

## **1.0 GENERAL**

### **1.1 WORK SEQUENCE**

- .1 Supply and installation of engineered horizontal life line (HLL) as shown on the drawings and as specified in the Contract Documents. Work includes but is not limited to:
  - .1 Material and labour to install horizontal life line and fall protection systems as shown on the drawings or as directed by the Departmental Representative.
  - .2 All associated framing, hardware, and connecting components.

### **1.3 REFERENCE STANDARDS**

- .1 Reference Standards are latest editions, unless noted otherwise.
- .2 Canadian Standards Association (CSA)
  - .1 CSA G40.20/G40.21, General Requirement for Rolled or Welded Structural Quality Steel
  - .2 CSA W47.1, Certification of Companies for Welding of Steel Structures
  - .3 CSA W59, Welded Steel Construction - Metal ARC Welding.
  - .4 CSA G164, Hot Dip Galvanizing of Irregularly Shaped Articles.
  - .5 CAN/CSA Z271: Safety Code for Suspended Elevating Platforms
  - .6 CSA Fall Arrest Systems – Practical Essentials
  - .7 CSA Z259.16: Design of Active Fall Protection Systems
  - .8 CSA Z259.2.1: Fall Arresters, VLL, and Rails
  - .9 CSA Z259.2.2: Self-Retracting Devices for Personal Fall Arrest Systems
  - .10 CSA Z259.11: Energy Absorbers and Lanyards
  - .11 CSA Z259.12: Connecting Components for Personal Fall Arrest Systems (PFAS)
  - .12 CAN/CSA Z91 Health and Safety Code for Suspended Equipment Operations
  - .13 CAN Z259.13: Flexible Horizontal Lifeline Systems.
  - .14 CAN Z259.15: Anchorage Connectors
  - .15 CSA G4: Steel Wire Rope for General Purpose and for Mine Hoisting and Mire Haulage

- .3 American Society for Testing and Materials International (ASTM)
  - .1 ASTM A167, Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
  - .2 ASTM A500, Cold Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.

#### **1.4 REGULATORY REQUIREMENTS**

- .1 Conform to the Occupational Health and Safety Act and regulations that apply to the work being performed.
- .2 Conform to the National Building Code and requirements of CAN/CSA Z91 (Safety Code for Suspended Equipment Operations), CAN/CSA Z271 (Safety Code for Suspended Elevating Platforms), & CAN/CSA Z259.16 (Design of Active Fall-Protection Systems).

#### **1.5 DESIGN AND COORDINATION**

- .1 All permanent fall protection anchors and all components for life line systems, including all connecting components, are to be designed in accordance with CAN/CSA Z259.16 to resist without fracture a pull-out force of 22.2 kN, applied in the most adverse direction.
- .2 Design of lifeline system shall limit the maximum arrest force (MAF) on a worker's full body harness to 6kN or less.
- .3 Pre-engineered life line systems are to have testing certification. Testing must have been completed within the last ten (10) years.
- .4 Coordinate work of this Section with Section: 11 24 01 Fall Protection Anchors as well as coating and waterproofing specifications to provide continuous waterproofing protection and coordination of installations.

#### **1.6 SUBMITTALS**

- .1 Submit shop drawings for all pre-engineered proprietary systems and components. Shop drawings are to include but not be limited to the following:
  - .1 Show complete horizontal life line system, anchorage connection layout, and configuration, including all connecting components, hardware, and accessories.
  - .2 Fall protection components and system layout must meet or exceed the performance requirements of CSA Z91, CSA Z259.16, CSA Z259.13, the Occupational Health and Safety Act and National Building Code.

- .3 Include dimensions, detail drawings of attachment to structure and design details.
- .4 Indicate method of attachment to the building structure as design by Professional Engineer.
- .5 Drawings to be stamped by a Professional Engineer.
- .6 Manufacturer's descriptive literature for each product, including section or other type details.
- .7 Manufacturer's written installation instructions and quality assurance statements describing fabrication quality control measures.
- .2 Submit test data from a qualified testing laboratory indicating that the lifeline system connecting components and anchorage connectors have been load tested in accordance with CSA Z259.13 and CSA Z259.15.
- .3 Contractor to provide the following upon installation of the horizontal life line:
  - a. Unstrained length of cable (with no tension):
  - b. Distance between supports (+/- 25mm):
    - i. Span 1:
    - ii. Span 2:
    - iv. Span n:
  - c. Installation Sag:
    - i. Span 1:
    - ii. Span 2:
    - iv. Span n:
  - d. Installation Temperature (degrees C):

## 1.7 QUALITY ASSURANCE

- .1 Submit Test Reports and substantiating engineering data prepared an independent laboratory indicating that system meets required performance criteria. Tests must have been conducted within the last ten (10) years.
- .2 Design of structural support framing components and inspection of the installation to be completed under direct supervision of a Professional Engineer.
- .3 Co-ordinate the Work with installation of fall protection anchors and roofing assembly and sheet metal work as required.

## **1.8 WARRANTY**

- .1 Warrant products installed under this section of work to be free of defects in materials and/or manufacture for a period of 5 years (from the date of project completion) when installed in accordance with the manufacturer's written instructions.

## **2.0 PRODUCTS**

### **2.1 MANUFACTURER**

- .1 Life line manufacturer to be a company specializing in the design, fabrication and installation of permanent lifeline and fall protection safety systems.
- .2 Provide horizontal life lines complete with energy absorbers or approved equivalent.

### **2.2 HORIZONTAL LIFE LINE REQUIREMENTS**

- .1 Life line systems and all connecting components are to be in accordance with CSA Z259.12, CSA Z259.13, CSA Z259.15, and CSA Z259.16.
- .2 All metal components are to be stainless steel unless otherwise noted.
- .3 All metal components shall show no evidence of corrosion that would affect their function.
- .4 Components made of materials that are vulnerable to degradation by exposure to sunlight or other environmental conditions shall be protected against such degradation by proper shielding or other suitable means.
- .5 Design and material specifications of all components shall ensure durability and reliability of operation in temperatures from -35 C to +35 C (-31 F to +95 F) and in course of handling under normal field conditions.
- .6 Components shall not contain any combination of metals that have the potential, when combined, to cause an adverse galvanic reaction.
- .7 All components within the life line system are to be compatible in that they are installed to meet the design intent and preserve their intended function as outlined in this Section, the drawings, and the Contract Documents.

## 2.3 MATERIALS

- .1 Horizontal Life Line Wire Rope:
  - .1 Wire ropes lines shall comply with CSA G4.
  - .2 Wire rope to be stainless steel (Type 316 or better)
  - .3 Minimum wire rope diameter shall be 10mm – Stainless Steel 6x19 IWRC or 7x19 Aircraft Cable.
  - .4 Minimum breaking strength 53 kN
- .2 Connecting Components:
  - .1 All connecting components shall conform to CAN/CSA Z259.12: Connecting Components for Personal Fall Arrest Systems (PFAS).
    - .1 All connection components are to be stainless steel or approved alternate. Components shall not contain any combination of metals that have the potential, when combined, to cause an adverse galvanic reaction.
    - .2 All components shall exhibit an ultimate breaking strength of not less than 22.5 kN when subjected to static strength tests (CAN/CSA Z259.12).
  - .2 The use of rope clips is preferred to swagging for field connections. Wire rope clips number, spacing, orientation and installation torque to be in accordance with manufacturer's installation instructions. Substitution of rope clips with swaging (e.g. Flemish eye Splice) will be subject to pre-approval by the Departmental Representative. Swaging certificates to be provided by the manufacturer. The Departmental Representative may also request samples for independent testing, the cost of which will be a consideration in selecting the use of swaged connections.
  - .3 Terminate ends of cable with a neat square cut. Frayed ends of cables will not be acceptable.
  - .4 Turn-buckles must be provided to allow adequate adjustment of initial tension and sag on the horizontal life line. Turn-buckles to be stainless steel.
  - .5 Shackles to be stainless steel and in accordance with ISO 2415:2004: Shackles for General Lifting Purposes.
  - .6 Fasteners: Stainless Steel Type 316 or better, lock washers and hex nuts.
  - .7 Welding materials: in accordance with CSA W59.
  - .8 Exposed structural units: Stainless Steel, Type 316 or better.
  - .9 Manufactures load certificates for all components must be submitted for any stainless steel connecting components. Stainless steel connecting hardware

will be subjected to third party tension testing in accordance with ASTM E8 / E8M. Test reports comprising a representative sampling completed within five years from the date of award must be provided. The Departmental Representative may also request samples for independent testing, the cost of which will be a consideration in selecting the use of stainless steel fittings.

.3 Horizontal Life Line Energy Absorbers:

- .1 Horizontal Life Line Energy Absorbers are to meet or exceed requirements of CSA Z259.13-04 and CSA Z259.16-04.
  - .1 Minimum breaking strength of a horizontal lifeline energy absorber at maximum extension shall be at least twice the MAL (Maximum Arrest Load) but not less than 22.2 kN
  - .2 Metals used in ductile energy absorbers for outdoor applications shall, at minimum, meet the low temperature requirements of CSA G40.20/G40.21 for Category 4 low temperature steels.
  - .3 Elastic devices (i.e. devices that store energy and return it to the system when applied forces are reduced) shall not be acceptable.

.4 Anchorage Connectors:

- .1 All anchorage connectors and connecting components shall conform to CSA Z259.15 and CSA Z259.12. The design and testing of all anchorages shall conform to CSA Z259.16.
- .2 Mobile attachment devices shall not be acceptable unless pre-approved by Departmental Representative. Submittals for mobile attachment devices shall be made in accordance with Submittals Section.

### **3.0 EXECUTION**

#### **3.1 EXAMINATION**

- .1 Report to the Departmental Representative in writing, defects of work prepared by other trades and other unsatisfactory site conditions.
- .2 Verify site dimensions before commencement of work. Final placement of all fall protection anchors must ensure coverage of exterior surfaces as intended by the design intent and per horizontal life line layout shown on the drawings.
- .3 Commencement of work will imply acceptance of prepared work.

### **3.2 PREPARATION**

- .1 In the event of structural deficiencies, deck corrosion or deterioration, ensure that a structural engineer has assessed and approved all surfaces upon which the work of this Section depends. Institute repairs and/or reinforcement where necessary.
- .2 If necessary, protect building interior and contents against ingress of water, dust, debris or other material.

### **3.3 INSTALLATION**

- .1 Install equipment in accordance with manufacturer's printed instructions, shop drawings and as specified.
- .2 Ensure equipment is installed under the supervision of a Professional Engineer.
- .3 Where necessary, provide protection against deterioration due to contact of dissimilar materials.
- .4 Ensure work is inspected prior to application of roofing
- .5 Install roof support flashing in accordance with manufacturer's printed instructions.

### **3.4 FIELD QUALITY CONTROL**

- .1 All permanent fall protection anchors forming part of life line system installations to be tested by a qualified testing agency as determined by the Departmental Representative upon completion of work. Testing is to be conducted in accordance with Section 11 24 20 – Fall Protection Anchor Testing.
- .2 All life line components to be reviewed by a qualified person for conformance with manufacturer's installation and usage instructions and engineered design intent.
- .3 Dynamic field testing of lifeline system or any of the system components shall not be acceptable.

### **3.5 ADJUSTING AND FINAL INSPECTION.**

- .1 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.
- .2 Fall protection system manufacturer is to perform final inspection for acceptance and provide documentation to commission the system upon completion of Work.
- .3 Initial adjustment to ensure appropriate sags and tension to suit design conditions as tabulated on the drawings.

### **3.6 CLEANING**

- .1 Remove all debris and scrap resulting from the execution of this trade.
- .2 Clean manufactured units using materials and methods approved by manufacturer. Do not use cleaners or techniques which could impair performance of the fall protection system or waterproofing and wall coatings.

**END OF SECTION**