Barrel Alignment Keeps Production on Target —And Saves Lots of Trouble

What happens when an extruder barrel becomes misaligned? For starters, the screw, the barrel, and even the gearbox undergo premature wear. Then there is the falloff in efficiency as rapid wear increases the diametral clearance between the screw flights and the barrel. In extreme cases, misalignment leads to catastrophic failure, as components undergo so much deflection that the screw either breaks outright or forms a metal-to-metal, adhesive weld with the barrel so that the extruder seizes up.

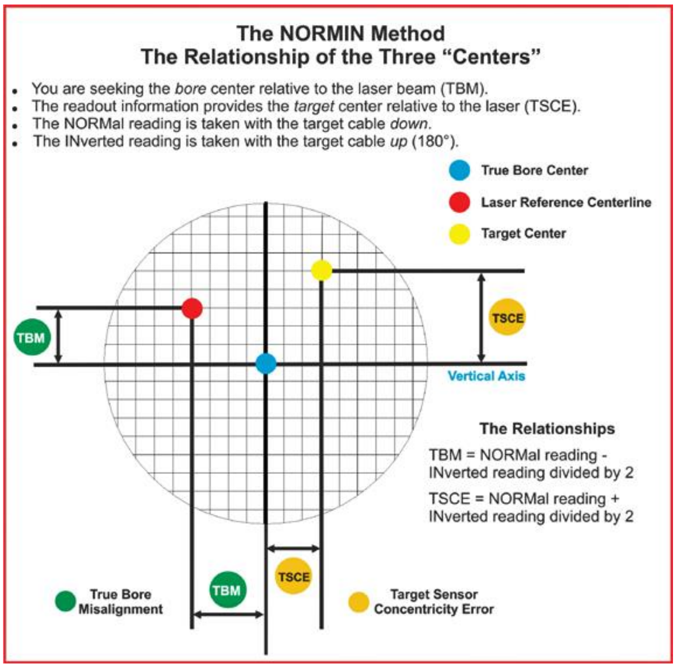
In thinking about how to prevent such problems, it is important to remember that barrel misalignment is measured with respect to the rotation axis of the extruder drive quill. A perfectly straight brand new barrel, in other words, can still easily be misaligned to the quill's rotation axis, with potentially ruinous results. One common misconception that has not entirely disappeared is that alignment can be indicated by use of a level. This measures only the levelness of the outside of the barrel, which has virtually nothing to do with the alignment of the barrel's centerline relative to the rotation axis of the extruder drive quill.

Two types of misalignment typically exist. 1. ***Radial misalignment*** occurs when a barrel is mounted parallel to the quill's rotation axis but is offset radially, causing interference between screw and barrel along the entire length. 2. ***Angular misalignment*** takes place when a barrel is centered to the quill's rotation axis at the mounting surface but slopes up/down or left/right relative to the quill's rotation axis, causing progressively worse interference and wear on the barrel and screw in the downstream direction.

To accurately measure the degree of misalignment and monitor the progress of returning to alignment, the most common method until recently was to position a "bore scope" to the rear of the gearbox and adjust it so that it optically represents the centerline of the drive. Inside the barrel are one or more transparent work targets with crosshairs. Looking through the bore scope, you can measure deviations from the centerline and determine how much to adjust the positions of machine components in order to return the system to alignment. You can continue using the scope and work targets to monitor the progress through various stages of adjustment.

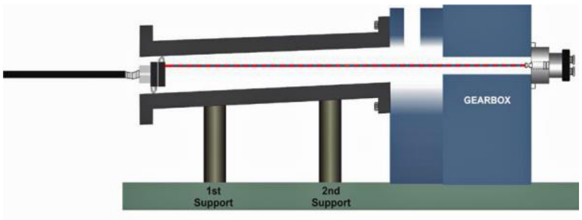
Today, laser alignment systems have largely replaced this optical method. Such systems can be purchased, or technicians can be hired to carry out laser alignment. The accuracy of laser alignment systems is typically two to three times better than the bore scope method. Laser alignment also cuts alignment times in half and reduces the likelihood of human error.

The laser is mounted into the gearbox through-hole (counter bore) by using a self-centering chuck, which has a specially adapted plate that is centered to the feet to within 0.0005 in. (0.0127 mm). In a simple procedure, the laser is aligned to the quill's rotation axis and is then projected onto a two-axis self-centering target located at the end of the barrel. This procedure is called the NORMIN (NORMal and INverted) procedure and was developed by Hamar Laser® to compensate for laser or target mounting errors in bore or spindle alignment. The two-axis bore target and self-centering bore adapter are designed to find the center of the bore, without any moving parts, to a tolerance of 0.0005 in. or 0.0127 mm (with care, tolerances of 0.0002 in. or 0.005 mm can be achieved). A 2-axis digital readout is attached to the



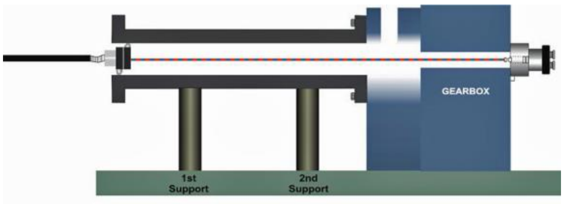
In the NORMIN method of laser alignment developed by Hamar Laser®, a laser that has been aligned with the gearbox axis of rotation is projected onto a two-axis self-centering target that is placed inside the extruder barrel.

target to produce X-Y alignment reading and a 5-foot pole (with optional 5-foot extensions) is attached to the target to insert it deep into the barrel so a full measurement of barrel straightness can be taken if desired.



Schematic shows misalignment of the free end of the barrel with respect to the gearbox axis of rotation.

The alignment reading produced after completing the NORMIN procedure is a measurement of the misalignment of the free end of the barrel relative to the quill's axis of rotation. To align the barrel, it is best to move the target into the barrel just above the fixed barrel support. The barrel can then be shimmed or moved, while alignment values on the readout automatically update, until it displays zero in both axes. Barrels with multiple supports must be checked and adjusted if necessary at each support location and then rechecked after adjustment at other support locations.



Following alignment, the barrel is fully concentric with the gearbox axis of rotation.

The alignment procedure should be carried out with the extruder and components at room temperature and the barrel as clean as possible. It is recommended that you align the barrel every time it has been disengaged from the gearbox—whether for installation of a new or refurbished barrel or for system maintenance. This applies to any barrel whose inside diameter (i.d.) is 2.5 in. (63 mm) or larger.

During laser alignment, a pole with the NORMIN target is inserted into the barrel. In the foreground is the digital readout of data from the target.

Barrel supports play a critical role in barrel alignment. They must be robust enough to bear the weight of the barrel, screw, and other components and incorporate adjusting mechanisms for correcting misalignment. A poorly designed support can restrict the expansion of the barrel when heat is applied and make it very difficult to properly align it.

Barrel alignment requires an investment of downtime, but the return on this investment is considerable. Processors have reported that, with proper alignment, barrel and screw life increased by two to three times. Alignment also helps to maintain a high level of productivity and product quality and can save on electrical costs, since a properly aligned extruder requires less torque to turn the screw. With the advent of sophisticated alignment techniques and the availability of outside specialists, these benefits can be achieved for extrusion processes of all types.

Contact

For any questions about barrel alignment, please contact:

Mark Colella, Global Product Manager for Xaloy® Products
E-mail: mark.colella@nordson.com

Polymer Processing Systems
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