



Components of the pelleting system

An in-depth look at the various aspects of making feed pellets

by Fred Fairchild



This article will address the components in a pelleting system for animal feed. It will be a walk-through of a system. Specific information and features about different pieces of equipment used in the system will be addressed in a future article. A diagram of a typical pelleting system is shown in Figure 1.

MASH SUPPLY BINS

The system begins with the supply of the feed (mash) to be pelleted. The mash is usually a mixture of relatively dry ingredients that has been formulated and blended prior to delivery to the supply bins. This mash is a mixture of particles of different sizes uniformly blended together. It is important that in moving these ingredients into the supply bins that particle separation is minimized. In filling a bin with materials of different types and sizes of particles, some separation will occur. The spout into each bin should be designed so the material flow is vertical as it enters the bin, and the inlet spout is located in the center of the bin top.

It is also important that the supply bins be designed with a hopper of sufficient slope to allow for mass-flow of the materials out of the bin. Mass-flow allows all materials in the bin to discharge uniformly, even if some particle separation occurs at a given level. If the supply bins are square or rectangular, the hopper must be designed to avoid flow hang-ups in the valley (corners) of the hopper. The corner where two sides of a hopper meet must have a steep enough slope to permit flow without restriction.

One method of mass-flow hopper design for square or rectangular bins is to build the hopper with a top that fits the bin body and the outlet as a circle. This eliminates any valleys in the hopper. In order to attach the hopper to the feeder, a transition from the round hopper outlet to the feeder inlet is built. This transition into the feeder should be of stainless steel construction in the event any steam vapors from the pelleting process migrate through the feeder.

In many cases, multiple mash supply bins are desirable. When this occurs, a second hopper transition is required to direct the mash from the multiple bin hoppers to the feeder

inlet. This transition should also be built for mass-flow of the materials. Additionally, each mash bin hopper must be equipped with a gate of proper design and size to allow the mash to flow freely through it from the bin hopper. It is recommended that the transition be built of stainless steel.

Each bin should be equipped with a vibrator on the hopper that is remotely controlled by the operator or an automated control system. It is also desirable to have a bin level devise to determine the amount of material in the bin. This is especially helpful to know when the bin is full or empty.

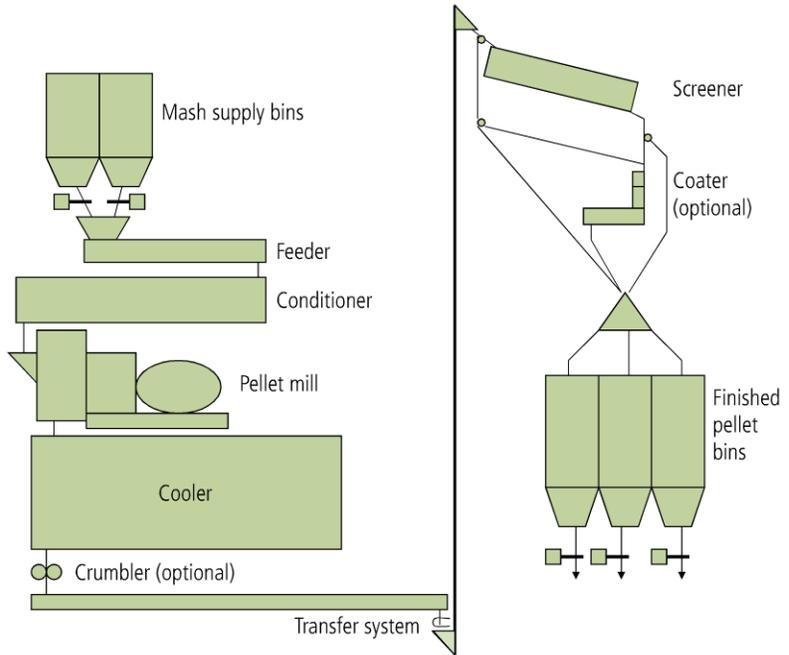
PELLET MILL FEEDER

The rate of mash supplied to the pelleting equipment is determined by a type of feed control devise. This devise requires a design that controls the rate at which the mash is delivered to pelleting equipment. Most often a screw feeder with speed control to set the rate at which the material enters the equipment is used. The screw feeder is a volumetric device but doesn't measure the weight or mass passing through it. An estimate of the mass of mash being delivered through the feeder may be determined if the density of the mash is known and the cubic volume being delivered by the screw feeder is known.

If it is desired to know the actual rate of the weight or mass passing through the feeder, a loss-in-weight bin may be installed above the feeder. The loss-in-weight bin is mounted on load cells so the amount of material in it may be weighed at any time. As material leaves the loss-in-weight bin, a computer can determine the rate at which the material is leaving the bin.

The feed rate controls the amount of mash passing through the pelleting equipment and is used to control the amount of work the pellet mill main drive is using to make the pellets. With correct feeder speed settings, the allowable motor load on the pellet mill may be approached but not exceeded. It is a key component of any automated pellet-

Figure 1. The pelleting system



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The pellet mill, such as this Bühler Kubex T, is the workhorse of any pelleting system. Photo courtesy of Bühler.

ing system control. The feeder should be constructed of stainless steel.

CONDITIONER

The conditioner is the vessel in which the dry mash materials and steam are blended together to make a wet mash mix to send to the pellet mill for forming into pellets. The conditioner is an enclosed continuous mixing chamber with paddles to mix the dry mash and added steam and any other added liquids at that point. It has two functions, first to fully blend the materials and liquids, and second to be long enough and large enough to provide the desired time for that function to fully occur and the mash heated to a desired level before entering the pellet mill die.

The conditioner and all inlet and outlet ports should be made of stainless steel. The conditioner may be a one section enclosed single shaft paddle mixer or of multiple sections or designs to enhance mixing characteristics or retention time. The depth of mash passing through the conditioner is also important. The picks (paddles) on the shaft may be adjusted for the rate at which the mash is retained or moved through the conditioner. If several types of mash and different amounts of liquids are added, it is often desirable to install a variable frequency A.C. motor starter in order to adjust the speed of the conditioner drive.

In pellet system automation, the discharge temperature of the mash is controlled by the amount of steam injected into the mash and how long the mash is retained in the conditioner. An automated pelleting system senses the temperature of the wet mash leaving the conditioner and controls the amount of steam injected into the conditioner. A properly designed steam control system is important. Each conditioner manufacturer has recommended design for the steam system that should be considered when installing a pelleting system.

PELLET MILL

The pellet mill is the workhorse of the system where the hot moist mash from the conditioner is pushed through a ring

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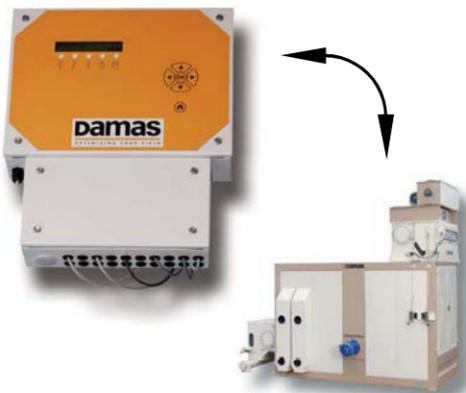
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die to form the mash into the pellet size and shape. The pellet mill die is fed with mash from the conditioner by gravity or a forced feeder system.

The amount of electrical load on the pellet mill motor is determined by the amount of work it takes to force the mash material through the die and the rate the work is being done. This varies based on a number of things including ingredients in the mash, amount of moisture in the mash, and die design and configuration. The rate of work being done is limited by the size of the drive motor on the pellet mill and the rate the feeder is delivering material to the system. If a number of different types of mash formulas and different diameter pellets and pellet die configurations are used, it is desirable to also equip the pellet mill drive motor with a method of adjusting its speed. Again, a variable frequency A.C. motor starter would work well for this purpose.

When preparing to install the pellet mill, room must be provided on all sides to allow a full 180-degree swing when opening the die housing door. This is required in order to exchange dies. The area at the other end where the motor cooling fan is located must also be free of obstructions to allow air to enter the fan. The sides must provide adequate

room to service the steam systems and other equipment. The mill should be mounted on a properly constructed base

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with vibration mounting pads between the base of the mill and the base.

COOLER

The newly formed hot pellets then enter the cooler. Two types of construction are normally found: a horizontal cooler with moving beds on which the pellets ride in a layer or a counter-flow design with air passing up through a column of pellets. I will discuss the features of these coolers in a future article. In both types of coolers, room air is passed through the pellets to both cool and remove moisture from the pellets. Upon exiting the cooler, the air is moist and has particles or fines entrained in the air. This air is passed through high-efficiency centrifugal cyclone type collectors to separate and recover the particles and exhaust the moisture-laden air to the atmosphere. All of the air ducts, cyclones, airlocks and valves should be of stainless steel con-

struction. All of this system should be insulated on the exterior surfaces to avoid moisture condensation inside the system.

Since the system uses room air for cooling, provisions must be made for letting sufficient air into the room through exterior wall openings. These openings should be above floor or exterior grade to avoid bringing trash into the system. Discharges must be located where the discharged air cannot be drawn back into the cooling system.

I will continue with the rest of the pelleting system in the next article and look at features of various pieces of equipment in the system. **WG**

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