

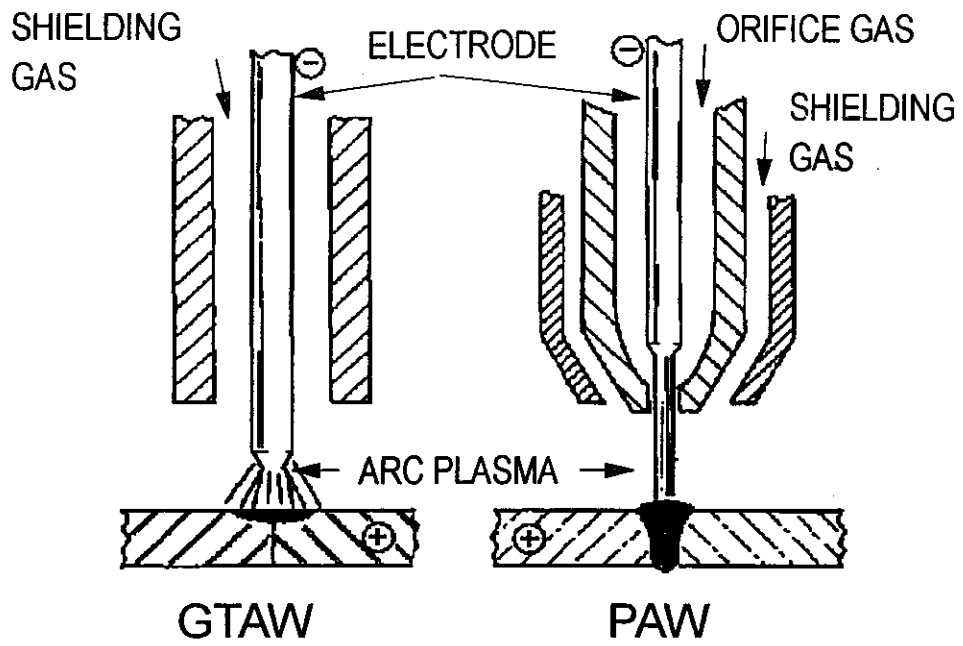
Gas Shielded Welding Processes

Plasma Arc Welding (PAW)

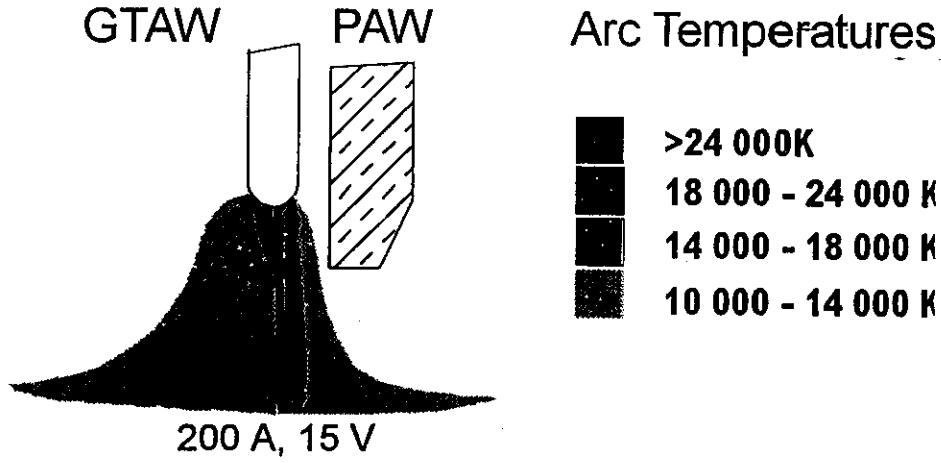
PAW: Process Fundamentals

- In PAW the heat source is an arc maintained between a non-consumable electrode and the workpiece
- The arc is constricted by a cooled orifice that surrounds the electrode
- Inert gas is supplied separately to the orifice and to a surrounding low-velocity shielding flow

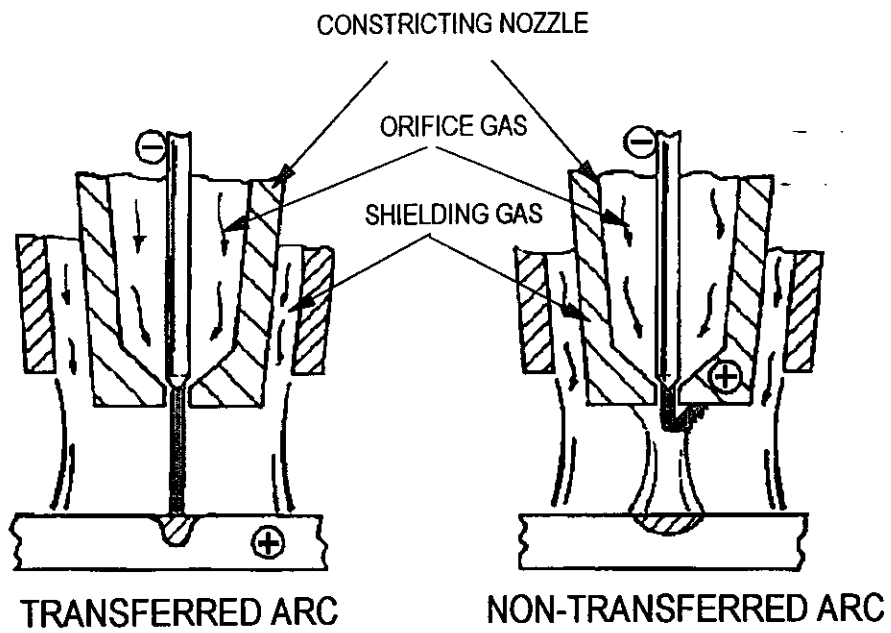
PAW: Comparison with GTAW



PAW: Effect of Arc Constriction

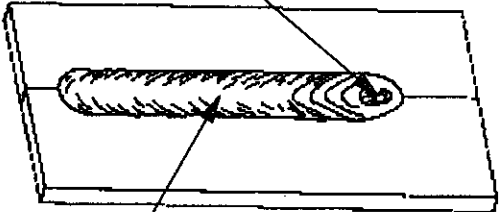


PAW Modes



PAW: Keyhole technique

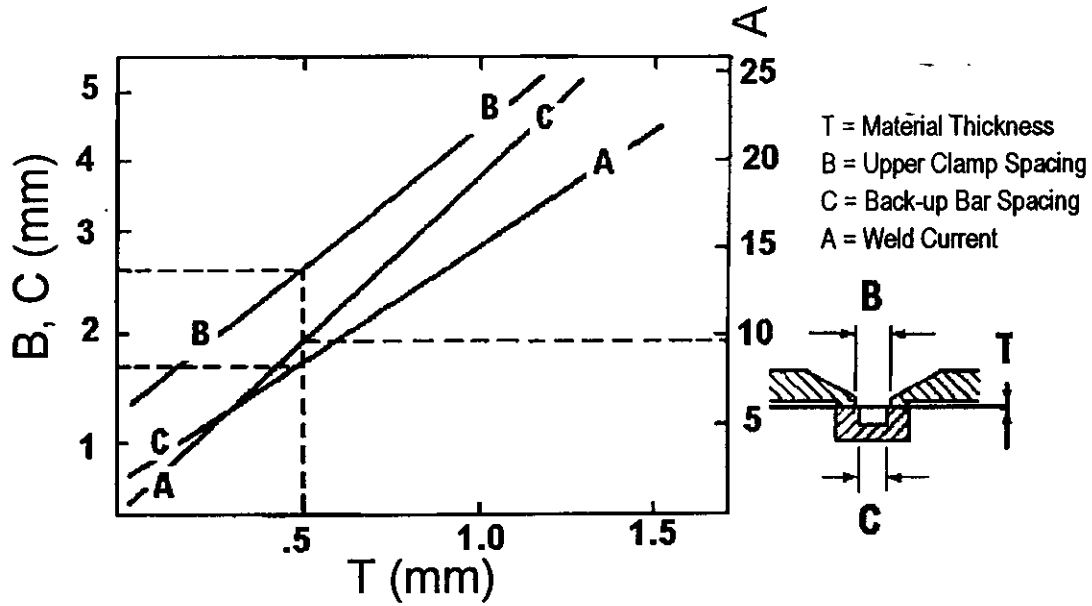
KEYHOLE



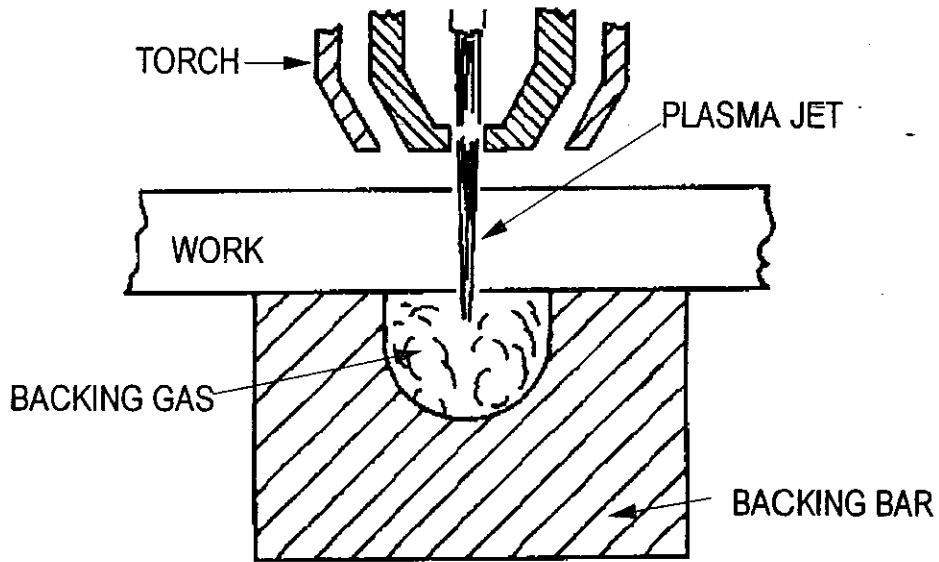
WELD BEAD

PAW: Welding Procedures

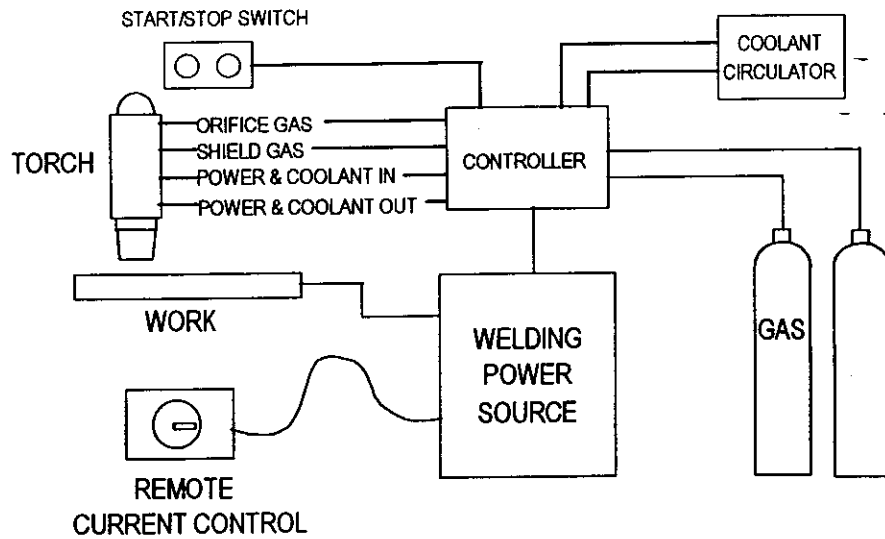
Keyhole welding of stainless steel sheet



PAW: Backing for Keyhole Welding



PAW Welding Equipment



PAW Applications

- Very thin sheet (down to 0.1 mm), wire and mesh sections in microplasma mode
- Full penetration welding of sheet and plate up to about 5mm thick in single pass keyhole mode.
- Keyhole mode usually in flat position, rarely for tube and pipe welding
- Melt-in mode applications similar to GTAW

PAW Capabilities & Limitations

- | | |
|--|--|
| <ul style="list-style-type: none">+ Higher intensity heat source than GTAW<ul style="list-style-type: none">- higher welding speeds- reduced heat input and distortion+ Insensitive to torch stand-off distance+ Applicable to almost all metals+ Adaptable to precision mechanized applications | <ul style="list-style-type: none">- Little tolerance for joint misalignment- Torch orifice must be well maintained for consistent weld quality- PAW torches are more bulkier and more difficult to manipulate manually than GTAW |
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Electron Beam & Laser Welding

LBW, EBW Capabilities and Limitations

- + Very high energy density heat sources
- + Very deep penetration in "keyhole" mode
- + Narrow welds and HAZ
- + High welding speed
- + Reduced heat input and distortion
- + Adaptable to precision mechanized applications

- Little tolerance for joint misalignment
- EBW requirement for vacuum chamber limits maximum size that can be welded
- Equipment is complex and costly.

LBW High Shallow, Low Penetration & Low