

## SECTION XXXXX

### RIGID RAIL FALL PROTECTION SYSTEM

#### PART 1 GENERAL

##### 1.1 SYSTEM DESCRIPTION

- A. Type of Fall Protection system(s) required: Horizontal Lifeline (HLL), Single Point Anchors, Ladder Climbing Systems, Rigidrail
- B. System location: Roof/ Wall/ Tower/ Fixed Ladder, Misc. Structure, etc...
- C. Maximum number of workers on system at one time: ##
- D. Systems environmental exposure: What are the service conditions (indoors, outdoors, corrosive environment)? What materials will be required (steel, hot dip galvanizing, stainless steel, marine grade stainless etc...)?
- E. Workers task while on the system: Workers will walk along edge. Occasionally, workers are required to look over the edge. While walking, workers need to carry heavy objects.
- F. Type of fall protection required: Passive, Fall Restraint or Fall Arrest
- G. Range of movement while on the system: Uninterrupted movement throughout the entire length of the system
- H. Additional components: All attaching devices necessary for # workers.
- I. Insurances required: Commercial Liability and Workers' Comp.

##### 1.2 RELATED SECTIONS

- A. Section 03300 - Cast-In-Place Concrete
- B. Section 03400 - Pre-Cast Concrete
- C. Section 05100 – Structural Metal Framing
- D. Section 05400 – Cold Formed Metal Framing
- E. Section 05310 - Metal Deck
- F. Section 06100 – Rough Carpentry
- G. Section 07510 - Built-Up Roofing
- H. Section 07700 - Roof Specialties and Accessories

I. Section 11010 - Maintenance Equipment

1.3 REFERENCES

A. Occupational Safety & Health Administration (OSHA)

1. 29 CFR 1910.28 (b) (1) & 29 CFR 1926.501(b) (1) - Occupational Health and Safety Standards General Industry & Construction: Duty to have fall protection
2. 29 CFR 1910.140(c) (11) (i-ii) & 29 CFR 1926.502(d) (8) - Safety and Health Regulations for General Industry & Construction: Horizontal Lifeline Design Requirements.
3. 29 CFR 1910.140(c) (13) (i-ii) & 29 CFR 1926.502(d) (15) (i-ii) - Safety and Health Regulations for General Industry & Construction: Anchorage Design Requirements.
4. 29 CFR 1910.66 (e) (1) (i) - General Industry: Powered Platform Installations -Affected parts of buildings.

B. American National Standards Institute (ANSI)

1. Z359.1 [2016] – The Fall Protection Code
2. Z359.3 [2017] – Safety Requirements for Positioning and Travel Restraint Systems.
3. Z359.6 [2016] – Specifications and Design Requirements for Active Fall Protection Systems.
4. Z359.11 [2014] – Safety Requirements for Full Body Harnesses.
5. Z359.12 [2009] – Connecting Components for Personal Fall Arrest Systems.
6. Z359.13 [2013] – Personal Energy Absorbers and Energy Absorbing Lanyards.
7. Z359.14 [2014] – Safety Requirements for Self-Retracting Devices for Personal Fall Arrest and Rescue Systems.
8. Z359.15 [2014] – Safety Requirements for Single Anchor Lifelines and Fall Arrester for Personal Fall Arrest Systems.
9. Z359.18 [2017] – Safety Requirements for Anchorage Connectors for Active Fall Protection Systems.

C. Materials, Bolting, Finishing: American Society of Testing Materials (ASTM)

1. A36 - Standard Specification for Carbon Structural Steel.
  2. A500 - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
  3. A53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
  4. F1554 - Standard Specification for Anchor Bolts, Steel, 36, 55, and 105 KSI Yield Strength.
  5. A193 - Standard Specification for Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications
  6. A123 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
  7. A666 - Standard Specification for Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
  8. A992 - Standard Specification for Structural Steel Shapes.
  9. F3125 - Standard Specification for High Strength Structural Bolts, Steel and Alloy, Heat Treated, 120ksi and 150ksi Minimum Tensile Strength, Inch and Metric Dimensions.
- D. American Welding Society (AWS) D1.1/D1 - Structural Welding Code – Steel
- E. Design Standards
1. International Building Code (IBC) [20XX] – Building Design Manual
  2. American Society of Civil Engineers (ASCE/SEI) 7-10 [20XX] – Minimum Design Loads for Buildings and Other Structures
  3. American Institute of Steel Construction (AISC) 360-XX [XX<sup>th</sup> ed.] – Steel Construction Manual. In accordance with local building code and adopted standards.
  4. American Concrete Institute (ACI) 318-11 Building Code Requirements for Structural Concrete.
  5. National Design Specification (ANSI/NDS) [20XX] – Wood Construction Manual
- F. Definitions

1. Anchorage – per ANSI Z359.0 – A secure connecting point or a terminating component of a fall protection system capable of supporting impact forces applied by a fall protection system.
2. Anchorage Connector – per ANSI Z359.0 – A component or subsystem that functions as an interface between the anchorage and a fall protection, work positioning, rope access or rescue system for the purpose of coupling the system to the anchorage.
3. Clearance – per ANSI Z359.0 – The distance below an authorized person that must remain clear of obstructions in order to ensure that the authorized person does not make contact with any objects that would cause injury in the event of a fall.
4. Continuous Fall Protection – per ANSI Z359.0 – One or more fall protection systems that provide fall protection without interruption.
5. Fall Arrest – per ANSI Z359.0 – The action or event of stopping a free fall or the instant where the downward free fall has been stopped.
6. Fall Hazard – per ANSI Z359.0 – Any location where a person is exposed to a potential free fall.
7. Fall Restraint/Travel Restraint – per ANSI Z359.0 – A combination of anchorage, anchorage connector, lanyard (or other means of connection) and body support (full body harness) that limits travel in such a manner that the user is not exposed to a fall hazard.
8. Qualified Person – per ANSI Z359.0 – A person with a recognized degree or professional certificate and with extensive knowledge, training and experience in the fall protection and rescue field who is capable of designing, analyzing, evaluating and specifying fall protection and rescue systems to the extent required by the Z359 standards.

#### 1.4 PERFORMANCE

- A. System shall comply with 1.1 System Description
- B. Performance Requirements
  1. System Performance
    - a. The Anchor Post(s) shall provide a secure attachment means to the supporting structure in conjunction with the manufacturer's requirements. The Anchor Post shall provide compatible connections with the applicable anchorage connector. All components shall be designed by the fall protection system supplier and shall meet the applicable fall protection ANSI standards and applicable OSHA regulations.

- b. The Fall Protection Horizontal Lifeline System shall be designed to allow users to walk the entire length of the system without having to disconnect from the system to pass through intermediate support points. The system shall be designed to support required number of users in case of a fall and to prevent the users from free falling more than 6 feet. All components shall be designed by the fall protection system supplier and shall meet the applicable fall protection ANSI standards and applicable OSHA regulations.

2. Structural Performance:

- a. Structure supporting the Horizontal Lifeline system must be capable of withstanding design loads as required by governing regulations and codes. Where component design loads are specified herein, they represent design minimum requirements.
- b. Structure supporting Anchor Post(s) must be capable of withstanding the design loads as required by governing regulations and codes. Where component design loads are specified herein, they represent design minimum requirements.
- c. All fall protection components and systems shall be designed with a minimum 2:1 safety factor per reference 1.3.A.2.

1.5 DESIGN

A. Design Requirements

- 1. Fall protection rigid rails shall comply with current applicable OSHA, ANSI, IWCA, and state regulations and standards.
- 2. The fall protection system and any supporting structure shall be designed by:

Gravitec Systems Inc.	Phone:	1-800-755-8455
21291 Urdahl Road NW,	Website:	www.gravitec.com
Poulsbo, WA 98370-7124	E-mail:	solutions@gravitec.com.

3. General Requirements:

- a. Rigid rails shall be designed and installed, under the supervision of a Qualified Person, as part of a complete personal Fall Protection system.
- b. The rigid rail must be level (less than a 5% grade).
- c. Engineers shall, at minimum determine the performance of the system when a fall occurs on the shortest span (largest forces) and the longest span (largest total fall distance) in the system.

- e. Anchorages for rigid rails systems shall be verified and designed, prior to use, by a Qualified Person with experience and training in designing and using rigid rails systems.
  - f. Rigid rail shall satisfy the seismic conditions for nonstructural components as described by ASCE/SEI 7 and the most current edition of the IBC. No exceptions can be taken if the system is required to function for life-safety purposes after an earthquake.
  - g. Brackets and supports shall be attached to the structure with appropriate anchors of proper size to adequately support the intended load.
  - h. The rigid rail shall comply with the manufacturer's design requirements.
4. Restraint rigid rails shall be designed per ANSI Z359.2 & ANSI Z359.6:
- a. The rigid rail shall prevent workers from reaching and falling into any open hole or off the edge of a working surface.
  - b. The rigid rail shall comply with the requirements for fall arrest rigid rails as indicated in this document.
  - c. Where a worker is using a full body harness the force on the worker's body shall not exceed 400 lbs.
  - d. The use of fall restraint systems shall be limited to surfaces at or less than a slope of 4:12 from the horizontal. This is so a fall will not result in dynamic loading on the fall restraint system or where the authorized person could end up being suspended vertically from the system.
5. Fall Arrest rigid rail (s) shall be designed per ANSI Z359.2 & ANSI Z359.6:
- a. The selection, design, and installation of fall arrest rigid rails shall be performed under the supervision of a Qualified Person.
  - b. Fall arrest rigid rails shall have the strength capable of sustaining static loads applied to the trolley at the system's worst case loading of at least two times the maximum arresting force.
  - c. When more than one user is attached to a rigid rail, the strengths set forth in b. above shall be multiplied by the number of users attached to the system.
  - d. The swing fall shall comply with ANSI Z359.6 [5.3]

- e. The clearance safety margin shall comply with ANSI Z359.6 [7.2.6.2]
- 6. Window Washing System (ANSI/IWCA I-14.1):
  - a. Fall Protection Systems shall provide independent fall arrest anchorages in addition to suspension line anchorages for each descent location as required by IWCA.
  - b. The trolley shall be designed to be compatible with current window cleaning industry standard equipment (e.g. rope descent systems, Boatswain chairs, swing stages, transportable suspension devises).
  - c. Design of the fall protection rigid rails, and equipment shall meet or exceed the following:
    - I. The primary support trolley(s) and the safety line trolley(s) shall be designed by a registered professional engineer and designed to support an ultimate capacity of not less than 4 times the rated load (swing staging) plus the fall arrest load for each operator suspended from the track.
    - II. All rigid rail and supporting structure shall be connected to the super structure using a minimum of two fasteners (e.g. bolts, epoxy anchors, threaded rod, etc...) per anchorage.
- B. Sub-System Requirements
  - 1. Harnesses and Vertical Lifelines (VLLs) used with the system shall comply with ANSI Z359.1
  - 2. Connecting Components (carabiners and snaphooks) used with the system shall comply with ANSI Z359.12
  - 3. Energy Absorbing Lanyards (EALs) used with the system shall comply with ANSI Z359.13
  - 4. Self Retracting Lifelines (SRLs) used with the system shall comply with ANSI Z359.14
- C. Rigid rails shall be used exclusively for their designed use and shall be marked to prevent other uses.
- D. The design shall take into consideration the potential uses of and loads on the rigid rail, in order to facilitate the prompt rescue of workers who may fall while attached to the system.

## 1.6 SUBMITTALS

- A. Submit under provisions of Section ##### – Submittal Procedures
- B. Product Data: Provide data sheets on each product to be used, including:
  - 1. Preparation instructions and recommendations.
  - 2. Storage and handling requirements and recommendations
  - 3. Installation methods
- C. Drawings and Calculations:
  - 1. Drawings:
    - a. Show the layout of the system including where the system is located and the complete assembly of all components.
    - b. Include a specification of the number, location, and qualifications of workers using the system.
    - c. Clearly specify the equipment dimensions, materials, fabrication details, hardware, and installation instructions.
  - 2. Calculations:
    - a. Calculations shall be prepared under the supervision of a registered Professional Engineer and Qualified Person.
    - b. Include a statement defining the type of system and indicating that the design is in accordance with the requirements of ANSI Z359.6.
  - 3. The Professional Engineer who oversaw the design of the system shall affix their professional seal to each drawing and calculation package issued.
- D. Operation and Maintenance Data shall be prepared per Z359.2 & ANSI Z359.6:
  - 1. Include complete list of equipment replacement parts; identify each entry with the equipment description and part numbers.
  - 2. Include technical information for servicing equipment.
  - 3. Include legible “as-constructed” drawings of the installed system.
  - 4. Include installation date and system owner’s name and address.
  - 5. Include detailed operating procedures:
    - a. Written by a Qualified or Competent Person.

- b. Identifying the rigid rails location
  - c. Stating any safety precautions that shall be followed during access and egress.
  - d. Describing the limitation on use of system: maximum load, designated equipment, required clearance and maximum number of persons permitted to be attached to the system at one time.
  - e. Instructions for inspection, maintenance, and retirement of the system and all of its components, including how often inspection and maintenance are to be performed and a description of the qualifications required for persons performing these tasks.
  - f. Procedure for inspection:
    - I. Required or recommended inspection intervals.
    - II. Detailed instruction for inspecting each component of the system.
    - III. Description of acceptance or rejection criteria, including retirement criteria, of each component of the system.
    - IV. Fall protection procedures shall include a requirement that any incidents, including accidents or near misses, be investigated to determine if procedures can be improved.
6. Provide or direct the owner of the system or the employer of the workers using the system to develop and implement a rescue plan before the system is used.

## 1.7 QUALITY ASSURANCE

- A. Single Source: Obtain all materials and equipment required under this section from a single supplier.
- B. Designer/Installer Qualifications: Engage a single firm to assume undivided responsibility for the design and fabrication of all fall protection system components. Firm shall have a minimum of 5 years documented experience in the fabrication of such components similar to that required for this project. Additionally, the firm shall have a minimum of 5 years documented experience in the installation of such components and who offers a regular inspection and maintenance service on such systems.
- C. Design Engineer: Employ a firm with a minimum of 10 years experience designing fall protection systems with a minimum of 5 systems installed in the previous 12 months. Who employs a registered Professional Engineer (PE), with

evidence of being the principal PE on at least 3 fall arrest systems which have been in use for no less than 1 year prior to bid closing date.

- D. Professional Engineer and Fall Protection Qualified Person: Shall oversee the fall protection systems' design, such that all component items meet the "Structural Performance" requirements, including sizing and spacing of all attachments to the building structure and verify the design is compliant with all applicable OSHA and ANSI standards. Additionally, they must prepare, stamp and sign all required calculations; while also approving the system designer's drawings
- E. Welding to be executed by certified welders in accordance with AWS requirements.

#### 1.8 DELIVERY, STORAGE & HANDLING

- A. Material delivery shall be coordinated with all effected entities.
- B. Storage and Protection:
  - 1. Store originally packaged materials in a cool, dry, and protected location.
  - 2. Materials shall be in new condition and show no signs of damage.

#### 1.9 SEQUENCING

- A. Ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress.

#### 1.10 WARRANTY

- A. Manufacturer's standard year warranty for materials and workmanship.

### **PART 2 PRODUCTS**

#### 2.1 MANUFACTURERS

- A. Manufacturers shall comply with the *Quality Assurance* section of this documentation.
- B. All supporting structure which connects the rigid rail to the super structure shall be designed by:

Gravitec Systems Inc.  
21291 Urdahl Road NW,  
Poulsbo, WA 98370-7124

Phone: 1-800-755-8455  
Website: www.gravitec.com  
E-mail: solutions@gravitec.com.

#### 2.2 PRODUCTS

- A. Gravitec Systems Inc.  
21291 Urdahl Road NW,  
Poulsbo, WA 98370-7124

## 2.3 MATERIALS

- A. Product
  - 1. The system shall be a complete and turnkey complying with the performance and design criteria of this document.
  - 2. The rigid rail (s) shall be the product of Gravitec Systems.
  - 3. Components: All system components shall be A36 steel.
  - 4. The Fall Protection System shall be attached to the supporting structure with appropriate fasteners. The fasteners shall be designed to support a load on the fall protection system of 2 times the maximum design load without failure.
  - 5. Provide all designed sub-system items per Section 1.5 (B) of this document.
- B. Supporting Structure
  - 1. Structural Components shall comply with the applicable standards:
    - a. Structural Steel: ASTM A36
    - b. Structural Tubing: ASTM A500 Grade B
    - c. Structural Bars, Plates, Shapes, and Sheet Piling: ASTM A6
    - d. Piping: ASTM A53
  - 2. Fasteners shall comply with the applicable standards:
    - a. Structural Bolts: ASTM A325
    - b. Alloy-Steel and Stainless Steel Bolting: ASTM A193
  - 3. Flashing and Sealing Material shall comply with the applicable standards:
  - 4. Material substitutions shall be better than or equal to the requirements found in this section.
  - 5. Fabrication

- a. Fabricate work true to dimension, square, plumb, level, and free from distortion or defects detrimental to performance.
- b. Coordinate the system with supporting structure.
- c. Welding:
  - I. AWS D 1.1 as applicable.
  - II. If Butt welds are used, then surplus welding material is to be ground off to ensure exposed surfaces are smooth. Fillet welds shall not be ground.
  - III. Slag is to be removed from the materials surface.

6 Finishes

- a. Hot Dipped Galvanizing: Comply with ASTM A123.
- b. Powder Coat: Safety Yellow

2.4 RIGID RAIL DESIGN

- A. Rigid rail design shall comply with the *Design Requirement* section of this document.
- B. Steel design shall comply with AISC 14<sup>th</sup> ed.
- C. Wood design shall comply with ANSI/NDS [2005]
- D. Concrete design shall comply with ACI [2008]
- E. Fall protection systems attached onto an existing or new structure shall comply with IBC [2009] and ASCE/SEI [2010]

**PART 3 EXECUTION**

3.1 INSTALLATION

- A. Installation shall be performed by:

Gravitec Systems Inc.  
21291 Urdahl Road NW,  
Poulsbo, WA 98370-7124

Phone: 1-800-755-8455  
Website: www.gravitec.com  
E-mail: solutions@gravitec.com.

- B. Install in accordance with approved shop drawings and manufacturer's instructions.

- C. The Fall Protection System shall be installed under the direction of manufacturer's authorized trained personnel and under the supervision of a Qualified Person
- D. Install anchorages and fasteners in accordance with their manufacturer's recommendations to obtain the allowable working loads published in the product literature and in accordance with this specification.
- E. Do not load or stress the Fall Protection System until all materials and fasteners are properly installed and ready for service.
- F. Where bolting is used for fastening, no fewer than three threads are to be exposed and the nut is to be positively locked using a thread-locking fluid or the double nutting technique.
- G. Dissimilar materials with greater than 0.15V shall be separated by a faying surface.

### 3.2 FIELD QUALITY CONTROL

- A. After the Fall Protection System is installed and properly tensioned, the approved authorized Qualified or Competent Person shall inspect and operate the system and shall make all final adjustments for proper operation.

### 3.3 ADJUSTMENTS AND FINAL INSPECTION

- A. Verify that all manufactured units have been installed in accordance with specifications and details, and will function as intended. Adjust any items where necessary to ensure proper operation.
- B. Provide a complete drawing set with any revisions to the design or layout of the rigid rails during installation.

### 3.4 OPERATOR TRAINING

- A. Provide a minimum of 4 hours of operator training after system has been installed. Training is to be for the users of the system conducted at the installation site.

### 3.5 MAINTENANCE, INSPECTION AND TESTING

- A. Provide manufacturer maintenance, inspection and testing instructions.
- B. Provide documentation that is consistent with applicable OSHA, ANSI and IWCA standards.

**END OF SECTION**



# GRAVITEC CUSTOM SLOTTED RIGID RAIL SYSTEM

The Slotted Rigid Rail System, a custom design by Gravitec, is an attractive option because the fall protection system is hidden inside the rail. It has many features that have made it a popular choice. The user-friendly trolley travels inside the rail on polyurethane wheels and high-quality bearings, resulting in smooth movement. Unlike other rail systems that use an exposed flange, the enclosed trolley is protected from dust, birds, leaves and other foreign material which could affect the system's performance. This system easily spans 20' between connections, and the size of the rail can be increased to span greater distances if required by a building's design. Unlike cable or rope systems that generate high-end anchor loads, this rigid system distributes forces throughout intermediate anchors and rarely requires structural reinforcement. The slotted rigid rail reduces total clearance requirements necessitated by cable systems which experience sag and deflection. This system is equivalent in cost to other rigid rail systems and is a great choice when appearance and performance are important. For product details and ordering, call Gravitec's Engineering Department at 1.800.755.8455.

- **Spans 20' between connections and size of rail can be increased to span greater distances**
- **Distributes forces throughout intermediate anchors and rarely requires structural reinforcement**
- **Reduces clearance requirements necessitated by cable systems**
- **Equivalent in cost to other rigid rail systems**

