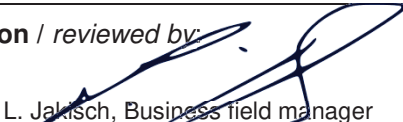


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Kunden-Referenz-Nr.: 1217367 <i>Client Reference No.:</i>		Auftragsdatum: 17/06/2019 <i>Order date:</i>			
Auftraggeber: Alumero Systematic Solutions GmbH <i>Client:</i>					
Prüfgegenstand: Photovoltaic (PV) mounting system <i>Test item:</i>					
Bezeichnung / Typ-Nr.: AS 2.1 (pitched roof system) <i>Identification / Type No.:</i>					
Auftrags-Inhalt: Qualification of a photovoltaic (PV) mounting system to bonding and grounding <i>Order content:</i>					
Prüfgrundlage: Photovoltaic (PV) mounting systems <i>Test specification:</i> ANSI/UL 2703, Issue 02: 2012 Bonding and grounding					
Wareneingangsdatum: 11/07/2019 <i>Date of receipt:</i>		Detaillierte Fotodokumentation siehe Anlage zu diesem Bericht Detailed photo documentation see appendix to this report			
Prüfmuster-Nr.: see clause 6 <i>Test sample No.:</i>					
Prüfzeitraum: 16/07/2019 – 09/10/2019 <i>Testing period:</i>					
Ort der Prüfung: Cologne <i>Place of testing:</i>					
Prüflaboratorium: Solar Energy Assessment Center <i>Testing laboratory:</i>					
Prüfergebnis*: Pass <i>Test result*:</i>					
geprüft von / tested by:		kontrolliert von / reviewed by:			
16/12/2019 D. Köster, Project manager 		16/12/2019 L. Jakisch, Business field manager 			
Datum <i>Date</i>	Name / Stellung <i>Name / Position</i>	Unterschrift <i>Signature</i>	Datum <i>Date</i>	Name / Stellung <i>Name / Position</i>	Unterschrift <i>Signature</i>
Sonstiges / Other: Only the relevant sections for bonding and grounding have been considered.					
Zustand des Prüfgegenstandes bei Anlieferung: <i>Condition of the test item at delivery:</i>			Prüfmuster vollständig und unbeschädigt <i>Test item complete and undamaged</i>		
* Legende: 1 = sehr gut 2 = gut 3 = befriedigend 4 = ausreichend 5 = mangelhaft P(ass) = entspricht o.g. Prüfgrundlage(n) F(ail) = entspricht nicht o.g. Prüfgrundlage(n) N/A = nicht anwendbar N/T = nicht getestet Legend: 1 = very good 2 = good 3 = satisfactory 4 = sufficient 5 = poor P(ass) = passed a.m. test specification(s) F(ail) = failed a.m. test specification(s) N/A = not applicable N/T = not tested					
Dieser Prüfbericht bezieht sich nur auf das o.g. Prüfmuster und darf ohne Genehmigung der Prüfstelle nicht auszugsweise vervielfältigt werden. Dieser Bericht berechtigt nicht zur Verwendung eines Prüfzeichens. <i>This test report only relates to the a. m. test sample. Without permission of the test center this test report is not permitted to be duplicated in extracts. This test report does not entitle to carry any test mark.</i>					

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Liste der verwendeten Prüfmittel
List of used test equipment

[illegible]

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Produktbeschreibung
Product description

I	General			
1	Product details Produktdetails			
	Electrical ratings			
	System name	AS 2.1		
	Over-current protection rating [A]	25		
	Maximum system voltage [V]	1500		
	Indicate torque [Nm]	15 (M8 (A2-70 or A4-70), 30 (M10 (A2-70 or A4-70)		
	Maximum length [m]	15 (afterwards an expansion joint of at least 5 cm must be considered)		
	Maximum cantilever [cm]	30		
	Mechanical Design Load (Downward/Upward/Downslope) [psf]	Downward/Positive (Snow) = N/T	Upward/Negative (Wind) = N/T	Downslope = N/T
	Installation Manual, including Revision	Alumero AS 2.1 tiled roof Installation instruction, January 2013 Alumero AS 2.1 corrugated eternity roof Installation instruction, January 2013 Alumero AS 2.1 installation on trapezoidal metal sheet, May 2017		
2	Used materials Verwendete Materialien			
	See Constructional Data Form (CDF) no. 21290536.001			

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Produktbeschreibung
Product description

3	Address(es) of the manufacturing site(s) <i>Adresse(n) der Fertigungsstätte(n)</i> - Alumero Metal Components Sp.z.o.o., Ul. Kluczborska 29, 41-508 Chorzów, Poland Inspection report no.: 21217392.005 (January 2019)
4	Summary of test results <i>Zusammenfassung der Prüfergebnisse</i> All of the required tests of the standards ANSI/UL 2703, Issue 02:2012 were passed according to its regulations of the pass criteria. It is therefore declared, that the photovoltaic mounting system of the aforementioned types fulfil the requirements of the standards ANSI/UL 2703, and it is recommended that certification should be granted. The standard was only partially tested with focus on the section for bonding and grounding. The sections for mechanical testing and fire testing have not been tested. For this report the maximum system voltage was extended to 1500 V_{DC}. There has been no test performed which includes requirements or test parameter in relation to the maximum system voltage. Therefore it is concerning the given values from common PV module types. <u>Test failures:</u> N/A This test report includes a history of reporting and certification and photo documentation in the appendix. Throughout this report a <i>point</i> is used as the decimal separator.

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5	Test specification		
	ANSI/UL 2703 issue02:2012: Outline of investigation for mounting systems, mounting devices, clamping/retention device, and ground lugs for use with flat-plate photovoltaic modules and panels	applicable	—

5.1	List of test samples			
	☐ The modules tested were taken at random from a production batch and subjected to manufacturer's normal quality control and inspection for safety testing		—	
	☐ The modules tested were prototypes of a new design and not taken from a production batch.			
Sample no.	Sample SN	Test sequence		Remarks / constructional characteristics
HV2019003218	1	SaltMist		Individual parts
HV2019003219	2	SaltMist		Individual parts
HV2019003220	3	TC200		Assembly with relevant parts
HV2019003221	4	HF10		Assembly with relevant parts
HV2019003222	5	HF10		Assembly with relevant parts
HV2019003223	6	HF10		Assembly with relevant parts
HV2019003224	7	SaltMist		Assembly with relevant parts
HV2019003225	8	SaltMist		Assembly with relevant parts
HV2019003226	9	TC200		Assembly with relevant parts
HV2019003227	10	TC200		Assembly with relevant parts

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5.2	Overview of tests and test results		
Test	Remarks	Result	
Visual Inspection		P	
Bonding Path Resistance Test	Section 13	P	
Terminal Torque Test		N/A	
Fire Tests		N/A	
Accelerated Aging Test		N/A	
Temperature Cycling Test	Section 17	P	
Humidity Test	Section 18	P	
Corrosive Atmosphere Test	Section 19	P	
Metallic Coating Thickness Test		N/A	
Mechanical Loading Test		N/A	
Bonding Conductor Test	Section 22	P	
Bonding Strap Pull Test		N/A	

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II	Construction
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6	General		
6.1	The rack mounting system and all components shall be designed with suitable materials and at sufficient material thickness for structural integrity under the loads the rack system will be subjected to. Materials shall also have suitable corrosion resistance. Any dissimilar metals that significantly contribute to galvanic corrosion shall not be utilized. The electrochemical potentials table of Figure 6.1 shows various common metal combinations. Combinations below the table cutoff line are considered to be acceptable.		N/A
6.2	The rack mounting system shall be designed with suitable corrosion resistant materials to ensure that the rack system, through all connection points, is suitable bond/ground path		N/A
6.3	Clamping device shall be evaluated with their mounting hardware designed with suitable corrosion resistant material to ensure structural integrity to suitable retain PV modules for loading, cycling loading and, where applicable, to maintain a bond/ground path. The clamping devices for bonding, where intended to be utilized with aluminum framed PV modules, must have a means to pierce the PV module's frame anodization, paint or other non-conductive coatings		P
6.4	Threaded fasteners used to secure clamping device and other components shall be utilized at their recommended clamp load and shall not incorporate sheet metal threads. The tensile strength of the cap screw shall match the proof load of the female threads. Threaded fasteners are to be of suitable tensile strength and corrosion resistance and are to be tightened to recommended torque for the fastener type and size as specified by the mounting system manufacturer. The tightening torque specification shall result in clamp load on fastened joint that exceeds the force that the joint can exert against the threaded fastener. Threaded fasteners without suitable clamp load are subject to loosening and/or fatigue failure.		N/A

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6.5	It is necessary to consider cycling loading, that if a PV module's uplift potential, in accordance with Standard for Flat-Plate Photovoltaic Module and Panels, UL 1703, exceeds the fasteners clamp load, a fatigue potential exists. It will be necessary to calculate the fastener's clamp load, using the clamping device manufacturer's recommended torque for the fastener size and threads per inch, the number of fasteners per PV Module compare to potential upload, utilizing the 45 lb/ft ² up-loading (or greater based upon the PV module load rating) from UL 1703. A minimum safety factor of 4:1 must be utilized, where the clamp load exceeds potential uplift, based upon UL 1703 test values.		N/A
6.6	For threaded fasteners utilized in shear, a slip factor (where joint movement could occur) between the surfaces clamped shall be 2:1 when compared to the test load upforce (which is based upon the PV module's load rating and therefore may be greater than 45 lbs/ft ²). The same calculation in 6.5 is to be utilized, however the coefficient of friction (not the same as threaded fastener "friction coefficient" in 6.5) is also to be considered between the joint mating surfaces.		N/A
6.7	Where a threaded rod is utilized, such as but not limited to a leveling device, and as such a clamp load is not possible, then it is necessary to apply a 10:1 factor to the tensile strength of the 300-series stainless steel (not the clamp load noted in example 6.5 since there would not be a clamp load).		N/A
6.8	The rack mounting system and clamping device(s) shall not be designed such that a module or panel assembly bolt, screw, or other part integral to the construction of the module or panel is used for securing the PV module or panel to the rack mounting system.		N/A
6.9	The rack mounting system and clamping device(s) shall not be designed such that a PV module or panel requires any alteration unless specific details describing necessary modification(s) for alternate installation(s) are provided in the installation instructions. If a module or panel must bear a definite relationship to another for the intended installation and operation of the array (for example, to allow connectors to mate), it shall be constructed to permit it to be incorporated into the array in the correct relationship without the need for alteration.		N/A
6.10	The construction of a rack mounting system and clamping device shall be such that during installation it will not be necessary to alter or remove any cover, baffle, insulation, or shield that is required to reduce the likelihood of excessive temperatures, or unintentional contact with a part that may involve a risk of electric shock.		N/A
6.11	Parts shall be prevented from loosening or turning if such loosening or turning may result in a risk of fire, electric shock, or injury to persons.		N/A

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6.12	Friction between surfaces is not acceptable as the sole means to inhibit the turning, loosening, or movement of a part.		N/A
6.13	Screw threads that are intended to clamp two or more materials together shall engage a single layer of material only.		N/A
6.14	An adjustable or movable structural part shall be provided with a positive locking device to reduce the likelihood of unintentional shifting, such as but not limited to a cap screw or machine screw with a definite clamp load, retaining pin or the like, if any such shifting may result in a risk of fire, electric shock, or injury to persons.		N/A
6.15	Metals used in locations that may be wet or moist shall not be employed in combinations that could result in deterioration of either metal such that the product would not comply with the requirements in this Outline of Investigation.		P
6.16	Edges, projections, and corners of rack mounting system and clamping devices shall be such as to reduce the risk of injury to persons.		P
6.17	Whenever a referee measurement is necessary to determine that a part as referenced in 6.16 is not sufficiently sharp to constitute a risk of injury to persons, the method described in the Standard for Tests for Sharpness of Edges on Equipment, UL 1439, is to be employed.		P
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7	Polymeric materials		
7.1	A polymeric material utilized in a rack mounting system and/or clamping device shall comply with the applicable requirements in the Standard for Polymeric Materials - Use in Electrical Equipment Evaluations, UL 746C, concerning: a) Flammability, b) Ultraviolet light exposure (when exposed to direct sunlight), c) Water exposure and immersion, d) Hot-wire ignition (HWI) (when relied upon for electrical isolation or insulation), and e) Relative Thermal Index (RTI).		N/A
7.2	A polymeric material serving as the mechanical support or insulation of a part involving a risk of fire or electric shock shall: a) Have a flammability classification b) Have a minimum High-Current Arc Ignition performance level category (PLC) c) Have a Comparative Tracking Index performance level category (PLC) of 2 or better, d) Have an Inclined Plane Tracking (ASTM D2303) rating of 1 h e) Comply with the requirements for exposure to ultraviolet light		N/A
7.3	A polymeric material that serves as mechanical or electrical support and has an exposed surface area greater than 10 ft ² (0.93 m ²) or a single dimension larger than 6 ft (1.83 m) shall have a flame spread index of 100 or less as determined under the Standard Method of Test for Surface Flammability of Materials Using a Radiant Heat Energy Source, ASTM E162-2001.		N/A

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8	Grounding and Grounding Devices		
8.1	The requirements in Section 9, Bonding, also apply to grounding.	See section 9	P
8.2	Mounting systems shall have a means for grounding/bonding all accessible potentially conductive parts. Grounding devices shall comply with the Standard for Grounding and Bonding Equipment, UL 467, and also to the requirements of this Standard. The grounding means shall be bonded to each conductive part of the rack mounting systems and clamping devices. The grounding means shall be described in detail in the installation manual. See Installation and Assembly Instructions, Section 26.	See section 26	P
8.3	A wire-binding screw or stud- and nut-type terminal used to terminate conductors not larger than 10 AWG (5.3 mm²) shall comply with the following: a) A threaded screw or stud shall be of nonferrous metal, 300-series stainless steel, or plated steel appropriate for the application, shall not have more than 32 threads/in, and shall not be smaller than No. 8 when used to terminate 10 or 12 AWG (5.3 or 3.3 mm²) wire; and not smaller than No. 6 when used to terminate 14 AWG (2.1 mm²) and smaller wire. A wire-binding screw or stud- and nut-type terminal shall be provided with upturned lugs, a cupped washer, a barrier, or other equivalent means to retain the wire in position. The head of a wire-binding screw used to terminate 12 AWG or smaller wire shall have a minimum diameter of 0.275 in (7.0 mm) and the head of a screw used to terminate 10 AWG wire shall have a minimum diameter of 0.327 in (8.3 mm). b) A tapped terminal plate shall: 1) Be of nonferrous metal or 300-series stainless steel, 2) Not have less than two full screw threads, and 3) Be of metal not less than 0.050 in (1.27 mm) thick when used to terminate 10 or 12 AWG wire and not less than 0.030 in (0.76 mm) thick when used to terminate a 14 AWG or smaller wire. Unextruded metal for screw threads obtained by extruding a hole shall have a thickness not less than the pitch of the screw thread.		P
8.4	If a terminal connection is employed as part of a rack mounting system or clamping device (a wire-binding screw, a pressure wire connector, or a stud) for an equipment grounding conductor, it shall be identified by being marked "G," "GR," "GROUND," "GROUNDING," or the like, or shall have a green-colored part. None other than grounding terminals shall be so identified.	No marking on the system. Description is valid in the manual.	P

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8.5	If a marking is used to identify an equipment grounding terminal, it shall be located on or adjacent to the terminal.	No marking on the system. Description is valid in the manual.	P
8.6	If a green-colored part is used to identify the equipment-grounding terminal, it shall be readily visible during and after installation of the equipment-grounding conductor and the portion of the terminal that is green shall not be readily removable from the remainder of the terminal.		N/A
8.7	Grounding devices secured with 300-series stainless steel cap screw(s), nut and starwasher(s) are acceptable for use with Anodized/coated aluminum PV module frames or Rack Mounting system frame/rails (anodized/coated or mill finish) when the following parameters are specified in the installation instructions and subjected to the tests in Sections 13, 17, 18, and 22: a) Surface type – flat, curved, ribbed, etc.; b) Contact area with surface; c) Material type and thickness range; d) Mounting Hole Diameter Range; e) Grounding Conductor size/type AWG copper/other, solid conductor; and f) Rated OCD Levels per AWG.	Grounding device See section 13, 17 18 and 22	P
8.8	Evaluation of the grounding devices shall include, but necessarily not be limited to, the following test program: a) Bonding Path Resistance Test, Section 13; b) Temperature Cycling Test, Section 17; c) Humidity Test, Section 18; and d) Bonding Conductor Test, 135%, 200% and Limited Short Circuit, Section 22.	See section 13, 17, 18 and 22	P
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9	Bonding		
9.1	Mounting system and clamping/retention device(s) shall have a means for bonding all accessible potentially conductive parts to ground. The grounding means shall comply with the applicable requirements in Grounding and Grounding Devices, Section 8. The grounding means shall be bonded to each conductive part of the rack mounting systems and clamping devices.		P
9.2	Routine maintenance of a module or panel shall not involve breaking or disturbing the bonding path. A bolt, screw, or other part used for bonding purposes, which is an integral part within the construction of a module or panel, or is a dedicated/identified grounding or bonding point, shall not also be intended for securing the complete device to the supporting surface or rack frame.		P
9.3	The securement of bonding devices or achieving bonding shall be by a positive means, such as clamping, riveting, bolted or screwed connections, or welding, soldering (see 9.5) or brazing. The bonding connection/device shall penetrate nonconductive coatings, such as but not limited to anodization, paint or vitreous enamel. Sheet metal threaded fasteners are not positive mechanical means.		P
9.4	A bolted, screwed or riveted connection that incorporates a star washer under the head of the fastener, a serrated screwhead, or a bonding device between surfaces may be acceptable for penetrating nonconductive coatings. If the bonding means depends upon threaded fasteners, two or more screws with at least a full thread, or two full threads of a single screw shall engage the metal.		P
9.5	All joints in the bonding path shall be mechanically secure independent of any soldering.		P

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9.6	A separate bonding conductor or bonding strap shall: a) Be of copper, copper alloy, aluminum or other material acceptable for use as an electrical conductor; b) Be protected from mechanical damage; c) Not be secured by a removable fastener used for any purpose other than bonding, unless the bonding conductor is unlikely to be omitted after removal and replacement of the fastener; d) If terminations are included, be factory crimped terminations, not field crimped; e) Comply with the sizing requirement in Table 9.1; f) Be subject to the Bonding Path Resistance Test, Section 13; Temperature Cycling Test, Section 17; Humidity Test, Section 18; Bonding Conductor Test, 135%, 200% and Limited Short Circuit, Section 22 and evaluated in accordance with the Standard for Grounding and Bonding Equipment, UL 467; and g) If a flat bonding strap with flat end terminations/crimps, be subject to the Bonding Path Resistance Test, Section 13; Temperature Cycling Test, Section 17; Humidity Test, Section 18; Bonding Conductor Test, 135%, 200% and Limited Short Circuit, Section 22, and a the Bonding Strap Pull Test, Section 23.	See section 13, 17, 18, 22, 23	P
9.7	A bonding device that pierces non-conductive coatings such as, but not limited to; anodization, paint, vitrious enamel may be a separate piercing device such as, but not limited to; a piercing washer, star washer, serrated fasteners, or integral to the component. It shall have sufficient hardness to pierce the non-conductive coating and as such may be 300-series stainless steel, or a suitably corrosion protected conductive material.		P
9.8	A ferrous metal part shall be protected against corrosion by metallic or nonmetallic coatings, such as painting, galvanizing, or plating. 300-series stainless steel is acceptable without additional coating. Any corrosion protection shall not interfere with the grounding/bonding path.		P
9.9	Suitable corrosion resistant metal-to-metal multiple load bearing pin-type hinge may be an acceptable means for bonding.		P
9.10	Bonding only devices that rely on spring force and piercing function to penetrate the anodization or other nonconductive coating and thereby secure into the base material, shall also demonstrate that upon removal, base material is also removed or deformed.		P
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10	Corrosion Resistance		
10.1	Aluminum, 300 series stainless steel, or polymeric materials may be used without corrosion-resistant coatings or platings.		P
10.2	Steel, iron or other non-inherently corrosion resistant materials which may be exposed to the weather shall be made corrosion-resistant by one of the following minimum coatings: a) Hot-dipped, mill-galvanized sheet steel conforming with the coating designation G90 in the Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot Dip Process, ASTM A653/A653M, based on the minimum single spot-test requirement in this ASTM specification. The weight of zinc coating may be determined by any acceptable method; however, in case of question, the weight of coating shall be established in accordance with the Standard Test Method for Weight of Coating on Zinc-Coated (Galvanized) Iron or Steel Articles, ASTM A90-81 (1991). b) A zinc coating, other than that provided on hot-dipped mill-galvanized steel, uniformly applied to an average thickness of not less than 0.00061 in (0.015 mm) on the surface with a minimum thickness of 0.00054 in (0.014 mm). The thickness of the coating shall be established by the Metallic-Coating Thickness Test, Section 20. An annealed coating shall also comply with 10.5 and 10.6. c) A cadmium coating not less than 0.0010 in (0.025 mm) thick on both surfaces. The thickness of the coating shall be established by the Metallic Coating Thickness Test, Section 20. d) A zinc coating conforming with 10.1(a) or 10.1(b) with one coat of outdoor paint. The coating system shall comply with 10.3. e) A cadmium coating not less than 0.00075 in (0.019 mm) thick on both surfaces with one coat of outdoor paint on both surfaces, or not less than 0.00051 in (0.013 mm) thick on both surfaces with two coats of outdoor paint on both surfaces. The thickness of the cadmium coating shall be established by the Metallic Coating Thickness Test, Section 20, and the coating system shall comply with 10.3. f) An organic or inorganic protective coating system on both surfaces, applied after forming. The results of an evaluation of the coating system shall demonstrate that it provides protection at least equivalent to that provided by the zinc coating described in 10.1(a). See Polymeric Materials, Section 7, and Corrosive Atmosphere Tests, Section 19.		N/A

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10.3	With reference to 10.2(d) and 10.2(e), the results of an evaluation of the coating system shall demonstrate that it provides protection at least equivalent to that provided by the zinc coating as described (G90) in 10.2(a). See Corrosive Atmosphere Tests, Section 19.		N/A
10.4	With reference to 10.1 and 10.2, other finishes, including paints, other metallic finishes, and combinations of the two may be accepted when comparative tests with galvanized sheet steel (without annealing, wiping, or other surface treatment) conforming with 10.1(a) or 10.2 as applicable, indicate they provide equivalent protection. See Corrosive Atmosphere Tests, Section 19.		N/A
10.5	An annealed coating on sheet steel that is bent or similarly formed or extruded or rolled at edge of holes after annealing shall additionally be painted in the bent or formed area if the bending or forming process damages the zinc coating. If flaking or cracking of a zinc coating at the outside radius of a bent or formed section is visible at 25 power magnification, the zinc coating is considered damaged.		N/A
10.6	Simple sheared or cut edges and punched holes are not required to be additionally protected.		N/A
10.7	Iron or steel serving as a necessary part of the product but not exposed to the weather shall be plated, painted, or enameled for protection against corrosion.		N/A
10.8	Materials not specifically mentioned in this section shall also be evaluated on an individual basis. The Corrosive Atmosphere Tests, Section 19, may be used for the evaluation.		N/A
10.9	The corrosion resistance shall not interfere with the grounding/bonding path.		P
10.10	Steel parts which have either a through or surface hardness equivalent to Rc35 or greater, and are electroplated, shall be additionally treated following the electroplating process to relieve hydrogen embrittlement.		N/A

Supplementary information: -

11	Fire Resistance		
11.1	A rack mounting system intended for stand-off, rack, or direct mounting in combination with a specified roof, or intended for integral mounting, and that complies with 7.3, shall comply with the fire resistance requirements for a Class A, B, or C roof covering when the module or panel is indicated or implied as being fire rated. For a combination construction, the rating shall be coincident with, or at a lower level than, the rating of the basic roof covering material. The fire resistance shall be determined in accordance with the Standard Test Methods for Fire Tests of Roof Coverings, UL 790, as modified by Fire Tests, Section 15.		N/A

Supplementary information: -

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II	Performance
-----------	--------------------

12	Visual inspection (initial)		
Test date (DD/MM/YYYY)		16/07/2019	—
Sample no.	Requirement	Nature and position of initial findings	
HV2019003218	No major visual defects	—	P
HV2019003219		—	P
HV2019003220		—	P
HV2019003221		—	P
HV2019003222		—	P
HV2019003223		—	P
HV2019003224		—	P
HV2019003225		—	P
HV2019003226		—	P
HV2019003227		—	P
Supplementary information: Test samples have been assembled by TÜV Rheinland.			

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13	Bonding Path Resistance Test (initial)		
Test date (DD/MM/YYYY)		17/07/2019	—
Fuse ampere rating [A]		25	
Current applied [A]		25	
Duration of applied current [min]		2	
Location of designated point for equipotential bonding		Grounding terminal – accessible conductive part	
No. of other conductive parts tested		1	
Sample no.	Max. measured voltage [mV]	Max. calculated resistance [mΩ]	
HV2019003220	494.9	19.8	P
HV2019003221	52.0	2.1	P
HV2019003222	51.0	2.0	P
HV2019003223	50.0	2.0	P
HV2019003224	54.0	2.2	P
HV2019003225	48.0	1.9	P
HV2019003226	42.0	1.7	P
Supplementary information: Maximum requirement is 0.1 Ω.			

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14	Terminal Torque Test		
Test date (DD/MM/YYYY)		N/A	—
Screw size [mm]		N/A	
Number of cycles		N/A	
No. of connection points tested		N/A	
Sample no.	Torque applied [Nm] initial	Torque applied [Nm] control	
N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A
Supplementary information:			
Screw size		Torque	
US	Metric [mm]	[Lbf x in]	[Nm]
No. 6	3.5	12	1.4
No. 8	4.2	16	1.8
No. 10	4.8	20	2.3

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Clause	Anforderungen - Prüfungen / Requirements - Tests	Measuring results - Remarks	Evaluation

15	Fire tests		
15.2	Spread of flame test		
Test date (DD/MM/YYYY)		N/A	
Sample no.		N/A	
Fire class test specification		N/A	
Test results			
Did any portion of the rack mounting system blow off or fall off the test deck in the form of flaming / glowing brands?		☐ Yes	☐ No
Did any portion of the roof desk fall away in the form of glowing particles?		☐ Yes	☐ No
Was the flame spread beyond 1.82m for Class A, 2.40m for Class B or 3.96m for Class C?		☐ Yes	☐ No
Was there a significant lateral spread-of-flame from the path directly exposed to the test flame?		☐ Yes	☐ No
N/A			
Supplementary information: -			
15.3	Burning brand test		
Test date (DD/MM/YYYY)		N/A	
Sample no.		N/A	
Fire class test specification		N/A	
Test results			
Did any portion of the rack mounting system blow off or fall off the test deck in the form of flaming / glowing brands?		☐ Yes	☐ No
Did any portion of the roof desk fall away in the form of glowing particles?		☐ Yes	☐ No
Did the brand burn a hole through the roof covering or through any part of the module?		☐ Yes	☐ No
Did any sustained flaming of the module occur?		☐ Yes	☐ No
N/A			
Supplementary information:			

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16	Accelerated Aging Test		
Test date (DD/MM/YYYY)		N/A	—
Temperature on material in temperature test [°C]		N/A	
Conditioning Procedure		N/A	
Sample no.	Tensile strength [%]	Ultimate elongation [%]	
N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A
Supplementary information: -			

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17	Thermal Cycling Test		
Test date (DD/MM/YYYY)		17/07/2019 – 20/08/2019	—
Total number of cycles		200	
Sample no.	Open circuits (yes/no)		
HV2019003220	No		P
HV2019003224	No		P
HV2019003225	No		P
Supplementary information: -			

17.1	Visual inspection after Thermal Cycling Test		
Test date (DD/MM/YYYY)		20/08/2019	—
Sample no.	Requirement	Nature and position of findings	
HV2019003220	No major visual defects	—	P
HV2019003224		—	P
HV2019003225		—	P
Supplementary information: -			

17.2	Bonding Path Resistance Test after Thermal Cycling Test - section 13		
Test date (DD/MM/YYYY)		20/08/2019	—
Fuse ampere rating [A]		25	
Current applied [A]		25	
Duration of applied current [min]		2	
Location of designated point for equipotential bonding		Grounding terminal – accessible conductive part	
No. of other conductive parts tested		1	
Sample no.	Max. measured voltage [mV]	Max. calculated resistance [mΩ]	
HV2019003220	578.9	23.2	P
HV2019003224	100.0	4.0	P
HV2019003225	393.9	15.8	P
Supplementary information:			
Maximum requirement is 0.1 Ω.			

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18	Humidity Test		
Test date (DD/MM/YYYY)		02/08/2019 – 14/08/2019	—
Total number of cycles		10	
Sample no.	Open circuits (yes/no)		
HV2019003221	No		P
HV2019003222	No		P
HV2019003223	No		P
Supplementary information: -			

18.1	Visual inspection after Humidity Test		
Test date (DD/MM/YYYY)		15/08/2019	—
Sample no.	Requirement	Nature and position of findings	
HV2019003221	No major visual defects	—	P
HV2019003222		—	P
HV2019003223		—	P
Supplementary information: -			

18.2	Bonding Path Resistance Test after Humidity Test - section 13		
Test date (DD/MM/YYYY)		15/08/2019	—
Fuse ampere rating [A]		25	
Current applied [A]		25	
Duration of applied current [min]		2	
Location of designated point for equipotential bonding		Grounding terminal – accessible conductive part	
No. of other conductive parts tested		1	
Sample no.	Max. measured voltage [mV]	Max. calculated resistance [mΩ]	
HV2019003221	346.9	13.9	P
HV2019003222	402.9	16.1	P
HV2019003223	310.9	12.4	P
Supplementary information:			
Maximum requirement is 0.1 Ω.			

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19	Corrosive Atmosphere Test		
19.1	Salt Spray Test		
Test date (DD/MM/YYYY)		01/08/2019 – 26/09/2019	—
Total number of cycles		8	
Sample no.	Open circuits (yes/no)		
HV2019003218	No		P
HV2019003219	No		P
HV2019003224	No		P
HV2019003225	No		P
Supplementary information: -			

19.1.1	Visual inspection after Salt Spray Test		
Test date (DD/MM/YYYY)		07/10/2019	—
Sample no.	Requirement	Nature and position of findings	
HV2019003218	No major visual defects	—	P
HV2019003219		—	P
HV2019003224			
HV2019003225		—	P
Supplementary information: -			

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19.1.2	Bonding Path Resistance Test after Salt Spray Test - section 13		
Test date (DD/MM/YYYY)		07/10/2019	—
Fuse ampere rating [A]		25	
Current applied [A]		25	
Duration of applied current [min]		2	
Location of designated point for equipotential bonding		Grounding terminal – accessible conductive part	
No. of other conductive parts tested		1	
Sample no.	Max. measured voltage [mV]	Max. calculated resistance [mΩ]	
HV2019003224	1317.8	52.7	P
HV2019003225	1448.8	58.0	P
Supplementary information: Maximum requirement is 0.1 Ω.			

19.2	Moist Carbon Dioxide/Sulphur Dioxide Test		
Test date (DD/MM/YYYY)		N/A	—
Total number of cycles		N/A	
Sample no.	Open circuits (yes/no)		
N/A	N/A		N/A
N/A	N/A		N/A
N/A	N/A		N/A
Supplementary information: -			

19.2.1	Visual inspection after Moist Carbon Dioxide/Sulphur Dioxide Test		
Test date (DD/MM/YYYY)		N/A	—
Sample no.	Requirement	Nature and position of findings	
N/A	No major visual defects	N/A	N/A
N/A		N/A	N/A
N/A		N/A	N/A
Supplementary information: -			

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19.2.2	Bonding Path Resistance Test after Moist Carbon Dioxide/Sulphur Dioxide Test - section 13		
Test date (DD/MM/YYYY)		N/A	—
Fuse ampere rating [A]		N/A	
Current applied [A]		N/A	
Duration of applied current [min]		N/A	
Location of designated point for equipotential bonding		N/A	
No. of other conductive parts tested		N/A	
Sample no.	Max. measured voltage [mV]	Max. calculated resistance [mΩ]	
N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A
Supplementary information: Maximum requirement is 0.1 Ω.			

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20	Metallic Coating Thickness Test		
Test date (DD/MM/YYYY)		N/A	—
Method:		N/A	
Sample no.	—		
N/A	N/A		N/A
N/A	N/A		N/A
Supplementary information: -			

20.1	Visual inspection after Metallic Coating Thickness Test		
Test date (DD/MM/YYYY)		N/A	—
Sample no.	Requirement	Nature and position of findings	
N/A	No major visual defects	N/A	N/A
N/A		N/A	N/A
Supplementary information: -			

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21	Mechanical Loading Test			
Test date (DD/MM/YYYY)		N/A		—
Load direction applied		Positive (downward)	Negative (upward)	
Design load [Pa]		N/A	N/A	
Safety factor γ_m		N/A	N/A	
Test load [Pa]		N/A	N/A	
Mounting method		N/A		
Sample no.	Open circuits (yes/no)		Deflection [mm]	—
N/A	N/A		N/A	N/A
Supplementary information: -				

21.1	Visual inspection after Mechanical Loading Test		
Test date (DD/MM/YYYY)		N/A	—
Sample no.	Requirement	Nature and position of findings	
N/A	No major visual defects	N/A	N/A
Supplementary information: -			

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22	Bonding Conductor Test				
Test date (DD/MM/YYYY)			16/08/2019, 20/08/2019, 09/10/2019		—
Rating of intended branch-circuit (OCPD) [A]			30		
Current applied at 135% [A]			40		
Current applied at 200% [A]			60		
Capacity of test circuit [A]			5000		
Sample no.	Current applied 40 A for 60 min		Current applied 60 A for 2 min		—
	Voltage [mV]	Withstand [mΩ]	Voltage [mV]	Withstand [mΩ]	
HV2019003221	104.0	2.6	219.0	3.7	P
HV2019003224	127.0	3.1	231.0	3.9	P
HV2019003226	168.0	4.1	247.0	4.1	P
Supplementary information:					
The measured withstand needs to be below 100 mΩ.					

22.1	Visual inspection after Bonding Conductor Test			
Test date (DD/MM/YYYY)				—
Sample no.	Requirement	Nature and position of findings		
HV2019003221	No major visual defects	—		P
HV2019003224		—		P
HV2019003226		—		P
Supplementary information: -				

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Clause	Anforderungen - Prüfungen / Requirements - Tests	Measuring results - Remarks	Evaluation

22.2	Bonding Path Resistance Test after Bonding Conductor Test - section 13		
Test date (DD/MM/YYYY)		16/08/2019. 20/08/2019, 09/10/2019	—
Fuse ampere rating [A]		25	
Current applied [A]		25	
Duration of applied current [min]		2	
Location of designated point for equipotential bonding		Grounding terminal – accessible conductive part	
No. of other conductive parts tested		1	
Sample no.	Max. measured voltage [mV]	Max. calculated resistance [mΩ]	
HV2019003221	56.0	2.2	P
HV2019003224	156.0	6.2	P
HV2019003226	120.0	4.8	P
Supplementary information: Maximum requirement is 0.1 Ω.			

23	Bonding Strap Pull Test		
Test date (DD/MM/YYYY)	N/A		—
Sample no.			—
N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A
Supplementary information:-			

23.1	Visual inspection after Bonding Strap Pull Test		
Test date (DD/MM/YYYY)		N/A	—
Sample no.	Requirement	Nature and position of findings	
N/A	No major visual defects	N/A	N/A
N/A		N/A	N/A
N/A		N/A	N/A
Supplementary information: -			

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Absatz <i>Clause</i>	Photovoltaic (PV) mounting systems <i>Anforderungen - Prüfungen / Requirements - Tests</i>	Messergebnisse - Bemerkungen <i>Measuring results - Remarks</i>	Bewertung <i>Evaluation</i>
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III	Ratings
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24	Details		
24.1	The ratings of a rack mounting system shall include the maximum size, orientation and number of PV modules intended to be installed.		—
Supplementary information: -			

IV	Markings
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25	Details		
25.1	A rack mounting system shall have a plain, legible, permanent marking that includes:		—
	a) The manufacturer's name, trademark, or other descriptive marking by which the organization responsible for the product can be identified		N/A
	b) The model number or the equivalent		N/A
	c) The load rating, see 24.1		N/A
	d) The date or other dating period of manufacture not exceeding any three consecutive months		N/A
25.2	A permanent marking shall be molded, die-stamped, paint-stenciled, stamped, or etched metal that is permanently secured, or indelibly stamped on a pressure-sensitive label secured by adhesive that complies with the Standard for Marking and Labeling Systems, UL 969. Ordinary usage, handling, storage, and the like of the unit shall be considered in determining whether a marking is permanent.		N/A
25.3	If a rack mounting system is manufactured at more than one factory, it shall have a marking indicating its place of manufacture.		N/A
25.4	When 7.1 is applicable, a rack mounting system shall be marked relative to its fire resistance rating as a roof covering. A module or panel shall be marked "Not Fire Rated," unless it complies with the requirements for fire rating. If a module or panel is fire rated and if its use is so intended by the manufacturer, it shall be marked accordingly, for example, "Modules mounted freestanding 6 in above a Class B roof constitute a Class C roof."		N/A
25.5	A rack mounting system intended and evaluated for structural loads greater than the standard 30 lb/ft ² (146.5 kg/m ²) (tested at 1.5 times the rated load for downforce and upforce) shall be marked with the rated load in lb/ft ² .		N/A

Supplementary information: -

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V	Instructions
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26	Installation, Assembly and Maintenance/Inspection Instructions		
26.1	Rack mounting systems and clamping devices shall be supplied with installation instructions describing the detailed methods of installation. When the fire rating is dependent on a specific mounting structure, specific spacings, or specific means of attachment to the roof or structure, details of the specific parameter or parameters shall be included in the instructions. The installation instructions shall include a list of all evaluated PV modules or the statement "To be used only in combination with modules that include this specific rack system in their installation manual."		N/A
26.2	The installation instructions shall include a detailed description of the grounding method, where applicable, to be used in accordance with the National Electrical Code, ANSI/NFPA 70. This description shall include:		—
	a) The size, type, and temperature rating of the conductors to be used		N/A
	b) The specific grounding devices and hardware (nuts, bolts, star washers, split-ring lock washers, flat washers, bonding devices and the like) that are used to attach a listed grounding/bonding device.		N/A
26.3	The installation instructions for rack mounting systems intended to be installed on a roof shall include:		—
	a) A statement indicating the minimum mechanical means to be used for securement of the rack mounting system to the roof		N/A
	b) For a non-integral module or panel, a statement that the assembly is to be mounted over a fire resistant roof covering rated for the application		N/A
	c) Indication of any slope less than 5 in/ft (127 mm/305 mm) required to maintain a fire Class rating.		N/A
26.4	Assembly instructions shall be provided with a product shipped in subassemblies and shall be detailed and adequate to the degree required to facilitate total assembly of the product.		N/A
26.5	When mounting instructions furnished with a unit specify mounting hardware that is not readily available commercially, the manufacturer shall provide the hardware with the unit.		N/A
26.6	For devices that are only to be utilized one time, such as torque to yield fasteners or single-use bonding/grounding devices; the installation instructions shall include the statement "For single-use only" or the equivalent.		N/A
Supplementary information: -			

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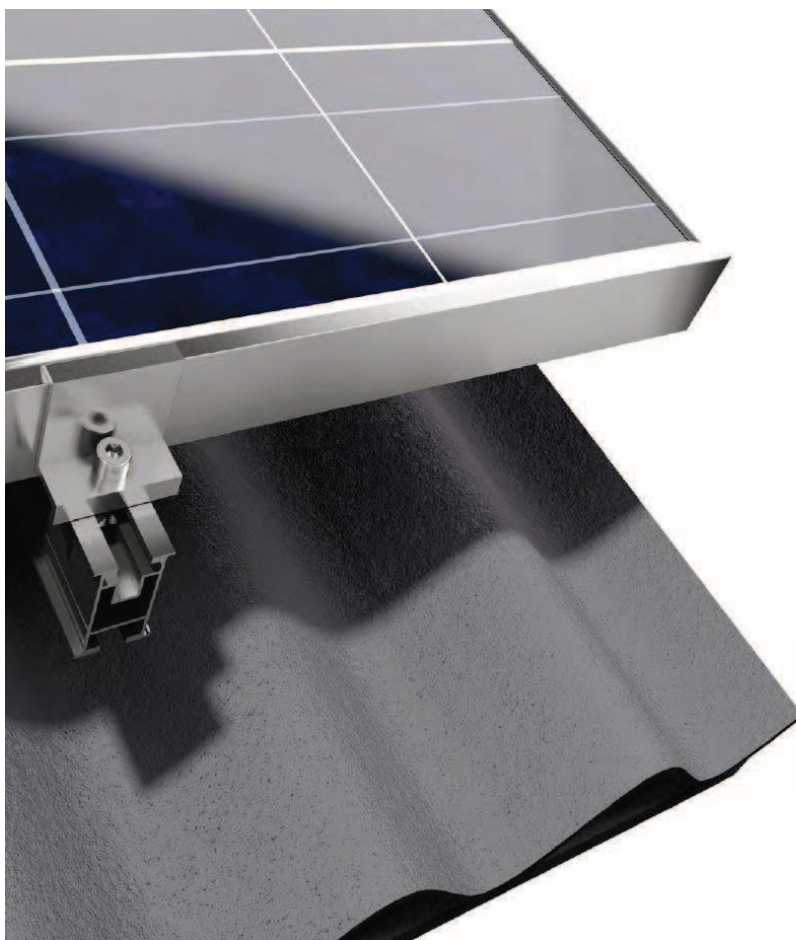
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ZUSATZ-DOKUMENTATION
ADDITIONAL DOCUMENTATION

Appendix A: Screenshot of manual (cover page)



ZUSATZ-DOKUMENTATION
ADDITIONAL DOCUMENTATION



INSTALLATION INSTRUCTIONS



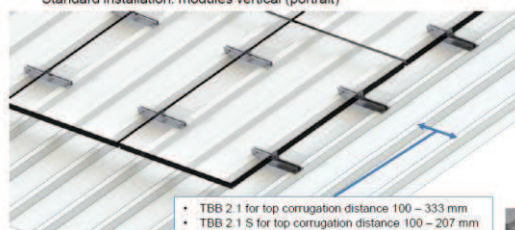
AS 2.1 CORRUGATED ETERNIT ROOF

ALUMERO AS 2.1



Installation on trapezoidal metal sheet

Standard installation: modules vertical (portrait)



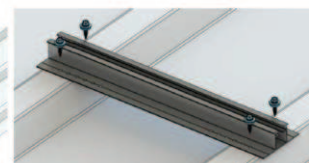
- TBB 2.1 for top corrugation distance 100 – 333 mm
- TBB 2.1 S for top corrugation distance 100 – 207 mm

- Max. length of modules in row: 12 m
- Min. distance of clamps to end of bridge: 20 mm
- Each bridge has to be placed and fixed on two top corrugations
- Fixation of bridge to metal sheet with 4 thin sheet metal screws

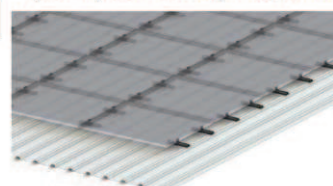


Cross section (side view) of
trapezoidal sheet and pv-system

Alumero Systematic Solutions, Dipl.-Ing. Tilman Elsner – 05/2017



Trapezoidal sheet bridge 2.1, L=400mm
Option: Trapezoidal sheet bridge 2.1 S, L=250mm



Option: modules horizontal (landscape)

Fixation of pv-modules in trapezoidal
sheet bridge 2.1 with premounted
mid- and endclamps



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ZUSATZ-DOKUMENTATION
ADDITIONAL DOCUMENTATION

Appendix B: History of reporting and certification

Project no.	Report no.	Date of issue	Result	Remarks
21247131	21290536.001	November 2019	Passed	UL 2703 "Bonding and Grounding"

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FOTO-DOKUMENTATION
PHOTO-DOCUMENTATION

Appendix C: Photos

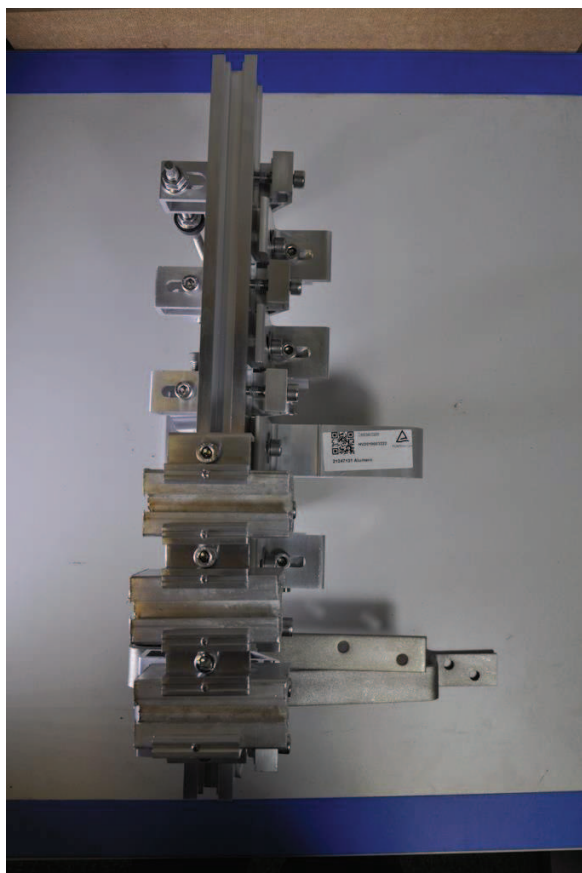


Fig. 1: front view of test sample

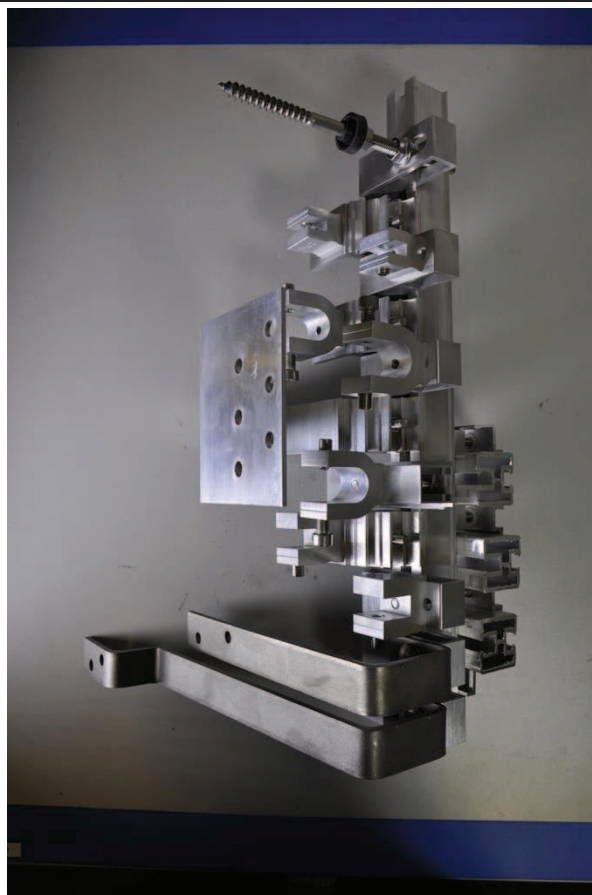


Fig. 2: side view of test sample

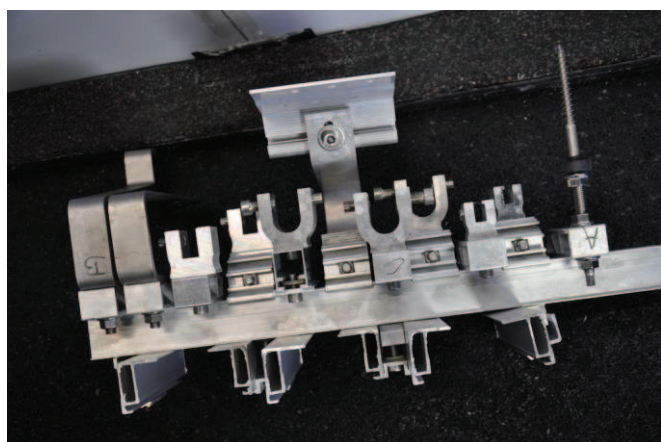


Fig. 3: detail view of test sample after HF10

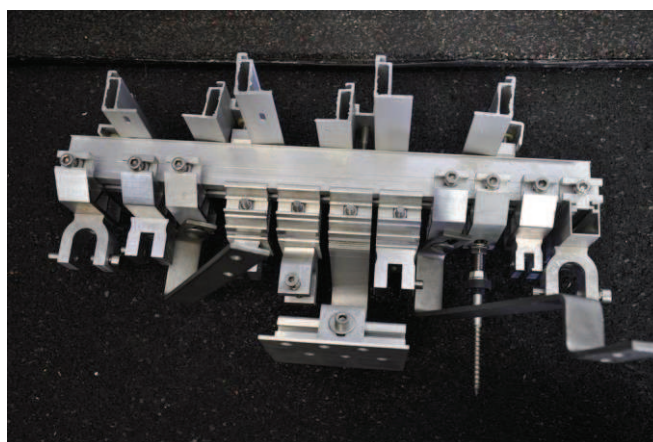


Fig. 4: detail view of test sample after HF10

FOTO-DOKUMENTATION
PHOTO-DOCUMENTATION

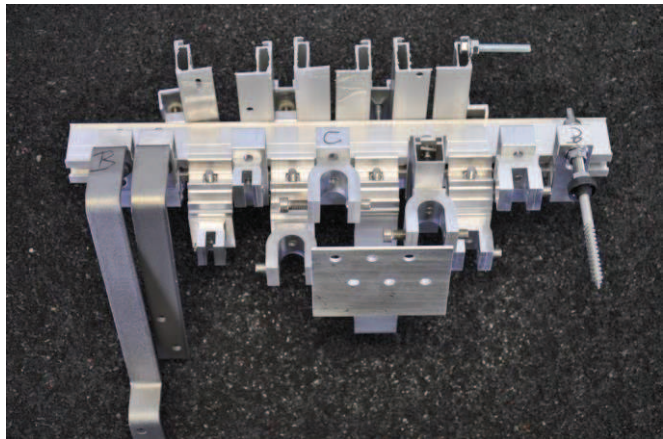


Fig. 5: detail view of test sample after TC200

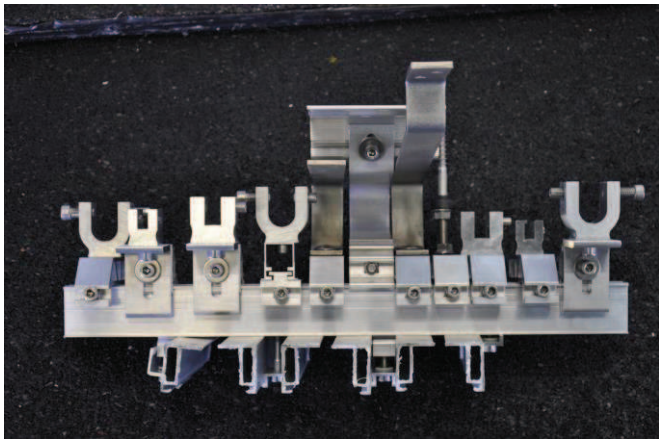


Fig. 6: detail view of test sample after TC200

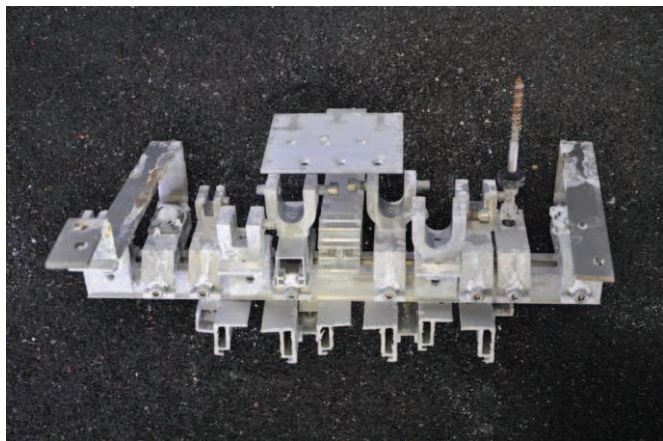


Fig. 7: detail view of test sample after SaltMist



Fig. 8: detail view of test sample after SaltMist

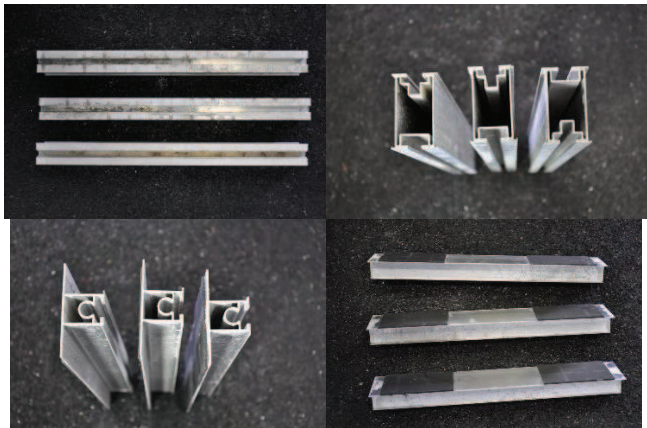


Fig. 9: detail view of test sample after SaltMist

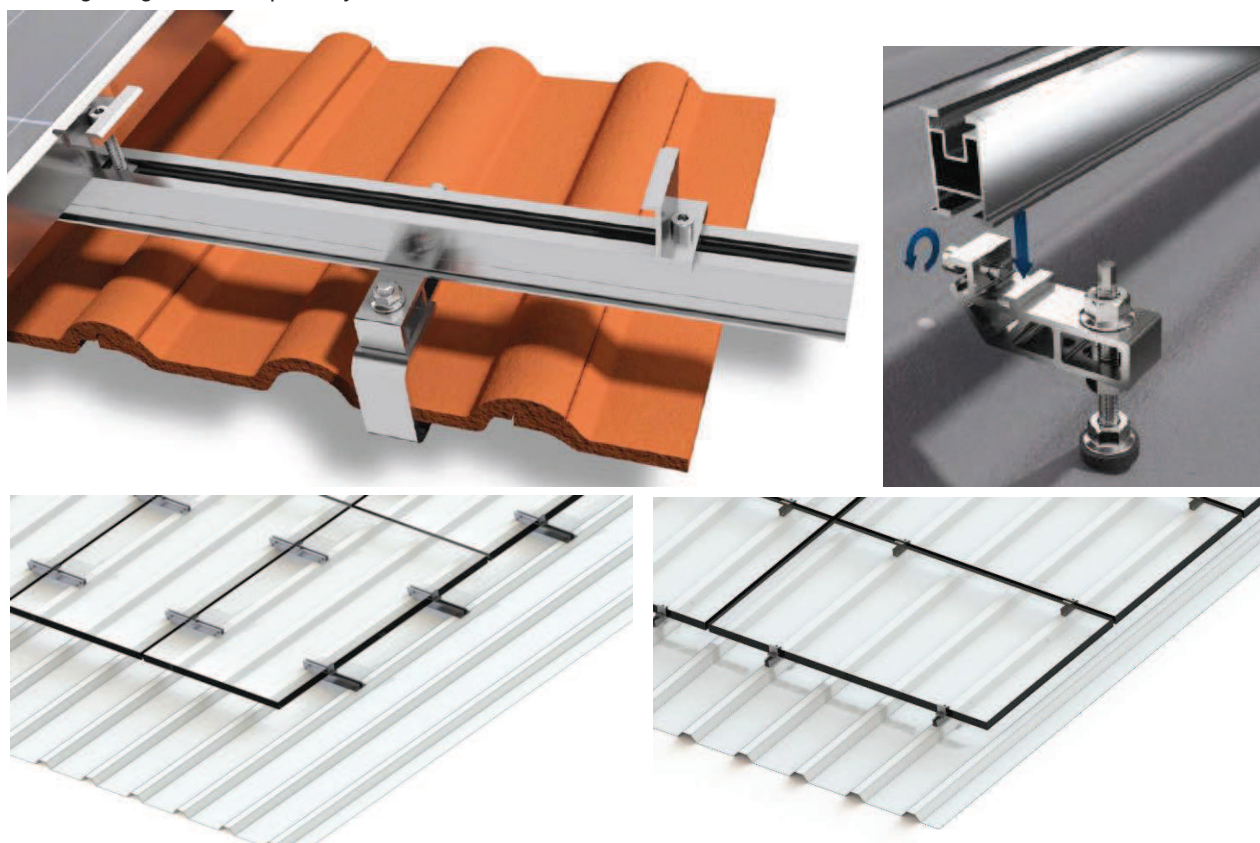


Fig. 10: detail view of test sample after SaltMist

Constructional Data Form for PV-Mounting Systems

License Holder : (full address)	Alumero Systematic Solutions GmbH Sonneweg 1-2 5164 Seeham Austria
Production Factory : (full address)	Alumero Metal Components Sp.z.o.o. Ul. Kluczborska 29 41-508 Chorzów Poland
Type of Product :	Photovoltaic (PV) Mounting systems
Trademark..... :	
Type of mounting system :	Sloped roof system
Type designation :	AS 2.1

Drawing of figure of complete system:



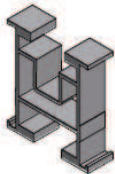
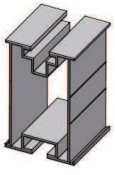
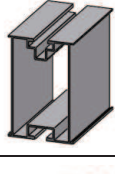
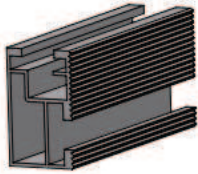
Constructional Data Form for PV-Mounting Systems

Product information

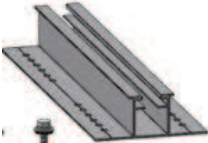
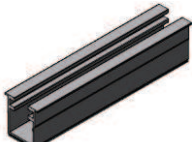
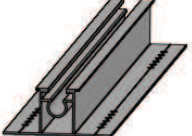
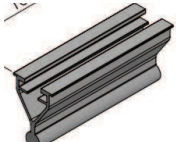
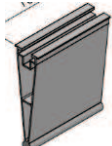
☒ The design being submitted has not been previously certified. ☐ The design being submitted is an alternative construction for a design already certified. (please check only one box)			
Design specifications submitted for certification			
Product/System name or model number	Alumero AS 2.1 – Installation on tiled roof Alumero AS 2.1 – Installation on corrugated eternity roof Alumero AS 2.1 – Installation on trapezoidal sheet		
Applicable standard(s)	☐ ANSI/UL 2703 complete		☒ ANSI/UL 2703 bonding path resistance
	☐ ANSI/UL 2703 mechanical testing		☐ ANSI/UL 2703 fire testing
Over-current protection rating [A]	25		
Indicate torque [Nm]	15 (M8 (A2-70 or A4-70) 30 (M10 (A2-70 or A4-70)		
Maximum length [m]	15 (afterwards an expansion joint of at least 5 cm must be considered)		
Maximum cantilever [cm]	30		
Mechanical Design Load (Downward/Upward/Downslope) [psf]	Downward/Positive (Snow) = N/T	Upward/Negative (Wind) = N/T	Downslope = N/T
Other Specifications/Ratings	N/T		
Installation Manual, including Revision	Alumero AS 2.1 tiled roof Installation instruction, January 2013 Alumero AS 2.1 corrugated eternity roof Installation instruction, January 2013 Alumero AS 2.1 installation on trapezoidal metal sheet, May 2017		
Post-testing Sample Disposition	☒ Dispose per lab policies; ☐ Return to client; save shipping materials		
☒ Primary safety critical components manufactured and shipped from one factory location to each installation site.			
☐ Primary safety critical components manufactured and shipped from one factory location to authorized location for storage/shipment.			
☐ Safety critical components (including attachment hardware) drop-shipped to each installation site from multiple manufacturers.			
☐ Other method:			

Constructional Data Form for PV-Mounting Systems

Profiles / Construction Bars

Item #	Part name:	Dimension [mm] L x W x H	Material	Figure, specification, standard, approvals,
802105-xx 802195-xx (blk)	Mounting Profile 37	37x32xXX	EN AW 6063 T66	
802100-42 802100-xx 802190-42 (blk) 802190-xx (blk)	Mounting Profile 45	45x32x4200 45x32xXX	EN AW 6063 T66	
802102-62 802102-xx	Mounting Profile 65	65x40x6200 65x40xXX	EN AW 6063 T66	
802104-xx	Mounting Profile 80	80x50xXX	EN AW 6063 T66	
802103-xx	Mounting Profile 95	95x62xXX	EN AW 6063 T66	
802106-62 802106-xx	Mounting Profile 44S	44x26x6200 44x26xXX	EN AW 6063 T66	
Remark	Xx represents the length of the profile - Cutting of profiles at Alumero			

Constructional Data Form for PV-Mounting Systems

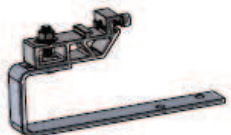
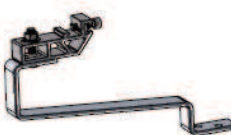
Item #	Part name:	Dimension [mm] L x W x H	Material	Figure, specification, standard, approvals,
802440	Trapezoidal bridge 2.1	400 x 80 x 30	EN AW 6063 T66	
802441	Trapezoidal bridge 2.1 S	250 x 80 x 30	EN AW 6063 T66 EPDM	
802442	Trapezoidal short rail 2.1 T	100 x 35 x 32	EN AW 6063 T66 EPDM	
802443	Trapezoidal short rail	150 x 32 x 26	EN AW 6063 T66 EPDM	
802445	Trapezoidal bridge 2.1 PLUS	400 x 80 x 35	EN AW 6063 T66 EPDM	
802446	Front parts PLUS	100 x 32 x 46.75	EN AW 6063 T66	
802447	Back part PLUS	100 x 32 x 119.75	EN AW 6063 T66	
Remark		- Cutting of profiles at Alumero - Pressing of nut at Alumero		

Item #	Part name:	Dimension [mm] L x W x H	Material	Figure, specification, standard, approvals,
802200	Cross Connector	83,5x35x29	EN AW 6063 T66	
Remark		Inkl. M8x30 Screw (Inbuss) and M8 nut (quare nut) Inkl. M8x16 Screw (inbuss) and M8 Plate Typ 28x15 with Precote - Cutting of profiles at Alumero - Pressing of nut at Alumero		

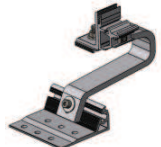
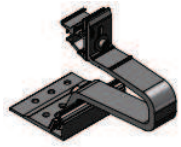
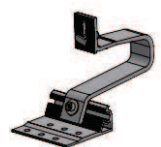
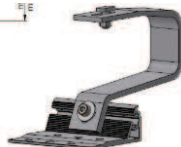
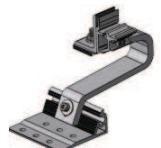
Constructional Data Form for PV-Mounting Systems

Roof hooks / Sheets

Item #	Part name:	Dimension [mm] L x W x H	Material	Figure, specification, standard, approvals,
802400	Roof Hook 35x6	Plate 150x50x5 35x6	1.4301	
802401	Roof Hook DV 30x6	Plate 140x56x5 30x6	1.4301	
Remark		Welded roof hook, screwed roof hook (DV), pre-assembled with mounting plate incl. M10x45 screw and locking nut M10 or if variable with M12 diameter.		

Item #	Part name:	Dimension [mm] L x W x H	Material	Figure, specification, standard, approvals,
802402	Roof Hook 35x8	Plate 150x80x5 35x8	1.4301	
802406	Roof Hook 40x10	Plate 157x80x5 40x10	1.4301	
802407	Roof Hook 35x8 adj.	Plate 150x80x5 35x8	1.4301	
802423	Roof hook slate	235x63x30x5	1.4301	
802425	Roof hook Biber	305x63x30x5	1.4301	
Remark		Welded roof hook, pre-assembled with mounting plate incl. M10x45 (M10x50) screw and locking nut M10 or if variable with M12 diameter.		

Constructional Data Form for PV-Mounting Systems

Item #	Part name:	Dimension [mm] L x W x H	Material	Figure, specification, standard, approvals,
802412	Roof hook DH AL 12	Plate 115x100 Hook 40x9.3	EN AW 6005 T6 A2-70	
802413	Roof hook AI 13	Plate 115x100	EN AW 6005 T6 A2-70	
802414	Roof hook AL 13 X	Plate 115x100 Hook 40x9x160	EN AW 6063 T66 A2-70	
802416	Rook hook ALS 13	Plate 115x100 Hook 40x6x147.5	EN AW 6063 T66 A2-70	
802417	Roof hook AI slim	Plate 115x100	EN AW 6063 T66 A2-70	
802418	Roof hook AI UK slim	Plate 115x100 Hook 40x6.5	EN AW 6005 T6 A2-70	
802420	Roof hook ALS 13 X	Plate 115x100 Hook 40x9x160	EN AW 6005 T6 A2-70	
Remark		Incl. M8 Plate 15x20x5, clamping and intermediate profile, washer 8.4, M8 nut, locking nut M8x45, locking nut M8x25, spring VD-152 Cutting and pressing plus pre-assembling		

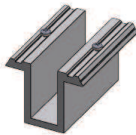
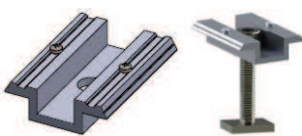
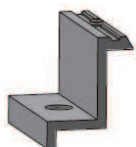
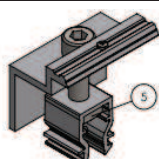
Constructional Data Form for PV-Mounting Systems

Item #	Part name:	Dimension [mm] L x W x H	Material	Figure, specification, standard, approvals,
802403	Hanger Bolt 2.1	M10x200	Stainless steel V2A EPDM	
802404	Hanger Bolt 2.1	M12x300	Stainless steel V2A EPDM	
802405	Hanger Bolt 2.1	M12x200	Stainless steel V2A EPDM	
802499	Hanger Bolt 2.1	MXXxXXX	Stainless steel V2A EPDM	
Remark		Pre-Assembling with 3 locking nut and sealing and Mounting Plate XX is variable on customer request		

Item #	Part name:	Dimension [mm] L x W x H	Material	Figure, specification, standard, approvals,
800462-10	Mounting Plate 2.1 M10	43,1x30x99	EN AW 6063 T66	
800462-12	Mounting Plate 2.1 M12			
Remark		Pre-mounted with roof hooks and hanger bolts inkl. M8x30 Screw (Inbuss) with Precote and M8 nut (quare nut)		

Constructional Data Form for PV-Mounting Systems

Module clamps / Fixation of modules

Item #	Part name:	Dimension [mm] L x W x H	Material	Figure, specification, standard, approvals,
80030X P1 80039X P1 (blk) 18-7867 820302-30-50V P2	Middle Clamp with Pin Middle clamp black with Pin	50x37,4x25,7 70x37,4x25,7 80x37,4x25,7 100x37,4x25,7 M8xXX	EN AW 6063 T66 A2-70	
80030X-P1 80039X-P1 (blk) 18-8071	Middle Clamp with Pin Middle Clamp with Pin black	50x37,4x8,2 70x37,4x8,2 80x37,4x8,2 100x37,4x8,2 45x37,4x8,2 M8xXX	EN AW 6063 T66 A2-70	
802301C-P1 802391C-P1 (blk)	Middle Clamp Click 2.1 with Pin	50x35,9 M8x45	EN AW 6063 T66 A2-70	
802304-xxV P1 802394-xxV P1 (blk) 80030X-xx P1 80039X-xx P1	End Clamp with Pin End Clamp with Pin black	50x32xHH 70x32xHH 80x32xHH 100x32xHH M8x25	EN AW 6063 T66 A2-70	
24066-002 24066-006 (blk) 24066-004 24066-007 (blk)	End Clamp 32mm with Pin 32mm with Pin 35mm with Pin 35mm with Pin	50x32x3 50x32x3 50x35x3 50x35x3	EN AW 6063 T66 A2-70	
802304CP 802394CP (blk)	End clamp with Pin adjustable	50x28.5x3	EN AW 6063 T66 A270	
Remark		Cutting and punching and pre-assembled with screw and nut.		

Remarks :

Cologne, 14/10/2019

TÜV Rheinland Energy GmbH
Am Grauen Stein, 51107 Köln

Seeham, 14/10/2019
(city) (date)

(stamp and/or signature of applicant)


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Tel. 0043 (0)6217/6841-0, Fax: -41
E-mail: alumero@alumero.at
Http://www.alumero.at

