GI GWT

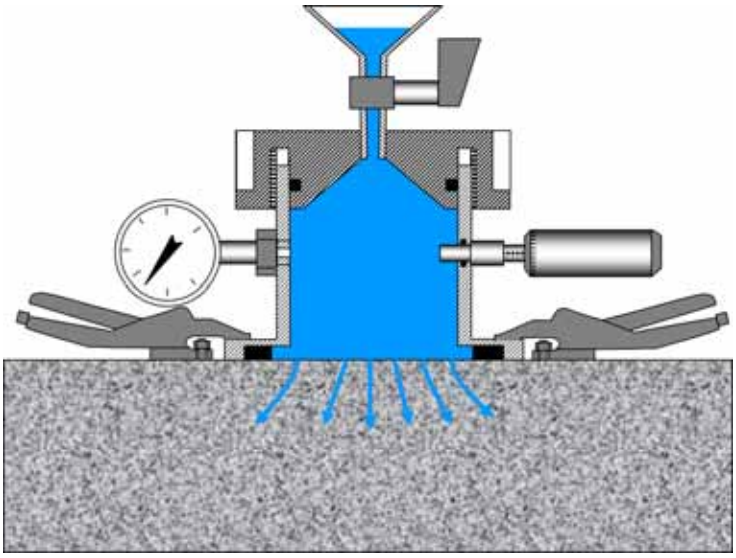
Purpose

The **GWT** (**G**ermann **W**ater permeation **T**est) is used for on-site evaluation of

- The water permeation of the skin-concrete in finished structure
- The water permeation of masonry panels
- The water tightness of construction joints and sealed control joints
- Effectiveness of water proofing membranes

Principle

The **GWT** measures the permeation of water into the test surface under an applied pressure.



A pressure chamber containing a watertight gasket is secured tightly to the surface by two anchored clamping pliers or by means of a suction plate. Alternatively, the gasket may be bonded to the surface with an adhesive.

The chamber is filled with water and the water is allowed to be absorbed by the test surface for 10 minutes. The filling valve is closed, and the top cap of the chamber is turned until a desired water pressure is displayed on the gauge. As water permeates into the concrete, the selected pressure is maintained by means of a micrometer gauge pushing a piston into the chamber. The piston movement compensates for the volume of water penetrating into the material.

The travel of the piston as a function time is recorded and the speed the piston travel in µm/s is used to characterize the permeation of the test surface.

Application Examples

1. Permeation of Concrete Surface

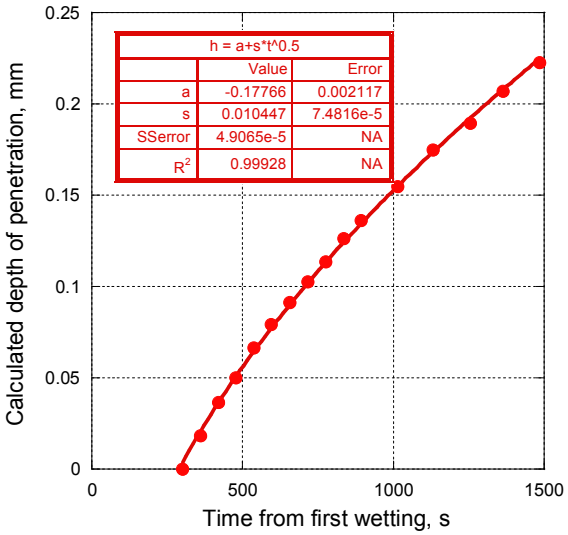
On the left, the cap of the **GWT** is being tightened to bring the water pressure to 100 kPa. On the right the **GWT** is being used on a vertical concrete surface. An elbow is used to permit initial filling of the chamber. The micrometer is turned to advance the piston and maintain the water pressure at 100 kPa. The micrometer position is recorded as a function of time. Testing is usually conducted for 10 minutes, but longer times and a higher pressure (500 kPa) may be required for low w/cm concrete..

2. Laboratory Evaluations

With the use of the optional laboratory kit, the **GWT** can be used to determine the water penetration characteristics of alternative concrete mixtures or surface sealers. While a standard method for evaluating test data exists, one approach is to calculate the "depth" of water penetration as a function of time using the following relationship:

$$h(t) = \left(\frac{d}{D}\right)^2 (g(t) - g_1) \qquad (1)$$

where $h(t)$ = depth of water penetration at time t, mm
d = diameter of micrometer piston, 10 mm,
D = inside diameter of gasket, 62 mm,
$g(t)$ = micrometer gauge reading at time t, mm, and
g_1 = micrometer gauge reading at start of measurement, mm.



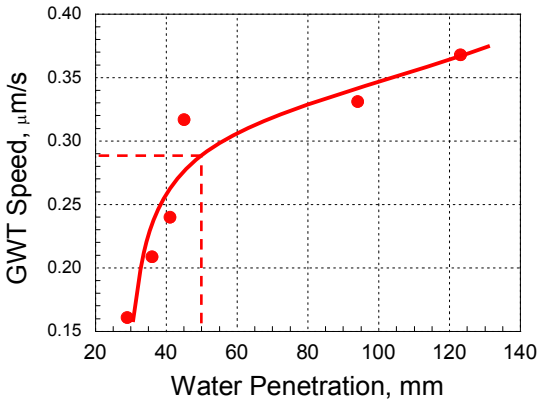
It has been found that the depth of water penetration is a linear function of the square root of time **(1)**, where time is measured from when water is first added to the GWT chamber. Therefore, the following function can be fitted to the data:

$$h(t) = a + s\sqrt{t} \qquad (2)$$

where a is the intercept and s is called the **sorptivity index** in units of mm/$t^{0.5}$. The plot to the left is an example of typical data of depth of water penetration versus time. In this case measurement of water penetration began after a 5-minute delay from the time water was introduced into the chamber. The chamber pressure was 100 kPa. The best-fit of Eq. (2) is shown, and the sorptivity index from the regression analysis is 0.01 mms$^{0.5}$.

3. In-place Quality Assurance Testing

Correlations can be established between the speed of piston travel and the depth of water penetration measured on companion specimens using EN 12390-8 "Testing Hardened Concrete-Part 8: Depth of Penetration of Water Under Pressure." The graph on the right is an example of such a correlation. Project specifications may require that the concrete meet a maximum water penetration using the 72-h EN 12390-8 test. For example, a maximum depth of 50 mm is specified typically for concrete in non-corrosive conditions. Using the established correlation, the **GWT** can be used for in-place testing to demonstrate that the concrete in the structure conforms to the water penetration requirements.



4. Masonry Permeability

The GWT is shown being used for testing the water tightness of a brick masonry wall. It was found that when it rained and for a normal wind pressure, water penetrated the wall. The first thought was that there was a problem with the mortar joints. By using the GWT, however, the problem was shown to be the related to the brick units, not to the mortar joints. The brick units had been burned at a higher temperature than normal to produce the required color, but the higher burning temperature increased the permeability of the brick.

Reference

Mohammadi, B and Nokken, M.R., "Influence of Moisture Content on Water Absorption in Concrete," 3rd Specialty Conference on Material Engineering & Applied Mechanics, Montreal, May 29-June 1, 2013.

GWT-4000 Kit Ordering Numbers

Item	Order #
Pressure chamber unit with 0-1.5 bar* gauge	GWT-4010
Wrench for pressure lid	GWT-4020
Extra 0-6.0 bar gauge	GWT-4030
Water filling cup	GWT-4050
Adjustable clamping pliers	GWT-4060
Set of anchoring tools	GWT-4080
Wrenches: 14 and 17 mm	GWT-4090
Sealant tape	GWT-4100
Bottles with boiled water, 3	GWT-4110
Gaskets, 10 mm thick, 4	GWT-4120
Gaskets, 15 mm thick, 4	GWT-4130
Manual	GWT-4140
Attaché case	GWT-4150

*1 bar = 100 kPa

Optional Items:

Item	Order #
Suction plate & vacuum pump	GWT-4230
	
Hammer drill	GWT-4240
GRA glue, box	GWT-4250
Laboratory kit	GWT-4260