Part 1. Construction of Two (2) Single Section Manufactured Housing Units (MHUs)

Contents

Part 1: Design Requirements

The manufacturer agrees to build two MHUs according to the following requirements. One of these units will follow the provided designs for a FEMA Next-Generation 3-bedroom unit, the other an Express unit.

A. Referenced Codes and Standards

Codes and standards listed below may be referred to by their abbreviations shown in parentheses.

Manufactured Home Construction and Safety Standards 24 CFR 3280 & 3282 (HUD Code)

Uniform Federal Accessibility Standards (UFAS)*

2010 ABA Standards for Accessible Design (ABA)*

United States Access Board Final Guidelines for Emergency Transportable Housing 2014: 36 CFR Part 1191 (ETH)*

Department of Energy 10 CFR Part 460: Proposed Ruling on Energy Conservation Standards for Manufactured Housing

Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes (NFPA 13D)

*Except where explicitly noted

B. Applicable Reference Standards

The following standards shall be adhered to where referenced in this document.

American Architectural Manufacturers Association Standard Practice for the Installation of Exterior Doors in Wood Frame Construction for Extreme Wind/Water Exposure (AAMA 300-12)

American Architectural Manufacturers Association Standard Practice for the Installation of Windows with Flanges or Mounting Fins in Wood Frame Construction for Extreme Wind/Water Conditions (AAMA 100-12)

American Society for Testing and Materials International Standard Test Method for Surface Burning Characteristics of Building Materials (ASTM E84)

American Society for Testing and Materials International Standard Test Methods for Fire Tests of Building Construction and Materials (ASTM E119)

American Society for Testing and Materials International Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C (ASTM E136)

American Society for Testing and Materials International Standard Specification for Application and Finishing of Gypsum Board (ASTM C840)

Gypsum Association Application and Finishing of Gypsum Panel Products Standard 216-2016 (GA-216)

South Coast Air Quality Management District Rule #1168 (SCAQMD)

California Air Resources Board Airborne Toxic Control Measure 93120 Title 17 (CARB ATCM 93120 Title 17)

ANSI/Kitchen Cabinet Manufacturers Association A161.1 – 2012 (KCMA)

United States Department of Transportation Federal Lighting Equipment Location Requirements for Trailers (USDOT)

Referenced National Electrical Code (NFPA 70) Articles in HUD CFR 3280

Consumer Product Safety Commission Standards (CPSC)

California's Wildland-Urban Interface Code (California Wildlands)

United States Environmental Protection Agency ENERGY STAR (ENERGY STAR)

C. Classifications and Requirements

Manufacturers shall build each housing unit to meet the following HUD Code 24 CFR 3280 classifications:

- Northern Zone roof load
- Wind Zone III
- Thermal Zone III

Part 2: Envelope Construction

Fastening shall be as shown in the Fastening and Tie-Down Schedules.

Penetrations to be sealed with caulk, foam, compatible tape or other materials suitable to the purpose for a finished product without gaps) include:

- Plumbing trap under tubs/showers
- Pipes – seal to floor/wall
- Electrical boxes (on both exterior and interior walls) – seal to wallboard
- Fans and duct boots – seal to drywall
- Wires penetrating through top plates and floor
- Around refrigerant lines
- Window and door openings (use low-expansion foam)
- Around ducts passing through ceiling

Caulk and adhesives shall be low-VOC and conform to SCAQMD #1168.

A. Exterior Construction

For dimensional details of the transportation system and main frame, see diagrams. All items not specified in this section shall be designed by the manufacturer and shall be submitted for approval by TLP.

Chassis Frame

- Industry-standard tapered 12-gauge outriggers with a 9" nominal base shall be used
- All metal-to-metal contact with 1/8" fillet shall be welded
- Floor shall be lagged to frame with frame clip, 5/16" x3" f.t. tested lags or lags equivalent in size and strength at each joist
- Lags shall have a minimum bending yield stress of 160,000 PSI
- Clips shall be welded to I-beam
- Frame shall be after all welding is complete. All parts of the chassis including added/welded parts shall be completely coated with waterproof paint'
- Tire, axles, brakes, and brake wiring shall meet all federal standards
- Tires shall be new, 8-14.5" rim diameter, 14 ply with "G" load range
- Wheels and tires shall meet or exceed the axle rating and be rated for continuous speeds of 65 mph or greater. Tires and rims shall meet or exceed minimum US DOT requirements of FMVSS 571.110 for trailers of 10,000 lbs or less, or 571.120 for trailers more than 10,000 lbs
- New axles shall be used for each axle
- All axles shall be brake axles
- Rims, bolts, nuts, or other related tire-mounting hardware must be new
- Serial number must be stamped on the front cross-member in 3/8" high letters and be legible and robust
- A valve stem cover must be present on every tire
- Camber shall be added to main I-beam per industry standards
- Chassis tie-down brackets:

    - Install frame brackets for installation of 1-1/4" x 0.035" tie-down strap
    - Attach to bottom of the I-beam by welding per bracket manufacturer's specifications
    - Size, material, and configuration shall be equivalent to *Lippert HTB-04* or *Master craft#5703*
    - Two brackets shall be installed at 48" from each end of the home
- See Chassis Frame diagrams for assembly layout. 3-Bedroom unit I-beams shall be 12", and Express unit I-beams shall be 10". Sister beams shall be present in the 3-bedroom unit, as shown
- Express unit drawbar shall be dimensioned such that the total unit length, including the kingpin and I-beam extensions for the condensing units, does not exceed 53'. Kingpin-to-center of rearmost tandem axle distance shall not exceed 40', and kingpin-to-center of single rear axle distance shall not exceed 38'

A chassis extension for the HVAC condensing units shall be built as specified in Part 6. The extension shall be covered by a metal plate as shown in the 'Chassis detail' drawings.

Floors

Floor assemblies shall be constructed as shown in Construction Assembly Detail drawings.

- Framing
    - The floor joists shall be 2 X 8 #2 SPF and run transverse to the length of the unit
    - The Floor joists shall be spaced 16" O.C with additional joists added where shown on floor-framing drawing
    - Rim joists at end walls shall be doubled at 2 X 8 # 2 SPF or equal
- Sidewall Tie-Down Brackets
    - Install sidewall brackets for installation of 1-1/4" x 0.0035" tie-down strap. Install with fasteners into floor rim per bracket manufacturer's specifications
    - Minimum design vertical resistance of bracket and fasteners is to be 1200 lbs. for the 3 bed and 1400 lbs. for the Express Unit (determined by testing or calculations)
    - Brackets shall be spaced along the floor, at 4'-0" O.C.
- Decking
    - The floor decking shall be 23/32" OSB or APA-rated plywood laid out as shown in decking plan
    - Decking shall be Exposure 1 rated, at minimum
    - Long edges of the panel shall be tongue-and-groove installed perpendicular to the floor joist
- Insulation
    - The insulation shall have a flame spread of 25 or less and a smoke develop of 450 or less
    - The insulation shall be identified and marked by an approved testing and inspecting agency, conforming to ASTM E84 and ASTM E136
    - The floor insulation shall be R-21 FG blanket insulation minimum
    - Coordinate location of piping to ensure that it is placed on the warm side of insulation
    - Plumbing and electrical penetrations shall be sealed, leaving no gaps

- Bottom Board
    - Rolled Bottom Board shall be used, meeting beach puncture test with all penetrations sealed per bottom-board manufacturer's instruction
    - Plastic materials shall be a minimum of twenty (20) mil thickness. Multiple layers of acceptable material [24 CFR 3280.305(g)(6)] may be used to meet the twenty (20) mil thickness requirement
    - The bottom board shall be secured under the unit to prevent rodents from entering and shall be moisture resistant
    - The manufacturer shall install wooden board or other material that shall deflect or prevent material from tire blowouts from damaging the "Bottom Board" or other items above the tires

Exterior Walls

Wall assemblies shall be constructed as shown in Construction Assembly Detail drawings.

- Framing
    - The exterior wall framing shall be 2 X 4 nominal #3 SPF or equal at 16" O.C to meet HUD Wind Zone III requirements
    - Wall framing shall be 7'-6" from floor to ceiling
    - Sidewall and end-wall top plates shall be single 2 X 4 nominal #3 SPF, with splices at no less than 48" O.C
    - Sidewall and end-wall bottom plate shall be single 1 X 4 nominal # 3 SPF minimum
    - End walls shall serve as shearwalls. Shearwalls shall be constructed, fastened, and tied down as indicated in the "Shear Wall Framing" drawings
- Air Sealing
    - All major joints—wall to wall, wall to ceiling, wall to floor—shall be caulked or gasketed to prevent air infiltration
    - Provide continuous sealant at all joints with dissimilar construction and bezels including wood trim, lighting/electrical fixtures, dryer vents, etc.
    - Plate gasket foam strips or sealant shall be used at all of the following locations to seal without any gaps or voids:
        - Between bottom plate of wall and the floor
        - Where sidewalls meet endwalls
        - Above top plate where the wall meets roof
- Batt Insulation
    - The insulation shall have a flame spread of 25 or less and a smoke-develop rating of 450 or less
    - The insulation shall be identified and marked by an approved testing and inspecting agency, conforming to ASTM E84 and ASTM E136

    - For the 3-bedroom unit, the wall insulation shall be R-13 fiberglass batt insulation with a paper-facing vapor retarder with Class II vapor permeance. Paper facing shall be oriented inwards
    - For the Express unit, the wall insulation shall be R-15 high-density fiberglass batt Insulation with a paper-facing vapor retarder with Class II vapor permeance. Paper facing shall be oriented inwards
    - The wall insulation shall be installed without voids, gaps, or compression; cut insulation to fit for narrow stud bays and around electrical and other obstructions
- Structural Sheathing
    - 7/16" APA-rated oriented strand board (OSB) shall be attached to the wall studs, as diagramed in the Sheathing Elevations
- Weather Resistant Barrier
    - The XPS exterior foam sheathing shall act as the weather-resistant barrier and must be assembled with joint-sealing tape as stated below
- Rigid Insulation
    - One (1) layer of 4'-wide extruded polystyrene (XPS) board product (1" thick) shall be stapled to the OSB sheathing.
    - The rigid foam shall comply with 'AC71, 'Acceptance Criteria for Foam Plastic Sheathing Panels Used As Water-Resistive Barriers'
    - Foam sheathing joints shall be offset from OSB joints by staggering the joints as shown in Sheathing Attachment Diagram
    - Rigid foam shall be fastened as follows: foam shall be fastened with 1" wide crown staples (provided by TLP) with minimum 3/4" penetration to studs. Staples shall be placed at least every 8" on perimeter and every 16" in the field. Staples at joints shall bridge both panels of rigid foam to ensure both ends secure in stud. Staples shall be inserted at 30 degrees from horizontal
    - Where envelope penetrations or interruptions exist, the board shall be cut to fit around the interruption. For window penetrations, a roughly 1" perimeter shall be left empty, later filled by 1" lumber (as stated under "Windows" in Part 3)
    - A bead of adhesive shall be applied at the top and bottom of OSB sheathing where foam is applied to create a seal between rigid foam and OSB
    - Compatible tape shall be used to seal all joints in the foam board (applied according to manufacturer instructions)—both vertically and horizontally, where applicable—to act as a continuous weather barrier. Tape should also be applied at corners where sidewalls meet end-walls
- Siding
    - Siding shall be light gray vinyl
    - Vinyl siding shall be double 4" lap
    - The siding shall be approved for 110 mph winds exposure and for HUD Wind Zone III requirements
    - Siding shall be chosen and installed in accordance with 24 CFR 3280.307

- Siding and corners shall be the same color. Soffits, trim and J-block shall be either the same color or white
- J-channels over windows and doors shall not be punctured with weep holes or joints
- Install lap siding on rigid foam, and secure with galvanized fasteners , penetrating stud at least 1.25”

Roof

Roof assemblies shall be constructed as shown in Construction Assembly Detail drawings.

All roof penetrations shall be capped with a galvanized metal cap that is primed and painted to prevent rust and to match the roof covering color. Rubber grommets shall not be used.

- Framing
  - The roof trusses shall be engineered to meet the design loading conditions listed in Part 1 and shall be approved as such. The trusses shall be spaced 16” O.C max, with a 4” overhang beyond the frame in the 3-bedroom and a 3¾” overhang beyond the frame in the Express Unit
    - Overall shipping width of 3-bedroom unit shall not exceed 14’
    - Overall shipping width of the Express unit shall not exceed 8’-6”
  - The roof pitch shall be 4:12 (with a heel height of 5½”).
  - The roof trusses shall not be cut for the passage of any electrical, plumbing or mechanical system, unless positioned over a wall and braced on each side of piping or wiring, with DAPIA approval
  - Eave blocking shall be ¾” thick for the 3-Bedroom and ½” thick for the Express unit. Refer to roof eave detail drawing
- Insulation
  - The attic insulation in the Express unit (R-value measured at ridge) shall be R-51 blown FG or R-49 blown CE (for a U-value of 0.03)
  - The attic insulation in the 3-Bedroom unit (R-value measured at ridge) shall be R-43 blown FG or R-42 blown CE (for a U-value of 0.03)
  - The ceiling insulation shall be installed uniformly
  - A 1” min air space shall be maintained between the roof decking and insulation using baffles
- Attic Ventilation
  - The roof shall have a ridge vent and shall use Cor-A-Vent S-400 soffit vents (as shown in detail drawings). Vents shall run the entire length of the MHUs. Roof vents shall be installed sloped outwards to drain water away from the home
  - There shall be atleast 5 fasteners for every 8’ while installing the drain
- Roof Decking
  - The roof sheathing shall be at least 3/8” structurally rated OSB
  - Roof felt shall be 2 layers of 15# felt or 1 layer of 30# felt, or DAPIA approved HUD-WZIII-approved underlayment

    - The felt or roof covering shall be cemented to the roof decking with a 6” wide strip of cement, (as per DAPIA for HUD-WZIII) around the perimeter of all felt. Felt installation shall adhere to manufacturer’s installation instructions.
    - Ice and weather shield of self-adhering rubberized asphalt 40 mils. min thick shall be installed with 36” width at the eaves, starting from the lowest roof edges
- Roof Covering
    - Exterior roof coverings shall be secured to 3/8” structural rated OSB sheathing. The roof shall have manufacturer-standard shingle roof covering, with minimum 325# asphalt shingles
    - Roofing shall be installed to resist the loads indicated in the Table of Design Wind Pressures in 24 CFR 3280.305 for Wind Zone III, as specified in Part 1 of this document

Transportation wind guards

Temporary wind guards for both shingles and siding shall be installed on the MHU exterior as shown in Transit Protection drawings.

Siding wind guards shall be made of OSB strips. Shingle wind guards shall be made of 26 guage galvanized steel. Layout shall be as shown in Transit Protection drawings, at minimum.

Shingles shall be secured with a plastic wrap on the first 20’ from the hitch end to prevent them from flying off during transport.

B. Interior Construction

Interior Wall Framing

Interior walls shall be framed as specified in “Interior Wall Framing” drawings.

Wall and Ceiling Finishes

- Wall interiors shall be faced with ½” Gold Bond eXP gypsum board without paint or XP gypsum board with paint, fastened to the studs, installed according to the Gypsum Board Application and Finish Standards: ASTM C840 and GA-216
- Gypsum board shall run vertically along the entire height of wall interiors and shall be mechanically fastened (or use 2-part adhesive) and 100% glued
- Wall panel trim (1/2” x 2”) shall be used between gypsum panels, with trim fastened to only one of the two gypsum panels being joined
- Walls shall be sanded as needed to assure a smooth finish (Level 3 finish minimum)
- Ceiling shall be faced with ½” or 5/8” Gold Bond eXP gypsum board fastened to the trusses with an approved IRC foam, foam nail, or equal. Foam system shall be installed in accordance with the manufacturer’s instructions
- Ceiling and walls facing interior spaces shall be painted with latex, low-VOC paint (Class II vapor permeability)

- Paint shall be off-white interior color with either eggshell or matt finish
- Paint shall have a primer coat and be finished as per manufacturer's instructions

Floor Covering

- Industry-standard vinyl flooring shall be installed on all interior floors of the home
- Vinyl shall be low-VOC and conform to SCAQMD #1168 and CARB ATCM 93120 Title 17
- No carpet shall be used anywhere in the home

Molding

- Crown and baseboard molding shall be 1/2" X 2" and used throughout the home
- The casing around doors and windows shall be 1/2" x 2" minimum lumber flat
- Prior to delivery, the manufacturer shall ensure that all joints (between trim and walls, molding and walls, molding and floors, etc.) shall be sealed and caulked with appropriate caulking material to ensure that there is a tight seal

Soffits

- Where soffits for fire-sprinkler piping are specified, crown molding may be omitted
- The fire sprinkler system shall be concealed using a soffit that is attached to the structural members of the MHU
- Soffit hangers, if required by the soffit system shall be installed along with sprinkler pipes. The spacing of hangers shall be determined based on product being used
- Decoshield®, Soffi-Steel®, or ALumA-Fit™ soffit systems shall be used to conceal fire-suppression-system piping. Alternate soffit systems may be proposed for FEMA approval.
- Sprinkler soffit shall not be sealed or caulked to the wall/ceiling

Part 3: Doors and Windows

A. Exterior Doors

- All exterior doors shall be insulated fiberglass or steel with assembly U-value no greater than 0.33 BTU/(hr °F ft^2)
- Door assemblies shall contain all elements shown in the design details, including a J-channel above the door assembly (unless included in the door), extending beyond the width of the door opening, as shown in Door Details
- All exterior doors, except for the Express unit's rear entry door, shall be outswing with primary and secondary seals, whose primary seam surrounds the perimeter of the door. The Express rear entry door shall be inswing with a storm door
- Manufacturer shall include two (2) UFAS- and ABA-compliant door threshold transitions with the MHU to be installed on site, with a total rise sufficient to meet the door's threshold
- Outswing doors shall open to the exterior, with the hinge at the tail end of the home

- Entry doors shall be 80” tall with 32” clear width when door is opened 90 degrees (36” total width)
- Exterior door jambs shall be ½” by 6”
- TPS closet access door unit shall be 36” nominal clear-width (min 35.25” measured clear width) and 82” in height
- Doors shall meet HUD CFR 3280 requirements and shall be compliant with Wind Zone III
- All entry doors shall have lever-type handles in compliance with UFAS 4.1.3
- Entry doors shall be provided with a dead-bolt lock and a brushed satin nickel lock set
- Peep holes and other parts shall be installed as per drawings
- Doors shall be installed as per the manufacturer’s instructions and shall meet the stated flashing requirements listed in this document

C. Interior Doors

- All doors shall be swing doors with lever-type handles in compliance with UFAS 4.1.3
- Interior passage doors shall have 32” clear width when doors are open 90 degrees (36” total width)
- There shall be no lock on the Express bedroom door since the panel box is located in the room.
- Closet doors shall be 24” wide
- DHW access panel doors shall be 20” wide by 60” high
- Interior door handles shall be nickel, and door hinges shall be 3 nickel hinges per door
- Door jambs shall be ½” by 3.5”
- Interior doors shall have a floor-to-door clearance of between ½” and ¾”. No doors shall be undercut by more than ¾”
- Air-transfer grilles for return-air pathways (Tamarak model TTi-RAP-Di or equal) shall be placed at all bedroom doors, at the top, or at the bottom of doors or both if required, where shown on the drawings
- An air-transfer grill shall be installed between the TPS closet and the living space in each of the units
- Door stops shall match the interior hardware. Door stoppers shall be installed at all interior and wardrobe doors at either at the wall or at the floor, such that accessibility is not affected

D. Windows

- Windows shall be low-e with vinyl frame, with a maximum SHGC of 0.30 and a maximum assembly U-value of 0.34 BTU/(hr °F ft^2)
- Windows shall meet HUD CFR 3280 requirements
- Windows shall have R-PG50 rating
- Windows shall be installed as per manufacturer’s specifications and per the construction drawings
- Windows shall meet the flashing specification shown on the drawings

- A drip cap should be installed above the windows, as detailed, unless a J-channel integral to the frame is already present
- Roughly 1” (or slightly wider than the window’s flange) of the exterior rough opening of the window perimeter shall be left without rigid foam, and 1” lumber shall be nailed to the exterior of the rough opening. Window flange shall be secured to lumber, not the rigid insulation
- All windows shall be provided with blinds that have 1” to 2” slats. Blinds shall be designed to meet required industry safety standards, ANSI standards, and CPSC recommendations. Blinds shall be white, stain-resistant, fade-resistant vinyl with horizontal slats
- Operable windows must be constructed such that operability can be adjusted to adhere to UFAS 4.27.3 and 4.27.4 using counterweights or other retrofit feature. Windows shall be mounted for operability within accessible reach (as shown on drawings)

B. Flashing

Flashing procedure shall be performed as outlined below and according to flashing diagrams.

- Install self-adhering flexible flashing at perimeters of doors, windows, louvres, vents, and penetrations of exterior wall surfaces. Seal the doors and windows to the WRB as shown in the drawings
- Flashing shall be a pliable and adhesive waterproofing membrane, with a removable release liner
- Cut flashing in lengths required for application as indicated on drawings
- Remove release liner and apply membrane starting from lowest point and work upward, securing the flashing firmly in place
- Seal seams, laps, protrusions, and accidental cuts with manufacturer’s recommendations
- Seal all fastening nails at windows before flashing around it
- Use flashing manufacturer’s standard priming and bonding products for securing flashing materials to substrates as required
- If manufactured flashing (non-formable flashing) is used at sill, ensure that corner between end dam and back dam is folded and overlapped—not cut—and then sealed
- Refer to flashing instructions on diagrams for step-by-step window- and door-flashing procedures
- All supply and return openings on the envelope shall be flashed

Part 4: Appliances, Fixtures, and Furniture

Furniture and finishing adhesives and sealants shall be low-VOC to ensure high indoor air quality.

All furniture and furnishings shall remain in packaging. See ship-loose drawings in designs for storage and securement of furniture. Tape shall not be used to secure furniture.

Furniture shall be new, shall not require assembly, and shall be free of sharp or abrasive surfaces and edges.

A. Living Area

Express Unit

- A loveseat sofa shall be provided whose dimensions are 48” long by 24” deep (max). Cushioning with stain-resistant protection shall be provided
- One coffee table shall be provided, whose length and width are roughly 30” x 18”, respectively

3-Bedroom

- A full-sized sofa with stain-resistance protection shall be provided, whose maximum dimensions are 72” long by 36” deep
- A non-reclining arm chair shall be provided, whose maximum dimensions are 36” wide by 32” deep. Cushioning may be provided if fabric has stain-resistance protection
- One coffee table shall be provided, whose length and width are roughly 30” x 18”, respectively
- Manufacturer shall provide one end table for the living room, whose dimensions are 12” x 12” square x 21” to 24” tall

B. Kitchen

- All refrigerators shall be ENERGY STAR qualified and have the ENERGY STAR label affixed to the appliance when delivered with the MHU. All other appliances shall be energy-efficient and meet federal requirements
- Range and oven controls shall be at the front of the appliance. Finishes on adjacent surfaces to the range/oven must have a flame-spread rating not exceeding 50. Bottoms and sides of adjacent cabinets (within 6” horizontally from range) shall be protected with limited combustible material, per HUD code
- All cabinets shall include hardware that adheres to ABA and UFAS 4.25, UFAS 4.27.4, and UFAS 4.24.6.10 requirements, with handles located within accessible reach
- Range hoods shall extend the width of the range, be centered on the range, and extend a minimum of 3” beyond the depth of the overhead cabinet (per HUD CFR 3280.204). Controls shall be provided at accessible reach, as shown in the electrical drawings. Accessible controls must be provided for light and fan separately, and for adjusting fan speed
- All cabinets shall be modular type with finished underside. Kitchen base cabinets shall have back panels
- Sheetrock shall be added at the cabinets above the stove for fire blocking
- Accessible edges, surfaces, and hardware of cabinets and counters shall be free from sharp edges, corners, and protrusions. Finishes shall be smooth and non-splintering
- Pantries (shown in drawings) shall have a toe space at least 2” deep and 3” high
- Countertops shall be made of high-pressure laminate post formed with a flame spread of 50 or less. All surfaces subject to food preparation shall be washable and constructed without joints.
- Countertop height shall be 34” above floor

- Backsplash shall be 4” high and shall be made of high-pressure laminate post formed. Backsplash and countertop shall be a single piece
- Kitchen sink shall have an operable water-spray unit, as defined in the ETH Guidelines.
- Countertop depth shall be 24”
- The microwave shall be 120V, 15A, and shall have a minimum capacity of 1.2 cubic feet. Its maximum exterior depth shall be 19” so as to fit on the countertop with space to plug into the wall. It shall have a child-lock feature and shall be stored for shipping in the bedroom closet with the glass plate secured under the living-room sofa cushions
- The range/oven shall be a 30”-wide electric cooking range/oven combination in compliance with UFAS 4.34.6.6 and 4.34.6.7. It shall have a thermostatically controlled and lighted oven. The range shall have indicator lights showing when burners are operating. Insulation shall be built in on all sides to prevent excessive heat exposure. The range shall have 4 burners. The appliance shall be plugged into the oven/range receptacle at the time of delivery
- The range hood shall be lighted and power-vented, with venting to the outside through the roof. Range exhaust shall have a damper and duct cap properly sized for the duct. Range hood shall be capable of 100 cfm. The vent opening at the cap shall be screened with a corrosion-resistant, noncombustible wire mesh with ¼” openings or equivalent. The range hood itself shall be secured to the layflat shown in the wall-framing diagram

Express Unit

- Refrigerator shall be 18 cubic feet minimum in capacity and shall have the following maximum dimensions: 2’6” wide x 2’8.5” deep (without handle) x 5’7” tall. Height may be greater than 5’7”, as long as both refrigerator and freezer space meet UFAS and ABA requirements, with at least half of usable space in each compartment below 54” high. The depth at the door must be such that the door clears the adjacent countertop. All compartment doors shall hinge on the right or otherwise offer full access to the compartment with the door open next to adjacent wall

3-Bedroom

- Refrigerator shall be 18 cubic feet minimum in capacity and shall have the following maximum dimensions: 2’6” wide x 2’8.5” deep (without handle) x 5’7” tall. Height may be greater than 5’7”, as long as both refrigerator and freezer space meet UFAS and ABA requirements, with at least half of usable space in each compartment below 54” high. All compartment doors shall hinge on the left, unless refrigerator/freezer is side-by-side type

C. Dining Area

Dining tables shall be made of wood or metal. Dining seating shall be made of wood or metal (matching table), with or without cushions.

Express Unit

- A 24” wide x 36” long x 30” high dining table on wheels with seating for 2 people shall be provided
- Identical dining chairs shall be provided with four legs each

3-Bedroom

- A 36” wide x 72” to 78” long x 30” high dining table with seating for 6 shall be provided
- Identical dining chairs shall be provided with four legs each

D. Bathrooms

- A shower rod and new, neutral-colored plastic shower curtain (71” long x 71” high) with full set of rings/hooks shall be provided for all shower/bath fixtures
- Grab bars and accessibility features shall be installed where detailed on drawings.
- Grab bars shall be installed 1 ½” from the finished wall
- Medicine cabinet (16” X 26” min) shall be mounted as shown in the drawings and shall be surface-mounted with hardware included. Medicine cabinet shall be neutral in color and shall have a mirror on the door and two wood or aluminum shelves. One shelf must be placed no higher than 48” vertically from the floor
- Metal, rust-resistant, wall-mounted towel bars with chrome finish shall be provided in each bathroom as shown on the drawings
- Metal, rust-resistant toilet-paper holders with chrome finish shall be installed in each bathroom as detailed on the drawings
- Toilets and sinks shall be white porcelain
- Toilets shall be floor-mounted, tank type, white front-bowl with matching tank, compliant with UFAS Section 4.34.5.2 with the height to the top of the toilet seat between 15” and 19”. Toilets shall consume no more than 1.28 gallons per flush (gpf)
- Scald-protection devices shall be used at the showerheads of the home

Express and 3-Bedroom, Bathroom 1

- Sink shall be wall-mounted
- The Express-unit sink shall be no greater than 20” wide and mounted next to the tub/shower, in order to provide a T-shaped turning space as shown on floor plans
- Pipes to the sink shall be wrapped according to UFAS standards and as shown in section drawings
- Tub shall be a 1-piece white 60” fiberglass tub/shower combination (transfer-type) with grab bars and controls repeated on side within reach of the seat, compliant with UFAS. 1-piece tub/shower shall not have seams and shall be contiguous

3-Bedroom, Bathroom 2

- Pipes to the sink shall be wrapped according to UFAS standards and as shown in section drawings

- Tub shall be a 1-piece white 60” fiberglass tub/shower combination but does not need to be UFAS compliant
- 1-piece tub/shower shall not have seams and shall be contiguous

E. Bedrooms

Note: NOAA weather radios shown in drawings shall *not* be required in prototype units.

Mattresses shall be innerspring, non-latex (can be polyester, cotton, or blend ticking and wadding) new mattresses with medium firmness and 9” to 11” height.

Express

- Bedroom shall be furnished with one full-sized bed, 54” x 74”, with a rust-resistant metal bed frame, a mattress, and a box spring
- One five-drawer dresser shall be provided with the following approximate dimensions: 48” high x 33” wide x 18” deep
- A closet space shall be provided, enclosed by a door and equipped with a shelf and rod running the length of the closet and supported on both ends. Closet space shall be built to the dimensions shown and shall be compliant with UFAS

3-Bedroom, Bedroom 1 and 2 (bedrooms at tail end and hitch end)

- Bedroom shall be furnished with one full-sized bed, 54” x 74”, with a rust-resistant metal bed frame, a mattress, and a box spring
- One five-drawer dresser shall be provided with the following dimensions: 48” high x 33” wide x 18” deep
- A closet space shall be provided, enclosed by a door and equipped with a shelf and rod running the length of the closet and supported on both ends. Closet space shall be built to the dimensions shown and shall be compliant with UFAS
- One nightstand shall be provided, with the following dimensions: 12” x 12” square x 21” to 24” high
- Night stand shall be stored in the closet during shipping, as shown in ship-loose drawing

3-Bedroom, Bedroom 3 (middle bedroom)

- Bedroom shall be furnished with one free-standing wooden or rust-resistant metal bunk-bed frame, complete with attached ladder, slats, and safety guardrail (without gaps between the rail and upper bed bunk frame), with two twin-XL-sized mattresses (39” x 80” each). Bed frame shall be 60” to 72” high. No box springs shall be included. Bunk bed shall meet the requirements of the CPSC for children
- One five-drawer dresser shall be provided with the following dimensions: 48” high x 33” wide x 18” deep

- A closet space shall be provided, enclosed by a door and equipped with a shelf and rod running the length of the closet and supported on both ends. Closet space shall be built to the dimensions shown and shall be compliant with UFAS
- One nightstand shall be provided, with the following dimensions: 12” x 12” square x 21” to 24” high
- Night stand shall be stored in the closet during shipping, as shown in ship-loose drawing

F. Hallway

Washer and dryer space shall be provided as specified. No washer/dryer shall be provided. Electric washer/dryer hookups and venting shall be installed where shown, with a vent cap provided and secured to the dryer vent. Dryer shall be vented through the wall in the Express unit and through the roof in the 3-Bedroom unit.

Part 5: Lighting and Electrical

- Lighting and electrical shall be installed as shown in electrical drawings. See drawings for further details.
- Electrical wiring may be wired through either the ceiling or the floor
- Electrical components shall be configured on circuits as indicated in the Panel Schedule on the Electrical Plan. Circuit configuration on the electrical panel may be altered by manufacturer but must contain the circuits indicated
- The highest breaker in the panel box should be 54” high (side approach) and the panel bottom must be at least 24” from the floor
- Light bulbs shall be provided everywhere where lighting is specified. Bulbs shall be LED, equivalent to 60-watt incandescent bulbs. Brightness shall be at least 750 lumens. Lighting shall be white in color, between 2,700 and 4,100 K
- Ceiling fixtures in the living/dining area, kitchen, and bedrooms shall have two (2) LED bulbs each.
- No glass shall be used in any of the lighting globes
- Bathroom vanity lights shall be a wall-mounted light bar with three (3) bulbs
- Overhead bathroom light/exhaust fans shall be installed where shown on the drawings. Fan and light shall be on separate switches. Fan shall be ducted through the roof
- The range hood shall have a light and fan capable of 100 cfm, with separate switches (located where specified on drawings)
- The exterior porch lights shall be jelly-jar lights, whose covers and luminaries shall be installed on site and stored in the refrigerator during transportation, as shown in ship-loose drawings.
- Light switches and thermostat must be installed at 40” above the finished floor, as shown in section drawings
- All receptacles/switches shall be installed at least 6” away from the kitchen stove
- Light switches shall be plate-rocker type

- Transportation lighting for the Express unit shall comply with USDOT requirements and shall be configured as shown on the Trailer Lighting plan
- Interconnected smoke detectors shall utilize the home's primary power source and shall have battery backup. Smoke detectors shall have a strobe function as required by UFAS for visual signal of smoke or fire. Push-button testing is required with temporary silencing devices. Smoke detectors shall be placed where indicated on electrical plans
- Electrical panel shall have a locked breaker switch (locked to the "ON" position) controlling the tank-and-pump system exclusively, as discussed in the "Fire Safety" section. An electrical conduit shall be provided for the TPS Annunciator Panel to connect this Panel to the TPS, as shown in electrical drawings and as discussed in "Fire Safety."

A. Emergency Systems

Weather Radio

- Weather radios shall *not* be required in prototype units.

Transponder

- The manufacturer shall provide a transponder sled to mount a transponder with the following dimensions: 7.25" long x 3.25" wide x 1" deep (184mm x 83mm x 25 mm), with weight of 13 ounces (369 g) (without mounting bracket) or 7.61" x 3.52" x 1.06" (192.42mm x 89.82mm x 26.9mm) with a mounting bracket
- The transponder location shall be mounted on the rear elevation as shown in the drawings and shall allow for removing the transponder without any special tool, without damaging the MHU, the surface, or the transponder
- The transponder sled shall be mounted such that the top of the transponder points to the sky (up position). There shall not be any object obstructing the signal that is emitted and/or received from the satellites
- Manufacturer is not responsible for procuring the transponder. A transponder may be provided to the manufacturer during construction

Part 6: Mechanical Systems

A. Water Heater

- Water heaters shall be electric storage tank dual-element quick-recovery water heaters, 240V and 30A (max), with a minimum energy factor of 0.95 or federal minimum—whichever is greater
- Water heater shall be placed on a dedicated circuit clearly marked and taped in the off position; tape shall be labeled, "Water Heater: Do not turn on until water service operational and tank is filled"
- Water heaters must be equipped with a pressure-release valve, as well as a corrosion-resistant drain pan 2" greater in diameter than the water heater itself, and a metal tank drain valve

- The manufacturer shall secure the water heater compartment with an access panel screwed in with security screws

Express

- Water heater shall be approximately 30 gallons in capacity and measure no greater than 19" in diameter (jacket dimension)
- Drip pan shall measure 22" in diameter

3-Bedroom

- Water heater shall be approximately 40 gallons in capacity and measure no greater than 21" in diameter (jacket dimension)
- Drip pan shall measure 24" in diameter

B. HVAC (Subject to current testing)

Two HVAC configurations will be tested for each of the prototype units, as shown in Table 2. The manufacturer will not be responsible for procuring certain HVAC components as listed in Table 1. All other components are to be provided by MHU manufacturer. MHU manufacturer shall install all systems into the MHUs so that each system may be used and tested independently in the field. Where ducts are present, MHU manufacturer shall design ductwork and approve it with TLP. All fresh-air intakes shall have MERV 8 filters installed.

Table 1 Parts Provided to Plant

Equipment (or equivalent)	
Ductless heat pump	(1) Mitsubishi MUZ-FH09NA (outdoor unit)
	(1) MSZ-FH09NA (indoor unit)
Energy recovery ventilator	(1) Panasonic WhisperComfort Spot ERV FV-04VE1
Bath exhaust fans—(1) Express; (2) 3-Bedroom	(3) FV-0510VS1 WhisperValue DC
Bath fan switch (1) Express; (2) 3-Bedroom	Panasonic WhisperControl Condensation Sensor Plus FV-WCCS2
Transfer fans	(1) Panasonic WhisperGreen Select FV-11-15VK1 (Express bedroom)
	(1) Panasonic WhisperGreen Select FV-05-11VK1 (Express bathroom)
Single packaged vertical unit	(1) BARD W12AAAA03XPXXXX (60 Hz) (Express)
	(1) BARD W24A2-A8XPXXXX (3-Bedroom)
Split system	(1) TBD (3-Bedroom)
Ventilating dehumidifier	(1) Ultra-Aire 70H Whole House Ventilating Dehumidifier with controller to meet ASHRAE 62.2 (3-Bedroom)

Table 2 HVAC Systems

	Express		3-Bedroom	
	System 1	System 2	System 1	System 2
Primary heating/cooling equipment	Ductless wall-mounted heat pump	Single packaged vertical unit Integrated resistance heating capacity at least 3.6kW	Split-system heating and AC Integrated resistance heating capacity at least 6.8kW	Single packaged vertical unit Integrated resistance heating capacity at least 6.8kW
Supplemental heating	Baseboard convectors: ~750W in bedroom; ~570W in bathroom (see floor plans)	None	None	None
Ventilation	Panasonic spot energy-recovery ventilator, vented through attic at gable end (see plans), set to 19 cfm continuous operation	Outdoor-air intake integrated in wall-mounted unit (50 cfm capacity)	Integrated outdoor-air intake (50 cfm capacity)	Ventilating dehumidifier integrated into supply ducting (see HVAC detail drawings); (provide ventilation when dehumidifier coil on or off, 50 cfm minimum outdoor air capacity)
Air distribution	Transfer fans in overhead closet box-outs	Ducts in attic	Ducts in attic	Ducts in attic
Supplemental dehumidification	None	None	(Ventilating dehumidifier)	(Ventilating dehumidifier)
Mounting location	Condenser bracket-mounted at tail end of MHU	Wall-mounted at tail end of MHU	Condenser bracket-mounted at tail end of MHU	Wall-mounted at tail end of MHU

See diagrams for specific installation and mounting locations. Follow manufacturer's instructions for installation of all mechanical equipment, including condensate drains.

Return-air pathways shall be provided as shown in drawings.

The split systems and single-packaged vertical units shall have a damper for adjustable outside-air intake capable of at least 50 cfm but no more than 75 cfm.

The ventilating dehumidifier shall have a drip pan and be plumbed separately to the WH drain, rather than draining in the WH pan, in order to protect the water heater. It shall also have a manual damper in

the outside-air duct to adjust the flow rate. A backdraft damper shall be installed on the dehumidifier supply to avoid furnace supply-air backdraft.

Mounting the Condenser

Condensing units that are not wall-mounted (the mini-split and split-system condensers) shall adhere to the following bracket-mounting guidelines:

- Condenser units shall be mounted on a support that is an extension of the chassis frame
- A vibration damping pad shall be placed between the condensing unit and the rigid framing elements to minimize sound and vibrations conducted to the MHU during HVAC operation. 1/8" thick High Capacity Fiber Reinforced Neoprene Vibration Damping pads (cut from McMaster Carr part number 5940K61 or M-C part number 5940K64) or its equivalent may be used.
- A 1" ratchet strap with 500-lb capacity shall be installed around the outside of the unit and bracket extension for transportation
- Lines shall be pre-charged in the factory per manufacturer specifications and shall not have any leaks

For shipping and transportation, MHU manufacturer shall cover the condensing units with a galvanized metal cabinet.

Additional guidelines will be provided for HVAC installation and mounting, and TLP staff will be present to oversee the installation process.

Part 7: Plumbing

- The plumbing system shall comply with HUD code.
- Units shall be ready to hook up to municipal sewage or an on-site septic system.
- Supply piping shall be ¾" and ½" CPVC or PEX tubing, as shown in plumbing diagrams.
- Main potable water supply pipe shall be equipped with a metal ¾" master shutoff gate valve or quarter-turn ball valve, as well as a frost-free hose bib.
- Access panels (12" X 12" min) shall be provided in the walls at the shower area. They shall match the wall color and finish
- An individual shutoff valve shall be provided at each installed plumbing fixture except for the tub/shower
- The washer box shall contain vacuum breaker hose bibs for hot and cold water
- Water piping shall be tested appropriately for the type of piping used. When the manufactured home is delivered to site, the entire water system shall be dry without any water in it
- The drainage system shall connect to the main sewer line, which shall run below the floor, above the bottom board, as shown in the plumbing diagrams
- The exit pipe shall protrude at least 6", but not more than 8", from the bottom board, shall have a threaded end, and shall be capped with a removable plastic cap and chain. The drainage

system shall be accessible without removing the wheels and/or axles during the installation and deactivation (un-installation) process

Part 8: Fire Safety

A. Fire Extinguisher

Each home shall be equipped with a mounting bracket for a 5-pound A-B-C-type fire extinguisher complying with NFPA 10 Annex F, where shown on the section drawings. Fire extinguisher shall be provided for prototypes, along with mounting bracket. The mounting bracket shall be secured to a wall stud and shall be mounted 40" above floor surface along the accessible route, as shown.

B. Fire Sprinkler Tank-and-Pump System (TPS)

- Fire (pump running) alarm and sign shall be mounted above the tongue of the MHU. Alarms shall have a sound output rating of at least 80 decibels at 10 feet. Visual alarms shall have a visual notification appliance (strobe) that has an output of at least 15 candela
- MHU manufacturer is not required to install a tank-and-pump system in the MHU and must only provide the connections necessary for installation in the field
- The electrical connections between the MHU and the TPS shall be a 30 Amp 240 volt rated 12H IEC 60 309-2 International Pin and Sleeve standard device, provided in the TPS closet inside a single-gang electrical box
- Back boxes shall be provided and installed for the exterior alarm system (single-gang), the Annunciator Panel (two-gang), and the main power supply to the TPS (single-gang). Exterior alarm box shall be weatherproof. Exterior mounting box shall sit within exterior rigid foam, attached to OSB, so as not to project the alarm beyond dimensional limitations. This penetration shall be air- and weather-sealed. Provide a ¾" PVC conduit through the wall where shown on drawings to pass through electrical wiring that will come with the Annunciator Panel and TPS.

Locking Circuit breaker

- Provide and install a locking circuit breaker, exclusively serving the TPS and Annunciator Panel, in the main circuit breaker panel. (To be locked in the ON position.) Provide two keys for the lock. Keys shall be provided with the keys to the MHU. Circuit breaker shall be clearly labeled as "FIRE SPRINKLER SYSTEM"

TPS Closet

- The Annunciator Panel mounting location shall be placed as shown on drawings to comply with UFAS height limitations so that the occupant can reach the silence button
- The external horn/strobe assembly electric box shall be installed as shown on drawings on the side of the MHU as a single-gang weatherproof back-box, sealed as specified in Part 2
- Provide a 38" nominal locking door for the TPS closet as shown on the MHU plans. Lock shall be a deadbolt lock with a "SCHLAGE" brand, 6-pin Everest cylinder with a C123 keyway that shall be keyed to a 6-pin combination. The key combination shall be "746105". A door knob is not

required on the TPS door(s). Provide two keys for the TPS closet with the MHU. Keys shall be provided with MHU entry-door keys

- Provide a light inside the room to facilitate maintenance. Light shall be activated by a switch inside the room, located on the wall beside the latch side of the door, as shown in drawings
- Provide two air-transfer grills (Tamarak model TTi-RAP-Di) between the walls of the TPS closet and the living space to prevent mold growth. See floor plans for grill placement

Anchoring

- Manufacturer shall install two ratchet straps in the TPS closet as shown in TPS Closet Detail Drawings.

Plumbing

- **Floor Drain**: provide and install a 1-inch diameter drain line plumbed through the floor and vinyl flooring. Use flush-mounted drain. Drain shall be pre-piped through the floor, as shown in TPS closet detail drawings. Drain shall be finished on site and equipped with a stainless steel insect vent screen. Acceptable screens include Hytech Air Vac screens, part no. BUGSCRN-1"M., and PVC Vent Screens model #SVC-IS15 (See detail drawings for location of drain line.)
- In the 3-bedroom unit, to separate the TPS floor area from the water heater, provide a 2x4 laid on edge, nailed to floor where shown.
- **Drain and Vent Manifold**: provide and install a Drain & Vent Manifold through the floor and belly board with connections for tank overflow and sprinkler pipe riser. Drain and vent shall be finished on site and equipped with a stainless steel insect vent screen at the underside of the MHU. Acceptable screens include Hytech Air Vac screens, part no. BUGSCRN-1"M, and PVC Vent Screens model #SVC-IS15. The sprinkler-system drain line shall be connected to the Drain and Vent Manifold

C. Sprinkler Distribution System

- Sprinkler distribution system shall be approved by a fire-protection engineer and installed in MHU plant as shown on the drawings, in adherence to NFPA 13D. A sprinkler shall also be provided in bathrooms and in the DHW closet
- A sprinkler wrench shall be provided with the MHU, secured inside the fridge during transportation, as shown in the ship-loose drawings

Sprinkler Heads

- UL Listed, concealed sidewall sprinklers with glass bulb thermal elements shall be used. Concealed sprinklers shall have a flat or domed cover plate to minimize visual impact. Sprinklers shall be UL Listed for maximum ambient temperature of 150°F, Reliable F1 Res 44 HSW or alternate approved by FEMA.
- Sprinklers using eutectic metal heat sensitive elements shall not be used due to the risk of cold flow during storage. Sprinkler cover plates shall not be installed at the factory, but shall be

shipped in packaging that will protect the plates from heating during anticipated transportation and storage

- Cover plates shall not be installed to cover the sprinklers at the time of delivery of the MHU. This will allow FEMA and AHJ inspectors to inspect the sprinkler head installation, and should prevent premature activation of the cover plates. Cover plates for each MHU shall be packaged in a new box, one box per MHU by manufacturer and type, and protected against physical damage during transport or storage. The box shall include one cover plate for each sprinkler installed in the MHU, plus one spare cover plate. Boxes shall be clearly labeled "*Sprinkler System Parts*" and shall be placed inside the refrigerator in the MHU
- Sprinkler heads shall be installed horizontally with deflector on top, parallel to ceiling, or as stated in manufacturer instructions
- The sprinkler, support cup, and opening in the wall or soffit shall be properly positioned and aligned so that installation of the cover plate in the field can be accomplished without the need for adjustments, alterations, or force to achieve proper alignment. Acceptance testing will include a test installation of a cover plate onto each sprinkler in the home to ensure proper alignment

Pipes and Tubing

- Sprinkler pipes shall be installed after interior painting is completed
- Pipe or tubing shall be structurally supported by attachment to structural elements of the housing unit. Attachment to drywall only, cabinetry, or other non-structural components is not permitted. Except as otherwise noted herein or in contract documents, pipe used for sprinkler system shall be BlazeMaster® CPVC pipe. The use of either Uponor AquaSAFE™ PEX tube, or Viega PEX tube will be considered upon submission of complete details of the products and materials to be used in the installation. FEMA may choose to specify pipe material used in any task order awarded under this contract
- Non-metallic pipe or tubing shall be protected against damage from chafing during transport. Chafing protection shall be installed at all locations where non-metallic pipe or tube can rub against structural members, walls, metallic pipe hangers, or other components of the housing unit. Pipe hangers/straps/supports shall be used to attach and support tubing. Pipe hangers/straps/supports shall have metal load-bearing elements
- Pipe hangers/straps/supports shall be attached to the structural member using screws to provide not less than 2 inches of grip in wood studs
- To ensure that the pipe remains in place during transportation of the MHU, the maximum distance between pipe hangers specified in the manufacturer's installation instructions shall be reduced by 50% (i.e., if the manufacturer's installation instructions recommends hangers every 36 inches, the maximum distance between hangers shall be 18 inches.) All pipes shall be located within the thermal envelope of the MHU, just below the ceiling
- Routing of pipe across hallways or rooms shall be prohibited unless no other alternative routing is feasible. Pipe may be routed through closets to reduce the visual impact; however, pipe in closets shall be protected with a soffit system.

Exception: Pipe in TPS and water heater closets, which are normally locked closed, is not required to be protected by a soffit

- In the event Uponor PEX tubing is not used for sprinkler pipe, a CPVC expansion loop shall be installed as shown in the TPS closet
- Where a sprinkler is to be installed on the opposite side of a wall from the pipe, sprinklers shall be installed inside walls, flush with the wall surface, without soffit system where possible. See the Sprinkler piping diagrams for details.
- In bedrooms where a bunk bed is shown on the floor plan, the sprinkler shall be positioned so that it is not easily reached by the occupant of the top bunk
- At the end of each branch line, removable pipe plug or cap shall be provided or installed to be used to drain the system of all water after testing or during decommissioning. Drain plug or cap shall be accessible for use, and shall be concealed behind the soffit system. Riser connection for the TPS shall be a metal, 1½ NPT male pipe fitting. Note: Cam-Locking connectors shall be provided by TPS vendor and shall comply with the most current edition of Commercial Item Description A-A-59326, General Specification for Coupling Halves, Quick Disconnect, Cam-Locking Type. Connections shall be Class A, Style 2
- FEMA MHUs can experience a temperature change of up to 150°F during years of storage without electric or water. The pipe system must be installed to permit thermal expansion/contraction resulting from temperature that range from – 30°F to + 120°F
- When CPVC pipe is used for the sprinkler system, expansion loops shall be provided as shown in the Expansion loop diagrams. The expansion loop shall be installed at the ceiling of the TPS closet to avoid conflict with TPS installation

Concealment

- All system components and pipe, with the exception of the sprinkler concealer plates, shall be concealed from occupant view with a fabricated soffit system
- Any component that is within a locked space that the occupant does not have access to (e.g., the water heater closet) shall be considered concealed and does not require further concealment
- Decoshield®, Soffi-Steel®, and ALumA-Fit™ soffit systems are approved for this purpose. Alternate soffit systems may be proposed for FEMA approval. Soffits shall be installed in accordance with the manufacturer's installation instructions except as noted below.
- In order to ensure that the soffit system remains in place during transportation of the MHU, the maximum distance between soffit hangers specified in the manufacturer's installation instructions shall be reduced by 50%. (i.e., if the manufacturer's installation instructions recommend hangers every 36 inches, the maximum distance between hangers shall be 18 inches.)
- The manufacturer shall follow all of the sprinkler soffit manufacturer's installation instructions
- All soffits shall be securely affixed to the structural members of the MHU. Attachment into drywall or cabinetry is not permitted
- Where removal or installation of the soffit requires a special tool, one tool shall be provided in the sprinkler parts box

Water Supply to the MHU

- The sprinkler system shall be designed and installed to draw water from a prepackaged tank and pump system (TPS) installed inside the TPS closet. This system will provide 30 gpm at 50 psig to the water point of connection inside the TPS closet. Sprinkler system design and calculations shall be based on this water supply
- Sprinkler designers should use a churn pressure of 55 psig as the second point on the water supply curve in their design calculations
- Design safety factor: Include a safety factor in the design calculations.

Electrical requirements

- The MHU manufacturer shall provide and install all electrical parts and components required to install the TPS in the MHU
- Provide and install a circuit providing 30 Amp, 240VAC to the TPS. Interface between TPS and MHU shall be at a single-gang standard electrical box installed inside the TPS closet at the location shown in the TPS closet diagrams. All wire between the circuit breaker panel and the electrical connection for the TPS shall be concealed within the wall(s) of the MHU
- The circuit breaker(s) providing power for the TPS unit shall be equipped with a UL-listed locking device that can secure the breaker(s) in the ON position. Devices shall be installed set to the ON position, and shall be equipped with an appropriate lock that fits inside the panelboard

- Two keys shall be provided for each lock. The keys for the lock shall be attached to the lock or device inside the panelboard using a wire tie or shall be otherwise securely attached to the panelboard so that the keys will be in place after repeated road transportation and long term storage
- A locking device provided by the panelboard manufacturer is preferred over aftermarket devices. One example of an acceptable device is Siemens Padlocking Device, Catalog Number ECPDL 2
- Three standard back boxes shall be provided and installed to prepare for installation of the TPS: a single-gang box for the power supply to the TPS, a double-gang box for the TPS Annunciator Panel, and a single-gang box for mounting of the exterior alarm device. Back boxes shall be provided with flat covers. The exterior alarm mounting box and cover shall be weatherproof. See TPS closet diagrams for location of the back boxes
- Back boxes for the Annunciator Panel and the exterior alarm device mount shall be provided with ¾ inch PVC conduit that runs straight through the wall from inside the TPS closet to the rear of the back box. There shall be no turns or bends in this conduit so that the low-voltage cable and connector can easily pass through the conduit during TPS installation.

Sprinkler Riser

- The sprinkler riser shall be located inside the TPS closet. Sprinkler riser and drain valve shall be located at the front of the TPS closet to allow access for installation of the TPS unit.
- The sprinkler system point of connection to the water supply shall be located at the base of the sprinkler riser inside the TPS closet as shown in the Sprinkler Riser diagram. Point of connection shall be a 1 inch diameter male cam-locking connector. Cam-Locking connector shall comply with Commercial Item Description A-A-59326D, General Specification for Coupling Halves, Quick Disconnect, Cam-Locking Type.
- The sprinkler system point of connection shall be capped with an aluminum locking style 1-inch female cam-locking dust cap. In addition to the locking mechanism in the dust cap, the arms of the cap shall be secured in the closed or locked position using a nylon cable tie at the conclusion of all work and testing of the sprinkler system, and before the MHU is shipped. If a TPS unit is installed, the MHU may be shipped with the TPS connected to the sprinkler riser, and the dust cap tie-wrapped to the pipe for possible future use.
- The sprinkler riser shall be fabricated of Schedule 40 galvanized steel pipe, 1 inch diameter, from the point of connection to the ceiling of the TPS closet, and shall include a horizontal length of pipe at the ceiling, as shown in the Sprinkler riser diagram. Sprinkler pipe shall transition from steel to Blazemaster® CPVC pipe or PEX tubing using an approved transition fitting at the end of the steel pipe. Provide and install a steel pipe hanger on the horizontal section of the riser that is securely attached to a stud. The pipe hanger used shall prevent both horizontal and vertical movement of the pipe.
- Both the sprinkler riser and cam-locking fitting shall be supported and restrained in all three axes so that the cam-locking fitting remains rigid and does not move while the water supply

hose is being attached to the riser. An alternative restraint system to the pipe stand and thrust block described below may be proposed: submit full details to FEMA for approval before starting work.

- Note: These sprinkler riser requirements are intended to prevent the damage to plastic pipe or tube that has occurred during transportation and installation of the MHU.
- Sprinkler riser shall be vertically supported by a stanchion type pipe stand that is secured to the floor. The pipe stand shall have a strap or U-bolt to secure the pipe to the saddle support on the stand. Provide and install an anti-chafing pad between the pipe stand and the waterproofing membrane on the floor to prevent damage to the waterproofing membrane during transport of the MHU.
- Sprinkler riser shall be horizontally restrained by a thrust block between the sprinkler riser and the wall of the TPS closet, as shown in the Sprinkler Riser diagram. Thrust block shall be in contact with both the wall and the sprinkler riser (i.e., no gap is permitted), and shall be securely attached to two (2) vertical wall studs. Thrust block shall prevent deflection of the drywall and/or movement of the pipe when 200 lbs. force is applied axially to the cam-locking fitting in either direction perpendicular to the wall (i.e., both push and pull). Sprinkler riser shall be securely attached to the thrust block to prevent lateral movement.
- Tank Anchoring: The manufacturer shall provide 2" ratchet straps with double-J hook ends, secured to the wall studs with a D-Ring tiedown, that will be used by installer to anchor the sprinkler tank in the TPS closet, as shown the tank strapping diagrams.
- The fire sprinkler water inlet shall be clearly marked "Fire Sprinkler Connection." The label shall be fabricated of waterproof material and securely attached so the label will not be damaged, destroyed or rendered not legible during storage and transportation.
- A check valve shall not be installed on the riser.

Sprinkler Drain

- A sprinkler drain line and drain valve shall be provided. Drain line shall be connected to the identified 1" male NPT connection on drain manifold in the TPS closet as shown on the Sprinkler drain diagram.
- The sprinkler drain line shall be clearly marked "Fire Sprinkler Drain". The labels shall be fabricated of waterproof material and securely attached so the labels will not be damaged, destroyed or rendered not legible during storage and transportation.

Accessories

- The sprinkler system accessories listed below shall be provided and installed as described below:
- A red metal cabinet shall be provided and securely mounted to studs inside the TPS closet. Cabinet shall be large enough to provide secure storage for the spare parts listed below that are to be provided with the system. Cabinet door shall close fully when the required spare parts are installed inside the cabinet at the final home site. Cabinet shall be sized to store the following parts:
- One spare sprinkler of each type of sprinkler installed in the home.

- One spare sprinkler cover plate for each type of cover plate installed in the home.
- One manufacturer's approved sprinkler wrench for each type of sprinkler installed in the home.
- Where a special tool is available to aid in removal of the soffit system, the tool shall be provided.
- In addition to the cover plates, the spare parts listed above shall be provided. All required spare parts shall be securely stored in a cardboard box placed inside the refrigerator. The spare parts shall not be installed inside the metal cabinet during system installation.

Testing

- The MHU manufacturer shall perform hydrostatic testing of the sprinkler system after installation is complete. Pressure testing using compressed air or any other gas is not permitted under any circumstances due to the severe safety hazard that testing with compressed gas could present. A hydrostatic test pump shall be connected to the sprinkler system at the base of the riser. Test pressure shall be 200 psig. A hydrostatic test will be considered successful when not less than 200 psig pressure has been maintained for 2 hours with no loss of pressure.
- Documentation of passed testing shall be provided with QA checklist
- All water must be removed from the sprinkler system prior to shipping

Testing Qualifications

- All sprinkler system design work shall be performed by an individual possessing a current NICET Level IV certification in Water Based (formerly Automatic Sprinkler) Systems Layout or a licensed Fire Protection Engineer. Submit qualifications of sprinkler system designer(s).
- Fire sprinkler system installation and testing shall be overseen and inspected by Journeyman level technicians with experience in the installation of residential fire sprinklers. The requirement does not require the installation work to be conducted by said individual.
- At least one licensed tradesmen shall be present on the job site for each professional trade that is needed to complete this work.
  Experience Requirements:
- Submit evidence of experience designing and installing NFPA 13D sprinkler systems. In light of the many significant differences between NFPA 13D, NFPA 13R, and NFPA 13 sprinkler design standards, experience must be specific to NFPA 13D to be considered. Include prior experience installing NFPA 13D systems in manufactured homes and/or modular homes.
- Every individual who is performing work on a sprinkler system must be factory-trained to install the brand(s) and type(s) of plastic pipe or tube being installed. Factory training is defined as training authorized and delivered by the manufacturer of the pipe or tube; training by the MHU manufacturer is not acceptable. Evidence of the factory training shall be submitted and approved prior to start of work. The individuals must be factory trained on the specific brand and product being installed. These materials require special handling and installation practices that are unique to the product. No waivers or alternatives to this requirement will be granted.

Quality Control

- The design for the sprinkler system shall be incorporated into the DAPIA approved design for the MHU.
- The DAPIA does not have to approve the sprinkler system itself.
- The DAPIA shall provide approval for the design for the method of fastening the sprinkler components to the MHU; the electrical connection to the TPS and any other items that fall within the DAPIA's scope. All work shall be inspected by the IPIA for items that fall within the scope of the IPIA's purview.
- Provide an updated quality control plan for the manufacture of the MHUs that shall include the inspection and acceptance of the fire sprinkler system.
- Perform the acceptance tests in accordance with NFPA 13D and this document. The minimum pressure for hydrostatic test shall be 200 psi.
- Where a TPS unit is installed in the MHU, the hydrostatic test shall be performed via the hydrostatic test port on the TPS, which will test both the MHU sprinkler system and the connection between the sprinkler system and the TPS discharge pipe or tube. Follow TPS instruction manual carefully to avoid damage to the TPS unit.
- Testing is to be performed with the sprinklers installed.
- After testing, the system shall be prepared for long-term storage by being drained of water by use of a Gecco Dropmaster® DM12 or similar vacuum device and the plug or cap at the end of each branch line.
- Ensure that the plug or cap is properly installed on the end of each branch line and sealed after system is drained.
- Submit a signed and dated certification of acceptance test completion with each MHU. Submit certification of the fire sprinkler system which shall include details of tests performed and the results of each test.
- Include a copy of the certification in the information packet shipped with the MHU.
- After the hydrostatic test, vacuum water out of the fire sprinkler system and TPS prior to shipping.