Anton Paar

Penetrometer

PNR 12



A Tradition of Competence

Founded in 1922, Anton Paar today employs over 2000 people in 20 countries who manage a global business and provide the whole value chain, starting from product ideas, research and development, production, sales and application support to after-sales services.
The acquisition of Petrotest by Anton Paar resulted in a unique concentration of talents and know-how. The product portfolio now covers a wide range of laboratory instruments, process technologies and automation systems, ranging from standardized QC to complex R&D solutions for the petrochemical, food, cosmetics and pharmaceutical industries.
Anton Paar is close to you and your work.
An experienced local team speaks your language and provides application support and training.

The world of consistency

We come across consistency in everyday life without ever thinking about it. For example:

- Lipstick often breaks because its consistency is too high.
- Liquid-like lotions soak into the skin easily – a good example here is sunscreen lotion. More solid-like ointments stick on the skin. This is useful for treating open wounds and cuts, for example.
- Butter, margarine, cheese, honey and other foods need to be spreadable but not so runny that they drip off the bread or knife.

In industry, consistency is an ever-present challenge:

- Hard grease will not properly feed a bearing that needs to be lubricated. On the other hand, if a grease consistency is too low, it may leak away from the area to be lubricated.
- Soft bitumen consistency under warm climatic conditions and with insufficient stiffness of the bitumen binder causes rutting on the road, and bitumen dropping from roof shingles.
- Very hard bitumen consistency under cold climatic conditions results in fatigue cracks on the road surface and in cold coatings; the material becomes more brittle.



Precise Consistency Measurement

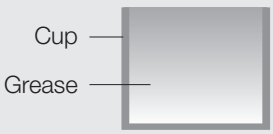
All penetration methods – All standards – One product: PNR 12

Anton Paar has the most suitable test kits for each type of measuring task. These include tests according to many standardized methods and cover a wide range of applications for the petrochemical field, chemical, pharmaceutical, cosmetics and food industries.

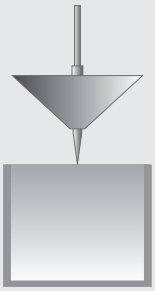
With Anton Paar's penetration devices, you obtain data about the quality of pasty or creamy products, their processing characteristics or their plasticity. You can also easily gain information about the solidification and the setting of your product or determine the tenacity of a dough, the maturing of sausages or cheese.

What is consistency?

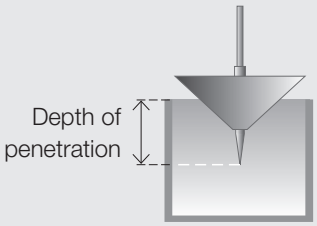
Consistency describes the degree to which a pasty, creamy, semi-solid or highly viscous sample resists a deformation by an applied force.
The measure of consistency is called penetration.



Fill a cup with grease, without forming air bubbles, and smooth the surface with a spatula.



Place the cup directly below the standard cone, making sure the cone tip just touches the grease surface.



Allow the cone to penetrate the grease for five seconds, then read the depth of penetration.

Benefits at a glance

- Patented automatic surface detection
- 20 programs (16 of which are individual user-definable)
- Extended application range
- Automatic data conversion (NLGI-class, EN-bitumen value, ¼-cone to solid cone and ½-cone to solid cone)
- High sample throughput
- Limit indicator which gives alarm when test value falls outside preset values
- Statistical and database functionality (storage of 200 tests, evaluation of Min, Max, Mean)
- Data readout with USB stick, conversion to Excel®
- Automatic measurements of electrically conductive samples
- Temperature sensor for exact test temperature recording
- Password protection

How does a penetrometer work?

A typical example of consistency determination is the penetration measurement of grease. A cone assembly of given weight (150 g) is allowed to sink into a grease for 5 seconds at a temperature of 25 °C (77 °F).
The depth, in tenths of a millimeter (Penetration Unit, PU), to which the cone sinks into the grease is the penetration. The deeper the cone sinks into the material, the softer the material is.

PNR 12
Versatility in Consistency

PNR 12 meets a wide range of international standards and fulfills the repeatability and reproducibility requirements of, for example, ASTM, ISO, EN and DIN.

PNR 12 has a broad application range. From high-viscosity liquids (honey) to solids (bitumen), you can determine the consistency of a wide range of materials with just one instrument.

Time-saving benefits

- No zero-position adjustment of the system
- No releasing of the test body
- No needle tip adjustment on the sample surface (if you use a sensor plunger)
- No stop-watch monitoring and inaccurate manual stopping at the end of the short penetration period (only 5 seconds in most standards)
- No indicator shaft depressing for distance reading
- No handwritten records of result and test condition (sample temperature etc.) after the test
- No conversion calculations for the product classification system
- No transfer of handwritten comments and results into the lab data management system and statistical programs like Excel® for further calculations and reports

Easy handling

PNR 12 has a magnifier and extra bright LED sample illumination for reliable manual surface detection.

Automatic surface detection

A sensor hook, if used with electrically conductive materials, allows PNR 12 to detect the sample surface automatically.



Sensor plunger – Master of its class in bitumen and wax testing

The patented force sensor plunger (optional) will detect the surface of samples even underneath a layer of water. You no longer run the risk of errors coming from observing the reflection of the needle tip in the water bath. The automatic surface detection allows precise adjustment even by inexperienced personnel.
The standardized test sequence starts automatically. Suitable samples are comparably hard materials.



Intuitive operation

- The large digital display guides you through the measurement procedure.
- Start your tests immediately:
  PNR 12 comes with preprogrammed standard test methods which you can select from the menu. To customize your test routines, you can create and store up to 16 user-defined programs.
- A start delay can be set with up to 9999 seconds. The plunger and test body will not be released before the preset delay time has expired. This delay may be useful for tests that involve a temperature stabilization as well as tests that require exactly reproducible reaction times in order to pass.
- The limit indicator is very helpful for routine testing. An audible signal will sound if a reading is outside the upper and lower limits.
- Results are converted into NLGI-class, EN-bitumen value, c-value, ¼-cone to solid-cone, ½-cone to solid-cone, as required.
- For statistics, PNR 12 offers a result history for 200 tests as well as the statistical evaluation of test results with min/max/average and standard deviation.
- PNR 12 provides versatile connectivity via a USB stick, e.g. to export test results as an Excel® file. Interfaces ensure LAN and LIMS network compatibility.
- Password-protected operation retains your data privacy.

Up-to-date technology

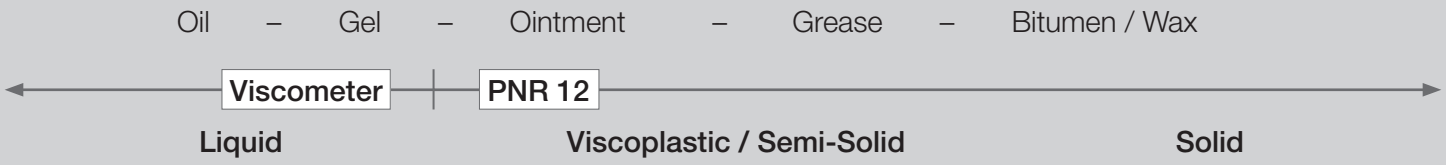
The jog wheel program navigation (push and turn) has a scroll function: just turn and push the wheel.

With this convenient program operation you can enter test parameters, sample name and program selection, even with protective gloves on.

Optimal Selection of Test Sets for Excellent Test Results

PNR 12's versatility comes from the many different test kits which can be used with the instrument.

The harder (more solid) the material is, the smaller the cone angle should be. Therefore, a needle is used for bitumen and a perforated disk penetrator is used for liquid-like samples.





Plungers (clamping rods)
Plungers serve as clamping and guide shanks for various test bodies. Unless specifically listed conditions impose restrictions, it is always possible to combine any test body with any plunger. Additional weights can be placed on the plunger for test variation.

Sample containers
In the case of disks and cones the shape or size of the sample container has to be selected carefully so that possible wall effects are avoided. Special centering disks and holders for the containers are available.
The dimensions of the sample containers have been selected in accordance with the requirements of international standards, and are characterized by uniform dimensional accuracy and excellent stability.

Cones
The specified cones have proven practical for measurements on fats and greases, jellies, creams and similar semi-solid materials.
Due to their large cross-sectional area, cones compensate inhomogeneities in a sample.

Perforated disks
Perforated disks are primarily used for measuring fluid and highly viscous materials.
With some substances, it is possible to obtain good correlations to the viscosity values.

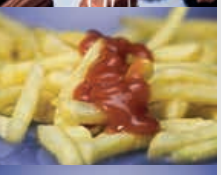
Needles
In general and as an initial approximation, the following is true: The harder and more solid a sample is, the more pointed and needle-like the test body should be.
The specified test needles have proven practical for measurements on bitumen, wax, fruit, cheese, yeast, chocolate, etc.

Rods and rams
Rods and rams are suitable for semi-liquid fats, greases and pastes, emulsions, honey, paints, varnishes, potting compounds, ceramic pastes, bread and confectionery.

One Device for Every Application

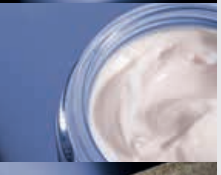













Petroleum industry Set	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Bitumen <200 PU	●		●		●																										
Bitumen <350 PU		●																													
Bitumen >350 PU				●																											
Grease											●	●	●	●				●													
Petrolatum, vaseline																●	●	●													
Paraffins, waxes						●	●																								

Food industry Set	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Agar																	●														
Bread																											●				
Butter, margarine, edible fats																		●			●	●									
Candy, confectionery	●	●			●																	●									
Cheese						●	●														●										
Chocolate	●	●	●				●																								
Corned beef																						●							●		
Cream, whipped cream						●					●							●						●							
Curds													●																		
Dough									●	●														●							
Fruit						●		●	●	●																					
Fruit pulp												●																	●		
Gelatine, jelly										●											●					●			●		
Honey																						●	●	●					●		
Ice cream																										●					
Jam, marmelade																					●				●						
Ketchup																				●									●		
Marzipan, marshmellows						●																									
Mayonaise																				●									●	●	
Meat products, sausage						●		●													●										
Mustard																								●							
Pastry									●																		●				
Potato mash																						●									
Pudding										●														●			●				
Roe (fish)																										●		●			
Yeast						●							●																		
Yogurt														●															●	●	

Cosmetic industry Set	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Balm, lotion																		●		●			●								
Compact powder, eye shadow	●	●								●																		●			
Cosmetic cream																	●	●								●					
Deodorant stick, lipstick	●	●				●	●																								
Hair styling wax, gel																										●			●		●
Make up, mascara	●	●								●								●										●			
Toothpaste																		●				●									

Chemical industry Set	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Adhesive stick	●	●				●	●																								
Dispersion, emulsion																		●			●				●				●	●	
Floor polish						●																									
Glue, adhesive						●																									●
Paint, varnish																						●	●						●		
Pastes						●	●																			●					●
Putty																		●								●					●
Safety classification liquid/solid																							●								
Sealant, fillers						●	●								●													●			
Shoe polish						●																									
Silicone																													●		

Building material Set	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Cement, gypsum								●																		●					
Joint mortar																															●
Mastic						●									●																
Potting compound, ceramic paste								●									●	●								●					

Pharma industry Set	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Dental plaster/gypsum								●																							
European Pharmacopoeia 2.9.9.																●		●	●												
Pharma qualification package																		●	●												
Ointment, wax						●										●		●	●												

Other industries Set	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Candles						●	●																								
Composite propellants												●																			

Note: Details of the above suggested test kits and their content will be found on the following pages.
Depending on the application, only a test body and a plunger of the test kits might be necessary.

Choose Your Set out of Our Well-Proven Test Kits

Set	Test Body	Order-No.	Test Kit Content
	Needles		
1	**Standard needle 2.5 g** ASTM D5 (<200 PU), AASHTO T49, JIS K 2207 manual surface detection	106926	3 bitumen needles (2.5 g), 1 plunger (47.5 g), 1 load weight (50 g), 5 sample containers I (Ø 55 mm x 35 mm), 1 Petri dish I (Ø 43 mm x 11 mm), 1 transfer dish (Ø 160 mm x 80 mm)
2	**Standard needle 2.5 g** ASTM D5 (<350 PU), EN 1426 (<330 PU) manual surface detection	106928	3 bitumen needles (2.5 g), 1 plunger (97.5 g), 3 sample containers I (Ø 55 mm x 35 mm), 1 sample containers III (Ø 70 mm x 45 mm), 1 transfer dish (Ø 160 mm x 80 mm) with heat exchanger tube, 1 intermediate bottom, 1 thermometer holder, 1 thermometer ASTM 63C / -8 to +32 : 0.1 °C
3	**Standard needle 2.5 g** ASTM D5 (<160 PU), EN 1426 (<160 PU) (100 g, 5 seconds) automatic surface detection	106929	3 bitumen needles (2.5 g), 1 sensor-plunger (97.5 g), 3 sample containers I (Ø 55 mm x 35 mm), 1 transfer dish (Ø 160 mm x 80 mm) with heat exchanger tube, 1 intermediate bottom, 1 thermometer holder, 1 temperature sensor Pt100
4	**Long needle 2.5 g** ASTM D5 (>350 PU), EN 1426 (>330 PU) manual surface detection	106930	3 extended bitumen needles (2.5 g), 1 plunger (97.5 g), 3 sample containers (Ø 55 mm x 70 mm), 1 transfer dish (Ø 160 mm x 80 mm) with heat exchanger tube, 1 intermediate bottom, 1 thermometer holder, 1 thermometer ASTM 63C / -8 to +32 : 0.1 °C
5	**Standard needle 2.5 g** ASTM D5 (<160 PU) (200 g, 60 seconds) automatic surface detection	106931	3 bitumen needles (2.5 g), 1 sensor-plunger (97.5 g), 1 load weight (100 g), 3 sample containers I (Ø 55 mm x 35 mm), 1 transfer dish (Ø 160 mm x 80 mm), 1 intermediate bottom, 1 thermometer holder, 1 temperature sensor Pt100
6	**Tapered needle – wax** ASTM D1321, DIN 51579, IP 376 manual surface detection	106932	2 tapered wax needles (2.5 g) stainless steel, 1 plunger (47.5 g), 1 load weight (50 g), 3 wax test cylinders (Ø 25 mm x 32 mm), 3 base plates, 1 transfer dish (Ø 185 mm x 90 mm) glass with heat exchange tube, 1 thermometer ASTM 64C / 25 to 55 °C : 0,1 °C
7	**Tapered needle – wax** ASTM D1321, DIN 51579 (<160 PU) automatic surface detection	113428	2 tapered wax needles (2.5 g), 1 sensor-plunger (97.5 g), 3 wax test cylingers, 3 base plates, 1 transfer dish (Ø 185 x 90 mm) glass with heat exchange tube, 1 thermometer ASTM 64C / 25 to 55 °C : 0,1 °C
8	**VICAT needle** and special cone ISO 6873, EN 26873/EN 196-3	132390	2 VICAT needles (2 g) stainless steel, 1 plunger (98 g), 2 load weights (100 g), 1 special cone (85 g), 1 plunger (15 g), 2 plaster / gypsum molds, 2 base plates
9	**Pin needle – brass**	106941	3 pin needles (3 g) brass, 1 plunger (15 g), 1 load weight (2 g)
10	**Pin needle – stainless steel**	106942	3 pin needles (3 g) stainless steel, 1 plunger (15 g), 1 load weight (2 g)
	Cones		
11	**Optional hollow cone – grease** ASTM D217, IP 50, ASTM D7342, ISO 2137	106935	1 optional hollow cone (102.5 g) brass, steel tip, 1 plunger (47.5 g), 1 sample container (Ø 76.5 mm x 63.5 mm)
12	**Solid cone – grease** ASTM D217, IP 50, ISO 2137	106940	1 standard solid cone (102.5 g) aluminum, steel tip, 1 plunger (47.5 g), 1 sample container (Ø 76.5 mm x 63.5 mm)
13	**Half-scale cone – grease** ASTM D1403, IP 310, ISO 2137	106937	1 half-scale cone (22.5 g) brass, steel tip, 1 plunger (15 g), 5 sample containers (Ø 38.1 mm x 31.8 mm)
14	**Quarter-scale cone – grease** ASTM D1403, IP 310, ISO 2137	106936	1 quarter-scale cone (1.08 g) plexiglass, metal tip, 1 plunger (8.3 g), 1 grease container with cover (Ø 19 mm x 11 mm)
15	**Optional hollow cone – sealant** ASTM D5329, EN 13880-2	106925	1 optional hollow cone (102.5 g) brass, steel tip, 1 plunger (47.5 g), 1 sample container (Ø 55 mm x 35 mm), 1 transfer dish (Ø 160 mm x 80 mm), 1 intermediate bottom
16	**Optional hollow cone – petrolatum** ASTM D 937, IP 179, ISO 2137	106933	1 optional hollow cone (102.5 g) brass, steel tip, 1 plunger (47.5 g), 1 sample container (Ø 100 mm x 65 mm)

** Penetration Unit = 0.1 mm*

Set	Test Body	Order-No.	Test Kit Content
	Cones (small)		
17	**Micro cone – ASTM**	132391	1 micro cone (5 g), 1 plunger (15 g), 1 three-section grease collection container
18	**Micro cone acc. to Klein – Pharma** European Pharmacopoeia 2.9.9. (in combination with Set 19)	106938	1 micro cone (7.0 g) aluminum, 1 plunger (16.8 g), 1 centering disk 3 three-section grease container (Ø 9.5 mm x 57 mm)
19	**Document** **Pharma Qualification Package – Smart** (Set 18 is recommended)	162194	Final Qualification, Qualification Instruction, Design Qualification, Installation Qualification, Operation Qualification, Performance Qualification, Standard Operating Procedure
20	**Hollow plexiglass cone**	106947	1 hollow cone (15 g) plexiglass, stainless steel tip, 1 plunger (10 g)
21	**Aluminum cone – 20°** AOSC Cc 16-60	106946	1 AOSC-cone 20° (45 g) aluminum, 1 plunger (47.5 g)
22	**Aluminum cone – 40°** Unilever method	106922	1 cone 40° (31.5 g) aluminum, 1 plunger (48.5 g), 1 load weight (80 g)
	Disks		
23	**Perforated disk – ASTM** with tip	106939	1 perforated disk, Ø 70 mm (102.5 g) aluminum, 1 plunger (47.5 g), 1 sample container (Ø 76.5 mm x 63.5 mm)
24	**Perforated disk – conical holes**	130654	1 conical perforated disk, Ø 35 mm (19.5 g) aluminum, 1 plunger (15 g), 3 load weights (5 g, 10 g and 20 g)
25	**Perforated disk – cylindrical holes**	130653	1 perforated disk, Ø 39 mm (28 g) stainless steel, 1 plunger (10 g), 5 sample containers (Ø 70 mm x 45 mm)
	Rams / Rods		
26	**Test ram – Ø 6.3 mm**	106949	1 test ram, Ø 6.3 mm (6.4 g) stainless steel, 1 plunger (47.5 g)
27	**AIB Test ram – bread** American Institute of Baking, Chicago	106943	1 test ram, Ø 30 mm (67 g) aluminum, 1 plunger (98 g), 1 load weight (50 g)
28	**Test ram – Ø 3 mm**	130651	1 test ram, Ø 3 mm (4.3 g) stainless steel, 1 plunger (47.5 g)
29	**Hollow rod**	106897	1 hollow test rod, Ø 10 mm (7 g) aluminum, 3 load weights (3 g, 13 g and 23 g)
30	**Plexiglass rod**	132386	1 test rod, Ø 10 mm (10 g) plexiglass
31	**Test cylinder with tip**	132392	1 cylinder with tip, Ø 10 mm (15 g) stainless steel, 1 cylinder with tip, Ø 15 mm (35 g) stainless steel, 1 plunger (15 g)

Note:

- All elements of these test body combinations are also available individually.
- Frequently applications may require a test body and a plunger from the above test kits only.
- For special needs there are further test kits and parts available on request.
- Examples of possible applications are listed on the previous page.

Useful Accessories



Grease sample preparation

The GWM 5 automatic grease working machine simplifies the exhausting grease working procedure necessary for preparing greases and other semi-solid materials for shear stability tests. The comparison between penetration and other rheological test values for fresh, unworked and worked samples indicates the shear stability of the material.

The GWM 5 grease working machine is suitable for either single or double worker operation.

Exact tempering – exact results

The ambient condition that influences the consistency most is the temperature. With some substances a temperature variation of 1 °C can cause a penetration change of 10 %. With the optional temperature sensor connected to PNR 12 an exact recording of the temperature is provided in the range from -25 °C to 100 °C.

Circulator baths are used for sample pre-tempering and constant tempering of a transfer dish which is placed directly on the penetrometer table.





On-site calibration

The testing accuracy is enhanced by a self-explanatory display-guided calibration procedure for distance, time and temperature.

The certified calibration kit is a mandatory accessory for the PNR 12 calibration program.

Technical Specifications

Standard methods – Depending on the accessories

Needle and Ram Penetration: ASTM D5, ASTM D1321, ISO 6873, EN 1426, EN 13179-2, DIN 51579, IP 376-A, IP 376-B, JIS K 2207, JIS K 2235 and more

Cone and Disk Penetration: ASTM D217, ASTM D937, ASTM D1403, ASTM D7342, ISO 2137, IP 50, IP 179, IP 310, European Pharmacopoeia 2.9.9. and more

Operation	
Measuring range	0 mm to 80 mm (plunger-dependent)
Automatic surface detection	▸ Force sensor plunger ▸ Electrical conductivity sensor
Password security	Multi-level password protection
Calibration	Display guided for time, distance and temperature
Languages	English, German, French
Handling	▸ Jog wheel (turn and push) ▸ Selection of mm or 1/10 mm (Penetration Unit)
Resolution	0.01 mm
Test duration	0.1 s to 999,999 s
Start delay	Up to 9999 s
Temperature recording	-25 °C to 100 °C with optional Pt100 sensor
Limit indication	Low and upper limit alarm
Documentation	
Data memory	▸ 200 results ▸ 4 standard programs ▸ 16 user-definable programs
Data export	▸ Memory stick (Excel®) ▸ Printer ▸ To laboratory network: LAN, LIMS compatibility
Interfaces	1x USB, 1x LAN, LIMS compatibility
Data input option	Keyboard
Statistics	Mean, min, max, standard deviation
Display	3.5"
Data conversion	NLGI-class, EN-bitumen value, ¼-cone to solid cone and ½-cone to solid cone
Requirements and dimensions	
Electrical conditions	▸ DC 24 V, 2.5 A ▸ External AC mains power adapter ▸ 100 V to 240 V, 50 Hz/60 Hz, 1.5 A (earth protection required)
Total power	Max. 70 W
Air humidity	Max. relative humidity: 80 °C (non-condensing)
Dimensions	300 mm x 385 mm x 570 mm (W x D x H)
Weight net	11 kg

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H611P002EN-A

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