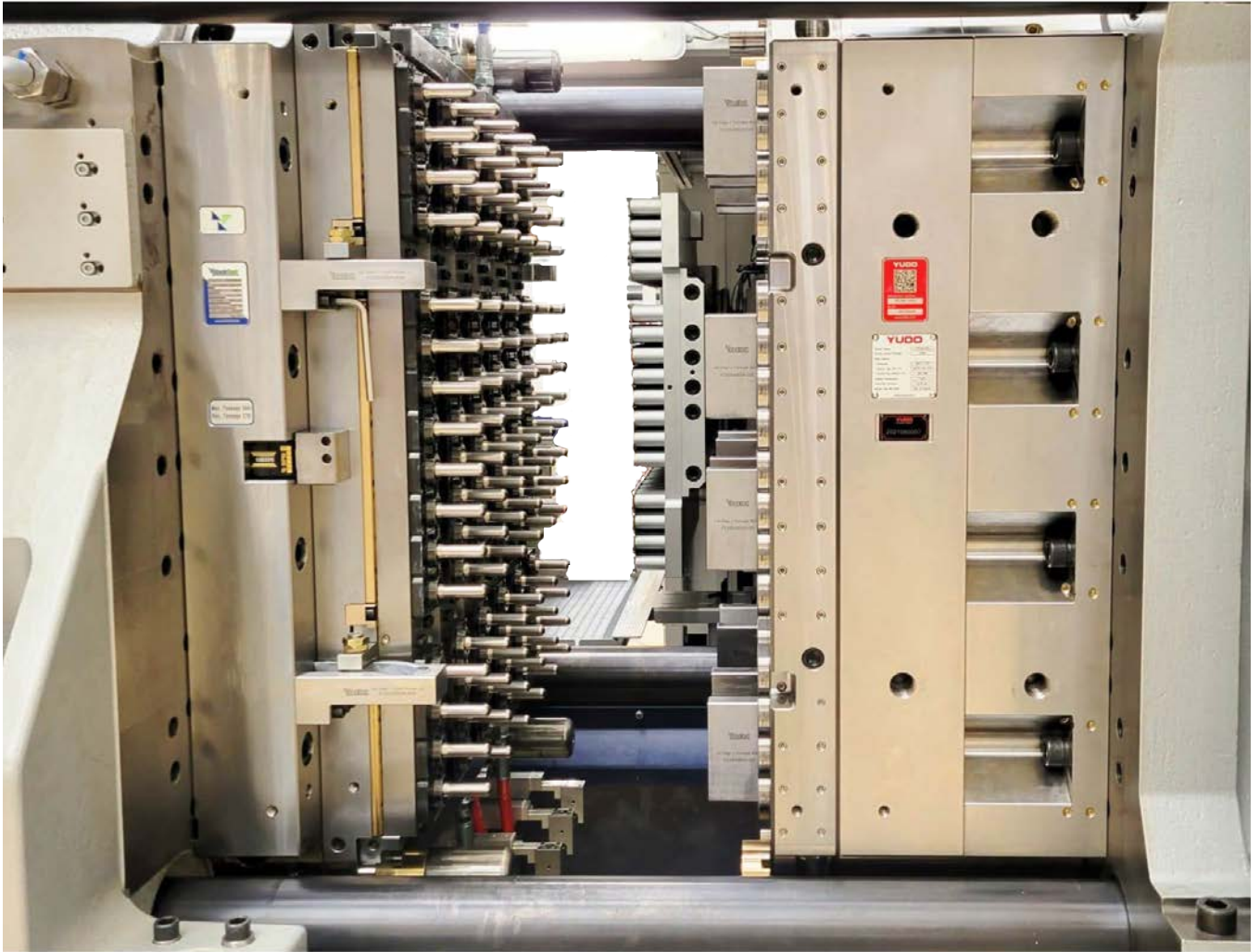


# PET Molds and Technologies



 **StackTeck**®



## Our Beverage Packaging Origin

StackTeck and its parent company were well positioned to enter the PET industry in 2009. Utilizing unique hot runner technology for PET preform molds, StackTeck achieved rapid growth and earned the trust of their local customers. Today, StackTeck is a globally recognized company, offering complete PET preform mold packages up to 144 cavities, mold conversions and replacement components, mold repair and refurbishing services, and also integrate complete preform molding cells in cooperation with their industry partners.

StackTeck PET preform molds take advantage of innovative ISO hot runner technologies that reduce pressure drop, improve cavity to cavity balance, significantly reduce color changeover time, and generate lower AA levels than conventional designs, while virtually eliminating PET dust. The molds also utilize KoolTrack™ conformal cooling to improve productivity, and a patented post mold cooling technology called PiCOOL™ that speeds up cycle times and reduces piece part costs.

Working within a development lab and in cooperation with select customer partners, StackTeck continually works on development activities that improve molding performance and efficiency, as well as increasing mold life expectancy, remaining on the forefront of technology.

Examples of successfully delivered projects:

- ✔ High-cavitation 100% rPET preform molding system
- ✔ Family mold program for 13 preforms
- ✔ Drop-in hot runners for a wide range of cavitations
- ✔ Overmolding molds for barrier applications
- ✔ Mold conversions for multi-platform operations

### *Experience and Track Record*

✔ *140+ preform molds built since 2009 up to 144 cavities*

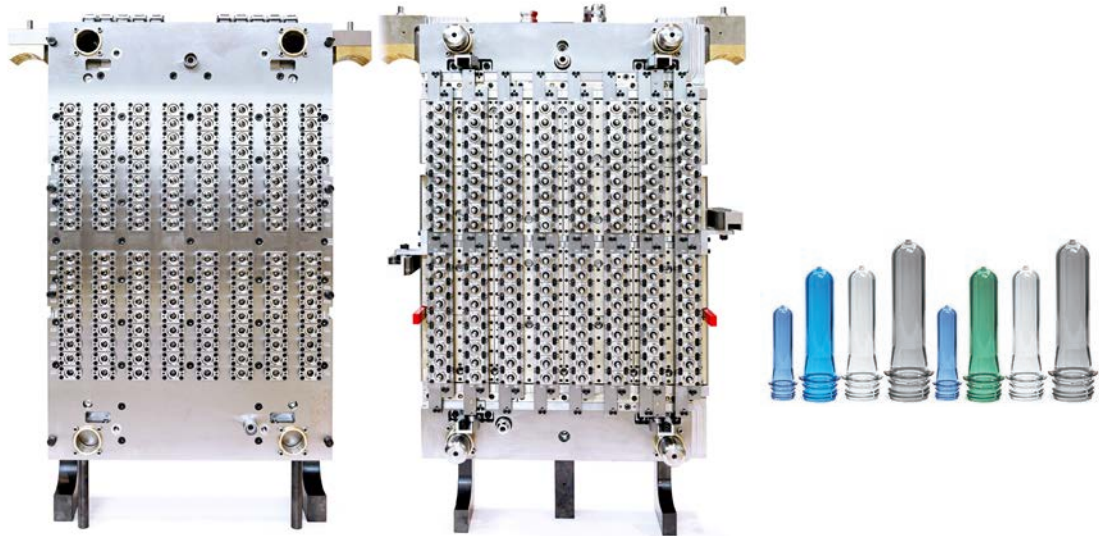
✔ *420+ beverage cap molds built since 1969 up to 128 cavities*



# PET Preform Molds

Our PET preform offerings are:

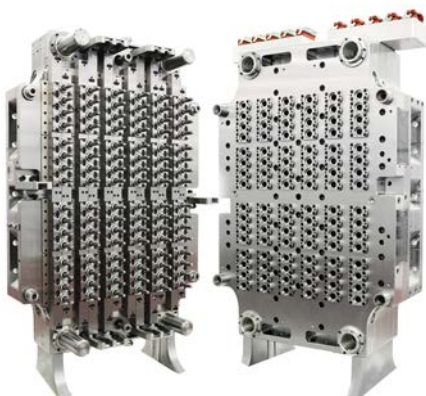
- ✔ PET preform development services
- ✔ PET Molds ranging from 2 to 144 Cavities
- ✔ Standard and customized mold frames & pitch layouts available to accommodate a variety of leading platforms and preform applications
- ✔ Preform overmolding



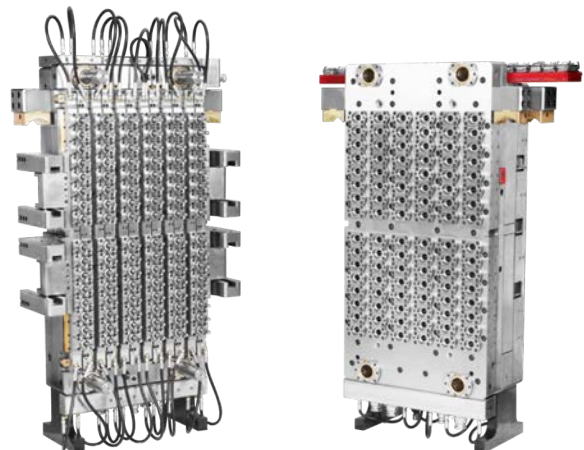
**This 144 cavity mold produces PET preforms for the beverage industry**

Our PET preform features are:

- ✔ Top or side entry machine configurations and automation compatibility
- ✔ Advanced ISO hot runner technology
- ✔ Advanced KoolTrack™ conformal cooling technology
- ✔ Integrated post mold cooling: Patented PiCOOL™ technology
- ✔ Special coatings for component wear resistance and improved ejection



**Side entry EOAT configuration**

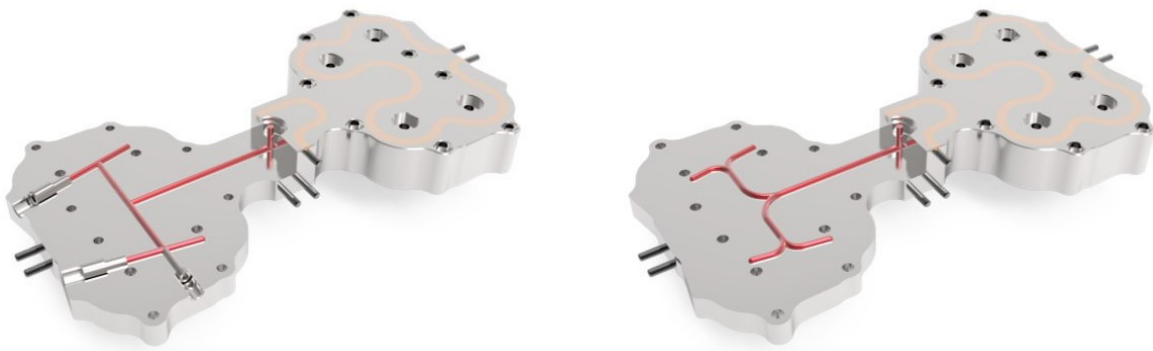


**Top entry EOAT configuration**

# PET Innovation: ISO\* Technology

ISO\* represents a 3-dimensional isometric projection of an object. It is an effective way to envision a network of melt channels distributed throughout a hot runner; and by way of using a special diffusion bonding technology to manufacture the hot runner manifolds, it allows engineers to be creative when balancing the melt flow paths to each cavity.

Diffusion bonding offers more design freedom to geometrically balance melt flow to each cavity and minimizes pressure drop throughout the channel layout.



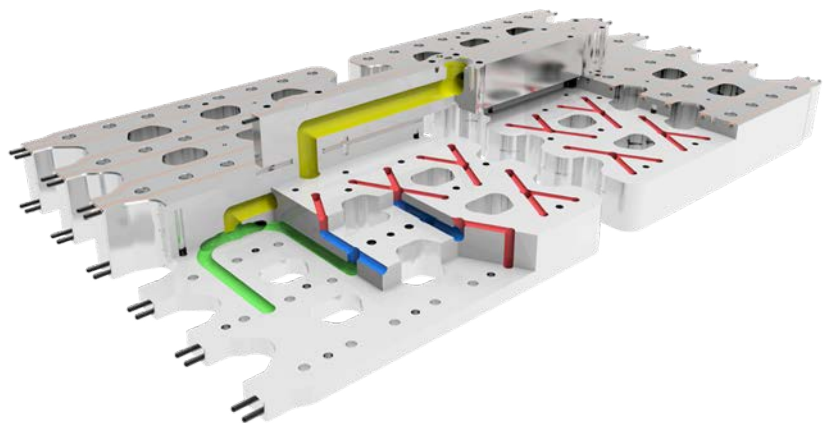
## Manifold comparison: Conventional gun-drilled (left) vs. ISO\* Diffusion bonded (right)

*\*ISO is a trademark of YUDO and StackTeck preform molds are supplied exclusively with YUDO hot runners.*

*Images provided courtesy of YUDO.*

Manifolds using the ISO\* diffusion bonding technology result in:

- ✔ Reduced injection pressure and reduced fill time
- ✔ Reduced melt degradation (AA levels, PET)
- ✔ Reduced resin flow stress of shear sensitive materials
- ✔ Improved hot runner balance for uniform part quality
- ✔ Improved color change times



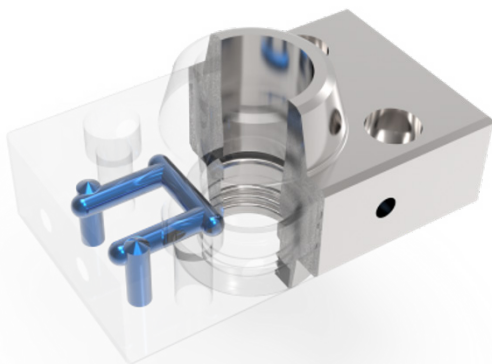


## PET Innovation: KoolTrack™

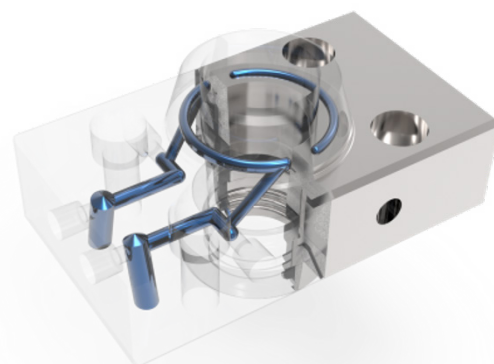
Another advanced technology that we have used in our PET preform molds is our diffusion bonded KoolTrack™ conformal water cooling circuitry.

Below is a comparison of a conventional drilled neck insert (left) and a neck insert with our KoolTrack™ technology applied (right). It illustrates how the water circuit can be designed to reach difficult areas resulting in reduced cooling / cycle times and improved molded part geometry thanks to the diffusion bonding manufacturing process. KoolTrack™ has delivered good success with custom preform shapes and preforms with thick sections.

- ▶ Faster cycle times
- ▶ Improved molded part geometry



Conventional



KoolTrack™

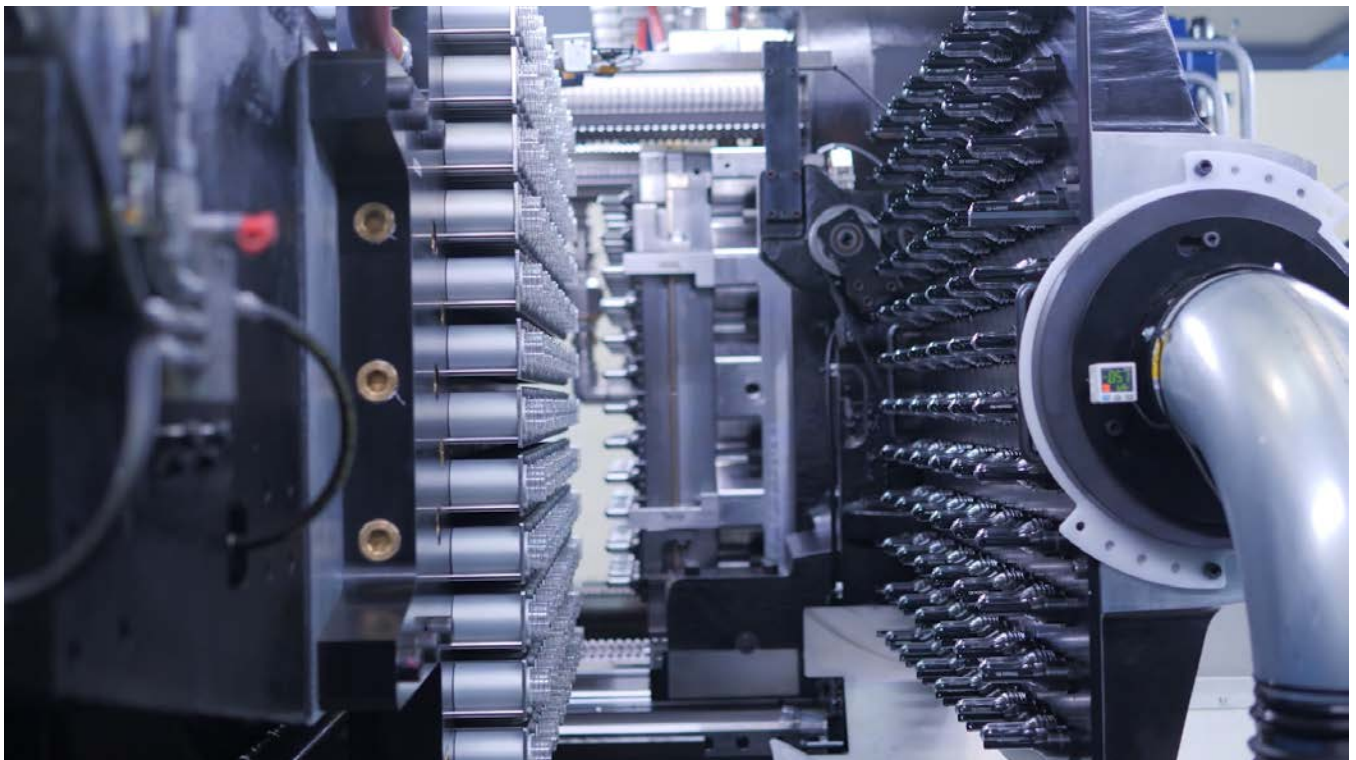
# KoolTrack™



# PET Innovation: PiCOOL™

StackTeck's patented PiCOOL™ technology has been engineered to enhance the productivity of PET preform molding. To produce this effect, we developed a nozzle that would force the air in a spiral stream inside the preform, kind of like a cyclone. Unique geometries in PiCOOL™ create spiral air flow streams, resulting in turbulent and uniform cooling along the entire interior surface of the preform. Engineering design and modeling expertise have been combined with practical research and extensive production testing resulting in a new standard for post-mold cooling of preforms.

StackTeck's PiCOOL™ patent was granted in 2018.



**Non-operator side of a preform molding machine**

The End Of Arm Tool (EOAT) on the left and a cooling station on the right provide post mold cooling. The EOAT cools the external surface of the preform body by conduction, and the cooling station cools the internal surface by convection. PiCOOL™ technology is used on the right side cooling station.



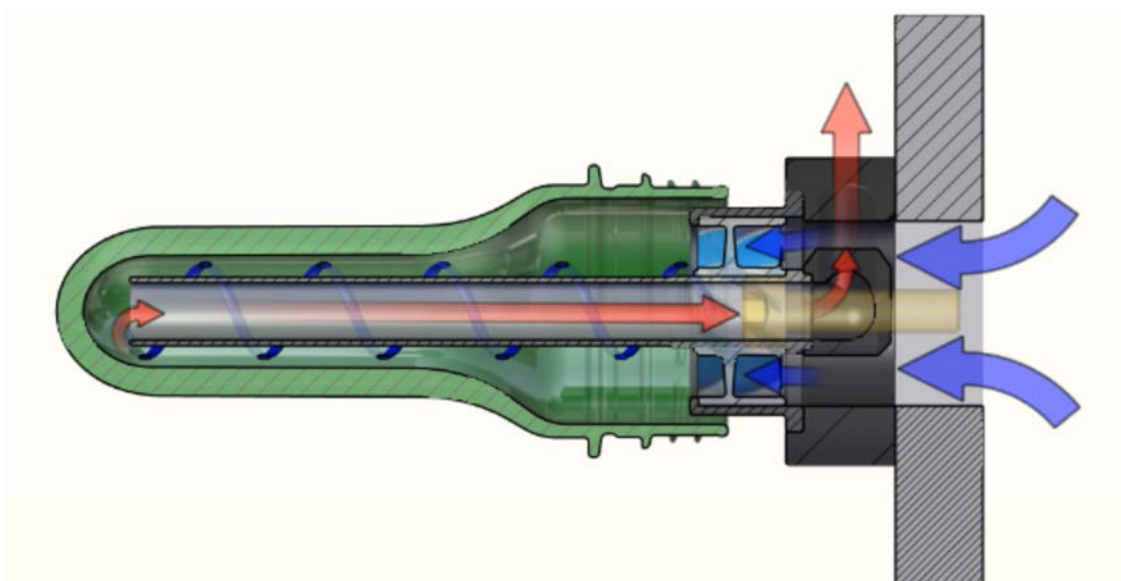


# PiCOOL™

The key benefits of PiCOOL™ are:

- ▶ Cycle time reduction of 5-15%
- ▶ Shorter cooling time and/or significantly reduced preform exit temperature
- ▶ Improved preform quality including ovality and straightness

The illustration below, shows how the air stream circulates through the nozzle, up into the preform in a spiral direction, then exits through the center tube. The cyclone characteristics of this technology better explain the cooling technique.



**PiCOOL™ - Unique method to direct an air stream on the interior surface of a preform**

# PET Innovation: Preform Overmolding

Innovations in PET preform overmolding, an injection process which molds preforms in two layers, has been developed by the PET team at StackTeck. Overmolded parts, with an inner and outer layer, has been successfully used in applications for products requiring UV barrier for dairy beverages. Alternatively, overmolding can be used for other preform applications.



**Single serve dairy bottles and PET preforms – 250 ml**

The overmolding process can also be used for applications such as molding recycled PET molded overtop of virgin PET, and more opportunities are now opening up with interest in using various colors with gloss “candy apple” type finishes.

StackTeck overmolding molds feature standard stack components and standard “off the shelf” PET hot runners. They are specifically engineered to allow:

- ✔ Easy stack conversions
- ✔ Use in single face / mono layer applications
- ✔ Overmolding solutions are available for standard injection molding machines, and on cube machines with a rotating turret.



**Cube mold as it rotates in the machine**







## Preform Molding Development Services

Whether it is custom applications or high performance high productivity applications, we can help from the initial preform design stage through prototyping in our pilot mold systems.

Our prototyping services include:

- ✔ Preform design consultation
- ✔ 2-cavity pilot mold used for development and prototyping activities
- ✔ Samples provided for testing in customers' blow molding equipment
- ✔ PET part / process optimization



As the market for PET preforms continues to develop and evolve, new technologies are required to meet demanding commercial and technical needs. StackTeck engineers apply a focused effort in optimizing part quality and process demands by combining all of our innovative technologies available for PET preform molds and systems.

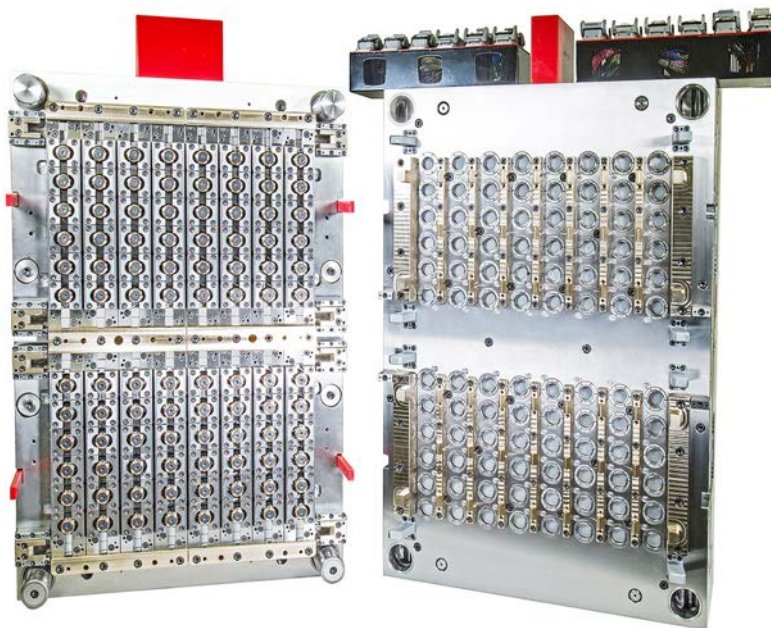


## Our Caps and Closures Expertise

StackTeck has been in the beverage packaging industry as a technology leader, including expertise in CSD closures, water closures, and specialized beverage closures.

With over 50 years of experience in providing solutions for customers in the beverage market, StackTeck was well positioned to provide focused technologies to the PET preform market. A culture of partnering in high volume beverage applications, combined with industry leading capacity and continuous investment, has provided a solid foundation for continuous growth and customer support within this market.

StackTeck provides full support through an experienced part design team that has done thousands of different custom caps and closure mold applications since 1969.



**96 cavity 1881 closure mold**





Over 10,000 injection molds delivered



Operations in Canada:

- Mold Making & Engineering: 9,290 m<sup>2</sup>
- Technical Services Center: 2,787 m<sup>2</sup>

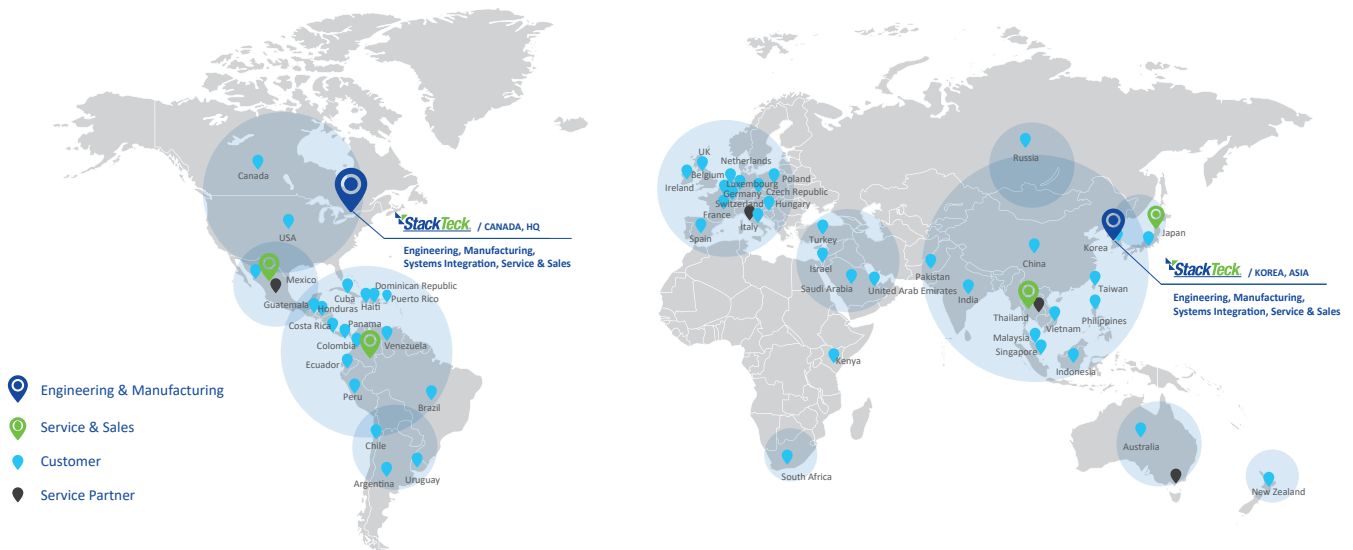
Operations in Korea:

- Mold Making & Engineering: 9,987m<sup>2</sup>
- Technical Services Center: 3,092m<sup>2</sup>

## Innovation: 50+ Years of Focused Development

- 1969 Unique Mould Makers established in Toronto
- 1976 Tradesco established in Toronto
- 1991 World's first 4 level stack mold
- 1991 World's first self-decompressing multilevel hot runner system
- 1992 First Quick Product Change (QPC) stack mold
- 1994 World's first 4x24 stack mold
- 1998 World's first fully balanced 3-level stack mold
- 1999 StackTeck Systems was created as parent company of Tradesco in October, 1998 and Unique was acquired in June, 1999
- 1999 World's first 5 piece collapsing core mold
- 2001 Tradesco and Unique merged
- 2002 First Turnkey IML system in North America
- 2003 First IML show system at NPE2003 in Chicago
- 2004 World's first 4x32 stack molds
- 2005 First turnkey IML stack mold systems in North America
- 2007 World's first 2x64 unscrewing cap mold
- 2012 World's first 2x32 co-injection stack mold
- 2013 First production mold with the use of TRIM™ technology
- 2014 Fastest 1881 2.5g beverage cap mold (3.5 seconds)
- 2015 PET development cell was established in Canada**
- 2016 World's first 2x64 flip-top closure mold
- 2017 World's first Klear Can co-injection production mold
- 2017 World's first production mold for a 1.3g 2925 post mold folded and slit closure (2.5 seconds cycle time)
- 2017 First stack mold for TRIM™
- 2017 First injection compression development mold
- 2018 PiCOOL™ patent was granted for post mold cooling use in PET Preform molds**
- 2018 World's first TRIM™ MuCell thinwall cup mold
- 2018 First servo IMC for flip-top cap mold
- 2018 First injection compression show mold for NPE2018
- 2019 First FastTrack™ mold capability announced with automated design & 8 week delivery.
- 2019 First Rectangular TRIM™ production mold built
- 2019 StackTeck Asia established in South Korea
- 2021 KoolTrack™ conformal cooling technology was introduced for PET Preform molds**
- 2022 World's first 5 piece collapsing core paint can mold – body with integral rim





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