

# Useful Tips for the Screen Printing and Firing Enamel Colors on Glass Holloware

## **Screens and Squeegee Set-Up**

- Squeegees at rest should be central to the bottle to be printed.
- Snap distance (distance between underside of screen and bottle surface) should be as great as possible, typically 3-4 mm (0.8 in).
- Squeegee pressure should be the minimum required to obtain a clear print. The larger the print area, the lower the pressure recommended.
- Screen temperature should be the minimum required to obtain the desired ink fluidity.

## **Ambient Temperatures/Humidity**

- Glass should be kept dry. Prints onto damp glass can result in migration of parts of the printed image during firing; the ink may also be re-deposited on the reverse of the next screen on the printing machine.
- When ambient temperatures are  $>40^{\circ}\text{C}$  ( $104^{\circ}\text{F}$ ), first and second prints may remain “tacky,” resulting in pick-up of the first printed image on the reverse of the second screen. Specially formulated TP ink systems can be supplied to help overcome these conditions of extreme plant temperature.

## **TP links**

- Avoid overheating of the inks during melting or printing. Extremes of heat can result in evaporation of solvent, leading to a change in the formulation and properties of the ink.

## **LEHR Cycles and Conditions**

- Pre-heat zone must be hot enough to volatilize the medium quickly. Extraction in this zone must be good to remove all volatilized organic material.
- Peak temperature in the firing zone must be sufficient to fully mature the enamel ink.
- Total cycle must be sufficient to anneal the bottles.
- Airflow through the lehr should be in the direction of the entrance to ensure that carbonaceous products of combustion are not present in the firing zone.
- Temperature progression through the zones, from pre-heat to fire zone to the cooling zone, should be as smooth as possible to avoid any rapid changes of temperature. In practice, dampers normally control the cooling zone, and rapid cooling is therefore avoided.
- Total cycle time can range from 80 mins to 2 hrs, depending on the nature of the color and final product.

- Typical cycles would be:

Zone		Temperature (°C)	Temperature (°F)
1	Pre-Heat Zone	390-450	734-842
2	Firing Zone	620	1148
3	"	"	"
4	"	"	"
5	"	600	1112
6	Cooling Zone	500-550	932-1022
7	"	450	842
8	"	400	752
9	"	350	662
10	"	300	572

- For a large mass of glass:

Zone		Temperature (°C)	Temperature (°F)
1	Pre-Heat Zone	300	572
2	"	390-450	734-842
3	Firing Zone	620	1148
4	"	620	1148
5	"	600	1112
6-10	As above	As above	As above