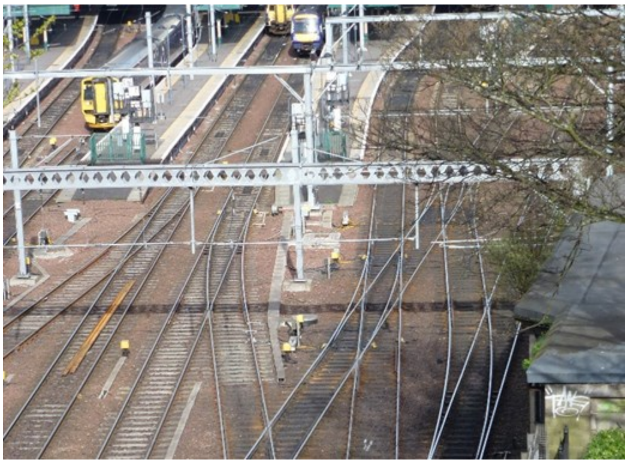
As the date for the new EMC Directive draws closer, **Dr Mark Tyndall** of Eurofins York (formerly York EMC Services) explains the implications of Fixed Installations on Depots.

In this article, we will consider the Railway Depot as a Fixed Installation (or FI) from an EMC perspective, and discover what that means for the contractor building the depot, for suppliers providing electrical equipment for the depot and for the running of the depot after completion. Eurofins York has shepherded depots through the EMC process many times, writing EMC documentation, managing interfaces and providing advice, support, and testing where appropriate throughout the construction and commissioning stages.

What is a fixed installation?

The current EMC Directive defines the FI as "a particular combination of several types of apparatus and, where applicable, other devices, which are assembled, installed and intended to be used permanently at a pre-defined location", and this is unchanged in the new (2014/30/EU) EMC Directive.



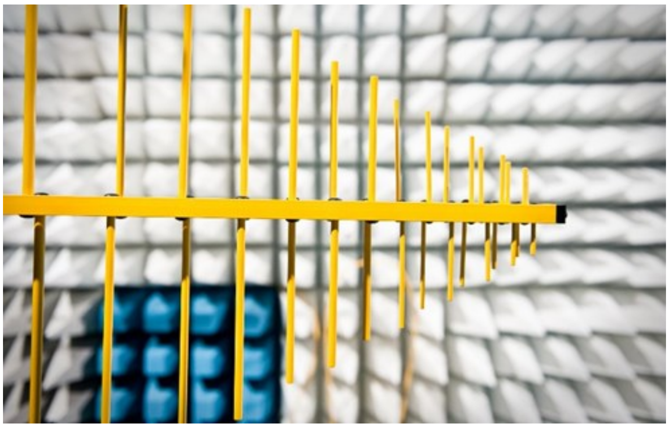
This definition is clearly applicable to depots. The Directive contains requirements for Fixed Installations, which must be met. The first two are the essential requirements for EMC: the FI must be suitably non-emissive for its environment, and it must be suitably immune for its intended function. In addition to these, there are specific additional requirements for FIs. The FI shall be installed applying good engineering practices and respecting the information on the intended use of its components, with a view to meeting the protection requirements. Secondly, the "good engineering practices" shall be documented.

Why regulate a fixed installation?

It is instructive to consider why Fixed Installations are regulated. Apparatus also needs to meet the essential requirements, and this is typically done using harmonised standards. These standards lay out an integrated set of emission limits and immunity levels for a variety of environments, with the dual aims of not disturbing communications, broadcasts or other equipment, and of functioning correctly (in the presence of the same communications, broadcasts and other equipment). The difference between emissions limits and immunity levels is known as the margin of compatibility. The margins that are built in to harmonised standards allow most apparatus to work as intended – this has the effect of making simple cases (such as a home) work. For a depot (or other complex installation), there are a number of reasons why additional measures are required.

Firstly, the environment tends to be more severe, which means that more energy is available as potential interference. Next, the installation of several pieces of apparatus generally requires significant lengths of cabling, which is a significant vector for disturbances. It also increases the likelihood that one or more pieces of apparatus will not be intended for the installation environment. Finally, the greater the energy for disturbances, and the more complex the installation, the more likely it is that the installation's neighbours will be affected. Economists refer to this as an externality - a cost affecting a party who did not choose to incur that cost. The regulation of Fixed Installations is part of the Directive to address this externality, to ensure there is a mechanism for minimising undue interference to a Fixed Installation's neighbours.

Although the driver for the regulation of Fixed Installations is primarily the effect on third parties, this



should not be seen as its main purpose in a depot. The planning and documentation requirements encapsulated by the "good engineering practices" are very beneficial in assuring overall compatibility of the finished installation, not just at the boundary with its neighbours. Without planning, even an installation far from any neighbours runs the risk of compatibility problems. Equipment could be incorrectly installed, poorly positioned or simply incompatible with its installed environment, leading to malfunction of the equipment itself or of other equipment.

Good engineering practice

At the most abstract level, good engineering practice for a Fixed Installation is engendered by the following steps:

- Determination of the installation environment, and of the environment created by critical parts of the new installation
- Specification of a coherent set of standards for apparatus sourced as part of the installation
- Dissemination of requirements down the supply chain
- Verification that all equipment meets the requirements
- Procedures to mitigate emerging issues

The Directive states that "These good engineering practices shall be documented and the documentation shall be held by the person(s) responsible at the disposal of the relevant national authorities for inspection purposes for as long as the installation is in operation."

The above statement mentions a Responsible Person. This person can change throughout the life cycle of a depot (from design through to build and operation) and does not necessarily have to have EMC competence, but does need access to EMC competent personnel if required. The responsible person, as the title suggests, is responsible for holding the EMC documentation at the disposal of the relevant national authority. The operator of the FI must identify their Responsible Person before the FI is taken into service.

Member States are responsible for establishing provisions to identify such persons who are responsible for a FI. UK regulations state that a Responsible Person is "A person who holds a position of sufficient responsibility to control the configuration of the fixed installation" and that "Their name and address must be available on request by the Enforcement Authorities".

Managing a fixed installation

When following the above steps, occasionally an interference issue will be encountered. At the design stages, this is relatively easy to fix: simply by reducing source emissions or boosting victim immunity, whichever is the easiest. In practice though, the mitigation(s) may be expensive or complex. Where a third party is involved, the EMC Directive mentions the concept of the interface, an imaginary boundary across which all disturbances pass, where limits can be set and agreed between parties. In general, the management of EMC interfaces is set out by the EMC Management Plan, which forms part of the EMC documentation for the FI.

Often a “nested” FI is employed for more complex scenarios. For example, a Bogie Drop could be classed as a FI in its own right, being made up from “a particular combination of several types of apparatus” and also being “intended to be used permanently at a pre-defined location”. This smaller FI is ‘nested’ within the larger FI of the depot as a whole, which in turn can be viewed as being nested within the still larger FI of the UK rail network (or relevant part thereof). When combined with the concept of the interface, this is a powerful tool for dividing a very complex installation into more manageable chunks.

Regarding apparatus and equipment to be installed in a depot, there are two ways to show conformance. For apparatus already placed on the market, there should be a Declaration of Conformity, for that piece of apparatus, stating that the apparatus is fit for a given environment. It is sometimes the case that apparatus to be procured does not meet the requirements for a rail environment; in this case a gap analysis can be performed or the apparatus re-procured.

For apparatus that is made specifically for the FI, and is otherwise not commercially available, then the manufacturer must detail installation procedures sufficient to maintain the conformity of the overall FI. The responsible person should pay particular attention to such apparatus from the earliest stages and obtain suitable assurances (backed up by evidence) that the apparatus will maintain compatibility with the defined environment.

On-site EMC testing at locations around the fixed installation (to EN 50121-2 for a depot) may be required, both before energisation to measure the baseline electromagnetic environment, and after energisation to both compare with the pre-energisation results and to confirm that the installation meets the requirements for emissions. The need for such measurements should be identified in the planning stages.

The guidelines have some suggestions for how to apply good engineering practice. Definition of border lines / geographical boundaries of the FI is recommended to aid with the interface definition. This is particularly relevant to depots, as they are invariably connected to the rail network, and often squeezed in to compact areas, meaning interface definition is of paramount importance. For a depot with such interfaces, these will be defined, and controls outlined in the EMC Management Plan.

Another suggestion is “Suitable Technical Behaviour”, which takes account of recognised Standards and codes of practice. In the rail environment, the EMC management structure suggested by Network Rail will provide this.

The practices above (good engineering practice, interface management and suitable technical behaviour) shall be documented both on completion and for any future changes. UK regulations state that for as long as the FI is in operation the Responsible Person shall have documentation demonstrating

compliance of the FI with the Essential Requirements available for the Enforcement Authority to inspect.

Final thoughts

It is important for the depot to ensure that compatibility is considered from the outset and will be met, achieved by defining the environment and ensuring a coherent set of requirements for apparatus and smaller FIs within the depot environment.

There are some useful questions that will help the responsible person through the process of EMC for FI's, answering these will help greatly when the EMC documentation is being complied for handover:

- what is the EMC environment?
- what are the EMC requirements? Do the requirements match the environment?
- is there an EMC plan?
- are there recognised quality/competency systems in place?
- how will deviations from the plan, the specifications, or the declared environment be resolved?
- what documents will be produced? Are they sufficient to demonstrate compatibility?

Want to learn more?

At Eurofins York, we provide training on all aspects of EMC, including the EMC in Railways. This 5 day course is designed to deliver an in-depth study of EMC in the complex railway environment. It will provide an understanding of its importance and the need to manage EMC from project concept to completion.

The legal EMC requirements will be explained and how these are satisfied by use of standards and the Technical Documentation.

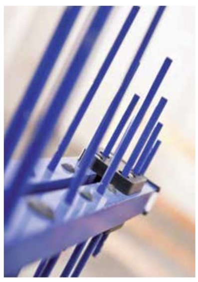
The course includes general EMC background topics such as EM waves and radiation, decibels, the EMC Directive and commercial standards. Railway specific topics include an introduction to railway EMC standards, overview of signalling, threats and AC and DC traction.

The course also covers technical documentation, interoperability and EMC management throughout the project.

Topics covered:

- The power feeding arrangements in ac and dc railways
- The EMI threats posed by traction drives
- How unwanted signals couple into lineside S&T cables
- How to shield/screen equipment; the effects of earthing strategies on 'touch' potentials
- Practical immunisation case studies Railway EMC measurements both at the trackside and within the laboratory

We also run courses to share our knowledge of electrical safety and equipment. For more information please visit our website www.yorkemc.com.



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