Brabender®

… where quality is measured.

# Technical Notes

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## Mixer Maintenance and Inspection-Keys to Good Data

The determination of the flour quality and its processing characteristics are a basic demand in the milling and baking industries for ensuring optimum and uniform flour qualities for the multitude of baking and pasta I noodle products. Brabender® mixers, with sigma blade configuration, mounted onto the Farinograph® are a valuable tool in determining these characteristics in flour and dough .

**Brabender® mixing bowls on a Farinograph ® allow you to:**

- Measure the water absorption of flours
- Determine the rheological properties of the dough
- Check production and flour blends in the mill.
- Test rye flour, sponge batters, egg foam, etc .
- Special applications e.g . for chocolate, chewing gum, fish, cheese, meat etc.
- Test full formula doughs

**Principle**

Fill your flour / water suspension into the heated measuring mixer where it is subjected to a defined mechanical stress by the rotating mixer blades which are driven by a motor, carried in a pendulum bearing. The Sigma Mixer is a low shear mixer which provides a tumbling and kneading force within the mixing chamber .

The geometry and profile of the sigma blade is designed such that the viscous mass of material is pulled, sheared, compressed, kneaded, and folded by the action of the blades against the walls of the mixer trough . The resistance of the dough against the blades, which depends on the viscosity of the dough, causes an opposite deflection of the motor housing. This deflection is measured as torque and recorded and plotted on-line as a function of time in a clear color diagram.

It is essential to maintain the mechanical and physical integrity of the mixer and sigma blades because proper blade geometry and mixer condition are key to obtaining good data. Regular maintenance and inspection will keep your mixer working properly. This work should be carried out by Brabender® certified personnel.

**Inspection**

Consists of checking:

- Gearbox housing
- Gearbox lubrication
- Concentricity of sigma blades
- Bushing diameters on sigma blades.
- Surface condition on mixer bowl, back wall and sigma blades

- **Gear box housing**
  Ball bearings and gear bushing assemblies perform best when a clean working environment is maintained. Operating conditions should be free of airborne particles that may compromise the integrity of equipment.

- **Gear box lubrication**
  Ball bearings and gear bushing assemblies must maintain an even coat of lubricant and spin freely . CWB recommends using Lubriplate 630-AA Lithium grease or the equivalent.

- **Sigma Blade Inspection:**
  - **Concentricity of sigma blades:**
    All sigma blades possess a pilot hole located in the center face of each blade.
    First step - In order to check for concentricity of the blades, you will need to separate the mixer from the **Farinograph®**.
    Second step - Place the mixer in a location where the shear coupling is going to be easily accessible.
    Third step - Remove the mixer bowl and install your sigma blades.
    Fourth step - You can manually begin to rotate your blades by turning the shear coupling in the proper operating direction . As you begin the rotation of the blades focus on the pilot holes on the face of the blades. The pilot hole must remain stable . If the pilot holes are unable to maintain a concentric motion during rotation it usually indicates the sign of a bent blade or worn gear bushing sleeve .

- **Bushing diameters:**
  A visual indication from worn bushings is easily detected. Large amounts of sample leak passed worn bushings and deposit on the rear side of mixer back wall.

- **Surface condition:**
  Blade must present clean operating surface . Clean sharp edges, not rounded or damaged . Free of deep gouges or imperfections . Bowl surface condition should present a clean smooth operating surface free of gouge marks or deep imperfections .

  Bowl cavity/back wall cooling channel-Checking of flow rate by volume is the method applied when checking for blockage.

If there is no physical damage, a standard test is run . Once the test is complete if the results are within limits then the mixer is working properly, if it is outside of limits further investigation will be needed by **Brabender**® certified personnel.

**Maintenance**

Steps the operator can take to visually inspect the mixer between uses:

- Be aware of your instrument. Conduct visual assessment to ensure proper state of the mixer Check bowl surface condition. Ensure that it is a smooth surface free of gouge marks.

- Mixer and blade surfaces should be free of any flour/dough.

- Inspect the holes on back plate of the mixer. They should be free from any build -up .

Visual inspection of the sigma blades:

- Sigma Blades must glide freely into gear box assembly and lock into position with relative ease.

- Sigma blades and shafts must be dried thoroughly prior to blade installation. Water migrating into gear box housing often occurs when there is inadequate water removal from the channel of blade shafts.

- Migration of water will shorten the operating time of mixer, create poor test results, and cause damage to bearings, sleeves, keys, and blades. Inspecting your **Brabender**® Mixer regularly and having scheduled maintenance performed by certified **Brabender**® personnel will prolong the life of your mixer and provide you with the most accurate and consistently repeatable results.

**Further articles to consider for in-depth studies on sigma blade mixers:**

Journal Articles

Connelly, R.K. and Kokini, J.L. (2006) Mixing simulation of a viscous Newtonian liquid in a twin sigma blade mixer. *AIChE J., 52{10} : cover, 3383-3393*.

Connelly, R.K. and Kokini, J.L. (2006) 3D
numerical simulation of the flow of viscous Newtonian and shear thinning fluids in a twin sigma blade mixer. *Adv Poly Tech., 25{3} :182 194*.

*Book Chapters*

Cullen, P.J . and Connelly, R.K. (2009) Rheology and Mixing. Chapter 3 in *Food Mixing* :

*Principles and Applications*, P.J. Cullen (ed .), Blackwell Publishing.

Reilly, C.D. and Gimbun, J. (2009) Computational Fluid Mixing. Chapter 8 in *Food Mixing: Principles and Applications*, P.J. Cullen (ed.), Blackwell Publishing.

Vyakaranam, K., Evans, M., Ashokan, B. and Kokini, J.L. (2009) Evaluation of Mixing and Air Bubble Dispersion in Viscous Liquids Using Numerical Simulation. Chapter 12 in Food Mixing: Principles and Applications, P.J. Cullen (ed.), Blackwell Publishing.

Connelly, R.K. and Kokini, J.L. (2007) Analysis of Mixing Processes Using CFD. Chapter 23, pgs. 555-588 *in Computational Fluid Dynamics in Food Processing*, Da-Wen Sun (ed.), Taylor and Francis Group, LLC, Boca Raton, FL.

Technical Periodicals, Invited Contributions

Connelly, R.K. (2008) Going with the flow: computational fluid dynamics simulation of dough testing mixers. *Cereal Foods World, 53(4):186-192*.

Connelly, R.K. and Kokini, J.L. (2006) Looking inside dough mixers . *Fluent News. Spring: 22-23*.

*Proceedings*

Connelly, R.K. and Kokini, J.L. (2001) Analysis of mixing in a model dough mixer using numerical simulation with particle tracking. *Proceedings of the Seventh Conference of Food Engineering*, A Topical Conference of the 2001 AIChE Annual Meeting, Reno, NV, Nov. 4-9, pp . 579-585.