11 December 2015

Mr. Angelo Cacciatore
Product Safety & Compliance Engineer
MIDDLE ATLANTIC PRODUCTS
300 Fairfield Road
Fairfield, NJ 07004

Project 157505.20 – Middle Atlantic Products, 2015 Seismic Testing

Re: Observed Seismic Performance Testing of the SR Series Enclosures

Dear Mr. Cacciatore:

At your request, Mr. William M. Bruin, PE of Simpson Gumpertz & Heger Inc. observed seismic qualification testing of SR-46-32 and SR-24-32 wall mounted rack enclosures, both with nominal widths of 28 in. This testing was conducted at Middle Atlantic Products, Inc. (Middle Atlantic) Fairfield, New Jersey facility on 4 November 2015.

Previous testing of this series of enclosures was conducted in 2011. However, a new width has been added to this series since that testing was performed. The present testing was performed in order to include both widths within a comprehensive report. Findings presented herein supersede previous seismic testing reports for the SR Series.

The tested enclosures have the largest and smallest wall footprints (defined by the width and height of the enclosure) within the SR series. Specifically, the tallest (SR-46-32) and shortest (SR-24-32) models were tested. The 24-in and 28-in. wide models were tested in 2011 and 2015, accordingly; these are the only two widths currently available for the series. In addition, the tested enclosures have the largest available depths. As the enclosure frame and anchorage details for each footprint within the series are identical, regardless of depth, the tested enclosures represent a worst case for seismic loading and testing results for the deepest enclosures are applicable to all other SR series enclosures with equal or lesser depth and the same footprint. Additionally, construction of the enclosure frame is similar for the entire range of heights manufactured, such that performance of the entire series of enclosures can be bound by the shortest and tallest enclosures available with a fixed width. The racks tested bound the SR series.

Testing Procedure

Each enclosure was statically tested on an inclined test frame. Prior to testing, each enclosure was anchored to a wall frame which was mounted to the test frame. The racks were then loaded with rack-mounted weights, positioned such that 50% of their total weight was placed in the bottom third of the enclosure rack height, 25% in the middle third, and 25% in the top third. After installation we made initial observations of the enclosure's condition and tested the functionality of the pivoting mechanism, latch, and lock. The rack was then locked into the closed position, and the entire assembly was slowly tipped to a target angle to simulate lateral seismic loading. At maximum inclination, we again observed the enclosure for any signs of distress or extreme deformations. The enclosure was then lowered back to its original at-rest position and inspected for signs of permanent deformation. The pivoting mechanism, latch, and lock were all examined and operability was verified. The enclosures were tested in both the front-to-back and side-to-side directions. In the side-to-side direction, the load was applied such that the maximum tension load was placed on the lock and latch mechanisms.

We determined the quantity of weight for each test based on the enclosure's target content capacity rating, per Table 2 below, the self-weight of the enclosure, and the seismic design force requirements for nonbuilding components as determined from the following building codes:

- 2005 Edition of ASCE Standard 7 (ASCE 7-05) which is the basis for the 2006 and 2009 International Building Codes (IBC), and 2007 and 2010 California Building Codes (CBC)
- 2010 Edition of ASCE Standard 7 (ASCE 7-10) which is the basis for the 2012 International Building Code (IBC) and 2013 California Building Code (CBC)

We determined seismic loading using the largest mapped accelerations within the Continental US (as provided in ASCE 7-05 or ASCE 7-10, respectively), an assumed Site Class D condition, and assumed top floor or rooftop installations, where amplification of seismic shaking is greatest. We computed capacities for High Importance installations and for Standard installations. The High Importance category applies to installations within or attached to Occupancy Category IV facilities as defined in the IBC, CBC, and ASCE 7; installations required to function for life-safety purposes after an earthquake; and components supporting any hazardous substances. Design for these High Importance installations use an importance factor (I_p) of 1.5. The Standard installation category includes all other installations and uses an importance factor of 1.0. This approach provides capacities that are generic in nature, covering all possible installations. As such, enclosures installed at sites with less seismicity or on lower floors may have content capacities greater than those provided.

Observations

The tested SR enclosures performed adequately under the lateral loading, remaining structurally sound throughout the test and functional for purpose after test completion. Table 1 summarizes the applied loads and results for each tested enclosure. Photos 1 through 8 show the enclosures at various stages throughout the testing.

At maximum inclination, the tested SR Series enclosures showed no significant signs of distress. For both enclosures the hinge opened slightly (less than 1/2 in.) before the latch engaged, but the locking mechanism remained secure throughout the tests (Photo 6). No significant permanent deformations were observed for any of the tested enclosures; only a very slight dimple remained near the latch mechanism of SR-24-32 (Photo 5). After testing, the lock, the latch, and the pivot mechanism were all operational. No difficulty was encountered removing the rack weights from the enclosures following testing. Evaluation of the operability of actual equipment installed on this rack is beyond the scope of this test program and the responsibility of the end-user.

Table 1: Summary of Testing Results[2]

Enclosure	Year Tested	Lateral Test Load[1] (pounds)	Was the Lock & Latch Mechanism Operable following Testing?	Was the Pivot Mechanism Operable following Testing?	Were Weights Easily Removed following Testing?
SR-24-32 x 24-in. wide	2011	713	Yes	Yes	Yes
SR-46-32 x 24-in. wide	2011	769	Yes	Yes	Yes
SR-24-32 x 28-in. wide	2015	718	Yes	Yes	Yes
SR-46-32 x 28-in. wide	2015	739	Yes	Yes	Yes

1 Lateral test load is representative of the seismic base shear.
2 The deepest of the SR enclosures represent the worst case seismic loading for a given wall footprint (defined by the width and height of the enclosure).

Table 2: Seismic Content Capacity (pounds)[1,2,3,5]

Enclosure	High Importance Installations[4]		Standard Installations	
	ASCE 7-05 2006/09 IBC 2007/10 CBC	ASCE 7-10 2012 IBC 2013 CBC	ASCE 7-05 2006/09 IBC 2007/10 CBC	ASCE 7-10 2012 IBC 2013 CBC
SR-24-XX	362	326	623	569
SR-40-XX	314	277	584	528
SR-46-XX	314	277	584	528

1 Capacities provided are for SR Series wall anchored enclosures. Selection and installation of enclosure rack anchorage are the responsibility of the end user and are not addressed in this evaluation.
2 Capacities provided are based on testing discussed herein and applicable when 50% of the weight of enclosure contents are positioned in the bottom third of rack, 25% in the middle third, and 25% in the top third.
3 Capacities are based on worst case seismicity (S_{DS} = 1.90g for ASCE 7-05; S_{DS} = 2.04g for ASCE 7-10) and top floor or rooftop installation. Additional capacity may be available based on a site-specific evaluation.
4 High Importance Installations include any installation where ASCE 7 defines a component importance factor (Ip) of 1.5; including (but not limited to) Occupancy Risk Category IV structures.
5 Capacities provided are for enclosure widths between 24 in. (nominal) and 28 in. (nominal); and all enclosure depths (up to 32 inches) for the models listed.

Conclusion

Based on the test results, we conclude that the SR Series enclosures have sufficient seismic load resistance to support the content capacities listed in Table 2 for the indicated building construction codes. These seismic capacities are appropriate for all models within the series with the same wall footprint as those tested, and with the same or shallower depth.

Please note that the observations and conclusions noted herein are applicable only to the SR Series enclosures when anchored as per Middle Atlantic's recommendations. Selection and installation of rack enclosure anchor bolts are the responsibility of the end-user and are not addressed in this evaluation. Any changes to the enclosure design, fabrication, materials, and anchorage may invalidate these observations and conclusions.

Please feel free to contact me directly (510-457-4449 or wmbruin@sgh.com) if you would like to discuss the contents of this letter report in further detail.

Sincerely,

REGISTERED PROFESSIONAL ENGINEER
WILLIAM M. BRUIN
C 57867
EXP. 6/2016
CIVIL
STATE OF CALIFORNIA

12/11/2015

William M. Bruin
Senior Principal
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Photo 1
SR-46-32 at maximum inclination in front-to-back direction

Photo 2
SR-46-32 opened to verify operability after completion of testing

Photo 3
SR-46-32 at maximum inclination in side-to-side direction

Photo 4
SR-24-32 at maximum inclination in side-to-side direction

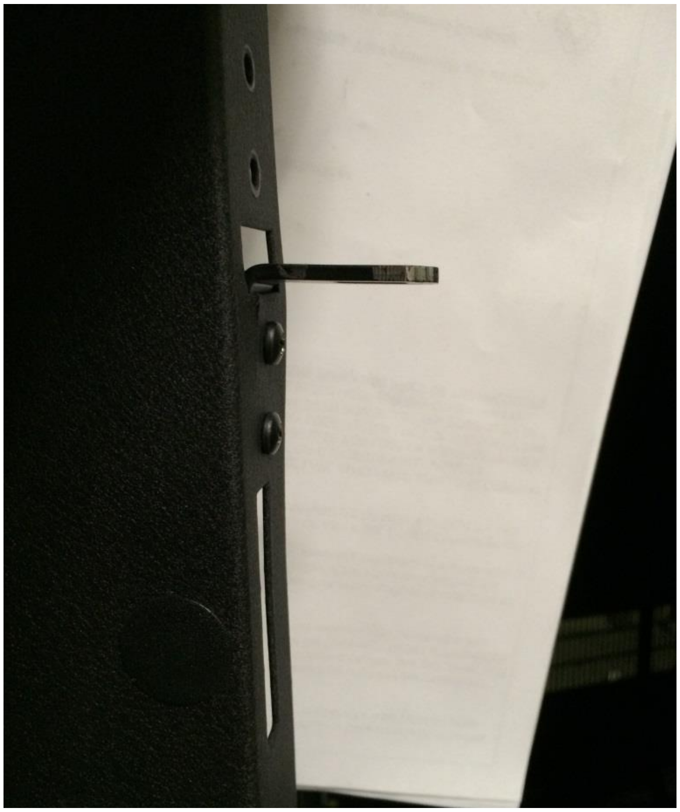

Photo 5
Slight dimple at secured latch mechanism in SR-24-32 (photo taken after completion of testing in side-to-side direction)

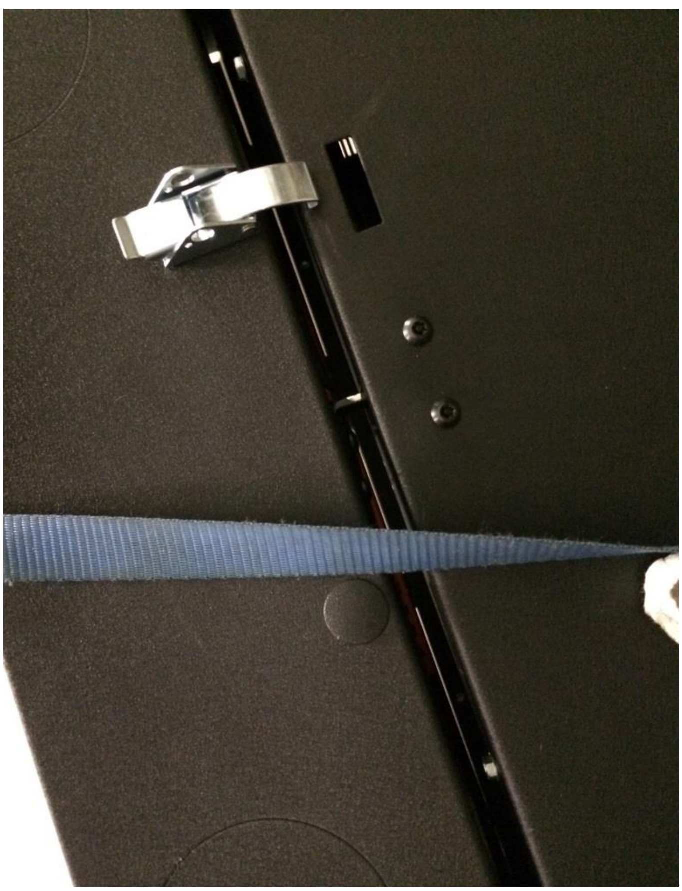

Photo 6
Minor opening at secured latch mechanism in SR-24-32 (photo taken while loaded at maximum inclination in front-to-back direction)