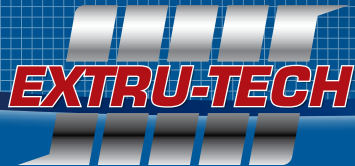
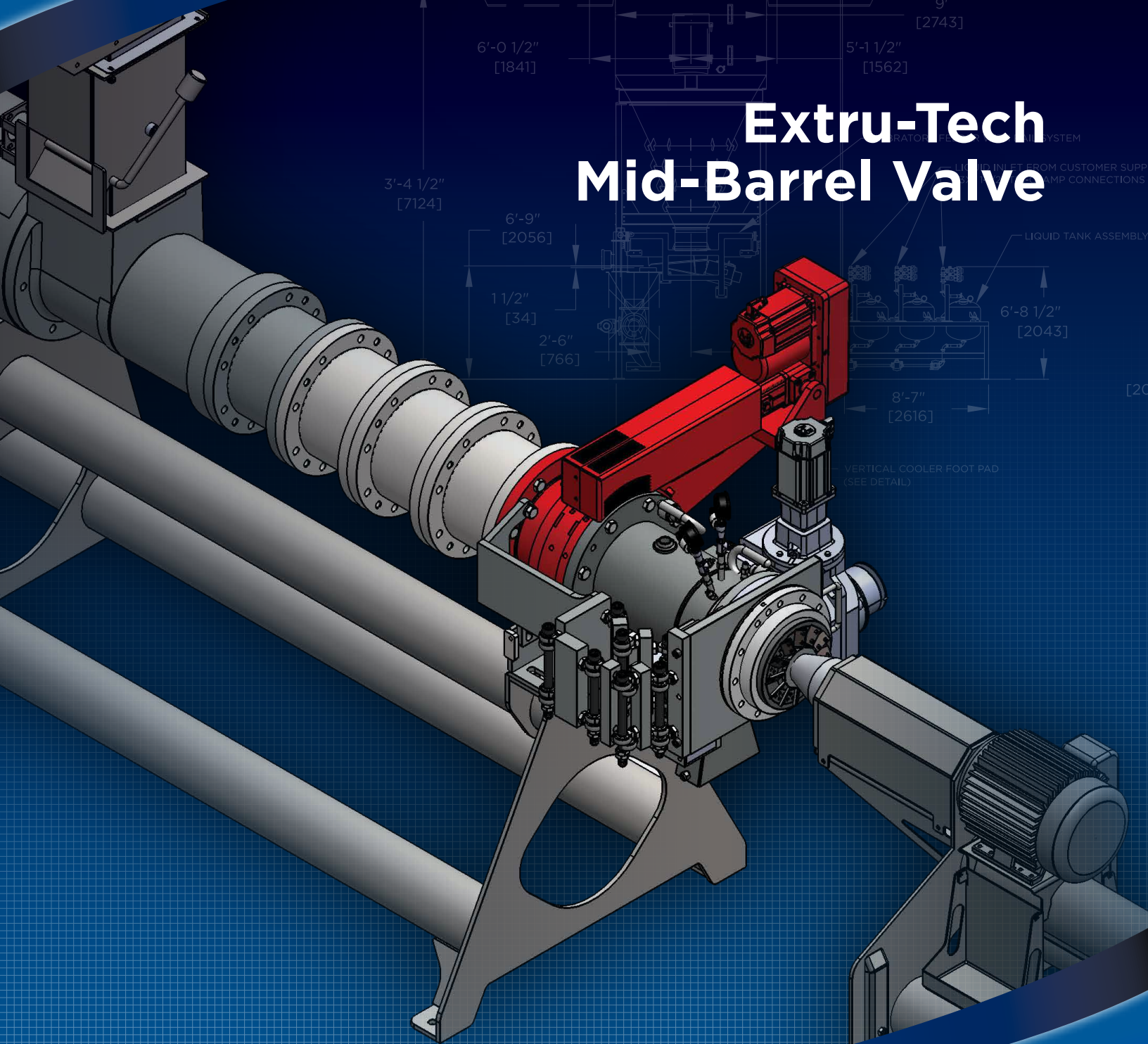


Extru-Tech Mid-Barrel Valve





An Extru-Tech innovation that's moved the industry forward

The Extru-Tech Mid-Barrel Valve (MBV) was designed and developed to allow for high levels of fat inclusion, high levels of cook, and high density, primarily for high-fat sinking aquafeeds. The high mechanical shear enables high levels of gelatinization while maintaining product density, preventing it from floating. By applying energy in the middle of the barrel, the end of the barrel can cool and densify the product using Advanced Density Technology, special high-volume, low-shear screws, and an extra-large die plate.

The MBV is a variable-opening orifice positioned in the middle of the extruder shaft (typically between heads 4 and 5 on an eight-head system) that allows for in-process tuning of mechanical shear (cook). This, along with a tailored die configuration, allows for the densification of the product in the final heads of the extruder (heads 5 to 8 on an eight-head system).

The MBV allows for a variety of inclusion rates and formulations—from high-protein to high-fat to standard products—without requiring the long six-hour plus downtimes required to change a screw element configuration. With the emergence of new functional ingredients monthly, this adaptability is vital to remain competitive in today's market.

Expanding beyond Aquafeed

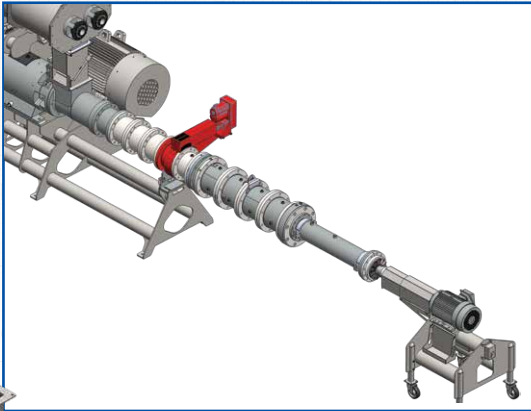
The versatility of the MBV quickly diversified its adaptation beyond aquafeed. The MBV delivers key capabilities and product characteristics in aquafeed, pet foods and treats. Some of those include:

- Improved consistency for all diets, particularly grain-free diets and small kibble
- Higher energy profile capabilities, especially with cat diets
- Ability to target a wider range of densities
- Wider energy profiles when coupled with the MCMS (removing the EMV when using the MCMS)
- Improved ability to compensate for raw material variability
- Production of dental sticks (high-energy, high-density chews) with comparable chew-time (elasticity/hardness) as twin screws and multi-step processes

The MBV is engineered as a solution specifically for petfood products and aquafeed products. The MBV excels when utilized on products incorporating the following characteristics:

- High Meat
- High Starch
- Low Starch
- Grain-Free
- LID
- Combinations of the above (e.g., High-Meat Grain-Free)





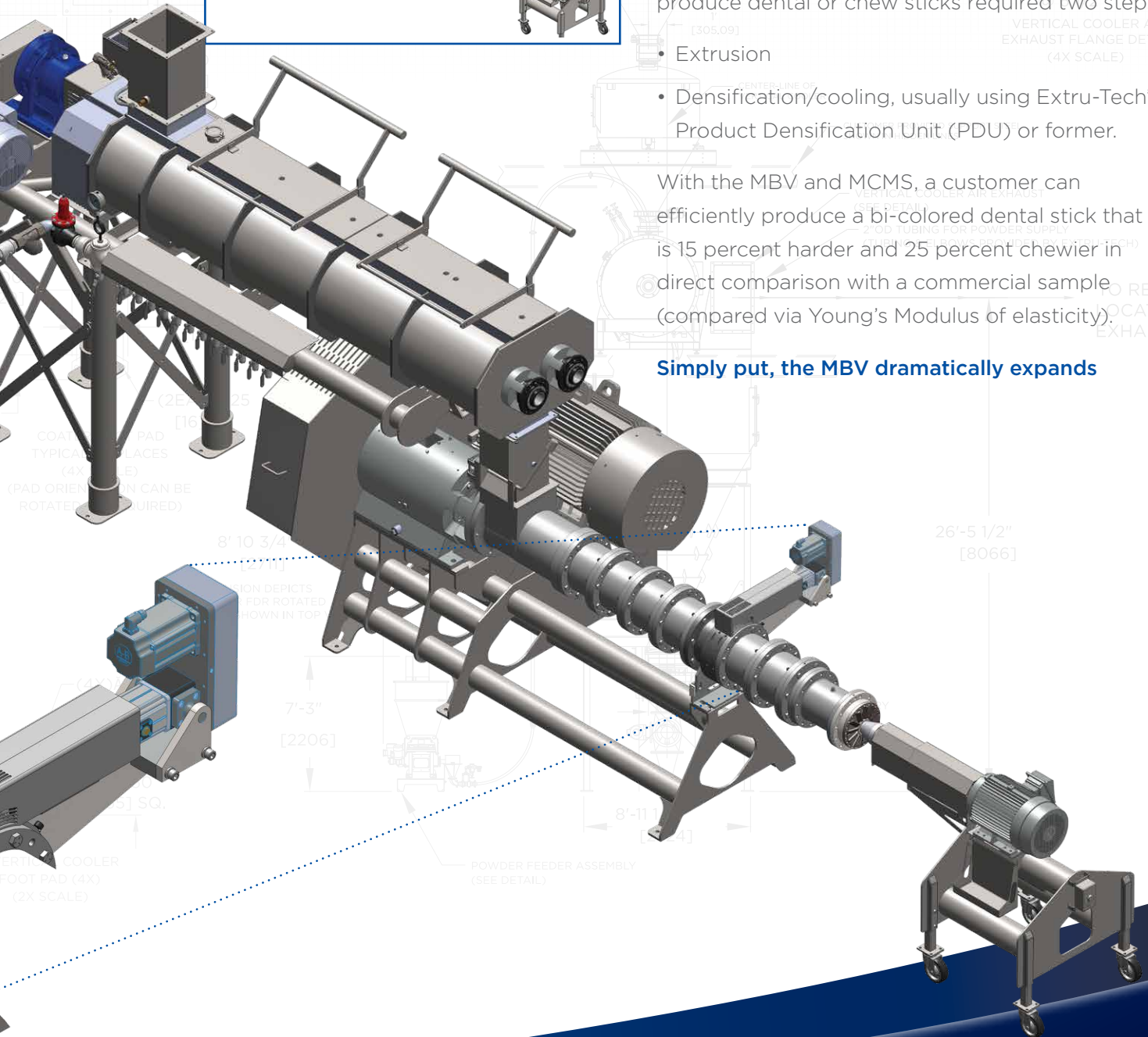
MBV and MCMS work together like a treat

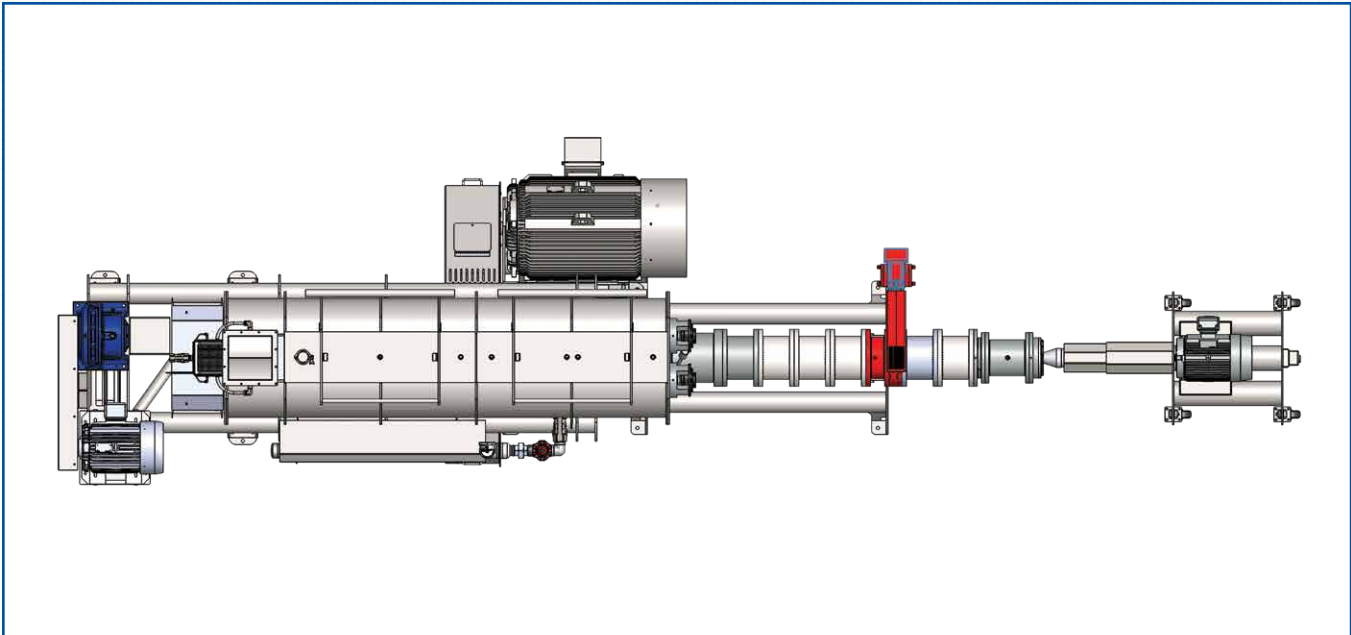
Using the Extru-Tech MCMS (Multi-Color/ Multi-Shape) system and MBV has dramatically expanded the efficacy of using a single-screw extruder in the production of dental sticks or chew sticks, within a single production step. Previously, the single screw process used to produce dental or chew sticks required two steps:

- Extrusion
- Densification/cooling, usually using Extru-Tech's Product Densification Unit (PDU) or former.

With the MBV and MCMS, a customer can efficiently produce a bi-colored dental stick that is 15 percent harder and 25 percent chewier in direct comparison with a commercial sample (compared via Young's Modulus of elasticity).

Simply put, the MBV dramatically expands





product possibilities

The MBV allowed for a more distinct separation in the zones of our Extrusion Systems. Sinking aquafeeds were an ideal use of implementing the MBV. Immediate benefits included:

- Dramatically moving the primary shear zone earlier in the extruder allows the final screws and heads near the die to focus on forming pellets only.
- This separation permits new screw designs for reducing shear and improving uniform flow to large die plates.
- The large die plates improve capacity and pellet quality.
- The MBV facilitates better control over thermal

and mechanical energy balance, resulting in improved capabilities over a range of formulations, raw material variations, final cell structure, water stability, durability, and final bulk density.

Additionally, improved mixing of gelatinized raw materials and functional protein leads to stable conditions and consistency in the physical attributes of final products, including uniformity of size, texture, shape, and density.

Simply put, the MBV is another Extru-Tech innovation that has moved the industry forward.

