

# INJECTION MOLDED SUB-ASSEMBLY WITH ELECTRONICS

## APPLICATION

General industry: Smoke/Fire  
detection unit

## MATERIALS

UL94V polycarbonate (Makrolon®)  
Thermoplastic vulcanates (TPV)  
Silicon rubber  
Closed-cell foam  
SAE 304 stainless steel  
C360 brass

## MANUFACTURING PROCESSES

Injection molding

- Molded in brass and stainless steel components
- Optically clear molding (light pipes)
- TPV molding (round seals, button, test port)

Compression molding

Machining (screw machine, knurling)

Stamping

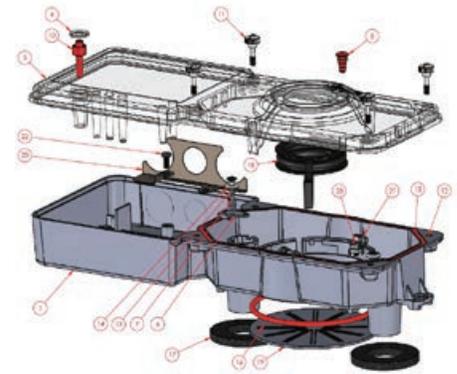
Die cutting

Wire harness (purchased)

Assembly

- Attached components (pressed in, fastened, glued)
- Electrical connection (sequenced, connected, torqued)

## Smoke Detection Housing Unit



**Challenge:** A leading manufacturer of fire safety equipment was experiencing warping issues with one of its smoke detection housing units. The warped housing unit, which was being manufactured in their company-owned factory in China, wasn't sealing properly and was negatively impacting the performance of the smoke detector. If the unit, which is used in heating/cooling ducts in large industrial-style buildings and stadiums, isn't 100 percent air tight, it can't accurately measure the amount of smoke particles in the ducts and provide adequate warning should a fire occur.

Besides addressing the warping issue, molding and manufacturing of the housing unit posed additional challenges:

- The company already possessed a UL certificate, so the part needed to be manufactured to exacting design specifications and from optically clear polycarbonate for the upper half and a specific gray shade of polycarbonate for the bottom half.
- The light pipe areas needed to be optically clear, completely free of any bubbles or voids that would interfere with the visibility of the warning lights.
- The unit included patented terminals, threaded inserts and connectors molded into the upper and lower halves to provide the reliable connection conductivity needed for the wire sequence.
- Proprietary clips and a silicone baffle with very tight tolerances were specified for the air-tight seal.

## Smoke Detection Housing Unit

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### REQUIRED TESTING

Material certification (UL, ASTM, SAE)  
TPV physical properties (durometer)  
Electric function/conductivity  
Leakage (artificial smoke)

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### TOLERANCES

#### *General Tolerances*

- Linear  $\pm 0.015$  in
- Angular  $\pm 1^\circ$

#### *General Dimensioning & Tolerancing (GD&T)*

- Position within 0.25 mm
  - Flatness within 0.25 mm
  - Perpendicular within 0.25 mm
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**Solution:** To meet the very specific UL product files, UGS worked with a long-time, trusted supplier to develop and validate a proprietary injection molding and assembly process for the housing unit. This process included custom tooling to ensure all air was evacuated from the light pipe areas of the upper half, resulting in an optically clear molding. It also involved molding in various electrical components. Because we specialize in sub-assemblies that include electrical components, we were able to implement a reliable molding process that incorporated brass and stainless steel terminals, threaded inserts and connectors into the unit. Due to sourcing difficulties, we also formulated a custom colorant to match the approved gray tone for the bottom half of the unit.

An extremely important part of the process was the cooling method. We tested various cooling techniques until we validated one that routinely produced units with proper flatness, without cracking or warping.

Final assembly involved securely attaching a silicon rubber gasket to create an airtight seal and adding a hardwired wiring harness from a sub-supplier. We developed testing procedures for each step in the sub-assembly process, including the connections, sequencing and screw torque.

Lastly, we worked with our logistics partners to develop and validate reliable shipping materials and methods to prevent warping or other damage during ocean transit.

Through all of these challenges, UGS managed the entire process seamlessly. Moreover, we were able to manufacture the parts to the specified quality standards, the requested delivery timeline and at a competitive price point.