



DISCOVERY HYBRID RHEOMETERS
TEMPERATURE SYSTEMS AND ACCESSORIES

advanced peltier plate

TEMPERATURE SYSTEMS

New Advanced Peltier Plate

The new Advanced Peltier Plate combines ultimate flexibility with exceptional temperature performance in a single Peltier Plate temperature system designed to cover the widest range of applications. The unique Quick Change Plate system provides the ability to easily attach lower plates of different materials and surface finishes, disposable plates for testing curing materials, and an Immersion Cup for characterizing materials in a fluid environment.

Features and Benefits

- Unique Smart Swap™ technology
- Wide temperature range: -40 °C to 200 °C
- Accurate temperature control: ± 0.1 °C
- Plates and cones up to 50 mm in diameter
- Robust hardened chrome finish
- Quick Change Plates provide flexibility for modifying lower geometry surface
 - Stainless steel, Anodized Aluminum and Titanium plates
 - Smooth, Sandblasted and Crosshatched plates
 - Disposable plates available for curing materials
- Fully accessorized
 - Extremely efficient Solvent Trap with built-in Purge Cover
 - Immersion Cup
 - Camera Viewer option
- Open platform to easily adapt custom-made lower geometries





Stepped Plate



Sandblasted Plate



Disposable Plate

Quick Change Plates

The Advanced Peltier Plate's simple bayonet-style locking ring facilitates the effortless attachment of a wide range of different lower plate covers including hard anodized aluminum, titanium and stainless steel plates with either a smooth, sandblasted or crosshatched surface finishes. Standard disposable Aluminum plates expand the capabilities of the system to test curing materials using a single Peltier Plate.



8 mm Stainless Steel



20 mm Disposable Aluminum



25 mm Crosshatched



40 mm Anodized Aluminum



40 mm Sandblasted



50 mm Titanium

Immersion Cup

The Advanced Peltier Plate's Immersion Cup adds the capability to characterize material properties when completely immersed in a fluid. It is easily attached to the top of the Advanced Peltier Plate through the bayonet fixture and gives access to the sample for loading, trimming, and subsequent sealing and filling – a rubber ring provides the fluid seal. The Immersion Cup is ideally suited to investigating hydrogel materials and can accommodate plates or cones up to 40 mm in diameter.



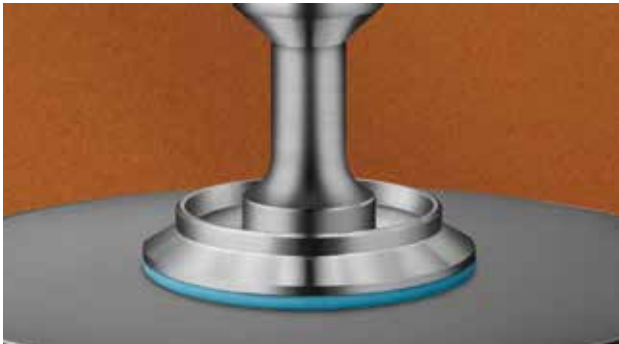
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TEMPERATURE SYSTEMS

Complete Peltier Plate Temperature Systems

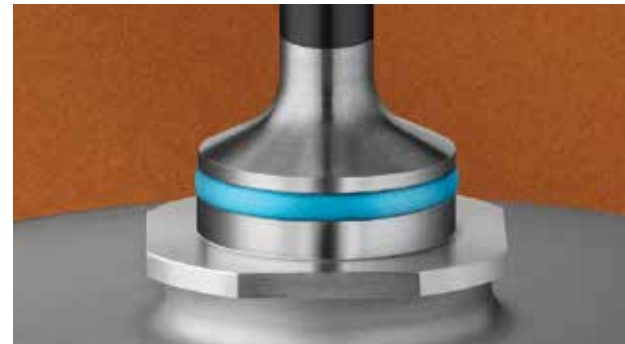
Over 20 years ago, TA Instruments first introduced Peltier Plate temperature control to rheometers. Since then, this core technology has been continuously developed and adapted to meet the expanding needs of our customers. With superior technology designed into four convenient Smart Swap™ models, we offer the highest performing, most versatile, and best accessorized Peltier Plate Temperature Systems available.





Standard Peltier Plate

The Standard Peltier Plate is the most common selection, offering an 80 mm diameter hardened chrome surface to accommodate up to 60 mm upper plates for maximum sensitivity.



Stepped Peltier Plate

The Stepped Peltier Plate provides the convenience of interchanging plate diameters and surfaces up to 25 mm in diameter or for remote sample preparation. Stainless steel and titanium plates are available in flat, sandblasted, and crosshatched finishes.



Stepped Disposable Peltier Plate

The Stepped Disposable Peltier Plate is ideal for thermoset curing or other single-use applications and is compatible with standard disposable plates.



Dual Stage Peltier Plate

The new Dual Stage Peltier Plate is the perfect choice for applications requiring sub-ambient temperature control. The unique design uses a stacked Peltier element approach, enabling fast and easy temperature control down to an unprecedented $-45\text{ }^{\circ}\text{C}$, without the use of expensive circulators.

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TECHNOLOGY

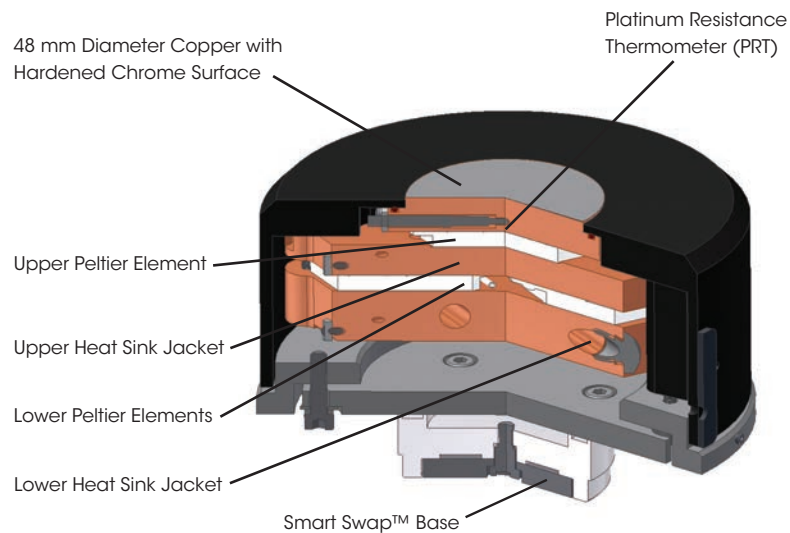
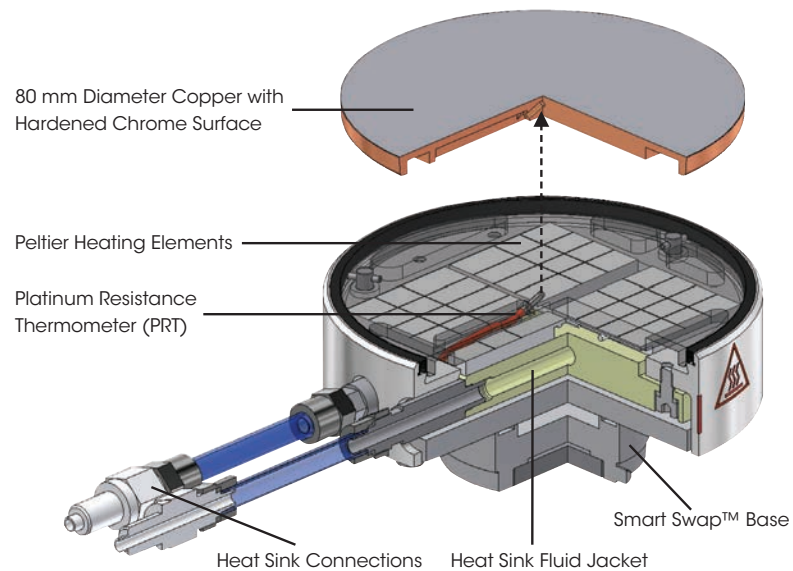
Peltier Technology

Standard and Stepped Peltier Plates offer a temperature range of $-40\text{ }^{\circ}\text{C}^*$ to $200\text{ }^{\circ}\text{C}$, heating rates up to $50\text{ }^{\circ}\text{C}/\text{min}$, and temperature accuracy of $0.1\text{ }^{\circ}\text{C}$. Four Peltier heating elements are placed directly in contact with a thin, 80 mm diameter, copper disc with an extremely rugged, hardened chrome surface. A platinum resistance thermometer (PRT) is placed at the exact center, ensuring accurate temperature measurement and control. The unique design provides for rapid, precise, and uniform temperature control over the entire 80 mm diameter surface. This allows for accurate testing with standard geometries up to 60 mm in diameter.

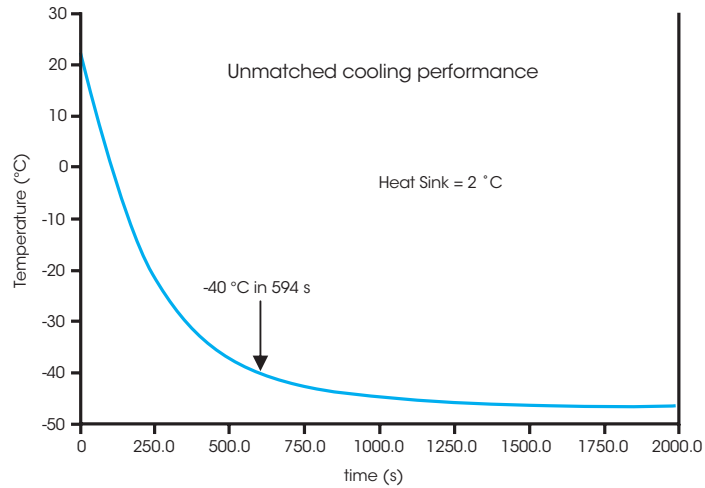
* with appropriate counter cooling

Dual Stage Peltier Plate Design

The new Dual Stage Peltier Plate uses a unique stacked Peltier element design that offers a temperature range of $-45\text{ }^{\circ}\text{C}$ to $200\text{ }^{\circ}\text{C}$, with standard counter-cooling options. It integrates a unique stacked Peltier element configuration that provides enhanced low temperature responsiveness and continuous temperature control over the entire operating range with a single heat sink temperature of $2\text{ }^{\circ}\text{C}$. This eliminates the need to have expensive powerful circulators to obtain temperatures down to this range.



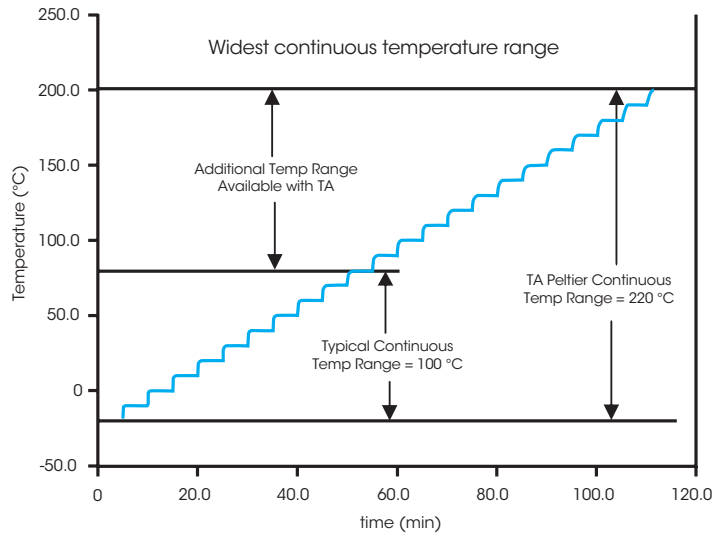
Dual Stage Peltier Plate Cooling Test



Performance

Peltier temperature control devices require that they be connected to a heat sink, typically a circulating fluid medium such as water. Most Peltier systems have a continuous temperature range of approximately 100 °C for a single heat sink temperature. The unique design of the Standard and Stepped Peltier Plate systems from TA Instruments extends the continuous range to 220 °C, as seen in data in the figure to the left. The benefit of this wide range is that it more than doubles the actual useable temperature range during any single test. The new Dual Stage Peltier Plate extends the low temperature limit and dramatically improves cooling performance. The figure to the left shows that this device can reach -40 °C from room temperature in under 10 minutes with a heat sink set at 2 °C.

Peltier Plate Temperature Steps over 220 °C Range



Features and Benefits

- Unique Smart Swap™ technology
- Wide Temperature Range: -45 °C to 200 °C
- Widest Continuous Temperature Range
- Accurate Temperature Control: ± 0.1 °C
- Hardened Chrome Surface
- Standard, Stepped, and Dual Stage Models
- Plates and Cones up to 60 mm in Diameter
- Disposable Plates
- Large Variety of Geometry Materials and Types
- Fully Accessorized
 - Extremely Efficient Solvent Trap
 - Smooth, Crosshatched, and Sandblasted Covers
 - Purge Gas Cover
 - Insulating Thermal Cover
 - Camera Viewer Option
 - Immersion Cell

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GEOMETRIES

Smart Swap™ Peltier Plate Geometries

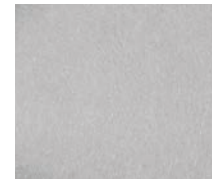
An extensive range of TA Instruments unique Smart Swap™ geometries⁽¹⁾, with automatic recognition are available for use with Peltier Plates. Cones and plates come standard in a variety of sizes, cone angles and material types. Custom geometries of non-standard sizes, materials, and surface finishes (such as sandblasted or Teflon® coated) are available upon request.

(1) Patent # 6,952,950

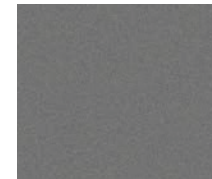


Standard Geometry Dimensions

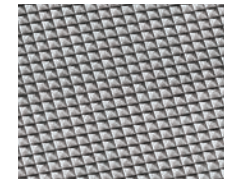
Peltier Plate geometries are available in 8 mm, 20 mm, 25 mm, 40 mm, 50 mm, and 60 mm diameters. Upper Cone geometries are readily available in 0.5°, 1°, 2°, and 4° cone angles. Non-standard diameters and cone angles are available upon special request. By changing diameter and cone angle, the measurable range of stress and strain or shear rate can be varied to capture the widest range of material properties.



Smooth



Sandblasted



Crosshatched

Materials of Construction and Surfaces

Peltier Plate geometries come standard in the following materials:

- **Stainless Steel:** Rugged, very good chemical resistance for highly basic or acidic materials
- **Stainless Steel with Composite Heat Break:** Same properties as stainless steel with added benefit of composite heat break, which insulates upper geometry when controlling temperatures away from ambient
- **Hard Anodized Aluminum:** Excellent thermal conductivity, low mass, fair chemical resistance
- **Titanium:** Low mass, excellent chemical resistance

Geometries are available in multiple surface finishes, including smooth, sandblasted, and crosshatched.



No Solvent Trap



With Solvent Trap



With Solvent Trap and Composite heat break

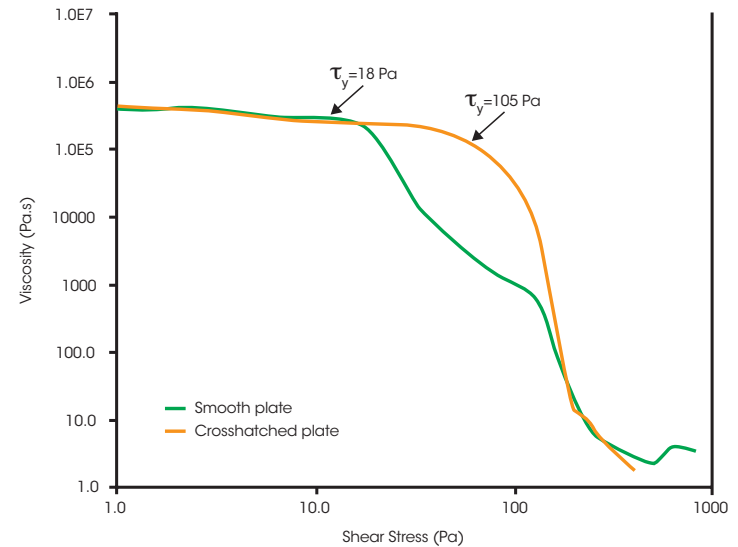
Peltier Plate Standard Geometry Types

Peltier Cone and Peltier Plate geometries are available in three basic types. They include geometries without solvent trap, geometries with insulating composite heat break, and geometries with solvent trap. Heat break geometries are available in stainless steel only. Solvent trap geometries are designed for use with the solvent trap system discussed separately. The figure below shows a comparison of stainless steel 40 mm geometry types.

Eliminating Wall Slip on Toothpaste with Crosshatched Plates

Wall slip phenomena can have large effects on steady shear rheological measurements. To mitigate such issues, a roughened surface finish is typically used. The figure to the right shows the steady state flow testing results on toothpaste with smooth and crosshatched plate geometries. With this type of material, standard smooth surface plates slip at the interface and lead to a false measured yield stress on the order of about 18 Pa. However, with crosshatched geometries, slip is eliminated and an accurate yield stress of 105 Pa, which is more than 5 times higher, is measured.

Yield Stress Measurements on Toothpaste



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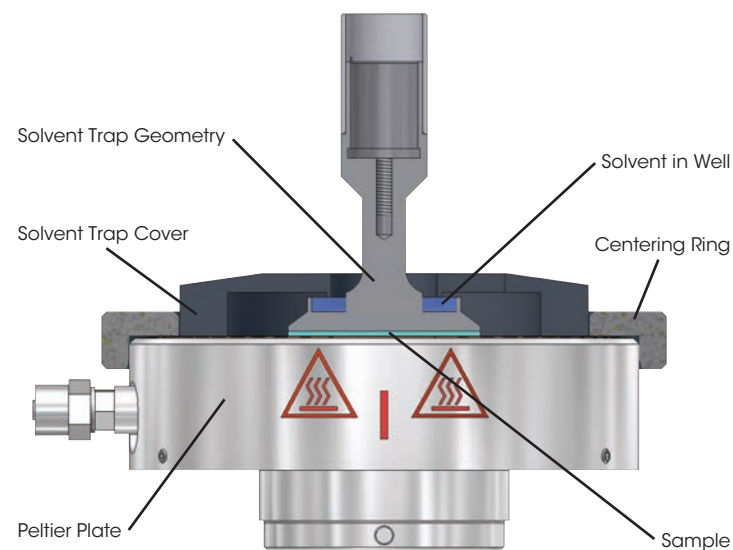
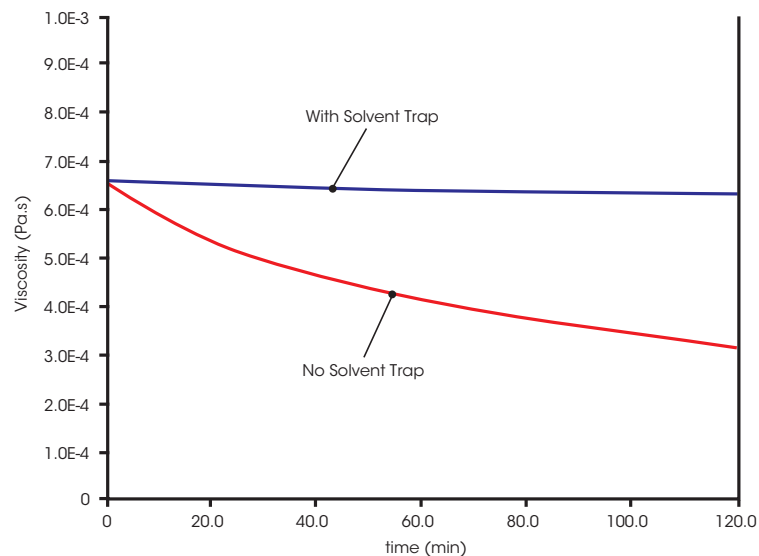
ACCESSORIES

Peltier Solvent Trap and Evaporation Blocker

The Solvent Trap cover and Solvent Trap geometry work in concert to create a thermally stable vapor barrier, virtually eliminating any solvent loss during the experiment as shown in data for water at 40 °C to the right. The geometry includes a well that contains very low viscosity oil, or even the volatile solvent present in the sample. The Solvent Trap cover includes a blade that is placed into the solvent contained in the well without touching any other part of the upper geometry. The Solvent Trap sits directly on top of the Peltier Plate surface and an insulating, centering ring insures perfect placement for quick and easy sample loading. The solvent trap is also available in an insulated model. See Insulating Thermal Covers section for details.



Water at 40 °C with and without Solvent Trap



Purge Gas Cover

The Purge Gas Environmental Cover is a hard-anodized aluminum two-piece split cover with 6 mm diameter compression fittings. An insulating location ring insures precise and easy location of the cover. This cover is ideal for purging the sample area with nitrogen to prevent condensation during experiments performed below room temperature or with a humidified purge to keep a sample from drying.



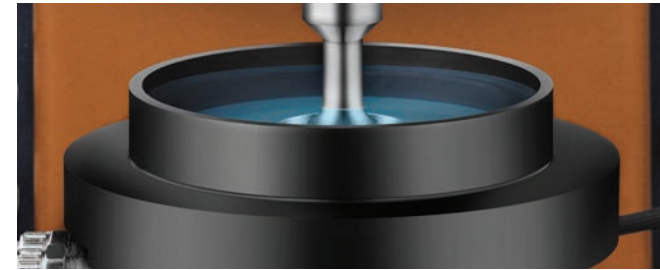
Insulating Thermal Covers

Thermal Insulation Covers are constructed of an anodized Aluminum core surrounded by an insulating exterior. The aluminum core conducts heat to the upper geometry, providing uniform temperature throughout the sample. The cover is available in standard and solvent trap models. The standard cover accommodates up to 25 mm plates and can be used with all Peltier plate models. It is recommended for use over a temperature range of -10 °C to 90 °C, with samples not susceptible to drying such as oils, caulk, epoxy, and asphalt binder. The Insulated Solvent Trap Cover is compatible with the Standard Peltier Plate and geometries up to 60 mm in diameter. It is recommended for testing of low viscosity materials over the same temperature range above and offers the added benefit of evaporation prevention. Heat break geometries are recommended for use with both covers.



Peltier Immersion Ring

The Peltier Plate Immersion Ring allows samples to be measured while fully immersed in a fluid. The immersion ring is compatible with all Peltier Plate models and is easily attached to the top of the Peltier Plate. A rubber ring provides the fluid seal. This option is ideal for studying the properties of hydrogels.



Peltier Plate Covers

A variety of Peltier Plate Covers are available for applications that can harm the chromium surface of the plate or for samples that exhibit slip during testing. They are available in stainless steel, hard-anodized aluminum and titanium. Crosshatched and sandblasted Peltier covers are used to eliminate sample slippage effects. Covers are compatible with solvent trap.



Peltier Plate Camera Viewer

The camera viewer is used in conjunction with streaming video and image capture software. Real-time images can be displayed in the software and an image can be stored with each data point for subsequent viewing during data analysis. The camera viewer is perfect for long experiments with unattended operation for visual inspections of data integrity.



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