Laser welding training Certificate

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First day

1- Laser Basics
- 1.1 Introduction to laser and laser properties
- 1.2 Principle of laser generation
- 1.3 Laser components/resonator
- 1.4 Laser materials/pump sources

2- Industrial Lasers
- 2.1 Co2 laser
- 2.2 Excimer lasers
- 2.3 Fiber lasers
- 2.4 Disk lasers
- 2.5 Direct diode laser
- 2.6 Blue (GaN) diode laser

3- Changing Laser Wavelength
- 3.1 Second harmonic generation (SHG)
- 3.2 Third harmonic generation (THG)

4- Laser Operation Modes
- 4.1 Continuous laser
- 4.2 Pulsed laser, Q Switching and Mode-locking
- 4.3 The symbols, definition and units of pulse laser

5- Laser Beam Delivery
- 5.1 Reflective optics
- 5.2 Transmissive optics
- 5.3 Beam expander
- 5.4 Laser beam scanning systems
- 5.5 Feed Fiber/Processing Fiber

6- Laser Beam Modes
- 6.1 Co2 laser modes
- 6.2 Fiber laser modes
- 6.3 Beam Shaping (fixed optics and multi fibers)

7- Laser Beam Parameters Calculation
- 7.1 Co2 laser calculation
- 7.2 Fiber/Disk laser calculation

8- Laser Measurements Devices
- 8.1 Wavelength
- 8.2 Power/Energy
- 8.3 Beam profile

Second day

9- Laser Welding
- 9.1 Advantage of laser welding
- 9.2 Laser welding modes
  - 9.2.1 Conduction welding
  - 9.2.2 Keyhole welding

10- Laser Welding Process Parameters
- 10.1 Laser wavelength – Laser copper welding
- 10.2 Laser focus position, finding focus position and focus shift
- 10.3 Laser depth of focus
- 10.4 Laser power and power density
- 10.5 Laser mode
- 10.6 Beam shaping
- 10.7 Laser operating mode (continuous/pulses)
- 10.8 Laser remote welding without/with power modulation
- 10.9 Hybrid Laser beam welding
- 10.10 Hot and Cold wire laser welding
- 10.11 Laser brazing
- 10.12 - Materials Properties
  - 10.12.1 Chemical composition
  - 10.12.2 Thermal properties
  - 10.12.3 Oxide layers
  - 10.12.4 Surface condition/ Surface roughness
  - 10.12.5 Material thickness

11- Joint configurations

12-Tooling and Motion
- 12.1 Welding speed
- 12.2 Alignments
- 12.3 Shielding gas
- 12.4 Fume extraction system

Third day

13- Laser Welding Defects and Qualification
- 13.1 Surface defects
- 13.2 Internal defects

14- Testing and Inspection of Laser Welds

15- In-Line Laser Welding Control, Monitor and Inspection

16-Laser welding examples
- 16.1 Welding similar materials
  - 16.1.1 Stainless steel
  - 16.1.2 Pulsed Nd:YAG Laser Welding Dual-Phase (DP) 1000 Steel Butt Joint
  - 16.1.3 Welding galvanized steel
  - 16.1.4 Aluminum
  - 16.1.5 Copper
- 16.2 Welding dissimilar materials
  - 15.2.1 Laser Welding Aluminum/Steel
  - 15.2.2 Laser Welding Aluminum- Copper

17- Weld troubleshooting

18- Maintenance - Optics Cleaning

19- Laser safety

Testing