15 October 2013

Mr. David Linder
Product Safety and Compliance Engineer
MIDDLE ATLANTIC PRODUCTS
300 Fairfield Road
Fairfield, NJ 07004

Project 127150.03 – Middle Atlantic Products, 2013 Seismic Testing

Re: Observed Seismic Performance Testing of the ERK Series Enclosures

Reference: *Letter to Mr. Keith E. Carney, Subject: Revised Seismic Certification of ERK Series Rack Enclosures installed with Seismic Anchoring Kit*. *Halcrow, Inc. Project No. DRMAP3. May 3, 2011.*

Dear Mr. Linder:

At your request, Ms. Julie Galbraith, PE of Simpson Gumpertz & Heger Inc. observed seismic qualification testing of the ERK-4428 rack. This testing was conducted at Middle Atlantic Products, Inc. (Middle Atlantic) Fairfield, New Jersey facility on 12 September 2013.

The tested enclosure is the tallest and deepest model available in the series. As the enclosure frame and anchorage details for each footprint within a series are identical, regardless of height, the tested enclosure represents a worst case for seismic loading; and testing results for the tallest enclosures are applicable to all other ERK series enclosures with equal or lesser height and the same footprint.

Previous testing of this series of enclosures was conducted in 2001, including the ERK-4420 and ERK-4425, with depths of 20 and 25 in., respectively. The present testing is intended to re-evaluate the ERK series for a deeper footprint (28 in.), and higher seismic loadings. Findings presented herein supplement previous seismic testing reports for the ERK Series.

Testing Procedure

Each enclosure was statically tested on an inclined test frame. Prior to testing, each enclosure was mounted on the test frame with an appropriate seismic anchorage kit. 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 and measurements of geometry. Then, 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, and also measured overall enclosure drift. The enclosure was then lowered back to its original at-rest position and inspected for signs of permanent deformation. We measured the unit again, in the lowered position, to estimate final drift. The enclosures were tested first in the side-to-side direction, than rotated 90 degrees and tested for back-to-front loading.

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 & 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 ERK-4428 enclosure 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 measured drift ratios for the tested enclosure. Photos 1 and 2 show the tested cabinet at maximum inclination, in each of the two directions of testing.

At maximum inclination, the tested ERK-4428 enclosure showed no signs of significant distress. No visual permanent deformations were observed after completion of the tests. As noted in Table 1, the maximum drift ratio measured was 1.39% of the enclosure height, during the application of maximum lateral load in the side-to-side direction. After load removal, the corresponding maximum permanent enclosure drift was 0.53%. No difficulty was encountered removing the rack components from any of the tested 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.

The referenced letter report discusses performance of the two ERK models tested in 2001. We have reviewed that letter and concluded that the performance in 2001 was similar to that observed presently for the ERK-4428, noting that no visible permanent deformations were reported for either the ERK-4420 or ERK-4425 upon completion of the tests. The capacity loads provided in Table 2 reflect the updated seismic criteria discussed herein, and are based on the testing loads reported in Table 1.

Table 1: Summary of Measured Drift Ratios[2,3]

Enclosure (Testing Year)	Lateral Test Load[1] (pounds)	Enclosure Drift (%) (Top Displacement / Height)			
		Loaded to Max Inclination		Permanent after Testing	
		Front-Back	Side-Side	Front-Back	Side-Side
ERK-4428 (2013)	1,216	0.24%	1.39%	0.04%	0.53%
ERK-4425[3] (2001)	1,067	0.39%	1.77%	0.15%	0.58%
ERK-4420[3] (2001)	1,054	1.31%	1.46%	0.50%	0.85%

1 Lateral test load is representative of the seismic base shear.
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 Previous testing results for this series are taken from Table 1 of the 2011 referenced report.

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
ERK-XX20	650	597	1035	956
ERK-XX25	645	591	1035	954
ERK-XX28	741	680	1185	1094

1 Capacities provided are for 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 all enclosure heights (up to 44 rack spaces) for the models listed and includes enclosures with either cage nut or tapped rail assemblies.

Conclusion

Based on the test results and referenced letter report, we conclude that the ERK 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 footprint as those tested, and with the same or lower total height and weight.

Please note that the observations and conclusions noted herein are applicable only to the ERK 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 (510-457-4456 or jagalbraith@sgh.com) if you would like to discuss the contents of this letter report in further detail.

Sincerely,

Julie A. Galbraith

Julie A. Galbraith, P.E.
Senior Staff I
CA License No. 76178

REGISTERED PROFESSIONAL ENGINEER
JULIE A. GALBRAITH
C 76178
EXP. 6/30/2014
CIVIL
STATE OF CALIFORNIA
Julie A. Galbraith
10/15/2013

William M. Bruin

William M. Bruin
Senior Principal
CA License No. C57867

REGISTERED PROFESSIONAL ENGINEER
WILLIAM M. BRUIN
C 57867
EXP. 6/2014
CIVIL
STATE OF CALIFORNIA
10/15/2013
William M. Bruin

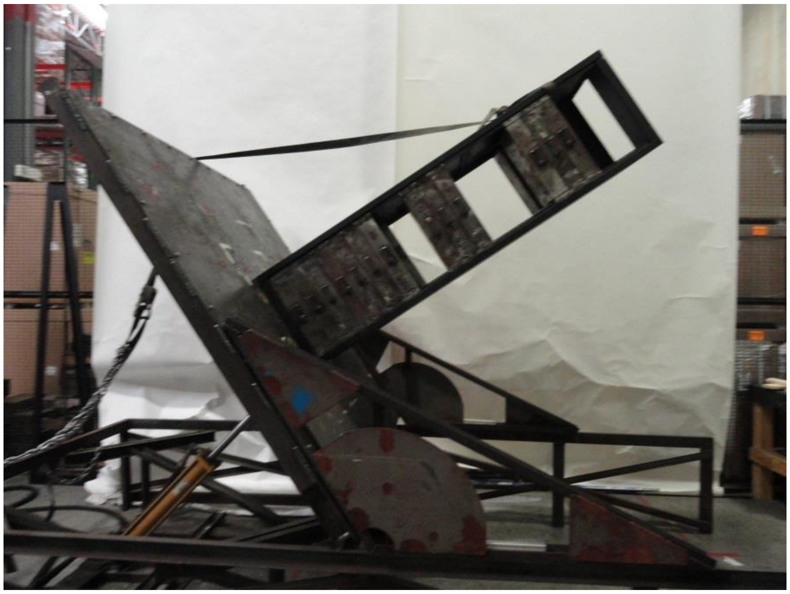

Photo 1
ERK-4428 at maximum inclination in side-to-side direction

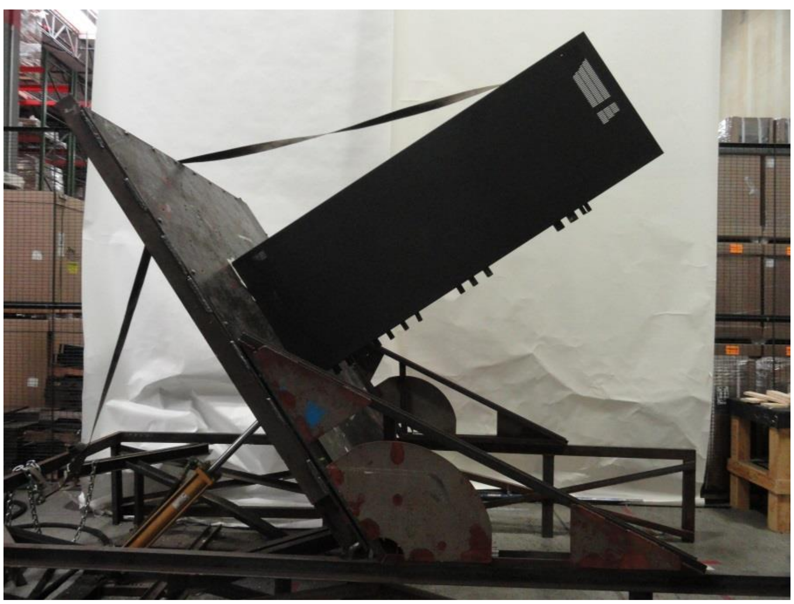

Photo 2
ERK-4428 at maximum inclination in front-to-back direction