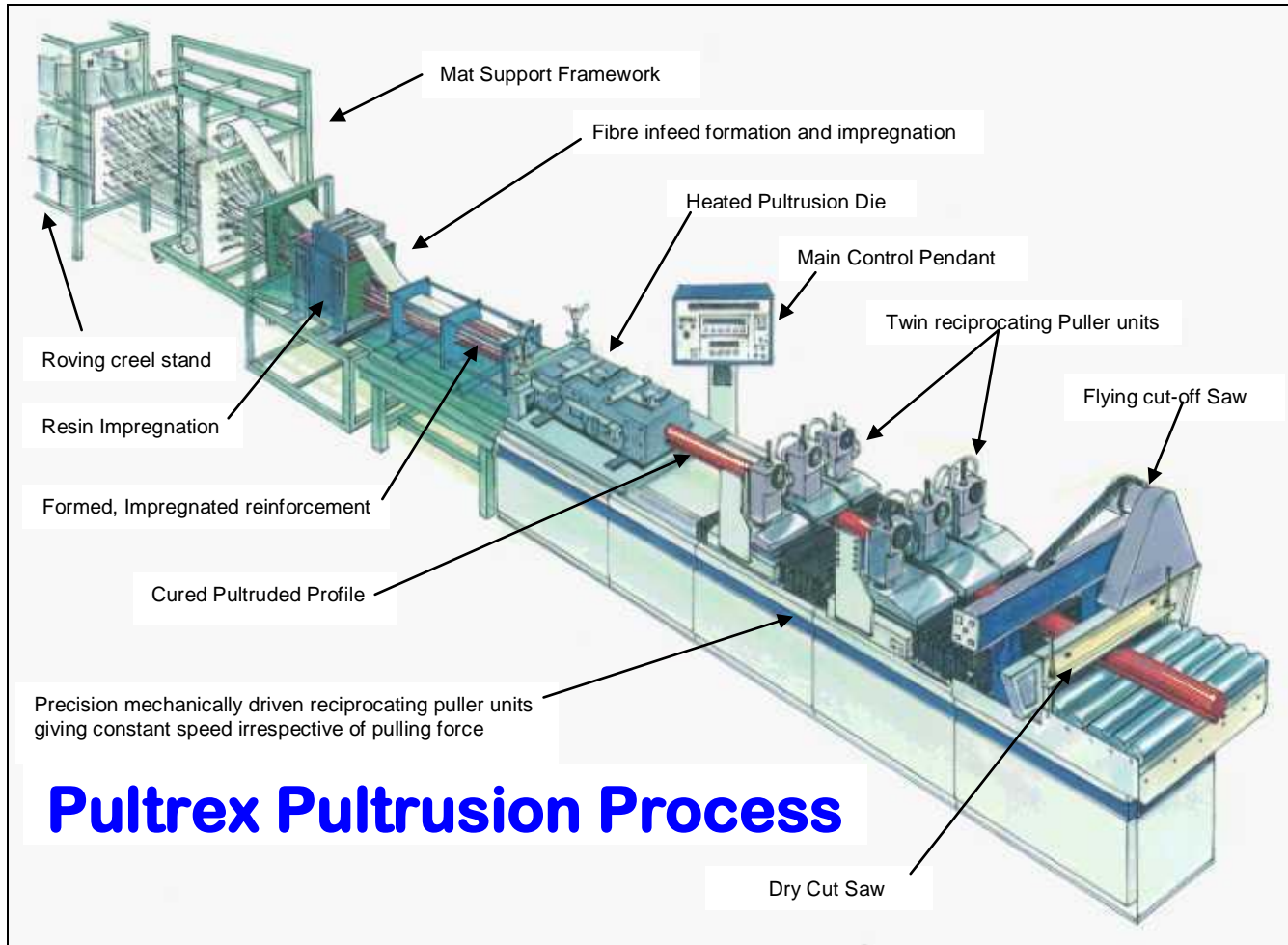
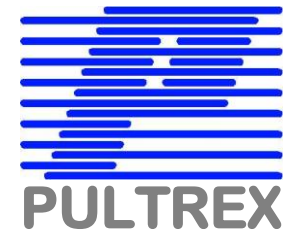


PULTREX Ltd

The Pultrusion process explained



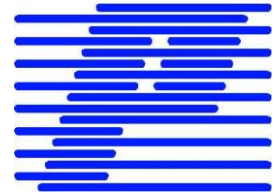
The Pultrusion process is a highly automated continuous fibre laminating process producing high fibre volume profiles with a constant cross section.

Having a high fibre volume fraction makes pultrusion an ideal process for structural component production giving a *high strength to weight ratio*.

The process starts with the support of the reinforcements. These can be glass, carbon or aramid and in a roving/tow, mat, woven or stitched format. The material is pulled into the infeed area where it is accurately formed to the required shape and impregnated with a resin matrix. The resin matrix can be polyester, vinylester, epoxy or phenolic. From the infeed area the impregnated reinforcement is pulled into the heated pultrusion die. The resin matrix is such that it solidifies and cures within the die. The cured profile exiting the die is allowed to cool before being clamped and pulled by the reciprocating puller units. The puller units reciprocate in a 'hand over hand' motion, with the return stroke being faster than the pulling stroke' to give a smooth continuous pull at a constant speed irrespective of the pulling force required. From the puller units the profile passes into the flying cut off saw where it is cut to the required length.

ADVANTAGES

Pultrex' design policy is of uncompromising excellence, providing machinery and equipment for efficient, long term reliable production

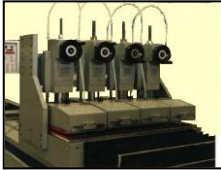


Pultrex Pultrusion machines have many features not found in competitor's machines. The following guide is used to highlight some of these features and explain their advantages in production.

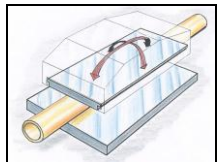
When comparing Pultrex machines from different manufacturers the following important features must be considered:

- **Profile Clamping**
- **Machine efficiency and power consumption**
- **Machine speed control/stability at varying pulling loads**
- **Machine safety**

Profile Clamping: The fixed lower puller platen on Pultrex machines gives a precision reference alignment base-point for all die/tooling settings ensuring good profile dimensional accuracy.



The modular upper clamping system on Pultrex Pultrusion machines allows for maximum production flexibility. Starting with the Px500-6T multiple clamp modules can be fitted to the machine. The Px1000-12T is fitted, as standard, with 3 clamp modules and as an option can have 4 narrower units fitted. Whilst the smaller pultrusion machines are fitted with a single clamp module, as an option, they can be split into two discrete clamping areas. This allows maximum flexibility for either single large profiles or multiple streams of profiles on the one machine.



The actual clamping plate, on the clamp modules, floats in both planes to allow for any profile gripper misalignment or wear thus preventing profile slippage. The clamp units on the Pultrex machines have an adjustable clamping force up to 11,000kg/clamp unit. The long clamp modules allow this clamping force to be evenly distributed over a large area thus preventing profile damage. This combination allows the minimum clamping force to be used on thin delicate profiles without slippage. All Pultrex machines allow approximately 2 times the maximum pulling force as an available clamping force on the profile. In addition to the high clamping forces achievable with the Pultrex machines the actual clamping force is applied over a large area (600 mm long clamp units) thus keeping the actual force per square mm down to a minimum to prevent profile damage.

Machine speed control/stability at varying pulling loads: The nature of the Pultrusion process makes it extremely important that the production speed remains **constant irrespective of the pulling loads**. Pultrex' **highly efficient** mechanical drive system, not only ensures that speed control is stable to better than 0.5% irrespective of pulling load but also both the platen speeds are absolutely synchronised during the gripper change over. This level of precise speed control is not available as standard on any other Pultrusion machine.

Machine efficiency and power consumption: The range of Pultrex Pultrusion machines utilises highly efficient mechanical drive systems. This not only gives high precision speed control but also has low power requirements for the pulling capacities achieved. Many competitors use very **inefficient** hydraulic systems with poor speed control and which require additional cooling and noise reduction systems.

Machine safety: The complete drive system on Pultrex pultrusion machines is totally enclosed. This not only acts as a safety feature but also prevents the ingress of highly abrasive glass particles on the moving parts. This ensures long life and low maintenance. The saw blade cutting system is also totally enclosed to ensure no personal contact with the saw blade and also ensure a highly efficient dust extraction system. The gripper clamping movement on the Pultrex machine is restricted to 5 mm as a safety feature. This is particularly important at start-up when the operator's hands are near the gripper units. Gripper heights are manually set to within 5 mm of the profile to be gripped.