

Industrial Robots for Continuous-Casting Tasks



How Manufacturers Use Robots for Continuous -Casting Tasks

Manufacturers use robots for continuous casting tasks to improve efficiency, accuracy, safety, and product quality. Continuous casting, also known as strand casting, is a process in which molten metal is solidified into semi-finished billets, blooms, or slabs for subsequent rolling in the finishing mills. Robots help automate critical steps of this process, such as Mold handling, monitoring, cutting, and transportation. Here's how manufacturers use robots in various stages of continuous casting:

Ladle Handling and Molten Metal Transfer

- **Automated Ladle Handling:** Robots or automated systems handle the movement of large ladles filled with molten metal from the furnace to the continuous casting machine. This ensures precision in positioning and reduces the risk of human error.
- **Molten Metal Pouring:** Robots control the flow of molten metal into the tundish (a vessel that feeds the casting Mold), ensuring that the metal flows at a consistent rate, which is critical for maintaining product quality and consistency.

Mold and Tundish Operations

- **Tundish Maintenance:** Robots are used to clean and maintain the tundish between heats, ensuring that it remains free of debris and operates efficiently.
- **Mold Monitoring and Adjustment:** Robots equipped with sensors monitor the temperature and condition of the Mold. They can also make real-time adjustments to Mold oscillation or cooling to optimize the solidification process and prevent defects such as cracks or inclusions.

Casting Process Control

- **Pour Rate and Level Monitoring:** Robots help monitor and regulate the flow of molten metal from the tundish into the Mold, ensuring consistent filling and preventing overflows or underflows.
- **Temperature Monitoring:** Robots equipped with infrared sensors or thermal cameras continuously monitor the temperature of the molten metal and the cooling water in the Molds to ensure uniform solidification and prevent defects.

Cutting and Shearing

- **Automated Cutting:**
 - After the molten metal has solidified into slabs, billets, or blooms, robots control the cutting torches (oxy-fuel or plasma) or mechanical shears to cut the continuous cast strand to the desired lengths.
 - Precision Cutting: Robotic cutting systems ensure precise cuts, improving the quality of the final product and reducing the need for rework or manual corrections.

Billet, Bloom, or Slab Extraction and Transport

- **Automated Part Removal:** Robots are used to remove the solidified billets, blooms, or slabs from the casting machine, transporting them to cooling areas or the next stage of production.
- **Transport and Logistics:** Automated Guided Vehicles (AGVs) or conveyor systems controlled by robots transport the cast products to storage or rolling mills. This improves efficiency and reduces the need for manual handling of heavy and hot metal products.

The Types of Robots Used for Continuous -Casting Applications

The types of robots used for continuous casting applications are selected based on their capabilities to handle high temperatures, precision, heavy loads, and hazardous environments. These robots automate various tasks such as metal pouring, cutting, mold handling, and inspection. Here are the main types of robots commonly used in continuous casting applications:

- Articulated robots
- Mobile robots (AGVs / AMRs)
- Vision-Integrated robots

Articulated Robots

- **Description:** These robots have multiple joints (typically 6-axis), allowing for a wide range of motion and flexibility, like a human arm.
- **Applications:**
 - **Ladle Handling:** Articulated robots handle the ladle and control the pouring of molten metal into the tundish or Mold.
 - **Cutting and Shearing:** They are used to operate cutting tools (plasma, oxyfuel) to cut cast strands into billets or slabs.
 - **Part Removal:** Used to extract heavy and hot billets, slabs, or blooms from the casting machine.

Mobile Robots (AGVs/AMRs)

- **Description:** Automated Guided Vehicles (AGVs) and Autonomous Mobile Robots (AMRs) are mobile robots that transport materials across a facility. AGVs follow pre-set paths, while AMRs navigate autonomously using sensors and mapping software.
- **Applications:**
 - **Material Transport:** These robots are used to transport molten metal, raw materials, or finished billets and slabs between different stages of production.
 - **Mold and Part Delivery:** AGVs or AMRs handle logistics, delivering Molds and finished parts within the plant.

Vision-Integrated Robots

- **Description:** Robots equipped with vision systems that use cameras and sensors to perform tasks requiring visual feedback.
- **Applications:**
 - **Automated Inspection:** These robots inspect cast billets or slabs for surface defects like cracks, inclusions, or dimensional inaccuracies.
 - **Dimensional Control:** They can measure cast products with laser or vision systems to ensure they meet specifications.

Technical Specifications of Continuous Casting in Metal Industries

Specification	Details
Process Type	Continuous Casting
Materials Used	Steel, Aluminum, Copper, Alloys
Casting Method	Semi-Solid Casting
Casting Speed	Up to 20 m/min
Mold Type	Water-Cooled Copper Molds
Thickness Range	100 mm to 300 mm
Width Range	500 mm to 2000 mm
Casting Temperature	1450°C to 1600°C
Cooling Method	Water or Air Cooling
Control System	Automated PLC Control
Power Consumption	Variable, typically 200-500 kW
Production Capacity	Up to 200 tons/day
Surface Finish	Good, usually requires minimal finishing
Common Applications	Automotive, Construction, Machinery
Quality Control	Real-time monitoring and inspection