EN-FOLD
TECHNICAL DESCRIPTION

UNI-SYSTEMS

KINETIC ARCHITECTURE

The En-Fold is a fully automated, motorized covering system that is engineered to behave as a true tensile membrane structure, with configurations capable of withstanding winds up to 90 mph and snow loads up to 30 psf provided the structure and collateral framing is properly designed and installed. While originally conceived as an overhead retractable covering, the En-Fold can also be configured in a variety of vertical applications, such as wall panels or facades. The En-Fold's simple, clean and strong modular design allows it to be feasible for use in a wide variety of locations, such as restaurants, shopping centers, residential homes, stadiums, or other gathering spaces.

The En-Fold mechanization equipment consists of a toothed belt drive that acts as both the means of extension of the fabric and final tensioning device of the membrane. The toothed belt circulates around an arrangement of pulleys. As the motor turns, it circulates the toothed belt and moves the driving carriage back and forth along the internal guide ways of the drive beams. The drive beams also serve as the primary support members and act as the enclosure for the mechanization system. The leading edge beam that lays perpendicular to the primary support member is attached to the bottom of the driving carriage. This leading edge beam is also attached to the leading edge of the fabric membrane. Additional idler beams lay parallel to the leading edge beam and are spaced at intervals based on the custom size of the unit. The structural fabric membrane is divided into long strips that are attached to the idler beams by means of a keder edge retained in a continuous gripper edge in the leading and trailing edges of the idler beams. The edges of the fabric panels are cut with a catenary curve and have a small diameter stainless steel cable hemmed into the edge. As the driving carriage is tensioned by the toothed belt, the catenary cables in the ends of the fabric panels are tensioned, thus producing tension in both directions in the fabric membrane. This tensile strength gives the fabric its capability as a true structural element. As the fabric membrane is attached to the idler beams by means of the keder edge tangent to the top edge, it allows water to flow unobstructed over the tops of the idler beams when the En-Fold is in an inclined position. The En-Fold must be inclined sufficiently to drain water in the desired direction to prevent ponding. The entire En-Fold structure is supported by attachments at each of the primary support members. These attachment details vary according to the site and the surrounding supporting structure.

The En-Fold size can range from a minimum of 25' x 35' to 100' x 400', or greater, in a single unit. The En-Fold membrane fabric can be selected based on the unit's function, life cycle and budget. The unit's control system can be customized from a simple, push-button design to a human machine interface (HMI) operator PC with a full online help system and diagnostic program. The control system can also be integrated with intelligent building automation systems.

The En-Fold is powered by linear drives housed within extruded aluminum drive beams. Each drive will have a 3/4HP to 1HP, 3 phase, 240 volt electric motor equipped with an absolute encoder and a variable frequency drive (VFD).

The VFDs for each of the units will be mounted in local control panels located near each of the linear drive motors.

The En-Fold system can be controlled with a hand-held wireless remote or at an operator control station (OCS) located in a secure location on the premises. It is imperative that with these two modes of operation the operator will have clear view of the En-Fold system and its motion. The operator station will be in a lockable covered cabinet with a momentary open, a momentary close, and a stop button. Also available will be LED indicator lights to advise the operator of system status.

The system will have variable speed control and the linear drives will be synchronized through system monitoring of the absolute encoders located at each motor.

Upon initiating a deployment cycle, the leading edge beam will begin movement. As the En-Fold system reaches its fully extended position signaled by the encoders, the VFD's will slow the motors and the programmable logic controller (PLC) will monitor the torque value of each VFD and stop each linear drive and engaging the motor brake as its desired torque value (i.e. fabric tension) is reached, ensuring a uniformly tensioned membrane structure.

Upon initiating a retraction cycle, the leading edge beam will begin movement. When the En-Fold system reaches full retraction, the system will shut down based on encoder counts from the absolute encoders at each of the motors.

The En-Fold control system can be customized with several options which include building management system tie-in, fire or smoke detection tie-in and anemometer tie-in.

The building management system tie-in allows the En-Fold system(s) to be operated and monitored along with other building systems by a single control system from a central location.

The fire/smoke detection tie-in allows the En-Fold to automatically retract upon detection of smoke or flame within the building and depending on the jurisdiction can eliminate the need for sprinkler system beneath the En-Fold.

The anemometer tie-in enables the En-Fold system to automatically retract in wind conditions with maximum 3-second gusts of approximately 30 mph.