

# On-Farm Equipment Efficiency Improvements

## Greenhouse Energy/Shade Screens



### Introduction

Greenhouse energy/shade screens are a mechanical system consisting of a drive motor, shade/energy material, support cables and controls to provide energy savings and/or cooling or day length control in a greenhouse. (sometimes referred to as curtains, blankets or shades).

This practice is installed to reduce energy usage and promote better plant growth. Energy savings of 30% or more are possible.

This practice applies:

- In greenhouses that are heated during the fall, winter and spring.
- In greenhouses where excessive temperature during the spring, summer and fall affects plant growth.
- In greenhouses plant production where day length control is needed to regulate growth and flowering.

This standard does not apply to detailed design criteria and construction specifications for systems in individual greenhouses.

### General Specifications

Plans and specifications for energy/shade screen systems shall be in compliance with this specification guide and follow good engineering practice. Specific specifications for each project shall include the equipment and materials to be used and show details of how the edges of the screen are to be sealed.

### General Criteria

The system shall meet the International Building Code (IBC) and the National Fire Protection Association Code (NFPA).

Select the shade system based on the intended use: energy savings, shade (cooling), day length control or a combination of these.

The system shall be either gutter-to-gutter (screen pulled flat across the greenhouse at gutter height) or truss-to-truss (screen pulled between adjacent trusses).

Screen materials shall be polyester, polyethylene or composite fabrics. Select the screen material for its ability to fold compactly and for functional life. Screen material for production greenhouses shall have firebreaks. Material for retail or institutional installation shall be flame-retardant.

Provisions shall be made in system design and screen material to handle moisture that condenses or drips from overhead. This can be either porous screen material or a sloped screen system.

Stainless steel wire or fire-retardant monofilament line shall be used for support of the screen material.

The system shall be installed to minimize the amount of shade created by the screen in the storage position.

### Heat Retention Screen

Design the system for maximum heat retention by trapping the heat, reducing the volume of the greenhouse that must be heated and reflecting the radiant heat back to the inside.

When closed, the system shall have a tight seal around the perimeter to eliminate heat escaping to above the screen.

The screen material shall be ultra-violet light stabilized and close weave.

### Shade Screen

Design the system to provide uniform shade over the growing area.

The shade material shall provide adequate shading on bright sunny days.

Select open weave (perforated or open strips) when the greenhouse has an open roof or when it is cooled with roof vents. This allows the heat to escape through the screen material when the curtain is closed.

### Blackout Screen (Photoperiod control)

Design the system to exclude at least 99% of incident light.

The seal between the sidewall screen and the overhead screen shall exclude all light.

When summer temperature reduction is desired, use screen materials with a black/white composite with the black as the lower layer and white or aluminized material on top to reflect light.

### Sidewall Screen

Sidewall screen systems shall be designed for energy conservation, blackout or for both.

The drive system can be either a roll-up system which raises and lowers the screen by rolling the material around the tube or a drop down system which uses a set of pulleys and cables to raise or

lower the top edge of the curtain. Drive systems may be either manual or electric gear motor.

The screen shall form a tight seal around the edges.

### Considerations

Systems with multiple levels should be installed to increase heat retention or provide for multiple uses such as energy savings and shading.

Electrical wiring, water pipes, fuel supply pipes, light fixtures, etc. may have to be moved to provide an open area for the screen movement.

The screen material should be above heaters, circulating fans, heat supply pipes, fin or pipe radiation and supplemental lighting fixtures.

It is desirable to have the greenhouse empty when installing a screen system to allow movement of man-lifts and materials.

### Operation and Maintenance

An operation and maintenance (O&M) plan shall provide recommended guidelines for the system. Periodic maintenance items include:

- Repair of screen material tears
- Check for tightness of edge seals
- Adjustment of support cables
- Adjustment of limit switches
- Lubrication of bearings and rack and pinion drives

### References

*Energy Conservation for Commercial Greenhouses*, Northeast Regional Agricultural Engineering Service, NRAES-3, 2001.

*Standards and Guidelines - Curtain Systems*. National Greenhouse Manufacturer's Association.