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WRIST - Grant Agreement 636164

Innovative Welding Processes for New Rail Infrastructures

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## Deliverable D2.4

Draft requirement for operator training  
and on-site operational procedure



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## 1 Introduction

In accordance with Task Package 2, a device (module 1.0) has been developed and constructed to carry out aluminothermic welding with automated alignment, forging and partially automated shearing. This module is used in laboratory tests to create welds to produce a technology that makes it possible

- to carry out partially automated aluminothermic welding,
- to record the resulting welding data,
- to store the data either locally or on a server and subsequently to evaluate it.

In order to carry out all these activities, the operator or welding team must have the appropriate knowledge and skills.

Since, in contrast to the plan, the tests will take place in the lab instead of on the track, this report will have recourse to the experiences gained in laboratory use.

According to the tests carried out in the lab to date, it is possible to identify the following key skills:

- theoretical and practical knowledge of aluminothermic welding
- workplace safety during welding and behaviour when working on the track
- knowledge of how to use hydraulics and hydraulic controls
- knowledge of how to use the process control system, and IT knowledge

## 2 Necessary skills

### 2.1 Theoretical and practical knowledge of aluminothermic welding

Despite the fact that this is a semi-automated process, the personnel operating module 1.0 must have the abilities and mechanical skills of an aluminothermic welder so as to understand the process and be able to intervene manually at any time.

Observations as to the necessary skills are based on the assumption that the semi-automated welding process using module 1.0 is a welding process certified to EN 14730-1. This is the only permissible application in EU countries. This document does not deal with requirements for applications outside of the EU.

Requirements as to the content of the training completed by an aluminothermic welder are described explicitly in EN 14730-2, section 4.1, e.g.

-Knowledge of the welding process made available by the process supplier and of the work instruction describing the process

-Basic safety provisions in relation to the welding process

-Cause and effects of completed work that does not comply with the regulations

- Importance and meaning of warning symbols
- Basic skills in grinding rail joints (welding transition regions)
- Clear checking of the weld

Training is provided by an institution certified by the railway company.

## **2.2 Use of hydraulics and hydraulic controls**

Module 1.0 is a device driven by hydraulics; in other words, the cylinders for clamping the rails, for reinforcement, the forging and shearing processes, and also the measuring sensors for alignment are hydraulically actuated.

The module operator must be capable both of operating the hydraulic system and of understanding how it works. Ideally, the operator should be capable of making minor repairs to the hydraulics themselves. In this case it is crucial that the operator has acquired general knowledge of the maintenance of hydraulic units.

Owing to the high pressures and associated risks, workplace safety is of fundamental importance. The operator should be able to transfer the system safely to an unpressurised state.

It is therefore essential that intensive instruction in the hydraulic components is provided by the manufacturer of the module. Furthermore, handling of hydraulic oils is an important point for the future in respect of environmental protection during track applications. Another point that should be taken into consideration is fire protection and specifically how to deal with the combination of molten steel and hydraulic oil. The operator must take every precaution, in addition to the measures incorporated in the design, to ensure that the hydraulic components of the module are protected against steel spatter, runout and excess heat radiation. There should be clear instructions for what to do in the event of an accident.

## **2.3 Knowledge of how to use the process control system, and IT knowledge**

Module 1.0 is controlled using a process control system. This includes the option of selecting different operator levels. At the lowest operator level, the operator can only call up predefined procedures and execute these in a partially automated manner, without being able to intervene in the details of the process.

This mode is used in standard operation.

At higher operating levels, it is possible to access the various cylinder groups in detail. This requires corresponding knowledge of the program sequence, as otherwise the machine could be damaged or people could be put at risk.

This mode is used when creating or adapting a welding procedure.

The specification of predefined procedures and the definition of reports for the data produced during welding is carried out using a web browser tool that can be linked to the

control system via the Internet. Here, the operator can define every process step individually and specify the details of the report for each process step.

As an additional function, the manufacturer can provide online support and carry out remote maintenance via the cellular network.

If the operator is also entrusted with evaluation of the welding data, here there is also a requirement for further knowledge for statistical evaluation of the data.

In order to operate the module, there must accordingly be training in different operating levels for operator (user with restricted access) and setter (user with advanced access). Whereas the operator does not need any in-depth knowledge of IT, since the control screens are self-explanatory, the setter requires advanced IT knowledge when using the web browser tool.

## **2.4 General information about working with module 1.0**

### Transport

Owing to its weight, module 1.0 is transported using a specially made lifting beam which ensures even distribution of weight over the frame and takes account of workplace safety accordingly.

### Handling

In laboratory trials it has been shown that the operator team ideally comprises two welders and a module operator. While the welders are dealing with the work steps relevant to welding, one person is responsible solely for controlling the module. Because, by the very nature of the forging process, the time window between forging and shearing is very short, it is awkward for one person to switch between handling at the weld and controlling the module; this leads to rushing and causes errors.

### Protection against the dangers of rail operations

When using the device on a closed track, the specific regulations of the rail operator should be observed.

## **3 Conclusion**

Operation of module 1.0 has a far greater requirement on the operating personnel than was necessary for previous welders of aluminothermic welding processes. Depending on the operator level, different levels of training are required. It would currently seem that expanding the welding team from two to three people is appropriate.