

Polymer Optics Ltd.

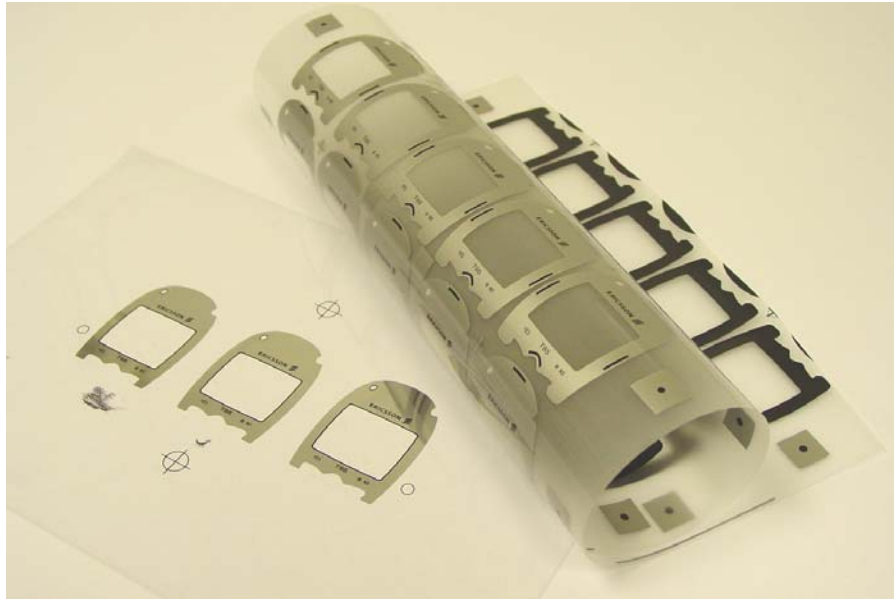
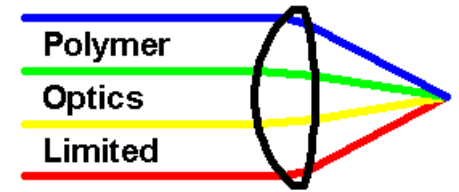
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In-Mould Label Development
for
Optical Product Enhancement

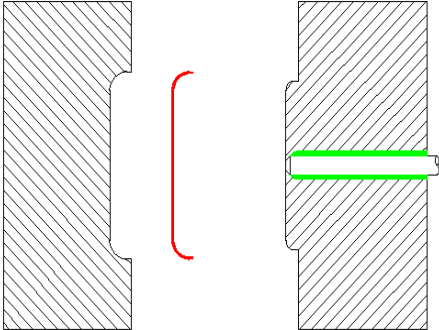
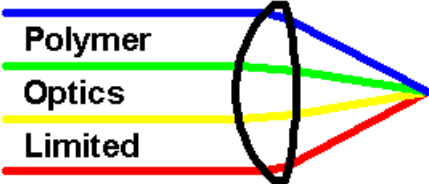
In-Mould-Labeling (IML)

Typical Label Components for IML

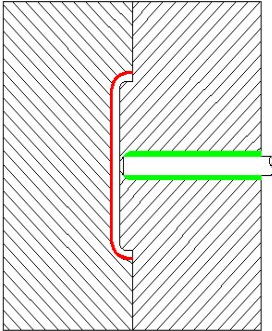


In-Mould-Labeling (IML)

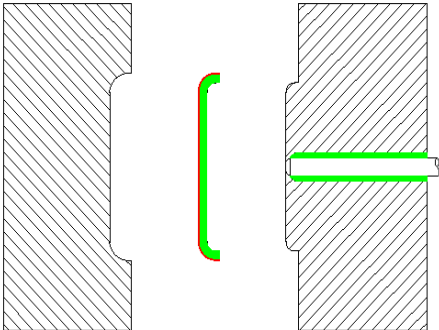
Direct Feed Injection Moulding



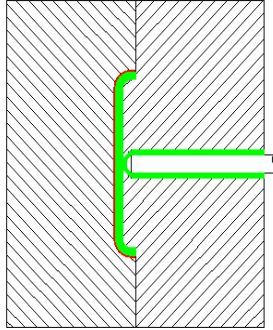
Label is robot placed in tool



Tool closes to retain label



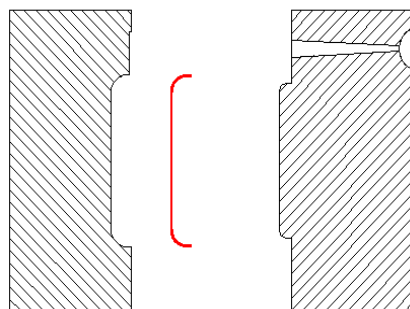
Finished component is ejected from tool



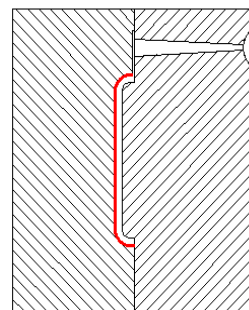
Melt is injected behind label

In-Mould-Labeling (IML)

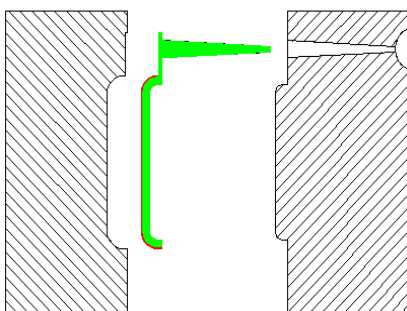
Cold Runner Injection Moulding



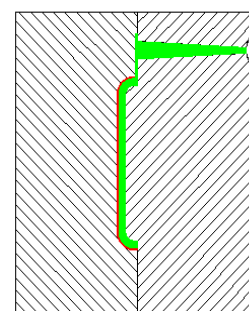
Label is robot placed in tool



Tool closes to retain label



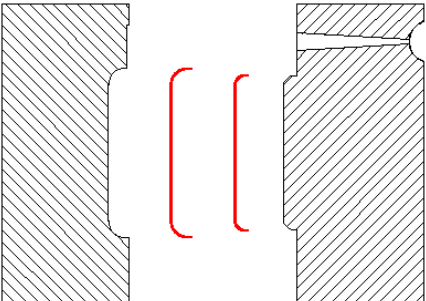
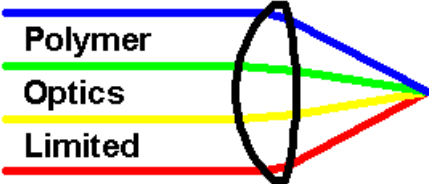
Finished component is ejected from tool and degated



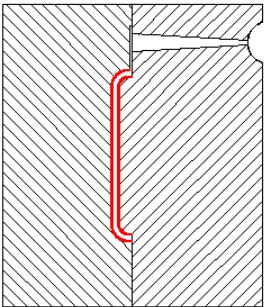
Melt is injected behind label

In-Mould-Labeling (IML)

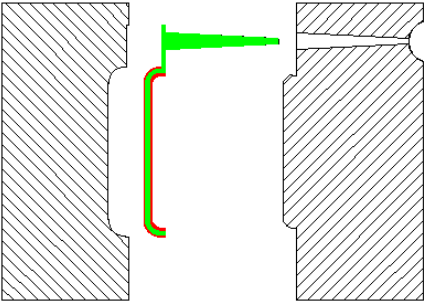
“Twin Labeling”



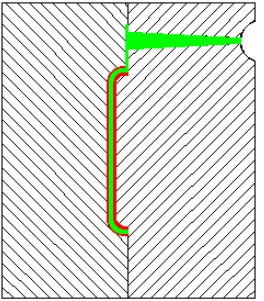
Twin labels are robot placed in tool



Tool closes to retain labels



Finished component is ejected from tool and degated



Melt is injected between labels

In-Mould-Labeling (IML)



Advantages

No operator intervention needed – process can be fully automated with robot handling.

High level of product cleanliness possible due to reduced operator intervention in process.

High production yields of greater than 95% possible.

Multi-cavity tooling possible with 1 to 8 cavities to support a range of volume requirements.

Quick change over between product variants possible for “mass customisation”.

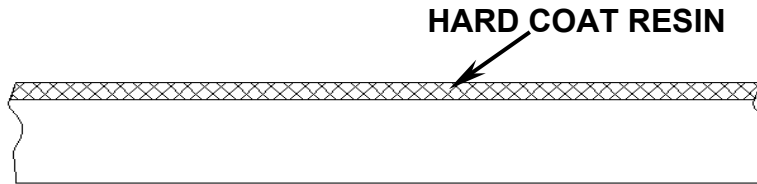
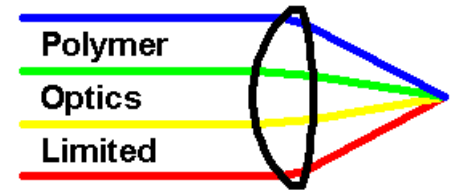
Typical print alignments of around +/-0.1mm possible depending on product geometry.

Disadvantages

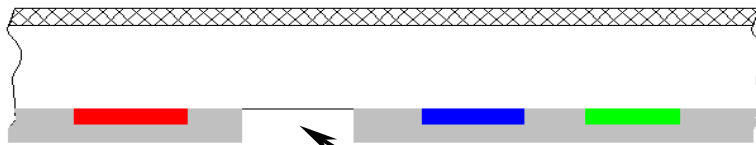
Initial cost of ancillary tooling can be high for complex parts, but easily justified on volume product.

In-Mould-Labeling (IML)

Label Printing



Front surface hard coated on continuous material web

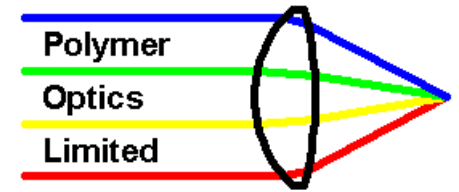


Back face printed with decorations in successive layers of artwork

CLEAR WINDOW AREAS

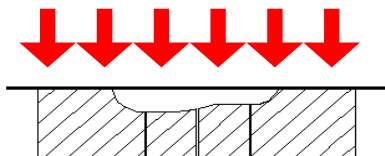
In-Mould-Labeling (IML)

Product Decoration

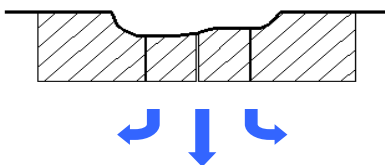


IML for 3D Shaped Parts

Vacuum Label Forming Process



Printed label web is heated from above and placed over forming die



Vacuum is applied through vent holes in the forming die to pull material in to die



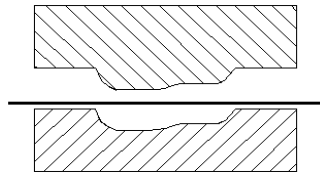
Cooled web is removed from die

Process is typically used for larger or lower toleranced components

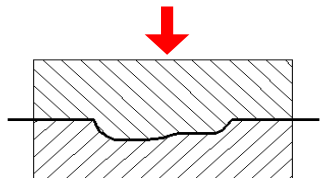
IML for 3D Shaped Parts



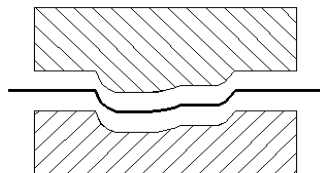
“Matched Metal” Label Forming Process



Printed label web is fed between heated forming die halves



Die halves are closed under high pressure to deform label form



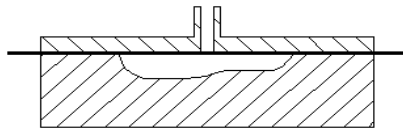
Formed labels are removed from dies or indexed on web

Process can be designed to form and trim labels in one operation

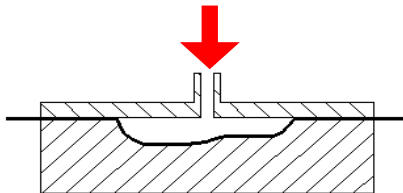
IML for 3D Shaped Parts



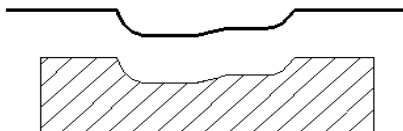
“Niebling” High Pressure Label Forming Process



Printed label web is sealed over the heated forming die



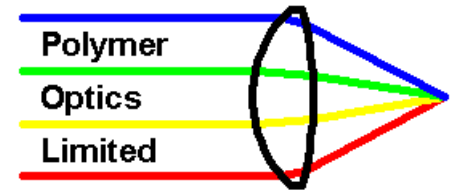
Compressed air pressure is applied above the film to force it into the forming die



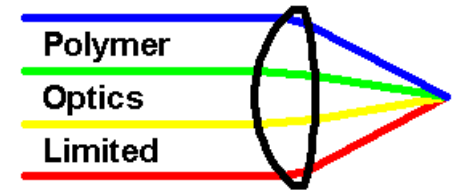
Formed web is removed from the die for cutting
Capable of deep draw depths and minimal print distortion

IML for 3D Shaped Parts

3D Formed Labels



Optical IML Developments



- Mirror metal finishes for decoration
- Metal mirror finishes for optical applications
- “Secret to lit” in metals where windows are only visible when lit from behind
- Advanced AR coatings applied by IML
- Advanced “hybrid” surface technology applied by IML.

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