

## Roman bath heating system

Roman Baths were designed for bathing and relaxing and were a common feature of cities throughout the Roman empire. Baths included a wide diversity of rooms with different temperatures, as well as swimming pools and places to read, relax, and socialise. Roman baths, with their large covered spaces, were important drivers in architectural innovation, notably in the use of domes.

Generally opening around lunchtime and open until dusk, baths were accessible to all, both rich and poor. In the reign of Diocletian, for example, the entrance fee was a mere two denarii - the smallest denomination of bronze coinage. Sometimes, on occasions such as public holidays, the baths were even free to enter.

Plan of the Baths of DiocletianB. Fletcher (Public Domain)

Roman Baths Floor, ButrintMark Cartwright (CC BY-NC-SA)

Walls could also provide heating with the insertion of hollow rectangular tubes (tubuli) which carried the hot air provided by the furnaces. In addition, special bricks (tegulae mammatæ) had bosses at the corners of one side which trapped hot air and increased insulation against heat loss. The use of glass for windows from the 1st century CE also permitted a better regulation of temperatures and allowed the sun to add its own heat to the room.

The vast amount of water needed for the larger baths was supplied by purpose-built aqueducts and regulated by huge reservoirs in the baths complex. The reservoir of the Baths of Diocletian in Rome, for example, could hold 20,000 m<sup>3</sup> of water. Water was heated in large lead boilers fitted over the furnaces. The water could be added (via lead pipes) to the heated water pools by using a bronze half-cylinder (testudo) connected to the boilers. Once released into the pool the hot water circulated by convection.

Some of the more famous and splendid baths include those at Lepcis Magna (completed c. 127 CE) with their well-preserved domes, the Baths of Diocletian in Rome (completed c. 305 CE), the large bath complexes of Timgad at Ephesos, in Bath (2nd century CE), and the Antonine Baths at Carthage (c. 162 CE).

Natatio, Baths of CaracallaMark Cartwright (CC BY-NC-SA)

Caracalla Baths, Rome, Italy - Digital ReconstructionQS Supplies (CC BY-NC-SA)

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