



LOAD TESTING OF ACRO BUILDING SYSTEMS 12075 RAKE-EDGE GUARDRAIL SYSTEM

ATS JOB # D167754-1

PURCHASE ORDER # 22383

Prepared for

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Subject

Load testing of the ACRO Building Systems 12075 Rake-edge Guardrail System

Material

Carbon Steel

Background and Objective

The purpose of this testing was to load test the 12075 rail system in accordance with OSHA 1926.502b1,3,4 & 5 as well as customer specific requirements and fastener configurations. Appendix A shows the type of fastener specified by the customer for mounting the base plate. The fastener locations, Configuration 1 and 2, can also be found in Appendix A. Bases were mounted to a test platform constructed by Applied Technical Services, Inc. (ATS) as specified by the customer. The test platform was constructed with 2"x6" studs on 16" and 24" centers, 10' long, covered with ¾" OSB board. The customer provided four samples to be tested. An untested part was not necessarily used for each test.

Test Procedure and Results

The customer requirements state that each rail system is to undergo load testing at each bracket in the longitudinal (parallel to handrail) and lateral (perpendicular to handrail) directions. The handrail was assembled per the customer's specifications. The specifications for assembly state to: space the brackets 8' apart and join both uprights via a 2"x 4" wooden top rail placed inside the posts and attached with two 16d nails through the provided holes. The types of fasteners used to attach the base plate to the mounting surface were also specified by the customer and can be found in Appendix A. All loads were applied from the D fastener hole locations to the A fastener hole locations of the base plate for lateral tests and from Side 1 to Side 2 for longitudinal tests (see Appendix A). Load was applied within two inches of the top of the handrail per OSHA 1926.502(b) (3). The required test load was 200 lbs. The load was held for one minute. During the test, the top rail height was measured to verify that it did not deflect to a height less than the allowable 39 inches. After one minute, each bracket was checked for fastener retraction. The retraction is recorded in Table I for setups without a handrail installed and Table II for setups with a handrail installed. Each configuration was then loaded to fastener failure.



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The load at failure (when rail deflects below 39 inches vertically or when bracket becomes detached from mounting surface) is recorded in Table III for setups without a handrail installed and Table IV for setups with a handrail installed. The test setup used for testing configurations with a handrail installed is shown in Figure 1. The test setup used to test all configurations without a handrail (stand-alone setup) is shown in Figure 2. Figure 3 & 4 depict the setup for lateral and longitudinal testing with a handrail, respectively.



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Table I - Fastener Retraction at 200 lbs.(no handrail installed)

	Configuration 1	Configuration 2
Retraction from Lateral Load (200 lbs.)	Not Tested	Not Tested
Retraction from Longitudinal Load (200 lbs.)	<0.125" retraction	<0.125" retraction

Table II - Fastener Retraction at 200 lbs. (handrail installed)

	Configuration 1	Configuration 2
Retraction from Lateral Load (200 lbs.)	Nail D2 retracted < 0.5" Nail C2 retracted < 0.25"	<0.125" retraction
Retraction from Longitudinal Load (200 lbs.)	<0.125" retraction	Not Tested

Table III - Maximum Load Recorded at full fastener retraction (no handrail installed)

	Configuration 1	Configuration 2
Max Lateral Load	Not tested	Not tested
Max Longitudinal Load	302 lbs. to lower hand rail to < 39" 319 lbs. max	307 lbs. to lower hand rail to < 39" 672 lbs. max*

*Failure caused by upright deforming to the point that it slipped from the sleeve on the base.

Table IV - Maximum Load Recorded at full fastener retraction (handrail installed)

	Configuration 1	Configuration 2
Max Lateral Load	247 lbs.	309 lbs.
Max Longitudinal Load	510 lbs.	Not Tested



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Discussion and Conclusions

Configurations 1&2 met the load requirements set forth in OSHA 1926.502(b) (3) in all three setups: longitudinal, lateral, and stand-alone. Configurations 1 & 2 also met the rail height requirements set forth in OSHA 1926.502(b) (4) when tested in the longitudinal, lateral, and stand-alone setups.



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Figure 1: Assembled 12075 rail system with handrail installed



Figure 2: Stand-alone setup without handrail with load applied



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Figure 3: Lateral load test with handrail, prior to loading



Figure 4: Longitudinal load test with handrail, load applied



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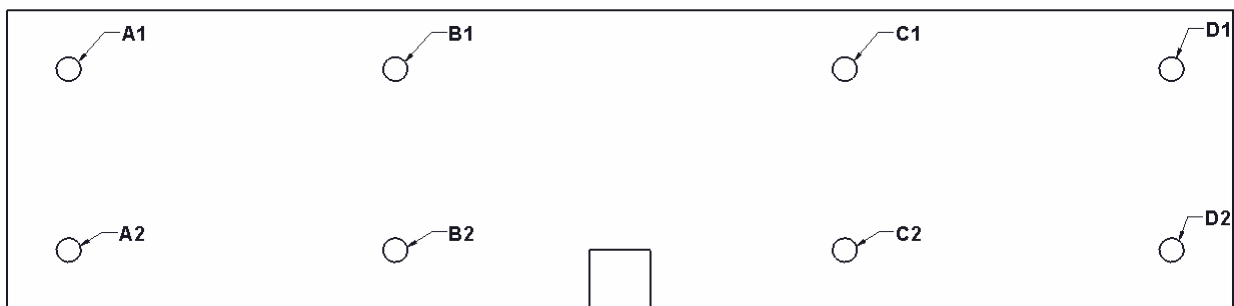
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Appendix A: Fastener Configurations and Base Plate Hole Layout

Hole	Configuration 1	Configuration 2
A1	16d Screw Shank Nail	16d Screw Shank Nail
A2	16d Screw Shank Nail	16d Screw Shank Nail
B1	16d Screw Shank Nail	16d Screw Shank Nail
B2	16d Screw Shank Nail	16d Screw Shank Nail
C1	16d Screw Shank Nail	16d Screw Shank Nail
C2	16d Screw Shank Nail	16d Screw Shank Nail
D1	16d Screw Shank Nail	16d Screw Shank Nail
D2	16d Screw Shank Nail	16d Screw Shank Nail

Red Fasteners are through OSB only, not into stud

Side 1



Side 2

