



Subject : Offer for production line of puffed cereals

Please find herewith our offer for a complete production line for puffed cereals products.

CEREX-500-PG puffing installation consisting of :

Pre-heater

The INCOMEC Pre-heater is a set (3 tubes) of steam-heated tubes through which the raw material is transported by means of Archimedes screws. The tubes are placed one above the other forming a battery of tubes with a considerable heated length. The temperature of the grain at entry is the environmental temperature. The set-point temperature is depending on the raw material. The preheating installation also has to prevent the raw material that is being treated from sticking together and loosing too much humidity. The pre-heaters are specially designed and constructed so that this critical preheating process can be done in optimal conditions. The pre-heater is normally delivered without steam valves and considerable bleeding valve, unless otherwise agreed.

Technical Specifications	
Dimensions	4.5 m L x 1 m W x 1.5 m H
Weight	3000 kg or 6600 Lb.
Material	Stainless steel
Voltage	3 x 220 V or 3 x 380 V + N
Steam Pressure	3 -10 bar or 40 -150 PSI
Steam Consumption	Depending on raw mat., ambient temp., setting temp., approx. 60 kW
Power Consumption	approx. 4 kW



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CEREX-500-PG

The **INCOME C CEREX-500-PG** is an innovative efficient system for the expansion of cereal grains and expandable half-products with an average output of 1100 pounds or 500 kg/hour. The CEREX series of puffing guns are designed for the processing of a broad range of grains (wheat, rice, corn, oats, sorghum, etc.) for the manufacture of Ready to Eat Cereals, animal feeds, and industrial products.

The INCOME C CEREX-500-PG steam-heated stainless steel expansion barrel provides a level of efficient and controlled application of heat to the barrel unmatched by conventional gas flame heated units. An innovative designed cover with a special seal closes the barrel, maintaining the high pressure critical to this process. An age old process with a few twists. A metered volume of treated grain is fed into the gun. Once in the barrel a rotating blade with variable speed keeps the raw material moving, preventing it from burning while obtaining an adequate and equal heating of the grains. The Barrel is pressurised by the introduction of steam or super heated steam while the grain is cooked. A programmed recipe control package regulates the pressure, temperature and cook time required to produce the desired product profile. The cover opens in milliseconds causing the grain to PUFF as a result of the differential pressure of the barrel versus the atmosphere. A steam jet assembly cleans the barrel and cover between cycles insuring a positive seal at all time.

Complete with support chassis, the gun is easily rolled backwards from the EXPANSION TUNNEL by a pneumatic cylinder to provide accessibility to all of the gun's components for ease of maintenance and sanitation. Built with operators and maintenance staff in mind, the CEREX-500-PG is built for performance.

Technical Specifications	
Dimensions	Approx. 3.5 m L x 1 m W x 2.5 m H
Weight	3000 kg or 6600 Lb.
Heating	Thermal oil heating
Processing steam	+/- 17 bar or +/- 250 PSI
Power consumption	Max:28 kW, Average :14 kW
Voltage	3 x 220 V or 3 x 380 V + N
Air Pressure	+/- 7 bar or +/- 110 PSI
Air consumption	1575 NL/h or 350 gallons of uncompressed air or 50 gallons at 110 PSI
Controls	B&R
Output Capacity	RICE: 440 kg - CORN: 320 KG – WHEAT : 440 kg

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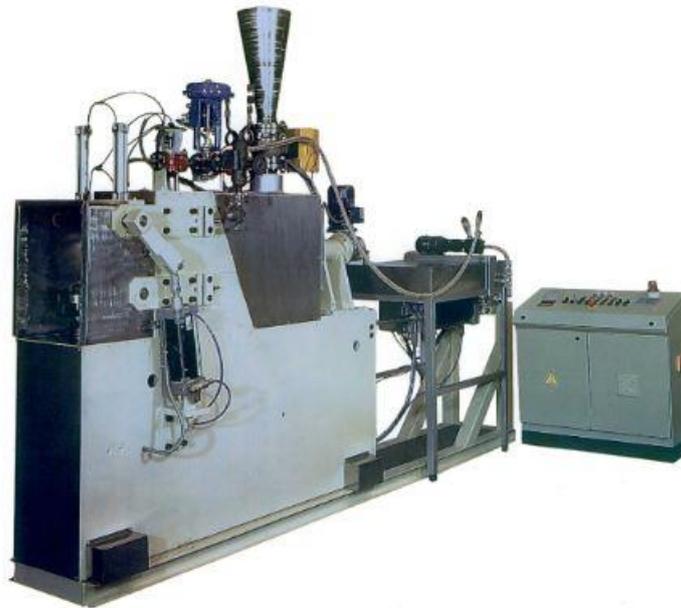
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Process description

The puffing process is determined by several parameters, such as moisture content of the grains, steam pressure and process time. The **initial moisture of the raw material** is very important for proper expansion. It should be around 12 to 13 % which is the normal moisture of wheat, corn (check !!!) , rice and other starchy grains.

The **quality of the raw material** is very important for the quality of the puffed, finished product. It must not contain too many broken, small or empty kernels or foreign materials which will give an inconsistent puffing result and increase the amount of product to be screened off after puffing. Wheat is sometimes pearled to a certain degree (4% to 8 %) to remove some of the outer bran of the grain. It gives the product a "cleaner" look after puffing because the percentage of bran is lower. It also allows the kernels to expand more evenly in all directions. The outer skin is stronger in some places and the kernel has the tendency to expand more at those spots where the skin is the weakest. Pearling decreases this effect. On the other hand, too much pearling will give tendency to create more lumps, due to sticking of the starch and gluten. Corn can be whole, broken, debranned or degermed, depending upon the desired finished product. Oats, rice, barley, buckwheat, millet, sorghum, amaranth, pellets, etc. can also be processed. Pellets however are handled slightly differently. (tilting of the gun might be required because gun pressure is usually lower).

The grain enters the **pre-heater** at 12 to 13 % moisture. It travels through the pre-heater and is heated up. The temperature of the raw material coming out of the pre-heater has to be at least 100 °C. Moisture content has dropped down a little bit but should be more than 9%. The temperature of the pre-heater can be controlled by means of a steam pressure reducing valve which allows to control the steam pressure from 3 to 13 bar. The elapsed time inside the pre-heater can be controlled by means of the frequency drives which control the driving motors of the screws inside the pre-heater. The residence time is usually as long as three complete cycles. This provides for the material to have even preheating without losing too much moisture. At the beginning of each cycle the pre-heater starts turning at high speed for about 20 seconds. At the same time the rotating dosing valve underneath the raw material silo starts turning at a certain speed (frequency drive) feeding in a certain volume inside the pre-heater. The pre-heater and

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rotating dosing valve stop turning after approx. 20 seconds. The rest of the cycle takes place while the screw inside the pre-heater turns at low speed and with a certain interval time one turn backward ,one turn forward, one turn backward... This gives the material a gentle stirring action, allowing it to be evenly preheated without burning the product or losing too much moisture.

Approx. three cycles after starting up production, the pre-heater will start feeding preheated material inside the gun for about 20 seconds while the screws are turning at high speed in forward direction. Once the material has entered the gun, the ball-valve is closed (lid is already closed and locked at the beginning of each cycle). Steam pressure is now being built up inside the gun. The time during which the pressure builds up and the end pressure are parameters which can be controlled.

Building up pressure too quickly gives a wet and too small product while building it up too slowly might give the product a burnt taste and burnt smell. Building up end pressure too low gives a too small product, while building it up too high shatters the product and might give it a burnt taste. These parameters need to be adjusted to obtain the desired product quality for each product. Once determined, each product can have its own recipe for repeatable performance. For certain products (pellets) an end pressure of less than 10-11 bars is used and the moisture is less. When this is the case, the gun must be tilted shortly before shooting in order to clean out fully the gun barrel .The pressure inside the barrel is not strong enough anymore to clean out the gun barrel fully in its horizontal position. This feature should not be used when working at pressures higher than 10-11bars.

The puffing action itself is the result of the sudden pressure drop when the lid of the gun opens very fast. The product is projected out of the gun into the **expansion tunnel**. The expansion tunnel has to be at least 10 meters long to slow down the product sufficiently so that it doesn't get deformed or shattered. It also allows the product to cool down and dry out some of the hot excess moisture. The expansion tunnel is continuously ventilated with ambient air which is blown inside the tunnel at a rate of 7000 to 8000 cubic meters/hour. The puffed product ends up on the conveyor belt at the bottom of the expansion tunnel and is transported out of the tunnel. It is now ready to be cleaned, dried, coated, packed etc.

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