



What is Pultrusion?



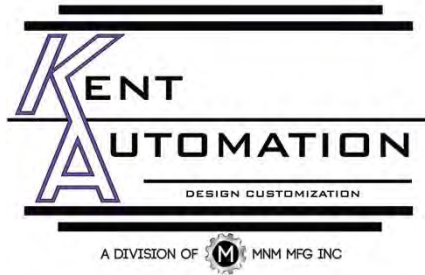
SERVO PUL[®]

Kent Pultrusion, LLC

ServoPul[™]

Fully Electric Servo-Driven
Pultrusion Lines

www.KentPultrusion.com



MNM IND INC

Over 5000 Installations



Kent Pultrusion
ServoPul™ Technology
SERVO PUL

- Kent ServoPul™ Lines
- Electric Servo Motor Controlled Pultrusion
- Secondary Composite Fabrication Solutions
- Wide range of Cut-off Saw System Solutions

Kent Automation
Window & Door Secondary Operation Equipment

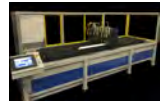
- Notching Saws
- End Cutting Mills
- Sawing Centers
- Routing Centers
- CNC Drilling Centers
- Length Gauges
- SDL Grid Application
- Fab Centers

Kent Automation
Automated Custom Equipment Design

- Palletizing
- Material Handling
- CNC Machining Centers
- Assembly
- Vision Systems
- Part Pick & Place Systems
- Robotic Solutions

Criterion Machinery, LLV
Valley, View, Ohio
Tube Fabrication Solutions

- Tube Punching
- Tube Fabrications
- CNC Bending Equipment
- Tube Notching
- Tube piercing Equipment
- Tube Materiel Handling
- Robotic Solutions






About Kent Pultrusion

- Located in Kent, OH
- 30 Employees
- Two Facilities
- ServoPul™ Fully Electric Pultrusion Lines
- Engineering, Sourcing, Fabrication, Machining, Electrics, & Assembly
- Kent Automation, Criterion Machinery

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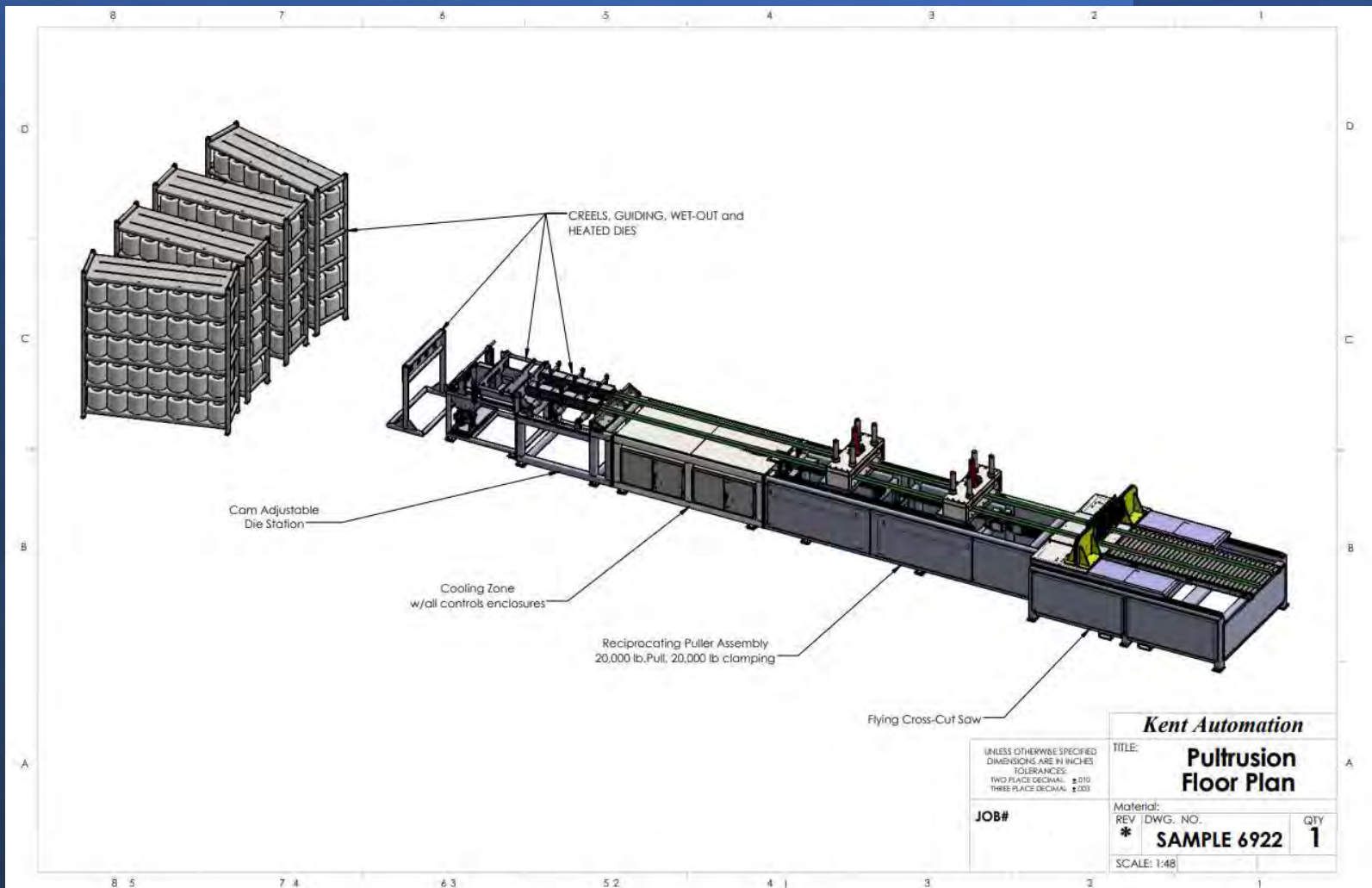
Pultrusion Line Systems

- Pultrusion Line Systems refer to the complete set of machinery and equipment used in the pultrusion process, where continuous fibers are combined with resin and **pulled** through a heated die to create composite profiles with a constant shape.
 - These systems are designed for highly efficient, continuous production of composite materials such as fiberglass or carbon fiber.
- 
- A series of four yellow dashed line segments are arranged in a curved, upward-sloping pattern in the bottom right corner of the slide.

Types of Pultrusion Lines

- Reciprocal
 - Hydraulic or Servo-Driven
 - Hand-Over-Hand Clamping Style
- Caterpillar
 - Counter-rotating tracks





UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES:
TWO PLACE DECIMAL ±.010
THREE PLACE DECIMAL ±.003

JOB#

Kent Automation

TITLE: **Pultrusion Floor Plan**

Material:
REV * DWG. NO. **SAMPLE 6922** QTY **1**

SCALE: 1:48

Key Components of Pultrusion Systems - Equipment



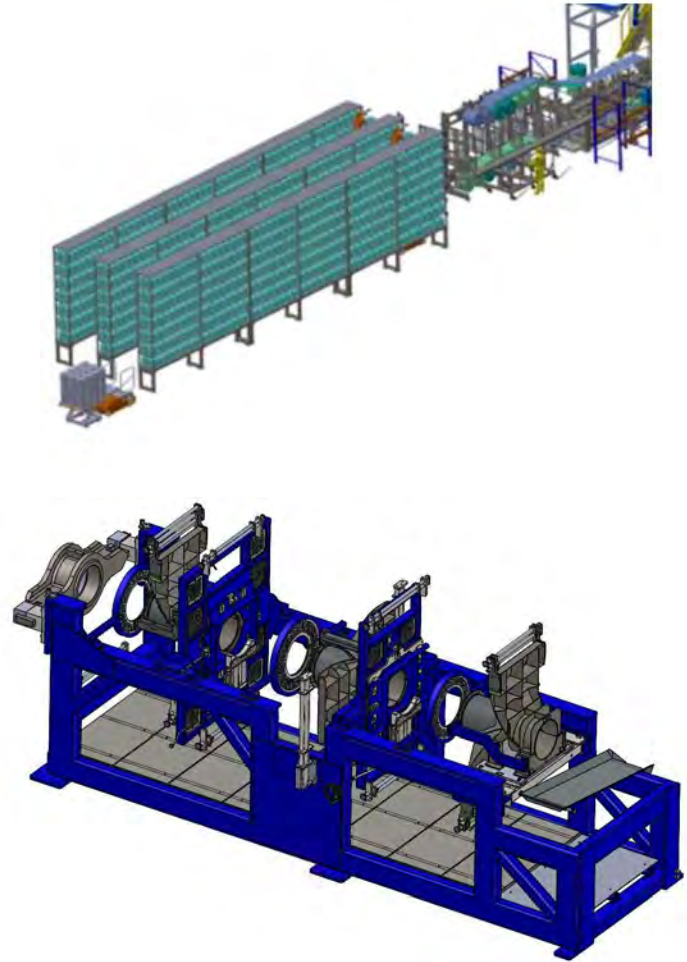
1. Creels

Creels: The system typically starts with the creels, which are racks that hold spools of reinforcing fibers (e.g., glass or carbon fiber). These fibers are unwound from the creels and guided into the system.



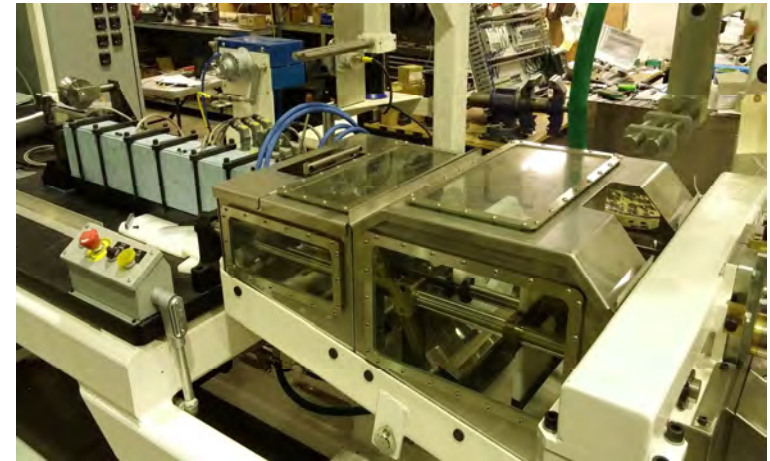
2. Guiding and Preforming Station

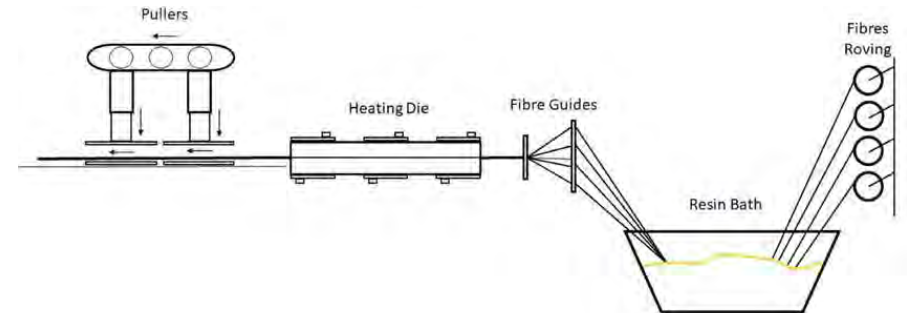
Guiding and Preforming Station: After the creel, fibers are aligned and organized into the desired shape before entering the resin bath or injection system. Preforming guides arrange the fibers into a pattern corresponding to the final profiles shape.



3. Resin Impregnation

- **Resin Bath:** In traditional pultrusion, the fibers pass through an open bath filled with thermosetting or thermoplastic resin. The fibers are fully saturated with the resin before moving to the next stage.
- **Resin Injection System:** In some systems, the resin is injected into a closed chamber, impregnating the fibers under pressure for more precise control of resin content.





Resin Bath

- **Fiber Entry:** The fibers are pulled from creels and fed through the resin bath, where they pass through the resin, allowing them to become thoroughly saturated.
- **Resin:** The bath contains a thermosetting or thermoplastic resin, which will later harden, bonding the fibers together. Additives may be included in the resin to modify its properties.
- **Fiber Wetting:** Fibers are drawn through the Resin.
- **Excess Removal:** Wiping rollers to ensure consistency.

4. Heated Die

The saturated fibers are pulled through a heated die where the resin cures (hardens) as it passes through. The die gives the material its final shape and dimensions. The temperature of the die is carefully controlled to ensure proper curing.

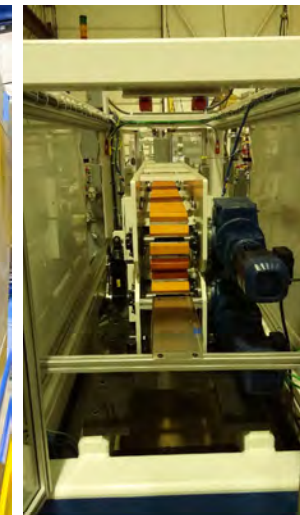
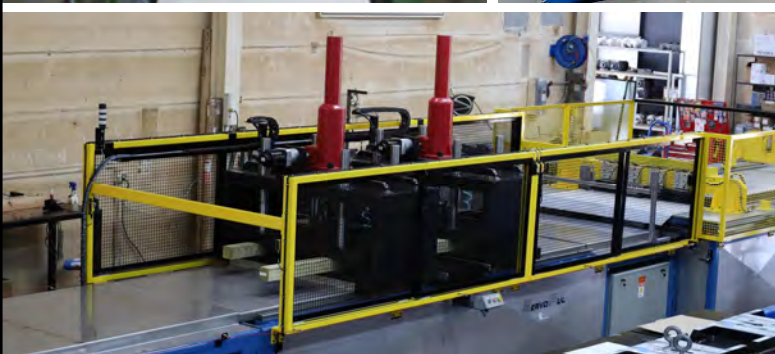


5. Pulling Mechanism

Puller Sleds: The puller sled or pulling system continuously pulls the fibers through the die, controlling the speed and tension. This can be a caterpillar-type puller with belts/tracks, or clamping carriages to grip the composite and pull it through the system.

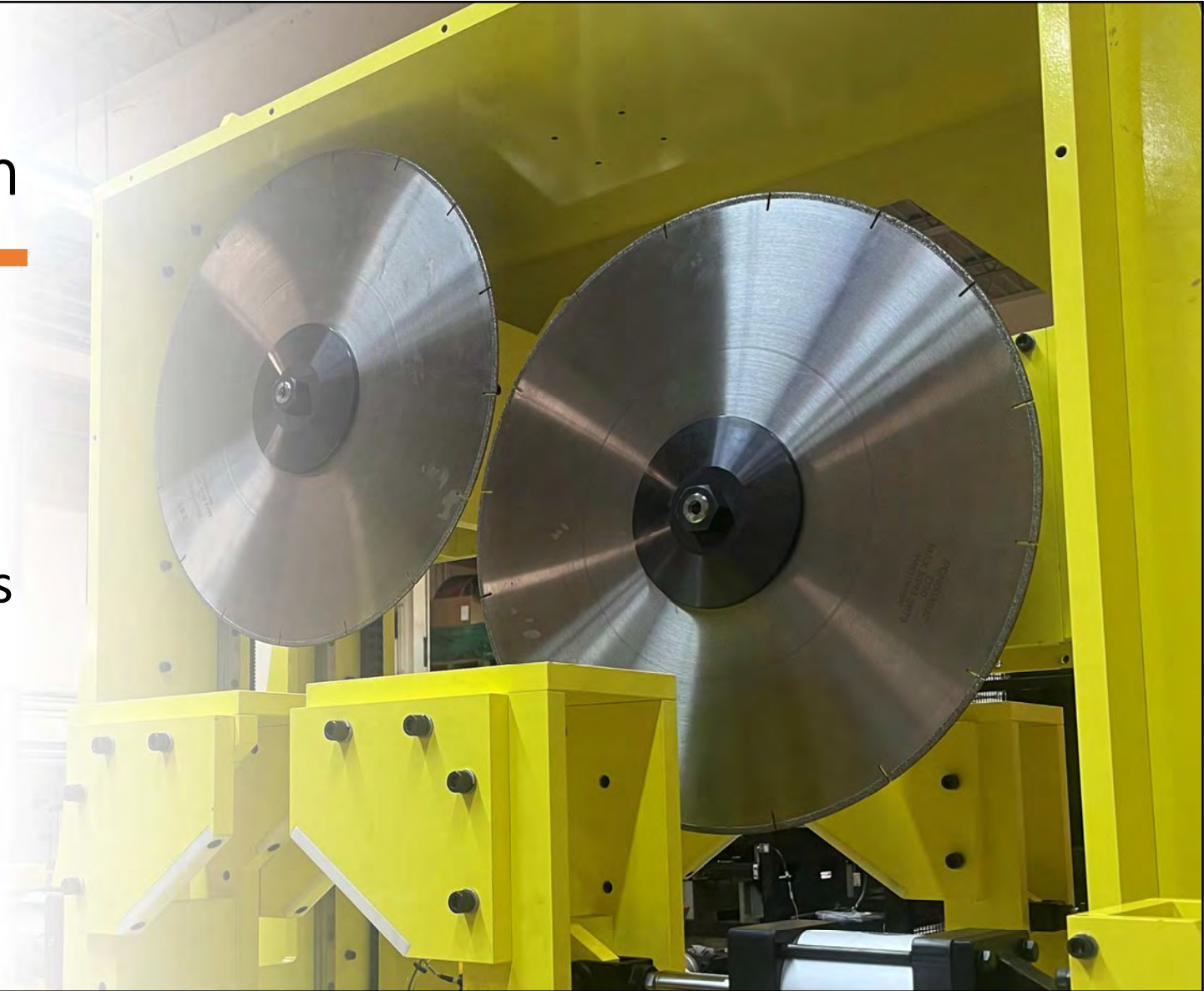


Varieties of Pull Systems Based on Pultruded Profiles



6. Cutting Station

Once the material exits the die, it is a fully cured composite profile. The cutting station cuts the continuous composite to the required lengths, which can vary depending on the application.

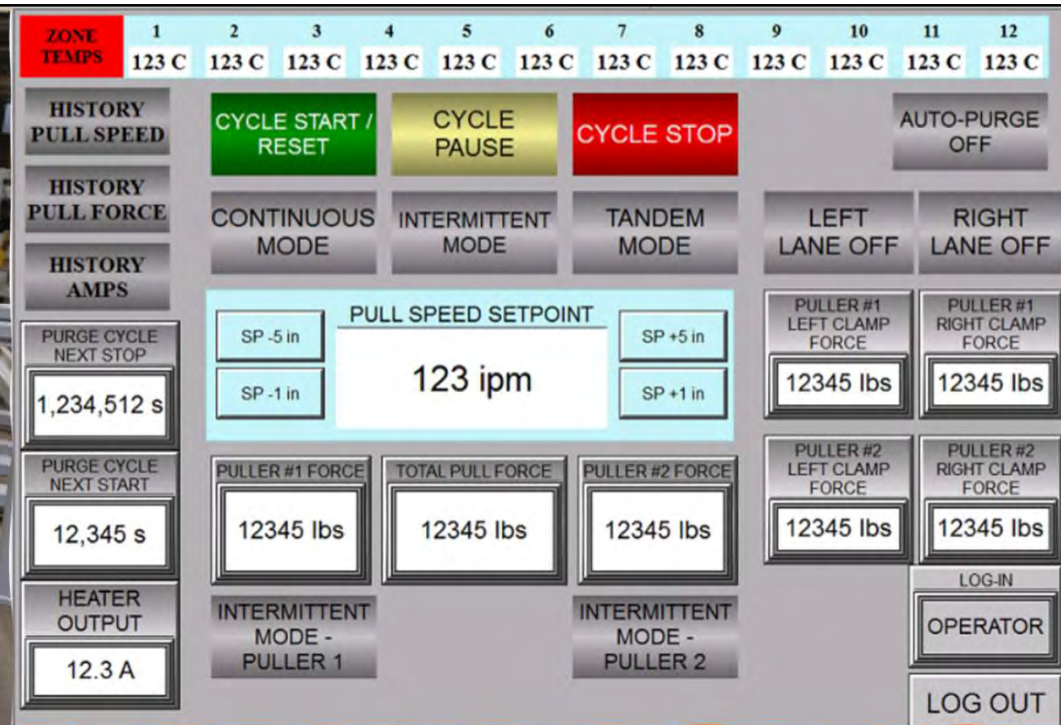




Varieties Based on Pultruded Profiles
and Pull Systems







7. Control System

Modern pultrusion systems are equipped with automated control systems that monitor and regulate various parameters, such as pulling speed, clamping force, and temperature (heater zones). These controls ensure consistent quality in the final product.




Additional
Equipment

Advantages of Pultrusion

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Additional Equipment

- Cooling Stations:** Some systems incorporate cooling stations after the die to help solidify the product more quickly.
 - Surface Finishing:** Post-pultrusion processes, such as sanding or coating, can be included to improve the surface finish of the final product.
 - In-Line Systems:** Some manufacturers will incorporate in-line printers or forming applications per customer and product requirements.
- 
- A yellow dashed line in the bottom right corner, consisting of four short, curved segments.

Advantages of Pultrusion Systems



•**Continuous Production:** Pultrusion is a highly automated, continuous process, which makes it ideal for producing large quantities of composite materials efficiently.



•**Cost-Effective:** The process is cost-effective due to its high output and relatively low labor requirements.



•**Versatile Shapes:** Pultrusion systems can produce a wide variety of profiles, such as I-beams, channels, rods, tubes, sheets, and custom shapes.



•**High Strength-to-Weight Ratio:** The final pultruded products are lightweight but extremely strong, with high corrosion resistance, making them suitable for demanding applications.

Applications of Pultrusion Systems



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ServoPul™ Pultrusion

Utility Pole Line

- Pulling Window of 36" x 24" which allows for various pole diameters
- 70,000 lbs Pull and Clamp Force
- In-line saw system cutting multiple lengths speeds up to 80" per minute
- The line incorporates a pulling winch system that facilitates access for product setup
- Operator friendly HMI for operation/maintenance troubleshooting/adjustment of parameters and store settings for recipe-based product selection
- Pole Support Rollers to support the pole line during the pultrusion process, alleviate pressure on puller clamps and saw blades, aid in maintaining consistent cuts for overall length accuracy.

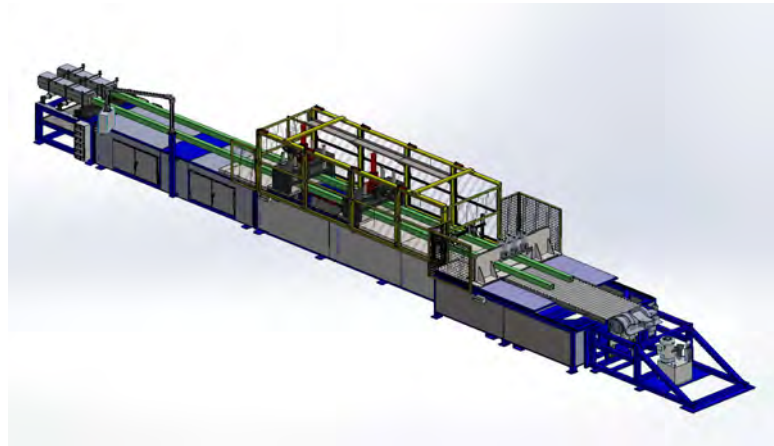




Kent Pultrusion, LLC

ServoPul™ Pultrusion

Fiberglass Cross Arms



- 24" wide by 12" high Pulling Window to accommodate for the square hollow lineal profiles
- Pulling two 4" x 4" lineal squares at a time
- 30,000 lbs Pull and Clamp Force
- In-line saw system cutting to lengths from 2' to 12' long at speeds up to 80 IPM
- The line incorporates a pulling winch system that facilitates access for product setup





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ServoPul™ Pultrusion

Single Lane ServoPul™ Pultrusion Line for the Window & Door Industry



- 16" wide by 6" high Pulling Window
- 25,000 lbs Pull and Clamp Force
- 6,000 lbs Side Clamping for profiles that require horizontal gripping
- In line up-cut Saw System: Hard Stop
- 8 Zones @ 2000 W





Kent Pultrusion, LLC

ServoPul™ Pultrusion

Fiberglass Window Lineals



- 12" wide by 13" high Pulling Window to accommodate for the Window shapes and flat profiles
- 10,000 lbs Pull and Clamp Force
- Line Speeds up to 100 IPM
- Single Lane up-cut Exit Saw in-line with the Pultruder

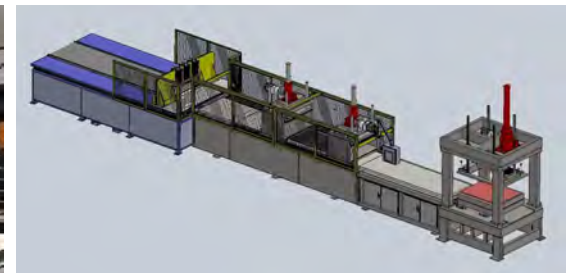


Kent Pultrusion, LLC

50,000 lbs ServoPul™ Installation

*Chemical Corrosion Resistance Applications,
Electrical Insulation*

50,000 lbs ServoPul™ Pultrusion Line with cross-cut saw for 36" wide sheets and special shapes;
Line incorporates a 75 ton die press to control the deflection within the sheets



- 50,000lb Pull & Clamp force
- 40" wide by 18" high Pulling Window
- Line Speeds up to 60 IP
- Flying Cut-off Saw inline with the Pultruder

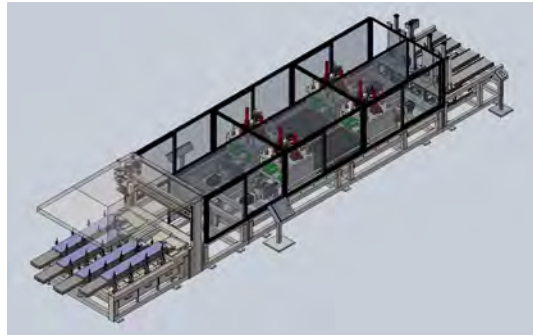


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ServoPul™ Pultrusion

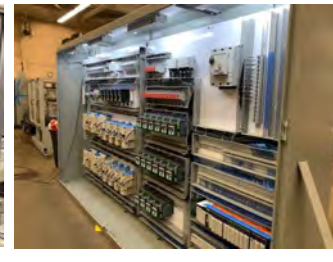
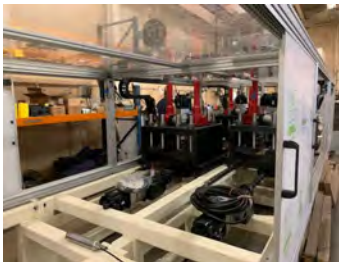
Four Lane ServoPul™ Pultrusion Line for the Automotive Industry

Kent ServoPul 0806 Four Lane Pultrusion Line



Four Lanes - Mechanical ability to tie lanes together for potential future operations as well as the ability to operate as one single, large, wide lane.

Four individual saws with angling features up to 20° in both directions from perpendicular to the production axis of the Pultruder Lanes



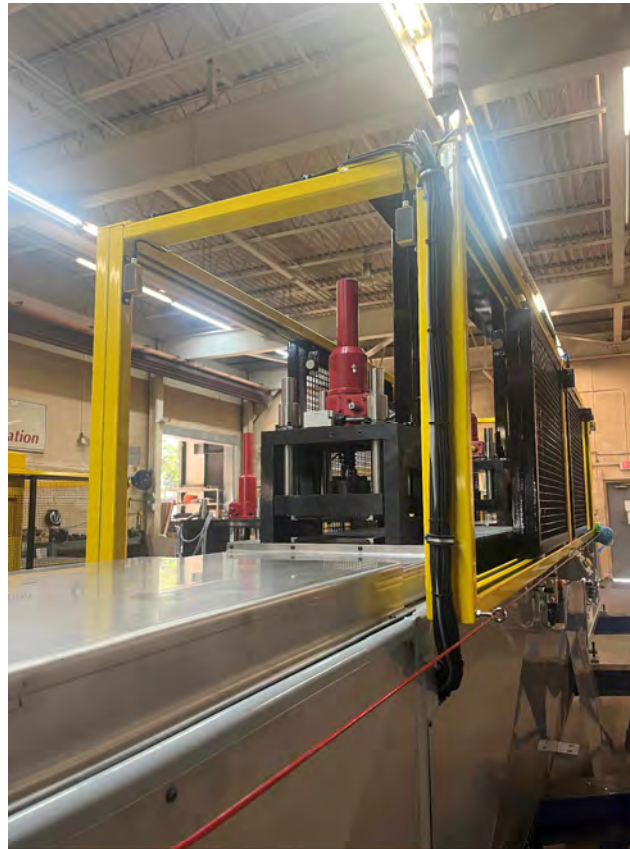
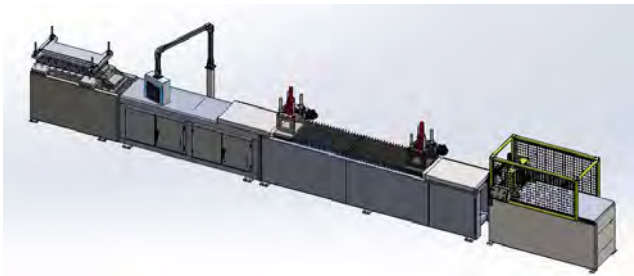


Kent Pultrusion, LLC

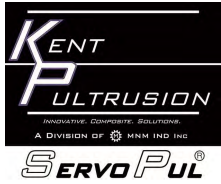
ServoPul™ Pultrusion

Kent ServoPul™ Lab Pultrusion Lines

R&D, Production



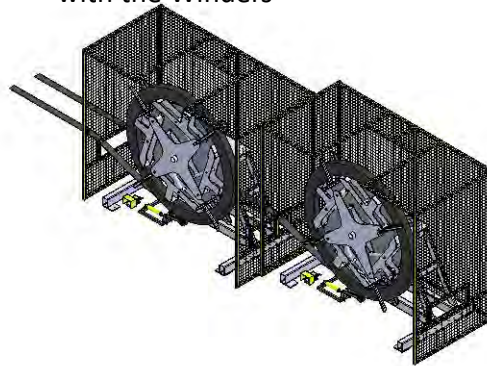
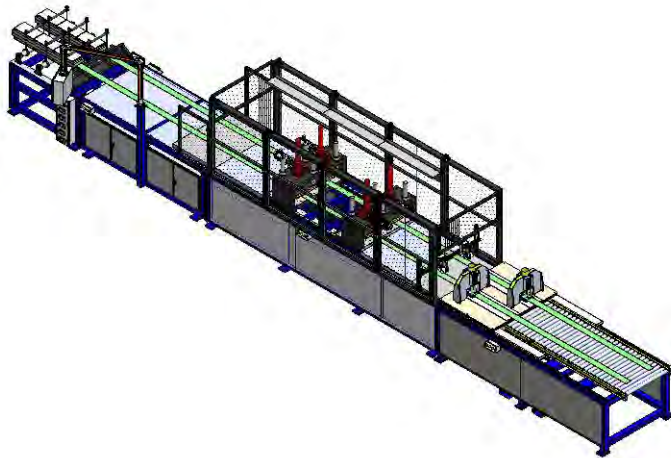
- Typical 12" wide by 5" tall Pulling Window
- 10,000 lbs Pull and Clamp Force
- Typical Line Speeds: 2 to 100 IPM
- Saw Solution to accommodate customer requirements
- Typical Machine Footprint of 27" wide x 30' length



Kent Pultrusion, LLC

Wind Energy: Spar Cap Carbon-Fiber Pultrusion Line & Spool Winders

- 30" wide by 6" high Pulling Window to accommodate for two (2) windows at 15" widths
- Pulling continuous Carbon Fiber Spar Cap Profiles
- 30,000 lbs Pull and Clamp Force
15,000 lbs clamp Per Window
- Dual Up-Cut saw system in-line with the Winders



- Collapsible Spindle for Spool Unloading
- Linear Encoder for Length Measurements
- Adjustable platen width for handling different material width
- Continuous Carbon Pultrusion Sheets are fed from Pultrusion Machine into Spooling Winder
- Winder initiates spooling process to match line speed
- Winder increases speed after saw cut to finish cycle and allow time for banding/unload
- Adjustable width platen guides can accommodate sheet width variance
- Spool Winder allows for manual banding of carbon fiber spool





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ServoPul™ Pultrusion

Structural Shapes

Single Stream Carbon Fiber Pultrusion Line

- 40,000lb Pull & Clamp force
- 32" wide by 12" high Pulling Window
- Line Speeds up to 78 IPM
- 12 Heat Zones @ 3,000 W each
- Flying Cut-off Saw inline with the Pultruder
- Hydraulic Winch System for initial threading of the material during set-up rated at 40,000lb capable of pulling through both puller sleds





Kent Pultrusion

TURN-KEY PULTRUSION SYSTEMS

Flat Sheet, Structural Shapes, Complex Profiles, and Secondary Equipment – CASE STUDIES



Kent Pultrusion supplied one of the largest Flat Panel Composite Pultrusion Lines in the world, processing 10 feet wide by 2"-4" thick products for the **transportation** industry.



Kent Pultrusion supplied four (4) carbon fiber ServoPul Pultrusion lines for the **wind energy** market



Kent Pultrusion supplied several Pultrusion Lines for the **road construction** industry to replace steel dowels and rebar with pultruded composite material.



Overall, Pultrusion Systems are key to producing high-quality composite materials that are strong, lightweight, and durable, making them critical in industries where these properties are essential.





MNM IND INC manufacturing process depends on raw materials, as well as supplies. Given the vast network of quality suppliers, MNM IND INC is able to address production demands to deliver the completed assemblies within customer required timelines.

Criterion Machinery, located in Valley View, Ohio, and Kent Pultrusion/Automation located in Kent, Ohio, has over 30,000 square feet of manufacturing and assembly capacity in two locations. Kent recently completed a building addition to address the growing Pultrusion Market.

Capacity





Design Platform
Custom Equipment Design



Auto Cad

Solid Works

Automation Design
Programing

Electrical Panel Design &
Build

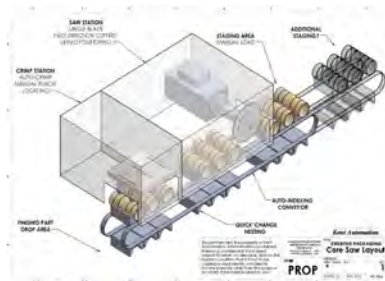
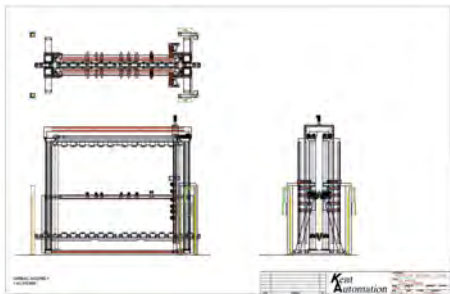
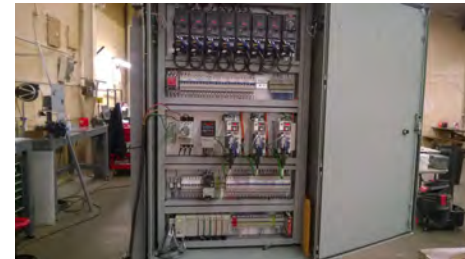


Rockwell
Automation



SIEMENS

KOLLMORGEN





With over 30 ServoPul™ Pultrusion Lines installed in the United States and abroad, Kent Pultrusion services a multitude of customers as per their needs, requests, improvements & modifications. Our team of experts combined with the technological advantages of our ServoPul Lines creates the ability to easily service machines both on-site and remotely.



Kent Pultrusion, LLC

Kent Pultrusion Service Team

Meet the Team

- **Richard Burrell – Service Manager**
 - rburrell@mnmind.com
 - Cell: (330) 606-3286
- **Jon Adams – Electrical Engineer**
 - jadams@mnmind.com
 - (330) 678-6343 ext 116
- **Jim Harp, Senior Engineering Project Manager**
 - jharp@mnmind.com
 - (330) 422-4300
- **Chris Eddinger , Senior Project Engineer**
 - ceddinger@mnmind.com
 - (330) 389-8424
- **Chuck Gibson – Technician**
- **Joe Catanese – Electrical Technician**
- **Chris Sanor – Technician**



Every ServoPul™ Line is equipped with a remote access router – EWON – allowing for the ability to instantly connect with each ServoPul machine from our facility in Kent Ohio. Troubleshooting, modifications, and diagnostics are immediately available for customer solutions in real-time, rather than waiting for on-site service. This is a critical feature, as we understand the urgency of getting a machine back & running as soon as possible.

At Kent, we have the ability to dispatch our servicing personnel to any facility in a timely manner. Our facility has in-house capabilities for full-service applications, including a machine shop, skilled electricians, and experience-derived resolutions.



Kent Pultrusion, LLC

Kent, Ohio - USA

Michael Pollard, President & CEO
Patrick Riley, Vice President & GM
Jessica Stewart, Plant Manager
Jim Harp, Senior Engineering Projects Manger
Dan DiCola, Sales Project Engineer
Lisa Zaucha, Accounting Manager
Richard Burrell, Service Manager
Jon Adams, Electrical Engineer
Chris Eddinger, Mechanical Project Engineer
Missy Meacham, Office Manager/Purchasing Coordinator

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Thank you

Dan DiCola, Sales Project Engineer – Kent Pultrusion