



# The Bonnot Company

Global Leaders in Extrusion Solutions Since 1891

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## OPERATING INSTRUCTIONS - 6" COOKING EXTRUDER

### I. INTRODUCTION

The 6" Cooking Extruder is used to continuously cook cereals and to extrude the product in either an expanded form or into a non-expanded "half product". The expanded extrusions may either be in their final form or the expanded rope may be passed through a secondary cold forming Extruder to produce pellets or other shapes for subsequent flaking or puffing. The non-expanded "half products" may be in the form of a pellet for subsequent rolling into flakes or in shapes which are subsequently puffed by guns or other means. The capacity of the Cooking Extruder in producing a "half product" is considerably less than when producing an expanded product, as lower speeds are necessary to allow the required cooling to take place.

Operating conditions will vary with the type of material being processed and the nature of the end product. The instructions contained herein are intended as a general guide and some experimentation will be necessary to establish exact operating conditions. The facilities of the Bonnot Test Laboratory are always available without charge or obligation to assist you in establishing operating conditions in advance of production runs on the 6" size Cooking Extruder. In order to conduct such trials, 50 to 100 lbs. of the proposed formulation are required and a description of the type of processing desired. Visitors are welcome during such trial runs.

General procedures for material preparation, startup, running and shutdown are contained in these instructions. Installation instructions are covered separately and required lubrication is covered in the drawings supplied with the machine.

### II. MATERIAL PREPARATION

All mixing of the various ingredients must be performed ahead of the Cooking Extruder. Normally, the various ingredients are thoroughly mixed in a batch type mixer from where they are conveyed to a bin ahead of the Cooking Extruder. Different starches require different amounts of moisture for proper cooking to take place. Most corn based products are cooked at moisture levels of 25 to 30%. Rice will normally be cooked at 20 to 25%. Wheat requires about 32% moisture. Lower moisture levels may be used where a higher degree of expansion is required. Keep in mind that more mechanical heat will be developed by the Cooker at lower moisture levels and that greater power will be consumed. Too low a moisture level will cause the machine to jam.

The amount of oil present in the mixture will have a significant affect on the operation of the Cooking Extruder. Higher oil content will tend to lubricate the mixture and will cause it to pass through the Cooking Extruder with greater ease and at greater capabilities. Very low levels of oil will have the opposite tendency. Emulsifiers are sometimes used as extrusion aids and will also make the product less sticky in cutting at the die face of the Extruder.



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If the materials to be cooked are very course, it may be necessary to allow the premixed material to absorb the moisture for one-half hour or more in the storage bin ahead of the Extruder. Bear in mind that the moisture must be thoroughly absorbed into the particles for proper cooking to take place.

All Cooking Extruders will operate most efficiently with a controlled rate of feed of material into the hopper. Therefore, it is desirable to have a feeder at the discharge of the bin ahead of the Cooking Extruder to assure a continuous rate of feed.

### III. BEFORE OPERATION

Before starting the Cooking Extruder be sure that no foreign material has dropped into the hopper of the Extruder, as severe damage could occur. Also, be certain that safety procedures accompanying the machine are being followed to prevent injury to personnel operating the equipment.

The extrusion barrel closest to the hopper is always cooled to assure proper conveying of material along the extrusion worm into the cooling zone. The remaining barrels are heated to the desired temperature, normally with steam. The extrusion barrel at the die end of the machine is heated if an expanded product is desired, or cooled if a non-expanded product is desired. The various barrel sections of the Extruder are cooled and heated as required before startup.

No steam or cooling water is passed through the extrusion worm until after the Extruder is filled with material. Introducing steam or water into the worm while the machine is empty may cause the worm to slide forward out of position and can result in damage.

If the Fly Knife Cutter is to be used, it is swung into the closed, operating position and bolted in place. The cutting blade assembly is adjusted so that the cutting blades just clear the face of the die. This adjustment is accomplished by means of unlocking the locking nut on the knife holder, adjusting the position of the knife, and retightening the locking nut. The individual blades are adjusted to be sure that both blades are in the same relationship to the die face.

### IV. STARTUP PROCEDURE

When starting a machine whose extruding qualities are unknown, it is recommended that the mixture be on the wet side. Also, material should be fed at a slow rate to the extrusion worm so that it operates in a starved condition until it is observed that the material is properly extruding from the die holes. When it has been observed that the material is properly flowing from the dies the rate of feed should be gradually increased until the extrusion worm is running completely full. The extrusion worm is running full when material just covers the flights in the hopper.

### V. DURING OPERATION

Within a very few minutes of startup the Cooking Extruder should reach a steady state condition. During operation periodically observe the



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production rate, power consumption, and characteristics of the extruded product. All of these conditions should remain consistent.

The most common problem during operation is that of surging, or erratic flow. This can be caused by irregular feeding of the Extruder, non-uniformity of the mixed material being fed to the Extruder, plugging of the extrusion die holes with foreign material too large to pass through the die holes, or material sticking to the extrusion worm inside the machine. Material sticking to the extrusion worm inside the Extruder is most commonly caused by overcooking and baking of the material to the extrusion worm. This condition is most readily corrected by providing a small amount of cooling water to the inside of the extrusion worm.

Undercooking of the product can be corrected by adjusting the temperature of the extrusion barrels, heating the extrusion worm, adjusting the speed of the Extruder, or varying the moisture content of the material.

When the Cooking Extruder is used to produce a non-expanded “half product” it will be necessary to operate the Extruder at lower speed settings to allow the final extrusion barrel to do enough cooling to prevent expansion.

Extrusion pressure can be changed by altering the moisture content of the material. Lower moisture levels will result in higher pressure. Pressure can also be increased slightly by reducing the open area of the die, either by utilizing smaller diameter extrusion holes or a fewer number of holes.

## VI. SHUTDOWN

The Extruder may be stopped briefly during a normal run while full of material, and restarted. The SCR drive provides the necessary controlled acceleration of the worm to prevent any damage. Shutdown while full of product should not exceed one minute, except where the product has a high moisture level or the main driving motor is lightly loaded.

At the end of an extrusion run, before stopping the machine, the heat should be turned off on the barrels and the extrusion worm. Feed to the extrusion worm should be cut off and the Extruder should be allowed to continue to operate until all material has been discharged from the extrusion die. The Extruder should then be turned off and the die end of the machine opened up. The Extruder should then be turned back on to discharge all remaining material.

The degree to which the machine empties itself will depend on the nature of the product being passed through it. Materials with a higher oil content will tend to more thoroughly discharge. It may be found helpful in some circumstances where significant amounts of material tend to remain in the Extruder to use a purging material. A course material having a relatively high oil content will tend to clear the machine fairly well. Cooked corn extrusions from the machine may also be used.

If the machine is to be shut down for any extended period of time, it is recommended that the Extruder be filled with water with the die holes plugged to thoroughly soften the material remaining in the Extruder. For a complete cleanout it is necessary to remove the extrusion worm. This is



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done by unscrewing the torpedo in the front end of the extrusion worm with the tool provided. The puller piece is threaded into the end of the extrusion worm and used to pull the extrusion worm from the Extruder. The extrusion worm should be supported during removal from the machine and reinstallation, as it fits very closely into the barrel. A monorail placed over and in line with the extrusion barrel is very helpful in providing this necessary support.

Feel free to contact the Bonnot Company at any time when any particular operating problems arise or whenever further information is needed.