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AWNINGS | CABANAS | CANOPIES | UMBRELLAS

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PURPOSE

- SHADING
- WEATHER PROTECTION
- IDENTIFICATION
- AESTHETICS

STYLES

- CONCAVE
- CONVEX
- DOME
- ELONGATED DOME

OPTIONS

- OPEN OR CLOSED ENDS
- DECORATIVE ARMS
- RIGID OR LOOSE VALANCES
- BACKLIT
- GRAPHICS
- ANY SIZE OR COLOR

USES

- STORE FRONTS
- WINDOWS
- ENTRANCES

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PURPOSE

- SHADING
- WEATHER PROTECTION
- AESTHETICS

STYLES

- STANDING SEAM
- SHEET METAL
- CORRUGATED
- C-CHANNEL

OPTIONS

- POWDER COATED
- ANY SIZE OR COLOR
- VARIOUS TYPE ROOFS (WHITE MESH, PERFORATED METAL, MESH FABRIC, ETC.)

USES

- STORE FRONTS
- WINDOWS
- ENTRANCES
- SHIPPING AREAS
- RETAIL/COMMERCIAL/ INDUSTRIAL

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PURPOSE

- SHADING
- WEATHER PROTECTION
- IDENTIFICATION

STYLES

- GABLE STYLE
- STANDARD PATIO
- ENTRANCE CANOPY
- FREE STANDING

OPTIONS

- FABRIC
- METAL
- ILLUMINATED
- RIGID OR LOOSE VALANCES
- GRAPHICS
- ANY SIZE OR COLOR

USES

- STORE FRONTS
- ENTRANCES
- VALET PARKING
- OUTDOOR STAIRWELLS
- AUTO DETAILING
- OUTDOOR DINING

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PURPOSE

- SHADING
- WEATHER PROTECTION
- AESTHETICS

STYLES

- PRESIDENTIAL
- EXECUTIVE
- CUSTOM

OPTIONS

- RIGID OR LOOSE VALANCES
- PRIVACY CURTAINS
- SHEER CURTAINS
- ANY SIZE OR COLOR
- FAN & LIGHTING MOUNTING BRACKETS
- VENT TOP

USES

- POOL SIDE
- RESTAURANT
- SPA
- OUTDOOR DINING

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PURPOSE

- SHADING

STYLES

- CABLE SUSPENDED
- TRAVERSING TRACK
- RETRACTING
- LOUVERS (STATIONARY)

OPTIONS

- MESH FABRIC

USES

- PATIO/OUTDOOR DINING
- LARGE ASSEMBLY AREAS
- POOL AREAS
- COMMERCIAL / SCHOOLS

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Section 1: GENERAL DESIGN CONSIDERATIONS

The major elements of an awning-system design are:

Purpose
Style, configuration, color
Size and fit
Economy
Safety: egress & fire
Stability
Anchorage
Strength
Drainage & Ponding
Graphics
Fixed vs. moveable

PURPOSE

What is the functional objective of the awning – shading, weather protection, identification or aesthetics?

STYLE, CONFIGURATION, COLOR

Most awnings and canopies consist of fabric stretched over and secured to a fixed metal frame that is secured by laces or screws. These frames may be welded, bolted or otherwise connected. Other awnings and canopies that consist of individual fabric panels can be stapled to a groove in the face of an extruded aluminum, fixed-frame element. Still other awnings and canopies consist of rollers and lateral arms that can be retracted manually or automatically.

SIZE AND FIT

The size of an awning is determined by its length, width and projection from the building to which it is attached. Other aspects of size include clear height (underneath), rise (pitch) of roof and post or rafter spacing. These features are usually important to those involved in the planning and review process.

The fit of an awning is determined by the interfacing of its frame with other connecting structures (most often building, but frequently the ground or a concrete slab on the ground). In the case of a building, it is important to coordinate the appropriate parts of the awning frame with structural members in the building so that loads are transmitted properly.

ECONOMY

The economy most directly affects customers and awning contractors. It is clear that an awning system should not have to meet the same code requirements as a high-rise building. However, in most cases, a code does strictly apply. In rare cases when it expressly required, there is still a moral and legal obligation to install an awning that can withstand any foreseeable loads.

To develop an economical awning system, the designer must understand how to arrange, size and connect structural members so that foreseeable loads will be transmitted to its supports while incorporating safety factors, without over-engineering the system.

The awning industry and building and code officials should develop a working relationship to better understand each others' needs. In addition, the industry members' active involvement in implementing code changes is very important. The objectives should be to assure public safety and to avoid needless, expensive over-design.

Sound economical design does not necessarily result in the lowest first cost.

Diagram 1: Awning Designs

Standard

Custom Ends

Concave

Custom Concave

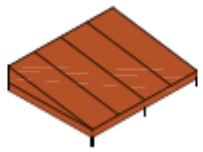
Dome

Convex

Custom Convex

Elongated Dome

Gable Style Canopy



Standard Patio Canopy

Entrance Canopy

Diagram 2: Scallop Styles

Large Regency

Small Regency

Continental

Contemporary

Ritz

Small Wave

Parisian

Roman Key

Large Wave

Waldorf

Greek Key

Egyptian

SAFETY: EGRESS AND FIRE

Except in rare cases, this is not a significant issue with modern awning and canopy systems. In most cases, frame materials are non0combustible, and fabrics are flame-retardant. However, this point should be ascertained whenever appropriate, such as for enclosed walkway canopies and enclosed patio canopies.

The answer is not necessarily to require fire doors and sprinklers for these systems. But the building official does have the right (indeed the obligation) to design systems that provide an open, safe and quick exit to the outside.

STABILITY

The average designer may have a concept of how beams and posts work structurally. But to design a safe structure, one must fully understand stability issues. A structure comprised of simple beams mounted on the top of simple posts is inherently unstable. This means that the structure is susceptible to falling down because the number, arrangement and method of connection of the members.

Common post and beam structures, such as pole barns are rendered stable by the addition of siding, roofing, “x”-bracing and fixed cantilevered footings.

Fabric has no in-plane stiffness; therefore, it does not replace, in an awning or canopy, the function that siding or roofing performs as in a pole barn. This in-plane stiffness, which is instrumental to the development of stability, can usually be supplied by triangulation of structural members.

Examples of triangulation are demonstrated as follows:
The important lesson to learn here is that substituting larger beams or posts for smaller ones doesn’t solve the problem of stability.

ANCHORAGE

This involves the location, style and strength of connections from the awning or canopy to the building or to it foundations.

Proper design of this element assumes recognition of the amount of force occurring, and the direction in which this force acts, at the connection at the time that the maximum design load occurs on the frame.

Most common types of connections involve bolt-through, expansion anchors, wood lag screws and adhesive anchors.

Bolt through connections are preferable, when they are feasible, because the bolt and the nut are manufactured to controlled specifications, and there is a wealth of data on the strength provided by such a connection. Such connections are not generally subject to site questions that are often associated with other types.

Expansion anchors are sued to fasten awnings to concrete surfaces. They develop their essential strength by pressing hard against the side of the drilled hole in which they are set. This pressure results in high frictional resistance to pull-out. While these kinds of anchors have been in successful use for a long time and may be well-manufactured, their use requires more good judgment than the use of a simple bolt-through solution. Obviously, when fastening to concrete surfaces, expansion anchors may be the only practical choice.

Wood lag screws are tapered to a point and do not utilize nuts. These are not as sound as bolt-through connections because they are subject to pulling out as the wood surrounding their threads crumbles or chips. Their strength, then, is proportional to the hardness of the wood in which they are embedded. In many awning applications that require fastening to wood framing, bolt-through connections are not possible and wood lag screws may be the best available option.

Adhesive anchors have been made available in recent years to provide the awning installer a way to address field situations in which the preceding anchor types are not suitable. Examples of such conditions are veneer brick surfaces and fasteners located close to corners, where the high pressures associated with expansion anchors will raise the risk of being pulled out.

ANCHORAGE (cont.)
Adhesive anchors are bonded directly to the substrate by filling an oversized drilled hole, which contains the threaded fastener, with an epoxy adhesive. This system does not rely on pressure. A certain amount of cure time may be required before the anchor can be loaded.

When anchoring awnings and canopies, the awning contractor is often attaching to existing structures (building's wall, roof, foundations, slab, etc.). Responsibilities for assuring that these structures are safe for the additional loads imposed on them must be properly coordinated.

Proper anchorage is the single most important structural quality of an awning design.

STRENGTH
After a stable configuration has been established for an awning design frame, members should be chosen for strength consistent with the amount and type of stress imposed on them. The most common types of stress are tension, compression, bending and shear.

A common misconception about awnings is that they are safe as long as they don't fall down. All code and engineering standards have long required that a safe design use members that are 1.67 to 2 times stronger than the yield strength required to satisfy the actual design stress. The yield strength is the strength at which the material no longer fully recovers to its original shape when the load is removed; the yield strength is usually significantly lower that the ultimate strength. Thus, it can be immediately recognized that a "safe" structure is stressed well below its breaking strength when in is exposed to its maximum design load.

DRAINAGE AND PONDING
Provisions must be to drain water off an awning or canopy. Fundamentally, this involves establishing a steep enough pitch, properly spaced bows or rafters, as well as maintaining a taut fabric, so that draining water or melting snow cannot cause the fabric to sag and collect water on the surface. Lack of proper attention to this detail can result in potentially large forces on the frame and anchors.

GRAPHICS
The overall success of a commercial awning may hinge on the design of its graphics. Local codes and ordinances may dictate the size and other characteristics of this feature.

FIXED VS. MOVEABLE
A fixed awning's frame cannot be deployed from a stowed position and vice versa. A moveable awning can be stowed against the building to which it is attached. The standard lateral arm/retractable awnings and horizontal bow awnings are examples of a moveable awning.

Section 2: BENEFITS OF AWNINGS AND CANOPIES

Fabric awnings and canopies can meet various design needs. Many modern fabrics are long-lasting, bright easily cleaned, strong and flame-retardant. Modern frame materials offer a high strength-to-weight ratios and corrosion resistance. The proper combination of these properties can result in safe, strong, economical and attractive products.

WEATHER PROTECTION

These systems afford protection from the sun, rain, snow, sleet and hail. In certain configurations, they can also protect from wind.

IDENTIFICATION, ADVERTISING

Applying graphics directly to awning fabrics provides identification and/or advertisement without the need for “add-on” sign structures.

ARCHITECTURE

Creative designers and architects can develop useful and intriguing designs for modern awning and canopy systems that incorporate shape, light, color, texture, graphics and structure, at modest cost. Most awning frames are custom made by cutting, bending and welding metal tubing, and fitting the fabric to the frame. With these custom methods, almost any shape and size can be attained and covered with awning fabric.

Hence, the same surface can serve at least three necessary functions: weather protection, identification and architecture.

Section 3: DESIGN LOADS

Loads for which awning and canopies may need to be designed can be categorized as follows:

DEAD LOAD

This is the self-weight of the awning or canopy frame, fabric and hardware. This load must always be included with other design loads since it is always acting on the structure. For instance, if one were designing an awning for 20 psf snow load, and the structure itself weighed 2 psf, then the design for show should actually account for 22 psf total load.

WIND LOAD

This load, as well as snow load, is usually the most critical loads on awnings and canopies. Important aspects of wind load are:

A. Speed or Velocity
Basic wind pressure is a function of its speed. Basic wind pressure (psf) can be computed as the product of 0.00256 times the square of the wind speed (mph). It can be readily observed then, for example, that the wind forces on an awning are four times greater if the wind speed is doubled, and the forces are nine times greater if the wind speed is tripled. Design wind speeds are generally shown on maps published in the building code. Local codes may require higher design wind speeds.

B. Exposure
This is a general category for the amount of protection from the wind that is afforded by the surrounding environment. Structures located in wooded areas, for instance, do not have to de designed for as much wind force as a structure located in an open area.

C. Gusts
These are short-term excursions of velocity above the steady design velocity, which must be accounted for in the design.

D. Drag, Lift
Drag is the wind-induced pressure toward the fabric surface, and lift is the pressure away from the fabric surface. Wind forces on an awning system act in different directions (toward or away from the fabric surface depending on a variety of factors). When designing an awning frame, all these factors must be taken into account.

E. Return Period
This term is used to describe the time interval which is the basis for establishing the required design wind speed. For most applications the return period is 50 years. This simply means that the required design wind speed is that which has a 0.02 statistical probability of occurring once in 50 years. Loss and safety experts have determined that it is an acceptable level of risk and have based code design requirements on it.

SNOW LOAD

Required design snow loads are established by maps published in the building code. As in the case for wind, sometimes local requirements are more stringent. On the other hand, in many localities there is no requirement for snow load design. Check with the local department of building and safety.

Some important considerations about designing for snow are:

A. Ground Snow
The beginning point for snow design, this is the pressure of the designed snow load occurring at ground level.

B. Exposure
A categorization of the amount of protection afforded by the surroundings. Interestingly, the exposure factor works opposite of the way it works for wind. Whereas a wooded environment would result in a lowering of the wind forces on a structure, a wooded environment would result in higher snow loads than an open environment would.

SNOW LOAD (cont.)

C. Flat Roof Snow Load

This is the design load occurring at the actual roof level, and results from factoring the ground snow load by coefficient accounting for exposure and height. Many times the flat roof snow load can be as little as 0.6 or 0.7 times the ground snow load; the actual design pressure required for an awning may be as little as 12 psf.

D. Drifting

Building codes require that the phenomenon of drifting snow be accounted for in the design of roofs; this includes awnings and canopies. While it is beyond the scope of this publication to discuss this in detail, the effects of drifting snow can be significant. The codes describe the procedure for designing with snow drifting in mind.

E. Return Period

See discussion under Wind Load.

LIVE LOAD

These are loads associated with the forces related to human occupants, furniture, equipment, etc. Since these loads are moveable, the love load stipulation is an allowance for the most severe anticipated condition or case. Common code requirements for roof live loads are from 12 to 20 psf. Provided that the case of ponding water is properly addressed, live loading is not a practical requirement in the design of awnings. Some codes do not require love load design, and others greatly reduce the requirement.

PONDING

Addressed elsewhere in this publication, this is a potential load on an awning or canopy and must be addressed in one of several ways:

A. Design for ponding must be taken structurally.
B. Keeping the fabric properly supported and taut will avoid the problem.
C. Remove snow before it melts and ponds water.
D. All the above.

SEISMIC LOAD

These are loads due to earthquakes or earth tremors. The design process for earthquake loads is also too elaborate to be included in this publication.

However, awnings and canopies tend to fare well in earthquakes for the following reasons:

A. They are lightweight; lightweight structures do not have a lot of mass, therefore, relatively small seismic forces are likely to be developed. F=ma.

B. They are generally small, secondary structures. Compared to the structures to which they are attached, which are subject to significant destructive forces due to their large mass, these structures are relatively unaffected. F=ma. Although seismic design requirements are not rigorously pressed in geographical areas not significantly affected by earthquakes, most model codes contain the provision in current editions.

Section 4: CHOICES OF MATERIALS

The range of modern materials available for awning or canopy designers is impressive.

The following is a brief overview of the more popular choices for fabric and framing in the industry:

FABRICS

Modern awning fabrics come in roll widths that range from approximately 30 inches to 84 inches and weigh from 9 ounces to 22 ounces per square yard.

Popular fabric types are:

- Vinyl laminated or coated polyester
- Vinyl laminated polyester
- Vinyl-coated, polyester or polyester/cotton
- 100% woven acrylic
- Vinyl laminated or coated mesh
- Acrylic, vinyl or resin-coated polyester or polyester/cotton
- Acrylic-painted cotton or polyester/cotton
- Woven natural and synthetic fabrics

Some of these fabrics are heat-sealable, which results in a water-tight joint (assuming that the fabric itself is water-tight).

Other properties of interest to the designer are:

- Colors
- Warranty
- Water repellency
- Mildew resistance
- Graphics acceptance
- Light transmittance
- UV resistance
- Flame resistance
- Wick resistance

FRAMING

Steel Pipe – This material can be characterized as a relatively thick, round section of mild steel, with manufactured foot lengths up to 24'-0". It is easily welded, bolted and threaded, and is adaptable to many shop environments. It is heavy and functional, but not necessarily highly aesthetic.

Steel Tubing – Steel tubing is similar to steel pipe, but available in a range of wall-thickness and shapes, including round, square and rectangular. It is easily welded or bolted, and can be obtained in higher strengths that steel pipe.

High-Strength Steel Tubing – This is cold-worked, thin-wall steel tubing that is available round, square and rectangular shapes. Popular sizes are under 2 inches. High-strength steel tubing normally is furnished with corrosion inhibiting surface treatments. It is also easily bent to designer shapes, relatively light weight and easily welded.

Aluminum Pipe – Manufactured with the same dimensions as steel pipe, it weighs only one-third as much. On the other hand, it is only one-third as stiff as steel pipe. Temper is lost at welded joints, which reduces its strength.

Aluminum Tubing – This is available in a wide variety of shapes, sizes and tempers, with an array of advantages and disadvantages in comparison to steel.

Staple-On Extrusions – Aluminum tubing is extruded into cross-sections that are used top connect fabric panels to the face of the tubing. Connections are made by stapling the fabric inside a groove that is filled with a pressure-installed weather strip/trim piece.