# 131200 - PREFABRICATED BUILDINGS – COMMUNICATIONS SHELTER

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

### 1.2 SUMMARY

A. This Section includes the following for the communications shelter:

1. Foundation.
2. Procurement and delivery to site.
3. Construction.
4. Erection and inspection.
5. Related equipment described in this section.

B. Related Sections include the following:

1. Section 033000 - "Cast-in-Place Concrete" for concrete foundations and anchor-bolt installation.

### 1.3 REFERENCES

A. Upon request, the prefabricated building manufacturer shall provide the locations and Owners of three (3) similar concrete shelters that have been in service more than three (3) years. This will allow the Architect/Owner to inspect on site and obtain a statement for the Owners on the quality of workmanship (fit and finish).

### 1.4 SUBMITTALS

A. The Contractor shall provide, for Construction Manager review and approval, prior to the commencement of any work on the new shelter, complete and detailed design drawings and calculations for the:

a. Shelter and all components
b. Shelter foundation, include concrete design mix and reinforcing.
c. Ice Bridge
d. Site Plan

B. All drawings and calculations shall be stamped and sealed by a Professional Engineer and competent in civil and structural design.

C. By submittal and seal, Contractor's submittal shall attest that the designs are in full compliance with the mechanical, structural and electrical parameters established by the Project Specifications, the Shelter manufacturer's requirements and the Uniform Fire Prevention and Building Code.

D. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles and finishes. Drawings shall include elevations, section, floor plan, electric schedule, service entrance locations and anchor clip detail.

1.5 QUALITY ASSURANCE

A. The Contractor shall have the complete and total responsibility for:

1. Licenses and liability insurance of any required items for Contractor, manufacturer and any required subcontractors during shipping, handling and installation.
2. Supplying and installing a new concrete Shelter and Foundation.
3. Provide all site work and grading required to install the shelter, foundation and fencing.
4. Topsoiling, fertilizing and seeding all disturbed areas.
5. Shelter contractor shall coordinate ice bridge installation provided by Commercial Radio Service, Inc.
6. New electrical service to shelter by the electrical contractor. Shelter contractor shall coordinate installation.
7. Backfill holes, topsoil, fertilize and seed all areas disturbed.
8. All Commercial Radio Service, Inc. work from tower into racks, etc. inside shelter by Commercial Radio Service, Inc. Shelter contractor shall coordinate.

1.6 DELIVERY, STORAGE AND HANDLING

A. The Contractor shall schedule and coordinate the shipping and delivery of the shelter and components with the Construction Manager.

B. The Contractor shall be responsible for the protection, safety and security of the shelter, components and accessories during transport and prior to and during installation.

1.7 COORDINATION

A. Contractor shall coordinate the scheduling, site preparation, foundation construction and shelter installation with the Shelter manufacturer, Construction Manager and others as needed.

B. Coordinate design of concrete footings and foundations with Section 033000 "Cast-in-Place Concrete."

C. Site Conditions: Must meet manufacturer's Required Job Site Conditions for Installation.

1. Anchor bolts must be installed per erection drawings. Footings need to be free of debris and anchor bolt threads undamaged.

2. All work surfaces must be even with no exposed product lines.

1.8 WARRANTIES

A. The Contractor shall provide the Construction Manager with a copy of the shelter manufacturer's one (1)-year warranty on the shelter and all components, equipment and systems included. The one (1)-year warranty shall commence upon final installation and startup of the shelter.

B. The Contractor shall provide the Construction Manager with the manufacturer's warranties for all components and equipment installed in the new shelter including:

1. Lights
2. Air Conditioners
3. Heaters
4. Alarms
5. Accessories

C. All power distribution (generator, UPS, electrical panels etc.) to be provided by the electrical contractor.

D. Ice bridge, communications racks, etc. all provided by Commercial Radio Service, Inc.

E. The Contractor shall also provide a one (1) year labor and material warranty on all labor and equipment supplied during the installation of the Shelter. The one (1)-year warranty period shall commence after final acceptance. It shall include all parts, labor and travel from the Shelter. The cost of this Warranty shall be included in the Total Base Bid.

F. The Contractor shall warrant that all equipment furnished shall be free from defects in workmanship and material.

PART 2 – PRODUCTS

2.1 COMMUNICATIONS SHELTER

A. General:

1. The specifications contained herein encompass the labor, equipment and materials for a prefabricated concrete communications shelter. The shelter structure shall be bullet resistant withstanding 30/06 rifle fire at a distance of 15 feet per UL 752 standards. The shelter shall be vandal resistant and be constructed of steel reinforced concrete. The shelter structure shall provide a 2-hour fire rating as defined by Uniform Fire Prevention Building Code and meet seismic requirements.
2. The Shelter shall be designed for the explicit use of housing electronic equipment within a controlled atmosphere required for the proper conditions for transmitting and receiving equipment.

3. The Shelter shall incorporate non-porous wall and roof sections, to preclude capillary action and shall be so designed and constructed to provide a minimum useful life period of twenty (20) years, without need for major maintenance actions. Manufacturer shall provide shelter maintenance and warranty information.
4. The Shelter shall include a complete power supply and distribution system as required by this specification and in compliance to applicable codes.
5. The Shelter shall include a complete heating, ventilation and air conditioning system as required to comply with the environmental conditions of these specifications.
6. The Shelter shall use the building's generator capable of supplying emergency power to operate all equipment in the Shelter.
7. The Shelter shall include interior and exterior lighting systems as required by the specifications.
8. The Shelter shall include a grounding system for the Shelter and all equipment compliant with Motorola's R-56 Standard.
9. The Shelter shall include all alarms and alarm systems as required by these specifications.
10. The Shelter shall include all other accessories, parts, components, connectors and equipment as required by these specifications or as required to provide a complete and operational communications shelter.
11. The Contractor or Shelter Manufacturer shall be responsible for handling, transporting and unloading the Shelter to the Project Site.

B. Manufacturer:

1. Basis-of-Design Product: Subject to compliance with requirements, provide "Standard Single Modular Concrete Shelter" as manufactured by VFP, Inc. or a comparable product by one of the following:

   a. BDC Group, Inc.
   b. Fibrebond.
   c. Thermo Bond buildings.

C. Structural Requirements:

1. Structural Design Loads:

   a. 300 pounds per square feet (PSF) uniform floor live load per ASCE 7 while on foundation.
   b. 125 PSF distributed floor load while lifting per ASCE 7.
   c. 150 PSF distributed roof load per ASCE 7.
   d. 120 mph wind load per ASCE 7.
   e. Seismic Design Info:

      1) $I_e$=1.500
      2) $S_s$=0.328
      3) $S_1$=0.131
      4) $S_{DS}$=0.262

5) $S_{D1}$=0.146
6) Site Class C

f. 2-hour fire resistance per ASTM E119 or exterior walls.
g. Level 4 high rifle (30-06) bullet resistance per UL 752 requirements. A Test Certificate signed by an officer of the Shelter Manufacturer verifying the shelter design fully meets or exceeds all of the specifications and requirements as set forth in UL752, Level IV bullet resistance must be submitted with bid.

2. Foundation:

a. Reinforced concrete footings and walls designed to support new shelter.
b. Backfill area under slab and along foundation walls per approved design plan.
c. Top of foundation wall shall be flush with existing grade or elevation established by the Engineer.
d. Top of foundation wall must be within 0.02-inch of elevation specified by the Engineer.
e. Anchor building to foundation walls.
f. Reference S0.1 General Notes for soil and foundation information.
g. Minimum depth of footings is 24" below finished grade.

3. Concrete:

a. Use concrete formulation with a minimum of 4,000 psi compressive strength of 28 days and a density of 100 pcf.
b. Cement: Type I or II Portland Cement per ASTM C150.
c. Aggregate: lightweight sand compliant with ASTM C33. Lightweight coarse aggregate no larger than ¾-in. diameter. Nominal and compliant with ASTM C330.
d. If any concrete used in the foundation does not meet specifications, the Contractor shall remove the foundation and pour one using compliant materials, at no expense to the Owner.

4. Embedded Reinforcement and Structural Steel:

a. Rebar: Must use grade 60 deformed reinforcing bar compliant with ASTM A615.
b. Welded Wire Fabric: Must use fy-60-ksi wire fabric reinforcement compliant with ASTM A185.
c. Other Steel: Must use steel compliant with ASTM A36 or better for other steel components; eg. Weld plates, lifting and tie-down hardware. A steel frame cast in as support of walls, roof, or floor is unacceptable.
d. Glass Fiber: Use of glass fiber integral to the concrete mix is not permitted.
e. Lifting Assemblies: Shall be integral to the floor of the shelter. Screw on or bolt on lifting hardware is not permitted. Lifting from wall sections is unacceptable. The lifting assembly shall be one device in the floor. It shall be hot dipped galvanized.
f. Quality Control: Building manufacturer must have at least two (2) ACI inspectors on staff to test strength of concrete during break tests. Concrete must be from batch within plant, outside contractors for concrete is not acceptable.

g. Construction Methods: Where floor to walls, walls to walls and roof to walls meet, there shall be step joints to prevent water intrusion. "Butt joints" are not acceptable.

D. Shelter Description:

1. Size: 12 ft. wide by 30 ft. long.
2. Interior Height: 9 ft.
3. Shelter Plan: One room for radio communications equipment.
4. Wall:

   a. Thickness: 4-inch reinforced concrete.
   b. Exterior Sheathing: Composite wall panel with high performance insulation.
   c. Finish: Exposed aggregate concrete.

5. Floor:

   a. Thickness: 6-inch reinforced precast concrete.
   b. Insulated and equipped with integral lifting points.
   c. Finish: VCT.

6. Flat Roof:

   a. Thickness: 4-inch reinforced concrete.
   b. Coating Material: Reflective elastomeric coating building cap.

7. Ceiling:

   a. Material: Composite panel with insulation.
   b. Finish: White laminate.

E. Fabrication:

1. Construct floor, walls and roof into pre-cast reinforced concrete panels in conformance with ACI 318 with a minimum thickness of 6-inches on floors and 4-inches on roof and wall panels. Cast reinforced steel plates in floor, walls and roof panels to provide for welded panel-to-panel connections.
2. In addition:

   a. Measure, mix and transport concrete per ACI 304.
   b. Collect concrete samples for strength testing per ASTM C172, mold into cylinders per ASTM C31 and test for compressive strength per ASTM C39.
   c. Cure concrete in forms and protect from moisture loss, excessive heat and freezing until removal from form; conform to ACI 305 and ACI 306 as required for hot and cold concreting.
   d. Consolidate concrete per ACI 309.
   e. Mold and screed minimum 1/4-inch per foot slope on roof in two directions for proper water drainage.

f. Mold steel door frames into cast panel walls; include step-joint threshold to prevent water from entering concrete shelter.
g. Mold keyed or step-joint edges into fabricated panels to enhance moisture protection and water runoff; mold roof/wall so that joint is not exposed.
h. Treat wall panels with retarders as required to permit exposure of coarse aggregate for exterior finish; "seeding" of exterior surface with coarse aggregate is not permitted.

F. Assembly:

1. Install weatherproofing features as concrete panels are assembled.
2. Weld finished panels together to form rigid concrete shell.

G. Additional Shelter Requirements:

1. Shelter exterior shall be an exposed aggregate that is inherent to the concrete mix used for the poured concrete walls. Panels attached to the shelter exterior are not acceptable. Exterior finish to be irregular variations of aggregate. A smooth/flat aggregate appearance on the exterior achieved by having the stone introduced at the bottom of the casting table is unacceptable.
2. Shelter walls shall have a minimum 2-hour fire rating.
3. Shelter shall meet the following insulation requirements:

   a. Walls and Ceilings Total Thermal Resistance: R-19.
   b. Floor Total Thermal Resistance: R-26.

4. Shelter interior walls and ceiling shall be sheathed with white high density polyethylene board.
5. The generator and equipment rooms shall be separated by a 1-hour fire-rated wall.
6. Shelter shall be provided with two (2) exterior steel doors to provide access to the two (2) rooms in the Shelter.
7. Each door shall be 42-inches wide by 84-inches high, highly insulated exterior door with stainless steel ball-bearing tamper-proof hinges, passage style level handle, dead bolt lockset and fiberglass weatherboard. Supply five (5) keys with each door.
8. Each door shall be supplied with a hydraulic door closer.
9. Outside each door shall be a concrete pad 4' x 4' x 6" with welded wire mesh. Each pad shall be installed on top of 18" of compacted aggregate fill.
10. Each door shall have an engraved, plastic laminated sign installed on it designating the room. The exact wording shall be determined by the Owner.
11. Provide base cove molding along floor and cove molding at all wall corners and all ceiling/wall joints.

H. Electrical Requirements:

1. Electrical Distribution:

a. The concrete shelter shall be constructed with the following:

1) One (1) 200 Amp, 42,000 AIC, 270/480 VAC, three phase, 60 Hz, 42 space main breaker, snap in Square D utility power distribution panel, in a NEMA 1 surface mount enclosure.
2) One (1) 45KVA, 480V, 3-phase, 3-wire primary, 208V/120V, 3-phase, 4-wire secondary dry type transformer with 115-degree rise.
3) One (1) 200 Amp, 10,000 AIC, 120/208V, 3-phase, 60HZ, 42 space panel, 175A main breaker, snap in Square D power distribution panel in a NEMA 1 surface mount enclosure.
4) Two (2) remote surge protective devices (SPD's). Refer to One-Line Diagram for more information.
5) One (1) Metal Oxide Variston (MOV) only lightning arrestor.
6) One (1) MOV/Silicone Avalanche Diode (SAD) lightning arrestor.
7) One (1) 60 Amp, enclosed circuit breaker for lightning arrestor isolator during maintenance.
8) Circuit breakers for all customer loads.
9) One (1) shelter wall penetration to serve as utility power service.
10) One (1) 200 Amp, 240 Volt, fused, double pole, single throw safety switch.
11) Ten (10) 20 Amp specification grade duplex receptacles.
12) One (1) 20 Amp specification grade exterior duplex receptacle on a ground fault interrupter circuit.
13) Two (2) rows of overhead single, 20 Amp receptacles fed from dedicated UPS circuits. Total of 32 receptacles per row for total of 64 receptacles.
14) Electrical distribution equipment shall be Square D or equivalent.

4. Materials

a. Provide materials, components and devices that are new and of highest quality and standard products of manufacturers regularly engaged in their production. Ensure that, where applicable, electric materials are listed or recognized by Underwriters Laboratories or other third-party agency approved by Engineer.
b. All electrical materials and components shall conform with the following:

1) Power wiring: 600V THHN or THWN wire sized in accordance with NFPA-70; use size 12 awg minimum.
2) Control wiring: 250V TFFN solid wire sized in accordance with manufacturer or listing instructions for class 2 thermostat, generator, or fire detection systems; use #18 awg minimum.
3) Alarm wiring: 250V solid shielded, twisted cable assemblies; use #22 awg minimum.
4) Fixed raceway: EMT, rigid metal conduit, or metal wireway size per NFPA-70.
5) Flexible raceway; use liquidtite conduit on exterior and flexible metal conduit on interior of concrete shelter.

6) Branch circuit breakers: thermal magnetic circuit breakers; rate breakers that supply lighting circuits as "SWD" and motor loads as "HACR".

7) Light fixture: 2' x 2' or 2' x 4' General LED recessed flat panels with 350K color and 80+CRI.
8) Wiring Devices: Use UL listed dual technology, wall or ceiling mounted, solid-state indoor occupancy sensors and grounded receptacles.

5. Installation

a. Perform all wiring in accordance with best commercial practice in accordance with NFPA-70.

1) Install wiring in surface mount EMT conduit; where flexible conduit is required by code between equipment and final junction box in circuit, use flexible metal conduit on interior and liquidtite conduit on concrete shelter's exterior.
2) Where required, use properly sized and insulated wire nuts for conductor splices; locate no splices except in outlet or junction boxes.
3) Coordinate location of interior light fixtures to maximize illumination of equipment.

I. Lighting:

1. The concrete shelter shall be constructed with the following:

a. Seven (7) 2' x 4' General LED recessed flat panels with 3553 lumens, 3500K color and 80+CRI.
b. One (1) 34W, 5006 lumens, 600mA driver, 1 light square with Type IV forward throw distribution, 80 CRI, 4000K color, built-in photocell, 1P66 rated exterior wall mounted light.
c. Two (2) emergency lights.

J. Environmental Conditions:

1. The Shelter shall be designed, constructed and equipped with a heating, ventilation and air conditioning system that will maintain interior temperatures under specified operating conditions. Calculate heating and cooling based on heat load of concrete shelter manufacturer's installed equipment, concrete shelter conduction losses, solar loading; sensible and latent losses from radio and communications equipment loads, ventilation and personnel losses.
2. The building's heating, ventilation and air conditioning system shall be sized for 100% redundancy under the following operating conditions:

1. Ambient temperature: -30°F (-35°C) thru 104°F (40°C)
2. Interior temperature: 65°F (18°C) minimum at minimum ambient and 84°F (30°C) maximum at maximum ambient temperature.
3. Ambient humidity: 5-95%

3. The Shelter shall be designed and equipped with an environmental control system consisting of heating and air conditioning capable of maintaining the inside temperature

under operating conditions, plus sensible and latent gains from personnel, at 72 degrees F. The system shall control the internal temperature of the shelter so as to not rise above 80 degrees F nor fall below 65 degrees F.

4. With respect to air conditioning, the concrete shelter shall be supplied and installed with the following:

    a. Two (2) normal 36,000 Btu/hr wall mount air conditioning units, with low ambient and compressor anti cycle controls, integral 5 kW resistance heat strips and washable dust filters
    b. Redundant lead/lag controls allowing approximately equal operating time on each air conditioning unit.
    c. The HVAC units shall be controlled via a separate remote mounted thermostat unit and the necessary controllers for each HVAC unit. The units shall be mounted and secured to the shelter sub structure for adequate structural support. The units shall be sealed weather tight to the shelter. All hardware shall be mounted, installed, wired and ready for use upon delivery. A drip cap shall be installed to protect the units.

5. Install air conditioners for transport as well as operation. Use stainless-steel fastening hardware for mounting air conditioners. Seal exterior with UV-resistant caulk and install drip edge over top of each unit to prevent water entry. Install fixed return grille and supply grille with one-way adjustable slats. Locate units for maximum circulation and behind non equipment obstructions.

K. Alarm Device Contacts:

1. The concrete shelter shall be supplied and installed with the following:

    a. One (1) line voltage smoke detector.
    b. Two (2) intrusion alarm switches with form "C" contact rated .1 Amps at 28 VDC.
    c. One (1) high temperature alarm.
    d. One (1) low temperature alarm.
    e. Standard set of (8) generator alarms.

2. All alarms shall be connected/interfaced with the Facilities fire alarm and building management system as needed, coordinate with Electrical and Mechanical contractors.
3. Alarm device contacts will be wired and brought to a location specified by the Construction Manager.
4. All alarms will be brought to (2) punch down blocks.

L. Grounding:

1. The concrete shelter shall be constructed with the following:

    a. A grounding electrode system for the Shelter, all service equipment, cable and radio communications equipment.
    b. IPG B system compliant to Motorola R-56 standard.

c. Ground kit consisting of interior and exterior ground bars with exterior ground straps and covers.

M. Accessories:

1. The concrete shelter shall be supplied with the following:

a. One (1) 24- port /waveguide cable entry panel with 4-inch sleeves and protective blank covers.
b. Fifty feet (50') of 24inch wide cable ladder/ tray.
c. One (1) 4' x 8' x 3/4" equipment mounting board with two (2) punch blocks.
d. Two (2) 2-inch telco penetrations.
e. One (1) 5 lb $CO_2$ fire extinguisher.

PART 3 - EXECUTION

3.1 FIELD QUALITY CONTROL

A. General:

1. Installation monitoring and reporting shall be conducted during the installation.
2. Inspection of all materials shall be conducted upon arrival to site and prior to installation.
3. Written reports of tests and observations. Record defective materials and workmanship and unsatisfactory test results. Record repairs and adjustments. These reports shall be supplied to the Construction Manager.
4. Repair damaged finishes using methods and materials recommended by manufacturer.

B. Concrete:

1. The Contractor shall pay for the cost of employing an approved commercial testing laboratory, approved by the Architect, to provide field inspection of all concrete. Continuous inspection shall be provided during all concrete pours. If any portion of the work shows unacceptable test results, the Architect may require additional testing, load tests, cored samples, or replacement of the faulty work, etc., at the Contractor's expense.
2. The Contractor shall submit concrete mix designs to be reviewed by the Architect. The mix designs shall be confirmed by making and testing trial mixes for each class of concrete specified.
3. The Contractor shall make all laboratory or field tests as required and shall furnish all necessary equipment. The Contractor shall transport all test cylinders from the site to the laboratory. The Contractor may substitute certification by the Batch Plant Operator of the above items.
4. The Contractor shall utilize a competent field concrete inspector to duties as follows:

a. Check each truck on arrival to make sure that the concrete is not retempered.
b. Make necessary slump tests for uniformity control.

c. Make air tests and yield tests as required.
d. Make any and all test cylinders as may be required in the Specifications.

5. Tests: Concrete shall be tested as follows:

a. Standard 6" x 12" compression cylinders shall be in compliance with C-39 in sets of four and shall be moist cured.
b. Break 2 at 7 days and 2 at 28 days. One set shall be made for approval of each mix design, one set for first pour of 50 cubic yards or less and one set for each additional pour of 50 cubic yards. If less than 50 cubic yards are placed in one day, one set shall be made for each day's pour. Slump tests shall be made of each batch.

6. All test cylinders shall be cast, water cured and broken under laboratory conditions in accordance with the ASTM C31 and ASTM C39. All four cylinders of a test shall be taken from the middle third of a single load. Each cylinder shall be properly labeled with an identifying mark, the mix proportions, air content, amount of water, slump and the location in the structure where the concrete was placed. Test reports shall include all this information. Distribute copies of reports as requested by the Construction Manager. Should any results be questionable, the Construction Manager shall be notified immediately so that corrective measures can be taken
7. The cost of the concrete testing shall be included in Contractor's Base Bid.

3.2 FOUNDATION

A. Forms for concrete foundations shall fully support the concrete and be braced accordingly. Finished concrete surfaces shall be even and smooth and be level within 1/16 inch.

B. Steel used for reinforcement shall be new material and be free of foreign matter.

END OF SECTION 131200