SCOPE OF WORK AND SPECIFICATION
FOR A FABRIC MEMBRANE COVERED STRUCTURE
Town of Lyme
12175 NYS Route 12E
Chaumont, New York 13622
Jefferson County

PART 1

1.1 INTENT OF SPECIFICATION

1.1.1 This specification covers the design, manufacture, shipping, handling and erection of a prefabricated membrane covered structure.

1.1.2 The specification as heretofore set forth is general in nature and scope and shall not be construed as to limit the work other than the requirement that the new re-locatable building shall match the specification in materials, appearance, configuration and details.

1.1.3 It is the intent of this specification that the bidder shall include all labor, materials, equipment services and transportation to locate the building on the site designated with all other work.

1.1.4 Buildings shall be complete and operating and shall include all exterior and interior materials and systems as shown or indicated in contract documents.

1.1.5 All workmen shall be skilled and qualified for the work that they perform. All materials used, unless otherwise specified, shall be new and of the types and grades specified. The contractor shall certify that no asbestos containing building materials that exceed Federal mandated safe asbestos levels have been used in the construction of the membrane-covered structure.

1.1.6 Work shall be performed as necessary and required for the construction of the project as indicated. Such work includes the supply and installation of a membrane-covered structure complete with exterior and interior finishes. The building shall be as dimensioned with all features and quantities as per specification.

1.2 APPROVAL OF PLANS

1.2.1 **Upon award of this contract, The Contractor shall furnish detailed drawings for all structural work stamped by an engineer certified by the State of New York to verify compliance to local building code.** Site specific calculation packages will be provided upon request of the customer (Additional Fees will apply).

1.2.2 All work to be performed under the conditions of this specification shall comply with the rules and regulations of all agencies having jurisdiction for this classification of construction and design and shall conform to the applicable live loads due to wind, rain and snow.

1.2.3 OMITTED

1.2.4 Building supplier must provide written references with contact information for at least five salt sheds currently in operation in New York which have a footprint in excess of 9000 ft².

1.2.5 Installer must provide documentation of New York State Workers Compensation and Disability and their Certificate of Authority from New York State if not from New York.

1.2.6. Town of Lyme reserves the right to reject any and all proposals received following the approval of the Permissive Referendum. Decision will be made based on best price and best qualifications

1.2.7 Preference will be given to New York State based companies. WBE/DBE/MBE participation is encouraged as there must be 30% participation

1.3 WORKMANSHIP

1.3.1 The workmanship of all materials and components of the structure shall be commensurate with the functional requirements of the item.

1.3.2 Building prefabrication shall be performed under factory conditions in a plant specifically arranged for this type of work. Contractor shall provide adequate space, equipment, personnel, and technical ability to coordinate the assembly and factory prefabrication of all major components of the work and all necessary operations in the packing, shipping and installation procedures. No fabrication shall be done until the materials have been tested and approved.

1.3.3 Welding: Welding shall be employed only when specified in the original design. As per Section 1704.2 of IBC, the truss fabricator must be an Approved Welding Fabricator to **AWS B5.17 and QC17**. **Successful bidder MUST supply AWS certificate of approval.**

1.3.4 On Site Welding: If welding is required on site, no welding shall be started until the AWS welding inspector has inspected and approved the materials, joint preparation, equipment and the qualifications of the welders. Welders doing unsatisfactory work will be removed and required to pass qualification tests again before returning to work.

1.3.5 Manufacturer: The structure supplier shall be a reputable manufacturer, shall have a direct experience in the design, manufacture and installation of structures of the type specified herein; shall operate according to a comprehensive quality system and shall provide three references with structures in use for at least five years which are clear span and each must enclose an area in excess of the square footage as stated in section 1.2.4.

1.4 DIMENSIONS

THE STRUCTURE SHALL OCCUPY AN AREA OF 60'WIDE BY **160'LONG.**

1.5 SCOPE OF WORK

1.5.1 Rigid steel frame supporting membrane covered roof and wall structure of the type described herein:

a. Flat gable ends with (4) 4' x 4' passive vents on each end.
b. Soffit vent system at top of foundation wall.

c. Termination of Fabric to Concrete Wall System
d. Internal height at peak of 37’ minimum when mounted on 8’ concrete wall

1.5.2 Foundation / Wall System 8’6”
1.5.3 Site Work by Town of Lyme
1.5.4 Delivery to Site
1.5.5 Complete Structure & Accessory Installation

PART 2

2.1 GENERAL DESIGN REQUIREMENTS

2.1.1 Scope

1. The membrane shall be tensioned over the framework. The structure shall be rectangular in shape with vertical gable end walls. The interior of the structure below the main trusses shall be clear span free of any structural support members and shall provide unobstructed floor space. No exterior purlins, guy ropes or cables shall be used for anchoring the structure.

2. The structure shall include accessories to the extent shown on the project drawings required for the scope and intended use for:

    a. Ventilation systems.
    b. Other structure accessories

2.1.2 Design Requirements - Structural Frame

1. Roof and Wall Surfaces: To provide for maximum compatibility with standard door, window, ventilation and other accessory and cladding systems, the structure shall be designed such that roof and gable side wall surfaces form flat planes.

2. Purlin Spacing: To provide for structural stability and to provide for installation of accessory items, the main structural trusses shall be laterally braced by load bearing purlins at intervals required by the truss design.

3. Wind and Frame Bracing: The structure shall be appropriately stabilized with wind bracing cable as well as any required secondary node restraint assemblies so as to efficiently transfer wind, snow and seismic induced stresses to the foundation/anchoring system. Cable diameter for main wind bracing shall be a minimum of 5/16” diameter and larger if so required. The end bays of the structure shall be designed to be X - braced early during installation to allow for permanent stability of the frame during installation.

4. Connecting Joints: Connections between structural elements shall be designed so as to transfer the compressive and tensile forces present in a given joint. A minimum of Grade 5 bolts shall be used at each truss chord joint. Primary axial steel, secondary purlins, and end wall frame connections shall be made with a minimum of Grade 5 hex bolts, carriage bolts and self drilling screws.

5. Mechanical Equipment Interface: The main structural roof trusses shall allow for installation of electrical and mechanical equipment based on collateral loads as defined in section 2.2.2. Likewise, the structure shall accept penetrations through the membrane for access doors and mechanical services with minimal modification.

6. Ancillary Systems: The structure shall be designed such that it can be readily retrofitted with insulation systems and other ancillary systems such as lighting, sprinklers, HVAC, provided collateral load factors are taken into account.

7. Alternative Cladding materials: The structure shall be designed such that alternative covering materials such as metal wall cladding can be added with minimal modification, if required (provided collateral load factors are taken into account).

8. Shipping: The main structural trusses shall be standard planar-style trusses which nest tightly together in order to minimize shipping and storage volume.

2.1.3 Design Requirements - Membrane Cladding System

1. Membrane: The roof membrane shall form a weather tight shell over the structural frame. In order to provide for a good finished appearance and to insure weather tightness, the membrane shall be assembled and tensioned, in a manner to minimize wrinkles in hot and cold temperatures.

2. The gable wall membrane cladding shall be manufactured and connected to form one piece to the adjacent end wall and roof cladding.

3. Roof membrane horizontal stretch shall be maintained with horizontal purlins requiring no ongoing maintenance. Vertical stretch shall be maintained with a winch lock system (locked with cotter pins) requiring minimal ongoing maintenance.

4. Each bay shall have an individual fabric panel attached to each truss via a keder system. **The keder system must include a white, leak-proof vinyl cap to seal all extrusion and prevent leaking.**

5. Base Tensioning System: The membrane cladding will be provided with a mechanical tensioning system that allows the membrane to be fully tensioned around the structure perimeter. The system will be designed such that the membrane can be tightly and neatly secured over the structural frame and such that the system has remaining range of adjustment.

6. Membrane Seal at Openings and Base: The Dealer supplying the structure will provide all materials and methods necessary to fully tension and seal the membrane material around all door, ventilation and other openings as well as around the structure perimeter below the main tensioning system. This seal shall provide a neat and finished appearance and eliminate any loose membrane cladding that could otherwise be damaged by flapping or abrasion.

7. **The membrane shall not be designed to function as a structural member** such that, should any damage to or penetrations of the membrane occur, the integrity of the structural framework shall not be affected.

8. The Contractor shall provide drawings and calculations acceptable to the Architect/Engineer of Record, meeting the provisions of the applicable State Building Code. The Contractor shall bear all costs for production of drawings and associated structural calculations. Contractor shall make all revisions and corrections to those documents required for approval and shall resubmit as required to obtain approvals.

9. Successful bidders shall make all required changes or corrections and will deliver to the Owner's Architect all approved drawings and reactions.

2.2 ENGINEERED DESIGN CRITERIA

2.2.1 The structure shall be designed using methodology as per the ASCE 7 standard referenced from the applicable building code. Primary and secondary framing shall comply with current issues of AISC, AISI, NEMA and ASTM specifications, as applicable. Structural members shall be designed using Allowable Stress Design (ASD) or Load Resistance Factored Design (LRFD) for the design loads given below. Appropriate safety factors to yield and ultimate shall be maintained. Wind load factors and coefficients used in design of structural members must be in accordance with the applicable ASCE 7 guidelines.

2.2.2 Snow Loads: The structure shall be designed based upon a minimum ground snow load of **50** pounds per square foot (Psf). At a minimum, the structure shall be capable of supporting a roof snow load of **60** pounds per square foot and a collateral load of 0.25 pounds per square foot projected over the entire roof area or portion of the roof area, and any probable arrangement of loading resulting in the highest stress in the members. (or as prescribed by the applicable building code)

2.2.3 Wind Loads: The structure shall be capable of withstanding a basic wind speed (3-second gust) from any direction of 115 miles per hour. The design wind pressure shall be based on an exposure category of **C** and appropriate wind load factors and coefficients in accordance with the applicable referenced ASCE 7 guidelines. In no event shall the wind load used in the design of the main wind force resisting system be less than 10 pounds per square foot multiplied by the area of the building or structure projected on a vertical plane that is normal to the wind direction (or as prescribed by the applicable building code).

2.2.4 Rainfall: The structure shall be capable of withstanding the effects of rainfall up to 4 inches per hour for at least 2 hours.

2.2.5 Deflection: For safety of specified or future suspended accessories, the maximum allowable deflection of structural members shall be no more than 1/180 of the clear span of that member when subjected to the design loads described herein.

2.2.6 Design Loads: The design shall be based as a minimum on the following design loads. Each member shall be designed to withstand stresses resulting from combinations of design loads that produce maximum percentage of actual to allowable stress in that member as per referenced ASCE 7 standard from applicable building code.

D= Dead Load + Collateral Load
S= Symmetrical Snow or Live Load (Balanced or Unbalanced)
Ws = Wind with internal suction
Wp = Wind with internal pressure
E = Earthquake

2.2.7. Building shall be engineered as Standard Hazard-1.0

2.3 OPERATION AND USE

2.3.1 The main structural frame shall be designed to provide a minimum 15-year operational use period with appropriate inspection and maintenance.

2.3.2 The structure shall be capable of being assembled, operated, and dismantled in all ambient temperatures between -20°F and 120°F.

2.4 MATERIALS

2.4.1 All materials used in the structure shall be new, without defects and free of repairs. The quality of the materials used shall be such that the structure is in conformance with the performance requirements as specified herein.

2.4.2 Cladding Membrane: The structure shall be clad with an **FRU coated polyolefin fabric** manufactured by an approved and reputable supplier with demonstrated long-term performance. The polyolefin membrane fabric shall be waterproof and free from defects. All roofs, walls, end walls and connecting sections shall be weather tight. The material will be selected from the manufacturer's standard colors for the sidewalls and roof panels. The material scrim and coating must be UV stabilized, **fire retardant,** and must carry a minimum ten-year manufacturer's warranty and have a minimum life expectancy of 10 to 15 years. The minimum fabric specification is as follows:

Total Fabric Weight	12.0 oz/yd² (407 g/m²) +/- 5%
Coating Thickness	4 mils average, each side
Finished Thickness	23 mils (ASTM D-5199)
Grab Tensile Strength	360 lbs (ASTM D-751)
Strip tensile Strength	265 lbs/in (ASTM D-751)
Tongue Tear Strength	110 lbs (ASTM D-2261)
Trapezoidal Tear	95 lbs (ASTM D-4533)
Mullen Burst	675 psi (ASTM D-3786)
Cold Crack Resistance	-60 °C (ASTM D-2136)
UV Resistance & Weathering	90% retention after 2000 hr. (ASTM G151)
Flame Spread	5 or less (ASTM E84)
Smoke Developed	58 or less (ASTM E84)
Flame Resistance	2 sec flame (NFPA 701)

Acceptable membrane suppliers include: Intertape, Fabrene, and Hagihara. The membrane manufacturer must demonstrate a minimum of **five** years successful field experience with provision of polyolefin membrane cladding in use on similar or larger size structures of the type contemplated in this specification.

2.4.3 Metal: The main structure shall consist of a welded truss arches with parallel tube chords separated apart by webbing. Truss sections are manufactured and post dip galvanized to insure proper protection on the inside as well as the external surfaces of the truss sections**. All sections must be post dipped galvanized post fabrication to a minimum of CSA G-164 / ASTM A123-09.** Truss will be manufactured of a cold-formed and induction welded modified grade carbon steel, providing a finished tubular product with exceptional mechanical and corrosion resistant properties.

2.4.4 Tolerances: All dimensional tubing tolerances are in accordance with ASTM A500, Section 10.

2.4.5 Tubing shall be manufactured using steel conforming to ASTM A568, ASTM A1011 and G40.21 350W. Finished steel tubing used in the structure must have the following minimum structural and mechanical properties based on standard ASTM A500:

ASTM A500 Grade C: Tension Ultimate: 55 KSI and Yield: 46 KSI
ASTM A500 Grade B: Tension Ultimate: 55 KSI and Yield: 42 KSI
G40.21 350W: Tension Ultimate: 55 KSI and Yield: 50 KSI

2.4.6 All steel flat bar, cross rods and other steel components shall be fabricated from hot dipped galvanized material, meet the stated standards and have the following minimum structural and mechanical properties (ASTM 44W):

Tensile: 50 KSI and Yield: 44 KSI

2.4.7 Corrosion Protection: as per 2.4.3 all Metal sections shall be hot dipped galvanized to a minimum of CSA G-164 / ASTM A123-09. This allows for maximum protection on **all welded surfaces including the interior sections. Flow coat process will not be acceptable (Commonly referred to as inline galvanizing).**

2.4.8 Hardware:

1. Bolts: Bolts subject to extreme stress and wear shall be structural bolts of Grade 5 and plated / galvanized that has been upgraded with a corrosion resistant topcoat finish. All bolts shall be installed and securely torqued so as to prevent change in tightness. Those subject to removal or adjustment shall not be swaged, peened, staked or otherwise installed.

2. Membrane Tensioning Hardware: The fabric membrane shall be tensioned with load rated hardware which is plated/hot dip galvanized so as to prevent corrosion.

Hardware shall allow full and free rotation at the foundation connection to avoid fatigue failure of threaded assemblies.

3. Membrane Tensioning Webbing: The membrane shall be tensioned with load-tested tie-downs.

4. Cable Assemblies: Main and wind bracing cable assemblies shall be manufactured to the required length and press swaged with metal sleeves. The cables are manufactured using preformed 7-19 stainless steel cables, sized with appropriate safety factors.

3/16” dia.	=	4,200 lbs.
1/4" dia.	=	7,000 lbs.
5/16” dia.	=	9,800 lbs.
3/8” dia.	=	14,400 lbs.
1/2" dia.	=	22,800 lbs

5. Other Fasteners: Non-structural fasteners such as wood screws, Tek screws, etc., shall be of standard commercial quality

6. Exterior Trim: The aluminum alloy used in the extrusion shall meet or exceed 6063-T6.

2.4.9 Piece marking and Identification: All individual parts or bundles and packages of identical parts are to be clearly marked for identification. Bolts, nuts, washers and fasteners shall be packaged according to type, size and length. Shipping documentation shall include a list showing the description, quantity and piece mark of the various parts, components and elements.

2.4.10 Material Delivery: The building system materials shall be delivered to the project site during normal working hours on weekdays. Installation contractor will provide adequate workmen and equipment to promptly unload, inspect and accept material delivery.

2.4.11 Handling: The installation contractor shall be responsible for unloading, field storage, protection and transfer to the work area of all materials and equipment required to perform the work. At no time shall materials be dropped, thrown or dragged over the transport equipment or the ground. Damage to any piece under its own or superimposed weight shall be cause for repair or replacement.

2.4.12 Short, Damaged or Excess Materials: Installation contractor shall inspect, count and verify quantities based on the shipping documents.

PART 3

3.1 REFERENCES AND STANDARDS

3.1.1 The following publications are for the standards listed below but referred to within the document by basic letter designation only. They form a part of this specification to the extent referenced thereto:

a. American Institute of Steel Construction (AISC):

S326-78	Design, Fabrication and Erection of Structural Steel Buildings
S329-85	Structural Joints Using ASTM A325 or A490 Bolts.

b. American Iron and Steel Institute (AISI)

SG 503-76	The Design of Fabrication of Cold-Formed Steel Structures

c. American Society for Testing and Materials (ASTM):

A 36-89	Structural Steel

A 123 A-89	Standard Specification for Zinc (Hot Dip Galvanized) Coatings on Iron and Steel Products
A 307-89	Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength
A 325-89	High-Strength Bolts for Structural Steel Joints
A 500 A-90	Standard Specification for Cold Formed Welded And Seamless Carbon Steel Structural Tubing in Rounds and Shapes
A 563 Rev A-89	Carbon and Alloy Steel Nuts
A 687-89	High-Strength Non-Headed Steel Bolts and Studs.

d. American Society of Civil Engineers (ASCE) Minimum Design Loads for Building and Other Structures. Latest edition as required by State Code.

ASCE 7-02	American Society of Civil Engineers
ASCE 7-05	American Society of Civil Engineers
ASCE 7-08	American Society of Civil Engineers

e. American Welding Society (AWS)

D1.1-2004	Structural Welding Code-Steel
D1.3-98	Structural Welding Code-steel sheet steel

f. National Fire Protection Association

NFPA 701-89.1	Standard methods of Fire Tests for Flame Resistant Textiles and Films. Small and Large Scale Test.
NFPA 701-96	Standard methods of Fire Tests for Flame Resistant Textiles and Films. Test Method 1 and Test Method 2.

END OF SECTION