

IRIS
International Railway
Industry Standard

GUIDELINE 3 : 2013
MAINTENANCE

English

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Guideline 3 : 2013

MAINTENANCE

1 INTRODUCTION

The aim of this guideline is to define clearly the specificities of the maintenance business required to comply with the IRIS requirements.

2 PURPOSE

Maintenance in rail sector is necessary in order to guarantee the safety, the availability, the comfort of the customer. It shall also enhance the life time of the products throughout the life cycle cost management. Compared to other industries, the rail sector has to comply with regulatory requirements and their evolutions. The maintenance carrying out is mainly heavy due to infrastructure constraints and needed means to have access to the products. Risks linked to the intervention are more accurate. The maintenance paths are very often out of proportion of the activity to be realized.

Maintenance activities are ensured either by the network operators, either by the system integrators, or by the equipment manufacturers or by private maintainers regarding the contracts or the necessary competences.

Maintenance activities can be both operated autonomously or combined with organization's manufacturing operations.

3 TERMS, DEFINITIONS, ABBREVIATIONS

The IRIS standard annex 5, defines maintenance as the combination of all technical and administrative actions, including supervision actions, intended to retain a Product in or restore it to a state in which it can perform a required function. (IEC 62278 § 3.21).

The IRIS standard also considers maintenance as an activity covering fleet Maintenance, refurbishment and Component overhaul/repairs (see IRIS booklet chap.3 § 1.2).

The maintenance activities as understood by IRIS are:

- ▶ Fleet maintenance: either single rail vehicle type or full operated fleet,
- ▶ Refurbishment: Modernization or renovation to more actual state of art, regulation or law,
- ▶ Component overhaul/repairs: Upgrade or put in conformity again.

The maintenance activities can be broken down by:

- ▶ Type:
 - o Containment maintenance: not planned but with immediate action (safety related, accident, vandalism, failure),
 - o Corrective maintenance: not planned but with action done during next scheduled intervention (train functions, not safety related issues for operations, to sustain a containment action),

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- o Preventive maintenance: planned action (maintenance plan),
- o Predictive maintenance: output of analysis (Return of Experience, statistical analysis, physical capture of data).

► Level:

- o First level: it includes actions monitoring service performed before the start, during or at the arrival of operation. Some of these actions can be performed by the agents in charge of the operation (driving agents, commercial agents, etc.) or use monitoring devices and automatic recording airborne or ground (hot box detectors, etc.).
 - light maintenance on rail vehicles (e.g. lubrication, cleaning, adjustments, ...),
- o Second level: it includes audits, tests, rapid exchange of replaceable equipment and interventions of limited duration. These activities can be generally carried out at intervals agreed between the two circulations, so as not to disrupt the operation program. This level corresponds to particular interventions on train site preparation.
 - light maintenance on rail vehicles with/without specific tools (e.g. part exchange, ...),
- o Third level: it corresponds to actions done in maintenance workshops. It features well interventions periodic visits and preventive removals of organs triggered according to criteria or a number of usage units. The withdrawal of the vehicle from operation is usually necessary. This level also corresponds to the actions of preventive and corrective maintenance requiring more complex settings or exchange components.
 - dismantling of systems for investigation and/or repair (e.g. bogie, HVAC, ...),
- o Fourth level: it includes major maintenance actions, generally referred to revisions (in modular subassembly or rolling stock). These actions include procedures involving the control of a technique and/or a particular technology and/or implementation of specialized support

- equipment. This level also corresponds to the corrective maintenance of subassemblies of complex deposited equipment and heavy repair of vehicles due to traffic accidents (collisions, etc. ...)
 - on a system in a dedicated workshop (e.g. wheelset, compressor engine, ...),
- o Fifth level: It includes production operations for upgrades and/or to accommodate changes.
 - on a sub-component in a dedicated workshop (e.g. bearing).

► Unit:

- o Line Replaceable Unit (LRU): e.g. door system,
- o Component: e.g. Door Control Unit (DCU),
- o Sub-component: e.g. printed circuit board (PCB). This unit is also called "Shop Replaceable Unit – (SRU)" in some cases.

Maintenance Terminology can be also found in the EN 13306 Standard.

Note 1: Application for signalling on wayside:

The maintenance activities for signalling equipment are managed with limited levels and types:

- *First Level: Repair or replacement of wayside equipment and facilities centralized locally.*
- *Second Level: Maintenance in a specific workshop (Maintenance Depot) with test benches.*
- *Third Level: Maintenance of equipment takes place on site but in a supplier Centralized Centers of Services (CCS).*

Consequently, the units are limited to LRUs (level 1&2) and SRUs (level 2&3).

Note 2: *The understanding and/or the above definition of the maintenance levels can differ regarding the actors: operators or system integrators or equipment manufacturers.*

4 IRIS MAINTENANCE REQUIREMENTS

The IRIS standard can be considered as a set of good practice in the rail maintenance activity as well as in the other rail activities (manufacturing, design and development).

As an activity within IRIS, it is possible for companies to be certified according to the IRIS requirements and to be awarded with an official IRIS certificate, in line with the IRI certification process.

Maintenance may include manufacturing and/or design activities.

IRIS has defined the possibility for a location to manage (include in their certification) site extensions. This aspect is particularly applicable in the maintenance field with the numerous “depots” organized around train projects either during the warranty period or for the maintenance period itself. It is the responsibility of each organization to assess and define the adequate way of control/certification of these locations (size, structure, risks, ...).

5 RESPONSIBILITY

The different actors and their duties in the maintenance process are:

- The carbuilder is responsible for the rail vehicle maintenance plan (for signaling onboard & wayside it's the responsibility of the system designer), which has to be consistent with the component maintenance plan,
- The owner of the fleet ensures a fully operational fleet,
- The operator ensures the availability of the product for the maintenance,
- The maintainer ensures the performance of the maintenance activity,
- The suppliers (operator, system integrator, equipment manufacturer, distributors, ...) provide products or services to the maintainer.

In the European context, a preliminary maintenance plan is delivered for each subsystem by the applicant in the Technical File at the authorization for placing into service, as requested by the Railway Interoperability Directive 2008/57/EC. For each vehicle authorised, an Entity in Charge of Maintenance shall be identified and recorded in the national vehicle register.

6 MAINTENANCE PROCESS

6.1 Management of maintenance

To properly and punctually manage the Maintenance activity, an Organization should address the following main questions, e.g.:

- **WHEN.** After commissioning and during the whole life cycle of the Product;
- **WHAT.** All the rail products are potentially subjected to maintenance;
- **HOW.** To specify how maintenance should be carried-out and how the results should be documented and recorded;
- **WHO.** Always related to contractual terms;
- **WHERE.** To determine whether the maintenance should be carried-out on track, in depot or in a workshop regarding the type, level or unit defined in clause 3 above.

Such and similar concerns should be included by the Organization into the documentation of Organization's Business Management System.

6.2 Applicability

The specificities of the maintenance business are mainly linked to the following three key drivers:

- The maintenance plan which is the basic document defining the activities,
- The resources where some particular focus has to be put,
- The IRIS processes with priority or particular application.

In the following paragraphs, you'll find a detailed approach of these drivers.

6.3 Execution

6.3.1 The maintenance plan

The maintenance plan contains the following information:

- List of safety related parts and related actions,
- Maintenance paths (frequency or periodicity),
- Verifications and check-ups,
- Documental references (maintenance or product drawings, RAMS analysis, standards, ...),

- Links to the maintenance levels,
- Requests further tasks and documents (Maintenance Management Plan, work instructions, ...),
- Needed specific tooling and means,
- Breakdown by equipment and functions (incl. localization and amounts),
- Description of the actions (general tasks),
- Constraints for procurement and storage of spare parts,
- Estimated lead time versus resources,
- See example in 7. Annexes below

6.3.2 The resources management

6.3.2.1 Skills of the teams

There are generally validated competences matrixes to manage the qualification in comparison with the maintenance levels.

Adequate educational background is required regarding the activities (mechanical, electrical, electronics, information systems) with additional tests.

A focus is put on the qualification on special processes (welding, crimping, ...) as well as specific inspection (non-destructive testing).

6.3.2.2 Training

Systematic induction plans are established in order to reinforce several behaviors like:

- Train Safety,
- Environment Health Safety,
- Specific tasks (dismounting, ...)

As authorizations are necessary to carry out some tasks, special trainings are done (e.g. electrical, handling, ...) with validation. Some need regular updates.

6.3.2.3 Infrastructure

Due to the localization of some equipment, they may always be accessible in the maintenance workshops. Therefore, means have to be adapted to be in capacity to intervene on, according to the maintenance plan.

Regarding the level of maintenance, a coordination of the available means and resources is to be done.

Some maintenance activities will need an intervention directly on the network, the availability of special means (jitney, crane, ...) is then required.

All infrastructure means might be adapted, qualified, validated and maintained in order to be in line with the maintenance activities requirements.

6.3.3 The process specificities

6.3.3.1 Design

6.3.3.1.1 Configuration management

The defined configuration of the vehicle/product is known when the maintenance period starts.

During the whole life time of the vehicle/product, the maintenance activity will always maintain the status of this configuration by controlling all updates.

6.3.3.1.2 Documentation management

All documents related to the technical status of the vehicle/product will be managed in order to guarantee a controlled update.

Proposals to update the maintenance plan can be made by taking into account the return of experience as from the first maintenance path. These modifications will be validated by the design authority.

6.3.3.1.3 Design for maintenance (refurbishment, LCC)

The design of Original Equipment Manufacturing parts is focused when maintenance optimization on mid or long term is targeted.

Following constraints have to be taken into account at very early stage of design:

- o Accessibility during maintenance,
- o Easy dismounting,
- o Intervention time for maintenance path,
- o Tooling and infrastructure in general,
- o Needed competence of operators,
- o Targeted Life Cycle Cost (wear parts, maintenance path, ...),
- o Obsolescence issues,
- o Safe maintenance operations,

- o Include the Maintenance Return of Experience systematically in new design,
- o Being able to test the product in its operational environment,
- o Environmental friendly (recycling, REACH, ...)
- o

The design authority has to be clearly defined at early stage for safety related decisions.

6.3.3.1.4 Control of change

Changes on products, systems, sub-systems are generated by:

- o Lack of reliability,
- o Obsolescence (products or suppliers),
- o Wear impacting other products,
- o Evolution of standards, regulations, laws,...
- o Evolution of needs, operations,...
- o Cost optimization,
- o Specific event: accident, incident, weather,...

The decision for change is taken by knowing all consequences for the customer and the maintainer. The full supply chain is generally involved when a design change is validated.

The applicable design and validation file is always the basis for analysis of a change request. It is key that the file is up to date.

The design change is to be validated according to the defined process in the management system of the design authority.

The impact of the change on the existing fleet (and OEM production if applicable) will be analyzed and the implementation will be organized adequately.

Regarding the criticality of the change or product, a rather simple or complex verification/validation process will be started in accordance with the existing organization process.

The design and validation files are always updated in order to ensure latest configuration.

6.3.3.1.5 Re-validation

After a product, sub-system or system has been put into operation, the design responsibility becomes a design authority.

This design authority will take the responsibility of decision and re-validation of the evolutions.

The design authority can remain at equipment manufacturer or system integrator level or can move to the operator or any other competent authority in given situations.

In the European regulation, no "design authority" is defined; the conditions under which a subsystem needs a new authorization is defined by the EC Railway Interoperability Directive 2008/57/EC.

It is the duty of the maintainer (Entity in Charge of Maintenance in case of vehicles) to ensure that the subsystem under his responsibility is maintained in order to remain into its design operating state.

6.3.3.1.6 Safety aspects

The current legislations are applicable in all cases.

In Europe, "Safety" is an essential requirement defined in the annex VI of the Interoperability Directive 2008/57/EC. In addition, the relevant Technical Specifications for Interoperability (TSI) lay down essential requirements for each subsystem.

6.3.3.1.7 FAI validity

FAI is to be re-taken by the producer in accordance with its management system (in full or partially regarding the evolutions) in case of:

- o Change of maintenance provider,
- o Supplier and/or supplier site change,
- o Production stop for specify time,
- o Industrial process change,
- o Product change.

6.3.3.2 Requirement management

The requirements related to maintenance are linked to the system, sub-system or product performance.

The performance criteria are generally assessed versus availability, reliability and safety.

The customer expects an effective service in order to be able to provide the operations according the performance needs.

6.3.3.3 Service provision

The service provision is largely linked to the reactivity of the organization to achieve the maintenance objectives (e.g. full on time).

Therefore, the organization has to manage resources, means, parts in a way which guarantees the respect of the customer requirements and needs.

It is recommended to have a preventive approach in this respect.

6.3.3.4 Containment planning

The organization has to be flexible enough in order to always take into account the containment actions notwithstanding the scheduled tasks in the maintenance plan.

6.3.3.5 Multi-Sites

If applicable, the organization has to implement an industrial organization where the lead unit is clearly identified versus the participating units. In each case, all the responsibilities, activities, scopes are defined.

6.3.3.6 Supplier engagement

During the maintenance period, the suppliers may be involved in following situations:

- Tender process
- Project Management,
- Providing spare parts,
- Non-conformities treatment,
- Design change (see 6.3.3.1.4 above),
- Reliability issues,
- Obsolescence management,

- Sub-contracting of maintenance activities,
- Documents update (manuals, documentation, drawings).

It is expected to ensure expertise and reactivity when involved.

Suppliers' Management System aims to deploy a robust system that will provide the maintenance activities with reliable sourcing of high quality resources, decreasing purchasing costs and disruption risks. From the process approach point of view supplier's management system can be described as a set of the following interrelated and interacted core processes:

- Suppliers' policy development and planning of suppliers' portfolio;
- Organization of assessment and selection of suppliers for inclusion in organization's suppliers' portfolio;
- Monitoring and ranking of the suppliers' portfolio;
- Strategic supplier's development. Auditing suppliers or delegate this function to the third party is very essential for the Suppliers' Management System. One factor that can be used during supplier's selection and evaluation using complex expertise methods is supplier quality data from objective and reliable external sources (e.g. from accredited certification bodies, government authorities).

6.3.3.7 Spare parts and repairs

The maintenance plan is an input for the definition of the spare parts needs during the maintenance period (preventive maintenance).

Second input is always the Return of Experience of the maintenance provider for similar products through methods such as FMEA studies (corrective maintenance).

The Return of Experience of the operator is used to determine the needs for accidents and vandalism (containment maintenance).

The consignment stock is a particular and important element of the corrective maintenance dedicated exclusively to the warranty period. The definition of this

stock (items and quantities) is done at an early stage of the OEM design taking into account data from RAMS and FMEA analysis.

The spare parts stock (consignment & others) needs to be always managed in configuration to ensure the availability of up to date products.

Some products may be repaired during their life cycle. These are previously defined.

The maintenance organization is understood to take appropriate measures to prevent the purchase of counterfeit and suspected unapproved parts.

6.3.3.8 Knowledge management

During the maintenance period, the management of the life of the products and the relation towards the performance, the life time or the maintainability may generate updates of the maintenance plan.

This knowledge will permit greater availability of the products, costs efficiency and optimization of the maintenance tasks.

The knowledge management is the corner stone of the continuous improvement for the OEM products. It will validate the previous assumptions and generates new improved products.

6.3.3.9 Work environment

In addition to the IRIS requirements, the maintenance activities are frequently done at customer sites, operator premises where specific safety rules apply and personnel has to be trained and respect those rules accordingly.

6.3.3.10 Obsolescence

Obsolescence appears mainly during the maintenance period. It is important to manage this potentiality with a preventive approach by defining the products which may be impacted (RoE, RAMS, FMEA,...). The management of obsolescence has to be initiated at early stage at design responsible level during the OEM design phase. It consists basically to prevent with solutions able to fulfill the need in form, fit and function.

Hereby refer also to the IRIS Guideline 5:2012 – Obsolescence.

6.3.3.11 Homologation

In the European framework the term “homologation” is replaced by “authorization”. All the legal aspects are in this case defined for the mainline network and are described in the Interoperability Directive 2008/57/EC.

The initial homologation of the system, sub-system or product may need a confirmation of its validity or an amendment if modifications are implemented at a certain level (e.g. in the European legislation it is called “renewal or upgrading”). This homologation is given by a relevant rail authority which may delegate the inspection/certification to competent bodies (e.g. in Europe, authorization is delivered by the National Safety Authority and the 3rd party checks are “designated bodies” for national rules or “Notified Bodies” for Technical Specification for Interoperability).

6.3.3.12 Customer service

The commissioning phase is a contractual requirement and as such to be managed within the management system accordingly.

The customer support is mandatorily to be organized, during the warranty period and the upcoming maintenance period, such as non-conformity management, update of technical documentation, supply of spare parts can be provided.

For the consignment stock see 6.3.3.7 above.

6.3.3.13 Customer/supplier relations

In the European context, the regulation 445/2011 “Certification of Entity in Charge of Maintenance” describes the fleet management function. This is currently for mandatory application for freight wagons only.

6.3.3.14 Entity in Charge of Maintenance (ECM)

In the European context, the Railway Safety Directive (2008/110/EC amending 2004/49/EC) defines mainly 2 actors in charge of the safety of the rail system:

- RU: Railway Undertaking who operates the vehicles,
 - IM: Infrastructure Manager who manages the network,
- supported by the ECM, Entity in Charge of Maintenance, for their maintenance activities for which they are fully responsible.

Each vehicle needs a registered ECM.

The regulation 445/2011 defines also a certification system for ECM and is currently only applicable for freight wagons. The extension to all type of vehicles is foreseen in the coming years.

6.3.3.15 Statutory/regulatory requirements

In the European context, operation and maintenance are regulated exclusively for mainline by the Railway Safety Directive (2008/110/EC amending 2004/49/EC), and the related regulation 445/2011 "Certification of Entity in Charge of Maintenance" and 1078/2012 "Common Safety Methods for Monitoring".

For other networks than mainlines, national, regional or local requirements may apply.

These requirements may concern all aspects linked to the maintenance in terms of organization, workshop, and validation.

6.4 Other specific approaches

6.4.1 Refurbishment

The particularism of refurbishment at fleet level is that IRIS clause 7.7 "Project Management" applies in full. At product level, it might be either a new or a repaired item and managed as such by the organization management system.

6.4.2 Best practices

A regular structured analysis of the reliability data (RoE) of the functions permits to improve product design and maintenance plans.

6.4.3 Open Issue Lists

If all issues are reported in a central database, the operator can organize the preventive and corrective maintenance in a more efficient way.

Moreover, the statistical analysis will generate the Return of Experience and feed the knowledge management system.

7 ANNEXES

Example of Maintenance plan:

A UNIFE initiative supported by

The rail industry



Pushing Performance



The rail operators



The rail associations



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