

Design and Fabrication of Water Jet Machining

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Abstract: The engineering and manufacturing departments are constantly on the look of edge. The water jet machining process provides many unique capabilities and advantages that can prove very effective cost. Learning more about water jet technologies will give us an opportunity to put these cost cutting capabilities to work. The water jet washes away the materials that “ERODES” from the surface of the work piece. The crack caused by the water jet impact is exposed to water jet. The extreme pressure and impact of particles in the following stream cause the small crack to propagate until the material cut. Water Jet Machining (WJM) is the process of material removal from a work piece by the application of a high speed stream of abrasive particles carried in a gas medium from a nozzle. The material removal process is mainly by erosion. The WJM will chiefly be used to cut shapes in hard and brittle materials like glass, ceramics etc. Care has been taken to use less fabricated components rather than directly procuring them, because, the lack of accuracy in fabricated components would lead to a diminished performance of the machine.

Keywords: WJM – Water Jet Machining.

I. INTRODUCTION

Water Jet Machining (WJM) is the removal of material from a work piece by the application of a high speed stream of abrasive particles carried in gas medium from a nozzle. The WJM process differs from conventional sand blasting in that the abrasive is much finer and the process parameters and cutting action are carefully controlled. The process is used chiefly to cut intricate shapes in hard and brittle materials which are sensitive to heat and have a tendency to chip easily. The process is also used for debarring and cleaning operations. WJM is inherently free from chatter and vibration problems. The cutting action is cool because the carrier gas serves as a coolant. Most of the studies argue over the hydrodynamic characteristics of abrasive jets, hence ascertaining the influence of all operational variables on the process effectiveness including abrasive type,

Revised Manuscript Received on 30 May 2017.

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size and concentration, impact speed and angle of impingement. Other papers found new problems concerning carrier gas typologies, nozzle shape, size and wear, jet velocity and pressure, stand - off - distance (SOD), or nozzle - tip - distance (NTD).

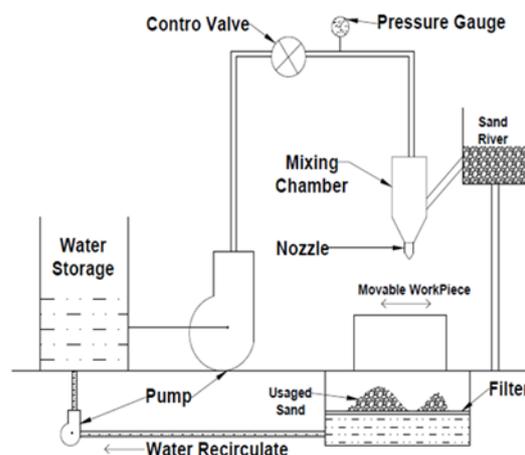
II. COMPONENTS USED

- 1) WATER STORAGE
- 2) PUMP
- 3) CONTROL VALVE
- 4) PRESSURE GAUGE
- 5) MIXING CHAMBER
- 6) NOZZLE

III. EXPERIMENTAL SETUP

Water from the reservoir is pumped to the intensifier using a hydraulic pump. The intensifier increases the pressure of the water to the required level. Usually, the water is pressurized to 200 to 400 MPa. Pressurized water is then sent to the accumulator. The accumulator temporarily stores the pressurized water. Pressurized water then enters the nozzle by passing through the control valve and flow regulator. Control valve controls the direction of water and limits the pressure of water under permissible limits. Flow regulator regulates and controls the flow rate of water. Pressurized water finally enters the nozzle. Here, it expands with a tremendous increase in its kinetic energy. High velocity water jet is produced by the nozzle. When this water jet strikes the work piece, stresses are induced. These stresses are used to remove material from the work piece. The water used in water jet machining may or may not be used with stabilizers. Stabilizers are substances that improve the quality of water jet by preventing its fragmentation

WATER JET MACHINE



IV. CONCLUSION

It appeared after studying the advantages and disadvantages of the water jet, that this is a tool that the construction industry should find very useful. Unfortunately, this does not seem to be the case.

Many of the regional companies do not seem to have any significant knowledge of the water jet, thus remaining unwilling to employ this technology. The responses that we have received have left us with the inability to comment on the cost effectiveness of the water jet in the construction industry. The majority of companies that we contacted do not employ the water jet in their companies, nor do most of them have any knowledge of the abrasive water jet. These companies seem to be conservative to new technology and unwilling to take risks. This may also be due to the fact that many companies are unwilling to invest in a new technology that is not widely used. The contractors that do employ the abrasive water jet technology did not provide us with the percentage of cost benefit to their company.

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