Section 13 34 23 – Modular Training Tower

PART 1– GENERAL

1.1 Work Included

A. The work under this section shall include the furnishing of all items shown as specified including:

1. Modular training units
2. Fabricated metal stair systems
3. Fabricated railing systems
4. Steel door and window shutter systems
5. Burn room insulating system
6. Miscellaneous components and accessories

1.2 Related Sections

A. Division 3 – Grouting (If required)

B. Division 3 – Concrete piers (If required)

1.3 Definition

A. The simulator shall be made up of pre-manufactured and pre-assembled modular training units (unless shipped overseas) to provide a complete installation of a modular training structure. The modular training structure shall be used to provide training for firefighters in a controlled simulated environment, which is commensurate with actual fire conditions. These specifications shall be used in conjunction with the drawings for dimensions, features, and exact configuration of the training structure. All components shall be new materials and designed specifically for the modular training tower. **Used, repurposed, or modified materials will not be acceptable.**

1.4 References

A. International Building Codes - Current edition adopted by local authority

B. National Fire Protection Association (NFPA)

1. NFPA 1402 – Guide to Building Fire Training Centers
2. NFPA 1403 – Standard on Live Fire Training Evolutions

C. American Society for Testing and Materials (ASTM)

D. AWS D1.1 – Structural Welding Code – Steel

E. American Institute of Steel Construction (AISC), Manual of Steel Construction, latest edition

F. Occupational Safety and Health Standards (OSHA)

1. 29 CFR 1910.23 – Guarding Wall and Floor Openings
2. 29 CFR 1910.24 – Fixed Industrial Stairs
3. 29 CFR 1910.27 – Fixed Ladders

1.5 Design Requirements

A. Structural Requirements

1. Provide modular training structure system capable of withstanding the effects of gravity loads per NFPA 1402 and the following loads & stresses within the limits and under conditions specified by local code.
    a. Wind Requirements:
        1) Wind Load: Assumed 105 MPH Ultimate or per local code if required
        2) Wind Exposure: Assumed C or per local code if required
    b. Seismic Requirements:
        1) Site Class: Assumed D or per local code if required
        2) S_S (Short Period) : Assumed maximum 10.9 or per local code if required
        3) S_1 (1-Second Period) : Assumed maximum 6.4 or per local code if required
    c. Risk Category: I
    d. Deflection Limits: Engineer primary & secondary framing components, floor systems, and wall assemblies to withstand design loads with deflections no greater than 1/240 of the span.
    e. Exterior Wall Panel System:
        1) The modular training structure exterior wall panels shall be a structural component of the design and provide shear and lateral loading as dictated by the design requirements.
    f. Handrails and Guardrails per OSHA requirements:
        1) Uniform load of 50 lb/ft applied in any direction
        2) Concentrated load of 200 lbs applied in any direction
        3) Uniform and concentrated loads need not be assumed to act concurrently.

B. Code Requirements

1. Structural design shall comply with the 2012 International Building Code for structural conformity.
2. Safety design shall comply with applicable OSHA requirements.

3. Training shall comply with applicable NFPA 1402 and NFPA 1403 requirements.
4. Due to the nature of the modular training systems and the intended use, egress and fire code requirements are not expected to satisfy code criteria for occupied buildings.
    a. Local codes may require the simulator to have a variance due to the intended use and features unique to its application.
    b. It is the responsibility of the owner or owner's representative to determine the proper procedures and variances for their location and obtain the necessary variances or requirements.

1.6 Submittals

A. Shop Drawings

1. Submit drawings showing structural module layouts to include overall modular structural frame design, floor modules, roof modules, modular openings, stair modules, railing modules, attachment details, and other details as may be required for a complete installation.
    a. Furnish three [3] sets of modular training component design drawings.
    b. Furnish three [3] sets of design calculations bearing the stamp and signature of a professional engineer registered in the State where the Modular Training Simulator is located.

B. Burn Room Liner

1. Submit three [3] sets of cut sheet information on the burn room liner.
2. Submit three [3] sets of SDS reports on all applicable materials to be used as burn room liner.
3. Submit three [3] 3"x3" samples of burn room liner material.
4. Submit three [3] sets of burn room layout drawings including ceiling layouts, wall layouts, and any necessary details.

C. Doors and Hardware

1. Submit three [3] sets of cut sheet information on all applicable door and hardware information.

D. Miscellaneous Submittals

1. Submit three [3] sets of cut sheet information on all applicable additional materials including rappelling anchors, temperature sensing and indicating system, color charts, and any other materials included as options.

1.7 Quality Assurance

A. Supplier shall have a minimum of 10 years of experience in the design, engineering, fabrication and installation of fire training simulators and must offer turn-key services to complete this section of work.

1.8 Delivery, Storage, and Handling

A. All components and accessories necessary for the assembly of the simulator including modular floors, modular roofs, modular columns, modular stairs, modular doors, modular window shutters, and insulating material for burn rooms shall arrive at the project site by over-the-road trailer.

B. Store all modules and components according to storage instructions above ground, separated, and protected from exposure to the elements & from physical damage caused by other activities.

C. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.9 Warranty

A. Supplier shall provide a one (1) year warranty from the date of Substantial Completion warranting all components to be free from defects in materials and workmanship under normal use and service.

B. Supplier shall provide a two (2) year extended materials and workmanship warranty from the date of delivery of the materials warranting all structural components included in the "Modular Steel Structure" to be free from defects in materials and workmanship under normal use and service.

C. Supplier shall provide a 30/20 year manufacturer's warranty on the steel wall panel paint finish covering chalking, cracking, checking, peeling, and fading.

D. Supplier shall provide a one (1) year warranty from the date of Substantial Completion warranting the thermal liner panels to be free from defects in materials and workmanship under normal use and service.

PART 2– PRODUCTS

2.1 Suppliers

A. Acceptable Suppliers: WHP Trainingtowers™; 9130 Flint, Overland Park, KS 66214. TEL: (800) 351-2525 or (913) 385-3663. FAX: (800) 736-7594. Email:info@trainingtowers.com Website:www.trainingtowers.com

B. Substitutions: As approved per Owner/Architect. Must be submitted [14] calendar days prior to bid date.

1. Include full set of drawings with submittal prior to bid.

2. Include cut sheets and/or samples of all products included in the package including but not limited to doors, door frames, hardware, shutters, burn room liner, and paint warranty prior to bid.
3. Provide an itemized list, specifically referencing each item of this specification section where the proposed substitution deviates from the specified product.

2.2 Materials

1. Conform to applicable ASTM specifications.
2. **Galvanize all structural materials** used including surfaces to be painted, whether or not exposed to the elements.
3. All components shall be new materials and designed specifically for the modular training tower. **Used, repurposed, or modified materials will not be acceptable.**
4. All major components and materials must be of United States origin. **New, used, or repurposed components originating from outside the United States will not be acceptable.**

2.3 Shop Finish Painting/Coating

A. Clean, prepare surfaces and shop prime structural steel except where members are zinc or aluminum-zinc alloy coated, or are to be incased in concrete.

B. Paint system for wall panel steel exposed to the exterior. Factory applied siliconized polyester in accordance with manufacturer's standard procedures. Minimum dry film thickness of 1.00 ± 0.10. This finish coating shall be oven-cured. Color to be from manufacturer's four (4) standard wall colors.

C. Paint system for all doors and window shutters. Factory applied aliphatic urethane in accordance with manufacturer's standard procedures. Minimum dry film thickness 2.0 mils. Color to be from manufacturer's six (6) standard door/window colors.

D. Shop finish for all stair stringers, stair rails, guardrail, bar grate treads, steel balconies, steel landings, ladders, and rappelling anchors. Steel shall be hot-dipped galvanized to conform to ASTM A123 after drilling, punching, cutting, bending and welding.

E. Shop finish for all other miscellaneous items including but not limited to trim, access hatches, studs, sheeting, and hat channels. Steel shall be galvanized to conform to ASTM A653.

F. Factory treatment of burn room liner. Burn room liner shall be pre-treated with a two (2) part chemical system to be water resistant/repellent.

2.4 Standard Fire Fighting Simulator System

A. Weather Sealing

1. All exterior wall module vertical seams, which are metal-to-metal laps, shall be sealed with a continuous strip of sealer. The sealer shall not run, separate, or deteriorate with age.
2. All sealer shall be applied according to assembly drawings to form a weather resistant structure.
3. Caulking shall be polyurethane where it is exposed and there is no thermal movement. All caulking or sealing shall be done in a neat manner with excess caulking or sealant removed from exposed surfaces.

B. Floor & Roof Modules

1. Structural Floor and Roof Modules
    a. The flat floor shall be a structural composite rigid board which has been rated to transfer horizontal shear. The rigid board shall be supported on structural "C's" placed 24" on center. The "C's" shall be a minimum of 16-gauge or heavier. "C's" shall be a minimum of 6" in depth nominally and G90 hot-dipped galvanized. Structural steel girders shall be used around the perimeter of each module and shall be galvanized. A weather resistant finish shall be applied to the walking surface.

C. Column Modules

1. The column modules shall be minimum ¼" tube steel, hot dipped galvanized and pre-punched or pre-drilled for attachment to floor and roof modules.

D. Wall Modules

1. The structural steel wall modules shall be minimum 18 gauge G90 hot-dipped galvanized, and conforming to the appropriate ASTM specification. The painted steel shall be roll-formed from flat steel and be attached per manufacturer specifications. The panels shall be able to transfer horizontal shear forces and transverse lateral forces.
2. Wall Modules shall be trimmed with minimum 18 gauge galvanized channels for attachment to floor and roof modules.
3. Exterior wall modules shall be galvanized and painted per the shop finish specification. Interior wall modules shall be galvanized.
4. **Wall Modules shall be bolted to the floor modules and shall be removable and interchangeable with door and window modules.**

E. Access Opening Modules

1. Steel Door Module
    a. Materials

1) Modular door frame shall be a fully welded tubular steel assembly fabricated from 3/16" steel. The entire frame assembly shall be hot-dipped galvanized.

2) Door skin is to be made of commercial quality 11 gauge steel.

3) Reinforce top, bottom and sides of all doors with continuous steel channel not less than 3/16" thick, extending the full perimeter of the door and stitch welded to the face sheet.

b. Door Hardware

1) All non-burn room doors shall have an operating passage knob set with handles on the inside and outside of the door. All doors accessible from the ground shall have a keyed lockset and shall be keyed alike.

2) All burn room doors shall have 1" of Padgenite material and shall have high tension spring action closures rated for doors over 200 pounds with an independent hydraulic closure catch to bring the door into the closed position. All doors accessible from the ground shall have a padlock hasp for security.

3) Continuous hinge shall be 11 gauge stainless steel with a 3/8" diameter stainless steel pin and be stitch welded to the door face and pre-assembled as part of the door modular component.

4) Each framed opening shall be provided with drip lip header.

2. Window Shutter Module

a. Materials

1) Modular window shutter frame shall be a fully welded tubular steel assembly fabricated from 3/16" steel. The entire frame assembly shall be hot-dipped galvanized.

2) All framed window openings shall receive 12-gauge steel, single leaf closure.

3) Window closures shall be constructed with a recessed lip perimeter and welded construction. The windows shall be designed to provide an overlap to the interior or exterior to minimize outside light.

b. Window Hardware

1) All shutters shall have an operating lever latch with handles on the inside and outside of the shutter. All shutters accessible from the ground shall have a key lock lever and shall be keyed alike.

2) All burn room shutters shall have 1" of Padgenite material and mounting channels in addition to the standard shutter including the operating lever latch.

3) Continuous stainless steel hinges shall be welded to the shutters and pre-assembled as part of the window shutter modular component.

4) Each framed opening shall be provided with drip lip header.

3. **Door, window, and wall modules shall be bolted to the floor modules and shall be removable and interchangeable.**

F. Stair Modules

1. Stair modules shall be pre-manufactured and assembled in 36” wide flights and 51” rise increments with an 8-1/2” rise and 10” run.
2. Stringers and landing supports shall be 1½” wide channel, minimum MC10x8.4. Drill all required holes prior to hot-dip galvanizing.
3. Stair top rails shall be 34” to 36” above the tread nosing and a minimum 1½”x 1½”x 11 gauge square tubing. Mid-rails shall be ¾” solid steel rod. Distance between rails shall be a maximum of 12”. Rails shall be completely welded assembly welded to the posts with all welds ground smooth, prior to hot-dip galvanizing.
4. Stair end posts and intermediate posts shall be minimum 1½”x 1½”x $^{3}/_{16}$” structural square tubing. Posts shall be a completely welded assembly welded to the stair stringer and rails with all welds ground smooth, prior to hot-dip galvanizing.
5. Stair treads shall be constructed of 19W-4, 1” x $^{3}/_{16}$” bar grate, hot-dipped galvanized steel with checker plate nosing.
6. Intermediate stair landings shall be 19W-4, 1”x 1/8” bar grate fastened to stair landing supports on the stair modules.

G. Rail Modules

1. Top edge height of top rails shall be 42” plus or minus 3” above the walking/working level.
2. Top rails shall be minimum 1½”x 1½”x 11 gauge square tubing. Mid-rails shall be ¾” solid steel rod. Distance between rails shall be a maximum of 12”. Rails shall be a three-line design and shall be a completely welded assembly welded to the posts with all welds ground smooth, prior to hot-dip galvanizing.
3. End posts and intermediate posts shall be minimum 1½”x 1½”x $^{3}/_{16}$” structural square tubing. Posts shall be a completely welded assembly welded to the toe board and rails with all welds ground smooth, prior to hot-dip galvanizing.
4. Toe board and kick plates shall be 4”x $^{5}/_{16}$" flat bar welded to the railings prior to hot-dip galvanizing and bolted through the structural members.

H. Burn Room Lining System

1. High temperature insulating panels and attachment materials shall be provided for the interior walls, ceiling, doors, and windows of the burn rooms as specified.
2. Panels in burn rooms shall be supported by a system of 18-gauge galvanized mounting channels mounted vertically and fastened to the modules using proper Tek screws. The vertical mounting channels shall be 24 inches center-to-center. Mounting channels shall be a nominal 6" in width and 1¼" in depth.
3. Panels shall be pre-cut to size and shall be 1" thick. Panels shall be pre-treated with a two part chemical system to be water resistant/repellent. Panels shall allow for live fires in temperature ranges up to 1200 degree F maximum depending on type of panel specified. Seams and joints shall be backed with 1" thick battens of similar material. Panels shall be fastened by 3" Tek screws with ¼" x 1 ¼" washers through oversized $^{5}/_{16}$"diameter field drilled holes, six per 2' x 4' panel. Use of "speed clips," insulating clips or building insulation washers is prohibited. Panels shall be installed with a ½" gap between panels and the panel perimeter shall be screwed to the channels. Fasteners shall be left with the washers being able to be turned with moderate pressure on the board.
4. Padgenite I insulating panels and accessories shall be capable of protecting the wall and ceiling surfaces of masonry, concrete or steel room, inclusive of windows, closures and doors from damage due to enclosed fires. Insulating materials shall be a minimum of: 1" thick, 46 PCF density, 800 PSI flex strength, possess a "K" factor of .81 or less at a mean temperature of 800 degrees F., and shall be capable of continuous service at temperature ranges to 1200 degrees F. System shall withstand repeated exposure to heat and the application of water to heated surfaces without the breakdown of insulating properties. Insulating materials shall not require "drying out' periods following the application of water nor be subject to "spalling" due to heat/moisture conditions. There shall be no restrictions placed upon use due to atmospheric conditions or ambient temperatures. There shall be no restrictions imposed upon the nature of the Class A fuel source, the fire location within neither the room nor any requirement of "special" precautions prior to ignition. A full set of engineered installation drawings shall be prepared by the panel supplier, which clearly shows the panel layout, sub-framing system and attachment layout. Materials proposed as equal to the "Padgenite" panels shall be approved seven (7) days prior to bid due date. The contractor shall provide a sample of the material, written specifications, drawing showing a typical installation with hardware clearly shown, and a MSDS.
5. Accessories shall be furnished and installed for temperature sensing and indicating system and shall include two thermocouples for each burn room with high temperature wire to a pyrometer. A weatherproof box shall be mounted to the modular structure. One portable pyrometer for temperature monitoring (ranges of -199 to +1999 degree F with, LED display with battery power), a minimum of ten receptacles with male plugs, and a selector switch for ten circuit

monitoring shall be included. Thermocouples shall be mounted at two different elevations within the burn rooms with wire from each run to box location. Boxes shall be mounted per the direction of the owner.

6. Complete layout drawings shall show all elevations, views, and details the location of the mounting channels, battens, and cut pieces of panels.

2.5 Modular Structure Description

A. The simulator shall be modular in nature and shall conform to the dimensions, number of windows, doors, stair locations and interior rooms indicated on the drawings which become a part of this specification.

1. (INSERT SPECIFIC DESCRIPTION HERE)

2.6 Additional Items

A. *(INSERT SPECIFIC ADDITIONS HERE)*

2.7 Items to be Included as Options

A. *(INSERT SPECIFIC OPTIONS HERE)*

PART 3 – EXECUTION

3.1 Examination

A. Verify that concrete work (if required) has cured a minimum of 14 days. Verify that piers are at the proper spacing. Report any variances to the owner's representative prior to proceeding with installation.

1. Concrete pier or pad elevations must be within tolerance of +/- ¼".

3.2 Installation

A. Comply with the respective manufacturer's recommendations for preparation of modules and components.

B. Comply with respective manufacturer's instructions and approved shop drawings.

3.3 Adjusting and Cleaning

A. Repair or replace damaged components.

B. Contractor shall properly maintain the site, collect all waste material, place all debris and waste in containers and remove from the site.