OROTIG

Welding comparison: Flame Welding vs. Laser Welding

TECHNICAL COMPARISON	Flame welding	Laser welding
Operating Principle	Based on the combustion of a fuel gas (acetylene or propane) mixed with oxygen, producing a high-temperature flame used to fuse metals	Utilizes a concentrated, coherent laser beam focused on an extremely small area (typically 0.1–1.5 mm) to achieve precise, localized melting
Working Temperature	Generates a broad, less controllable heat zone (2,500–3,200 °C) with a flame spot diameter of 5–15 mm, making precise control difficult	Produces a highly localized heat source (3,000–5,000 °C) with minimal thermal spread, ensuring targeted energy delivery
Impact on Gemstones	High risk of thermal shock, fracture, or surface alteration on heat-sensitive stones	Negligible risk; the localized energy input prevents damage to surrounding gemstones or settings
Precision	Limited precision, especially on fine or intricate components; manual skill required	Extremely high accuracy, suitable for micro-welding of delicate or minute parts
Materials Compatibility	Typically used for gold and silver alloys	Compatible with a wide range of metals — gold, silver, stainless steel, titanium, platinum, and other precious or technical alloys
Joint Appearance	Joints are often visible and require polishing or post-finishing	Produces nearly invisible seams, minimizing the need for additional finishing
Productivity	Discontinuous process, often requiring multiple stages and cooling intervals	Continuous and repeatable process, reducing overall production time and handling

SAFETY COMPARISON	Flame Welding	Laser Welding
Thermal Hazard	High thermal risk due to direct exposure to flame and heated metal components	Low thermal exposure; the heat-affected zone is extremely confined and precisely controlled
Use of Fuel Gases	Requires flammable gases, with inherent risks of leaks or explosions	No combustible gases required, eliminating explosion risks
Fumes and Vapors	Produces combustion fumes that may be harmful without adequate ventilation or extraction	Generates minimal fumes; extraction systems are typically integrated into professional laser welding units
Operator Ergonomics	May involve awkward working postures and physical strain during prolonged operations	Enhanced ergonomics through fixed workstations and integrated optical or microscope-assisted systems, reducing operator fatigue

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