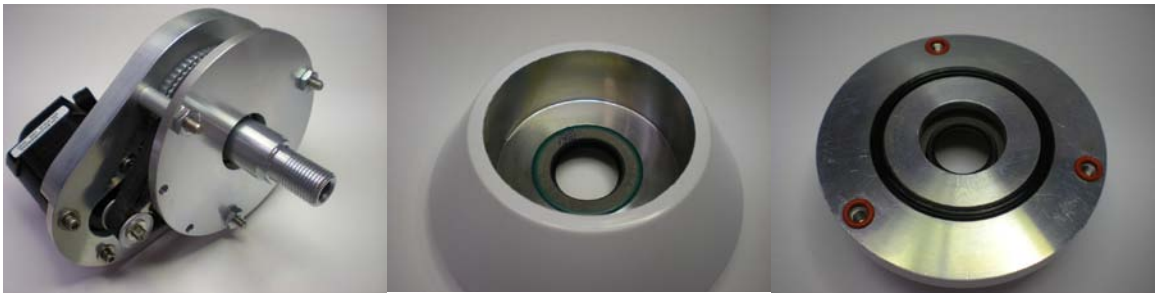
Dry as a Bone – How the Sidewinder Camera Gets It's IP67 Rating

One of the primary challenges of building an outdoor camera is trying to ensure that no water, moisture or dust is able to enter the camera enclosure and cause premature failure of the electrical, mechanical or optical components. Analyzing every nook and cranny that could allow moisture to enter the camera and then engineering an effective solution requires a little creativity and sometimes a little counter-intuitive engineering to achieve the best possible seal performance. Let's take a look at the various water entry points and the sealing solutions that allow the Sidewinder to be able to be immersed in 1 meter of water for 30 minutes and still remain bone dry inside.

Window Glass – Sealing the viewing window glass presents a bit of a challenge, as two materials with different temperature coefficients of expansion must be joined together. A silicone adhesive with a moderate Shore A hardness of 30 and a -60C

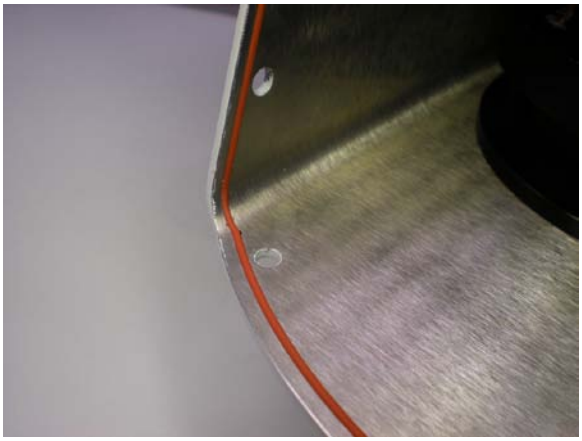
to +205C temperature rating was selected. This allows the glass and aluminum components to expand and contract without placing undue stress on the seal interface. Note the shallow groove around the edge of the glass. This groove prevents shear force from delaminating the adhesive from the aluminum surface.

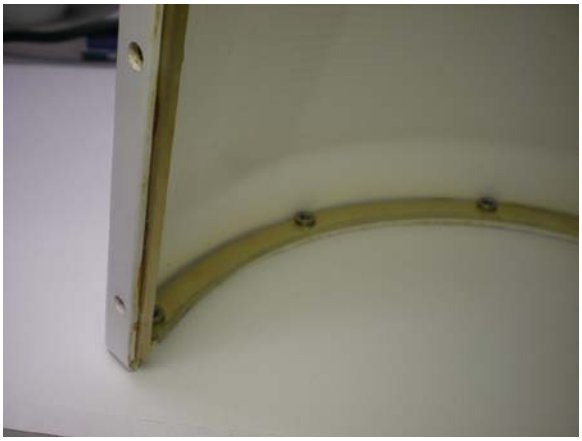
Front and Back Plate to Camera Tube Seal – Sealing the window face plate and the rear plate to the camera housing tube is accomplished using -45C to +120C temperature rated, Shore 65 hardness o-ring seals. The o-rings are greased with a -40C to +95C temperature rated silicone lubricant to provide an air tight and water tight seal. The o-ring seals mate with the precision machined surfaces on the inside front and inside rear of the camera housing tube.



Tilt Shaft to Tilt Seal Housing – The tilt seal housing incorporates five different seals to provide an air and water tight interface between the tilt drive assembly shaft, the main housing plate and the camera housing tube. Wide temperature range seals and wide temperature range silicone lubricants are also used in this assembly to provide the highest possible performance. The tilt drive shaft seal will withstand a 10 PSI pressure differential without leaking over the full -34C to +74C TS-2 temperature range. The four o-ring seals provide an air and water tight interface between the tilt drive seal housing and the main assembly plate of the Sidewinder.

Pan Shaft to Pan Seal Housing – The pan drive seals are arranged and perform in a manner similar to the tilt drive seals.





Cover to Main Plate Assembly – Sealing the Sidewinder cover to the main plate assembly was the most difficult of the design challenges in making the camera capable of achieving an IP67 water immersion rating. Since the length of the edges that need to be sealed is fairly long, a highly reliable method needed to be developed. Also, a method for applying the high joining force was required to be developed. Several gasket designs were tried until the current design shown was found to offer excellent performance. Instead of a wide gasket, which would intuitively seem to offer the best sealing performance, a narrow o-ring style gasket was found to offer much higher sealing pressures along the gasket ridge sealing surface, as the force of the cover screws holding the cover to the plate is concentrated into a much smaller surface area than it would be with a wider gasket. Aluminum reinforcement strips were added behind the flanges of the cover assembly to allow a much higher mounting force to be applied to the cover screws, ensuring a better seal. A special screw sealing compound is also used to prevent water ingress around the screws.

Power Supply Base Seal – The power supply base seal was actually pretty straight forward to implement. Since the main camera base structure is very heavy duty, large bolts could be used to apply the force necessary to get a highly reliable seal. A special laser cut gasket is used to seal both the mounting rim and the mounting bolts.

Bottom Egress Cable Seal – A water tight integrated cable seal and strain relief was used to seal the cable exit point on the bottom of the camera. A silicone sealant is used to seal the strain relief to metal housing joint. The strain relief provides a water tight seal around the cable itself.

Flying Cable Seal – The connector end of the flying umbilical cable must also be sealed, to prevent water from entering either the camera or the attached umbilical cable hanging down from it. The inside of the connector assembly is

potted with an electrically compatible silicone sealing compound to prevent any water from entering the cabling system.

Sealing all of the various potential water entry points in a camera with moving parts is a much more challenging enterprise than it is for a fixed camera. It was necessary to develop several different approaches to solve all of the unique material interfaces that resulted from the operational requirements of the various components. In the end, though, it is very satisfying to be able to immerse the camera entirely under 3 feet of water and know that it is completely protected from any potential water damage.

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