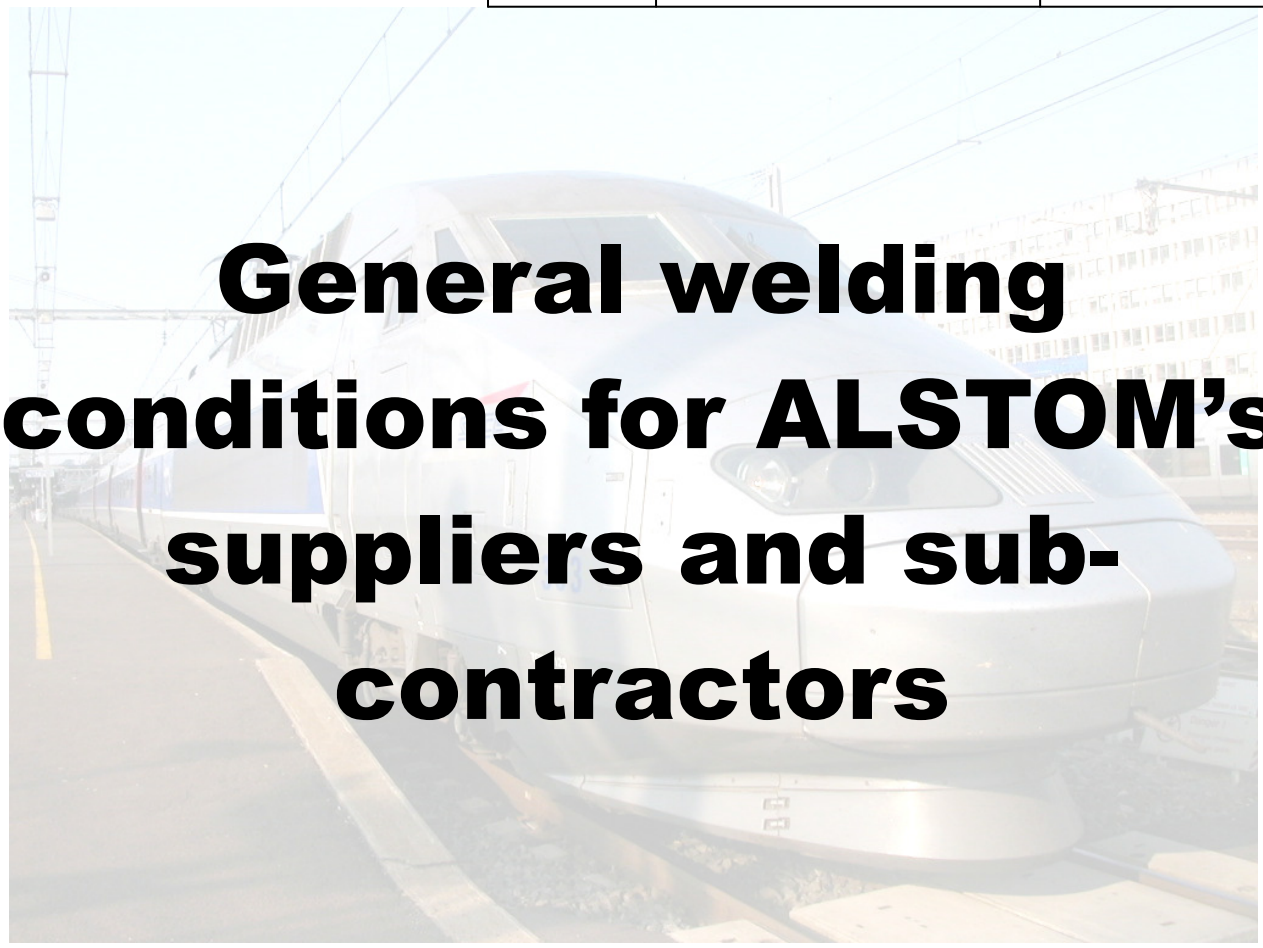
ENG'G & DESIGN DEPT.	APPLICATIONS (Series of equipment or machines)	No. of GROUP DRAWINGS



General welding conditions for ALSTOM's suppliers and sub-contractors

IDNR

			Date	Name
		Drawn	01/02/06	J.GOUBIN
		Checked	03/02/06	P.PEIGNON
		Scale	/	
	Creation - 01/02/06			
A		General tolerances Syntax modif.into English		
	Manufacturer Modifications			
B	Compliance with CEN TC256 WG31 N0047			
C	Series CCN Structure		Date	Name
D	Series CCN Structure			
E	Series Sourcing 16/01/07	Drawn		
F	03 / 12 / 2008			
G	21/01/09	Checked		
H	30/06/2010			
I	2014-07-28	Homol.		
J	2016-09-23			
	Network modifications			

ALSTOM SA

ALSTOM

Version : English

WELDING CONDITIONS FOR PURCHASED OR SUB-CONTRACTED MECHANICALLY-WELDED PARTS

Replaces :

DTRF 150215 J

Format	Sheet N°	Sheet No.
A4	1 / 14	

TABLE OF MODIFICATIONS

Revision	Date	Content of Modification	Author
J	2016-09-23	Addition of Annex A and corrections of errors	M. Strothmann
I	2014-07-28	All chapters according to return of experience	M. Strothmann
H	30/06/2010	All chapters according return of experience	G. Villemin
A	01/02/2006	Création	J. Goubin

	Name	Position	Date	Signature
Written by:	Martin Strothmann	*Welding coordinator* ATSA	*2016-10-24*	
Verified by:	Alberto Carneros-lara	*Welding coordinator BCN*	2016-10-25	
	Sebastian Ciron	*Welding coordinator* FBO		
	Hugo Mezin	*Welding coordinator* FLO		
	Krzysztof Cetnarowski	*Welding coordinator* KTW		
	Cédric Laurençon	*Welding coordinator* LRH		
	Christophe Hitter	*Welding coordinator* REI		
	Antonio Pezone	*Welding coordinator* SAV		
	Martin Strothmann	*Welding coordinator* SLZ		
	Patrick Cestari	*Welding Auditor* STO		
	Pierre Kornobis	*Welding coordinator* VPF		
Approved by:	Stephane Debavelaere	*Industrialisation & Manufacturing Engineering Director*		
	Bernard Tritz	*Carbody Shell Metier Director*		

Any changes to the present specification will be made during a meeting and with the agreement of the committee members mentioned above.

CONTENTS

SUBJECT

In this specification ALSTOM defines the general welding conditions for rail vehicles and rail components that sub-contractors or suppliers – external to Alstom – have to fulfil.

The purpose of this specification is a clear definition of the general welding conditions, which are demanded by different European and international standards, to avoid a later refusal of the welded components by the final customer of ALSTOM.
A refusal of single chapter of this specification by the supplier or subcontractor can be possible if this is agreed by a Senior Expert about welding of ALSTOM regarding the project necessities.
A refusal of the whole specification by the supplier or subcontractor is inacceptable in any case, because it shows the refusal of general and specific welding standards like e.g. EN ISO 15614 or EN 15085 by the supplier or subcontractor.

This specification does not concern sub-contractors carrying out design work for Alstom and who fall under the responsibility of the Alstom Design Engineer.
This specification does not concern the transfer of welding activity from one Alstom site to another.
This specification is not retroactive and is applicable from January 1st 2017.
The English version is the reference version.

1. FIELD OF APPLICATION

This specification is intended for Buyers.
It specifies the methods of manufacturing and acceptance of welded parts in steel or in aluminum alloys.
It defines the rules to be followed in order to guarantee welding inspection in compliance with series of standards EN ISO 9000, EN ISO 3834 and EN 15085.
If there is no other demand, the relevant national, European or international standards and guidelines must be used according to their last valid revisions.

Table 1: Application of DTRF 150215:

Design	Industrialisation	Production and/or Inspection	Application of DTRF 150215
ALSTOM (also subcontracted)	ALSTOM	ALSTOM	Not applicable
ALSTOM (also subcontracted)	ALSTOM	Supplier	Not applicable
ALSTOM (also subcontracted)	Supplier	Supplier	Applicable
Supplier	Supplier	Supplier	Applicable For the design of welded components additional ALSTOM Transport documents have to be considered, if required.

The following ALSTOM standards (DTRF's) must be considered in their last revisions:

- DTRF 150201 thin, medium and heavy carbon sheet steel
- DTRF 150202 profiles in structural aluminium alloy
- DTRF 150203 aluminium castings
- DTRF 150204 steel castings
- DTRF 150207 aluminium forged parts
- DTRF 150208 steel forgings
- EI 150211 design (when the supplier carries out the design)
- DTRF 150016 sheet in structural aluminium alloy

If there is no DTRF code for base metal on drawing, you must apply the correspondence DTRF's according to the class of material.

2. QUALITY REQUIREMENTS ACCORDING TO CERTIFICATION LEVEL

The supplier must have a documented quality system designed to fulfill the requirements of EN 15085 and completed by the present specification.

2.1. Supplier qualification (valid for CL1, CL2, CL3 and CL4)

- Certification according EN 15085-2 is mandatory for CL1, CL2 and CL4

- Because the final customers of Alstom Transport do not recognize the certification bodies systematically, Alstom can refuse the certificate EN15085-2. Consequently, the supplier must verify if the proposed certification body is or not accepted by Alstom. The most customers accept the certificates, which are published on www.en15085.net.
- In all cases the supplier must perform a clause by clause (acceptance or not of the requirements of the present document) according a questionnaire, which will be sent by ALSTOM Transport Supplier Quality Development (SQD) and must be sent back to Alstom in minimum together with the documents listed in chapter 4. Deviations must be proposed to ALSTOM Transport and the supplier must not start works without any previous approval by ALSTOM Transport. Depending on the kind of deviation, ALSTOM Transport can decide at its discretion, if a validation on the field is necessary to proceed.
- The supplier is qualified in case of positive results after audit of qualification performed by supplier quality development (SQD) with the support of a welding coordinator.
- For welded components with certification level CL 1 according to EN 15085-2 a quality plan is required. The quality plan must content all relevant documents for design, stress calculation, production and inspection and has to be delivered to ALSTOM Transport.
- For welded components with certification level CL 1 and CL 2 according to EN 15085-2 design documents, if the design is done by the supplier, work schedule and weld inspection plan (see chapter 2.14.1) are necessary and has to be delivered to ALSTOM Transport.

2.2. Design requirements

If the supplier creates the design for component, which should be purchased by ALSTOM Transport, the supplier has to consider the following issues:

- The demands of EN 15085-3 must be observed for the design of welded components.
- The combination of high safety category and high stress category according to EN 15085-3, which leads to weld performance class CP A, is not allowed for welded joints at components, which are purchased by ALSTOM Transport.
- The stress calculation must consider the demands and requirements of the final customer.
- According to EN 15085-3, chapter 7.4 the drawing must indicate the following specifications of every weld unequivocally:
    - Weld performance class according to EN 15085-3
    - Weld form
    - Weld thickness
    - Weld length
    - Welding consumables (can be defined in other documents)
    - Base materials (can be defined in other documents)
    - Surface quality of resistance spot welds according EN 15085-3, annex F, table F.3
- The definition of the certification level according to EN 15085-2 is necessary for every welded component on the drawing.
- If demanded a list of welded joints according to EN 15085-3, annex A has to be written.

ALSTOM Transport reserves the right to check the design documents (including drawings) by its experts, who can demand modifications, which the supplier has to fulfill.

2.3. Sub-contracting (valid for CL1, CL2, CL3 and CL4)

The responsibility of the level 1 supplier remains fully and it is its responsibility to provide its sub-contractor with all the information necessary to meet the requirements of the present specification and to ensure that the latter is able to meet them.
It is the sub-contractor's responsibility to implement the necessary provisions to obtain the expected level of quality and to maintain these for the whole manufacturing period. According to EN15085-5, chapter 8 audits shall be done in order to assure the requirements of the present document

2.4. Welding coordination (valid for CL1, CL2, CL3 and CL4)

It must be noted that this personnel must be present in sufficient number to ensure the coordination of the welding activity. For the CL3 activities, Alstom requires the presence of a welding correspondent appearing on the organization chart.
The organization thus put in place must be defined by an organization chart. The tasks and responsibilities of each of the actors must be described in assignment sheets. EN 15085-2, annex B may be used in the definition of tasks.

2.5. Welders and operators (valid for CL1, CL2 and CL3)

The following particularities call for a production weld test (to evaluate the skill of the welder see EN 15085-4, chapter 4.2.4 and EN 15085-2, chapter 5.1.1)

- Partially or full penetrated butt joints or T-joint
- Welds on low thickness (0,5 mm for example) or presenting major dissymmetry (thick plate with thin plate)
- Assemblies needing special gestures such as the performance of plug welds, pipe branches…
- Awkward positions / accessibility
- Carrying out TIG remelting

In addition to the requirements of EN 15085, welding personnel must be made aware of, and able to check and decide upon, what is generally referred to as "good practices":

- The state of the welding equipment
- Availability and compliance with work documents (WPS, mounting instructions, weld sequencing, stopping points for intermediate inspection, auto-control, tracking sheet….)
- Conformity of joint preparations

- Conformity of welding consumables
- Preheating temperatures, between runs and post-heating
- Conformity of the weld to the drawing and level of quality required

Welders, who weld steel, have to be qualified in accordance with EN ISO 9606-1; the maximum validity period of their qualification is three years, if there is no interruption of more than six month regarding welding activities in the validity range.

2.6. Requirements of welding activities (valid for CL1, CL2 and CL3)

The following requirements must be met:

- Concurrent work on carbon steel / stainless steel / aluminium alloys must be carried out separately. Any pollution must be removed in order to avoid any risk of corrosion and/or non-compliance with the required quality (ALSTOM Transport recommends to separate working areas by a distance greater than 5 m or curtain (height min. 2 m than the working position) or partition).
- precautions / obligations related to work with aluminium alloys or stainless steel (see series of standard EN 1011)
- Preheating to from 50 until 80°C of base metals before welding when the ambient temperature is below 5°C
- Production weld tests must be done in accordance with EN 15085-4, chapter 4.2
- NDT instructions for RT, UT, MT, ET and PT must be validated by a person certified in level 3 of relevant method
- Special work instructions are necessary for repair welding, cold or hot straightening, post weld heat treatment
- The responsible welding coordinator or one of his deputies must be present for the weld manufacturing of the first article and any repairs by welding
- A deputy of the responsible welding coordinator must be present in every weld workshop

2.7. Welding Procedure Specification (valid for CL1, CL2 and CL3)

Every weld must require a WPS according to relevant standard.

For fusion welds with a weld thickness of more than 4 mm for steel and 5 mm for aluminium alloys ALSTOM recommends multi-layer welding for a better process reliability.

2.8. Qualification of welding procedures (valid of CL1, CL2 and CL3 apart from exceptions)

2.8.1. Welding

Except for CP D, WPQR must be compliant to EN ISO 15614 part 1 or 2 depending to the parent metal.
For welded parts with certification level CL1 according to EN 15085-2 with carbon steel and a minimum thickness of 6 mm, an impact test and a specific hardness test without any difference higher than 80 HV between heat-affected zone (HAZ) and weld metal have to be performed in a WPQR.
In addition, in accordance to EN 15085-4, chapter 4.2 in case of difficulties e.g.:

- accessibility
- Joint with partial penetration (“s” notation on drawing)
- overlap joint

must be at least covered by a WPQR performed according to EN ISO 15613.
In addition, for WPQR on aluminium alloys the control of heat input is necessary.

When using pulsed current, the WPQR given is restricted to the welding equipment (trade name, designation of the supplier) used for the qualification; the change of welding equipment is possible, if an additional sample is welded with the same WPS parameters and if the results based on 2 macro examinations are compliant with the relevant standard. These results must be recorded.

In case of doubt the ALSTOM Transport welding coordinator may demand additional production weld tests according to EN 15085-4, which must be executed by the sub-contractor or supplier.

2.8.2. Other welding process

Other welding processes can be used only with the acceptance by Alstom Transport.

2.9. Welding consumables (valid for CL1, CL2 and CL3)

The used consumables must be delivered accompanied by a type 3.1 certificate according to EN 10204 for the chemical composition and at least 2.2 for the mechanical properties.
Welding consumables employed according to the WPQR, has to have a type « DB Abnahme » certificate available from the supplier (see also www.en15085.net). The grades of base metals, welding positions and shield gases employed must figure there; otherwise, the consumable must not be utilized.
The label has to imperatively show the marking « CE » accompanied by a certification number and the name of the certifying body.
The supplier has to take care that the use of the welding consumables is done according to the product description of the producers of the welding consumables.
For welding of aluminium alloys, ALSTOM recommends to perform reception tests (as fracture test or radiographic testing) for each batch of filler metal delivered.

For the choice of welding consumables Annex A has to be considered.

2.10. Base metals (valid for CL1, CL2, CL3)

2.10.1. Cutting, edges to be welded

It is the responsibility of the supplier to set himself dimensional and geometric tolerances for primary parts according to the means at his disposal and the manufacturing processes chosen.
In all cases, the edges to be welded must be prepared as defined by the WPS and in compliance with the standards covering defect acceptance levels.

If there is no requirement, the quality of cut out edges according to EN ISO 9013 should be at a minimum whatever the cutting process: steel and stainless steel class 54, aluminium alloys class 44.
If more modern and advanced cutting methods are used (ex :.laser, high definition plasma), no formal evidence of compliance is necessary and it's enough to prove that the equipment is subjected to maintenance and works in his standard working range, respecting the prescriptions or recommendations of the producer.
In the opposite cases, the supplier has to prove his cutting quality level; for that it's acceptable a procedure of visual comparison between the pieces cut during production and cut reference samples, validated - as compliant to classes 54 and 44 ISO 9013 - taking into account the total range of thicknesses and the different type of base material cut.

2.11. Post-weld heat treatment (PWHT) (valid for CL1, CL2, CL3)

Post-weld heat treatment is an essential variable of the WPQR. Any addition or suppression of an unforeseen heat treatment is not allowed.
Heat treatment applied to the sub-assembly must be in conformity with that recorded in the WPQR, to the nearest tolerance, and undergo a recording (heat treatment curve) checked and approved by the welding coordinator.
NB: Alstom does not accept vibratory stress relieving
No straightening / leveling operations may be carried out after heat treatment.

The heat treatment parameters fixed are the following (If the supplier deviates from these parameters, the supplier has to make a mock-up, which has to be accepted by ALSTOM Transport.):

2.11.1. Loading in the oven

At ambient temperature or in every case less than 200°C, elements to be treated have to be placed so that the heat can circulate freely between them.

2.11.2. Control of temperature

The unit will be provided with enough thermocouples which will be set to indicate the temperatures at the highest and lowest stages. We shall consider the average of the readings between the recorded extreme values; the difference of temperature shall not exceed 40°C, whatever the phases of the treatment are (rate, maintain, cooling).

2.11.3. Increase of temperature

The increase will have to be made slowly: maximum speed of temperature rise 150°C / hour.

2.11.4. Holding time and temperature

Motor: temperature to obtain is 590°C ±10°C to be held during 5 hours minimum.
Bogie element : 3 hours (0; +15 min)
Sub-assembly : minimum hold time is 2 min/mm with a minimum of one hour.

2.11.5. Cooling

low cooling in the oven at 120°C/hour maximum. The oven will be opened when the treated load will achieve a temperature of 200°C. At this stage, stabilized elements shouldn't be exposed to a cold draught.

2.11.6. Inspection

Every stabilization operation will be registered on a graph. The graph will have to allow the reading of the treatment phases (max and min. temperature, duration…).

2.12. Performance of the welding

2.12.1. General

A procedure or instruction must be defined in compliance with EN 15085-4:

- tack welding
- Pre-heating, temperature between runs….
- Marking
- Preparation of the edges to be welded
- run off , run on
- Welding
- Weld return
- Finishing / state of surface (for T-joint see picture 1)
- Grinding
- Cold straightening or rectification of distortion by heat straightening
- post weld heat treatment (PWHT)
- Repairing / finishing

These rules must be known by the welding personnei and be available at the work station

2.12.2. Straightening

a. Cold straightening is allowed under condition that the supplier shows proof of the absence of deterioration to the component (through additional surface inspections for example). For components with certification level CL 1: If there are doubts for ALSTOM that cracks appear because of the cold straightening, a destructive test or suitable non-destructive tests must be done to check also internal welds (e.g. at bolsters).
b. Heat straightening of steel: This is possible, if the requirements of the material are considered.
c. Heat straightening of aluminium alloys (6xxx): Flame straightening is forbidden. Shrinkage by TIG remelting without filler metal is forbidden. Shrinkage by welding with filler metal with or without machining of the existing joint is authorized and is considered as a repair

The method and process straightening have to be submitted to ALSTOM Transport and accepted by ALSTOM Transport.

2.13. Finishing (valid for CL1, CL2, CL3)

Generally:

- After welding of stainless steel the temper colors must be removed by pickling or passivation, other possibilities of their removal must be agreed by ALSTOM Transport.
- No spatter is allowed except in closed areas inaccessible and invisible after welding. The spatters must not have an influence on function or resistance against corrosion.

To increase the fatigue strength of the welded joint:

- TIG process can be used for weld finishing. Except for CP D welds, it has to be qualified according to standard EN ISO 15614.
- Grinding can be used for weld finishing. In the absence of opposite indications to the drawing, grinding of plate edges and welds is made without taking into account the sense of streaks, with abrasives such as grind disk, lapidary, sanding disks grade 50 in minimum.
- High frequency hammering can be used for weld finishing.

2.14. Inspection and testing (valid for CL1, CL2, CL3 and CL4)

2.14.1. General

Alstom reserves the right to perform unannounced tests (as surface tests and / or volumetric tests and/or destructive tests) on produced parts. These tests can be demanded by the ALSTOM Transport welding coordinators.
The inspection plan, covering all of the inspections to be carried out (NDT, dimensional, geometric…), their integration in the manufacturing process (intermediate inspection, before heat treatment…) and the results to be obtained together with tolerances, is to be drawn up according to the requirements of EN 15085.
It must be submitted to the Alstom SQA or SPQD for validation.
All inspections must be recorded. The name of the inspector, method / certification level, date, must necessarily appear in the reports.
The products used for austenitic stainless steel parts inspection mustn't generate corrosion risks linked to sulfur and chlorine.

2.14.2. Dimensional and geometric of welded parts

If no tolerance is mentioned in the drawing, EN ISO 13920 must be applied:

- Class B for linear and angular dimensions
- Class F for straightness, flatness and parallelism.

2.14.3. Dimensional and geometric of the machined welded parts

If no tolerance is mentioned in the drawing, EN ISO 22768 must be applied:

- Class M for linear and angular dimensions
- Class K for geometrical tolerances.

Roughness of machined surfaces:

- for aluminium alloys, Ra $\leq$ 6,3µm
- for steel, Ra $\leq$ 12,5µm

For the quality levels for welding imperfections chapter 5 of EN15085-3 must be applied.

2.14.4. Non destructive testing (NDT)

General Rules for non-destructive testing:

- The inspection concerns the weld and the 15 mm around it (HAZ).
- If there are special demands about NDT by the final customer of ALSTOM Transport, these demands have to be considered by the supplier.
- For dye penetration testing (PT): Utilization of an II-x-x-2 system according to EN ISO 3452-1 is mandatory.
- If base material and filler metal are magnetic, ALSTOM Transport demands the use of magnetic powder test (MT) as surface test. If it is not possible, ALSTOM Transport has to be informed.
- If a volumetric test is demanded and possible, the volumetric test has to be done.
- ALSTOM Transport has to be informed before the start of the production if ultrasonic testing (UT) or radiographic testing (RT) will be used, if necessary.
- NDT procedure instructions must be validated by an agent certified to level 3 (it can be an external personnel) in the method concerned except for visual testing (VT), for it a validation may be done by the welding coordinator himself. The validated NDT

procedure instruction must be checked and accepted by a NDT expert of ALSTOM Transport, therefore the NDT procedure instruction must be written in English, French or German language in addition to the native language of the supplier.

- In the case of weld performance classes CP B and CP C1 welds, the inspections must necessarily be carried out in the following order: VT then surface test (PT or MT) then volumetric test (UT or RT).
- All NDT inspections for weld performance classes CP B and CP C1 must be documented.
- The visual inspection of welded components has to be done on non-painted components with a clean surface. This has to be respected for first article inspections (FAI).

2.14.4.1. Leak testing

Leak tests can be carried out by implementing:

- "Medon white"
- "Spanish white"
- Penetrant testing
- Tracer liquid
- Soap liquid which produce bubbles or
- other equivalent methods

following an instruction written by the supplier and presented to ALSTOM.
This instruction doesn't require the validation of a level 3 certified agent, but it must be validated for the specific material and component.
Remark: The method and products used shall be chosen in compliant with further treatment surface

2.14.5. Destructive testing of welded joints

Destructive tests can be also performed to evaluate the quality of the welded joints such as mechanical properties, weld size, weld shape, type and dimension of defect, respect of WPS/WPQR. The equipment to measure mechanical properties must be calibrated annually. The destructive tests must be assessed by the responsible welding coordinator or a deputy respecting, what is indicated in EN 15085-2 Annex B. Documentation is always necessary and must be sent to ALSTOM, if demanded in the contract or inspection plan.

2.15. Non-conformity and corrective measures (valid for CL1, CL2 and CL3)

2.15.1. General

The supplier must have a procedure to handle any non-conformity and to carry out corrective measures.
If the supplier doesn't achieve the level of quality demanded or in case of lack of management of the industrial process, ALSTOM Transport reserves the right to give instructions necessary to achieve the required quality. The instructions must be implemented in practice.
If the requirements of the order are not met or quality requirements are often or continuously insufficient during the contract/order term, Alstom Transport reserves the right to delegate an inspector to the contractor's place or cancel the contract.
According to EN 15085-5, chapter 7.2.1, the supplier must inform Alstom Transport about all non-conformities.

2.15.2. Repair welding

The supplier must define instructions for repair welding. These instructions shall be available in the workstation and send to ALSTOM Transport for information and acceptance, if necessary.
If EN 15085-5, chapter 7 can't be respected, the supplier shall perform a mock up according EN ISO 15613 for validation of the repair welding process.

2.16. Calibration and verification of measuring equipment, inspection and tests (valid for CL1, CL2 and CL3)

A yearly calibration / verification are obligatory for e.g.:
Are calibrated annually:

- Measurement: ammeter / voltmeter,
- NDT: ultrasound equipment, luxmeter, densitometer, gaussmeter

Are checked annually:

- Welding: welding generators,
- Measurement: ammeter / voltmeter, if they belong to the welding generator
- PWHT: curves recording system,
- Measurement gauges of weld dimensions,
- negatoscope (following supplier recommendation).

Any difference recorded in comparison with the specified values must be corrected.
It must be noted that measure gauges of weld dimensions have to be checked (at a minimum every 5 years)
An annual calibration of welding generators or machines can be necessary, if there is such a demand by the final customer.

2.17. Records related to quality (valid for CL1, CL2, CL3 and CL4)

The supplier must keep and hold available to ALSTOM Transport, for a period of minimum 10 years (depending on the contract with the final customer) from the date of end of production of the component or last component in the case of series

- Certificate of conformity
- Certificate of base metals
- Certificate of consumables
- WPQR (when required)
- WPS
- welding sequence plans (if applicable)
- work instructions relating to welding
- Qualification reports of welders and operators
- Certification of NDT personal
- PWHT curves (if applicable)
- List and copies of reports on dimensional and geometrical control and NDTs and Destructive testing
- List and copies of non-conformities
- Other documents indicated in EN ISO 3834-2 if relevant

3. STATE OF MECHANICALLY-WELDED PARTS

The delivered sub-assemblies, machined or not, will be in compliance with the following requirements:

	Requirements				Inspection
	Carbon steel	Ferritic stainless steel	Austenistic stainless steel	Aluminium alloys	
Corrosion / surface	Mini Sa2 according to ISO8501	Not concerned	Pickling + passivation of the welded areas except opposite information mentioned to the drawing	Sparkling and clean surfaces (no mark of graphite)	Visual
Liquid retention (water, lubricant, oil)	Absence of mark on white rag	Absence of mark on white rag	Absence of mark on white rag	Absence of mark on white rag	Visual
Greasy substance	Absence of mark on white rag	Absence of mark on white rag	Absence of mark on white rag	Absence of mark on white rag	Visual
Shavings	Not allowed	Not allowed	Not allowed	Not allowed	visual
Burr (machined, sheared zones…)	Not allowed	Not allowed	Not allowed	Not allowed	Visual + tactile
referencing / identification	Absence of adhesive mark	Absence of adhesive mark	Adhesive free from chlorine and absence of adhesive mark	Absence of adhesive mark	Visual

The supplier must execute the inspection like it is explained in the table. Its execution must be written in the control plan.
The supplier will write instructions defining how to respect these requirements and maintain them throughout the order. These instructions shall be agreed before starting the production activity and validated during the FAI.

4. TENDER

For the tender of each project the supplier candidate must send to the buyer the following information or documents:

- Copy of the certificate according to EN 15085-2
- The list of the documents of reference
- The drawing according to EN 15085-3, if the supplier is the designer
- The manufacturing process (jigs included), if possible
- The list of welders and operators
- The list of the NDT personnel
- The list of the sub-contractors and copy of their certification according with EN 15085-2

ANNEX A (NORMATIVE)

CHOICE OF WELDING CONSUMABLES

A.1 Foreword

This annex about welding consumables is an application document (or working document) which takes up parts of the standards in order to clarify how ALSTOM apply and implement them.
The English version is the reference.

A.2 Introduction

This annex about the choice of welding consumables shall be applied to all suppliers and sub-contractors where welding operations are carried out or welded components are designed.

A.3 Field of Application

This annex shall apply to all projects and all contracts dealt with by ALSTOM and it is mandatory for any welding operation. There is no retroactive effect. But ALSTOM can request a change of the welding consumables in case of a big risk also in a running project.
This annex is based on standards EN 15085-3 and EN 15085-4.

A.4 General

The instructions of the manufacturer of the welding consumables have to be considered; deviations from these instructions have to be proven by a welding procedure qualification record (WPQR) or production weld test according to EN 15085-4.
The welding consumables can only be used for base materials, whose material groups according to ISO/TR 15608 are mentioned in the certificate of the base material.
Only the welding positions and shield gases can be used, which are mentioned in the certificate of the welding consumable.
Deviations from the following tables are only possible, if the supplier is able to demonstrate the sufficient suitability of the used welding consumables regarding in a welding procedure qualification record (WPQR) or representative mock-up according to EN ISO 15613 regarding demanded yield strength and hardness values, no risk of hot cracks or cold cracks, demanded value of the charpy impact test etc.; the results have to be validated by a senior expert about welding of ALSTOM with focus on the design of the component before the use of the welding consumables in the serial production.

A.5 Welding Consumables for Carbon steel

The welding consumables which have to be used for which type of carbon steel are listed in table 1.

The definition of the ALSTOM standard materials (carbon steel) are listed in DTRF 150201.

For laminate carbon profile type S355J2G3 or S355J2+N (EN10025) take RCS355N value.

Table 1: Consumables for AT standard materials carbon steel (sheets) for MAG welding (135)

Part 1			Part 2			Weld metal $Rp_{0,2}$ (MPa) DTRF150209	Consumable acc. to EN ISO 14341 (A5.18)
Reference	$Rp_{0,2}$ (MPa)	Base material (EN)	Reference	$Rp_{0,2}$ (MPa)	Base material (EN)		
RCS355 1≤T≤1,5	360	HC380LA EN10268	RCS355 1≤T≤1,5	360	HC380LA EN10268	327	A G 46 4 M 4Si1 (ER 70S-6)
			RCS355 2≤T≤20	375	S355MC EN10149-2	327	A G 46 4 M 4Si1 (ER 70S-6)
			RCS355N 20<T≤40	345	S355J2+N EN10025	314	A G 46 4 M 4Si1 (ER 70S-6)
			RCS450	500	S500MC EN10149-2	327	A G 46 4 M 4Si1 (ER 70S-6)
			RCS500	550	S550MC EN10149-2		A G 46 4 M 4Si1 (ER 70S-6)
			S700MC	700	S700MC EN10149-2		A G 46 4 M 4Si1 (ER 70S-6)
RCS355 2≤T≤20	375	S355MC EN10149-2	RCS355N 2≤T≤20	375	S355MC EN10149	350	A G 46 4 M 4Si1 (ER 70S-6)
			RCS355N 20<T≤40	345	S355J2+N EN10025	314	A G 46 4 M 4Si1 (ER 70S-6)
			RCS450	500	S500MC EN10149-2	350	A G 46 4 M 4Si1 (ER 70S-6)
			RCS500	550	S550MC EN10149-2		A G 46 4 M 4Si1 (ER 70S-6)
			S700MC	700	S700MC EN10149-2		A G 46 4 M 4Si1 (ER 70S-6)
RCS355N 20<T≤40	345	S355J2+N EN10025	RCS355N 20<T≤40	345	S355J2+N EN10025	314	A G 46 4 M 4Si1 (ER 70S-6)
			RCS450	500	S500MC EN10149-2		A G 46 4 M 4Si1 (ER 70S-6)
			RCS500	550	S550MC EN10149-2		A G 46 4 M 4Si1 (ER 70S-6)
			S700MC	700	S700MC EN10149-2		A G 46 4 M 4Si1 (ER 70S-6)
RCS450	500	S500MC EN10149-2	RCS450	500	S500MC EN10149-2	450	A G 46 4 M 4Si1 (ER 70S-6)
			RCS500	550	S550MC EN10149-2		A G 46 4 M 4Si1 (ER 70S-6)
			S700MC	700	S700MC EN10149-2		A G 46 4 M 4Si1 (ER 70S-6)
RCS500	550	S550MC EN10149-2	RCS500	550	S550MC EN10149-2	500	A G 50 4 M
			S700MC	700	S700MC EN10149-2		A G 50 4 M
S700MC	700	S700MC EN10149-2	S700MC	700	S700MC EN10149-2	550 t>3 600 t<=3	A G 69 4 M

A.6 Welding Consumables for Stainless Steel

The welding consumables which must be used for which type of stainless steel are listed in table 2.
The definition of the ALSTOM standard materials (stainless steel) are listed in DTRF 150233.
The green marked parent metals are preferred in ALSTOM production.

If the material needs a higher resistance against corrosion, it can be necessary to use more sophisticated welding consumables because of the metallurgy like it is listed in table 2.

Table 2: Consumable for standard material stainless steel (sheets) [shield gas for MAG welding (135)]

Parent metal A according to EN 10088	**Parent metal B according to EN 10088 or ASTM A959 UNS**				
	RSS A 230 C/H **(RSS A 304)** X5CrNi18-10 (1.4301) or S30400 **RSS A 350 C/H** **(RSS A 301 LN)** X2CrNiN18 7 (1.4318) or S30153)	**RSS D 500 C/H** X2CrNiMoN 22-5-3 (1.4462)			**RSS F 280 C/H or 360 C** X2CrNi12 (1.4003) or S41003
		X5CrNiMo 17-12-2 (1.4401) or S31600	X6CrNiTi18-10 (1.4541) or S32100	X6CrNiMoTi 17-12-2 (1.4571) or S31635	X2CrTi12 (1.4512) or S40900 X5CrNiMoTi15-2 (1.4589) (no designation acc. to AWS)
	Welding consumables according to EN ISO 14343-A or AWS A-5.9 **[Possible shield gases according to EN ISO 14175]**				
Carbon steel	G 18 8 Mn (1.4370) or ER 307L [M11, M12 or M23]*				
RSS F 280 or F 360 1.4003 (X2CrNi12)	G 19 9 L Si (1.4316) or ER 308L Si [M11, M12 or M23]*				
1.4512 (X2CrTi12) 1.4589 (X5CrNiMoTi15-2)	G 19 9 L Si (1.4316) or ER 308L Si [M11, M12 or M23]*				
1.4571 (X6CrNiMoTi17-12-2)	G 19 12 3 Nb Si (1.4576) or ER 318 Si [M11 or M 12]				
1.4541 (X6CrNiTi18-10)	G 19 9 Nb Si (1.4551) or ER 347 Si [M11 or M 12]				
1.4401 (X5CrNiMo17-12-2)	G 19 12 3 L Si (1.4430) or ER 316L Si [M11 or M12]				
RSS A 230 1.4301 (X5CrNi18-10) **RSS A 350** 1.4318 (X2CrNiN18-7)	G 19 9 L Si (1.4316) or ER 308L Si [M11 or M12]*				
*) or alternative: G 23 12 L Si (1.4332) or ER 309L Si [M12]					

A welding of carbon steel and stainless steel without filler metal is not allowed (Only for stud welding exceptions can be possible, if a WPQR exists.).

A.7 Welding Consumables for Aluminium Alloys

The welding consumables which shall be used for which aluminium alloy are listed in table 3 according to EN 1011-4, table B.1.
The definition of the ALSTOM standard materials (aluminium) are listed in the following DTRF's:

- DTRF 150202 : Aluminium profiles for structural parts
- DTRF 150203 : Aluminium cast for structural parts
- DTRF 150205 : Aluminium profiles for fitting
- DTRF 150206 : Aluminium cast for fitting
- DTRF 150207 : Aluminium forged parts
- DTRF 150216 : Aluminium sheets.

The green marked parent metals are preferred in ALSTOM production.

Table 3: Consumable for standard material aluminium alloys (cast, sheets and extrusion profiles)

<table>
<tr><td rowspan="2">Parent metal B according to EN 573</td><td colspan="7">Parent metal A according to EN 573</td></tr>
<tr><td>AlCu-cast alloys with Cu > 2 %</td><td>AlSi- and AlSiMg- cast alloys with Si > 5 %
RAC 03
(AlSi7Mg0,3)
RAC 06
(AlSi7Mg0,6)</td><td>AW-Al 99,0
(AW-1200);
AW-Al 99,5
(AW-1050A);
AW-Al 99,8(A)
(AW-1080A);
AW-Al 99,98
(AW- 1098)</td><td>RAP 5754 or AW-5754
(AW-AlMg3)

AW-AlMg2Mn0,8
(AW-5049);
AW-AlMg2,5
(AW-5052)
AW-AlMg5
(AW-5056A)</td><td>AW-AlMg4,5Mn0,7
(AW-5083)</td><td>AW-6060
(AW-AlMgSi);
AW-6005A
(AW-AlSiMg(A));
RAP 6082 or RAF240 or AW-6082
(AW-AlSi1MgMn);
RAP 6061 or AW-6061
(AW-AlSi1MgCu);
AW-6008
(AW-AlSiMgV);
AW-6106
(AW-AlMgSiMn)</td><td>AW-AlZn4,5Mg1
(AW-7020)</td></tr>
<tr><td></td><td colspan="7">Welding consumables according to EN ISO 18273 1)</td></tr>
<tr><td>AW-AlZn4,5Mg1
(AW-7020)</td><td rowspan="8"></td><td rowspan="8"></td><td>S Al 5356
(AlMg5Cr(A))
S Al 5087 2)
(AlMg4,5MnZr)</td><td rowspan="5"></td><td></td><td>S Al 5356
(AlMg5Cr(A))
S Al 5087 2)
(AlMg4,5MnZr)</td><td>S Al 5356
(AlMg5Cr(A))
S Al 5087 2)
(AlMg4,5MnZr)</td></tr>
<tr><td>AW-6060
(AW-AlMgSi);
AW-6005A
(AW-AlSiMg(A));
AW-6082
(AW-AlSi1MgMn)</td><td>S Al 5356
(AlMg5Cr(A))
S Al 5087 2)
(AlMg4,5MnZr)
S Al 4043
(AlSi5) 3) 4)</td><td>S Al 5356
(AlMg5Cr(A))
S Al 5087 2)
(AlMg4,5MnZr)</td><td>S Al 5356
(AlMg5Cr(A))
S Al 5087 2)
(AlMg4,5MnZr)
S Al 4043
(AlSi5) 3) 4)</td><td></td></tr>
<tr><td>AW-AlMg4,5Mn0,7 (AW-5083)</td><td>S Al 4043
(AlSi5) 4)</td><td>S Al 4043
(AlSi5) 4)</td><td></td><td>S Al 5087 2)
(AlMg4,5MnZr)</td><td></td><td></td></tr>
<tr><td>AW-5754 (AW-AlMg3);</td><td rowspan="2">S Al 5356
(AlMg5Cr(A))
S Al 5087 2)
(AlMg4,5MnZr)</td><td rowspan="2"></td><td rowspan="2"></td><td rowspan="2"></td></tr>
<tr><td>AW-AlMg2Mn0,8 (AW-5049);
AW-AlMg2,5 (AW-5052)
AW-AlMg5 (AW-5056A)</td></tr>
<tr><td>AW-Al 99,0 (AW-1200);
AW-Al 99,5 (AW-1050A);
AW-Al99,8(A) (AW-1080A);
AW-Al 99,98 (AW- 1098)</td><td>S Al 1450
(Al99,5Ti)</td><td></td><td></td><td></td></tr>
<tr><td>AlSi or AlSiMg cast alloys, Si>5 %
RAC 03 or 06</td><td>S Al 4043
(AlSi5) 4)
S Al 4047
(AlSi12) 4)</td><td>S Al 4043
(AlSi5) 4)
S Al 4047
(AlSi12) 4)</td><td rowspan="2"></td><td rowspan="2" colspan="4">1) In CODSOUD or in the list of welded joints the specification should be done with the short sign of the nominated composition (e.g. S AlMg4,5MnZr).
2) Alternatively: S Al 5183 (AlMg4,5Mn0,7)
3) S Al 4043 (AlSi5) may be used only for the repair of components, which have been welded with it in the production. The use of S Al 4043 (AlSi5) must be agreed by the customer.
4) For component without painting the change of color of the welded joint shall be considered.</td></tr>
<tr><td>AlCu cast alloys with Cu > 2 %</td><td>S Al 4047
(AlSi12) 4)</td></tr>
</table>