Advanced Manufacturing

Technology & Prototyping

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Lecture 6

Abrasive Water Jet Machining

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ABRASIVE WATER JET MACHINING (AWJM)

Abrasive Water Jet Machining

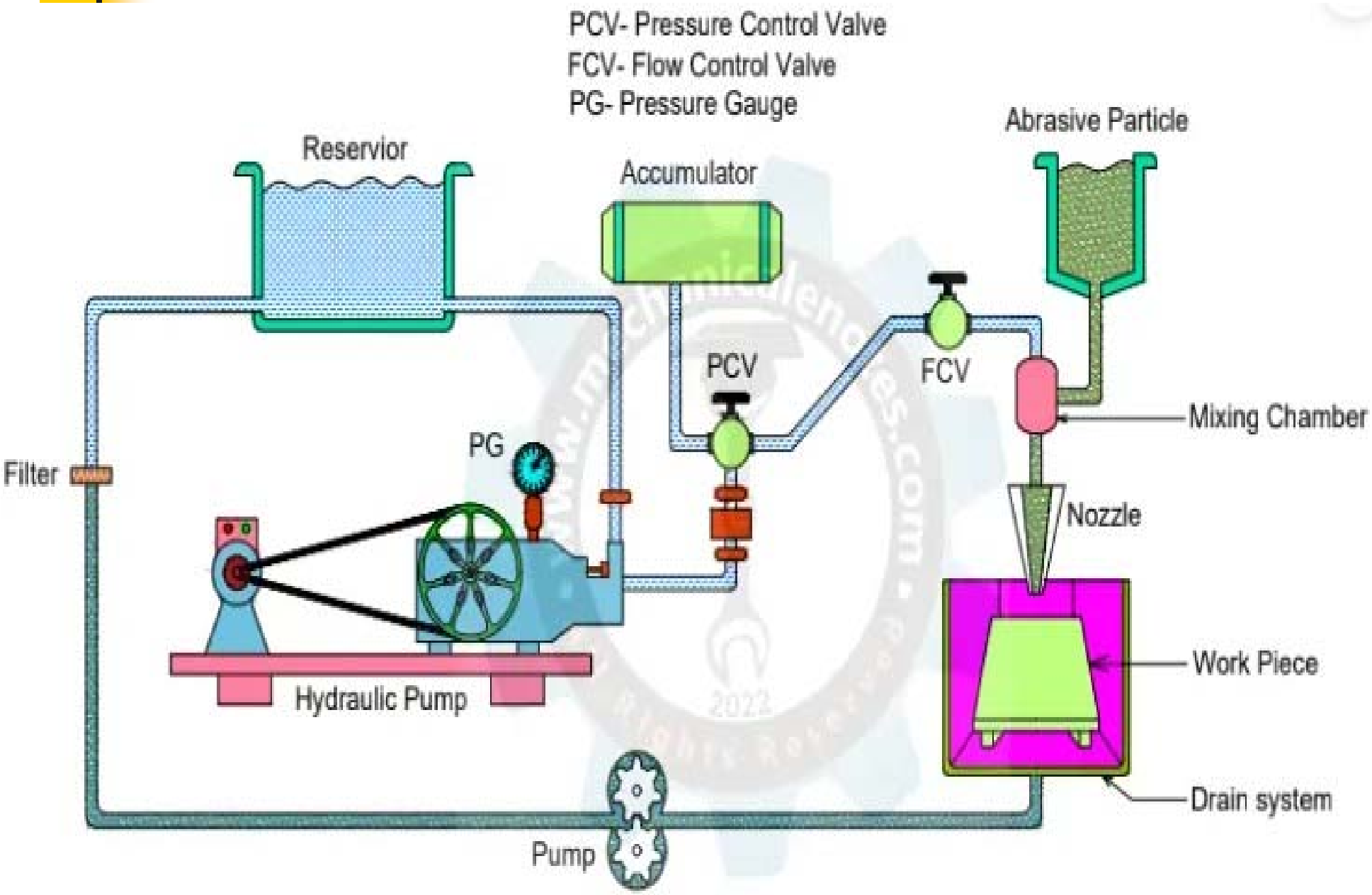
- Introduction
- The machining system
- Process capabilities
- Advantages and Disadvantages
- Applications

Introduction

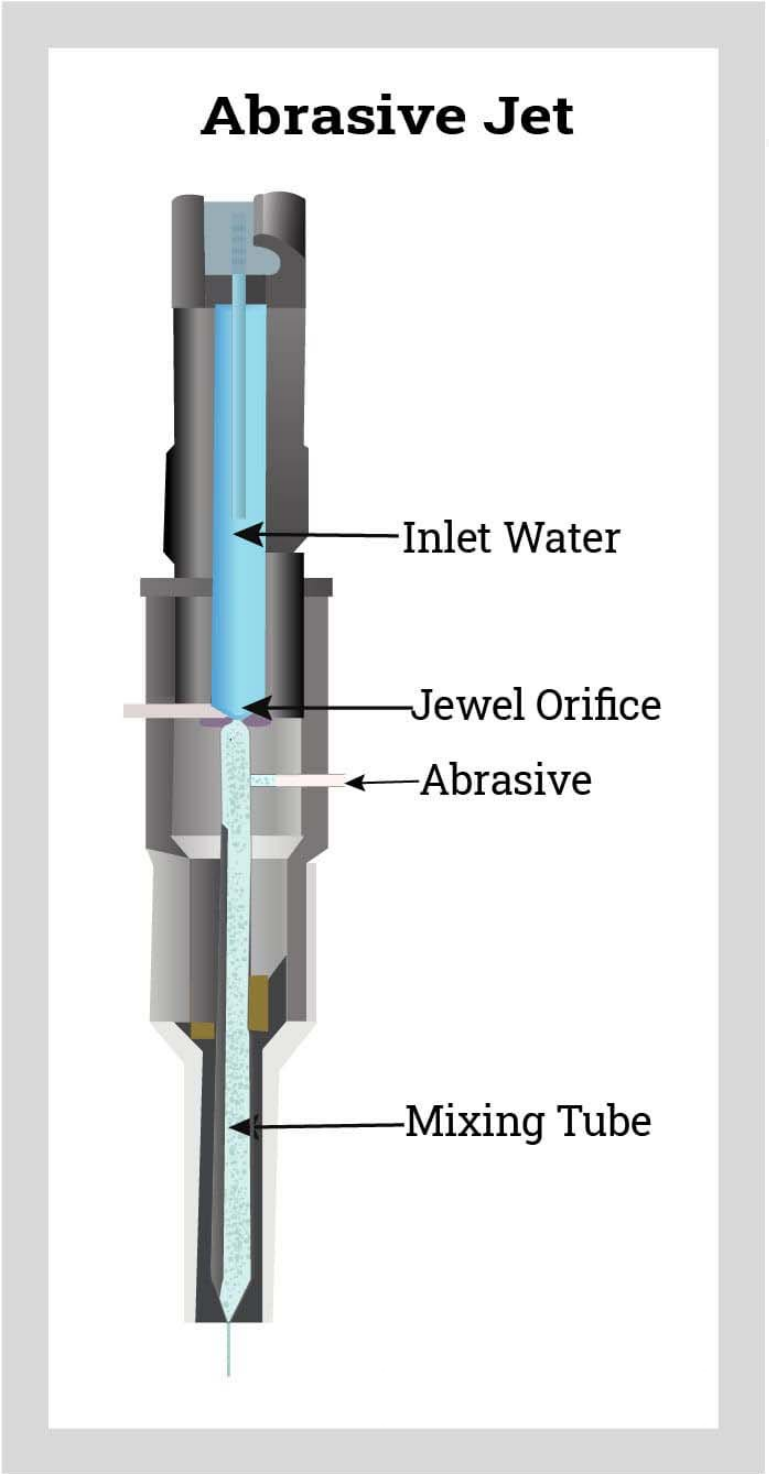
- Abrasive water jet machining is a non traditional or non conventional machining process.
- In these process the mechanical energy of water and abrasive phases are used to achieve material removal or machining.
- It is used to cut and machine hard materials like metals and granite by mixing an abrasive material in the water.
- It is an integration of Abrasive Jet Machining and Water Jet Machining.

The Machining System

- Water Delivery
- Abrasive Hopper and Feeder
- Intensifier
- Filters
- Mixing Chamber
- Cutting Nozzle
- Catcher


PCV- Pressure Control Valve
FCV- Flow Control Valve
PG- Pressure Gauge
Reservior
Accumulator
Abrasive Particle
PCV
FCV
Mixing Chamber
PG
Filter
Nozzle
Hydraulic Pump
Work Piece
Drain system
Pump

Description



Process Capabilities

- AWJM can be thought of as a combination of WJM and AJM principles
- But in terms of capability AWJM combines the best of both processes resulting in a new process that can cut materials whether they are hard or soft at high rates and in very thick sections.
- AWJM can cut materials as thick as 200 mm and still maintain a comparatively narrow kerf.
- Kerf width is a function of the material thickness and usually is between 1.5 and 2.3 mm.
- The resulting taper on the cut edge is a function of the material hardness.
- Where hard materials have the widest kerf at the top of the cut and soft materials have the widest kerf at the bottom of the cut.

Advantages of AWJM

- No heat-affected zone
- No cutter induced distortion
- Eliminates thermal distortion
- Low cutting forces on work pieces
- Localizes structural changes
- No slag or cutting dross
- Limited tooling requirements
- Typical finish 125-250 microns

Disadvantages of AWJM

- High capital cost.
- High noise levels during machining.
- It cannot cut the materials that degrade quickly with moisture.

Applications of AJWM

- It is highly used in the automotive, aerospace, and electronics industries.

- In aerospace industries, parts such as engine components (aluminum, titanium, and heat resistant alloys), aluminum body parts, titanium bodies for military aircraft, etc. are made using abrasive water jet machining process.

QUESTIONS?

END