Why is it necessary to add water to the wheat?

Mellowing of the endosperm
- Flour extraction can be increased
- Power consumption / noise level of the Rollermills reduced
- Flour ash content reduced

Toughening of the bran
- Bran tends to break up less and remains in larger pieces
- Large bran flakes can effectively be cleaned by the fluted rolls
- Less bran specks in the Flour

Adjustment of the Flour moisture content
- Constant moisture level = constant milling conditions
- Constant moisture level = constant baking conditions
- Profitability for the Miller
Factors influencing tempering time

- Wheat hardness
- Protein content
- Ambient temperature
- Wheat temperature
- Initial moisture content
- Target moisture content

- Harder Wheat ➔ longer tempering time
- Higher protein content ➔ longer tempering time
- Lower temperature ➔ longer tempering time
- Lower Wheat temperature ➔ longer tempering time
- Lower initial moisture content ➔ longer tempering time
- Higher target moisture ➔ longer tempering time
Recommended moisture content and tempering time.

**Recommended tempering time:**

- Hard wheat: 24 - 36 (48) hrs.  
  16.0 - 17.0% (17.5%)
  15.5 - 16.0%
- Semi-soft: 12 - 18 hrs.  
  15.0 - 15.5%
- Soft wheat: 6 - 12 hrs.  
  14.5 - 15.0%
General rules for Tempering in 2 steps.

1\textsuperscript{st} Tempering: 2/3 of total tempering time

- Water addition to about 1.0 – 2.0% lower than target moisture
- Maximum of 7% water addition with Turbolizer MOZL

2\textsuperscript{nd} Tempering: 1/3 of total tempering time

- 2\textsuperscript{nd} Tempering 8 – max. 12 hours (not longer leads to drying out of bran)
- Water addition 1.0 – max. 2.0%

- 1BK Tempering: Moisture addition 0.3 – 0.5%
- 1BK Tempering time: ca. 5 - 10 minutes
Tempering time for Durum.

The optimal tempering time depends on the granulation of the finished product and raw wheat moisture!

**Basic principles:**

Coarse Semolina

Fine Semolina

2 – 3 h for each % of water addition needed

3 – 4 h for each % of water addition needed

**2–step tempering:**

- **1st tempering:**
  
  6 – 12 h. A hard wheat requires more tempering time.

- **2nd tempering:**
  
  3 – 8 h. Depends in the water amount and the hardness of the wheat. By using “Pearling” min 4-5 hours!
Tempering time for Durum.

Mode with 1 dampening step:

• 12 - 24h
• Depending on the flour content in the semolina. (the higher the amount of flour in the semolina allowed, the more tempering time is required)
• 1st Break dampening of 0.2 - 0.3 % water before pearling
Influence of initial moisture content on conditioning time.

Tempering time ASW
Water addition: 2.5% of water

ASW 9.6% initial moisture content

ASW 12% initial moisture content
Influence of grain hardness on Conditioning time.

- Mellowing of the Endosperm is very important for the milling result.
- The correct moisture content and conditioning time are important for the production of low ash Flour.
- Inside the conditioning bins however is humid climate which causes bacteria growth. Proper design of bins with mass flow and good aspiration is vital to reduce bacteria growing places within this system.
Various dampening equipment.

**Low speed dampening**

- **Paddle screw conveyor**
  - $H_2O$ add.: < 3%

**High speed dampening**

- **MOZJ Intensive dampener**
  - $H_2O$ add.: < 5.5%
- **MOZK Tri-rotor dampener**
  - $H_2O$ add.: < 7%
- **MOZL Turbolizer**
  - $H_2O$ add.: < 7%
Why high speed dampening?

Water has a rather strong surface tension of 72.75 mN/m (at 20°C) which prevents an even water distribution on the grain under regular conditions.

With high speed dampening and its high centrifugal forces the surface tension can be overcome and a thin and uniform water layer can be created on the kernel surface.

Uniform water distribution on the kernel is key to allow high water additions of up to 7% in one pass.
Water migration.

- Water must be evently distributed on the kernel surface to avoid fluctuating moisture contents due to water migration.
- High water addition with unsuitable dampening equipment are inconsistent.
- Water migration results in movement of water towards the bin outlet.
- Uneven moisture content and blocked bin outlets are a common result.

Example of poor water distribution:

Target moisture: 15.5%

- Moisture content: 14.2%
- Moisture content: 15.5%
- Moisture content: 16.6%
- Moisture content: 17.8%
Water migration.

- **MTVA**
  - saving of building space
  - larger sieve area
  - circular motion

- **Color Sorter**
  - with water cooling
  - no resort
  - max. 4t/h per chute

- **MTSC**
  - recommended for Durum flows
Moisture control / Intensive dampening.

- Automatic moisture measurement
- Re-adjustment of moisture content
- Intensive mixing of grain for optimum water distribution
Automatic moisture control systems.

**MYFA**
- Throuput measurement by flowbalancer (MZAC)
- Moisture measurement by electrical conductivity

**MYFB**
- Without throughput measurement (concept: feed-back/forward operation)
- Moisture measurement by microwave absorption

**MYFC/D**
- Throughput measurement by flowbalancer (MZAH).
- Moisture measurement by microwave absorption
Automatic Moisture Control for Grain.
MYFD Properties and functions.

Moisture control and Product flow
- (1) Product
- (2) Partition plate
- (3) Product brake, top
- (4) Guide plate
- (5) Load cell
- (6) Impact plate
- (7) Temperature sensor
- (8) Measuring container
- (9) Microwave tongue
- (10) Product brake, bottom
Automatic Moisture Control for Grain.
Water Proportioning System MOZG.

Moisture control and Product flow
- (1) 2-way ball valve
- (2) Liquid filter
- (3) Pressure transmitter
- (4) Pressure reducer
- (5) Manometer
- (6) 2/2-way solenoid valve
- (7) 3-way ball valve
- (8) Inline flow sensor
- (9) 2/2-way proportional valve
- (10) Coupling gate valve
- (11) Float measurement cone
- (12) Control system for MEAG-CONWD
- (13) Operating mode selector switch
Modern intensive dampening equipment & data flow.

Input of desired moisture level [%]

MYFD
Moisture determination

MOZL
Intensive dampener

MOZG
Water dosing unit

Alarm
Release
Water dosing unit in manual mode (Calculating needed water addition)

\[ Water \text{ in } \% = \frac{100 \times (F2 - F1)}{100 - F2} \]

- **F1**: Incoming wheat moisture
- **F2**: Desired wheat moisture

Example: F1=12%; F2=16%, Capacity= 10 t/h (metric tons)

\[ Water \text{ in } \% = \frac{100 \times (16\% - 12\%)}{(100\% - 16\%)} \]

\[ Water \text{ in } \% = \frac{100 \times (4\%)}{84\%} \]

\[ Water \text{ in } \% = 4.8\% \]

\[ Water \text{ in } l/h = Water \text{ in } \% \times \text{Capacity } kg/h \]

\[ Water \text{ in } l/h = 4.8\% \times 10.000 \text{ kg/h} \]

\[ Water \text{ in } l/h = 480 l/h \]
MOZL Turbolizer.
Twin Rotor dampener.

- Softens the bran before grinding
- Intensive mixing of the grain for optimum water distribution
- No residues for optimal sanitation
Mass flow for tempering bins.

For tempering bins mass flow is critical to control tempering time ensuring constant milling conditions.

Mass flow can only be achieved with the correct hopper construction and dischargers.
Comparison: Mounting heights of various discharge elements in tempering bins.

- **Hopper**
  Height = 4540 mm

- **MFAK**
  Height = 4000 mm

- **MAK**
  Height = 3450 mm

- **MFVH**
  Height = 3810 mm

- minimal chance of blocking
- very low power consumption
- effective use of building area & bin volume
Influence of tempering to Product sanitation.
Reduction of bacteria counts Scouring in 1\textsuperscript{st} and 2\textsuperscript{nd} cleaning
Comparisons of various surface treatments.

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<th>Light Peeling</th>
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<th>Pearling</th>
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Scourer MHXS

Normal Scouring
• Grain against screen
• Grain against rotor segments
• Grain against grain
• 4 cam segments and 4 fluted segments

Intensive Scouring
• Grain against screen
• Grain against rotor segments
• Grain against grain
• 6 cam segments and 2 fluted segments
Comparisons of various surface treatments.

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DC-Peeler MHXL-WL / W

**Light Peeling**
- Ideal solution for Decontamination in hard- / soft wheat milling
- Replaces the traditional scourer, installed before the 1st break bin
- Compared to peeling lower power consumption, higher capacity (up to 20t/h) on one MHXM-WL

**Peeling**
- Solution for Decontamination
- High Sanitation
- For special cereal application like breakfast cereals
- < 0.8% water addition is required with the help of a intensive dampener
Comparisons of various surface treatments.

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Why Pearling for Durum?

- Simplifying milling flowsheet
- Easier control of the mill
- Request from the market
- Reduction of bacteria
- Less brown specks
- 5 - 15% more capacity on 1st Break of existing plants

**Higher yield with the same ash (semolina)**
Engineering Customer Success