Robotic Aluminum Casting Deflashing

Transforming Foundries and Human Lives

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About Grind Master Robotic Automation Group

Grind Master introduced Automation Division in 2011. Backed with over 35 years of experience in Machine Building, the Automation division develops sophisticated solutions with Robots, Gantries and other manipulators.

Key Strengths of Grind Master Automation

- Dedicated Automation Team led by Sameer Kelkar
- Domain Knowledge in Grinding, Polishing, Deburring
- Robot Application Tech Center
- Robustness and reliability of a machine tool builder
Grind Master Automation Team

Dedicated Team of:

- Strong Leadership by Sameer Kelkar
- Engineering And Design - including Simulation
- Assembly, Interfacing
- Robot Application Experts with KUKA, Fanuc, ABB robots
- Process Support Team with wide Experience in metal finishing
- Service, Spares and Consumables Support
Domain Knowledge : Grinding Polishing Deburring

- Vast Experience of Over 5000 Metal Finishing Machines in Operation Worldwide
- Selection of Correct Type of Tools Ensuring Optimized Process Cost
- Total Solution from Machine - Process Know-how- Consumables
Robot Application Tech Center
Process Research for Robotic Automation

- Dedicated Process Research Team
- Tech Center Equipped with Demo Robot and Various Metal Finishing / Deburring and Grinding Equipment
- Conducting Trials for Over 150 Applications a year
Robotic Automation
From a Machine Builder ...

- Robotic Automation built with Passion for Machine Building
- Performance and Reliability
- International Build Standards
- Deep Understanding of TPM, Ergonomics, Cost Per Piece, Peripheral Systems
- Strong Manufacturing Base with Quality Parts
- Rigorous Internal Inspection System at 3 levels - Part Level, Sub-assembly, Machine
Achievements

• Technology Leaders in Robotic Automation in difficult to automate applications in grinding, polishing, deburring.

• Completed 100 Robot Integrations successfully

• Breakthrough Technologies in field of:
  
  Robotic Grinding of Forgings

  Robotic Deflashing of Aluminum Castings

  Robotic Fettling of Iron Castings

  Robotic Machining Systems

• Technology Development: 2 Registered Designs in Machining and Deflashing technologies
Robotic Aluminum Die Casting Deflashing

Deflashing Process PDC

Deflashing Operations:
- Removing Parting Line Flash
- Removing Flash inside cavities, holes
- Grinding of Riser and Gate Left-overs
Robotic Aluminum Die Casting Deflashing

Deflashing Process GDC

Deflashing Operations:
• Removing Parting Line Flash
• Removing Flash inside cavities, holes
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AluCast Foundry
Solution Selection

Basic Guidelines
• Larger the Component – Faster the ROI
• Select High Volume Parts for Faster ROI

Deflashing
• For Large Components - RMT series machines - replace 2 operators - good ROI (2 years). Ref: Rockman, Mahavir, RICO
• For Small Components - RCP series machines - replace 1 operator - poor ROI (5 years). Ref: Sigma

Add on Activities with Deflashing
• PDC Automatic Extraction Complete Solution good for medium volume (1000/day) components. For lower volumes solutions get expensive due to gripper changer etc.

Gate Cutting/Riser Cutting Machines:
• Universal machine for variety of components with quick setup change (Fixture change) - applicable only for complex components. Competes with Band saw type manual Cutting and some SPMs for Gate Cutting
Aluminum Casting Deflashing

RCP/RMT Series
Robotic Aluminum Die Casting Deflashing Machine

Model : RMT Series - for Large Components
With Tool in Robot
Robotic Aluminum Die Casting Deflashing Machine

Model: RMT Series - Features

Flexible Deburring Tool

Raw Job Loaded Outside machine

Masked Loading/Unloading with Pallet Exchanger

Total Machine Enclosure
Safe and Healthy Work Environment

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Robotic Aluminum Die Casting Deflashing Machine

Model : RCP Series - Machine or Cell Concept with Part in Robot
Robotic Aluminum Die Casting Deflashing Machine

Grinding Processes

Riser and Gate Leftovers Removal. Correct tooling with Belt Grinder for Access

Deburring Processes

Parting Line Removal
Robotic Aluminum Die Casting Deflashing Machine

Model: RCP Series - Tools

Flexible Deburring Tool

Axially Compliant Spindle
For Removing Heavy Flash on face
(not to be used for light flash)

Rugged Belt Grinding System

Solid Milling Cutter to remove heavy flash on periphery (saving time for Flexible tool) (not to be used for finishing)
Robotic Aluminum Die Casting Deflashing Machine

Model: RCP Series - Grippers

Strong Well Designed Grippers with Core Technology Partner Schunk
Critical Factors - Gripping Force, Location, Sensing, Poka Yoke

Options: Automatic Gripper Change
For Multiple Variants in same setup with auto setup change -
Note: Fixtures and other parts may need to be changed

Gripper Stand with Grippers

Robot Side Flange
Robotic Aluminum Die Casting Deflashing Machine

Model: RCP Series - Features

- Full Metal Enclosure
- Wiremesh Fencing
- Automatic Load/Unload - Pallet Exchanger
- Load/Unload on Fixtures
Allied Applications
Operations

Possibilities with Casting Machine
Integrated Robotic Systems
Extraction from PDC

PDC Machine Extraction

• PDC machine must be modern PLC controlled machine with Fully Automatic mode including own system for Aluminum Shot filling and spraying as required.
• Die Design must allow for Auto Extraction. Any modifications required to Die in customer scope
• Robot Grips the Component on Biscuit (cannot hold on component area as it is hot and can distort)
• Requires robot with long reach - more than 2.5m (hence big robot used)
• Requires Foundry Grade Robot - Sealed Wrist

Equipment Includes: Gripper for extraction - Carefully designed to reach into the PDC machine
Sensing

Sensing Station

- To Check Whether Complete Casting is Extracted
- Sensing Fixture designed as per component. Includes required Sensors etc.
- Time Consumed : 3-4 sec

Subsequent Operation :
If Component is OK proceed to next operation, otherwise drop component in Chute

Equipment Includes : Sensing Station, Sensing Fixture
Quenching

Quenching Tank

- With Coolant to quench hot part
- Time Consumed: 5-6 secs

- Quenching Tank to be supplied by customer. Needs to have Sensors for Level etc.
- Robot holds the component by the Biscuit while dipping it in. The Biscuit portion remains about the tank level.
- After Quenching, Rotate.Tilt component to ensure most water is back into the tank
- Note: Cell with Quenching tank can never be Dry floor. Some water will always be on part and spill out. Dryer etc is usually not affordable.
Overflow Breaking

To be Avoided as far as possible.

Much better done with control in Trimming Press.

Overflow Breaking Station

- Hit Overflow on a Sturdy Fabric
- Critical to Check the overflow to break material
- Check if overflow is sufficiently weak in structure to be broken like this.
- Time Consumed: 3-4 sec
  For each overflow

Equipment Includes:
- Overflow Breaking Fabricated Items
- Chute/Trolley for collecting wastage material

This type of overflow can be broken
Pick/Drop from Trimming Press

Trimming Press
- Can Clean major material from the part in one shot.
- To be supplied by customers along with Fixture/Die for Press (not to take this part in GM scope)
- Access to/from the Trimming press must be clean.
- Typically the Robot loading the press holds part by the biscuit, whereas the unloading robot holds on base material.
- Fully Automatic with waste material ejection etc.

Equipment Includes:
Gripper for Loading: Usually same as Extraction Robot Gripper
Gripper for Unloading: Usually different dependent on Final job shape.
Gate and Riser Cutting

Cutting Station
• For Slicing Risers and Gates upto 50mm in thickness
• Used if components is complex and strong such as “Overflow Breaking” or “Trimming” cannot be used for rough cleaning.

Equipment Includes:
Cutting Spindle
Trolley for Waste Material
Very very Strong Gripper

Typical consumables:
SAW MAKE: KYK MAKE TCT BLADE
OD305 MM X 100TEETH X ID 38 MM.
FEED SPEED: 20 MM/SEC
RPM: 3000 RPM
THICKNESS OF RISER
CUT: 15 TO 25 MM.
DISTANCE FROM BASE
MATERIAL: 0.5MM-1.5 MM.
Dedicated Machine for Gate and Riser Cutting
RMT Series

Robotic Gate Cutting Machine
• For Slicing Risers and Gates upto 50mm in thickness
• Used as Universal Machine for Large Variety of Components (maybe 6-7 variants)
  *complex parts where Trimming is not possible
  *too many variants to make Auto Gripper change etc

Equipment Includes:
Inline Cutting Spindle
Trolley for Waste Material
Strong Fixturing
Usually Preferred to be completely closed as chips can fly

Remember - Waste material must fall down
Output Results Example
Drilling Holes

Drilling Station
• To Clean Holes or drill Holes to medium Accuracy (within 1 mm Absolute Accuracy) - eg mounting holes for cover type parts
• Typical Cycle Times : 4-8 sec per hole

Equipment Includes : Drilling Spindle
Allied Applications
Case Studies
Casting Machine Integrated Systems
Case Study: Robotic Deflashing of Engine Case

Robot#1: Extraction from PDC Machine Sensing Station
Overflow Breaking
Drilling Holes
Drop on Trimming Press

Robot#2: Pick up from Trimming Press Deflashing

Typical Cycle times: 60-120 sec.
PDC Deflashing Line
Robotic Deflashing Cell After Extraction

Case Study: Robotic Deflashing of Crank Case

Load: On Fixtures
Unload: From Fixtures

Complete Cleaning Operations:
1. Gate Cutting
2. Belt Grinding
3. Deflashing - Axial Compliant Tool
4. Deflashing - Radial Compliant Tool

Typical Cycle times: 60-120 sec.
PDC Deflashing Line
Robotic Deflashing Cell After Extraction

Case Study: Robotic Deflashing of M Case

Load: On Fixtures
Unload: From Fixtures

Complete Deflashing Operations:
1. Deflashing - Axial Compliant Tool
2. Deflashing - Radial Compliant Tool

Typical Cycle times: 60-120 sec.
PDC Deflashing Line
Robotic Deflashing Cell After Extraction

Case Study: Robotic Deflashing of Cylinder Block

Automatic Loading/Unloading

Deflashing Operations
1. Gate Cutting
2. Deflashing - Axial Compliant Tool
3. Deflashing - Radial Compliant Tool

Component Weight: 15 Kgs
Typical Cycle times: 80-90 sec.
Robotic Pouring for Al - Gravity Die Casting

Robotic Cell for GDC Ladling
- Management of 2 Furnaces and 4 Dies
- Improvement in Cell Productivity of 30%
- Eliminate Hazardous Working Environment
- Reduce Rejection by 300%

Note: GDC machine suppliers also provide Pouring Integrated Cells. Such solutions are more efficient.
Key Benefits of Robotic Aluminum Die-Casting Deflashing

- Eliminates Health Hazards of Manually Deflash Castings -

<table>
<thead>
<tr>
<th>Hazard</th>
<th>Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Noise</td>
<td>Hand Grinders - 98-100DB Permanent Hearing Impairment</td>
</tr>
<tr>
<td>Air Quality</td>
<td>Lung disorders from Fine Aluminum Dust</td>
</tr>
<tr>
<td>Vibrations</td>
<td>Continuous Exposure to Vibrations causes Nerve Damage</td>
</tr>
</tbody>
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- Consistent Quality of Deflashing

- Eliminates Manpower -
  1 Robot = 2-3 Manpower per shift

- Compliance with Global Manufacturing Practices
Why Invest in Robotic Aluminum Die Casting Deflashing ????

• ROI Works out to be 4-5 years. Why Invest ????

→ High Value Parts - Aesthetic or Export : Consistency and Finish Results Important

→ Automation is a process - START NOW to be competitive in FUTURE
Robotic Machines for Cast Iron Foundry

Model - RCF Series

Turnkey Solutions for
• Grey Cast Iron
• Nodular / Ductile Iron
• Steel
• Bronze / Zinc / Copper

Features
• Adaptive Grinding
• Automatic Path Correction
• Automatic Tool Changer
• Industry 4.0 Enabled
Reference List in Robotic Deflashing Systems
Thank you

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