MK & Associates

Expert Report

17-095: NACSP Fall Protection System Certification of Testing

FallBan 2

January 15, 2024

Submitted to:

Mr. Ronald Kempker

By:

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Descriptive Information

This report has been prepared in compliance with ASTM Designation E 620-04, "Standard Practice for Reporting Opinions of Technical Experts." It was prepared on January 15, 2024, under our file titled "23-039 FallBan 2". The opinions contained within have been rendered by Mark A. M. Ezra, PE of MK & Associates, LLC., P.O. Box 460440, St. Louis, Missouri 63146.

The following items have been reviewed and inspected:

1. An exemplar test section 60 feet in length of the subject roof perimeter fall protection system installed on a metal roof;
2. 11 photographs, taken by the author on the date of testing, showing the test setup of a FallBan 2 system, equipped with 30 feet of wire railing supported by FallBan 2 stanchions and the other 30 feet of the test installation using 2-inch EMT conduit having a wall thickness of 0.065 inches, as railings. Each 20-foot railing run is supported in the middle (at ten ft.) by a mid-brace, as required by the official FallBan 2 setup instructions. Thus, each 20-foot run is broken into two 10-foot sections. Test loads of each type of railing were applied in the middle of a 10-foot unsupported railing run so as to simulate the worst-case scenario of a worker falling onto a top railing in the middle of a 10-foot run.
3. The testing was performed in order to establish the performance of the FallBan 2 roof railing system and its conformance with the requirements of the following standards:

a) United States Department of Labor OSHA regulation 1926.502 for Construction Fall Protection.

b) United States Department of Labor OSHA regulation 1926.502(b) for Construction Fall Protection load;

c) United States Department of Labor OSHA regulation 1926.502(c) for Construction Fall Protection load;

d) United States Department of Labor OSHA regulation 1910.29

e) Corps of Engineers EM385-1-1 for Construction Fall Protection load;

The testing was also performed in order to establish the performance of the FallBan 2 roof railing system and its conformance with the following requirements of Canadian regulations:

a) (SOR) Statutory Orders and Regulations / 86-304 / 2.12 (1)(a);

b) (SOR) Statutory Orders and Regulations / 86-304 / 2.12 (1)(b);

c) (SOR) Statutory Orders and Regulations / 86-304 / 2.12 (1)(c); and

d) (SOR) Statutory Orders and Regulations / 86-304 / 2.12 (2);

Mark A. M. Ezra, PE (author), Mr. Ronald Kempker, and Mr. Thomas Scheppers were present during the load testing of the subject fall protection system.

Testing was conducted at a facility owned by Mr. Kempker and located at 5922 Route M, Jefferson City, MO, 65101. The test 60-foot run of the exemplar perimeter FallBan 2 protection system was installed on the metal roof of a barn structure located at the above address. One-half of the FallBan 2 test installation used wire railings, and the other portion of the test FallBan 2 system used EMT 2-inch conduit as railings. The purpose of the presence of Mark A. M. Ezra PE, the author of this report, was to certify the test load applications to two test sections of the FallBan 2 test installation; one section having wire railings and the other section of the test

installation having EMT 2-inch conduit as railings. Mr. Ezra's role during the system conformance tests was as a witness to the placing of the test loads and a witness to the deflections produced in each type of top rail. This report memorializes Mr. Ezra's observations of the results of the test load application.

Pertinent Facts

When the author arrived at the test site on August 29, 2023, the exemplar 60-foot-long test section of the roof perimeter FallBan 2 protection system had already been installed. Mr. Kempker supplied a mechanical scale, which was used to verify the bucket containing the required load for application during the actual testing of the upper runs of the two types of railing of the test FallBan 2 fall protection system. The author, with Mr. Kempker and Mr. Scheppers, proceeded to calibrate the mechanical load scale used for load application by first measuring a load on a previously calibrated digital weigh scale. This calibration load was 202 lbs. This same calibration load was then placed on the mechanical load scale for load application in the testing. The zero-set point adjuster of the mechanical scale was then turned in the appropriate direction such that the mechanical scale read 202 lbs. This now calibrated mechanical load scale in the range of the test load(s) was then used to re-verify the load applied to the FallBan 2 protection system during each of the two load applications of the test load to the two types of railing. This procedure was requested by Mr. Ezra each time a test was completed because the loading bucket that held the metal load plates had some of the load plates removed in order to facilitate taking the loading bucket off the railing being tested and moving to the next section to be tested.

Testing

Figures 1 through 11 are photographs of the test setup; Figure 1 shows the test load bucket placement in the middle of a ten ft. unsupported section of the wire railing section of the test installation. On the left of Figure 1 and Figure 2 photographs, one of the FallBan 2

stanchions can be observed. To the left of this FallBan 2 stanchion, and out of the Figure 1 and Figure 2 photographs, is a ***FallBan 2 terminating Stanchion.***

Figure 3 shows another FallBan 2 stanchion to the right of the 10 ft mid-run support stanchion of the wire railing portion of the test system, as shown in Figures 1 and 2. As can be seen in Figure 2, the load during testing was applied in the middle of the wire railing section situated between a FallBan 2 stanchion and the 1st mid-rail stanchion support, as seen in Figure 1 of the test setup.

Figure 3 shows the changeover from wire railing to steel 2-inch EMT diameter conduit railing. This demonstrates the flexibility of the FallBan 2 system, as the type of railing used may be changed in the middle of an installation, should the roofer or local regulations require such a change.

Results of the Test Loading using a 202lb. Test Load

1) Cable Railing Test:

The unloaded height of the top cable was measured at **44 ½ inches** above the roof that the stanchion base plates were attached. The loaded height of the top cable measured at the load application point, when the load was applied at the midpoint of a 10ft sub-section of cable railing, was **42 ¼ inches.** Therefore, the total sag of the upper cable with 202 lbs. of load applied to the middle of the 10ft. unsupported run of the top cable railing was **two ¼ inches.**

This meets the requirements of the standards mentioned above.

2) EMT Conduit Railing Test:

The unloaded height of the top of the top railing was measured at **41 1/4 inches** above the roof deck.

The loaded height of the 2-inch EMT conduit, measured at the load application

point, which is the midpoint of the unsupported top rail of the ten-foot test section by a 202-pound load, was **40 5/16 inches.**

Therefore, the total sag of the upper conduit railing, when loaded with 202 lbs. of test load applied to the middle of the 10 ft unsupported run, was **15/16 inches.**

This meets the requirements of the standards mentioned above.

Discussion of Opinions and Basis Thereof

The exemplar perimeter FallBan 2 protection system, whose testing was witnessed by the author of this report on August 29, 2023, will be marketed under the name **"FallBan 2"** and distributed by FallBan, LLC. This general concept of a temporarily mounted fall protection system created by placing a temporary guard rail system at the edge of a roof surface during work on a roof is standard industry practice. In the United States of America, such temporary work guarding is required by OSHA regulation.

Similar workplace requirements exist in Canada. The purpose of the witnessed testing on August 29, 2023, of the FallBan 2 design of a roof perimeter fall protection system is to certify that it conforms with both United States Department of Labor OSHA regulations 1926.502 and 1910.29, the Corps of Engineers EM385-1-1 for Construction Fall Protection load, as well as the Canadian regulation SOR/86-304 section 2.12 (1)(a), SOR/86-304 section 2.12 (1)(b), SOR/86-304 section 2.12 (1)(c), and SOR/86-304 section 2.12 (2).

It should be noted that a completely assembled 60-foot section of the "FallBan" system was tested on an actual roof, as it would be installed if the test roof were being worked on. Therefore, the testing witnessed by Mark Ezra, PE, represented "real life" installation conditions and not a testing laboratory setup, which often lacks any direct relationship to an "in-use" system setup.

This testing certifies that the FallBan 2 fall protection system meets all of the following

standards and regulations:

a) United States Department of Labor OSHA regulation 1926.502 for Construction Fall Protection.

b) United States Department of Labor OSHA regulation 1926.502(b) for Construction Fall Protection load;

c) United States Department of Labor OSHA regulation 1926.502(c) for Construction Fall Protection load;

d) United States Department of Labor OSHA regulation 1910.29; and

e) Corps of Engineers EM385-1-1.

The testing was also performed in order to establish the performance of the FallBan 2 roof railing system and its conformance with the following requirements of Canadian regulations:

a) (SOR) Statutory Orders and Regulations / 86-304 / 2.12 (1)(a);

b) (SOR) Statutory Orders and Regulations / 86-304 / 2.12 (1)(b);

c) (SOR) Statutory Orders and Regulations / 86-304 / 2.12 (1)(c); and

d) (SOR) Statutory Orders and Regulations / 86-304 / 2.12 (2) for Construction Fall Protection load;

The testing demonstrates that the test loads were applied sequentially to the cable railing section, and then the conduit railing section exceeded the regulation performance required using 890 N/200 lbs. test loads. Further, the deflection of the upper cable and upper conduit runs of the FallBan 2 perimeter fall protection system did not, under the vertical test load, deflect to a height less than 39 inches above the horizontal reference surface on which the exemplar FallBan perimeter fall protection system was mounted. There was no failure of the upper cable run, the conduit tube run of the railings, or any other components of the exemplar test FallBan 2 perimeter fall protection system.

It was further noted that upon removal of the 890+ N/200+ lbs. test load, the FallBan 2 perimeter fall protection system returned immediately to its original unloaded shape and height without the need for any remedial tightening of cables or conduit or adjustment of the test installation's terminating stanchions.

Because the FallBan 2 and the original FallBan stanchions are of the same structural strength, and because the mechanical hardware used to affix the FallBan 2 stanchions to the test roof are the same as those used on the original FallBan system and the test roof used in the FallBan 2 testing is the same as the roof used in the Original FallBan testing, engineering interpolation allows us to certify that FallBan 2 fall protection railing systems, erected according to the FallBan 2 installation instructions, will support the same outward horizontal side loading as the original, and certified, FallBan fall protection system.

Final testing was performed, as required, on the load-carrying capability of the middle or second railing of both the cable railing section and the 2-inch EMT conduit railing section of the test setup of the FallBan 2 fall protection system. A 150 lb. load was placed at the mid-span of the middle cable railing on the test installation. The cable railing supported the 150 lb. Test load without failure, and upon removal of the test load, the middle rail cable being tested returned to its original location without the need for retention.

Next, the same mid-span load testing of the EMT 2-inch conduit second rail section of the FallBan 2 test setup was loaded with the 150 lb. test load. The 2-inch EMT conduit railing did not permanently deform or collapse. Upon removal of the 150 lb. test load, the second rail 2-inch EMT conduit returns immediately to its original unloaded height.

Opinions and Conclusions

It is our opinion, within a reasonable degree of engineering certainty, that:

1. The testing conducted on the exemplar FallBan 2 perimeter fall protection system

shows that the system meets and exceeds the vertical load requirements of all the United States Department of Labor, OSHA, The Corps of Engineers, and the Canadian regulations, as listed above.

Signature

Opinions given by:

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Dated: 01/15/2024

Peer reviewed by:

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Dated: 01/15/2024

Qualifications

Qualifications of signatory are hereto attached as Exhibit A.

FIGURES

Figure 1

Figure 2

Figure 3

Figure 4

Figure 5

Figure 6

Figure 7

Figure 8

Figure 9

Figure 10

Figure 11