EV CHARGER MOUNTING SOLUTIONS

MODEL ID	LA-1013 LA-1020 LA-1010
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1. GENERAL NOTES

PRODUCT DESCRIPTION

The following analysis is prepared regarding the LA-1013, LA-1020, and LA-1010 EV charger wall mounts. This document will include an analysis on the wall mounts, the fasteners, and anchorage specifications. The wall mounts are assembled out of 0.25 inch (6.4 mm) thick mild sheet steel. The yield strength of the steel is assumed to be 300 MPa (300W grade). The wall mount is anchored into concrete via mechanical or epoxy-based anchors (i.e. HILTI HIT, etc.)

OVERALL DIMENSIONS

This section summarizes the dimensions of the final wall mount assembly:

Description	LA-1010		LA-1013		LA-1020	
	ISO (mm)	US (in)	ISO (mm)	US (in)	ISO (mm)	US (in)
Depth	406	16	260	10-1/4	311	12-1/4
Height	152	6	152	6	152	6
Length	768	30-1/4	768	30-1/4	768	30-1/4
Plate thickness	6.4	1/4	6.4	1/4	6.4	1/4

SUMMARY OF PARTS

This section provides an overview of all components that make up any sub-assemblies. Due to the simplicity of this part, this is a single component assembly, less the fasteners required, therefore no discussion can be provided on other components.

FASTENERS

The table below includes specifications related to the mounting layout. Washer dimensions and specifications are provided as per ASME B18.21.1. The finish for both bolts and washers is at the end user's discretion, based on operational requirements. For wall mounts installed in exterior applications subject to environmental conditions (e.g., rain, snow), galvanized or stainless-steel fasteners are recommended to prevent corrosion and ensure longevity.

Description	LA-1010		LA-1013		LA-1020	
	ISO (mm)	US (in)	ISO (mm)	US (in)	ISO (mm)	US (in)
Fastener diameter	12.7	1/2	12.7	1/2	12.7	1/2
Mounting hole diameter	14	9/16	14	9/16	14	9/16
Minimum horizontal edge distance	44	1-3/4	44	1-3/4	44	1-3/4
Minimum vertical edge distance	32	1-1/4	32	1-1/4	32	1-1/4
Count	4		4		4	
Washer required	Yes		Yes		Yes	
Washer type	Plain		Plain		Plain	
Washer inner diameter	14	9/16	14	9/16	14	9/16
Washer outer diameter	35	1-3/8	35	1-3/8	35	1-3/8
Washer thickness	2.8	0.109	2.8	0.109	2.8	0.109

FASTENER CAPACITIES

Shear and tensile capacities are calculated in accordance with CSA S16-09 Bolts in Bearing Type Connections. The ultimate and yield tensile strength of the fasteners is assumed to be equal to the base sheet metal for simplification. The following constants and formulas were used in the fastener calculations.

Variable	Value	Description
F_y	300 MPa	Yield strength of fastener material
F_u	450 MPa	Ultimate strength of fastener material
φ_b	0.8	Strength reduction factor
φ_{br}	0.8	Bearing capacity reduction factor

Variable	Formula	Description
V_r	$0.6 \cdot \varphi_b \cdot A_b \cdot F_u$	Factored shear strength
B_r	$3 \cdot \varphi_{br} \cdot t \cdot d \cdot F_u$	Factored bearing capacity
$V_{r.pin}$	$0.66 \cdot \varphi \cdot A \cdot F_y$	Factored shear strength of pin
T_r	$0.75 \cdot \varphi_b \cdot A_b \cdot F_u$	Factored tensile strength

Please note that the capacities provided below are for single fasteners only and should be compared with factored loads. V_r represents the shear capacity of the fastener; B_r, the bearing resistance of the adjacent metal (i.e., the connection); T_r, the tensile resistance of the fastener; and $V_{r,pin}$, the gross shear capacity of the pin. All fasteners are assumed to be in single shear, with threads excluded from the shear plane.

Description	LA-1010		LA-1013		LA-1020	
	ISO (mm^2)	US (in^2)	ISO (mm^2)	US (in^2)	ISO (mm^2)	US (in^2)
Fastener cross-sectional area	127.0	0.2	127.0	0.2	127.0	0.2

Description	LA-1010		LA-1013		LA-1020	
	ISO (mm^3)	US (in^3)	ISO (mm^3)	US (in^3)	ISO (mm^3)	US (in^3)
Part Volume	1.30e6	79.237	1.13e6	68.780	1.04e6	63.379

Description	LA-1010		LA-1013		LA-1020	
	ISO (kg)	US (lbm)	ISO (kg)	US (lbm)	ISO (kg)	US (lbm)
Part Mass	10.2	22.5	8.9	19.5	8.2	18.0

Description	Fastener Capacity	
	ISO (kN)	US (lbf)
V_r	27.4	6,150.0
B_r	87.8	19,731.0
$V_{r.pin}$	20.1	4,510.0
T_r	34.2	7,688.0

The fasteners at the wall are considered rigid in this analysis and the wall mount is loaded axially as a simple column. The arms act as two columns and transfer the axial load at an incline into the fasteners in both shear and axial compression.

MATERIAL PROPERTIES

The following table summarizes the assumed material properties of the wall mount:

Description	ISO	US
Yield tensile strength	300 MPa	44 ksi
Ultimate tensile strength	350 MPa	65 ksi
Modulus of elasticity	200 GPa	29,000 ksi
Poisson's ratio	0.3	
Shear modulus	77 GPa	11,200 ksi
Shear strength	340 MPa	49 ksi
Density	7,850 kg/m^3	0.284 lb/in^3

REFERENCES

- Metals Handbook, Vol.2 - Properties and Selection: Nonferrous Alloys and Special-Purpose Materials, ASM International 10th Ed. 1990.
- Metals Handbook, Howard E. Boyer and Timothy L. Gall, Eds., American Society for Metals, Materials Park, OH, 1985.
- Structural Alloys Handbook, 1996 edition, John M. (Tim) Holt, Technical Ed; C. Y. Ho, Ed., CINDAS/Purdue University, West Lafayette, IN, 1996.

REFERENCE IMAGES
Please reference the table in the overall dimensions section for numerical values if required.

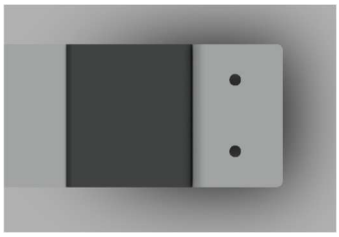

Figure 1 - End view (mount) of typ. wall mount

Figure 2 - Elevation view of typ. wall mount

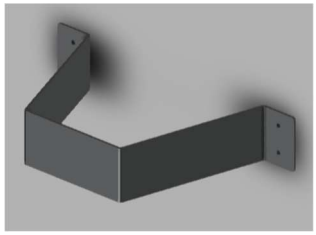

Figure 3 - Isometric view of LA-1010

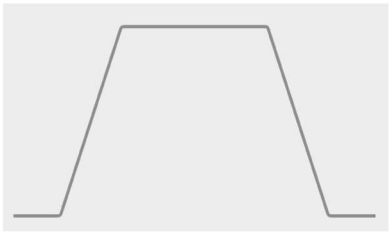

Figure 4 - Plan view of LA-1010

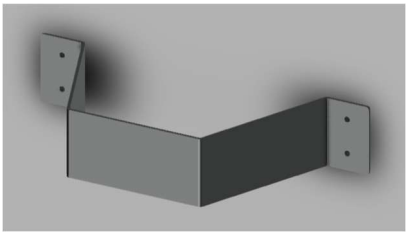

Figure 5 - Isometric view of LA-1013

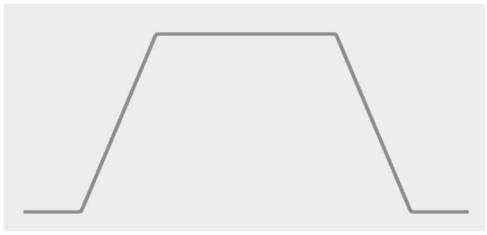

Figure 6 - Plan view of LA-1013

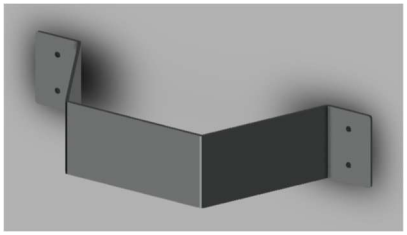

Figure 7 - Isometric view of LA-1020

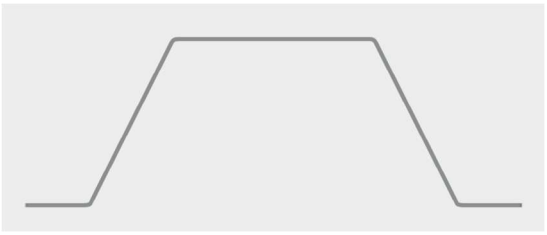

Figure 8 - Isometric view of LA-1020

2. ANCHORING ANALYSIS AND DESIGN

The load is applied to the free end of the wall mount as a horizontal load towards the anchors. A conservative factor of safety is taken at 2.5:1. No commentary or analysis is provided for any environmental loads on the wall mounts. Please note that all loads on the anchors when comparing to the manufacturer's specified capacities must be considered as unfactored or specified loads. This analysis considers the wall mount as a simple cantilever model. It is concluded via analysis that the load from the self weight and any environmental loads is considered negligible. Please note that no consideration or commentary can be made regarding the condition and capacity of the mounting surface (i.e. the concrete wall) given that no information is provided. It is recommended that the engineer of record (EOR) reviews the suitability of these wall mounts for compatibility with the existing wall system.

Description	ISO (kg)	US (lbm)
Upper quartile US/CAN EV vehicle weight	2,590	5,711

Description	Value
Collision distance (mm)	50
Vehicle speed (km/hr)	5.0
Collision energy (J)	2548
Stopping force (N)	50,900
Stopping force (lbm)	11,400

Description	Arm slope (deg)	Axial load per arm, specified (N)	Shear load per arm, specified (N)	Load per arm, specified (N)	Arm length (mm)
LA-1010	72	25,450	8,100	26,700	426
LA-1013	63	25,450	12,700	28,400	290
LA-1020	67	25,450	10,600	27,600	337

Description	Value
Axial capacity of arm @ 426 mm length (N)	7,500,000
Axial pressure at arm root from stopping force, average, specified (MPa)	1.8
Axial pressure at arm root from stopping force, peak, specified (MPa)	29.2

SIMPLIFIED ANALYSIS

The following is provided as a simplified analysis of the wall bracket arm using LA-1010 as the governing case due to its geometry resulting in the largest eccentricity. Please note that buckling, and as a result lateral-torsional buckling, is not considered in this analysis as the members are laterally restrained at both ends of the cantilever due to the geometry of the assembly.

Description	Value
Section width (mm)	6.4
Section depth (mm)	152
Cantilever length (mm)	426
Moment of inertia (mm4)	1,870,000
Modulus of elasticity (MPa)	200,000
Elastic section modulus (mm3)	24,600
Plastic section modulus (mm3)	36,900
Elastic moment capacity (Nm)	13,284
Elastic moment capacity per arm (Nm)	6,642

ANCHORAGE

Please note that the Contractor must follow all manufacturer's specifications and instructions for installing any third-party hardware as specified below. Alternatives can be requested by the Contractor for approval and may be approved on a case-by-case basis. The tension and shear capacity strengths provided below assume uncracked, normal density concrete with a minimum 25 MPa 28-day concrete compressive strength. No edge distance reductions, group effect reductions, or cracked concrete conditions are considered below. Additionally, the concrete must have minimum reinforcing as per CSA/ACI standards.

The following conditions must be met for the following anchor specifications below:

Description	Value
Hole type	Hammer drilled
Concrete strength @ 28 days	25 MPa (3,600 ksi)
Edge distance	> 4 times wall thickness
Minimum wall thickness	200 mm

Anchor Type	Uncracked concrete pull-out capacity (N)	Steel in tension capacity (N)	Steel in shear capacity (N)	Effective embedment (mm)
Mechanical				
HILTI KH-EZ 1/2 in dia. concrete screw	13,500	47,000	13,500	54.9
HILTI KB-TZ2 1/2 in dia. wedge anchor	14,500	34,000	19,000	63.5
Adhesive				
HILTI HAS-V-36 1/2 in dia. thread rod HILTI HIT-HY 200-R V3 epoxy	17,000	24,500	14,000	70.0