

BREAKING THE MOULDS...

The article highlights the technology behind robotic deflashing and how it may be successfully deployed across the aluminium die casting industry, with references from the industry serving as guides of do's and don'ts for good executions

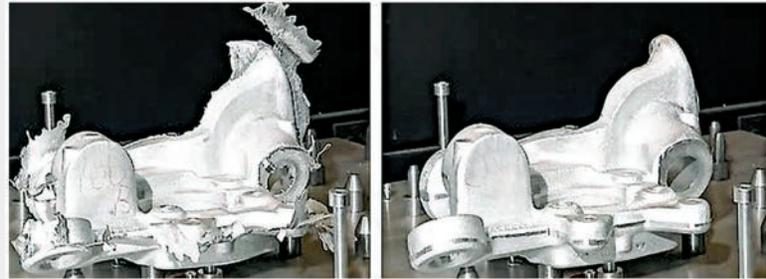


Sameer Kelkar
Executive Director
Grind Master Machines
sales@grindmaster.co.in

Manufacturing industry is undergoing a revolution in productivity, quality and EHS. The foundry sector in general and aluminium die casting industry in particular, have been slower than other manufacturing sectors to adopt automation and robotics as a way forward. Deflashing is a particularly dirty application requiring lots of manual labour working in unsafe unhealthy conditions. A revolution is coming in this sector, with the advent of robotic deflashing for aluminium die castings.

Robotic deflashing

Robotic automation has come a long way in the past 20-30 years. Robots have become the workhorse for manufacturing setups in applications such as welding and machine handling in automotive industries. Applications of industrial robots in foundry and aluminium casting industries include pouring, extraction and handling. Deflashing is a process in aluminium casting industry which is almost entirely manual and labour



Typical components before and after deflashing

intensive. It consists of removal of all extra material in the casting after the trimming operation.

Automation of this process brings several key benefits to the manufacturers of castings – namely increase in productivity (2-3 folds), dramatic upgradation in quality and entirely healthy and safe working atmosphere.

Deflashing has been difficult to automate and prove, as demonstrated by numerous failures visible in the market in form of systems lying idle or underutilised. System and application engineering for deflashing requires domain knowledge and expertise in deburring processes. In aluminium castings shops, typical process sequences are followed for pressure die castings and gravity die castings. Deflashing is the last process in most casting shops. Subsequently the workpiece is sent for machining to machine shop. Manual deflashing of aluminium castings is done by operators using a variety of tools, including belt grinders, files, pneumatic deburring tools, chisels and hammers.

Challenges in automation of deflashing

Complex shapes: Aluminium castings have some of the most complex shapes in manufactured parts, with holes, recesses, inaccessible areas and corners. Further, most aluminium castings are used in automotive industry, where product lifecycles have been becoming shorter and shorter over the years. This necessitates changes in the design of components, and automation must be ready for the same.

Hazardous conditions: Temperature, fumes, dust are tough conditions for man and machine alike. With the advent of rugged foundry grade industrial robots that can withstand the

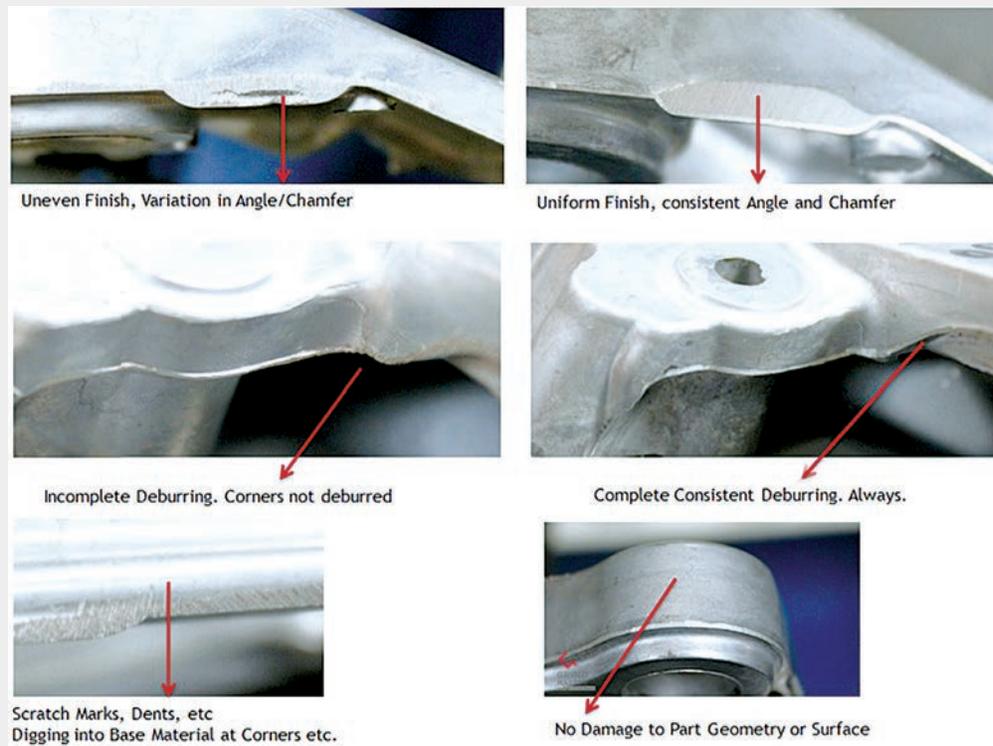
conditions in die castings shops automation is possible. Machine selection must carefully consider the conditions specific to the deployment area to ensure reliability over a long period.

Consistency required: Many aluminium cast parts are visible class A parts in automobiles, scooters and motorcycles. Inconsistency in deflashing leaves marks, scratches, dents, etc on visible surfaces. There is a very high consistency requirement for such parts.

High production volumes: Most aluminium die casting components are made in volumes of more than 2000-3000 parts/day, especially ones catering to the two-wheeler industry. Any automation system must be scalable, fast producing and extremely reliable to cater to this requirement.

Component variations: Deflashing operation is done on 'as cast' parts, which have part to part variations inherent to the casting process. These variations pose challenges in deflashing automation – starting from location and fixturing, to uniformity of pressure application during deflashing, to making adjustments for part variations.

Tool selection: Robotic deflashing systems deploy a combination of tools for completing the requirements. A knowledgeable system integrator is able to choose wisely the tools to be used for a specific job requirement. Tool selection is critical because process reliability, cycle time and running cost of the system are majorly based on the type of tools used. In certain cases, it is observed that selecting an 'optimal' tool can reduce cycle time and running costs by as much as 90%. The most commonly used tools in robotic deflashing include flexible pneumatic deburring tool and flexible belt grinding tool.



Comparison between manual (L) and robotic (R) deflashing

Quality improvements: Robotic deflashing gives tremendous improvements in the consistency and completeness of deflashing. Manual operations are subject to numerous variations through the days, weeks and months of the year. Also two operators are never working in exactly the same style. Component handling with a robot is much nicer and leaves no marks/dents/damages.

Cell configurations: Robotic deflashing systems can range from simple single robot deflashing machines to multiple robot high volume manufacturing systems. The basic modular element is a robotic deflashing machine with one robot deflashing a component loaded on a fixture. Such a setup operates just like any other machine. An operator loads/unloads the component manually, and the robot completes the deflashing operation in an automatic cycle. Different parts can be processed in the same machine by changing the fixture and selecting the part program. Such machines give cycle times between 20-60 secs for components upto 500 mm in size, typical components include 'back rest' of two-wheelers and alloy wheel rims.

For high volume manufacturing requirements of more than 4-5 parts/minute, 2 or more deflashing machines may be combined using automation (typically another robot) for handling. For several PDC parts, instead of having standalone machines, it makes more sense to integrate

deflashing operation as a one piece flow from the casting machine. In such cases, robotic deflashing cells include robots performing multiple operations such as extraction, checking/testing, quenching, handling in trimming press and deflashing. The advantage of such a setup is that the entire die casting line is automated, and one piece flow is reliably ensured. Selection of the correct configuration is critical for operational and economical success of the system.

Cost of operations and feasibility: Robotic automation systems have various costs associated with them which have to be considered in calculating cost per piece over the long run such as maintenance costs (annual maintenance, spares, etc), energy costs, air costs (most automation systems use pneumatics for gripping and deburring tools), consumables costs (use of customised tools for robotic application can save significantly this cost), retooling, reprogramming costs and labour costs (including future rise in the same).

Significant improvements in quality must be considered while calculating the investment returns of a robotic deflashing system. A drastic reduction in rejection rate, and removal of rework/checking stations required also brings about space savings. Correct selection of application and wise implementation can ensure a return on investment of robotic deflashing systems within 2 years.

Key steps for deploying robotic deflashing

Most aluminium casters have a large number of manual operators for deflashing operation. In order to successfully implement robotic automation across the manufacturing setup, following key steps must be considered:

- Long term commitment to deploy automation—Deflashing automation will go through learning, implementation, horizontal deployment phases and management must have long term commitment to do this.
- Reliable partner for deflashing—Deburring and grinding process know-how are key ingredients of any success in robotic deflashing. Robotic deflashing is more like a 'machine tool' than an 'automation system.' Choose a competent machinery maker with this expertise as your partner for robotic deflashing.
- Selection of first applications—Pluck the low hanging

fruits first. Your partner will help you identify the components which will give fastest economical return and impact. Successful implementation of the first application is a key for confidence in the team about robotic deflashing.

Summary

Robotic deflashing is a revolutionary technology in aluminium casting industry. It leads to key benefits such as consistency in quality, high productivity and health and safety on shopfloor. Aluminium casters can deploy this technology in foundry by taking certain precautions to ensure success. In the near future, robotic deflashing is likely to sweep the Indian aluminium casting industry setting new benchmark for shopfloor practices and methodologies, especially for deburring and deflashing. □