The Westland Corporation

PROCESSOR

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Resistance

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In the plastics industry we refer to viscosity as the melt index of a certain resin.

In general terms, though, viscosity is a resistance of a liquid to flow, or its "thickness". For example, pushing a spoon through a cup of coffee takes little effort and moves swiftly. However, dragging that spoon through a jar of molasses produces much slower results. Coffee, being a thin liquid, is a low viscosity (or low resistance) liquid. On the other hand, the molasses is thick, making it a high viscosity substance.

How do you like your mashed potatoes?

One of the major differences between styles of mashed potatoes is their viscosity. Some people like their potatoes runny with lots of butter, which makes them low-viscosity potatoes. However, others like their potatoes dry and sticky … being able to make a small, stiff mound out of them. These people prefer high-viscosity potatoes.

In this issue of the Westland Processor Newsletter, the issue of screw blockage is discussed. The fewer blockages developed in conveying material, the more homogeneous and isothermal the material is which provides for repeatability in the process.

Screw design plays a major role in helping to prevent blockage which results in rejected parts. The viscosity of the resin is just one of the properties that dictates screw design.

If you have been processing with the same "ole" general purpose screw design, you are probably getting the same "ole" results year after year. Perhaps you have been resistant to changing, believing the status quo is as good as it gets.

Why not become a low viscosity thinker?

Discuss screw design with the engineers at Westland Corporation. We can manufacture a screw designed specifically for the resin you process.

However, as the article inside states, sometimes having a screw designed specifically for a certain material is not practical due to the variety of materials running in a production cell. Westland can help with that too!

The people at Westland Corporation are dedicated to providing screw design, knowledgeable processing assistance, quality components and responsive customer service. In other words, we are dedicated to your success.

It costs nothing to talk to one of our engineers to see how we might help you further succeed in today's competitive, global market.

Call us today at 800-247-1144 and let the ideas begin to flow.

DO YOU KNOW?

Machinery Lubrication's website features an article by Ray Thibault titled "How To Read An Oil Can". It states the W is the oil's low temperature characteristics, while the higher number gives the oil's high temperature viscosity properties. A 10W-30 oil behaves as 10-weight oil at low temperatures but gives the protection of 30-weight oil at the high engine operating temperatures.

Do you know what the W signifies?

http://www.machinerylubrication.com/article_detail.asp?articleid=171

Dave Larson, Vinton Brown, Dan Johnson

Vinton Brown was recently recognized for 20 years of service at Westland Corporation. Vinton works as a CNC programmer, operator. His commitment to producing a quality product has been a true asset to Westland. Vinton is pictured between Dave Larson, President and Dan Johnson, Vice President of Westland.

CONGRATULATIONS VINTON!

Arlo Landreth, Tom Kramer, Dan Johnson

Arlo Landreth and Tom Kramer both recently celebrated 20 years of dedicated service at Westland Corporation. Arlo (on the left) has been our lead maintenance person, keeping our equipment up and running. Tom (second from the left) is Westland's cylinder lead man. These two men certainly typify Westland's statement "Our People Make The Difference".

THANK YOU ARLO & TOM!!

Answer to DO YOU KNOW?: The "W" that is in the Society of Automotive Engineering (SAE) designation for an oils viscosity stands for 'winter', indicating that the oil will flow at its rated viscosity in 'winter driving conditions', as defined by the SAE.

PREVENTING BLOCKAGE IN YOUR PROCESS

Screw Design Is Key to Consistent Parts and Quality

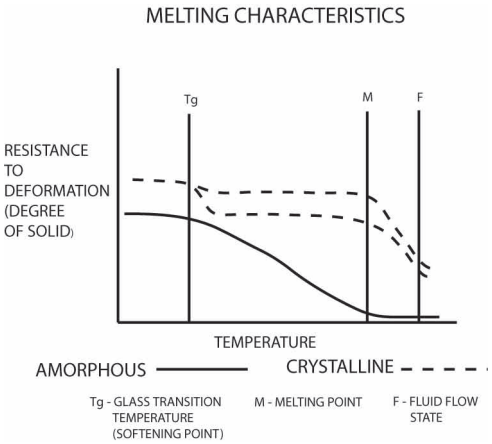
Being able to consistently run a process with the same results is key to profitability. Screw design provides the greatest opportunity for repeatability in your process. Custom designed screws are engineered to run specific and even multiple resins more effectively based on the melt patterns involved.

Have you ever had a process where five (5) shots are inventoried in the barrel, but a defect can be found every 10 or 20 shots?

TYPES OF RESINS

A major factor that influences the design of a screw is the degree of crystallinity in the resin being processed. The level of crystallinity influences the manner in which the resin changes from a solid to a melt. The differences between highly crystalline and less crystalline (or amorphous) resins includes the following:

Melting Point: High crystalline resins remain in a relatively solid state until the temperature reaches its melting point. Amorphous resins have no defined melting point but continue to soften gradually until reaching a fluid state.



Thermal Conductivity: Amorphous materials are especially slow to absorb heat and increases in temperature. Amorphous materials tend to degrade or burn when rapidly exposed to higher temperatures. High crystalline resins will melt more quickly.

Shear Sensitivity: Amorphous materials are considered more shear sensitive and should be gradually changed from solid to melt. In contrast, higher crystalline materials can be processed under greater shear and heat.

SCREW DESIGN

Screws have three (3) zones designed to accommodate these resins:

1) Feed (feeding) zone;
2) Transition (melting) zone; and
3) Meter (molten) zone.

From these considerations, screws with longer transition zones are more effective in melting the amorphous (gradual melt) resins whereas crystalline materials (defined melt point) can be processed more effectively with screws featuring shorter transition zones.

The chart on the next page details the difference in screws manufactured to process an amorphous and a highly crystalline material for a 20:1 L/D screw with a square pitch.

REPEATABILITY

All resins have a certain melt curve, depending on the molecular structure. Screws used in processing these resins should be designed to accommodate those curves.

Amorphous	Feed	Transition	Meter
Polycarbonate	6	10	4

Crystalline	Feed	Transition	Meter
Polypropylene	9	6	5

Failure to follow the melting curves developed by the resin manufacturer may result in obstruction of flow (blockage) during the plasticating process.

Obstruction of flow is caused when solids get to a point of the screw were they can no longer pass. This will generate an excessive amount of shear heat in a concentrated area, as the screw works to force the solids up the screw. It can also produce what is termed as “side loading the screw”. This occurs when the built up pressure forces the screw to glance the barrel, which can result in premature wear.

Have you ever had a process where five (5) shots are inventoried in the barrel, but a defect can be found every 10 or 20 shots?

Do you ever see inconsistent screw recovery times in your process?

Both of these occurrences can be the result of blockage occurring in your screw.

When blockage in a screw builds and releases, the molecular weight and viscosity of the resin changes causing issues with the melt quality (ie: splay, contamination, overheating the resin, etc.). The intermittent defect occurrence could be based on the time the blockage in the screw builds or releases. The fewer blockages developed in conveying material, the more homogeneous and isothermal the material is, which provides for repeatability in the process.

RUNNING MULTIPLE RESINS WITH ONE SCREW

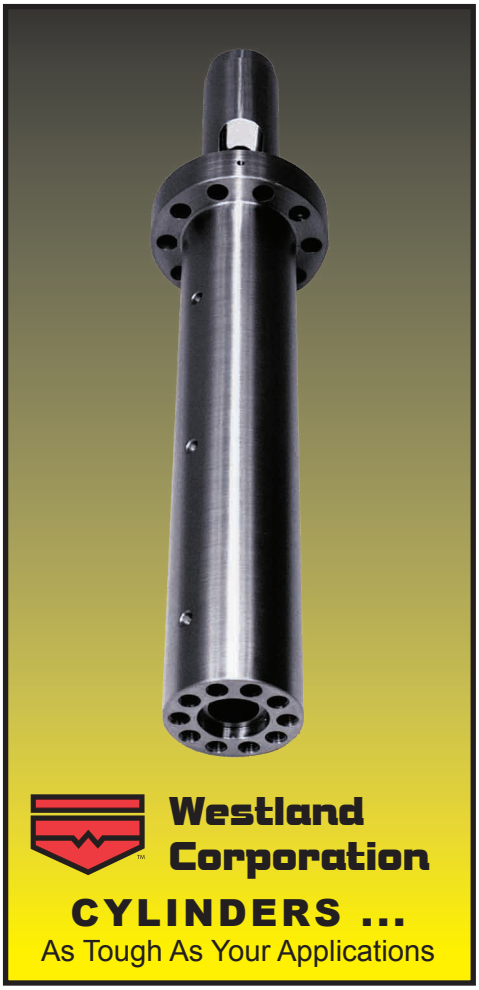
A screw designed for a specific material will provide the greatest opportunity to process with the most efficiency and repeatability. However, sometimes having a screw designed specifically for a certain material is not practical due to the variety of materials running in a production cell.

Westland will design a screw with the most latitude for all resins being processed. Then, variables on the machine (heats, back pressure, RPM, etc.) can be adjusted to compensate for any weakness in the screw design in order to process a wider range of materials.

We would welcome and appreciate the opportunity to further discuss a screw design for your process or processes. Just call us at 800-247-1144 with your questions and information.

Westland custom designed screws ... for a faster cycle

This is a “non-scientific” analogy for understanding the difference in how amorphous and high crystalline materials melt. One more example.	WATER VERSUS BUTTER	
	Water (as compared to High Crystalline)	**Butter** (as compared to Amorphous)
	As a liquid, water freezes at 32°F. Raise the heat and it quickly melts. For water, there is a defined melting point, just as with a high crystalline material.	In the refrigerator, a stick of butter remains at a constant consistency. Set that same stick of butter out on the counter and overtime it softens, yet maintains its shape. It is not yet a liquid. As butter is heated, it gradually becomes a liquid; however there is no set melting point just like an amorphous material.
	Put an ice cube in a hot skillet and it melts.	Put a pad of butter in a very hot skillet and it will quickly burn.



HOW DO BARRIER SCREWS DIFFER FROM MIXING SCREWS?

Mixing Screws are designed to improve melt homogenization, including color dispersion.

Barrier screws are designed to control the melting process. Control of the melt process is achieved by using two screw channels in the transition section of the screw separated by a barrier flight.

The “solids” channel retains the solid material until it has been melted. As the plastic is melted, it crosses over the undercut barrier flight into the “melt” channel. As the plastic moves forward, the “solids” channel decreases in volume and terminates, while the “melt” channel volume increases and becomes the meter section of the screw.

Barrier screws restrict solid bed breakup and thereby improve the melting process. In some cases, a higher production rate can be achieved because of the controlled melting.

To learn more about Westland’s patented Eagle Mixer or Eagle Barrier Screws, visit our webpage or call to speak with one of our sales engineers.

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