16 November 2020

Mr. Sam Yogasuntharam
Compliance & Regulatory Engineer
Legrand AV Division
Legrand, North America

Sent via email: sudharsan.yogasuntharam@legrand.com

Project 207513 – Legrand North America, 2020 Seismic Testing

Re: Observed Seismic Performance Testing of DWR Series Enclosures

Dear Mr. Yogasuntharam:

At your request, Simpson Gumpertz & Heger Inc. (including Julie A. Galbraith, P.E. or William Bruin, P.E.) observed seismic qualification testing of the DWR Series Wall-Mounted Rack Enclosures. This testing was conducted at the Legrand, North America (Legrand) Fairfield, New Jersey facility on 23 September and 7 October 2020.

The enclosures selected for testing, DWR-3532 and DWR-1032, are the deepest models in the series, with the largest and smallest wall footprints, respectively. Therefore, the tested enclosures represent a worst case for seismic loading, and bind the performance of the series. Since the enclosure frame and anchorage details for each footprint within a series are identical, regardless of depth; these testing results are applicable to all other DWR series enclosures with equal or lesser depth and the same footprint.

Previous testing of the DWR series enclosures was performed in 2011 and again in 2016 following design changes. This present testing is intended to re-evaluate the DWR series for seismic qualification with new design modifications. Therefore, the findings presented herein supersede all previous seismic testing letters for the DWR series.

TEST PROCEDURE

Each enclosure was statically tested on an inclined test frame. Prior to testing, each enclosure was anchored to a wall test frame which is then mounted on the inclining 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 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.

The enclosure was then lowered back to its original at-rest position and inspected for signs of permanent deformation. Each enclosure was tested first in the back-to-front direction, then rotated 90 degrees and tested for side-to-side loading. For side-to-side loading, the latch side was positioned up, and the hinge side was positioned down during inclination to maximum stress on the latch mechanism.

This enclosure seismic testing approach is the same as we have carried out for over 15 year of testing with Legrand (formerly Middle Atlantic Products). However due to travel restrictions with the ongoing COVID-19 pandemic, this group of testing was observed remotely by SGH, using multiple stationary and mobile cameras. This included Legrand staff facilitating a visual walkthrough with closeup views of the enclosure at critical stages before, during, and after testing, under our direction. Given our extensive experience of testing with Legrand, and previous data on this series of enclosures, we considered this level of observation sufficient for the purposes of determining the seismic content capacities reported herein.

We determined the quantity of weight for each test based on the enclosure's target content capacity rating, the self-weight of the enclosure, and the seismic design force requirements for nonbuilding components. The specifics of the seismic design criterion are described further within the later sections of this letter report.

OBSERVATIONS

The tested DWR Series 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 for each tested enclosure. Photos 1 through 6 show the tested enclosures during setup and after testing.

At maximum inclination, the tested DWR Series enclosures showed no signs of significant distress. During the side-to-side loading of the DWR-3532 frame, slight bending occurred in the flange directly behind the lock mechanism (Photo 6); however, this bending did not compromise the structural integrity of the frame or operability of the lock after completion. No difficulty was encountered removing the rack components from 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 is the responsibility of the end-user.

Table 1: Summary of Test Results[1]

Enclosure	Lateral Test Load[2] (pounds)	Was the Lock & Latch Mechanism Operable Following Testing?	Was the Pivot Mechanism Operable Following Testing?	Were Weights Easily Removed Following Testing?
DWR-35-32	504	Yes	Yes	Yes
DWR-10-32	380	Yes	Yes	Yes

1 Results provided are based on testing discussed herein.

2 Lateral test load based on enclosure weight, weight of contents, and test inclination. This is equivalent to code seismic base shear.

SEISMIC CONTENT CAPACITIES

The capacities presented herein are based on the testing of the DWR Series enclosures, as noted above, and the following building codes:

- 2016 Edition of ASCE Standard 7 (ASCE 7-16)

The above standard is referenced by several building codes, including:

- 2018 International Building Code (IBC 2018)
- 2019 California Building Code (CBC 2019)
- National Fire Protection Association (NFPA) Building Construction and Safety Code (NFPA 5000 – 2018 Edition)

For all reported values, the seismic design force is determined using an assumed Site Class D soil condition, and assumed top floor or rooftop installations, where amplification of seismic shaking is greatest. The capacities were computed 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 uses an importance factor (I_p) of 1.5. The Standard installation category includes all other installations and uses an importance factor of 1.0.

We determined seismic loading using the largest mapped accelerations within the Continental US (as provided in ASCE 7-16; mapped S_S=3.06g, design S_{DS}=2.04g). This approach provides capacities that are the most 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. Additional capacity may be found by conducting a site-specific evaluation considering the site seismicity and installation location.

Table 2 – Seismic Capacity (pounds) at Maximum Seismic Condition[1,2,3]

Enclosure	ASCE 7- 16 High Importance Installations[4]	ASCE 7-16 Standard Installations
DWR-10-XX	158	282
DWR-12-XX	146	282
DWR-16-XX	146	282
DWR-18-XX	146	282
DWR-21-XX	146	282
DWR-24-XX	146	282
DWR-35-XX	146	310

1 Capacities provided are for the DWR series enclosures, up to 32 in. nominal depth. Selection and installation of the enclosure rack anchor bolts are the responsibility of the end user and are not addressed in this evaluation.

2 Capacities provided are applicable when 50% of the enclosure contents are positioned in the bottom third of the rack, 25% in the middle third, and 25% in the top third.

3 Capacities are based on worst case seismicity (S_{DS} ≤ 2.04g for ASCE 7-16) and top floor or rooftop installation. Additional seismic capacity may be available based on a site-specific evaluation of the installation location.

4 High Importance Installations include any installation where ASCE 7 defines a component importance factor (I_p) of 1.5; including (but not limited to) Occupancy Risk Category IV structures.

Conclusion

Based on the test results, we conclude that the DWR 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, within 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 DWR Series enclosures. 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,

William M. Bruin, P.E.
Senior Principal
CA License No. C57867

Julie A. Galbraith, P.E.
Senior Project Manager
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Photo 1

DWR-1032 positioned on the test frame – front view.

Photo 2

DWR-1032 positioned on the test frame – side view.

Photo 3

DWR-3532 positioned on the test frame – front view.

Photo 4

DWR-3532 positioned on the test frame – left side view.

Photo 5

DWR-3532 positioned on the test frame – right side view after test.

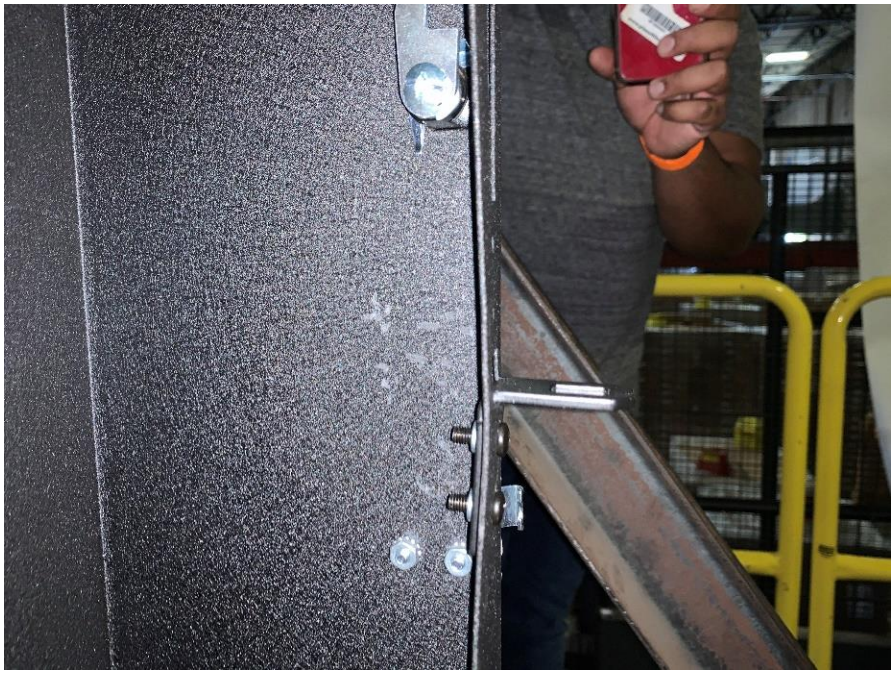

Photo 6

DWR-3532 – Slight bending in flange behind latch following side-to-side test. Latch still operable.