

The vast majority of tension structures available today have frameworks fabricated of either steel or aluminum. The manufacturers of aluminum structures generally use either extruded I-beams or rectangular shaped box sections as their main support members. RUBB, the world's largest manufacturer of steel frame supported tension structures, utilizes lightweight lattice trusses for all main arch members. We believe that the RUBB design offers a superior value to aluminum structures based upon several important factors:

CODE COMPLIANCE - All RUBB building range products are engineered strictly in accordance with building code requirements for wind, snow, and seismic loads. For structures sold in the US market we follow ANSI A58.1, Minimum Design Loads for Buildings and Other Structures, and apply loadings to our steel framework based upon accepted engineering principles. Other structure manufacturers sometimes claim that forces will be negligible due to aerodynamic shape or steep roof pitch. Based upon these then design the members without any safety factor to yield. RUBB's overall system safety factor is 1.7 to yield for snow and 1.25 for wind loading combinations.

The types of design assumptions made by some aluminum structure manufacturers and subsequent load reduction taken are not supported by building codes. As such, many aluminum structures which claim to comply with building regulations simply do not.

COMPONENT WEIGHT - Galvanized steel has approximately three times the density of aluminum. Given this many people assume that a RUBB structure will be substantial heavier and therefore more difficult to assemble than an aluminum structure, this is not necessarily true.

First, let's assume that a RUBB building and a comparable aluminum building are designed to the same code standards. For all practical purposes this means that loads applied to the structural frameworks will be similar.

Second, let's choose a method of comparison. For example, a good measure of the strength of a structural member is it's section modulus. The

section modulus of our 65' span BVC range truss is approximately thirty eight (38) cubic inches and the steel tubing we use is high strength with a 50 KSI minimum yield strength.

Most aluminum structures are manufactured with 6061-T6 grade aluminum which has a minimum yield of 26 KSI. Thus to obtain the same strength as our steel truss, the aluminum beam must have a section modulus of nearly fifty three (53) cubic inches. To achieve this modulus would require a 10" x 14" x 5/16" thick rectangular tube or a 10" x 10" wide flange beam with a 3/8" thick web and 9/16" thick flanges.

Third, let's compare the actual weights of these sections:

RUBB GALVANIZED STEEL TRUSS:
15.9#/linear foot

10" x 14" x 5/16" ALUMINUM TUBE:
17.4#/linear foot

10" x 10" ALUMINUM WIDE FLANGE BEAM:
16.9#/linear foot

Thus for sections with equal strength, RUBB's galvanized steel trusses are actually lighter than comparable aluminum beams. Additionally, RUBB's truss will exhibit significantly lower deflection under loading than will the beam sections, a factor which is critical when interfacing mechanical and electrical equipment with the structure.

LATERAL BRACING - Many aluminum structures have minimal numbers of bracing purlins and are structurally stabilized by their tensioned membranes. The term "structurally stabilized" implies that if the fabric covering is damaged, the structural integrity of the design is compromised.

RUBB structures do not rely in any way on the fabric covering membrane for structural support. Our trusses are structurally stabilized by steel frames, steel tubes and diagonal bracing cables. These members complete the framework of our structure and provide an excellent means for erecting the structure with minimal support equipment. They also provide ready made attachment points for lighting, electrical and mechanical equipment.

CORROSION RESISTANCE - Aluminum is excellent material in terms of resistance to corrosion. However, the hot-dip galvanized finish of RUBB's steel structural fabrications has excellent

corrosion resistance as well. In fact, galvanizing to ASTM A123 specification will give steel a maintenance free life in excess of twenty years in all but the harshest environments. When considering steel's residual strength, ease of repair, ready availability and cost, and it's corrosion resistance when galvanized, we feel steel is a superior material to aluminum.

FABRIC QUALITY - All RUBB buildings over forty feet in span are clad with PVC coated polyester fabrics weighing no less than twenty four (24) ounces per square yard. These materials have a minimum base fabric weight of five (5) ounces per square yard, grab tensile strengths in excess of 350 lbs./inch and tongue tear strength in excess of 190 lbs. The material is self-extinguishing when removed from a flame source and is treated to resist ultraviolet light.

PVC coated polyester fabrics are generally considered to be superior to both laminated and nylon materials on the basis of coating quality and dimensional stability. The expected lifetime of the PVC coated fabric materials we use is in excess of fifteen years. We can obtain pro rata manufacturers warranties up to ten years if required.

SPACE UTILIZATION - Most aluminum structures have curved sloping sidewalls and round ends. RUBB building are more conventional in appearance, have vertical side and endwalls, and are rectangular in shape. The RUBB design offers maximum cube utilization and a minimum overall building "footprint" for a given storage area requirement. The design of RUBB's gable end

walls allow the structures to be supplied or easily retrofit with virtually any type of conventional door system. We believe that this design is the most compatible with the space usage needs of our customers.

EASE OF INSTALLATION - Most RUBB buildings can be erected at a rate of thirty five square feet per person hour with minimal need for support equipment. The structure can be erected safely and effectively by unskilled personnel working in conjunction with RUBB's installation manual or a trained supervisor. Disassembly can be accomplished approximately thirty percent more quickly.

The design of RUBB buildings is more "conventional" than that of most aluminum tension structures. Given this, assembly of RUBB buildings is general quite simple for those with even minimal construction experience.

CONCLUSION - Listed above are many of the reasons why we feel that RUBB's galvanized steel tension structures are superior to those fabricated from aluminum. We strongly urge prospective customers to compare the relative features of our products versus those of our competition.

- A) Have an independent structural engineer review our structural calculations vs. theirs.
- B) Visit one of our buildings and one of their comparably sized and designed buildings.
- C) Compare material quality and also price.
- D) Compare the facts.

Our experience is that when comparisons are fairly made, people choose RUBB.

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