TPS

Semi permanent coupler

S-Bahn Köln

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Control Sheet

Issue verification

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Issue	Author	Date	Object of the modification
A0	D. Zier	10.03.2023	FIRST ISSUE
A1	D. Zier	29.03.2023	ISR, Standards, Painting & Gluing and Oper. Conditions added
A2	A.Göricke	26.07.2023	Update of coupling speed, coupling anlges, train mass; adding train dimensions

	Name	Position	Date	Signature
Written by :	André Göricke	Sys.-Eng.	26.07.2023	André Göricke Digital unterschrieben von André Göricke Datum: 2023.07.26 12:43:04 +02'00'
Written by :	Paul Gericke	Domain-Lead	26.07.2023	Paul Gericke Digital unterschrieben von Paul Gericke Datum: 2023.07.26 18:01:38 +02'00'
Verified by :	Micheal Zabel	TDE	26.07.2023	Digitally signed by Michael Zabel DN: C=DE, OU=RES, O=ALSTOM, CN=Michael Zabel, E=michael.zabel@alstomgroup.com Reason: I am the author of this document Location: Date: 2023-07-27 07:05:07 Foxit Reader Version: 9.4.1
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Property name	Requested value	Requirement number	Requestor Comments	Supplier Compliancy	Supplier Comments	Alstom Comments
Connector 0						
SR SERVICE FUNCTIONS						
SR040000 Connect vehicles and consists						
SR040100 Enable Coupling / Uncoupling						
OV1850 Maximum design coupling speed w.o. damage	OV1850-01 3 km/h		coupling speed influenced by desgin of front coupler; 3km/h, 4km/h and 5 km/h to be investigated			
OV1850-01 3 km/h	X					
OV1850-02 4 km/h						
OV1850-03 5 km/h						
OV1850-04 6 km/h						
OV1850-05 8 km/h						
OV1850-06 9 km/h						
OV1850-07 10 km/h						
OV1850-08 11 km/h						
OV1850-09 15 km/h						
OV1854 Applicable fire safety standard	OV1854-02 EN 45545 HL2					
OV1854-01 NFPA130						
OV1854-02 EN 45545 HL2	X					
OV1854-03 EN 45545 HL3						
SS300000 Coupling system (S30)						
116 116 SPB Semi-Permanent Bar						
OV1874 Temporary vertical	OV1874-02 No		can be offered as an option			
OV1874-01 Yes						
OV1874-02 No	X					
OV1889 MRP quick connection	OV1889-02 No					
OV1889-01 Yes						
OV1889-02 No	X					
OV1890 BP quick connection	OV1890-02 No					
OV1890-01 Yes						
OV1890-02 No	X					
OV1891 Gangway support	OV1891-02 No					
OV1891-01 Yes						
OV1891-02 No	X					
OV1894 Cable support	OV1894-02 No		cable support not needed, but supplier is free to offer an interface for screwing on a support			
OV1894-01 Yes						
OV1894-02 No	X					

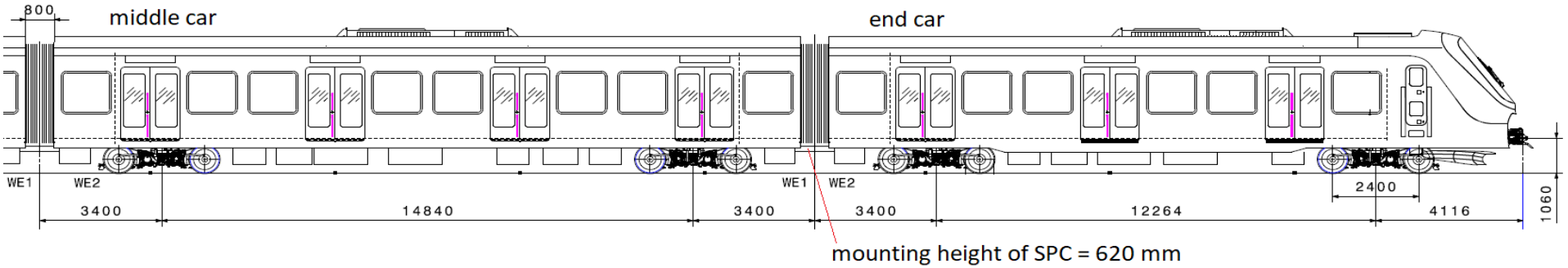
Property name	Requested value	Requirement number	Requestor Comments	Supplier Compliancy	Supplier Comments	Alstom Comments
OV1903 Distance between pivots (mm)	OV1903-03 2200-2399		2260mm; More important than pivot distance is the mounting face distance, which is 2300 mm. Due to low available space in the underframe area a coupler length from mounting face to mounting face above 2300 mm is not possible. Further details to the pivot distance are given below at the requirements of the movement angles.			
OV1903-01 1800-1999 OV1903-02 2000-2199 OV1903-03 2200-2399 OV1903-04 2400-2599 OV1903-05 >2600	X					
OV1904 Construction type	I4-02 Two piece (split at c					
OV1904-01 One piece (solid bar) OV1904-02 Two piece (split at center) OV1904-03 Unsymmetrical section	X					
SS300100 115 Couplers						
OV1006 Coupler compressive yield load (kN)	OV1006-02 1500 kN					
OV1006-02 1500 kN	X					
OV1853 Coupler tensile yield load (kN)	OV1853-08 1000 kN					
OV1853-08 1000 kN	X					
OV1864 Non-reversible energy absorption device type	OV1864-02 Def. Tube					
OV1864-02 Def. Tube	X					
OV1866 Max. available non-reversible stroke [mm]	OV1866-01 [100,300[		approx. 255 mm on each coupler half; More important than the non-reversible stroke is the overall stroke, which is 600 mm. Means the sum of reversible stroke and non-reversible stroke of both halfs must be minimum 600 mm to achieve a safe connection of the anti-climbing plates in case of a crash.			
OV1866-01 [100,300[	X					
OV1867 Coupling load case scenario	OV1867-03 AW3-AW3		refer to mass scenario sheet			
OV1867-03 AW3-AW3	X					

Property name	Requested value	Requirement number	Requestor Comments	Supplier Compliancy	Supplier Comments	Alstom Comments
OV1900 Maximum horizontal pivoting angles [°]	OV1900-02 [20°,30°[		16°; value is based on a pivot distance of 2260 mm; if supplier wants to use a joint, were the pivot distance of SPC is lower than 2260 mm, then supplier has to proceed a new calculation for the coupler movement angles; base for horizontal movements is 100m curve and 150m-6m-150m-S-curve; train dimensions in "train dimension" tab			
OV1900-02 [20°,30°[	X					
OV1901 C0008 Maximum vertical pivoting angles [°]	OV1901-02 [5°,8°[		7°; value is based on a pivot distance of 2260 mm; if supplier wants to use a joint, were the pivot distance of SPC is lower than 2260 mm, then supplier has to proceed a new calculation for the coupler movement angles; base for vertical movements is 500m trough/ hump; train dimensions in "train dimension" tab			
OV1901-02 [5°,8°[	X					
Connector 1						
ET212 SPB Semi-Permanent Bar						
20A01 Mass management						
Product Estimated Mass (kg)			400 kg			
Gaps Count						
Gap Type 1						
Gap Type 2						
Gap Type 3						
Development Technical Complexity						
Solution						

Load Scenarios/ Car masses

Car mass [kg]: (AW3 - Coupling scenario)	[kg]	33244	41526	41675	38851	41844	41700	32966	33230
Car mass [kg]: (Crash scenario)	[kg]	32194	39391	39540	36716	39709	39565	30831	32180

Train dimensions



DTRF Number	DTRF Name	Latest Revision	Supplier Compliancy	Supplier Comments	Alstom Comments
DTRF 150900	General Engineering Conditions with Suppliers	Rev B			
DTRF 150214	Fastened Assemblies Mounting Requirements	Rev K			
DTRF 150217	Metallic Parts Corrosion Resistance Requirements	Rev F			
DTRF 150608	Standard Painting Process	Rev G			
DTRF 150611 (only reference)	Commodity Catalogue	Rev G			
DTRF 150612 (Optional)	Graffiti Removal - Paint and films specification	Rev A			
DTRF 150210	Fastened assemblies design	Rev O			
DTRF 150213	Fastners Purchasing Specification	Rev K			
DTRF 150801	Generic Safety Specification for Supplied Sub-system	Rev C			
DTRF 150802	Generic Reliability Specification for supplied Sub-system	Rev C			

Painting & Gluing				
6 Vehicle technical requirements	**Fahrzeugtechnische Anforderungen**	Supplier Compliancy	Supplier Comments	Alstom Comments
6.1 Vehicle design and styling	**Fahrzeugdesign und -gestaltung**			
6.1.5 Paint	**Anstrich**			
All surfaces that require it for visual, decorative or corrosion protection reasons are coated.	Alle Flächen, die es aus optischen, dekorativen oder Korrosionsschutzgründen erfordern, sind mit einem Anstrich versehen.			
The exterior paintwork must be designed in such a way that the exterior surfaces can be covered with films (for example, large areas on the entire side of the car body for advertising purposes, stickers with the EVU logos).	Die Außenlackierung ist so zu gestalten, dass Außenflächen mit Folien (z.b. großflächig an der gesamten Wagenkastenseite für Werbezwecke, Aufkleber mit den Logos der EVU) beklebt werden können.			
The paint quality of the entire vehicle / of the complete outer skin must be suitable for washing in a machine wash.	Die Lackqualität des gesamten Fahrzeugs / der kompletten Außenhaut muss für das Waschen in einer maschinellen Waschanlage geeignet sein.			
The vehicle has a multi-layer paint structure with sufficient adhesive strength, which was applied in compliance with the requirements of the paint manufacturers and the specifications for (dry) layer thicknesses.	Das Fahrzeug verfügt über einen mehrschichtigen Anstrichaufbau mit ausreichender Haftfestigkeit, welcher unter Einhaltung der Vorschriften der Lackhersteller und der Vorgaben zu (Trocken-)Schichtdicken aufgetragen wurde.			
In the decorative area • A 2-component lacquer system with a clear lacquer top coat is used. • there are no technical and other surface defects in the coating • the gloss value and the respective colour tone are uniform.	Im dekorativen Bereich •wird ein 2-K-Lacksystem mit einer Klarlack-Deckschicht verwendet •sind keine technischen und sonstigen Oberflächenfehler im Anstrich vorhanden •ist der Glanzwert und der jeweilige Farbton einheitlich.			

Source	**Operational conditions - Requirements**	Supplier Compliancy	Supplier Comments	Alstom Comments
Thermodynamics	The design principles regarding vehicle and sub-systems of CEN/TR 16251:2016 "Railway applications – Environmental conditions – Design guidance for rolling stock" shall be followed.			
Thermodynamics	The vehicle and sub-system winter tests listed in CEN/TR 16251:2016 "Railway applications – Environmental conditions – Design guidance for rolling stock" should be taken into account.			
Thermodynamics	The vehicle shall be designed for temperature class T3 according EN50125-1. The corresponding temperature range is -25°C up to +45°C.			
Thermodynamics	All electrical and mechanical components shall comply and work without malfunction in all humidity levels and durations as specified in EN50125-1 clause 4.4.			
Thermodynamics Aerodynamics	The air intake inside the underframe compartment shall be placed at a relatively high place with little air movements to minimize snow and dust ingress.			
Thermodynamics	The vehicles shall be designed for altitude class A2 according EN50125-1. The corresponding altitude is up to 1000 m above sea level.			
Thermodynamics Aerodynamics	The vehicle shall be designed for snow heights up to 400 mm above top of rail (class S2) according EN50125-1.			
Thermodynamics Aerodynamics	The vehicle shall be designed for hail stones with a diametre up to 15 mm according EN50125-1.			
Thermodynamics	The vehicle shall be designed for rain water up to 6 mm/min according EN50125-1 clause 4.6.			
Thermodynamics Aerodynamics	Equipment installed outside the car shall be able to operate under sandy and dusty conditions and be adequately protected against ingress of sand and dust.			
Thermodynamics	Underframe mounted equipment shall take into account higher temperature than ambinet temperatures. Exact temperature to be calculated in project, approximate temperatures are that the air will heat up +5 ºC to the inlets and another +5 ºC within underframe to a total of +10 ºC for the underframe equipment and approximately +15 ºC in the bogie region. The Traction- and AUX Converter should approximately consider only +5°C temperature increase to ambient temperature in normal operation due to air intake situation.			

ID	Type	RAM - Requirements:	Required for SBK	Supplier Compliancy	Supplier Comments	Alstom Comments
Rel-1	req	The supplier shall comply with EN50126 part 1 as the reference standard for this activity.	Yes			
Rel-2	**Heading**	**Reliability Plan**	**Yes**			
Rel-3	Info	The Reliability Plan is the set of Reliability activities in accordance with the Reliability Management System of the supplier that are applied throughout the product lifecycle to ensure that the subsystem delivered to Alstom is reliable and remains reliable up to dismantlement.	Yes			
Rel-4	Info	The purpose of a Reliability Plan is to define the Reliability requirements (targets included) of the subsystem and the methods by which the reliability performances will be assessed and managed. This will detail resources, processes and reliability management activities. It will be subject to on-going audit and verification and will contain clear deliverables. All reliability deliverables and activities are subjected to a planning	Yes			
Rel-5	Info	If a Reliability plan is produced, it will be sent for acceptance before the contract award.	Yes			
Rel-6	**Heading**	**FMEA/FMECA**	**Yes**			
Rel-7	Info	The Failure Modes and Effects Analysis (FMEA) is a systematic, formal procedure for analysing a subsystem to identify potential failure modes, and their causes and effects on the functionality of the subsystem.	Yes			
Rel-8	Info	The FMECA (Failure Modes, Effects and Criticality Analysis) is an extension of the FMEA that includes a means of classifying failure modes by severity in order to give a priority to countermeasures.	Yes			
Rel-9	Info	From the FMEA/FMECA, the supplier shall communicate to Alstom a summary of: - failure rates for each failure modes having a performance defined; - list of all critical actions under Alstom responsibility related to failure modes having a performance defined.	Yes			
Rel-10	Info	Standard EN 60812 can be used as a reference.	Yes			
Rel-11	**Heading**	**Activities Before Contract Award**	**Yes**			
Rel-12	req	The Supplier shall send:	Yes			
Rel-13	req	The potential system functional failure modes affecting the mission of its equipment and the associated MTTF /MKTF (in hours and/or kilometer);	Yes			
Rel-14	req	The methodology used to justify that the proposed MTBF/MKBF values are achieved;	Yes			
Rel-15	req	Tests carried out on the product (endurance test report, aging, etc.) and tests that it plans to carry out (send the validation plan) to demonstrate that reliability objectives are satisfied;	Yes			
Rel-16	req	Reliability constraints to be manage by other if any (e.g. inspection interval, design like remote alarm,…).	Yes			

Rel-17	info	Alstom will work with the Supplier to put functional failure modes into groups and will define the objective to be achieved for each failure family or type. This summary shall be made contractually through the STD that will also include the measurement method.	Yes			
Rel-18	**Heading**	**ACTIVITIES IN DEVELOPMENT PHASE**	**Yes**			
Rel-19	req	The Supplier shall write a reliability report that will contain all demonstrations proving that the (sub-system) supplied product satisfies the specified reliability requirements, and shall include at least the following if applicable:	Yes			
Rel-20	req	Usage restrictions	Yes			
Rel-21	req	List of (functional) failure modes and their associated failure rates as a function of contractual commitments, specifying their origin	Yes			
Rel-22	req	Main components at the origin of the failure mode with a % distribution of the failure rate (for this failure mode)	Yes			
Rel-23	req	List of critical components (first level replaceable unit) in terms of reliability and actions to be implemented by other to achieve the defined objectives. They may relate to: o Storage, o Integration, o Commissioning, o Operation, o Tests and inspections to be done, o Maintenance.	Yes			
Rel-24	req	Tree structure of all first level replaceable units. This structure shall include: o The component description; o The reference to the block diagram; o The component identifier; o Quantity / train; o Supplier's name; o If identified as being critical for reliability, the functional failure modes to which it contributes; o If identified as being critical for reliability; o If identified as being critical for reliability, the failure rate	Yes			
Rel-25	Info	A preliminary reliability report will be sent before start-up of series production. The preliminary reliability report includes the reliability requirements from the supplier towards Alstom to be agreed prior the First Article Inspection (IPA).	Yes			
Rel-26	req	The final reliability report shall be provided and agreed between the Parties at the end of commissioning.	Yes			
Rel-27	**Heading**	**ACTIVITIES DURING THE OPERATION PHASE**	**Yes**			
Rel-28	req	As long as the supplied product is under guarantee, the Supplier shall send repair report and expertise to Alstom comprising at least:	Yes			

Rel-29	req	The reference to the failure mode defined in the predictive phase (or if necessary even creation of a new failure mode);	Yes			
Rel-30	req	The summary of investigations done;	Yes			
Rel-31	req	The cause of the failure;	Yes			
Rel-32	req	The description of repairs made;	Yes			
Rel-33	req	A prediction of the number of similar failures during the coming year (the spare part stock will be resized if necessary).	Yes			
Rel-34	Info	Alstom will provide during the period the available data to the supplier for investigation. Alstom will monitor reliability commitments.	Yes			
Rel-35	Info	Measurement method: The lower one-sided limit of the mean time to failure (MTTF – Mean Kilometer To Failure in fact) is calculated by using the chi-squared distribution with a confidence level of 80%. Time terminated test with replacement as defined by EN60605-4 - formula 4 applies.	Yes			
		Coupler specific failure rates				
FC_A	req	Failure Class: FC_A Example: Loss of coupling function between the cars Failure Rate Requirement (train level): 1.80E-03 FPMK	Yes			
FC_B	req	Failure Class: FC_B Example: Other failures not directly causing loss of coupling function Failure Rate Requirement (train level): 1.8E-03 FPMK	Yes			
FC_C	req	Failure Class: FC_C n.a.				
FC_D	req	Failure Class: FC_D n.a.				

REQUIREMENT ID	ISR - Requirements (ReqID)	Template_TRS_Serviceability	Supplier Compliancy	Supplier Comments	Alstom Comments
ReqID	Template_TRS_Serviceability	SUB-SYS concerned			
	1 Introduction	**INFO**			
	1.1 Purpose and Scope	**INFO**			
[TRS_SM-12422]	The purpose of the present document is to list the constraints related to Serviceability and Maintainability, which shall be taken into account for the design of a Rolling stock program. This document is destined to Alstom activities: Engineering, Train System, Train Design, RAMS, Sourcing, etc. It shall not be circulated to external entities. Only the requirement with specific allocation can be sent can be circulated externally to the corresponding sub-system suppliers. This specification covers the main performances of Services business: Best Availability of trains Best quality of service at the lowest possible cost: Preventive (on train and overhaul of equipment) + Corrective + Servicing + Cleaning Programmed activities + Work arising Labour + Material Make + Buy Technical activities + Logistic activities	INFO			
	1.2 Reference and Applicable Documents	**ALL SYSTEMS**			
[TRS_SM-12423]	For the purpose of the TRS Serviceability (reference under ACOMIS: ENG- TLS-EN-IM-STD-0020, https://alstom.apps.documentum.com/D2/?docbase=new_ecm_prod&locateId=0901b23080d1415a) the following documents shall apply: - DTRF150900 General Engineering Conditions with Supplier, which is send to suppliers for each project – it is not necessary to include those requirements in this TRS Maintainability. - TCMS Maintenance Requirements_ENG-TLS-EN-IM-STD-0017. - ENG_TLS_EN_IM_STD_001 (includes requirements of technical time for cleaning, products for cleaning, life durations, etc.). - DEV-WMS-002 Design for Serviceability implementation instruction.	ALL SYSTEMS			
	1.2.1 Alstom References and Standards				
	1.2.2 Applicable Standards	**ALL SYSTEMS**			
[TRS_SM-12338]	A clause by clause of the DTRF150900-General Engineering Conditions with Supplier latest revision shall be done.	ALL SYSTEMS			
	1.2.3 Customer documents				
	1.2.4 National Safety Agency Directives/laws for certification/homologation				
	1.2.5 Other documents				
	1.3 Abbreviations and Definitions				
	1.3.1 Abbreviations	**INFO**			
[TRS_SM-12425]	For the purpose of this document the following abreviations apply: -AMM: Adjustable Maintenance Module -CBM: Condition Based Maintenance -LRU: Line Replacable Unit -MCMH: Mean Corrective Man Hours -MPMH: Mean Preventive Man Hours -MTTR: Mean Time to Repair -OMS: On board Maintenance server -PHM: Prognostics & Health Management -SRU: Shop Replacable Unit -TSS: Train Sub System	INFO			
	1.3.2 Definitions	**ALL SYSTEMS**			

REQUIREMENT ID	ISR - Requirements (ReqID)	Template_TRS_Serviceability	Supplier Compliancy	Supplier Comments	Alstom Comments
[TRS_SM-12520]	Line Replaceable Unit (LRU) : The following definition is derived from MIL-STD-1390D- Appendix B] A LRU is a sub-assembly or single part installed in an item of equipment or system (e g: a vehicle) which is replaceable in an operational environment. (By operational environment, we mean at the maintenance depot safe for exceptional circumstances). A LRU may be a printed circuit board, an electronic module; a wheel set assembly, a pantograph, etc. Maintenance personnel undertake this repair by replacement. A LRU should normally be capable of removal without dismounting adjacent LRUs. Shop Replaceable Unit (SRU) : Shop Replaceable Unit is a subset of a LRU (examples: a relay of a turntable or a block, a chart of an electronic drawer, the rotor of an engine…) whose maintenance or exchange is carried out in workshop on LRU already deposited of the train. The exchange of a SRU is carried out to give in operating condition the LRU failing. A SRU can be repairable or Non Repairable called SNRU	INFO			
[TRS_SM-12521]	Definition of Maintenance Levels : Maintenance level 1 : Includes all the works that do not require any tool or control equipment. It can be done by staffs without technical training. Level 1 activity includes cleaning, visual checking, lamps exchange, etc. Maintenance level 2 : Includes actions that require simple procedures and/or simple to use support equipment. The safety checking handled by qualified technician, exchange of simple components such as lighting equipment, handled by non-qualified staffs, belongs to this level. Maintenance level 3 : Includes operations that require complex procedures or complex to use support equipment. Major inspection consists in measure and test, exchange of some components and general checking. These tasks also include parts exchange, both for small parts and for parts needing heavy lifting device. This maintenance level includes only part exchange. Maintenance level 4 : Includes operations that require the use of a specific technique, technology or specific support equipment. Level four concerns all the overhaul works. Components Exchange Overhaul (from less than 1 day to 20 days) consists of exchange and repairs of components, depending on the reliability of components. It is done every year to 15 years or more according to the expected lifetime duration of each component. This task necessitates repair shops in order to realize standard exchange of each component. Maintenance level 5 : Operations that require know-how based on particular techniques, technologies and process or support equipment. All the modifications aimed at upgrading the availability of the equipment or components are included in this level. It can be achieved in contractor light repair workshop, overhaul workshop, or at sub-contractors premises.	INFO			
	2 Technical requirement development and allocation				
	2.1 Requirements at train level				
	2.1.1 General	**ALL SYSTEMS**			

REQUIREMENT ID	ISR - Requirements (ReqID)	Template_TRS_Serviceability	Supplier Compliancy	Supplier Comments	Alstom Comments
[ISR_HEN-1]	As part of their commercial and technical offers supplier will provide 1. Spare Parts List (all spares and consumables used for preventive maintenance, corrective maintenance, overhauls and repairs in case of accident or vandalism. Two different types of prices should be stated for each item of the spare parts list = a) price associated with serial production/overhaul conditions b) price associated with after-market conditions for repairs. The spare parts list needs to be supplied by the supplier in the form of a Providor material tab (see below 3.) 2. Special Tools List (includes all Non-Standard Tools that can either only be purchased from the Supplier or a limited number of subcontractors, or that needs to be manufactured / assembled in-house by the Supplier, necessary to, test, operate or maintain the Equipment including software and hardware.Should a tool be required that is not standard, it shall be defined as a Special Tool and declared to ALSTOM. Special tools shall include, but are not limited to, any jigs, fixtures, lifting devices, measuring devices, equipment, hand tools, power tools, or other tools and equipment necessary for disassembling, maintaining, troubleshooting, repairing and reassembling vehicle system or subsystem LRUs. The special tools list shall contain all special tools necessary for the maintainer to peform all maintenance activities (level 4) during the lifetime of the train 3. Providor file (LCC assesment) When filling the providor template, the supplier shall consider that all maintenance activities are performed by the personal of the maintainer therefore separating man hours and material costs. Material costs shall be the cost for purchasing the materials and not include any workload.	ALL SYSTEMS			
[TRS_SM-12331]	Operational conditions: Annual Mileage: 270.000km/yr (Long Train) / 250.000km/yr (Short Train) Operational hours: 5.800h/yr Power-up hours: 7.200h/yr	ALL SYSTEMS			
[TRS_SM-12332]	A train set does not drive more than [350,000] km in a calendar year.	ALL SYSTEMS			
[TRS_SM-12333]	The shortest maintenance interval is [70.000] km or [3] months. The maintenance intervals shall consider at least a tolerance of respectively [1.200] km or [2] calendar days for km of time based tasks.	ALL SYSTEMS			
[TRS_SM-12334]	As a principle systems shall be designed such that no scheduled physical routine inspections, checks or tests are required < 1 year. Any required manual inspections, checks and tests <1 year shall be mitigated by one or more of the following: - •Inbuilt functional checks •Diagnostics •Prognostics •TrainScanner Minor Overhauls shall not be required at intervals less than 12 years Major Overhauls shall not be required at intervals less than 18 years	ALL SYSTEMS			
[TRS_SM-12335]	The Life Cycle Cost is given for a duration of the maintenance contract of [34] years duration.	ALL SYSTEMS			
[ISR_HEN]	The committed noise level shall remain the same over the train lifetime (considering that the equipment are maintained according to the recommended maintenance plan).	ALL SYSTEMS			
	2.1.3 Serviceability requirements				
	2.1.4 Design for Serviceability at train level				
	2.1.4.1 Maintenance free period				
	2.1.4.7 Accessibility	**ALL SYSTEMS**			
[TRS_SM-11403]	Maximum time to gain the access to the LRU shall be less than [2] min.	ALL SYSTEMS			

REQUIREMENT ID	ISR - Requirements (ReqID)	Template_TRS_Serviceability	Supplier Compliancy	Supplier Comments	Alstom Comments
[TRS_SM-11404]	Maintenance sockets shall be provided (RJXX for example) for connection and downloading from inside the trainset. These sockets shall be accessible to connect electrical cables and positioned inside the driving cab and on or near the equipment concerned.	ALL SYSTEMS			
[TRS_SM-11405]	On the roof and underframe: all the boxes shall be train LRUs.	ALL SYSTEMS			
[TRS_SM-11406]	Roof layout: [- When standing access for maintenance shall be forseen in front of an equipment, space of 333mm*333mm shall be available. - When walking area shall be forseen, 38cm width shall be available for walk (*as per MIL-STD-1472G)* with anti slip access. - Specify a room to stand / kneel / crouch the equipment when access from the roof is foreseen to be required - Areas to be identified as safe places to stand, regarding the temperature, rigidity, not to damage the boxes by standing.]	ALL SYSTEMS			
[TRS_SM-12587]	The maximum acceptable distance for reaching maintenance points of roof equipment shall be an operator forearm from working locations (lateral footbridges). In case of higher distance, a possibility on the equipment shall be given to the maintainer to reach the maintenance points safely (e.g.by integrating footpath or cover design, which are designed for supporting a man weight).	ALL SYSTEMS			
[TRS_SM-11407]	Underframe layout · Ability to remove underframe mounted equipment shall be possible by dropping it down, or sideway · All connection points for testing, troubleshooting and programming, all fluid filling and draining points, all pneumatic and electrical connections, all gauges, luminous indicators, sight glasses, switches necessitating work, adjustments and settings shall be accessible from the side of the train.	ALL SYSTEMS			
[TRS_SM-12522]	[All air reservoirs shall have clear access for removal according to local regulations]	ALL SYSTEMS			
[TRS_SM-12553]	Openable element which protects equipment that must be denied access to passengers and potentially mounted in passengers environment shall require the use of [square or standard] key to be manipulated. Key for opening all maintenance panels shall be uniform across sub-systems.	ALL SYSTEMS			
	2.1.4.8 Maintainability	**ALL SYSTEMS**			
[SBK_IHV_Anlage 2_004]	The extending of train set (from short train set to long train set) realised by adding a middle car (disconnecting the train set in the middle, adding a middle car and reconnecting its 2 sides) + commissioning shall be performed within within [16] (sixteen) hours.	ALL SYSTEMS			
[SBK_IHV_Anlage 2_005]	It shall be possible to replace all "replaceable" modules of a long train set within [48] hours during a planned workshop visit.	ALL SYSTEMS			
[TRS_SM-11408]	"HVAC unit saloon" unfitting / fitting time shall be less than [2]h by [2] persons.	ALL SYSTEMS			
[TRS_SM-11409]	"HVAC unit cabin" unfitting / fitting time shall be less than [30]mn by [2] persons.	ALL SYSTEMS			
[TRS_SM-11410]	"AGTU" unfitting / fitting time shall be less than [2]mn by [2] persons.	ALL SYSTEMS			
[TRS_SM-11411]	"Traction motor" unfitting / fitting time shall be less than [2]h by [2] persons.	ALL SYSTEMS			
[TRS_SM-11412]	"Motorized wheel" unfitting / fitting time shall be less than [XX]mn by [X] persons				
[TRS_SM-11413]	"Automatic coupler" unfitting / fitting time shall be less than [4]h by [2] persons	ALL SYSTEMS			
[TRS_SM-11414]	"Gangway" unfitting / fitting time shall be less than [4]h by [2] persons	ALL SYSTEMS			
[TRS_SM-11416]	"Toilet water tanks (grey, fresh, waste)" unfitting / fitting time shall be less than [1]h by [2] persons	ALL SYSTEMS			
	2.1.4.9 Testability & Diagnostic	**ALL SYSTEMS**			
	2.1.4.9.1 Netbox AMM	**ALL SYSTEMS**			

REQUIREMENT ID	ISR - Requirements (ReqID)	Template_TRS_Serviceability	Supplier Compliancy	Supplier Comments	Alstom Comments
[TRS_SM-12804]	The available space shall be predisposed in an electrical cabinet to install a Netbox OMS (Width:107mm (21TE) *height: 129mm (3U) *depth: 230mm). Following cables shall be installed: -Ethernet network. -Power supply (24VDC or 110VDC with 30W consumption). -Antenna GPS & GSM cables. Notes: The train shall include the following provisions to make the installation of netbox (OMS) at train manufacturing or at a later stage (in order not to impact the design later on). (The aim of the Netbox is to send informations to TrainTracer / HealthHub for commissioning, investigations and maintenance purposes.) The train network configuration must be ready for this additional device to connect to the network without having to update any software.	ALL SYSTEMS			
[TRS_SM-13056]	The available space shall be predisposed to install: -A Netbox AMM (Width:107mm (21TE) *height: 129mm (3U) *depth: 230mm). -To accomodate a GPS and GSM antenna on the roof of the car close to the cabinet hosting the netbox AMM, if no train to ground communication is already implemented at project stage. This space is closed with a watertight cover if no antenna is installed yet and can be easily removed in case of a later installation. -A Netbox storage extension 3U x 6TE board like DTR 0000482017 (Width:30.4mm *height: 128.5mm* depth: 147mm) close to the Netbox OMS so that the length of the USB (cable connecting them) does not exceed 3m. Notes: The train shall include the following provisions to make the installation of netbox (AMM) at train manufacturing or at a later stage (in order not to impact the design later on). (The aim of the Netbox AMM is to send informations to TrainTracer / HealthHub for commissioning, investigations and maintenance purposes.) The train network configuration must be ready for this additional device to connect to the network without having to update any software.	ALL SYSTEMS			
[TRS_SM-12805]	The TCMS shall send all the events to the NetBox without any modification of TCMS (eg: if the NetBox is not supplied on the first train but years after the TCMS shall comply with the Netbox needs).	ALL SYSTEMS			
[TRS_SM-12806]	The TCMS2Diag data flow shall be active by default on the MPU. Note: This requirement is related to the NetBox need. The aim of the netbox is to send informations to TrainTracer/HealthHub for commissioning and maintenance purposes.	ALL SYSTEMS			
	2.1.4.9.2 Testability	**ALL SYSTEMS**			
[TRS_SM-12817]	Each sub-system not hosting its own controller shall embed the necessary sensors allowing the controller (usually the TCMS or the BMS in the case of the bogie for instance) monitoring the sub-system to detect that it does not longer provide the expected functions or performances.	ALL SYSTEMS			
[TRS_SM-12818]	Each sub-systems hosting a controller shall monitor its components and the sensors connected to it to detect and report that it does no longer provide the expected functions or performances.	ALL SYSTEMS			
[TRS_SM-12819]	When the sub-system detects a malfunction, it shall create and record an event as explained in the diagnostic requirements.	ALL SYSTEMS			

REQUIREMENT ID	ISR - Requirements (ReqID)	Template_TRS_Serviceability	Supplier Compliancy	Supplier Comments	Alstom Comments
[TRS_SM-12820]	The FMECA, if provided for RAMS purpose, shall include columns showing for each failure modes of LRUs the following information : - The mean of detection of the failure mode (e.g. how the failure mode is physically detected, such as an analogue sensor compared to a threshold, the comparision of a command with a feedback, consistency check between two signals, a mathematical model deriving values from other values measured by sensors...) - The failure rate of occurrence of the failure mode. If the mean of detection detects only partially the occurence, the % of detection shall be indicated. - The corresponding fault code reported by the controller when the failure mode is detected. - The resulting functional consequence(s) on the sub-system as per the list defined in the section "functional consequences"	ALL SYSTEMS			
	2.1.4.9.4 Diagnostic	**ALL SYSTEMS**			
[TRS_SM-12822]	For sub-system implementing the web services / web server : The events recorded by the sub-system controller shall be compliant with ENG-RSC-EN-CR-STD-0019 and ENG-RSC-EN-CR-STD-0065. For sub-systems NOT implementing the web services : The sub-system shall include in the ICD one boolean variable per individual fault code (no group of faults is accepted).	ALL SYSTEMS			
[TRS_SM-12823]	The sub-system controller shall have an internal permanent memory able to store the events for a period of one calendar week (or more if requested by the customer), but at least for one day, even when its power supply is switched off.	ALL SYSTEMS			
[TRS_SM-12824]	The sub-system controller shall be equipped with an ethernet RJ45 / M12 local maintenance socket for connection with a maintenance laptop. This socket shall be different from the Ethernet port used to connect the sub-system to the train network.	ALL SYSTEMS			
[TRS_SM-12825]	The local maintenance socket, measurement points (such as pressure fitting for instance), buttons (tests, mode selection...), control lights, displays... shall be accessible without having to dismount or disconnect anything nor to void any torque, nor to replace any parts or consumable (screws, washer, seal...). Only opening a cover or a cabinet door and / or removing a protection cap of the socket without special tool is accepted. In case the socket has a protection cap, it shall not be possible to lose it when removed.	ALL SYSTEMS			
[TRS_SM-12826]	The Controller of the sub-system, its control panel and measurement points if any shall be safely accessible without having to ground or to power off the train so that various signals (except high voltage) can be checked in live during investigation.	ALL SYSTEMS			
[TRS_SM-12827]	Total access time : This is the time needed to connect the computer to the maintenance socket, access to the control panel or measurement points if any. It shall not take more than [30s] with only one technician. This time starts when the technician stands in front of the place where the device is, in a state ready for the train to go in service and ends when the laptop is connected to the socket, the technician can manipulate the control panel or connect to any measurement point.	ALL SYSTEMS			
[TRS_SM-12828]	Total closing time : Its the time to carry out in the reverse order, all the steps counted in the total access time, to put the sub-system in a state not preventing the train from being ready for service. This time shall not exceed 30 s as well with one technician, no special tools, nor having to replace any part or consumable.	ALL SYSTEMS			

REQUIREMENT ID	ISR - Requirements (ReqID)	Template_TRS_Serviceability	Supplier Compliancy	Supplier Comments	Alstom Comments
[TRS_SM-12829]	Connecting the maintenance laptop to the local maintenance socket shall allow the technician to: - Check the current embedded software version and to update it, - View the list of the faults currently active, - View the fault history (including faults which are no longer active), - Download the fault history to an excel file, erase the fault history, - Read and force variables (especially the hardware inputs and outputs or the network inputs / outputs), - Reset permanent faults and more generally perform all the corrective actions needed to restore the sub-system. - Launch / interrupt built-in tests and observe the result.	ALL SYSTEMS			
[TRS_SM-12830]	The sub-system shall keep operating normally when a laptop is communicated with the maintenance socket.	ALL SYSTEMS			
[TRS_SM-12831]	All the maintenance functions available via the local maintenance socket shall be available as well when the technician connects remotely via the train Ethernet maintenance socket (usually accessible in the driver cab and / or in electrical cabinets) without impacting the normal operation of the sub-system. This also applies to software updates.	ALL SYSTEMS			
[TRS_SM-12832]	The highly preferred maintenance software man machine interface is web pages embedded in the sub-system controller. They shall be compatible with standard free web browsers available on the market (such as at least Microsoft Edge, Mozilla Fire fox and Chrome). The web pages shall be compliant with ENG-RSC-EN-CR-STD-0019.	ALL SYSTEMS			
[TRS_SM-12833]	Sub-systems NOT implementing web pages shall provide their maintenance software free of charge, without any license limitation. The supplier commits to deliver updates when Windows operating system or computer technology change, making the existing version no longer usable on computers being less than 3 years old. These updates are free of charge and available for the train life duration.	ALL SYSTEMS			
[TRS_SM-12834]	The man machine interface shall be available at least in English and values in metric units.	ALL SYSTEMS			
[TRS_SM-12835]	The language and the units of the man machine interface shall be selectable between English and the rolling stock customer's local language.	ALL SYSTEMS			
[TRS_SM-12836]	The man machine interface shall show the live status of each individual conditions required to launch a given built-in test. When all conditions are met, the man machine interface allows the tehnician to launch the built-in test. The technician shall be able to interrupt it at anytime. The man machine interface shows if the built-in test succeeds and if not shows the reason why.	ALL SYSTEMS			
	2.1.4.9.5 Information made available by the sub-system to the TCMS	**ALL SYSTEMS**			
[TRS_SM-12838]	The sub-system controller shall make available in the ICD (even if not useful for the TCMS) the following information: - A copy of all its hardware inputs and outputs changing at a frequency less than once per second. Analogue values and values based on square or sinusoidal signals are put to scale and converted in the relevant metric unit (bars, degree, kph, Volt RMS, % of duty cycle…). The name of the variable shall match with the mnemonic of the sensor shown on the schematics. - If they exist in the sub-system, the validity bits related to the above values. - The physical values resulting from internal models (for instance the motor temperature calculated thanks to a thermal model, wear, consumable consumption…). Note Alstom does not require the supplier to disclose the details of its algorythm. Only the input sensors used (to be able to check them in case of doubt) and the output values are required.	ALL SYSTEMS			

REQUIREMENT ID	ISR - Requirements (ReqID)	Template_TRS_Serviceability	Supplier Compliancy	Supplier Comments	Alstom Comments
[TRS_SM-12839]	The sub-system shall make available in the ICD the following information: Serial number of the controller, Hard version number and Soft version number. The same information shall be made available throught the web services if they are implemented.	ALL SYSTEMS			
	2.1.4.9.6 Built-in tests	**ALL SYSTEMS**			
[TRS_SM-12841]	Built-In tests : For sub-system embedding built-in tests, the sub-system informs the TCMS via the ICD if the pre-conditions to launch the built-in test are met. The TCMS shall be able to request the sub-system to launch any of its internal built in test by setting a bit in the ICD. The sub-system accepts the built in test request if the pre-conditions are OK.	ALL SYSTEMS			
[TRS_SM-12842]	The sub-system communicates the progress and result of the built-in test with a code indicating if the built-in test succeeds or indicating why it fails in the ICD. When the built-in test fails, the sub-system shall also record a fault indicating the cause to help finding the faulty LRU.	ALL SYSTEMS			
[TRS_SM-12843]	A daily built-in test or a built-in test launched at power up shall not record an event if the test is launched, cancelled or successful, but only in case it fails to avoid flooding of events (n sub-systems per train x N trains per fleet can result to significant amount of events per days with little interest).	ALL SYSTEMS			
[TRS_SM-12844]	Preventive maintenance periodic tests to be launched manually by the maintenance are not allowed if the frequency is less than 13 months. The Sub-system shall be able to managed its periodic built-in test automatically.	ALL SYSTEMS			
	2.1.4.9.7 Documentation and Training	**ALL SYSTEMS**			
[ISR_HEN]	**General Requirements**	**ALL SYSTEMS**			
[ISR_HEN]	**Documentation list**	**ALL SYSTEMS**			
[ISR_HEN]	The product documentation is summarised in a documentation list.	ALL SYSTEMS			
[ISR_HEN]	All documentation that is listed in the Annex is listed in a documentation list for the system.	ALL SYSTEMS			
[ISR_HEN]	The documentation list corresponds to ALSTOM's specifications (see tab Documentation list) and contains document numbers, file names, DCC, FBS, availability date, sheet size, version, etc.	ALL SYSTEMS			
[ISR_HEN]	The Contractor shall provide the documentation in the metadata classified by standard EN 15380-2.	ALL SYSTEMS			
[ISR_HEN]	Documentation updates, corrections and extensions	ALL SYSTEMS			
[ISR_HEN]	Supplements to the existing documentation, changes to errors in the existing documentation and changes to the existing documentation due to changes to the regulations, changes to the system, new knowledge about the system from operation or due to the general state of the art: Shall be made available to ALSTOM immediately and at no cost.	ALL SYSTEMS			
[ISR_HEN]	ALSTOM shall be provided immediately with any additions and adaptations to the existing documentation that are required exclusively as a result of ALSTOM's special requests for changes and that go beyond the specifications specified here, stating the charged costs.	ALL SYSTEMS			
[ISR_HEN]	Any documentation subsequently provided as a replacement, supplement or correction must comply with ALSTOM's technical and content requirements specified here.	ALL SYSTEMS			
[ISR_HEN]	Updates to the documentation resulting from changes in statutory provisions, technical changes to the product, corrections to the existing documentation, changes to improve safety or changes required by an extended state of the art shall be made available to ALSTOM free of charge during the agreed warranty period.	ALL SYSTEMS			

REQUIREMENT ID	ISR - Requirements (ReqID)	Template_TRS_Serviceability	Supplier Compliancy	Supplier Comments	Alstom Comments
[ISR_HEN]	ALSTOM reserves the right to complain about documentation that does not comply with ALSTOM's specifications, does not comply with legal requirements or does not correspond to the technical quality of the delivered product. Any documentation complained about by ALSTOM shall be reworked by the Contractor within a reasonable period of time, but at the latest within 6 weeks, without charging any costs.	ALL SYSTEMS			
[ISR_HEN]	**Drawings and Models**	**ALL SYSTEMS**			
[ISR_HEN]	**General**	**ALL SYSTEMS**			
[ISR_HEN]	All documents must be submitted in electronic form.	ALL SYSTEMS			
[ISR_HEN]	Optionally, none of the submitted Supplier documents ALSTOM is requesting in purpose of producing Customer documentation shall be classified as confidential or have a copyright and duplication disclaimer. When the Supplier complies to this requirement it shall be seen equal to a written permission from the Supplier to give ALSTOM the right to use the documents for creating ALSTOM's Customer documents (Instructions, manuals, descriptions etc.).	ALL SYSTEMS			
[ISR_HEN]	All documents / 3D models must be delivered in released status.	ALL SYSTEMS			
[ISR_HEN]	All documents must be identified by following attributes: Name of assembly/system Document number (conveyed by ALSTOM) Legal owner of the document (IPR) Validity date in accordance to ISO 8601 Author, verifier and approver Versioning Page number and number of pages Name of Document Classification Codes (DCC) according to EN 61355-1 Classification codes according to EN 15380-2	ALL SYSTEMS			
[ISR_HEN]	All documentation must be provided in German and English language.	ALL SYSTEMS			
[ISR_HEN]	Text documentation (e.g. technical descriptions) must be provided in Microsoft Office Word format, version 2007 or higher (docx) and PDF/A-1 format, not encrypted and without scanned text elements, printable in paper format A4.	ALL SYSTEMS			
[ISR_HEN]	Lists / tables (including lists related to diagrams) must be provided in Microsoft Office Excel format, version 2007 (xlsx) and PDF/A-1 format, however not encrypted and without scanned text elements, printable in paper format A4.	ALL SYSTEMS			
[ISR_HEN]	Photos must be provided in JPEG (min. 400dpi).	ALL SYSTEMS			
[ISR_HEN]	Diagrams must be provided in TIFF CCITTG4 (min. 400dpi)	ALL SYSTEMS			
	The Titles of the documentation should be aligned with AT before delivering them to AT	ALL SYSTEMS			
[ISR_HEN]	If the documentation does not meet the requirements, ALSTOM can decline it. The Supplier needs to rework until the requirements are fulfilled.	ALL SYSTEMS			
[ISR_HEN]	**3D-Models**	**ALL SYSTEMS**			
[ISR_HEN]	The Supplier must provide 3D data (solids) as STEP AP242-file with max. 100 MB.	ALL SYSTEMS			
[ISR_HEN]	In the 3D Modell the Supplier shall provide details of all interfaces between sub systems, brackets, fasteners and protected air spaces within the Goods.	ALL SYSTEMS			
[ISR_HEN]	**Drawing/ Part Lists**	**ALL SYSTEMS**			
[ISR_HEN]	The Supplier shall provide a set of drawings including the bill of material.	ALL SYSTEMS			
[ISR_HEN]	Technical drawings (2D data) must be provided in PDF/A-1 format, not encrypted and without scanned text elements.	ALL SYSTEMS			
[ISR_HEN]	Parts lists must be provided in PDF/A-1 format, not encrypted and without scanned text elements, printable in paper format A4.	ALL SYSTEMS			

REQUIREMENT ID	ISR - Requirements (ReqID)	Template_TRS_Serviceability	Supplier Compliancy	Supplier Comments	Alstom Comments
[ISR_HEN]	For all agreed spare sparts and exchangeable parts, seperate drawings and parts lists need to be handed over.	ALL SYSTEMS			
[ISR_HEN]	The Supplier generally must adhere to the specifications in EN 15016, parts 1 to 3, for the creation of technical drawings and parts lists.	ALL SYSTEMS			
[ISR_HEN]	The drawings must include bonding aspects, if applicable (adhesive bonding: e.g.confirmation of conformity to standard DIN 6701).	ALL SYSTEMS			
[ISR_HEN]	The drawings must include welding aspects, if applicable (welding: e.g.confirmation of conformity to standard EN 15085).	ALL SYSTEMS			
[ISR_HEN]	Drawings must include static aspects, if applicable.	ALL SYSTEMS			
[ISR_HEN]	Circuit diagrams must be provided in PDF/A-1 format, however not encrypted and without scanned text pages, printable in paper format A3.	ALL SYSTEMS			
[ISR_HEN]	Lists/tables (e.g. equipment list) being related to circuit diagrams must be provided in Microsoft Office Excel format, version 2010 (according to ISO 19005-1:2005) and in PDF/A-1 format, however not encrypted and without scanned text pages, printable in paper format A4.	ALL SYSTEMS			
[ISR_HEN]	**Suppliers Manuals**	**ALL SYSTEMS**			
[ISR_HEN]	**General Scope**	**ALL SYSTEMS**			
[ISR_HEN]	The Supplier shall supply specific information about its Works. All documents shall be delivered electronically. ALSTOM will then produce the complete train operation and Maintenance Manual which will reflect the Supplier's Works as it is installed.	ALL SYSTEMS			
[ISR_HEN]	**Safety Requirements**	**ALL SYSTEMS**			
[ISR_HEN]	Within the Maintenance Manual and Operating Instructions, the supplier shall provide all necessary information for safe assembly, operation and maintenance of their goods. All safety-critical operations and saftey-critical items shall be highlighted.	ALL SYSTEMS			
[ISR_HEN]	**Maintenance Manual**	**ALL SYSTEMS**			
[ISR_HEN]	The Supplier shall describe in detail all maintenance and repair activities relating to the Goods in a Maintenance Manual. For each maintenance task specified on the Goods, the need for post-maintenance testing shall be considered by the Supplier. If post-maintenance testing is felt necessary for a task, then it shall be included in the content of the maintenance instructions.	ALL SYSTEMS			
[ISR_HEN]	The supplier shall indicate in its maintenance documentation what are the required inspections and criteria required to establish the remaining useful life of components and assemblies which need to be overhauled.	ALL SYSTEMS			
[ISR_HEN]	**Preventive / Corrective Maintenance Instructions**	**ALL SYSTEMS**			
[ISR_HEN]	The Supplier Shall provide Preventive Maintenance Instructions and Corrective Maintenance Instructions.	ALL SYSTEMS			
[ISR_HEN]	The maintenance documentation shall include all necessary information for the maintainer to perform himself all the maintenance activities during the lifetime of the vehicles (including all repair activities and overhauls, level 4).	ALL SYSTEMS			
[ISR_HEN]	The Preventive and Corrective Maintenance Instructions shall contain the step-by-step description of all activities, adjustments, repairs, overhauls and calibrations that can be performed on the Equipment, as long as these activities do not lead to a long down time of the Equipment.	ALL SYSTEMS			
[ISR_HEN]	If this tends to be the case, it is preferable to replace the defective unit (Line Replaceable Unit, LRU) on the Equipment and to perform the repair and/or adjustment as 2nd level corrective maintenance in the Customer’s workshop.	ALL SYSTEMS			

REQUIREMENT ID	ISR - Requirements (ReqID)	Template_TRS_Serviceability	Supplier Compliancy	Supplier Comments	Alstom Comments
[ISR_HEN]	The preventive /corrective maintenance instructions shall be structured as follows: a) General safety precautions b) The Good's sub-equipment/component concerned, c) A brief description of the activity to be carried out, d) Reference to the detailed instructions e) Part number of the consumables necessary for carrying out the activity f) Time necessary to carry out the activity (task analysis) g) Detailed maintenance instructions with step-by-step procedures h) Special tools i) Torque figures j) Material incl. consumables required k) Related drawings and diagrams l) Adjustment and Testing procedures m) Equipment safety Condition (e.g. Electrically isolated) n) Information of disposal (sorting to which waste fraction) of discharged / used articles o) Instructions for removal of accumulators and waste batteries	ALL SYSTEMS			
[ISR_HEN]	**Troubleshooting Manual (Defect Finding Guide)**	**ALL SYSTEMS**			
[ISR_HEN]	The repair of Defects (corrective maintenance) has to be done at different levels. For the sake of Equipment availability, repair on the Equipment is done by exchanging (Level 1 maintenance) the defective Goods, subassembly or component (LRU). The repair of this defective LRU itself (Level 2/3 maintenance) shall then be done off-line in a workshop. The Supplier shall supply a Defect Finding Guide in Preventive and corrective maintenance instructions which allows the Defect diagnosis of the Goods within the supplier's scope of supply, down to the replaceable unit that has caused that Defect. The detail of information shall be sufficient to allow this diagnosis to be completed within 1 hour by a train maintainer.	ALL SYSTEMS			
[ISR_HEN]	The Defect Finding Guide (also referred to as "troubleshooting manual") shall be structured as follows: a) Diagnostic trees b) Troubleshooting table c) Testing procedures d) Post process checks	ALL SYSTEMS			
[ISR_HEN]	**Operating Instructions**	**ALL SYSTEMS**			
[ISR_HEN]	The Supplier shall provide the Operating Instructions with the following information: a) General information on the Goods, its features and location of controls. b) Step-by-step procedures for operating the Goods under normal and emergency modes. c) For computer controlled Goods, a detailed command structure shall be provided. All possible Goods messages resulting from the use of a command have to be identified. Sequential use of commands for performing specific control actions have also to be explained. d) Any degraded mode or emergency isolation procedures. e) A detailed description of Goods generated messages shall be provided. f) Trouble shooting procedures for operators.	ALL SYSTEMS			
[ISR_HEN]	**Illustrations and Drawings in Supplier Manuals**	**ALL SYSTEMS**			

REQUIREMENT ID	ISR - Requirements (ReqID)	Template_TRS_Serviceability	Supplier Compliancy	Supplier Comments	Alstom Comments
[ISR_HEN]	The illustrations and drawings contained in Supplier documentation, such as manuals or system descriptions, shall be 2D isometric exploded views and shall be supplied in the latest version of CGM (type 4) using Isodraw or a compatible alternative. Isometric projections can be accepted in the following formats: CGM .cgm type 4 - Preferred, EPS .eps, Isodraw .iso, Adobe Illustrator files .ai, VRML .wrl, IGES .igs, DXF .dxf, DWG (Auto Cad) .dwg, PNG .png or other adequate formats agreed with ALSTOM. Any illustrations contained in Supplier documentation shall be supplied to ALSTOM also separately and in an editable format.	ALL SYSTEMS			
[ISR_HEN]	**Training**	**ALL SYSTEMS**			
[ISR_HEN]	**General**	**ALL SYSTEMS**			
[ISR_HEN]	The Supplier shall provide a Training Programm with Trainingmaterial in particular as follows: a) The number of training days required to fulfil the training obligation: to be discussed and agreed with the Supplier. b) The definition of trainees: Customer and/or ALSTOM personnel, etc. c) Language: all training will be conducted by default in German. d) Training locations will be defined as per project requirement. e) The Supplier shall provide a training window detailing earliest and latest training dates for each course. These dates shall be agreed with ALSTOM. f) The Supplier's training shall be provided by the Supplier in a form certified in accordance with the relevant current national standards. g) Training Programme.	ALL SYSTEMS			
[ISR_HEN]	The Supplier shall provide qualified trainers and training material for conducting the training program. The trainers shall be competent and completely familiar with the subject being taught. A ALSTOM training coordinator will liaise with the Supplier's trainers for approval of the Training Programme and the detailed planning. The Supplier's trainers shall have theoretical and practical knowledge of the lesson content. In order to optimise the out-come of the training, the courses shall be conducted in a direct way, by use of visual aids, actual Goods and actual manual materials as far as possible. They must in all circumstances have the necessary permits and passes to enable the training to be carried out at the defined contract locations.	ALL SYSTEMS			
[ISR_HEN]	**Contents of Training**	**ALL SYSTEMS**			
[ISR_HEN]	The training course shall have the following content: a) Summary and presentation of information contained in the manuals. b) Theoretical explanation of the Goods and how it is working (functioning). c) Practical demonstration of how to operate the Goods on the Equipment, incl. consequences of misuse. d) Theoretical and practical demonstrations of the preventive maintenance (up to level 4) e) Theoretical and practical training of Special Tools, diagnostic equipment, if any f) Practical demonstration of the corrective maintenance with the fault finding procedures (up to level 4) g) The Supplier shall develop with ALSTOM and/or the Customer the objective Pass/Fail criteria. h) Explanation of Health & Safety risks for the supplied equipment.	ALL SYSTEMS			
[ISR_HEN]	**Training Deliverables**	**ALL SYSTEMS**			
[ISR_HEN]	**Course Outline**	**ALL SYSTEMS**			

REQUIREMENT ID	ISR - Requirements (ReqID)	Template_TRS_Serviceability	Supplier Compliancy	Supplier Comments	Alstom Comments
[ISR_HEN]	The supplier shall submit a Training Course Outline in Trainingmaterial providing an overview of each course to be conducted including major and specific aims and objectives of the course; a list of training aids to be used: Goods / facilities / tools / training materials and information about course times and duration.	ALL SYSTEMS			
[ISR_HEN]	**Training Documentation**	**ALL SYSTEMS**			
[ISR_HEN]	The Supplier shall be responsible for the Training Documentation in Training Programm (including participants' handouts and any other required aids) and arrangement of all training course material in the contractual quantities. The participants shall be able to use this training documentation during the course. All training documentation shall be prepared and distributed by the Supplier at least in German language.	ALL SYSTEMS			
[ISR_HEN]	**Training Instructor's Guide and formal Course**	**ALL SYSTEMS**			
[ISR_HEN]	To support a "Train the Trainer" approach, the Supplier shall provide a Training Instructor's Guide (lesson plan) in Trainingmaterial, which outlines the training activities and provides guidelines for the trainer. The training courses may be recorded by ALSTOM on video tape and used for future training sessions.	ALL SYSTEMS			
[ISR_HEN]	**Training Assessment Templates**	**ALL SYSTEMS**			
[ISR_HEN]	A Training Assessment Template containing a set of questions-answer templates is required for each training section should be provided with the Training Programm. With this questions-answer feed-back from the trainees it must be possible to assess the success of the training sessions. A formal certificate shall be issued upon successful completion and pass/fail criteria being achieved at Suppliers cost.	ALL SYSTEMS			
[ISR_HEN]	The supplier shall provide a Training Certification & Log with the Trainingmaterial	ALL SYSTEMS			
	2.1.4.10 Obsolescence	**ALL SYSTEMS**			
[SBK_FLV-17]	. Implementation of Obsolescence Management according to DIN EN 62402:2019 . Alerts of discontinuation/ changes sent by the supplier until 31.12.2063 . half yearly reports of OM and status of components until 31.12.2063 . If the Supplier is no longer able to supply the spare part, it must provide Alstom with a replacement solution without delay. . The Prices for the replacement (Good or Spare Part) shall not exceed the agreed Price of the replaced Good or Spare Part being valid at the time of its obsolescence.. . The replacement solution must ensure backward compatibility and upward compatibility with the interfaces of the adjacent components and with the function of any other module, component or part of the vehicle, and be suitable for the intended installation space	ALL SYSTEMS			
	2.2.20 Coupling	**COUPLING**			
	2.2.20.1 Maintenance plan	**COUPLING**			
[ISR_HEN]	All preventive maintenance task periodicities shall be >= 12 months with the exception of the automatic coupler inspection (minimum 6 months)	COUPLING			
[ISR_HEN]	All preventive maintenance task periodicities for semi-permanent couplers shall be >= 12 months	COUPLING			
	2.2.20.2 Life potentials (overhaul periodicity)	**COUPLING**			

REQUIREMENT ID	ISR - Requirements (ReqID)	Template_TRS_Serviceability	Supplier Compliancy	Supplier Comments	Alstom Comments
[ISR_HEN]	Overhaul periodicity of the auto-coupler: >= 12 years (based on a pre-defined number of coupling cycles per year) That implies no preventive replacement of SRU components (as spring, nipple, locking, bushing for example) before overhaul. On condition maintenance is allowed. Exceptions shall be mutually agreed.	COUPLING			
[ISR_HEN]	Overhaul periodicity of the semi-permanent coupler: >= 18 years That implies no preventive replacement of SRU component (as spring, nipple, locking, bushing for example) before overhaul. Exceptions shall be mutually agreed.	COUPLING			
	2.2.20.3 LCC	**COUPLING**			
[TRS_SM-11503]	Mean yearly preventive Man-Hours of coupler scope (excluding overhaul) shall be less than or equal to [1] hours	COUPLING			
[TRS_SM-11507]	Overhaul Man-Hours for complete maintenance-MAKE scenario of coupler scope shall be less than or equal to [17] hours	COUPLING			
	2.2.20.4 Reliability / Corrective maintenance	**COUPLING**			
[TRS_SM-11514]	MTTR Total of coupler scope On train shall be less than [0,75] hours	COUPLING			
	2.2.20.5 Maintainability	**COUPLING**			
[TRS_SM-11519]	For coupler scope, the connection box replacement (LRU) shall be changed in less than [45] minutes by 1 operator (including the supplier equipment covers time removal, access)	COUPLING			
[TRS_SM-12565]	For coupler scope, Uncoupling+coupling time between 2 vehicles shall be less than [5] min	COUPLING			
[TRS_SM-11520]	For coupler scope, Covers shall be positively spring closed.	COUPLING			
[TRS_SM-11521]	For coupler scope, the life duration of electric components (connectors, wiring, switches) shall be greater than or equal to [30] years, or shall be the same as the life time of the train if it is greater than [30] years.	COUPLING			
[TRS_SM-11522]	For coupler scope, Critical bolts shall be secured using a secondary locking device such as a locking tab or wire lock.	COUPLING			
[TRS_SM-11523]	For coupler scope, Wearing holes shall be bushed wherever possible.	COUPLING			
[TRS_SM-11524]	Couplers shall be design and built with the Poke Yoke principles in mind.	COUPLING			
[TRS_SM-11525]	For semi permanent couplers, the reversible device (Gas Hydraulic buffer) shall be changeable in order to avoid to replace complete coupler	COUPLING			
[TRS_SM-11526]	For coupler scope, In the material kit for overhaul, the supplier shall clearly indicate which parts shall be replaced systematically, and which parts shall be replaced on condition base.	COUPLING			
[TRS_SM-11527]	For coupler scope, Easy access to "active" components shall be a priority when designing the equipment	COUPLING			
[ISR_HEN]	The coupler-to-coupler connecting bolts of the inter-vehicle coupler shall be directly visible from the side of the vehicle.	COUPLING			
[ISR_HEN]	The status of the semi-permanent coupler collapsible tube, if applicable, shall be visible to optical detection from underneath or sides. That means that the status shall be clearly visible to any maintaining personnel or optical maintenance detection system with a minimum indicator size of 10x10x10mm.	COUPLING			
[ISR_HEN]	Replacement of the automatic coupler unit (for overhaul or corrective maintenance): < 2 h, 2 persons	COUPLING			

REQUIREMENT ID	ISR - Requirements (ReqID)	Template_TRS_Serviceability	Supplier Compliancy	Supplier Comments	Alstom Comments
[ISR_HEN]	Replacement of both semi-permanent coupler halfs (for overhaul or corrective maintenance): < 2 h, 2 persons The measured time shall not consider any time needed to split gangways or open intercar-jumper-cabeling.	COUPLING			
	2.2.20.6 Accessibility	**COUPLING**			
[TRS_SM-11528]	The automatic coupler shall be moved to on side to allow full access along length of coupler for maintenance	COUPLING			
	2.2.20.7 Testability and TCMS	**COUPLING**			

4S03.01.01.REQ.SBK-1098	**Safety Requirements** **1.1.11 Design for Safety**	Include Req for SBK	Supplier Compliancy	Supplier Comments	Alstom Comments
4S03.01.01.REQ.SBK-1099	**1.1.11.1 General**	Yes			
4S03.01.01.REQ.SBK-2475	The following standard shall be followed in order to satisfy the Safety Integrity Level (SIL) requirement allocated to the system software: EN 50657:2017 (Railways Applications - Rolling stock applications - Software on Board Rolling Stock) Alternatively EN 50128+A2:2020 (Railway applications – Communication, signalling and processing systems – Software for railway control and protection systems)	Yes			
4S03.01.01.REQ.SBK-2476	The following standard shall be followed in order to satisfy the Safety Integrity Level (SIL) requirement allocated to the E/E/PE functions of the system: EN 50129/AC:2019 (Railway applications – Communication, signalling and processing systems – Safety related electronic systems for signalling) EN 50126-2:2017 (Railway applications –The Specification and Demonstration of Reliability, Availability, Maintainability and Safety (RAMS) - Part 2: Systems Approach to Safety)	Yes			
4S03.01.01.REQ.SBK-1101	The following standard shall be followed in order to ensure a correct integration of electronical equipment into the train: EN 50155:2007 Railway applications - Electronic equipment used on rolling stock	Yes			
4S03.01.01.REQ.SBK-1104	**1.1.11.2 Safety plan**	Yes			
4S03.01.01.REQ.SBK-2820	**1.1.11.2.1.1 Bid Safety Plan**	Yes			
4S03.01.01.REQ.SBK-2821	A Bid Safety Plan for the Goods to shall be based on the methodology of EN 50126-1:2017 *and shall include, but not be limited to:*	Yes			
4S03.01.01.REQ.SBK-2831	**1.1.11.2.2.1.1 Contract Safety Plan**	Yes			
4S03.01.01.REQ.SBK-2832	The Supplier shall update the Bid Safety Plan into a Contract Safety Plan to reflect the current design status.	Yes			
4S03.01.01.REQ.SBK-2833	It shall be reviewed, for identifying any additional or changed safety requirements that stem from the conditions of the signed Contract.	Yes			
4S03.01.01.REQ.SBK-2834	The contract Safety plan shall contain at least the following details: -Safety requirements and acceptance criteria for the Safety process and how the project specific criteria fulfil the AT's and National Safety Authority (NSA's) overall acceptance criteria for operation as mentioned in AT safety plan. It shall also show how the safety-related requirements in EN50126 are fulfilled -Applicable activities in order to support AT in fulfillment of the processes out in Common Safety Method for Risk Assessment (CSM-RA) No 402/2013 updated in No 1136/2015 -A description of the organization including responsibilities, competence, authorities and duties (related to the RAMS processes). The organization plan should describe necessary independency and responsibility for the Safety, Verification and Validation -A list of Safety task activities to be performed, and schedules for these activities, as Safety case, documentation reviews, risk analyses, testing and Safety management task verifications (EN50126) -A description of follow-up system for the Safety activities, including EN50126 task Verifications and hazard record/log according to CSM-RA	Yes			
4S03.01.01.REQ.SBK-2835	The Safety Plan shall be agreed with AT.	Yes			
4S03.01.01.REQ.SBK-2837	**1.1.11.2.2.1.2 Safety Requirements Specifications**	Yes			
4S03.01.01.REQ.SBK-2838	During the project design phase (after supplier contract is awarded), all safety requirements to the Goods to be delivered shall be described in a Safety Requirements Specification (SRS).	Yes			
4S03.01.01.REQ.SBK-2843	The supplier shall be responsible to identify the standards and laws which are relevant for the Goods/subsystem to be delivered.	Yes			
4S03.01.01.REQ.SBK-2845	The supplier shall request AT for clarification if safety requirements derive from standards or laws diverge with other safety requirements.	Yes			
4S03.01.01.REQ.SBK-2846	The Safety Requirements Specification shall be agreed between the Supplier and AT.	Yes			
4S03.01.01.REQ.SBK-2850	The Supplier shall clearly identify all functions of their scope of supply which directly deliver or contribute to a safety related function.	Yes			

4S03.01.01.REQ.SBK-1098	**Safety Requirements** **1.1.11 Design for Safety**	Include Req for SBK	Supplier Compliancy	Supplier Comments	Alstom Comments
4S03.01.01.REQ.SBK-2856	The AT's acceptance of the safety function and the applicable SIL/TFFR/SSIL written in the Safety Requirements Specification (SRS) will be based on the document provided by the supplier before the acceptance date (Subsystem's functions description, subsystem hazard analyses, necessary safety analysis …)	Yes			
4S03.01.01.REQ.SBK-2857	The Supplier shall agree the listed requirement to safety functions (and as a consequence the related analyses/report proving the compliance with the requirements) may be updated/completed during the design stage.	Yes			
4S03.01.01.REQ.SBK-2860	**1.1.11.2.2.1.3 Safety Critical Item List (SCIL)**	Yes			
4S03.01.01.REQ.SBK-2861	The Supplier shall use the results as derived from the Hazard Analyses and the Safety Analyses to prepare and maintain current, throughout all project phases, a Safety Critical Items List (SCIL). Component failure modes leading to hazard severity "Catastrophic" and "Critical" (according to EN 50126 Table C.4) shall be considered in the SCIL. This regard also the common cause and common mode failure consideration.	Yes			
4S03.01.01.REQ.SBK-2865	The Supplier shall submit in the SCIL a record of the analyses and verification actions performed in the SCIL to demonstrate that the safety property required to the Safety Critical Item are achieved and maintained throughout the component life.	Yes			
4S03.01.01.REQ.SBK-2866	It shall be proved that the resulting safety critical items are considered in design / sizing / manufacturing / quality / mounting / testing / maintenance areas. Regarding the sizing area, compliance with the technical requirement can be proved for instance by test report, calculation note for worst case loads, stresses or scenarios (Finite Element Analysis is required for complex sizing component).	Yes			
4S03.01.01.REQ.SBK-2867	The Supplier shall ensure that all the safety critical items are: • identifiable and traceable to the items/LRUs in the design submissions provided by the Supplier. Documentation references should be provided to aid traceability; • highlighted in the maintenance manuals to ensure that Maintainer is aware of the proper maintenance procedures/trainings that need to be implemented.	Yes			
4S03.01.01.REQ.SBK-2869	**1.1.11.2.2.2 Hazard Analyses Deliverable**	Yes			
4S03.01.01.REQ.SBK-2875	**1.1.11.2.2.2.2 Interface Hazard/Failure Analysis (IHA/IFA)**	Yes			
4S03.01.01.REQ.SBK-2883	**1.1.11.2.2.3 Safety Analyses**	Yes			
4S03.01.01.REQ.SBK-2892	**1.1.11.2.2.4 Safety Case EN 50129**	Yes			
4S03.01.01.REQ.SBK-2895	The contents of the Safety Case shall follow the structure described in EN 50129:2003. The Supplier shall also provide any other documentation, which may be necessary, e.g. for homologation of the Goods.	Yes			
4S03.01.01.REQ.SBK-2896	If solely a Safety Case EN 50129 is required in the SRD, the requirement to Safety Summary Report (in section §Evidence in relation toProduct Safety Area) shall be covered by the EN 50129 safety case	Yes			
4S03.01.01.REQ.SBK-1106	1.1.11.3 Safety Requirements Specification	Yes			
4S03.01.01.REQ.SBK-1107	1.1.11.4 Hazard Analysis	Yes			
4S03.01.01.REQ.SBK-1117	1.1.11.5 Safety Critical Item List (SCIL)	Yes			
4S03.01.01.REQ.SBK-3330	The SCIL shall distinguish safety critical components (as defined in the technical specification for interoperability (TSI)), for which a single failure has a credible potential to lead directly to hazard severity "Catastrophic" and "Critical" (according to EN 50126 Table C.4).	Yes			
4S03.01.01.REQ.SBK-1118	**1.1.11.6 Safety Related Application Conditions (SRAC)**	Yes			
4S03.01.01.REQ.SBK-1128	**1.1.11.7 Independent Hardware and Software Assessment**	Yes			
4S03.01.01.REQ.SBK-2469	The Contractor shall employ a qualified independent Assessor subject to acceptance by Alstom. The independent Assessor shall have experience of safety assessment on similar systems of this contract in accordance to EN 50128:2011 or EN 50657:2017 for the software and EN 50129 for the hardware or other equivalent standards.	Yes			
4S03.01.01.REQ.SBK-2470	The independent Assessor may be from the Suppliers' organization but must be totally independent from the project team.	Yes			
4S03.01.01.REQ.SBK-2471	All hardware assessment reports shall be submitted also to Alstom.	Yes			
4S03.01.01.REQ.SBK-2472	The Assessor shall be employed in the conceptual design phase and all assessments shall be planned during the conceptual design phase.	Yes			
4S03.01.01.REQ.SBK-2473	SW Assessment report (EN50128 / EN 50657, for SSIL>0) The Supplier shall provide SW Assessment Report as defined in PRD section for Software Safety Integrity Level (SWSIL)	Yes			
4S03.01.01.REQ.SBK-2474	Safety Assessment Plan & Report The Supplier shall provide Safety Assessment Plan & Report compliance to EN 50129.	Yes			

4S03.01.01.REQ.SBK-1098	**Safety Requirements** **1.1.11 Design for Safety**	Include Req for SBK	Supplier Compliancy	Supplier Comments	Alstom Comments
4S03.01.01.REQ.SBK-1129	**1.1.11.8 Quantitative Fault Tree analysis**	Yes			
4S03.01.01.REQ.SBK-1131	**1.1.11.9 Failure Modes, Effects & Criticality Analysis (FMECA)**	Yes			
4S03.01.01.REQ.SBK-1132	**1.1.11.10 Safety Demonstration**	Yes			
4S03.01.01.REQ.SBK-1133	The Supplier shall provide a EN 50129 safety case as defined in Section 2.4.2.2.5.1 of PRD.	Yes			
4S03.01.01.REQ.SBK-1137	Enable release external doors: - When the train is at standstill and the driver has given the release order from the active cab the exterior passenger doors shall be released. TSI Loc & Pass 2014 requirements 4.2.5.5.8 Safety requirements for clauses 4.2.5.5.2 to 4.2.5.5.7: 2) For the scenario “several doors are unlocked (with train crew not correctly informed of this door status) or released or opened in inappropriate areas (e.g. wrong side of the train) or situations (e.g. train running), it shall be demonstrated that the risk is controlled to an acceptable level, considering that the functional failure has typical credible direct potential to lead to: - "fatalities and/or severe injuries” for units in which some passengers stay in standing position in the door area in normal operation. Req.: failure rate < 10-9 operating hours. This scenario is identified with the following hazards: - Spurious release / opening of several doors (several or trainwide) at speed: SIL 4 / <10-9 fph - Spurious release / opening of doors (several or trainwide) at standstill on the opposite side: SIL 4 / <10-9 fph - Spurious release / opening of doors (several or trainwide) at standstill out of station area: SIL 4 / <10-9 fph - Spurious release / opening of doors (several or trainwide) at standstill with train stopped in the station, platform too short. Including Door selective single Door locking: SIL 2 / <10-7 fph - Undetected unlocked doors (several or trainwide): SIL 4 / <10-9 fph	Yes			
4S03.01.01.REQ.SBK-1138	Reduce the gap between vehicle and platform: - Safety requirements must comply SIL2 criteria	Yes			
4S03.01.01.REQ.SBK-1139	Cancel release external doors: The door release shall be removed when driver selects to close the exterior doors or when the train is no longer in standstill. - Safety requirements must comply SIL2 criteria	Yes			
4S03.01.01.REQ.SBK-1140	Enable selective external door including step opening - Safety requirements must comply SIL2 criteria	Yes			
4S03.01.01.REQ.SBK-1141	Manage the door including step according to obstacle detection - Safety requirements must comply SIL2 criteria	Yes			
4S03.01.01.REQ.SBK-1142	Lock external doors including step: - To keep the door & step closed and locked - Safety requirements must comply SIL3 criteria	Yes			
4S03.01.01.REQ.SBK-1144	Signal all external door closed and locked state: - When the interlock device is activated on the step then the step status shall be bypassed and considered closed and locked. - Safety requirements must comply SIL2 criteria	Yes			
4S03.01.01.REQ.SBK-1145	Signal external door including step status change/open/close - Safety requirements must comply SIL2 criteria	Yes			

4S03.01.01.REQ.SBK-1098	**Safety Requirements** **1.1.11 Design for Safety**	Include Req for SBK	Supplier Compliancy	Supplier Comments	Alstom Comments
4S03.01.01.REQ.SBK-1146	Enable external door opening in emergency: - Emergency opening of exterior passenger doors shall be possible from the inside and the outside of the train independent of train status. Emergency opening is possible even if the door is interlocked. TSI Loc&Pass 2014 requirements: 4.2.5.5.9 - Door emergency opening (4) For the scenario “failure in the internal emergency opening system of two adjacent doors along a through route (as defined in clause 4.2.10.5 of this TSI), the emergency opening system of other doors remaining available”, it shall be demonstrated that the risk is controlled to an acceptable level, considering that the functional failure has typical credible potential to lead directly to “single fatality and/or severe injury”. Req.: failure rate < 10-7 operating hours. The scenario is also identified with the following hazards: - Enable external door opening in emergency:SIL 2 / < 10-7 fph - Enable external door opening in emergency while driving: SIL 2 / < 10-7 fph	Yes			
4S03.01.01.REQ.SBK-1147	External doors (DBP*2) Prevent extraction of steps at speed: SIL2	Yes			
4S03.01.01.REQ.SBK-2933	It shall be possible for the Customer to configure the volume for the Passenger exterior door alert signal.	Yes			

FSR	Functional Safety requirement	Target
FSR01as	Hazard: Collision/projectile	< 1E-9/h*
FSR02as	Calculation note to demonstrate fixations on carbody are adequate and redundant (when applicable)	No quantitative target
FSR03as	Mechanical tests compliant with the TPS requirements	No quantitative target

Generic Functional Safety Requirements for automatic couplers:

FSR	Functional Safety requirement	Target
FSR01a	Hazard: Derailment/Collision	< 1E-08/h*
FSR02a	Hazard: loss of brake performances potential for collision/derailment	< 1E-9/h*
FSR03a	Hazard: Collision	< 1E-7/h*
FSR04a	Hazard: loss of safety function relaying on train line	< 1E-7/h*
FSR05a	Hazard: loss of safety function relaying on train line	< 1E-9/h*
FSR06a	Coupler compliant with EN60352 and IEC 61373 (to confirm robustness of electrical connections in line with FSR04 & FSR05)	No quantitative target

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Generic Functional Safety Requirements for semi-permanent couplers:

FSR	Functional Safety requirement	Target
FSR01s	Hazard: Derailment/Collision	< 1E-9/h*

Ref	Subsystem Safety Typical deliverables list	COUPLER
1	Safety Plan	-
2	Hazard Analysis(4)	M
3	Safety Management file (Hazard Log) (5)	-
4	FMEA/FMECA	R
5	Safety Demonstrations (like FTA)	M when applicable (1)
6	SIL Demonstration	-
7	Safety Case (§4.3)	M

M : Mandatory

HR : Highly Recommended R : Recommended

(1) : When a demonstration ofa feared event or a functional failure rate specified relies on the combination of failures (complementary with single failure analysis like FMEA/FMECA), the Supplier shall perform a safety demonstration other than FMEA/FMECA being a single failure analysis.

(2) : SIL Demonstration for Safety Functions relying on Electronic or Programmable Electronic shall be performed: random failure target is achieved and the required level ofconfidence on systematic failures (e.g. software development process and hardware part design) shall be justified.

(3) : Applies when the gas used for extinguishment is toxic

(4) : Hazard Analysis is under the supplier responsibility. When not requested, that means Alstom required only the summary in the Safety Case (including SRAC ifany).

(5) : Safety Management file (Hazard Log) is under the supplier responsibility. That means Alstom requires only the status of the safety requirements coming from the supplier safety studies and those defined by Alstom in the Safety Case (including SRAC if any).