Proposal: Alternative to Shot Blasting – High Pressure Water Deburring

Objective: To find an alternative to shot blasting deburring that can meet the following conditions:

1. Can deburr complex geometry parts (largest part size is 600mm x 600mm x 600mm)
2. Can operate within a 70 second cycle
3. Have feasibility evidence
4. Lower investment of cell cost (approximately 100,000€)
5. Can be integrated as a part of the die-casting injection cell (preferably with a footprint of 3m x 3m)

Potential Alternatives: An alternative to deburring a die-cast aluminum part via shot blasting is using a high pressure water deburring procedure. The main drawback of using shot blasting is the risk of damaging the parts being deburred or imbedding shot in the parts. In contrast, the high pressure water deburring’s mechanical abrasion can be tuned in by: either changing the water pressure being applied to the part or adding additional components such as grit or surfactants to the blasting stream. The fluid nature of the blasting media (water mostly) can be setup so that it removes burrs on external or internal surfaces left by the die casting. Thus a part can be fully abraded on all surfaces.

Process Description: A part or set of parts are put into a water jet blasting chamber and secured into place with a jig. The chamber is closed and either they are pressure blasted by an operator with a high pressure nozzle or an automated system blasts them. In either case, the blasting nozzle should be mobile so that the blasting stream can be moved over the entirety of the part. A high pressure water stream (5,000 PSI to 10,000 PSI) is applied to the parts [1]. Additional media can be added to aid burr removal such as garnet or sand). Afterwards, the parts are taken out of the chamber and cleaned to remove debris or blasting media. The parts are then sent to secondary deburring.

Objective Criteria 1 (Deburring Complex Geometries): Due to the liquid nature of the blasting media, high pressure water can conform to complex contours and reach within cavities of parts. This applies to shapes of differing sizes as well. Furthermore, the ability to have a moving nozzle means that a large part can be covered. If one blasting stream is not enough, a machine can be selected that can fire from multiple sides of the part. These multiple blasting streams can interact creating additional turbulence, causing even more abrasive events to occur.

Objective Criteria 2 (70 Second Operation Cycle): Using blasting media is considered to be one of the fastest forms of deburring parts. By comparison, using deburring tumblers or other vibratory techniques for large parts can take hours. For reference, consider a water jet, which can cut through aluminum and steel on the order of minutes. Comparably, this technique only seeks to remove 0.5 mm thick burrs on parts, so something similar in terms of speed can be expected. At the moment, a precise operating speed is not known; however, an article from manufacturing engineering states that a cycle time can be between 20 to 60 seconds based on blasting pressure, flow rate, and the number of blasting orifices [1].

Objective Criteria 3 (Feasibility Evidence): Besides the example of the waterjet, several companies already offer machines for this procedure. Some companies are listed below with product examples:

1. Bertsche Engineering Corporation ([www.bertsche.com](http://www.bertsche.com))
2. Prececo Limited ([www.prececo.com](http://www.prececo.com))
3. Valiant Corporation ([www.valiantcorp.com](http://www.valiantcorp.com))

Figure 1: An Example of a Bertsche High Pressure Water Deburrer [2]

Figure 2: An Example of a Hammond Roto-Finish High Pressure Water Deburrer [3]
Bertsche notes that the procedure is better suited for softer metals like aluminum and cast iron [4]. However, the process can also be used on harder materials specifically steels used to make gears. Most machines come automated with X, Y, and Z axes control that allow for full part coverage.

**Objective Criteria 4 (Lower Cost of Cell):** The cost of the deburring unit currently is not known; however, an estimation can be made by looking at a comparable piece of technology, a waterjet. Currently, the piece for a large bed (1.5m x 3.0m) waterjet is 76,000€ [5]. Given the enclosed nature of this machine, the price of this machine is expected to be higher, but still within the range of 100,000€ per unit. Most of the cost is accrued in the high pressure water systems, the servos, and the other high end electronics of the unit. Stripping the system of high cost electronics can greatly reduce the buying price and maintenance costs while retaining the core function of the unit. However, if the cost is high, a larger system can be engineered to accommodate the parts from two assembly lines for a potential equivocal cost of 200,000€.

**Objective Criteria 5 (Integrate Unit into Cell Line):** Given that each deburring unit is a separate machine, they should be able to be put into an assembly line. Automating each unit is a function of cost, but is doable if a unit of appropriate cost and capabilities is located. A 3m by 3m footprint is not guaranteed though as the automated units tend to be larger to accommodate all the servos and electronics in addition to loading chambers and pump units.

**References:**

2. [http://www.bertsche.com/products/#prettyPhoto/0/](http://www.bertsche.com/products/#prettyPhoto/0/)
5. [http://www.wardjet.com/wardkit5x10?gclid=CjwKEAiAx--2BRDO6q2T84_a52YSJABWAbfr1ze_UdUJHpxiVgWmzU6s9UtyW0CBhpRoGWYAhnZeexoCsdbwwcB](http://www.wardjet.com/wardkit5x10?gclid=CjwKEAiAx--2BRDO6q2T84_a52YSJABWAbfr1ze_UdUJHpxiVgWmzU6s9UtyW0CBhpRoGWYAhnZeexoCsdbwwcB)