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Case History # 2006-4

Corrosion

Injection Molding

This customer makes valves for use with corrosive or harmful materials. These parts are large, thick-walled and made from C-PVC. Large parts necessitate a long cooling cycle which can lead to degradation of the resin waiting to be injected. C-PVC is very shear sensitive and tends to degrade easily if over heated and then can stick to the screw. Sticking material burns and when released into parts leads to porosity and defects.

About 5,000 to 6,000 parts are made in a production run and then receive a post-mold machining step to complete fabrication. It is during this final step that porosity and defects are discovered. The customer estimates the scrap cost from degradation at \$60,000 to \$70,000 per year.

Their standard screw is hard faced with double and triple chrome to combat corrosive hydrochloric (HCL) acid that results from degraded PVC. Chrome is porous and HCL can penetrate to the screw surface and weaken the chrome bond. An aggressive cleaning procedure can roughen the screw surface and further loosen poorly bonded chrome.

A rough screw surface leads to material build up resulting in to polymer degradation and finally increased scrap. Scrap rates for this process vary between 15% and 30% depending on part size and the quantity of parts produced. Their standard procedure is to remove and clean the screw before beginning this process and then to purge regularly during production to reduce build up on the screw.

A 71 mm general purpose screw was coated with 0.010" (0,125 mm) of XC4000 Chromium carbide. The screw surface was polished to a 16/32 (0,4-0,8 Ra) mirror finish. A first production run of the largest part with the highest scrap rate occurred in August 2006. Of 6,000 parts produced, only 60 were found to have defects or porosity. This is a 1% rate compared with the 15%-30% previous rate. (The actual scrap rate dropped to ½% when 15 parts that had been initially rejected were found to be acceptable).

The initial results are very encouraging. Machine utilization is much improved, post-mold machining is reduced, material costs are less and overall operating costs are lower and more predictable.