

## Orion® Glass Solar Filters



**DANGER!** Viewing the Sun through any optical instrument without a correctly inspected and installed solar filter can cause immediate, permanent eye damage and blindness!

*Solar viewing is safe only if you understand the potential dangers and follow all directions. Read these instructions carefully and save them for future reference. Do not allow children or inexperienced adults to use the telescope or solar filter unattended.*



**DANGER! DANGER!** Always use a solar filter AND a light shroud when observing the Sun with a Truss Tube telescope! A solar filter will protect your eye and the telescope when you are pointed directly at the sun; but if the telescope is pointing slightly off axis (off-target), direct/unfiltered solar energy could be focused on interior portions of the telescope.

**DANGER! DANGER! DANGER!** Always cover your telescope if you leave it outside during the daytime! An open telescope, of any design, can burn the telescope or surrounding areas if an unfortunate alignment of the telescope and the sun occurs; any telescope will concentrate sunlight to very high temperatures.

### Mounting the Solar Filter

The inside of the filter cell will either be lined with foam tape or unlined, depending on the telescope or binocular it has been designed to fit. The filter should fit just tight enough to keep from slipping off when the telescope or binocular is pointed down. If your filter is too loose, it can be custom fitted by applying the supplied foam tape inserts on the inside rim of the cell. On some models, you may need only one insert to achieve a snug fit. On others, more than one may be required. The filter should not fit too tightly or the optical surfaces may be distorted due to stress on the cell.

Orion solar filters also feature three equidistant nylon set screws that, when tightened, ensure a secure fit to the telescope or binocular being used to observe solar activity.

**NOTE:** Do not solely rely on the nylon thumbscrews to keep your solar filter safely installed. If your filter is too loose, please use the supplied foam tape inserts to create a friction fit. The nylon thumbscrews have been provided as a “lock-down” safety feature which should be used in addition to the foam lining.

### Using the Solar Filter

1. Check the filter's optical surfaces for any possible damage before each use. The view through your telescope should be comfortable and not appear excessively bright. Stop looking immediately if the view is excessively bright.
2. Check for any pinholes. Even one bright pinhole could degrade the image quality. See “Inspection & Maintenance.”
3. Keep the front of any finder scope covered if it is not equipped with a solar filter. Better yet, remove the finder altogether when observing the Sun. An uncovered finder scope is dangerous to look through. Even if you do not look through it, unfiltered sunlight may melt internal parts of a finder scope.
4. ALWAYS use a light shroud and a solar filter if you are using a truss tube telescope.
5. Aim the telescope at the Sun by moving your tube assembly until the smallest shadow is cast on the ground.
6. Allow the telescope and filter to equalize to outside temperature for at least 15 minutes.
7. Direct sunlight may warm the tube assembly enough to cause internal heat currents that can degrade image quality, especially on dark-colored telescopes. Cover the tube assembly with a light-colored cloth to help avoid this.
8. If possible, do not view over pavement or buildings. Viewing over grass will help avoid surface heat currents.
9. Point the telescope away from the Sun before removing the solar filter! Removing the filter while the telescope is aimed at the Sun is dangerous if anyone is looking into the eyepiece, and can damage the telescope if left pointed at the Sun for too long.
10. “Ghosting” may occur with some compound telescopes, such as Schmidt-Cassegrains, which incorporate larger secondary mirrors in their design. If this is a problem, simply tilt the filter slightly to move the “ghost” outside the field of view.

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### **Cleaning the Solar Filter**

As with all optics, clean the filter only when absolutely necessary. Clean only with isopropyl (rubbing) alcohol and soft tissue (lens tissue or plain white tissue). Apply a generous amount of alcohol to the tissue and rub lightly across the front surface using long strokes. Allow alcohol to bead and puddle on the surface (10-30 seconds). Lightly wipe dry with fresh tissue. If filter is excessively soiled, or streaking occurs, repeat the procedure. **Do not clean the back surface of the filter!** Since the coating is on the back side of the glass facing the telescope it will rarely, if ever, need cleaning if handled carefully and kept sealed when not in use. The front surface can be cleaned often without danger of harming the coating. Loose dust on the inside surface can be blown off or lightly dusted with dry cotton.

### **Inspection & Maintenance**

Pinholes and scratches are common in all glass solar filters. Microscopic particles on the glass can not be completely eliminated in the coating process, and a minute amount of light transmitted through the resulting "pinholes" will be visible. Normal usage of the filter will reveal new pinholes and may also introduce small scratches.

Every effort is made to minimize pinholes in the manufacturing process. The glass is cleaned and coated three times in the coating process, meaning that the coating is even across the entire aperture and most pinholes will not be entirely transparent.

A few minutes spent occasionally touching up any brighter pinholes will prevent any possible "ghosting" due to scattered light. Opaquing of the pinholes should be done on the inside coated surface with a fine-point "permanent" felt marker.

Although it would never be necessary with our filters, as many as 20 touch-ups per inch of aperture could be done without loss of resolution or significant loss of brightness.

All filters are tested for safety before shipment. There is no danger if a few small pinholes or minor scratches are present, although we recommend opaquing all visible ones. The opaquing procedure will not lessen the optical performance. Light loss is not a problem since only about 1/1000th of 1% of light is transmitted anyway!

### **Solar Photography**

By attaching a camera body to a telescope, in effect using the scope as a telephoto lens, you can take striking photographs of the Sun. Only attempt this if the telescope is equipped with the proper solar filter.

Solar filters are coated to a neutral density of 5, which reduces the light about 100,000 times. Depending on the aperture and focal length of your telescope and "seeing" conditions, you will need to experiment to find the best exposure time for your equipment.

Do not be discouraged if your first attempts at solar are less than desired. The Sun is very difficult to image because of poorer "seeing" conditions caused by unavoidable heat currents associated with daytime viewing. The highest possible resolution for any land-based telescope, regardless of location, is about 1 arc second. Ideal seeing for any location will be available less than 5% of the time. It may be some consolation to consider that your results could equal those at professional observatories, as larger apertures and location have little, if any, advantage. During bad seeing conditions, it may help to "stop down" apertures over 5" with an off-axis mask.

## **One-Year Limited Warranty**

This Orion product is warranted against defects in materials or workmanship for a period of one year from the date of purchase. This warranty is for the benefit of the original retail purchaser only. During this warranty period Orion Telescopes & Binoculars will repair or replace, at Orion's option, any warranted instrument that proves to be defective, provided it is returned postage paid. Proof of purchase (such as a copy of the original receipt) is required. This warranty is only valid in the country of purchase.

This warranty does not apply if, in Orion's judgment, the instrument has been abused, mishandled, or modified, nor does it apply to normal wear and tear. This warranty gives you specific legal rights. It is not intended to remove or restrict your other legal rights under applicable local consumer law; your state or national statutory consumer rights governing the sale of consumer goods remain fully applicable.

For further warranty information, please visit [www.OrionTelescopes.com/warranty](http://www.OrionTelescopes.com/warranty).

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