



Melt Index Tester Series PETFlow

The new generation - user friendly, ergonomical and modular
The State of the Art!

PET is a light, transparent and mechanically highly resilient plastic. The application areas for PET as a vessel, film or textile materials are very versatile, whereas PET mainly is used as a packaging material. PET can be recycled easily and can still be used again. Unlike other packaging materials, PET is a superior alternative, because the manufacturing and the recycling process is environmentally friendly and energy saving.

PET consists of so-called macromolecules, where the structure of the molecule chains can be influenced by the requirements of the final product in the best possible way during the production. PET is a thermoplastic polymer and can therefore be processed in almost every conceivable form. Basically, PET will be produced as amorphous PET or as a semi-crystalline PET. The amorphous PET will be used solely for the production of fibres or films; the semi-crystalline PET is used for the production of bottles.

The PET production requires ethylene glycol and derivatives of terephthalate, which are derived from petroleum and polycondensed to macromolecules. The starting molecules (hydrogen, oxygen and carbon) will be put together (by ester compounds). This highly viscous polymer melt will be processed to PET granules.



PET - Granules



PET-bottles

To use the resulting PET granules for the manufacture of packaging materials, it is necessary to refine it in a further processing step (solid condensation). This colorless PET granules can continue to be processed. The final product now has the necessary mechanical strength values, in order to meet the demands as a material for eg bottles.

An important characteristic quality value for the PET is the mean molecular weight of the polymer molecules. The molecular weight indicates the chain length of the polymer molecules, which have a decisive impact on the processability of the polymer PET. The manufacturing process of PET can change the polymer chains (usually chain degradation). Therefore the properties of the finished part may be changed so much that the PET is no longer appropriate for its initial purpose. In the field of polymer research and development, new polymers developed and manufactured. Again, for the characterization of the final product, the chain length of the polymer molecules is of crucial importance.



PET-Preform



The molecular weight of PET is conventionally determined by the measurement of solvent viscosity (IV = intrinsic viscosity) in accordance with DIN 53728/3, ISO 1628/5 or ASTM D 4603. The viscosity of the dissolved PET will be compared with the viscosity of the solvent itself. Thus, it is possible to define for a specific application the desired PET quality. The molecular weight is used as an indicator of the crystallinity, the melting point and the tensile strength. The IV value is given in dL/g (or 100 ml/g).

However, while determining the intrinsic viscosity, certain conditions have to be considered:

- Use of toxic solvents (phenol / Dichlorobenzene, 50:50) and cleaning products (chromium sulfuric acid)
- Analytical work
- Costly intensive measuring instruments
- Relatively high temporal cost per measurement
- High running costs
- Measurements should be performed by trained personnel



Analytical testing equipment for the determination of the IV of PET - Schott, Mainz



The characterization of polymers in the quality control lab will be done mainly with a melt index tester (determination of the MFR- or MVR-value). Conventional melt index tester are „open“ systems, and therefore they can not apply for the determination of the MFR or MVR value of PET. This because, the presence of the ambient moisture will highly influence the measurement accuracy. Since PET is very hygroscopic, water molecules (at melting temperature) will affect the chain length of the polymer, resulting in a decrease of the IV values.

To solve this problem, E. KARG Industrietechnik has developed a new system, called **PETFlow** - a modified Melt Index Tester.

This instrument in semi- or fully automatic version is a modular tester optimized for the determination of the IV value and thus it differs from conventional melt index tester.

The PETFlow has a built-in integrated device for superposition of the testing cylinder with an inert gas and a new calculation basis for the calculation of the IV-value.

Because of the special design of the PETFlow, this instrument can of course be used to test all plastics within the meaning of the EN ISO 1133 (determination of MFR-/MVR-Wertes).

PETFlow @on



PET-Flakes

To be able to measure also PET flakes with this procedure, the flakes have to be crushed due to the geometry. To avoid sample warming during the grinding process, the grinding area have to be chilled (discharge of LN2 during the grinding). The total surface of the grinded PET flakes is many times greater than the original flakes and thus the influence of humidity is much stronger, which promotes the hydrolysis and the degradation of PET.

For the direct and rapid measurement of PET flakes we developed a special system to be able to renounce to the above described vulnerable sample preparation.

To get a precise and reproducible IV measurement, we recommend to dry sufficiently the material (granules, flakes or grinded preform) before the measurement. Upon request, we can provide for this application an optimized drying oven.

The necessary drying conditions are available on request.



Drying oven



Configuration:



PETFlow @on
Code 3200.000P

Determination of the IV value in dl/gr., the MFR in g/10 min. and the MVR in ccm/10 min. according DIN EN ISO 1133 and ASTM D 1238 method A and B

Motorized cutting device
Code 3200.170

Motorized weight lifter
Code 3200.160

Mass(es)
Code 3100.20x



Inert gas overlay
Code 3100.119

Nozzle plugging device
Code 3100.140

Filling funnel
Code 3100.112



Necessary option

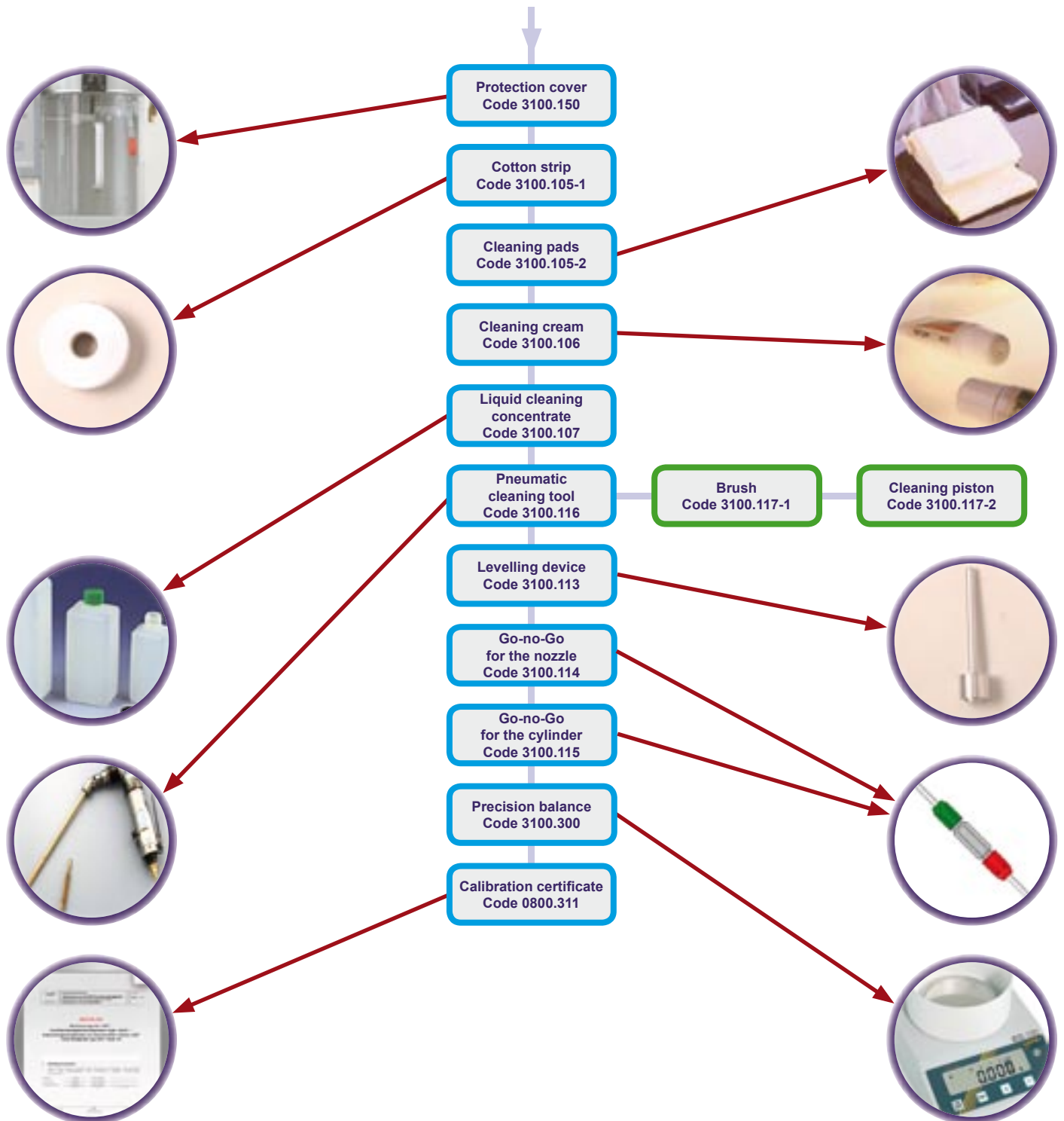
Particular options
(at least 1 pcs. is necessary)

Possible options
(depending on tested polymer)

Further possible options



Configuration:



Necessary option

Particular options
(at least 1 pcs. is necessary)

Possible options
(depending on tested polymer)

Further possible options



PETFloW @on
Code 3300.000P

Basic instrument PETFloW @on

The basic instrument PETFloW @on together with a precision balance can be used for the determination of the **IV in dl/gr.**, the **MFR in g/10 min.** as well as for the determination of the **MVR in ccm/10 min.**

The basic instrument is equipped with the following components:

- Control unit
- piston travel measurement
- Standard die, standard piston
- Cleaning tools (2 pcs.) for cylinder and cleaning tool (1 pcs.) for nozzle (die)
- Software k-BASE
- Technical documentation

We recommend the following accessories for an operational testing:

- at least one (1) testing mass (see „particular options“)
- Inertgas overlay, Code 3100.119
- Nozzle plugging device, Code 3100.140

Necessary options

Necessary options:

Optional for Code 3200.000P (necessary for the measurement of PET):

- Inertgas overlay, Code 3100.119
- Nozzle plugging device, Code 3100.140

If also other polymer materials have to be measured:

Optional for Code 3200.000P:

- Automatic cutting device, Code 3200.170 *)

*) Provided with this device, the MFR value should be calculated. For determining the MVR, the motorized cutting device is not mandatory.

**Particular option (at least 1
pcs. is necessary)**

Particular options:

Each tester (with exception of the MeltFloW @ plus) have to be equipped at least *) with one of the following options:

- | | |
|-----------------|---------------------------------------|
| - Code 3100.201 | Mass of 1000 Gr. (9,81 N) |
| - Code 3100.202 | Mass of 1050 Gr. (10,30 N) |
| - Code 3100.203 | Mass of 1200 Gr. (11,77 N) |
| - Code 3100.204 | Mass of 2160 Gr. (21,18 N) |
| - Code 3100.205 | Mass of 3800 Gr. (37,27 N) |
| - Code 3100.206 | Mass of 5000 Gr. (49,05 N) |
| - Code 3100.207 | Additional mass of 5000 Gr. (49,05 N) |
| - Code 3100.208 | Additional mass of 1600 Gr. (15,70 N) |
| - Code 3100.209 | Additional mass of 2500 Gr. (24,53 N) |

For the use of additional masses, in any case a standard weight code 3100.206 have to be considered. E.g., to reach a testing mass of 21.6 kg the following individual masses are necessary:

- 1 Pcs. Code 3100.206 (Mass of 5000 gr.)
- 3 Pcs. Code 3100.207 (Additional mass of 5000 gr.) and
- 1 Pcs. Code 3100.208 (Additional mass of 1600 gr.)

*) If only a 325 gram mass (equivalent to the weight of the piston) should be necessary, **no** further masses may be selected.



Possible options
(depending on tested
polymer)

Possible options (depending on tested polymer):

- **Corrosion resistant version, Code 3100.099:**
Necessary, if polymers which contain chlorine or flour have to be tested.
- **Filling funnel, Code 3100.112:**
Meaningful for powder or sticky materials, to prevent the material sticking at the inlet of the cylinder.

Further possible options

Further possible options:

- **Protection cover, Code 3100.150:**
Prevent the „flying away“ of the cutted extrudate pieces and facilitate the analysis.
- **Cotton strip, cleaning pads, cleaning cream and liquid cleaning concentrate:**
Serve as a tool for the necessary cleaning of the instrument after the test.
- **Pneumatic cleaning tool, Code 3100.116 with brush and/or piston:**
Serve as a tool for the necessary cleaning of the cylinder.
- **Levelling device, Code 3100.113:**
With this device, the instrument can be levelled exactly according to the cylinder axis.
- **Go-no-Go for the nozzle, Code 3100.114 and Go-no-Go for the cylinder, Code 3100.115:**
Allows a periodic review (independent of the regular calibration of the instrument) of the nozzle (die) and of the cylinder.
- **Precision balance, Code 3100.300 or 3100.350:**
Can be used for the evaluation of the cutted extrudate weight (necessary for the determination of the MFR value, if the melt density of the material is not known).
- **Calibration certificate, Code 0800.311**



k-BASE Software:



Our **k-BASE software** as a multifunctional software platform is taking into account the current Microsoft ® technology. Previous programs can also be used after an update (Service Pack) to the current version of our software program.

The connection of the instruments is made by RS 232 or USB to a standard PC or laptop.

The software can be installed on any computers in your corporate network. Thus, you have various access to your data.

This is possible even without the connection of an instrument and you can:

- create parameter sets and/or
- evaluate or work on existing tests.



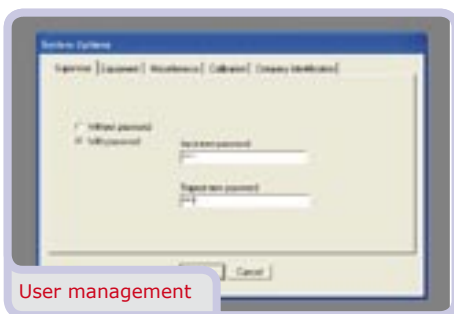
Language change



Online-change of languages

K-BASE is available in different languages, where the change of languages can be done online. It suffices a simple mouse click.

Thus, the test report can be printed in another language, saved as a PDF file, if necessary, sent via email to the customer.



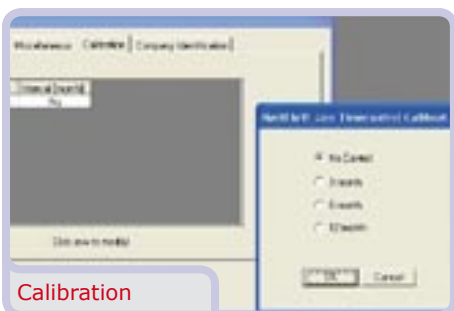
User management



User management

With k-BASE, specific program areas can be restricted. The setting of a password, different functions of the software to a specific user group (operator) can be hidden.

Under this user administration and the individual user definition, it can be documented any time who and when has worked with k-BASE.

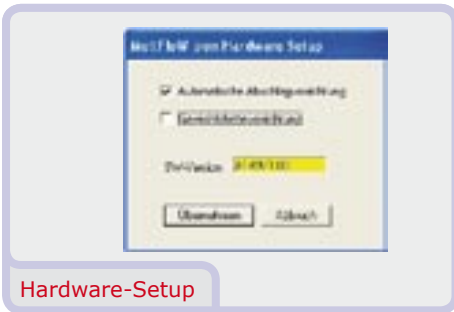


Calibration



Calibration

k-BASE reminds you automatically to the specified (predetermined by the administrator) calibration intervall - without any further obligation!

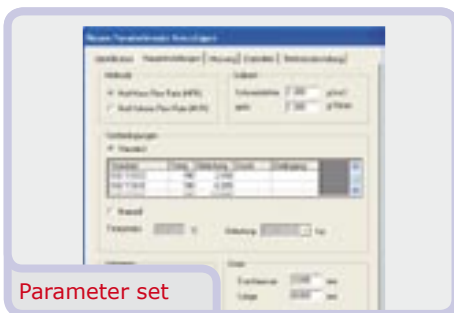


Hardware-Setup



Hardware-Setup

Due to the modular construction, k-BASE is always in a position to adjust a new instrument configuration. If you want to upgrade or expand your instrument at a later time - it is possible through a simple hardware setup done by the software at any time and without any additional expense (additional wiring or EPROM change).

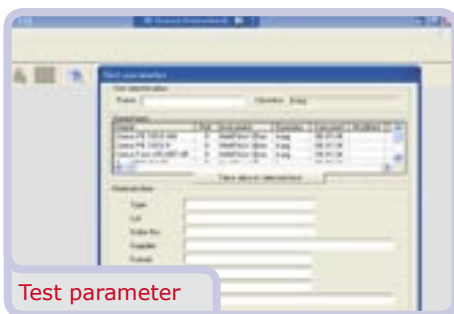


Parameter set



Parameter set

Your test parameters have to be entered in k-BASE only once. K-BASE separates the main input parameter from the individual test parameters (e.g. material data, etc.). This saves time while performing of tests. A input specified field monitoring prevents false entry.

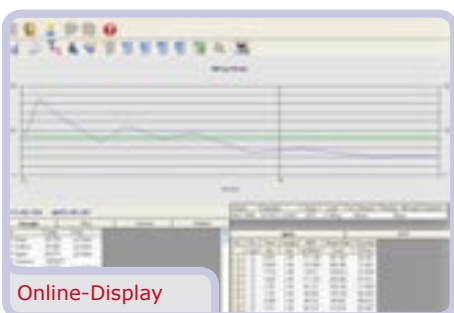


Test parameter



Test parameter

With k-BASE the test can be performed easily and efficiently. Your individual test parameters can be independently programmed or copied from a performed test. A convenient search function supports the selection.



Online-Display



Test run

With k-BASE you can display your actual test results online. The results will be displayed online during the test. A discontinuation of the measurement is possible at any time, whereby the results will be evaluated until the time of the break off.



Documentation



Documentation

K-BASE will record and document your data clearly and according the standard. All relevant test conditions, material data, parameters, etc. are documented according the standard. If reasonable and acceptable, a post-processing can be made at any time.

**Technical data:****PETFloW @on****Code-No.:**

3200.000 P

Dimensions

W x H x T (mm), max. (depending on configuration) 400 x 470 x 450

Weight standard instrument (kg), approx. 31

Weight incl. lifting device (kg), approx. 39

Temperature data

Temperature range (°C) +400 (optionally 450)

Resolution (°C) 0,1

Temperature distribution (K) $\leq \pm 0,1$

Temperature measurement by 1 PT 100 each zone

Further data

Measuring range (mm) selectable 1 ... 30

Resolution travel measurement (mm) 0,01

Electrical dataVoltage ($\pm 10\%$) 50/60 Hz (V) 230

Power (W), approx. 1600



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You can find what ever you like to know about us and our products under:

www.karg-industrietechnik.com

Beside any information, news, exhibitions you have also the opportunity to get in touch directly with your responsible sales manager.

We supply quality control instruments for:

- Plastic industry
- Automotive industry
- Laboratories / Universities / Technical high schools
- Electronic industry
- Rubber industry

Due to continuous development policy, changes may be introduced without any notice!