

Formula 1

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Formula 2

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Formula 3

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Detailed Explanation

ASME PTC 46-2021 provides a rigorous, industry-accepted framework for conducting performance tests on binary-cycle geothermal power plants—systems that avoid direct steam expansion by using a secondary organic Rankine cycle (ORC). The code emphasizes metrological traceability, specifying minimum instrument accuracy classes, calibration requirements, and uncertainty propagation methodologies (e.g., root-sum-square of component uncertainties) to ensure test results meet $\pm 1.0\%$ uncertainty targets for net plant output under specified conditions. It defines key test boundaries—including the plant control volume (from geothermal fluid inlet to electricity export point), reference conditions (e.g., ambient dry-bulb temperature, barometric pressure), and mandatory measurements such as geofluid mass flow rate, temperature/pressure at critical points, working fluid thermodynamic states, generator output, and parasitic losses (e.g., pumps, cooling fans). Unlike generic energy balance standards, PTC 46-2021 incorporates geothermal-specific considerations: non-condensable gas effects in brine, scaling/fouling impacts on heat exchanger UA values, and transient response protocols for low-grade, variable-temperature heat sources. Its application supports contractual performance guarantees, regulatory compliance, technology benchmarking, and optimization studies—particularly when evaluating working fluid selection, turbine design improvements, or heat recovery enhancements within the binary cycle.

Key Components

#	Component
1	Geofluid Heat Exchanger (Evaporator)
2	Organic Working Fluid Turbine-Generator System
3	Condenser and Cooling System

Applications

#	Application
1	Verification of contractual power output and thermal efficiency guarantees
2	Performance baseline establishment for plant commissioning and O&M optimization
3	Comparative evaluation of ORC configurations and working fluids

Related Concepts

#	Concept
1	Organic Rankine Cycle (ORC)
2	Geothermal Resource Assessment
3	ASME PTC 19.1 — Test Uncertainty

Tags

geothermal, binary_cycle, performance_testing

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