The Evolution of Plasma Cutting

• Major milestones to today’s High Performance Plasma Systems

Presented by Jim Colt
... in co-operation with MultiCam and Hypertherm
- Late 1950’s through mid 1960’s
  - Simple, high powered plasma systems were first used in the late 1950’s
  - First patented by Union Carbide Corporation
  - Thermal Dynamics later improved the process with Dual-Flow technology
  - Most productive way to contour cut non-ferrous metals

  - It took over 350 Amps to cut through ½” thick materials! This can be done with 50 amps today!
  - Consumable life was measured in feet….not hours!
  - Virtually all cuts required grinding to remove dross!
  - Typical angularity of the cut face was 8 to 12 degrees from square!
  - Cut quality was very poor on carbon steel.
• Radial Water Injection Plasma invented, Hypertherm Inc. 1968

Water is radially injected around a Nitrogen plasma arc...effectively squeezing the arc to increase its energy density.

Advantages:

• Faster speeds, less dross, less angularity, longer consumable life.

• The ability to cut carbon steel with plasma speed with no dross (thinner than 5/8”)
Water Table and Water Muffler Plasma Cutting Processes

1972

- Utilize a water table to trap hot particles of metal
- Utilize an airtight water shield that surrounds the plasma torch to reduce audible noise, and to eliminate smoke.

- Effectively eliminates heavy smoke, loud noise, and minimizes ultraviolet glare associated with high powered plasma cutting.
Oxygen Plasma Cutting for Carbon Steel

- Dramatic improvements in plasma cut quality and speed at the expense of consumable life.
  - Metalurgically pure edge...better welding, better forming, and better machining ability on the cut edge
  - Faster cutting speed at lower power levels....less noise, less smoke, narrower kerf
1985….Low cost air plasma systems are becoming popular, due to improved (chopper and inverter) power supply technology.

• Simple to retrofit to oxy-fuel machines
• Low capital cost, reasonable cut speed
• Can cut ferrous and non-ferrous
• Largest market is HVAC duct fabrication machines
Contact Start plasma systems developed that eliminate high frequency start circuit.....1987

• Further reduces cost of air plasma systems
• Totally eliminates electrical noise interference associated with high frequency start plasma systems
Shielded Torch Nozzle Dramatically Improves Nozzle Life

1989

- Shield electrically isolates the nozzle to minimize nozzle damaging double arc
- Allows thicker piercing
- Allows drag cutting..or contact with the plate
- Improves nozzle cooling
- Helps shield gas control cut quality
1992: Perhaps the finest year in Plasma Cutting History!

- Long Life Oxygen Cutting Technology released to the market
- High Flow Vortex Nozzle Technology invented
- High Definition Plasma introduced

- These three technologies….all released in 1992….have combined to revolutionize plasma cutting with….lower operating cost and dramatically improved cut edge angularity and overall quality
Long Life Oxygen Technology

- The superior cut quality of oxygen…combined with consumable life that rivals that of Nitrogen plasma systems

- Lower cost per foot of cut
- Minimal (if any) secondary operations required
- Faster at lower power levels
- Less Smoke
- Less Noise
High Flow Vortex Nozzle Design

- Allows for highly efficient gas swirl….which improves edge squareness on carbon steel
- Dramatically increases energy density, while allowing long nozzle and electrode life
High Definition Plasma Cutting Technology

• Superior cut quality...comparable to laser on some materials
• Quick disconnect torches for minimal downtime
• Cut part accuracy that perfectly fits between Laser and conventional Plasma
• Variety of gas and consumable combinations can be used to fine tune process
Coaxial-Assist jet Technology
1999-2003

• Dramatic Process Improvement
  • Speeds increased up to 50% at same power levels
  • Ability to pierce 1.5 times the thickness
  • Squarer, straighter cuts on thicker materials

HySpeed HT2000 vs HT2000 Cut Speed Comparison

<table>
<thead>
<tr>
<th>Material</th>
<th>HySpeed HT2000</th>
<th>HT2000</th>
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</thead>
<tbody>
<tr>
<td>1&quot;</td>
<td>200-250</td>
<td>150-200</td>
</tr>
<tr>
<td>3/4&quot;</td>
<td>180-220</td>
<td>130-180</td>
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<tr>
<td>1/2&quot;</td>
<td>160-200</td>
<td>120-170</td>
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<tr>
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<td>140-180</td>
<td>110-160</td>
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Cut Speed (ipm)
2004 High Performance Plasma Systems

- All of the best technologies:
  - Oxygen Plasma (all other gases available also)
  - Shielded technology for best piercing and longest nozzle life
  - High Flow Vortex gas flow technology
  - Long Life Oxygen
  - High Definition

- Combined with new technology:
  - Solid State automatic gas flow technology
  - Improved torch cooling circuit
  - Modular system design (shared components, 130 and 260 Amps)
  - Dramatic increase in consumable life...2 to 3x previous systems.
  - Cut quality traceable to ISO standards
  - Best quality cuts....easiest plasma system to operate
2004 High Performance Plasma Systems

- Modular…choose your power level
- Combines ease of use…with low operating cost and highest cut quality.

NUMERIK SRL - www.pantografosnumerik.com.ar
Simple to operate

- Operator simply chooses material type, thickness and power level desired…..all parameter settings are made in 2.4 seconds!
2004 High Performance Plasma Systems

Simple to operate

• Can switch from cutting to marking process in 2.4 seconds (automatically, through the part program)...without changing torch consumables.
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