

Glutomatic System

Operation Manual



Perten
INSTRUMENTS

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GLUTOMATIC SYSTEM

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PACKING LIST GLUTOMATIC GLUTEN INDEX SYSTEM

THE DELIVERY CONTAINS

2100	2200	Part No.	Fig	Description
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Glutomatic apparatus with pre-settable timer including:

1x	2x	21.18.10	A	Collecting cup for starch water (600 ml)
1x	2x	21.10.26	B	Wash chamber 88 micron for flour samples, complete
15x	30x	21.10.31	C	Fine polyester sieves - 88 micron
1x	2x	21.10.27	D	Wash chamber 840 micron for meal samples, marked with ring, complete
2x	4x	21.10.41	E	Coarse polyamide sieves - 840 micron
1x	2x	21.17.53	F	Silicon tubing for wash container - 2 metres
1x	1x	21.18.01	G	10 litres wash container with lid
1x	-	21.18.02	H	Submersible filter (2100)
-	1x	22.18.02	H	Submersible filter (2200)
1x	1x	21.18.11	I	Plastic ring for fitting flour to meal wash chambers
1x	1x	21.18.12	J	Adjustable dispenser
1x	1x	21.18.13	K	250 ml wash bottle with pipe
1x	1x	21.22.02	L	White plastic block for assembling wash chamber
1x	1x	21.18.14	M	Set of gauges 0.6, 0.7, 0.8 mm
1x	1x	10.01.18	N	Mains power cable (for 220-240V~ operation)
1x	1x	10.01.19	N	Mains power cable (for 110-120 V~ operation)
1x	1x			Operation manual Glutomatic System



SPARE PARTS SUPPLIED

2100	2200	Part No.	Fig	Description
1x	2x	21.16.24	O	Spare silicon tubing for the tube pump (93 mm)
2x	2x	12.22.09	P	Spare signal lamps 12 V, T5.5
1x	1x	10.02.14	Q	Piece plastic tubing for signal lamp change
2x	2x	90.16.10	R	Spare fuse T1AL 250V (220-240 V~)
2x	2x	90.19.30	R	Spare fuse T3AL 250V ceramic (110-120 V~)
1x	1x	90.16.10	R	Spare fuse T1AL 250V (see Note 1.)

Retain all packing materials for future possible service transport.

Note 1. This fuse is for all voltages and is located inside the apparatus. The fuse must only be changed by qualified personnel. See Technical Specifications.

CHECK YOUR DELIVERY FOR ANY OPTIONAL ACCESSORIES ORDERED.

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Optional Accessory: CENTRIFUGE 2015

THE DELIVERY CONTAINS

Part No.	Fig	Description
1x		Centrifuge 2015 including:
2 x 20.08.09	A	Sieve (for ICC 137/1 only)
2 x 20.15.10	B	Gluten Index sieve cassette (for ICC 155 and 158, AACC 38-12)
1 x 20.15.06	C	Tweezers
1 x 20.15.08	D	Spatula



SPARE PARTS SUPPLIED

1 x 20.15.40	E	Spare signal lamp 24V, T5.5
1 x 10.02.14	F	Piece plastic tubing for signal lamp change
2 x 90.16.10	G	Spare fuse T1AL 250V (for 220-240V~ operation)
2 x 90.19.20	G	Spare fuse T2AL 250V ceramic (for 110-120V~ operation)

Retain all packing materials for future possible service transport.

Optional Accessory: GLUTORK 2020

THE DELIVERY CONTAINS

Part No.	Description
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1x	Glutork 2020
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SPARE PARTS SUPPLIED

2 x 90.16.03	Spare fuse T315mAL 250V (see Note 1.)
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Retain all packing materials for future possible service transport.

Note 1. This fuse is for all voltages and is located inside the Glutimer. The fuse must only be changed by qualified personnel. See Technical Specifications.

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SAFETY INSTRUCTIONS

WARNING: To prevent operator injury or damage to the Glutomatic, optional Centrifuge or optional Glutork, verify that the line voltage is correct **before** connecting to the line power. Check details on each apparatus name plate. Also ensure the line power cable is connected to a line power outlet that is provided with a protective earth ground contact.
In case the power cable connector must be replaced, the replacement must only be made by qualified personnel.

WARNING: If the wash pump tubing of the Glutomatic need to be renewed, (see "Maintenance and periodical check"), **disconnect** the apparatus from the mains supply **before** any such action.

1. The apparatus must be placed on a stable and horizontal surface.
2. The Glutomatic mixing mechanism is protected by a safety switch. The mixing cannot be started without the wash chamber/s mounted. See Preparing the Glutomatic for operation.
3. **CAUTION.** If the Glutomatic mixing hook or Plexiglas body need to be removed, or otherwise adjusted, **disconnect** the apparatus from the mains supply **before** any such action.
4. **CAUTION.** If the time setting (see Appendix I) of the Glutomatic need to be changed, **disconnect** the apparatus from the mains supply **before** any such action.
5. **CAUTION.** If the Centrifuge is making excessive noise during operation, this may be caused by imbalance. Turn off the Centrifuge immediately. The cause for imbalance may be that only one piece of gluten is used in the Centrifuge. In this case, always use a counterweight.
6. **CAUTION.** If the Centrifuge bowl need to be removed for cleaning, (see cleaning of Centrifuge), **disconnect** the Centrifuge from the mains supply **before** any such action. Also, be careful not to mechanically damage the bowl by accidentally hitting it against hard surfaces as this may destroy the balance of the bowl.
7. **CAUTION.** The Glutork outer as well as inner surfaces become hot during operation. Do not touch the surfaces.

INSTALLATION INSTRUCTIONS

WARNING: To prevent operator injury or damage to the instruments, verify that the line voltage is correct **before** connecting to the line power. Check details on the instrument name plate. Also ensure the line power cable is connected to a line power outlet that is provided with a protective earth ground contact.

Place the Glutomatic Gluten Washer and the optional Gluten Index Centrifuge on a stable bench. It is recommended that the instruments are placed close to a water basin with outlet and tap water supply, so that sieves and wash chambers can be easily washed between tests. See fig. 1.

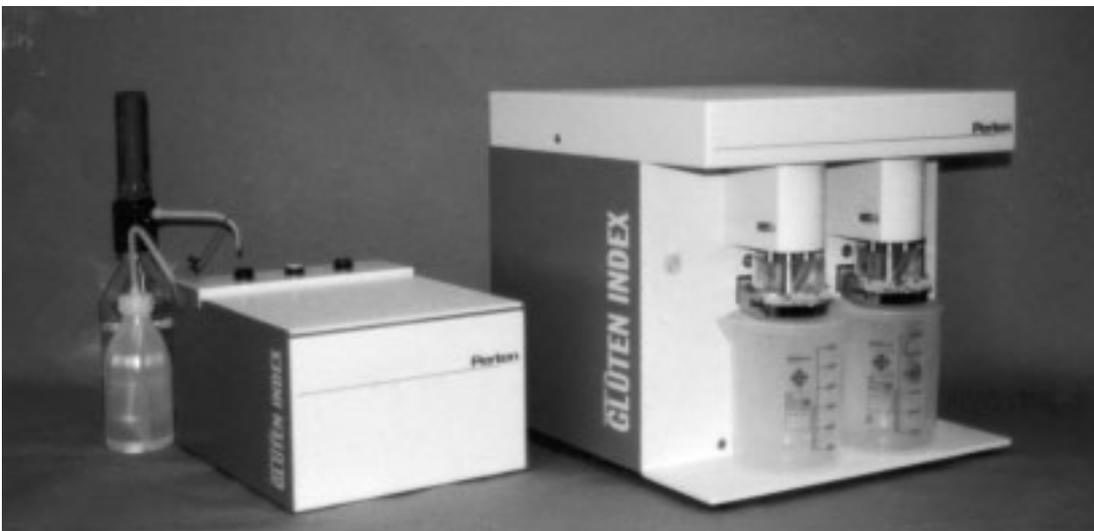


Fig. 1. Adjustable dispenser, wash bottle, Centrifuge 2015 and Glutomatic 2200 with collecting cups.

Preparation of sodium chloride solution

Sodium chloride solution, 20 g/l (2 %). The sodium chloride should be of recognised analytical purity and quality. The water used should be distilled or at least of equivalent quality. Dissolve 200 g sodium chloride in water, dilute the solution by adding water to a total of 10 l. The solution should be prepared fresh daily. The temperature of the wash solution should be $22 \pm 2^{\circ}$ C. See also notes and hints.

Installing the wash water supply and dispenser

1. Fill the 10 l container with the sodium chloride solution. The same solution is used for dough-mixing and washing. Connect the blue silicon tubing from the back of the Glutomatic through the hole in the container lid to the submersible filter, which is put into the 2 % sodium chloride solution. Place the container on the bench behind the Glutomatic.

2. Fill the adjustable dispenser (Fig. 1) with the same 2 % sodium chloride solution. Adjust the dispensing volume to 4.8 ml. The dispenser can be checked by weighing the amount of solution dispensed (4.80 ml = 4.80 g). Pump the dispenser a few times to remove any air in the system.

SET UP OF THE GLUTOMATIC SYSTEM

WARNING: To prevent operator injury or damage to the instruments, verify that the line voltage is correct **before** connecting to the line power. Check details on the instrument name plate. Also ensure the line power cable is connected to a line power outlet that is provided with a protective earth ground contact.

MIX	The yellow lamp is blinking during the mixing phase.
WASH/MEAL	<ul style="list-style-type: none"> a. Pressing this button activates the whole meal procedure. The yellow lamp lights. b. The yellow lamp is blinking during the washing phase.
START	<ul style="list-style-type: none"> a. The green lamp is lit when the washing chamber/s are mounted correctly and the machine is ready to be used. (See also "Preparing the Glutomatic for operation", paragraphs 4-5). b. Pressing this button starts the Glutomatic analysis. c. The green lamp is blinking when the procedure has been interrupted, e.g. by pressing the PAUSE button. Press the START button again to restart.
PAUSE	Pressing this button interrupts the analysis. The red lamp is lit. Press START to continue after a pause.
RESET	Pressing this button stops the analysis and resets the machine to the start position.

Preparing the Glutomatic for operation

1. After verifying line voltage, connect the Glutomatic to the line power and press the mains switch on the rear panel.
2. Before starting the Glutomatic, put a few drops of water into the hole in the front of the Plexiglas body of the mixing head, so that the water lubricates the shaft. A wash bottle for water is provided (Fig. 2).

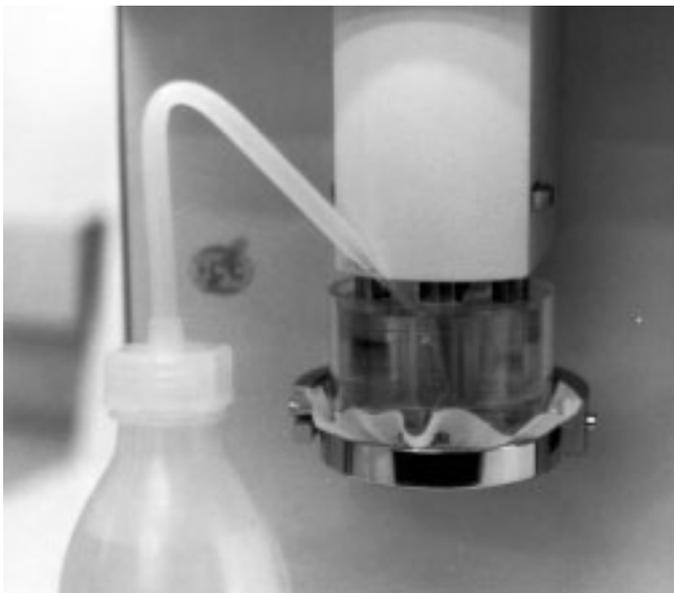


Fig. 2. Lubricating the shaft.

NOTE that there are 2 types of sieve holders (Fig. 3). One is unmarked and the other marked with a ring. The unmarked should be used with the fine sieve and the marked with the coarse sieve. Each sieve holder is individually adapted to the machine with which it is delivered. Do not mix sieve holders between machines. When new sieve holders for fine sieve are used, the distance to the mixing hook must be adjusted if necessary (See "Maintenance and periodical check).

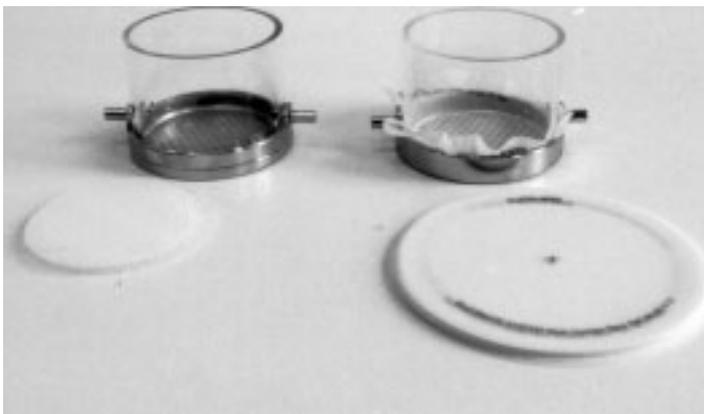


Fig. 3. To the left marked sieve holder for coarse sieve.
To the right unmarked sieve holder for fine sieve.

3. Assemble the wash chamber carefully with a fine sieve (88 micron aperture) between the plastic chamber and the unmarked sieve holder (Fig. 3). Centre the sieve over the unmarked sieve holder and press the plastic chamber firmly over the sieve. Use the white plastic block not to deform the plastic chamber (Fig. 4). Even a small deformation may influence the test result. Turn the plastic chamber to fasten the sieve. Check that the sieve has become properly stretched. If not, pull the edges carefully.



Fig. 4. Assembling the wash chamber. Fine sieve in the unmarked sieve holder.

4. Note that the sieve holder has a small round magnet on one side. The magnet is a safety device and must face inwards, towards the machine. Fit the wash chamber into working position on the bayonet fastening. Put the empty collecting cup under the wash chamber.
5. Check that the green START lamp lights up. Then press the green START button and check that the mixing hook rotates. The bayonet wash chamber holder moves down and the top yellow lamp (marked MIX) starts to blink.

(In case the green START lamp is not lit, the reason may be that the wash chambers are not in place or that the magnet on the sieve holder is not facing inwards).

6. After the preset dough mixing time - 20 sec - the program automatically switches to the washing phase, the bayonet holder moves up and the washing solution is pumped from the 10 l container into the wash chamber. The yellow lamp marked WASH/MEAL is blinking.

It is important that the washing solution is pumped immediately upon switching to the washing phase when analysing. Therefore, when first installing the Glutomatic or when refilling the wash solution supply, it is necessary to run the unit for 1-2 minutes in order to fill the system with washing solution. Stop the test by pressing the blue RESET button. On re-starting, the program will start again from the beginning.

The pumped volume should be between 250 and 280 ml after the whole 5 min washing period (50-56 ml/min). See also "Maintenance and periodical check".

Description of the Centrifuge 2015 top panel and switches

WARNING: To prevent operator injury or damage to the instruments, verify that the line voltage is correct **before** connecting to the line power. Check details on the instrument name plate. Also ensure the line power cable is connected to a line power outlet that is provided with a protective earth ground contact.

START	Pressing this switch starts the centrifugation. (The Centrifuge cover must be closed).
RUN	The lamp blinks when the centrifuge is started and remains lit while the Centrifuge speed is correct.
STOP/OPEN	Pressing this button interrupts the Centrifugation. The lock for the Centrifuge cover normally releases automatically when the Centrifuge stops. In case the lock does not release, press this button to open manually.

Preparing the Centrifuge for operation

1. After verifying line voltage, connect the Centrifuge to the line power, and press the mains switch on the rear panel.
2. Insert the centrifuge Gluten Index sieve cassettes, one on each side. The cassettes fit only one way (see Fig. 5).
3. Close the cover and press the green START button. The centrifuge will start and run for one minute at a speed of 6000 ∇ 5 rpm and then stops automatically.

The yellow lamp will be blinking for the first approx. 7-8 seconds and then remain lit during the rest of the one minute operation. A steady yellow light indicates correct speed.

When the centrifuge has stopped completely, an acoustic signal is given and the cover can be opened.



Fig. 5. Centrifuge cassettes in position.

DETERMINATION OF WET GLUTEN QUANTITY AND QUALITY - GLUTEN INDEX ACCORDING TO PERTEN - OF WHOLE WHEAT MEAL AND WHEAT FLOUR

ICC Standard No. 155 and No 158. AACC Method 38-12.

GENERAL DESCRIPTION

This method is based on the Glutomatic Gluten Washer and Gluten Index Centrifuge and provides information on both quantity and quality of wet gluten.

Wet gluten in wheat flour is a plastic-elastic substance consisting of the proteins gliadin and glutenin, obtained after washing out the starch from wheat flour dough.

Gluten separated from whole wheat meal or wheat flour by the Glutomatic is centrifuged to force wet gluten through a specially constructed sieve under standardised conditions. The special sieve allows for the collection of both the part of the gluten that remains on the sieve and the part which passes through the sieve. The total weight of the gluten is defined as gluten quantity. The percentage of wet gluten remaining on the sieve after centrifugation is defined as the Gluten Index. If the gluten is very weak all of the gluten may pass through the sieve, the Gluten Index is 0. When nothing passes through the sieve, the Index is 100.

APPLICATION OF GLUTOMATIC AND THE GLUTEN INDEX RESULTS

The Gluten Index Method for measuring wet gluten quantity and quality of whole wheat meal or wheat flour offers advantages thanks to the short time taken for testing - approx. 10 min - and the small amount of sample - 10 g - required, and because it permits the separation of gluten from whole wheat meal.

The Gluten Index Method has potential for measuring gluten quantity and quality at different stages in the wheat processing industry, such as Plant Breeding, Grain Intake, Flour Milling, Baking and Pasta and Commercial Dry Gluten Manufacturing.

Gluten Index results can be applied to the screening of wheat deliveries. Wheat with similar protein content and vitreousness can have different gluten contents and characteristics and can be classified according to Gluten Index values.

Gluten results can be applied to monitor wheat flour quality. Quality factors such as loaf volume and water absorption are related to gluten quantity and quality. Higher gluten quantity values generally give greater bread volume.

The Gluten Index Method can be used for the detection of heat and insect damage. Excessive heating will cause protein denaturation and decrease the wet gluten/protein ratio or destroy the ability to form gluten. Insects that damage wheat produce an enzyme that weakens the gluten bonds. Heat or insect damage to a wheat cannot be detected using a protein analysis only.

The Glutomatic System can be used in the starch and vital gluten manufacturing industry for monitoring incoming raw material and for process control.

**DIFFERENCE BETWEEN THE GLUTEN INDEX METHOD AND THE
ICC STANDARD 137/1**

The ICC Standard 137/1 (ICC 137 approved 1982 was revised to ICC 137/1 in 1994) specifies the use of a buffered 2 % sodium chloride solution. In the centrifuge a square metal plate with 0.6 mm holes is used as a gluten support during the centrifugation. The method is not applicable to whole wheat meal samples and can NOT be used for Gluten Index determinations.

The Gluten Index Method (ICC 155, AACC 38-12) specifies a 2 % sodium chloride wash solution without buffer, and is applicable to whole wheat meal as well as flour. Also the use of a high accuracy, speed controlled Centrifuge 2015 with a special sieve cassette is specified.

Comparing the wet gluten quantity in wheat flour between the two methods, there is a small but significant difference. The Gluten Index method gives on average approximately 1.5 %-units higher result than the ICC 137/1. That is 30 % wet gluten by ICC 137/1 corresponds on average to approx. 31.5 % wet gluten according to the Gluten Index method. The difference is due to the centrifuge Gluten Index sieve cassette. The ICC 137/1 is briefly described in Appendix II.

NOTE: Older type Glutomatic models with metal sieves and old Centrifuges 2012 cannot be used for the Gluten Index Method.

PROCEDURE FOR FLOUR SAMPLES

1. Put a few drops of water into the hole at the front of the plexiglass body. Fig.2. (This is not necessary during constant operation.)
2. Assemble the Glutomatic wash chamber with the fine 88 micron polyester sieve. Centre the sieve over the unmarked sieve holder (Fig. 3) and press the plastic chamber firmly over the sieve. Use the white plastic block (see Fig. 4). Turn the plastic chamber to fasten the sieve. Stretch the sieve by pulling carefully at the edges if necessary.

IMPORTANT: The 88 micron sieves usually give higher Gluten Index values for flours, for the first 5-6 tests, caused by the finish of the sieves. Therefore, the sieves should have their finish removed. Run the Glutomatic with one whole meal sample (obtained from a Perten Instruments Laboratory Mill 3100 or 120 with 0.8 mm sieve) 3 x 5 min. After the third run, carefully clean the apparatus and sieve/s.

3. Moisten the sieve thoroughly to achieve a capillary water bridge that prevents flour loss. Remove excess water by holding a cloth in one hand and knocking the wash chamber against it three times. Then dry the chamber walls with a cloth.
4. Weigh 10 ± 0.01 g of the sample and transfer it to the wash chamber. Shake the wash chamber gently to spread out the flour evenly.
5. Add 4.8 ml* of the 2 % sodium chloride solution from the dispenser. Hold the chamber at a slight angle and direct the water stream from the dispenser against the plastic chamber side wall, so that the water stream does not go directly through the sieve (Fig. 6). Shake the test chamber gently so that the water is spread evenly over the flour (Fig. 7).



Fig. 6. Adding mix water to the sample. Water stream directed against the sidewall.

* If it is **not** possible to obtain any gluten in the Glutomatic (flooding of water, caused by too small amount of gluten or too slimy characteristics) try to diminish the water addition (down to 4.2 ml).



Fig. 7. Water spread evenly over the test sample.

6. Place the wash chamber (with the sieve holder magnet facing inwards) with the sample in the working position and fix it in the bayonet fitting. Press the green START button (use the standard program - 20 seconds dough mixing and 5 min washing). The mixing and washing sequences now proceed automatically.

The Glutomatic gives a beep signal when 15 seconds remains of the washing sequence. When the Glutomatic stops, remove the washing chamber and take out the gluten carefully without stretching or tearing it. Ensure that no gluten remains on the mixing hook or in the washing chamber.

7. Continue by centrifuging the sample. (See section “Centrifuging The gluten”).

If at any time during the mixing/washing sequences it is necessary to stop the Glutomatic, the program may be stopped by pressing the red PAUSE button. The sequence may then be re-started without disturbing the program by pressing the green START button. However, resting time for a dough may influence both wet gluten content and Gluten Index results.

NOTE: The Plexiglas body and hook should be wiped clean with a cloth between tests.

PROCEDURE FOR WHOLE MEAL SAMPLES

1. Start the test according to paragraphs 1 - 5 in the flour sample procedure. Instead of flour, a whole meal - obtained from a Perten Instruments Laboratory Mill 3100 or 120 equipped with a 0.8 mm sieve - is used.
2. Place the wash chamber (with the sieve holder magnet facing inwards) with the sample in the working position and fix it in the bayonet fitting. Press the yellow button marked WASH/MEAL on the Glutomatic. The WASH/MEAL lamp remains lit. This indicates an automatic stop in the washing sequence after 2 min. Press the green START button. The mixing and washing sequences now proceed automatically.
3. After completing both dough mixing and the 2 min washing the Glutomatic stops with the red PAUSE lamp blinking. Remove the test chamber with the partly washed out gluten and transfer the total content carefully under a running water tap into the other wash chamber marked with a ring equipped with the coarse 840 micron polyamide sieve. It is suggested to put both test chambers end to end, and let a stream of running water transfer all content. Use the supplied plastic ring to connect the two chambers (Fig. 8).



Fig. 8. Whole meal procedure. Transfer of partly washed out gluten.
Note the different sieve holders.

4. Place the wash chamber (with the sieve holder magnet facing inwards) with the coarse sieve in the working position and press the blinking green START button. The program starts again and washes the sample for the remaining 3 min.
5. The Glutomatic gives a beep signal when 15 seconds remains of the washing sequence. When the Glutomatic stops, remove the washing chamber and take out the gluten carefully without stretching or tearing it. Ensure that no gluten remains on the mixing hook or in the washing chamber.
6. Continue by centrifuging the sample. (See section "Centrifuging the gluten").

PROCEDURE FOR DRY WHEAT GLUTEN

When analysing dry wheat gluten the procedure for flour sample is followed except for:

1. Weigh 1.5 ± 0.01 g of the sample.
2. No mix-water is added to the wash chamber. Gluten will be formed during the washing sequence.
3. The test is continued according to point 6 of the flour sample procedure and onward.

CENTRIFUGING THE GLUTEN

Check that the Centrifuge is ready for operation and that the bowl is dry and clean and that the centrifuge Gluten Index sieve cassettes are clean and properly positioned.

1. When the washing cycle in the Glutomatic is completed, put the gluten ball gently into the sieve cassette. Do not divide the gluten in parts but put a gluten sample in each cassette. If making a single test, use a counter weight for example a 3 g piece of a rubber stopper.
2. Start the Centrifuge 30 seconds after the completion of the Glutomatic washing cycle.

The Glutomatic has an internal beep signal warning the operator when 15 seconds remain of the wash cycle and giving a signal from 25 seconds until 30 seconds after the completion of the wash cycle.

3. After centrifugation, remove the Gluten Index sieve cassette. Check that no gluten remains in the centrifuge. Using the stainless steel spatula, carefully scrape off all gluten, which has passed through the sieve (Fig.9.). Weigh this portion to the nearest 0.01 g and record the result (=passed through, see below). Do not remove this portion from the balance.
4. Using tweezers, pull out all gluten, which has remained on the sieve and add this to the balance to achieve total gluten weight.

NOTE: Sometimes a drop of water remains on the gluten after centrifugation. Remove this by carefully shaking before weighing.

5. The amount of wet gluten remaining on the sieve, as a percentage of the total amount of wet gluten is defined as the **Gluten Index**.
6. Continue with calculation and presentation of results.



Fig. 9.Scraping off gluten passed through.

CALCULATION AND PRESENTATION OF RESULTS

Gluten Index

The percentage of wet gluten remaining on the sieve is defined as the Gluten Index and is calculated in the following way:

$$\text{Gluten Index} = \frac{\text{gluten remained on sieve (g)} \times 100}{\text{total gluten (g)}}$$

Example: Passed through = 0.60 g
 Total gluten = 3.00 g

$$\text{Gluten Index} = \frac{(3.00-0.60) \times 100}{3.00} = 80$$

The mean of two Gluten Index determinations should be reported rounded to whole numbers, for example 80.

Wet Gluten Content

The wet gluten content expressed as a percentage of the mass of the original sample is calculated in the following way:

$$\text{Wet gluten content} = \frac{\text{tot. gluten (g)} \times 100}{10 \text{ (g)}} = \text{tot. gluten} \times 10$$

The result of the wet gluten content determination may be reported on a fixed moisture basis, for example 14 % flour moisture.

$$\text{Wet gluten content(14\%)} = \frac{\text{uncorrected wet gluten content} \times (100-14)}{(100-\text{sample moisture})}$$

The mean of two wet gluten determinations should be reported rounded to one decimal place, e g 30.0.

REPEATABILITY AND REPRODUCIBILITY

The Gluten Index method was tested in a collaborative test within the ICC in 9 laboratories. The following statistical data (ICC Recommendation No. 203) were calculated:

Gluten Index repeatability and reproducibility

Standard deviation of repeatability $s(r)$ was below 5.2.

Standard deviation of reproducibility $s(R)$ was below 8.3.

As the Gluten Index itself is a percentage measure, the repeatability measured in percentage deviations is not always valid. The difference between the results of two determinations should not exceed 11 units in the range 70 - 100 and 15 units in the range below 70 according to the ICC Ringtest. If the difference is larger, a third determination or a new duplicate should be made and the average of all measurements is taken as the result.

Wet gluten quantity repeatability and reproducibility

Standard deviation of repeatability $s(r)$ was below 0.56.

Standard deviation of reproducibility $s(R)$ was below 1.0.

The difference between 2 tests carried out simultaneously or one immediately after the other by the same operator should not exceed 0.5 % of the wet gluten value. Otherwise, a third determination or a new duplicate should be made and the average of all measurements yields the result.

DRY GLUTEN DETERMINATION, GLUTORK 2020 OPERATION

There is generally a better correlation between dry gluten content and protein than between wet gluten content and protein.

If the dry gluten content is required, it can be determined as follows:

1. After verifying line voltage, connect the Glutork to the line power.
2. Start the Glutork by pressing the push button of the black Glutimer unit at the same time as the Glutomatic is started. This allows for a warm-up time for the Glutork during the Glutomatic wash cycle. The timer automatically turns the Glutork off after 4 minutes but the temperature remains at approx. 150°C for the duration of the wash cycle and during centrifugation, if the Glutork is kept in the closed position. During warm-up the Glutork shall be in the closed position. The green light indicates that the operating temperature (min 150°C) has been reached. The red light will go on and off periodically indicating heating in order to keep the temperature above 150°C.
3. Open the Glutork and place the wet gluten in the centre of the bottom plate. Use plastic tweezers so that the Teflon coated plate is not damaged. Close the Glutork. Press the push button on the Glutork black timer again.
4. After 4 min. the push button light on the Glutimer goes off and a short beep signal is given indicating the end of the drying cycle. Open the Glutork, remove and weigh the dry gluten (Fig.10). Weight multiplied with 10 gives dry gluten content in percent. Close the Glutork again.



Fig. 10. Glutork (optional accessory) with dried gluten and plastic tweezers.

NOTES AND HINTS WHEN USING THE GLUTOMATIC

Regulating the wash water temperature

When room temperature is higher than $22 \pm 2^{\circ}\text{C}$, the wash water will be too warm. For regulating the water temperature, put a container with salt solution in a refrigerator and use it for mixing, in order to achieve the correct temperature. If room temperature is lower, heat water for mixing. Check wash water temperature regularly, as incorrect wash water temperature may cause erroneous results.

Adjusting the amount of mixing water

The amount of mixing water added to the meal or flour is related to the quality of the wheat. For most meals and flours 4.8 ml is recommended. With very low or high gluten, the amount of water may have to be changed. Weak wheat or wheat with low gluten content should generally be tested with less mix water (down to 4.2 ml).

Adjusting the dough mixing time

The mixing time should be so that a dough is formed before the washing begins. This keeps the sieves clean. For most flours the standard 20 seconds mixing time is recommended. Changing of mixing time influence the results and normally the dough mixing time should not be changed.

Reasons for flooding

In case the wash chamber is flooded with washing solution, the most likely reason is that the sieve is clogged. Remove the sieve from the sieve holder and clean it under running water. Also remove the mixing hook and the Plexiglas body and clean them (see "Maintenance and periodical check").

If flooding occurs again, try with new fine sieves (see important note under flour procedure). If still not succeeding, check that a dough is formed before the washing begins. In cases of low gluten content or quality, try to diminish the amount of mixing water (down to 4.2 ml).

The distance between hook and sieve (See "Calibration of hook - sieve distance") is important for correct operation. If this distance is incorrect, it will influence the repeatability of all samples. If the Glutomatic operates correctly on high gluten content samples, but not on low gluten content samples, try to diminish the mix water addition before checking or adjusting the hook-sieve distance.

NOTE: In case the standard factory settings are not followed, the modifications must be indicated when presenting the test results. Values may be affected and not be the same as for standard settings.

MAINTENANCE AND PERIODICAL CHECK

Cleaning of the instrument

Clean the apparatus regularly using a soft cloth dampened in water and a mild household detergent. Do not use other cleaning liquids. If you spill water over the apparatus, disconnect from power and allow to dry for 24 hours.

Cleaning the sieve

The interchangeable plastic sieves should be cleaned after every test by rinsing under running water without dismantling the sieve. Occasionally it may be necessary to remove the sieve and clean it.

Cleaning the mixing hook and Plexiglas body

CAUTION. If the Glutomatic mixing hook or Plexiglas body need to be removed, or otherwise adjusted, **disconnect** the instrument from the mains supply **before** any such action.

The Plexiglas body and the mixing hook should be wiped clean with a cloth between tests.

The Plexiglas body should be removed daily for cleaning. To do this, unscrew the hook. Use the white plastic block to facilitate this (turn clockwise as seen from above). Turn both thumb-wheels anticlockwise (as seen from above). Lower the body to remove. Note that the body should be replaced with the lubrication hole facing forwards (Fig. 11).

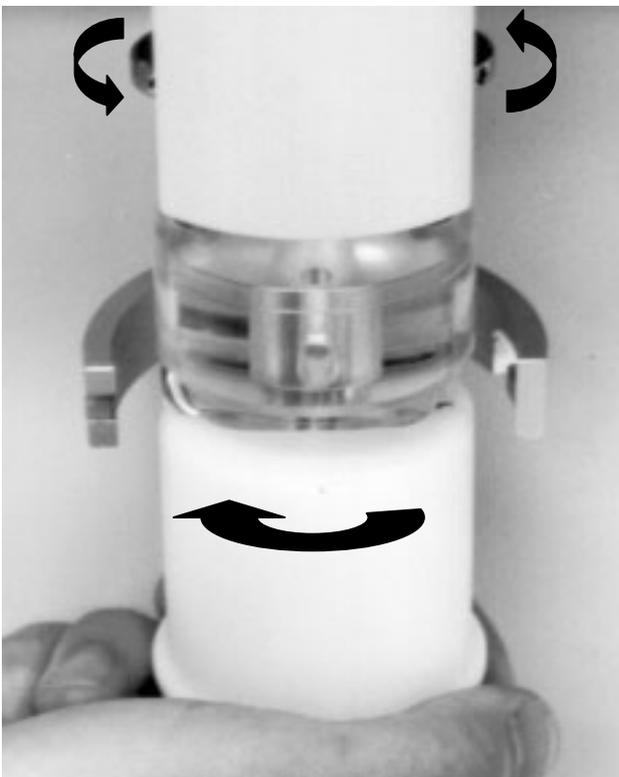


Fig 11. Removing the hook and Plexiglas body.

NOTE: If the machine is left to stand for any period of time, it is suggested to rinse the whole system with pure water, to avoid salt crystallisation in pumps and tubes.

Periodical check of the mixing hook

The mixing hook should be checked regularly to see that it has not become bent due to excessive pressure. Use a ruler to check for straightness. If bent, replace with a new hook and check the hook-sieve distance. (See "Calibration of hook - sieve distance").

Renewal of wash pump tubing

WARNING: If the wash pump tubing of the Glutomatic needs to be renewed, **disconnect** the instrument from the mains supply **before** any such action.

Perten Instruments **cannot accept responsibility** for any accidents that may occur while repairing or adjusting the instrument. **If in doubt, call your local service agent.**

Renewal of wash pump tubing should be carried out after approx. 3500 tests. Prolonged use may deteriorate the tube, causing a risk of water leakage in the apparatus. Check wash volume periodically. Wash volume should be 50-56 ml/min.

Procedure for renewal of tubing is as follows:

1. Disconnect the apparatus from the power supply.
2. Remove the tubes from the water supply. Remove the top cover - 2 screws, one on each side. The left side panel can then be removed by pulling upwards.
3. The S2-OEM tube pump has a quick release tube holder. Move the black knob under the tube holder to the left and the left side of the holder will fall down. See A in figure 12.

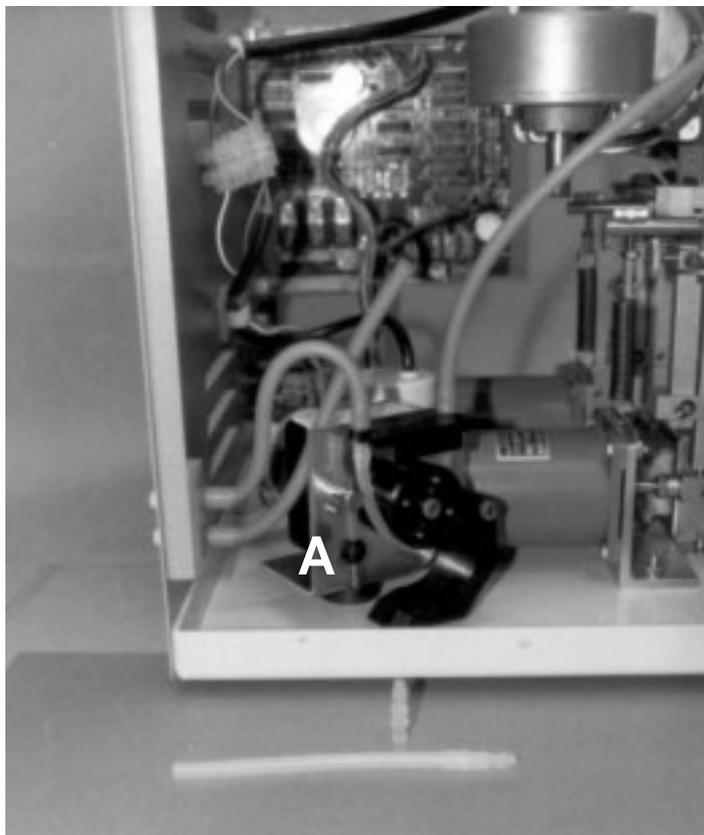


Fig. 12. Tube pump S2-OEM with quick release tube holder knob (A) and tube assembly. One tube released from the pump.



Fig 13. Releasing tube and nozzle from pump.

4. Remove tube and nozzle from the pump by carefully pressing one finger towards the tube holder and pulling the nozzle out. Remove tube from the nozzles (Fig. 13).
5. Fit the new tube until it reaches the collar of the nozzle. Tube shall be 93 mm long.
The distance between the two collars of the nozzle is for attachment to the pump.
6. Attach the tube assembly by pressing the nozzles into the slots of the pump. No grease should be added. Fit tube holder.
7. Check that water volume is correct between 50-56 ml/min (250-280 ml/5 min). If not, contact your local service agent.

Cleaning of Centrifuge. Removal of centrifuge bowl.

CAUTION. If the Centrifuge bowl needs to be removed for cleaning (see cleaning of Centrifuge), **disconnect** the centrifuge from the mains supply **before** any such action. Also be careful not to mechanically damage the bowl by accidentally hitting it against hard surfaces as this may destroy the balance of the bowl.

The bowl can be removed for cleaning. Place a 14 mm spanner on the nut. (Fig.14.) Hold the bowl by hand and loosen the nut **ANTICLOCKWISE**. Loosen the screw using a screwdriver, noting that the screw should be rotated **CLOCKWISE**. Remove the bowl.

To replace, rotate screw in **ANTICLOCKWISE** direction until tight and fasten the nut.

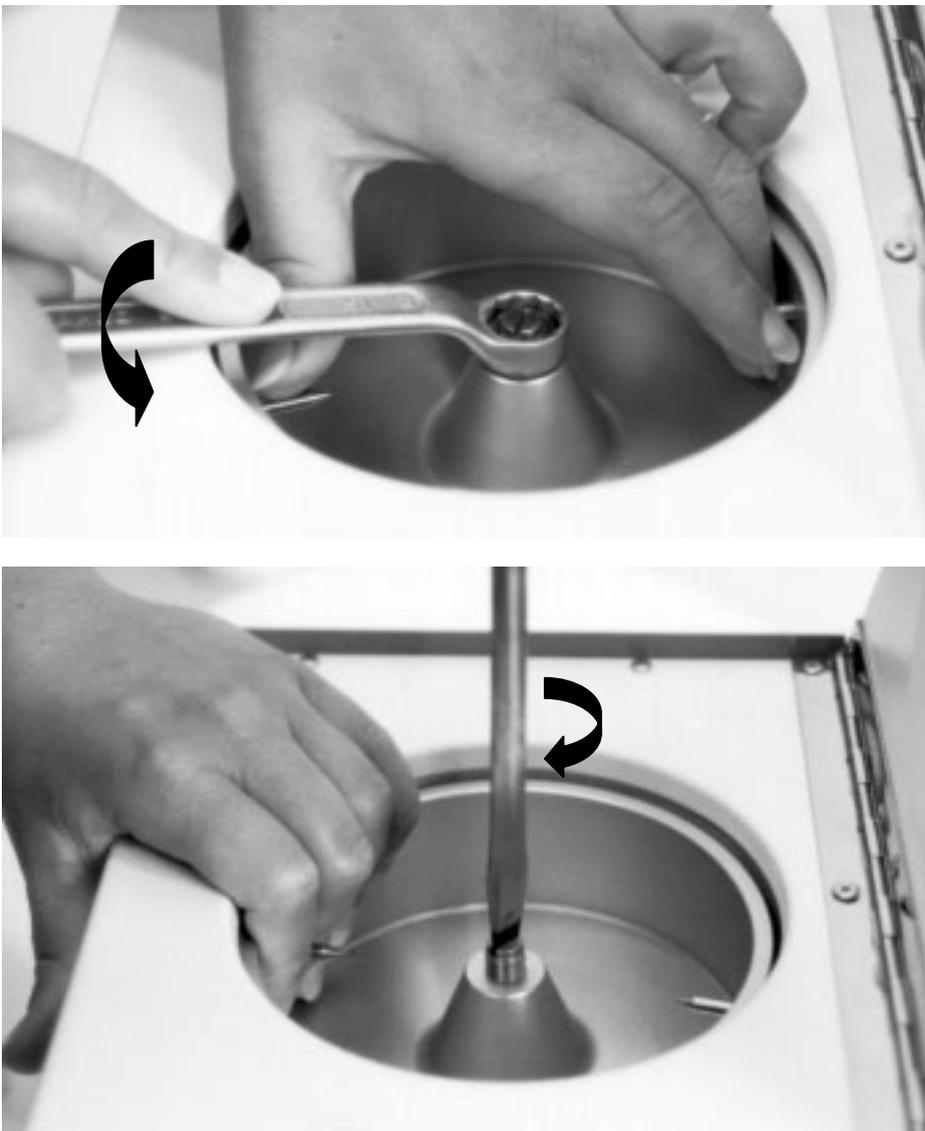


Fig. 14. Removal of the Centrifuge bowl.

Pump tube blocked or damaged

The pump tube may have become crimped during storage causing a blockage in the tube. Refer to maintenance, removal of wash pump tubing for instructions on how to take out the tubing. Press together the tube where it is crimped to make it uniform. Replace parts and test.

Salt crystals can be removed by washing and pressing the tube.

Pump tube may also split due to prolonged use. Refer to maintenance, renewal of wash pump tubing.

Calibration of sieve to hook distance

CAUTION. If the Glutomatic mixing hook or Plexiglas body need to be removed, or otherwise adjusted, **disconnect** the instrument from the mains supply **before** any such action.

The sieve - hook distance is factory set to approx. 0.7 mm. A larger distance will increase wet gluten results and can cause bad reproducibility. It may also cause clogging of the sieves, causing the wash chamber to flood.

DISTANCE IS FACTORY SET AND SHOULD NOT NEED ALTERATION.

Calibration may be necessary when replacing with new sieve holders.21.10.22, or when replacing with a new mixing-hook.

Three gauges 0.6 to 0.8 mm are supplied to check the distance. Distance should be checked using the chromed unmarked sieve holder without the 88 micron sieve also with the Plexiglas body removed.

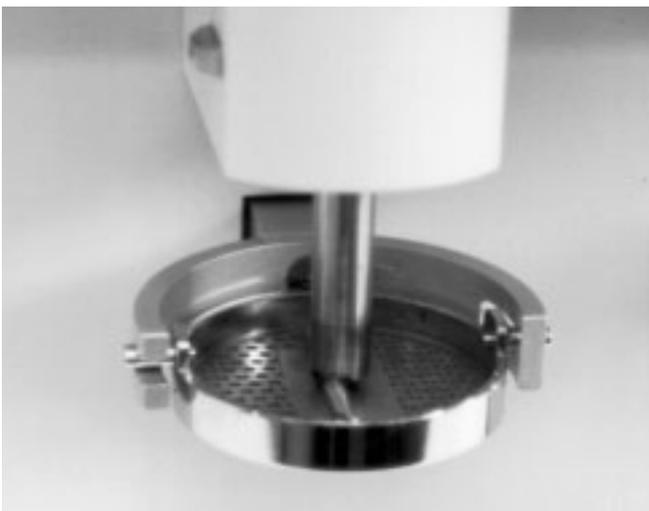


Fig. 15. Calibration of hook - sieve distance.
Measuring gauge placed on sieve holder.

Place the chromed unmarked sieve holder with the 0.7 mm gauge into the working position. Rotate the hook into the position shown in Fig. 15.

When properly adjusted the gauge just touches the mixing hook. This can be felt by slightly moving the sieve holder with the finger tips at the pins (Fig. 16). To confirm that the distance is correct test with 0.6 and 0.8 mm gauges, they should be loose and tight respectively.

WARNING: If the sieve to hook distance needs to be adjusted, **disconnect** the instrument from the mains supply **before** any such action.

Perten Instruments **cannot accept responsibility** for any accidents that may occur during repair or adjustments. **If in doubt, call your local service agent.**

If the distance must be adjusted, remove the top cover - 2 screws, one on each side. Lift off the side panels. Loosen the screw A (Fig. 17) and turn knob B clockwise (as seen from the back of the machine) to increase the distance or anti-clockwise to decrease the distance. Check as above.

One rotation of knob B changes the distance approx. 0.1 mm. Tighten the screw A, after adjustment. Reassemble side panels and top cover.



Fig. 16. Checking sieve - hook distance

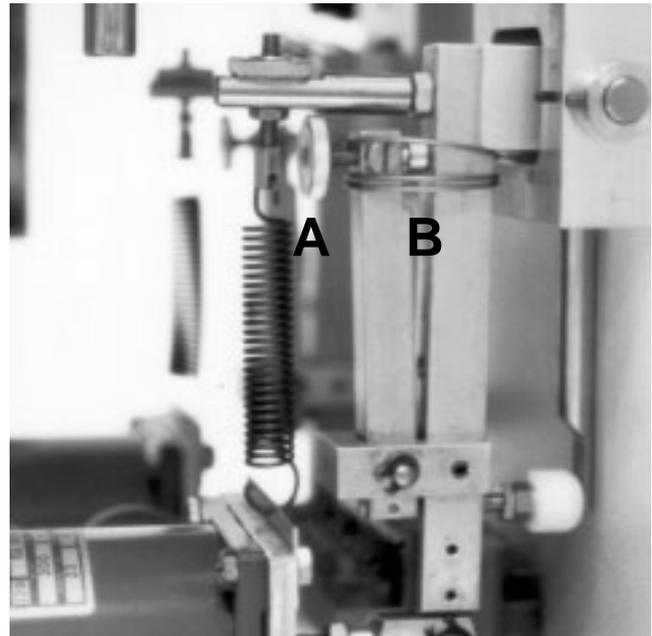


Fig. 17. A Locking screw.
B Distance adjustment knob.

TECHNICAL SPECIFICATIONS – GLUTOMATIC

Power requirement:	220-240 V~, 50 or 60 Hz, or 110-120 V~, 50 or 60 Hz 200 W (2100), 260 W (2200) refer to apparatus name plate)
Fuses: (Main fuses) (Internal fuse)	(2x) T1AL 250V, 5x20 mm (220-240 V~), or (2x) T3AL250V ceramic, 6.3x32 mm (110-120 V~) T1AL 250V, 5x20 mm (F1 on the CPU board, all voltages).
Environmental conditions:	Indoor use. 5 - 40°C ambient temperature. (See note below).Maximum relative humidity 80% for temperatures up to 31°C decreasing linearly to 50% relative humidity at 40°C ambient temperature.
Acoustic noise emission:	< 70 dB(A), operator position, normal operation
Dimensions (HxDxW):	320 x 350 x 330 mm
Net weight:	21 kg (2100), 24 kg (2200)

Note: The environmental conditions ambient temperature range, only refers to the temperature range in which the apparatus can be safely used. Temperature variations may affect the analysis result. For example the wash solution used should be $22 \pm 2^\circ\text{C}$. See "Installation instructions, preparation of sodium chloride solution".

DECLARATION OF CONFORMITY (CE)

We:

Perten Instruments AB
Box 5101, S-141 05 Huddinge, SWEDEN

declare under our sole responsibility that the product:

Glutomatic 2100-2200, Type 21001 and 22001
From serial number 964404

to which this declaration relates is in conformity with the provision of Directive:

89/392/EEG Machinery Directive,
91/368/EEG, 93/44/EEG, 93/68/EEG Amendments
89/336/EEC, EMC Directive (EN 50081-1 & EN 50082-1)

Place and date of issue: Huddinge, SWEDEN, 2 January 1996

A "Declaration of Conformity" in accordance with the above has been made and signed and is on file at Perten Instruments AB, SWEDEN.

TECHNICAL SPECIFICATIONS – CENTRIFUGE 2015

Power requirement:	220-240 V~, 50-60 Hz, or 110-120 V~, 50-60 Hz 90 W, refer to apparatus name plate
Fuses: (Main fuses)	(2x) T1AL 250V, 5x20 mm (220-240 V~), or (2x) T2AL250V ceramic, 6.3x32 mm (110-120 V~)
Environmental conditions:	Indoor use. 5 - 40°C ambient temperature. (See note below).Maximum relative humidity 80% for temperatures up to 31°C decreasing linearly to 50% relative humidity at 40°C ambient temperature.
Acoustic noise emission:	< 70 dB(A), operator position, normal operation
Dimensions (HxDxW):	165 x 220 x 265 mm
Net weight:	9 kg

Note: The environmental conditions ambient temperature range, only refers to the temperature range in which the apparatus can be safely used. Temperature variations may affect the analysis result.

DECLARATION OF CONFORMITY (CE)

We:

Perten Instruments AB
Box 5101, S-141 05 Huddinge, SWEDEN

declare under our sole responsibility that the product:

Centrifuge 2015, Type 20151
From serial number 962198

to which this declaration relates is in conformity with the provision of Directive:

89/392/EEG Machinery Directive,
91/368/EEG, 93/44/EEG, 93/68/EEG Amendments
89/336/EEC, EMC Directive (EN 50081-1 & EN 50082-1)

Place and date of issue: Huddinge, SWEDEN, 2 January 1996

A "Declaration of Conformity" in accordance with the above has been made and signed and is on file at Perten Instruments AB, SWEDEN.

TECHNICAL SPECIFICATIONS – GLUTORK 2020

Power requirement:	220-240 V~, 50-60 Hz, or 110-120 V~, 50-60 Hz 800 W (refer to apparatus name plate)
Fuses: (Main fuses) (Internal fuse)	Thermostat T315mAL 250V, 5x20 mm (SR1 on the Timer board, all voltages).
Environmental conditions:	Indoor use. 5 - 40°C ambient temperature. (See note below). Maximum relative humidity 80% for temperatures up to 31°C decreasing linearly to 50% relative humidity at 40°C ambient temperature.
Acoustic noise emission:	< 70 dB (A), operator position, normal operation
Dimensions (HxDxW):	100 x 190 x 250 mm
Net weight:	2.2 kg

Note: The environmental conditions ambient temperature range, only refers to the temperature range in which the apparatus can be safely used.

DECLARATION OF CONFORMITY (CE)

We:

Perten Instruments AB
Box 5101, S-141 05 Huddinge, SWEDEN

declare under our sole responsibility that the product:

Glutork 2020, Type 20201
From serial number 962187

to which this declaration relates is in conformity with the provision of Directive:

89/392/EEG Machinery Directive,
91/368/EEG, 93/44/EEG, 93/68/EEG Amendments
89/336/EEC, EMC Directive (EN 50081-1 & EN 50082-1)

Place and date of issue: Huddinge, SWEDEN, 2 January 1996

A "Declaration of Conformity" in accordance with the above has been made and signed and is on file at Perten Instruments AB, SWEDEN.

APPENDIX I. TIME ADJUSTMENTS 2100 & 2200

The factory setting corresponds to the ICC 155, ICC 158 and AACC 38-12 and is the same also for the ICC 137/1. **The time setting should generally not be altered.**

The control PC board is located on the rear panel of the Glutomatic and contains "dip switch units" for the setting of dough-mixing, washing and whole wheat meal procedure (stop) time.

The switches are used according to the following table:

TYPE 2100 AND 2200

SWITCH 1 (upper)		SWITCH 2 (lower)			
Whole wheat stop (min)	Switch on	Dough mix. time(sec)	Switch on	Wash time 1 (min)	Switch on
1	1	5	4	1	8
2	2	10	3	2	7
4	3	15	3+4	3	7+8
		20	2	4	6
		25	2+4	5	6+8
		30	2+3	6	6+7
		35	2+3+4	7	6+7+8
		40	1	8	5
		45	1+4	9	5+8
		50	1+3	10	5+7
		55	1+3+4	11	5+7+8
		60	1+2	12	5+6
		65	1+2+4	13	5+6+8
		70	1+2+3	14	5+6+7
		75	1+2+3+4	15	5+6+7+8

The factory setting is shown below

SWITCH 1

ON = =
 = = = = =
 1 2 3 4 5 6 7 8

1-3 Whole wheat interrupt time

SWITCH 2

ON = = =
 = = = = =
 1 2 3 4 5 6 7 8

1-4 Dough mixing time
 5-8 Washing time

APPENDIX II. ICC METHOD 137/1

The ICC 137/1 specifies a buffered 2 % sodium chloride solution. Prepare the sodium chloride solution as for the Gluten Index method but add 7.45 g of KH_2PO_4 and 2.46 g of $\text{Na}_2\text{HPO}_4 \cdot 2\text{H}_2\text{O}$. A fresh solution should be prepared daily.

The ICC 137/1 is applicable to flour and experimental flour but **not** to whole wheat meal.

Proceed according to the Gluten Index Method procedure for flour samples, but use the buffered sodium chloride solution.

Centrifuge using metal centrifuge plates, not the Gluten Index sieve cassette. Metal centrifuge plates can be obtained from your Perten Instruments Distributor part no. 20.08.09. These metal centrifuge plates cannot be used for the Gluten Index Method.

