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Carbon Steel Rolling Stock Welding

[Gaziray Project]

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INDEX

1	SUBJECT.....	4
1.1	DEFINITIONS	4
1.2	LIST OF ACRONYMS & ABBREVIATIONS.....	4
1.3	DOCUMENTS AND STANDARDS.....	5
2	TECHNICAL REQUIREMENTS	6
2.1	INTRODUCTION	6
3	GENERAL REQUIREMENT	7
3.1	MANUFACTURING	7
3.1.1	Bogie Frame Manufacturing Process.....	7
3.1.2	Manufacturing Documentation.....	7
3.1.3	Material Preparation Procedures.....	7
3.1.3.1	Preparation of Parts to Be Welded.....	7
3.1.3.1	Consumable.....	8
3.1.4	Implementation Conditions of Welding Process.....	8
3.1.5	Repair Welding	9
3.2	TEST.....	9
3.2.1	Production, Inspection, Testing.....	9
3.2.2	Specific Requirements	9
3.2.3	Calibration	10
3.2.4	Welding Coordinators.....	10
4	ANNEX.....	11

I. LIST OF FIGURES

N/A

II. LIST OF TABLES

Table 1 – Applicable Standards	5
Table 2 – Welded joint validation chart (Extract from EN 15085-3)	6

1 SUBJECT

This document provides the requirements to be applied to the carbon steel rolling stock welding for the Gaziray Commuter Train (EMU) produced by TÜRASAS for urban passenger management.

1.1 DEFINITIONS

Within this document, the following definitions are applied to the words reported below:

- “the End Client” means the Gaziantep Metropolitan Municipality (GAZİRAY)
- “the Administration” means the Turkish Rail Vehicle Industry Co. (hereafter called TÜRASAS)
- “the Designer” means BLUE Engineering that is the company responsible for the design EMU set
- “the Supplier” means the company who wins the tender to supply the good object of this specification
- “documentation” means all or any specifications, drawings, reports, networks, operating and maintenance manuals and all other information whether on paper or on magnetic or other format which is prepared by the Supplier in the course of the contract
- “the Bidder” means the company who want to join to the tender to supply the good object of this specification

1.2 LIST OF ACRONYMS & ABBREVIATIONS

DeBo	Designated Body
EMU	Electric Multiple Unit
EN	European Norm
FAI	First Article Inspection
IEC	International Electro technical Commission
ISO	International Organization of Standardization
LRU	Line Replaceable Unit
N/A	Not Applicable
NoBo	Notified Body
PRM	Person with Reduced Mobility
RAMS	Reliability, Availability, Maintainability and Safety
SI	International System
TBC	To be confirmed
TBD	To be defined
TOR	Top of Rail
UIC	Union International Chemin de Fer

1.3 DOCUMENTS AND STANDARDS

Standard	Year	Title
EN 15085 - 1	2007	Railway applications. Welding of railway vehicles and components. General
EN 15085 - 2	2020	Railway applications. Welding of railway vehicles and components. Quality requirements and certification of welding manufacturer
EN 15085 - 3	2007	Railway applications. Welding of railway vehicles and components. Design requirements
EN 15085 - 4	2007	Railway applications. Welding of railway vehicles and components. Production requirements
EN 15085 - 5	2007	Railway applications. Welding of railway vehicles and components. Inspection, testing and documentation
EN 15614	2019	Specification and qualification of welding procedures for metallic materials. Welding procedure test. Arc and gas welding of steels and arc welding of nickel and nickel alloys
ISO 14731	2019	Welding coordination - Tasks and responsibilities

Table 1 – Applicable Standards

2 TECHNICAL REQUIREMENTS

2.1 INTRODUCTION

The scope of this document is to supply guidelines about design and construction of carbon steel welded structures for rolling stock.

The present document is of general application for manufacturing carbon steel welded structures and assemblies.

It is not intended to cover specific requirements that could be requested by a particular product or purchasing order.

The specific product requirements shall be managed with dedicated documents: drawings, technical specification, manufacturing specification, etc.

This is valid also if the requirements from the End Client are the same but more stringent than those mentioned here.

Welding joints design shall be performed in accordance to the norm EN 15085-3.

In particular, the following process shall be followed by the design and verification team.

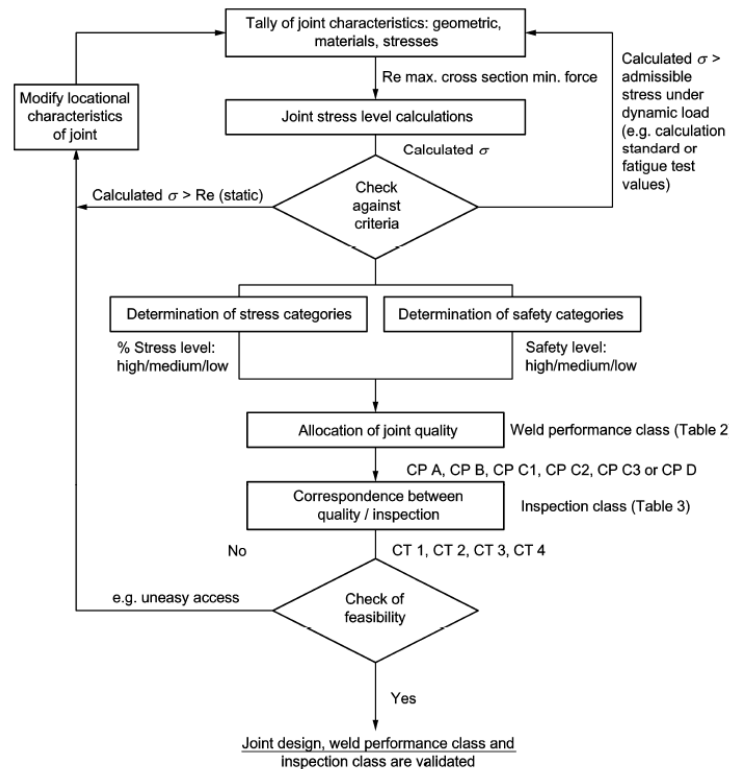


Table 2 – Welded joint validation chart (Extract from EN 15085-3)

The admissible stress (static and dynamic) shall be defined at project level.

3 GENERAL REQUIREMENT

3.1 MANUFACTURING

3.1.1 Bogie Frame Manufacturing Process

The Supplier shall manufacture the bogie frames according to TBG-Z-221 numbered document.

3.1.2 Manufacturing Documentation

Manufacturing documents specified in EN 15085 for each welded assembly shall be prepared by the Supplier. These documents are listed below:

- WPQR; Welding Procedures Qualification Records according to EN 15614-1
- WPS; Welding Procedures Specification according to EN 15609-1
- Mock-up Plan; Production Welding Tests
- Welded Manufacturing Workflow Form;
- Welded Parts Assembly Tracking Form;
- Welder/Operator Tracking Form;
- Welding Inspection Personnel Certificates
- Welder/Operator Certificates (ISO 9606-1, ISO 14732)

While the welding method approvals are being prepared, the test pieces and tests to be produced shall be carried out under the supervision of TÜRASAS. Welding qualification records, test records and production weld test records to be prepared by the Supplier shall be submitted to TÜRASAS for approval before the first product inspection. After the first product inspection, necessary revisions will be made and submitted to TÜRASAS for re-approval. Approved documents will be delivered to TÜRASAS in two (2) copies on CD (softcopy) and paper (hardcopy).

3.1.3 Material Preparation Procedures

3.1.3.1 Preparation of Parts to Be Welded

All parts used in the manufacture of welded steel construction shall be manufactured within the dimensions and tolerances given in the technical drawings.

Welding bends shall be opened by machining method.

In the preliminary preparation of welded steel construction parts; in the cutting process, plasma or laser cutting method or cold cutting methods (cutting by machining, cutting with scissors or cutting on a punch bench, etc.) shall be applied.

Welding joints in cast and forged parts shall be grinded each time to clear them of rolling and casting shells.

All the detailed parts used in the production of the bogie frame shall be sandblasted in the part sandblasting facility until the surface quality of ISO 8501-1 Sa 2½ is obtained in order to prepare for the welding process, and all the rust, dirt and slag layers on the surface shall be removed.

Local rust, dirt and slag layers that cannot be removed by sandblasting shall be mechanically removed.

3.1.3.1 Consumable

On the packages of welding consumables (welding wires) there shall be the DB sign, which means "Suitable for use on German Railways". The welding wire shall be SG3.

The packaging of the welding wires shall include the following information.

- Commercial name,
- Its abbreviation according to the relevant standard,
- Dimensions,
- Approvals (DB approval signs)
- Necessary health and safety warnings

Shielding gas tubes shall comply with the requirements of ISO 13769.

3.1.4 Implementation Conditions of Welding Process

The implementation conditions of welding processes are given below:

- Gas metal arc welding method (135/MAG) shall be used in welding processes.
- Welding operation shall be carried out in a closed place.
- The surfaces to be welded shall be dry and welding shall not be performed if the ambient temperature is below 5°C.
- In the place where shielding gas is used, special precautions shall be taken if the air flow affects the source.
- Welding joints, welding area and its surroundings shall be purified from rust, grease, oil and other foreign materials. Harmful substances such as oxide elements and flame wastes that occur during cutting shall be cleaned.
- Welding joints shall be cleaned with a wire brush before welding, if there is still rust on the surface, the surface shall be cleaned by grinding, milling, filing or scraping until a clean surface is obtained. No rust shall be allowed in the welding mouth in any way.
- Tack welds are made to temporarily hold parts until the final weld is done. Tack welds shall be made as little as possible. The weld filler metal used in tack welding shall be the same as that used in the last welding and must be removed before the final welding.
- Cracked parts of tack welds shall not be welded without cleaning the crack. In multi-run welds, welding shall not be continued until the slag of the previous pass has been completely removed. Welding shall be resumed after porosity; visible slag inclusions or other weld defects and cracks have been repaired and machined.
- No arc shall be formed between the parts to be welded and the additional metal outside the junction.

- Welds shall be made in PA and PB welding positions according to ISO 6947. In order to provide these positions, all welds shall be welded in the positioners. Welding seams must have clean and smooth surfaces with sufficient penetration and smooth transitions to the base material. Excessively high welding seams shall be avoided.
- In butt welds, additional pieces shall be added to the beginning and end of the weld to ensure that the weld starts and ends outside the joint length. These parts shall then be removed by mechanical ways. The material of these additional parts shall be the same or suitable for the main material.
- No fractures or cracks that may occur due to impact shall not be allowed. Cold hammering shall not be allowed in the last pass.
- Care shall be taken to ensure that the last pass welds are parallel to the stress directions.
- After welding; welds and their surroundings shall be cleaned until a flat surface is obtained and burrs shall be removed.
- After all welds are finished, the piece shall not be removed from the stand until it cools completely.

3.1.5 Repair Welding

All repairs shall be made according to a repair procedure prepared by the Supplier and approved by TÜRASAS.

Repairs shall be made by certified welders according to ISO 9606-1.

The repair area shall also be checked and tested in accordance with the original welding requirements.

The repair process shall not be more than three on the same part, the parts that are not suitable for repair shall be remanufactured.

TÜRASAS shall be informed in writing before the repair process.

3.2 TEST

3.2.1 Production, Inspection, Testing

The manufacturer of welded structures shall be certified in accordance to the norm EN 15085-2. Welded structures (complete assembly or partial sub-assemblies) production, inspection, testing and documentation shall be performed in accordance to the norms EN 15085-4 and EN 15085-5.

3.2.2 Specific Requirements

If the drawing requires the execution of the stress-relieving treatment after the welding process, the structures shall be subjected to the following heat treatment in an oven:

- initial temperature: 200 °C max
- heating to 590 ± 15 °C, with heat increment gradient of between 60 and 150 °C/h
- stay at a temperature of 590 ± 15 °C for a period of at least 1 h and not longer than 3 h
- cooling to 200 °C, with a heat gradient not to exceed 120 °C/h
- continuation of the cooling process in still air

Any different stress-relieving cycles shall be expressly indicated in the construction drawings of the structures.

The necessary venting holes shall be represented in the drawings.

3.2.3 Calibration

Plastic deformation interventions on the welded structures should be avoided as far as possible but could be admitted if they were indispensable (e.g. size and shape corrections, etc.).

However, such interventions shall be performed with the following precautions:

- for cold deformation processes: the strictly necessary load-effect shall be applied in a gradual manner, so as to prevent the occurrence of a permanent elongation of over 4% in any zone of the structure
- for heat deformation processes: it is necessary to resort solely to heat expansion and shrinkage processes; the max tolerated heat temperature depends on the parent material.

For example: S355J2, normalized steel:

- heat point, heat line: $T \leq 800\text{ °C}$
- all other heat figures: $T \leq 700\text{ °C}$

It is forbidden to operate with hammer blows or sudden load-effects.

3.2.4 Welding Coordinators

Welding coordinators shall be in accordance to ISO 14731.

4 ANNEX

Annexed documents

TŞ-01.139	General Technical Specification
TŞ-B00.0001	Bogie Frame Technical Specification
TBG-Z-221	Preliminary manufacturing process of motor and trailer bogie frames

END of DOCUMENT