Buss Kneader Technology for the Food Industry

FOOD INDUSTRY

BUSS
excellence in compounding

BUSS Food Extrusion Technology
50 Years of Experience in the Food Industry

As early as 1947 Buss supplied a commercial Kneader for the preparation of chocolate doughs thus, pioneering the continuous extrusion of food. From those early days Buss has continued developing innovative technologies resulting in fully continuously operating processes in well known applications such as the pulling of soft candies, the low-moisture preparation of granulated sugar for the production of sugar tablets and the compounding of Gum Base, Chewing Gum and Bubble Gum. The Buss Kneader is the leading equipment for all these technologies. Its unique operating principle results in a very gentle mixing of the shear and temperature sensitive stock. Macro- and micromixing is second to none and the laboratory, pilot and commercial lines operated worldwide confirm these outstanding features.
Our efforts are aimed at developing and supplying technologies and equipment for the economic production of high quality products.

Applications

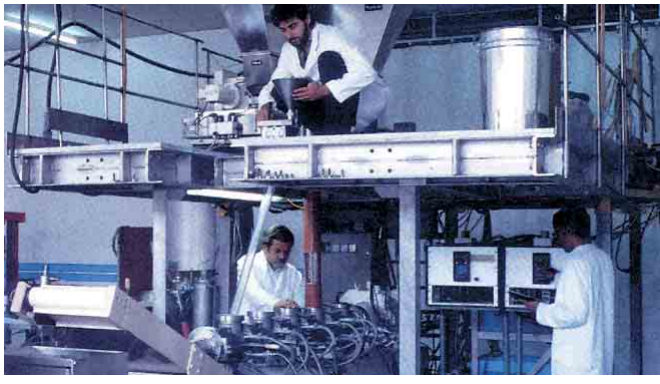
The unique operating principle of the Buss Kneader permits a gentle yet homogeneous processing. In addition, the efficient macro- and micromixing results in a narrow residence time distribution and an outstanding self-cleaning action. Consequently, the Buss Kneader is the preferred equipment used for the preparation of shear sensitive products; such as:

- Pastries, Cakes, Biscuits
- Breakfast Cereals
- Snack-Pellets
- Chocolate Doughs
- Sugar Comprimates
- Soft Candies
- Chewing Gum, Bubble Gum, Gum Base
- Pet Food

BUSS Laboratories

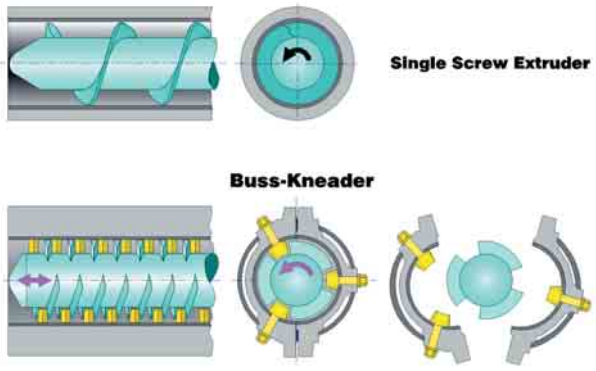
Our laboratories are equipped and serve for:

- establishing processing parameters for the design and supply of pilot and commercial lines
- Process optimization
- Process development
- Product development

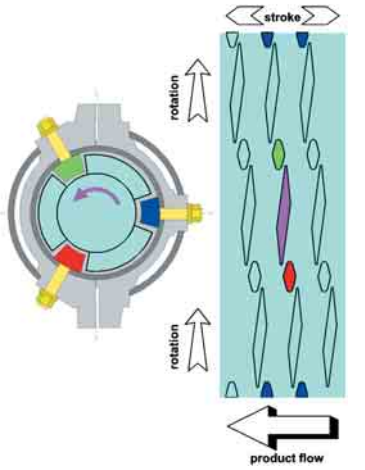


Buss Kneader®
Its unique Operating Principle

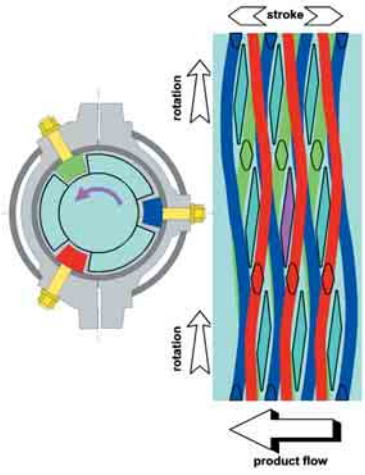
The Buss Kneader is a continuously operating single-screw machine, but its unique operating principle and its special screw and barrel design differentiate it from traditional single-screw extruders:
The screw of a common single-screw extruder has a continuous spiral. With the Buss Kneader this spiral is broken by three gaps per revolution resulting in the Kneading Flights.
Three rows of Kneading Pins or Kneading Teeth cooperating with the kneading flights are individually inserted in the barrel, at radial intervals of 120°.
The screw of a common single-screw extruder only rotates. The motion of the Buss Kneader screw is different: an axial stroke or oscillation is superimposed on the rotation. The gear box ensures that for each revolution the screw is accompanied by one full stroke forward and backwards.
An additional design feature appreciated by R & D engineers as well as maintenance personnel and operators is the vertically split barrel which easily can be opened and closed (see figure on the right).



In order to explain the operating principle of the Buss Kneader a section of the screw is projected into a flat plane.
The kneading flights appear as three rows of stretched rhomboids and the kneading teeth individually inserted in the barrel as three rows of diamonds.
The rotation of the screw correponds to a movement from bottom to top hence the stock is conveyed from the right to the left hand side.



Completing a full revolution, the paths traced by the kneading teeth cover and wipe the entire screw surface.
There are no dead areas or volumes left; the reason for the recognised performance of the Buss Kneader with regard to dispersive and distributive mixing and its outstanding self-cleaning efficiency.

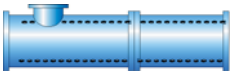


Buss Kneader®
A Modular Concept in every way

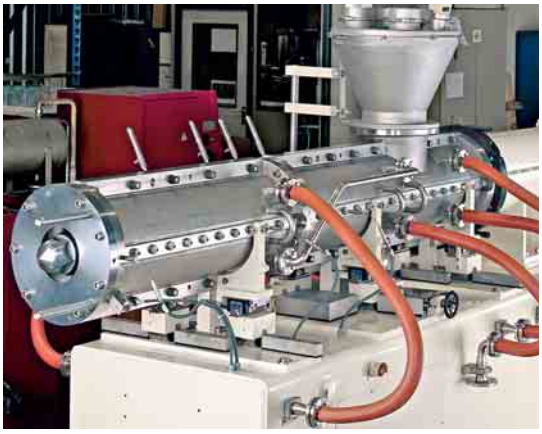
Modular Barrel Design

The barrel of the Buss-Kneader is vertically split and can easily be opened and closed. The barrel halves are pivoted and the screw remains in place. Hence, neither barrel modules nor the screw need to be removed from the base plate.
R&D engineers appreciate this feature as they can stop the machine in full and by opening the barrel they can visually observe and verify the progress of the process.
Maintenance people also profit from the split barrel making their work quick and easy. By means of the opening/closing mechanism the barrel remains positioned on the base plate and no screw has to be pulled.

Processing Length 7 L/D

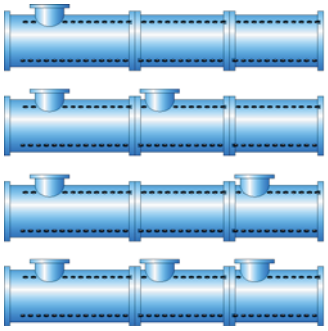


The basic and shortest Buss Kneader is made-up of two barrel modules resulting in a processing length of 7 L/D. Via the feed port of the first barrel module the individual raw material components of the compound or a premix of them are continuously fed into the Buss Kneader.



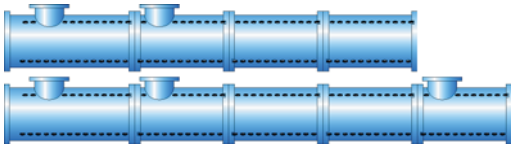
BUSS Kneader type LR 300-7

Processing Length 11 L/D



A third barrel module extends the processing length to 11 L/D. Barrel modules with and without feed ports can be combined at will. Thus, raw material components can be fed downstream into the Buss Kneader; a feature increasing the versatility and flexibility in processing.
The feed ports not only serve for feeding premixes or raw material components. They can also be used for devolatilization, either by atmospheric vent or by pulling vacuum. In doing so volatiles can be removed in a controlled manner from the stock.

Processing Length 15 L/D



Four barrel modules result in a total processing length of 15 L/D. Again the barrel modules can be equipped with feed ports for feeding or for devolatilization.

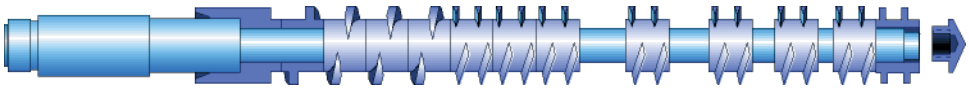
Processing Length 19 L/D

The most complex processes can be performed on a total processing length of 19 L/D which is made-up of five barrel modules.

Buss Kneader®
A Modular Concept in every way

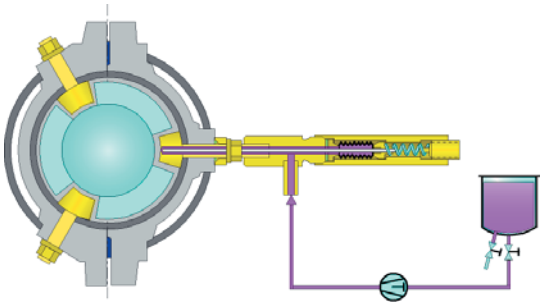
Modular Kneading Screw Design

The central shaft supports screw elements which are slid onto it. The screw end nut tightens the set of screw elements. The central screw shaft is hollow over its entire length. This shaft contains a circulation system for a fluid heat transfer medium.This heat transfer circuit is closed such that when removing the screw elements from the central shaft the heat transfer circuit need not be disconnected.



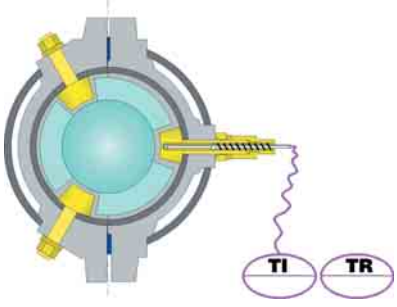
Injection Pin

Kneading pins or kneading teeth individually inserted in the barrel co-operate with the kneading flights of the screw elements. An injection channel is generated by drilling through a kneading pin along its entire length. When not pressurized by the fluid to be injected the injection orifice is automatically closed by a spring loaded needle. This prevents the stock from blocking the injection channel when not in use. As the kneading pins are individually inserted in the barrel an injection pin can be installed at any location of a pin. This unique feature makes the downstream injection of viscous fluid components at any location of pins, efficient and easy. The contours of the kneading pins and the injection pins are identical, leaving the mixing efficiency unchanged.



Thermocouple Pins

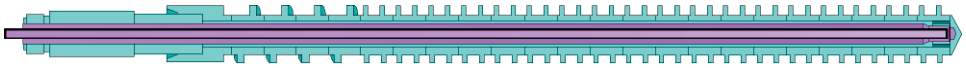
Similarly to the injection pin a kneading pin is drilled and a spring loaded thermcouple inserted into the bore. The pin is not completely drilled protecting thermocouple from any mechanical wear and damage.
The thermocouple sits within the stock hardly influenced by the temperature settings on the barrel. Thus, the thermocouple very accurately reads out the real stock temperature; a feature which contributes to the precise control of the process.
The contours of the kneading pins and the thermocouple pins are identical. Consequently, the mixing efficiency remains unchanged.



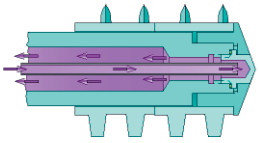
Buss Kneader®
Its Processing Features

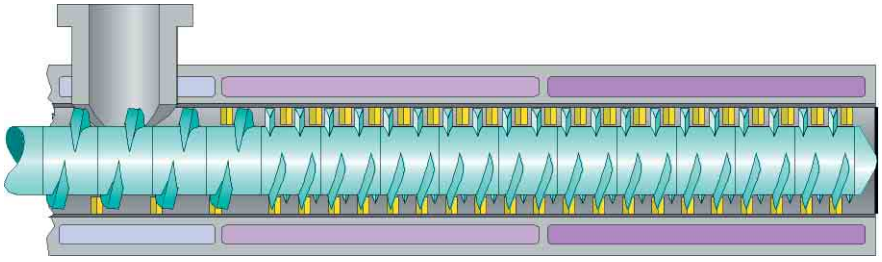
BUSS Kneader type LR 300-15

Temperature Control



The central shaft of the kneading screw is drilled over its entire length. A pipe is inserted into this bore. A fluid heat transfer medium flows through this central pipe to the tip of the screw and returns in the gap between the bore of the central screw shaft and the pipe. On its way back the heat transfer medium exchanges heat with the stock via the surface of the screw elements. In this way the stock is precisely temperature controlled.





The barrel modules are jacketed for the circulation of a fluid heat transfer medium. As a result and similar to the kneading screw the entire surface of the barrel contacted by the stock is precisely temperature controlled. According to the process requirements the barrel modules can individually set to different temperatures.

Depending on the temperature level required by the process, water, steam or mineral oils serve as fluid heat transfer media.

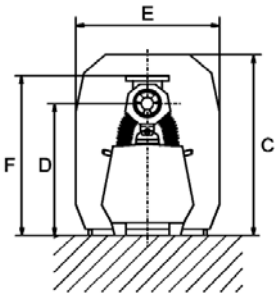
Shear and Energy Dissipation

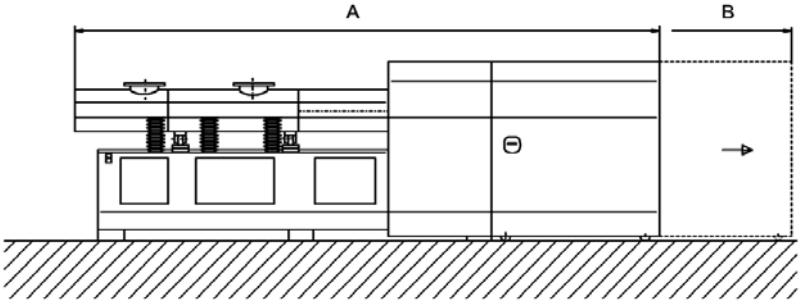
The kneading flights of the screw are wiping past the individual kneading pins. Thus, shear gaps are generated. The frictional forces within the stock (rheology) absorb mechanical energy. This mechanical energy dissipates into heat for heating up the stock to the desired process temperature. It also generates shear stress which performs dispersive and distributive mixing. Both, scientific work and field experience prove that the Buss Kneader operating principle generates moderate shear stress resulting in a maximum macro- and micro-mixing efficiency at minimum energy dissipation. This feature is second to none for screw type machines. It is the reason for the success of the Buss Kneader for the compounding of shear and temperature sensitive products in the field of food technology.

Buss Kneader®
for the Food Industry

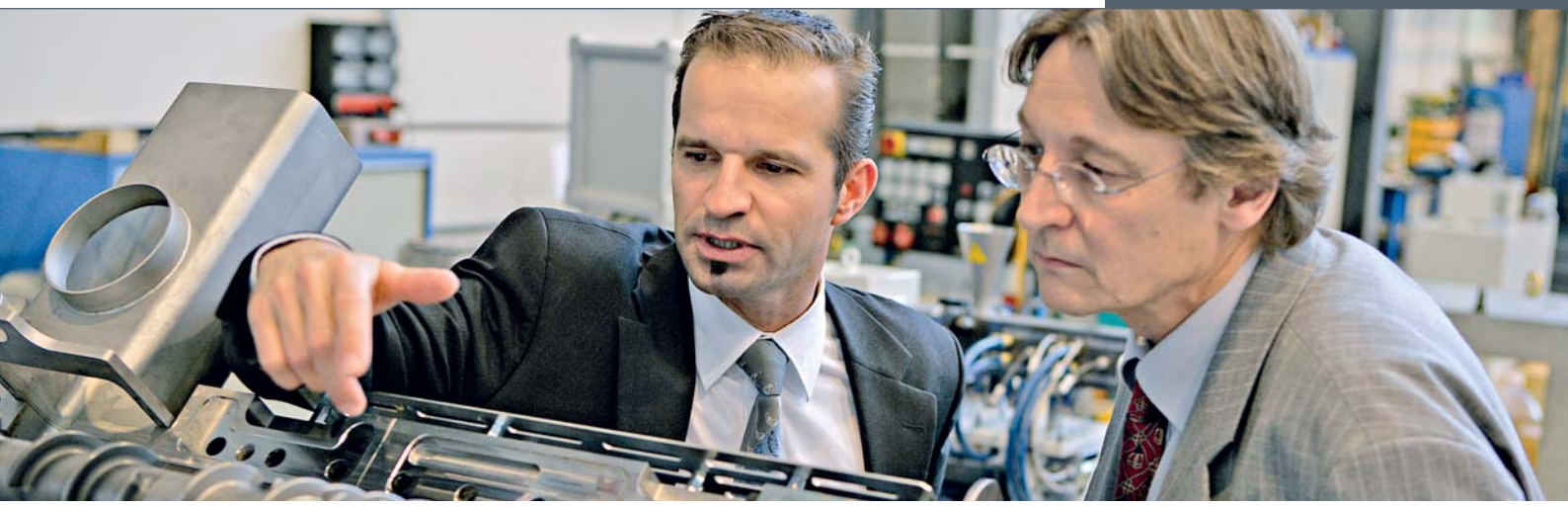
Buss Kneader Models and Technical Data

For food processing Buss Kneader models "LR" are used. The useful or processing length of screw type machines are typically specified in multiples of the nominal diameter (L/D). The same is true for the Buss Kneader.





	Nominal diameter [mm]		100	200	300	400
A	Overall length incl. drive assembly [mm]	7 L/D	2,800	4,900	7,000	9,500
		11 L/D	3,200	5,700	8,200	–
		15 L/D	3,600	6,500	9,400	12,700
		19 L/D	4,000	7,300	10,600	–
B	Length	[mm]	–	1,400	1,600	–
C	Height	[mm]	1,250	1,550	1,900	1,500
D	Centre line height	[mm]	1,000	1,095	1,450	1,250
E	Width	[mm]	1,200	1,200	1,400	2,200
F	Feed port height	[mm]	1,090	1,325	1,745	1,550
	Weight [kg]	7 L/D	950	2,700	8,000	10,000
		11 L/D	1,500	3,300	10,000	–
		15 L/D	2,050	4,000	12,700	14,000
		19 L/D	2,600	4,500	15,000	–
	Max. screw speed	[rpm]	300	250	150	120
	Max. drive rating	[kW]	50	115	200	280



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