

THE HOT MELT TECHNOLOGY

ADVANTAGE AND COST SAVING

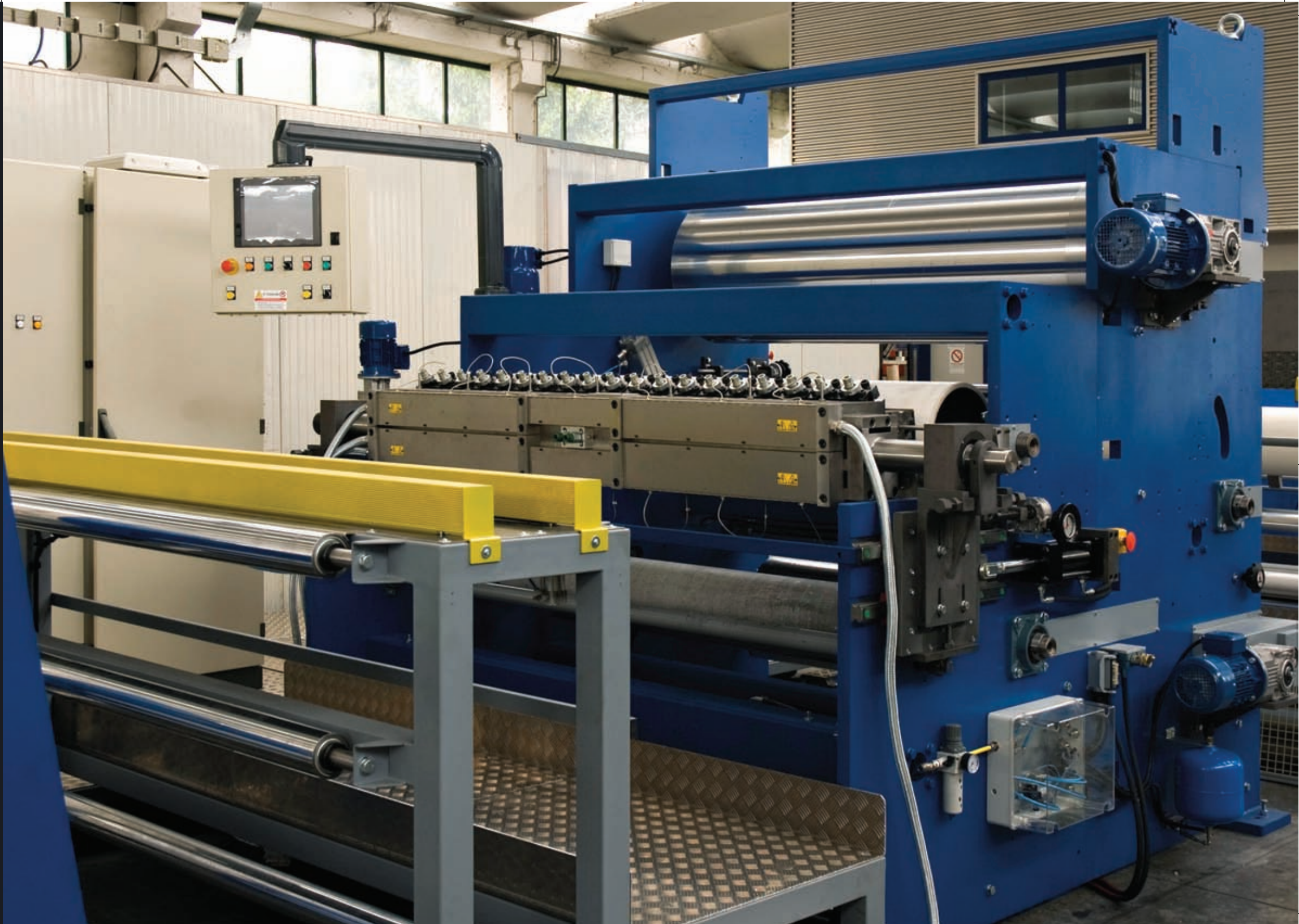
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Functional principle is based on direct application to one input material (fabric, non-woven, foamed polyurethane, leather and P-leather, silicone coated paper, film, etc.) of melting adhesive, reactive Hot Melt (PUR), thermoplastic Hot Melt (polyester, polyamide, EVA, self-adhesives, etc.) suitably liquefied by the melting system associated to the machine.

Afterwards, the support on which the adhesive is applied, is coupled (via calendaring process) with a second material at machine inlet, producing the end product that is sent to outlet.

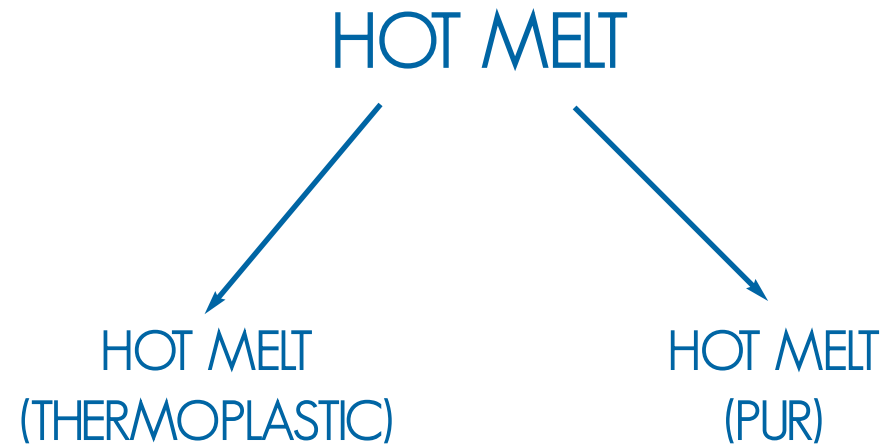
THE HOT MELT TECHNOLOGY



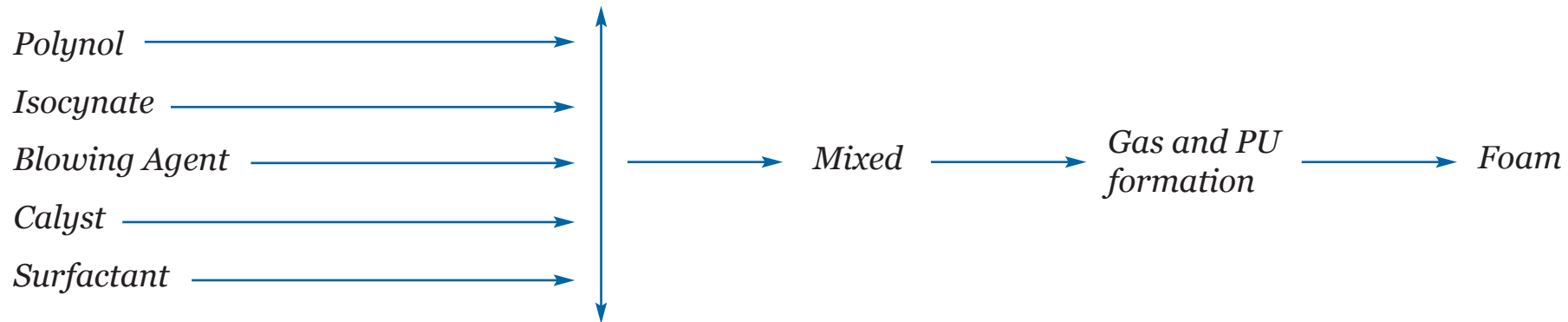
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FOAM PREPARATION PROCESS



BLOWING AGENT: CO₂ (From polyol and isocyanate), CFC-11, HCFC-141b and methylene chloride

SURFACTANT and NUCLEATING: Polymetilsiloxanes

CATALYST: Tert. Amine and Sn Complex

POLYURETHANE FOAMS

POLYESTER FOAMS:

- *higher resilience*
- *higher adhesion*
- *higher price*

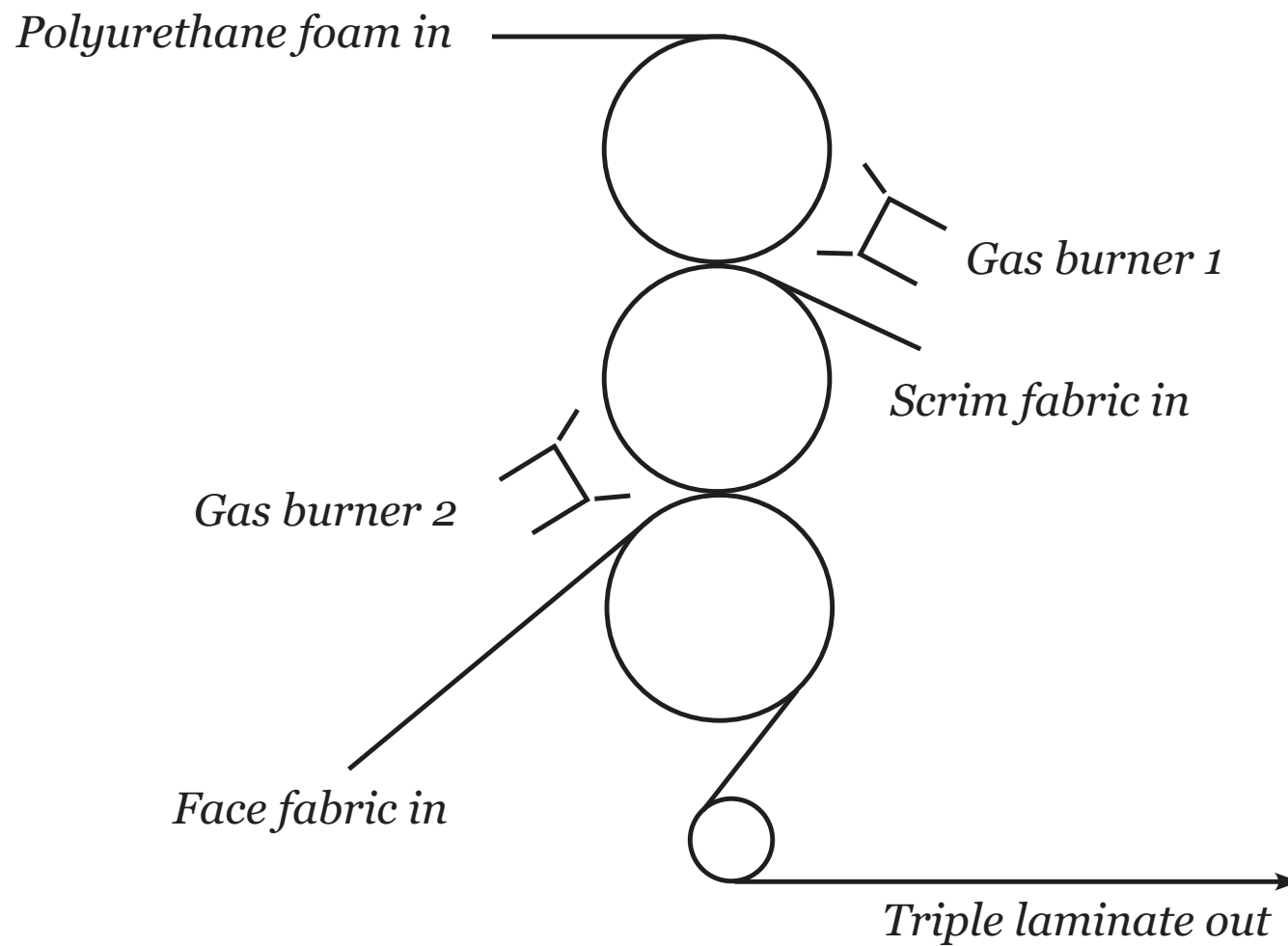
POLYETHER FOAMS:

- *lower properties*
- *lower price*
- *higher chem. resistance*
- *softener grade*

FLAME LAMINATION

- *Old technology (1950)*
- *Use of free flame (liquid Propane)*
- *Melting of PU FOAM and cooling for adhesion*
- *Standard performance*
- *Cheap process*
- *Cheap machine*

FLAME LAMINATION MACHINE



PARAMETERS FOR GOOD BONDING

- **PU Foam density (20-60 kg/m³):**
Higher density means higher adhesion
- **PU Foam chemical nature:**
Polyester gives better adhesion than polyether
- **Thickness of burned foam (2 – 20 mm):**
Same as density
- **Flame Temperature:**
At least 400°C
- **Flame Gas/Air ratio:**
Oxygen is important for total combustion

WEAKNESS OF FLAME LAMINATION

- *Low performance of adhesion*
- *Low resistance to laundry*
- *No resistance to dry cleaning*
- *Pollution: HCFC, Silicons and wrong Gas/air ratio are promoters of CO, Dioxine and CFC*
- *Free flame inside plants*
- *Active Carbon filters and Extractor fan*

FOAM COST IN LAMINATION

PRICE OF BURNED FOAM:

$[Starting\ Thickness\ (m) - Final\ Thickness\ (m)] * width\ (m2) * Density\ (kg/m3) * Price\ (€/kg) = €/lm$

AVERAGE PRICE OF HOT MELT:

$0,0015\ Kg/m2 * 1,5\ m2 * 3,5\ €/kg = 0,079\ €/lm$

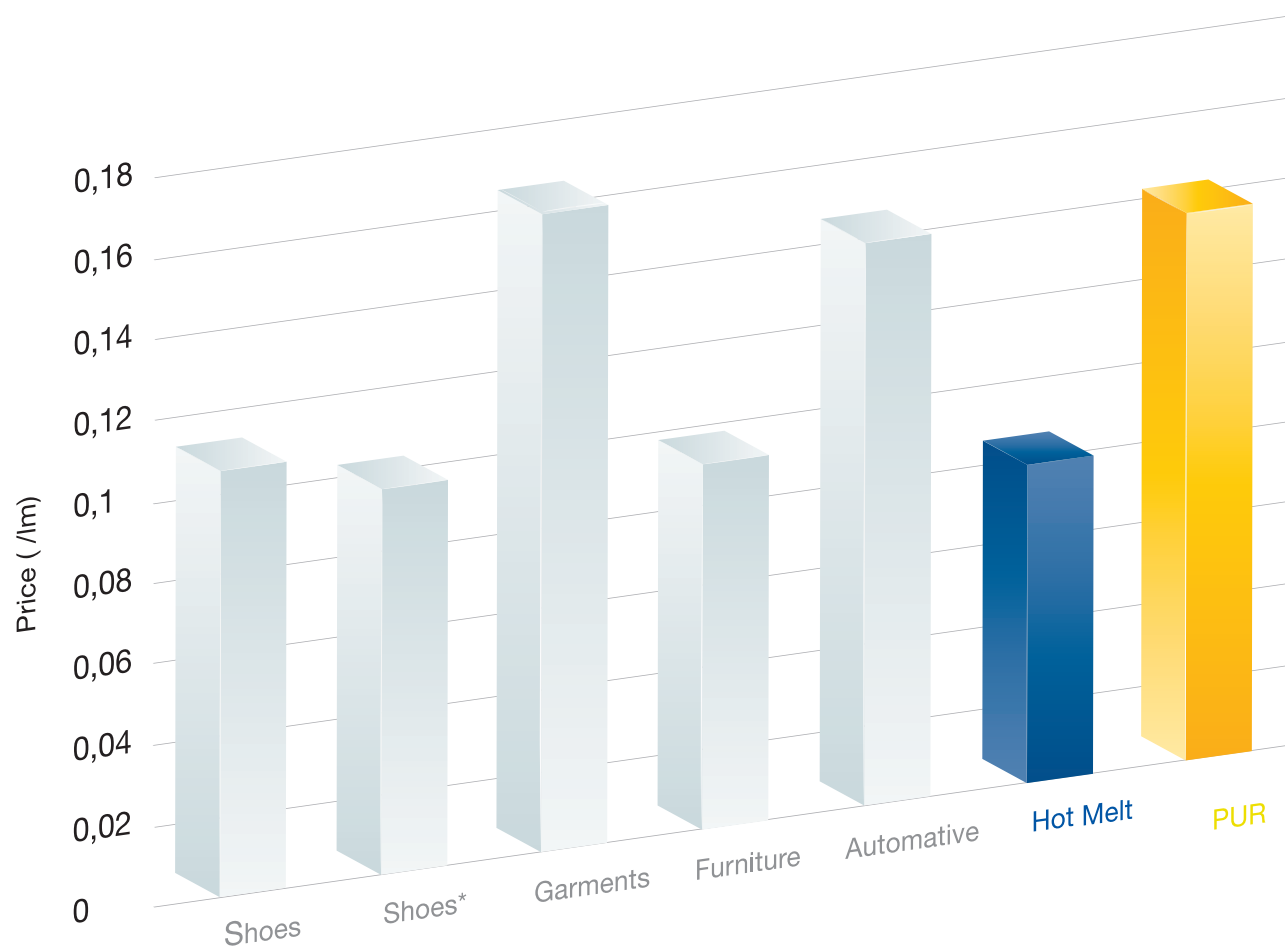
AVERAGE PRICE OF HOT MELT (PUR):

$0,0015\ Kg/m2 * 1,5\ m2 * 6,0\ €/kg = 0,135\ €/lm$

| Application | Grade of Foam | Density (kg/m3) | Starting Thickness (m) | Final Thickness (m) | Difference (m) | Width (m2) | Burned Weight | Price (€/lm) | Price of PU burned (€/lm) |
|-------------|---------------|-----------------|------------------------|---------------------|----------------|------------|---------------|--------------|---------------------------|
| Shoes | Polyester | 20 | 0,0035 | 0,002 | 0,0015 | 1,55 | 0,0465 | 2,6 | 0,1209 |
| Shoes | Polyester | 21 | 0,003 | 0,0015 | 0,0015 | 1,5 | 0,04725 | 2 | 0,0945 |
| Garments | Polyester | 24 | 0,0017 | 0 | 0,0017 | 1,55 | 0,06324 | 2,5 | 0,1581 |
| Furniture | Polyester | 40 | 0,003 | 0,0025 | 0,0005 | 1,55 | 0,031 | 2,9 | 0,0899 |
| Automotive | Polyester | 60 | 0,003 | 0,0025 | 0,0005 | 1,55 | 0,0465 | 3 | 0,1395 |

FLAME LAMINATION IS NOT ALWAYS A CHEAP PROCESS

HOT MELT VS FLAME: COST



HOT MELT VS FLAME: PERFORMANCE

Hot Melt has not any weakness against flame lamination.

Hot Melt (PUR) has only the disadvantages of green tack against flame lamination.

| | Hot Melt (PUR) | Hot Melt | Flame |
|--------------------|----------------|----------|-------|
| Bond Strenght | ***** | **** | *** |
| Thermic Resistance | ***** | *** | *** |
| Steaming | ***** | ** | ** |
| Washing | ***** | *** | ** |
| Dry Cleaning | ***** | * | * |
| Green Tack | ** | **** | *** |
| Pollution | **** | **** | ** |
| Chem. Resistance | ***** | ** | ** |
| Lamination Speed | **** | **** | **** |

HOT MELT VS FLAME: PLANT COST

Flame machine produce intensive ground noise

Fan and filters of flame unit must be cleaned/changed very often

Price of Machine

- *Flame machine : 80 – 120 T€*
- *Rotogravure machine : 200 – 250 T€*
- *Slot Die machine: 250 – 350 T€*
- *Retrofitting of a flame machine: 150-180 T€. Expensive.*

Cost of maintenance

- *PUR: 0,5 hours/day for cleaning*
- *Flame: Efficiency of Extractor fan and Carbon filters.*

Potential of daily production

- *Flame 8000 m/Day*
- *Rotogravure 6000 m/day*
- *Slot Die 9000 m/day*

COST SAVING

Polyether cost 25% less of polyester grade at the same density

With Hot Melt we can use lower tickness and polyether foam!

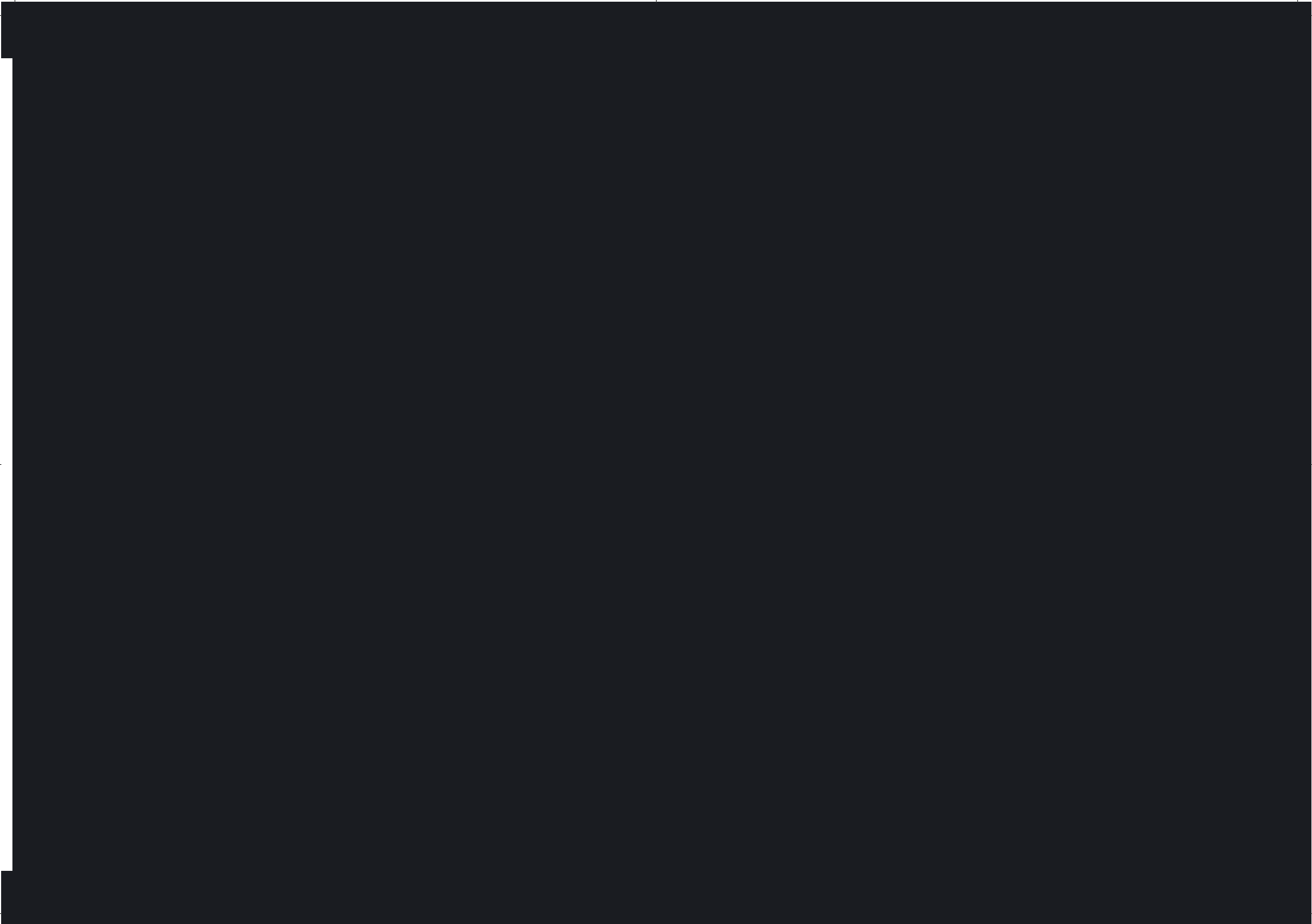
| | Start. Tickness (mm) | Final. Tickness (mm) | Cost (€/Kg) | Density (kg/m ³) | Rolls Lenght (m) | Width (m) | Price of rolls | Price of 1m |
|------------------|-------------------------|-------------------------|----------------|---------------------------------|---------------------|--------------|----------------|-------------|
| <i>Polyester</i> | <i>3</i> | <i>2,5</i> | <i>4,8</i> | <i>60</i> | <i>430</i> | <i>1,5</i> | <i>200</i> | <i>0,47</i> |
| <i>Polyester</i> | <i>2,5</i> | <i>2,5</i> | <i>3,6</i> | <i>60</i> | <i>520</i> | <i>1,5</i> | <i>150</i> | <i>0,29</i> |

- *Saving in cost of PU foam = 25%*
- *Saving in thickness = 15% s*
- *Saving in warehouse cost = 15%*

CONCLUSION

- *Expectations of customers could be totally fulfilled from Hot Melt technology*
- *New plants, for performance, are in big advantage with Hot Melt (PUR)*
- *Retrofitting is always really expensive*
- *Flame is not always the cheapest technique and cost saving with Hot Melt are possible.*
- *80 % of foam for automotive market is polyester based; we can substitute with polyether grade.*

Benefit of chemical stability of this PU to warm, moisture and sun rays.



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