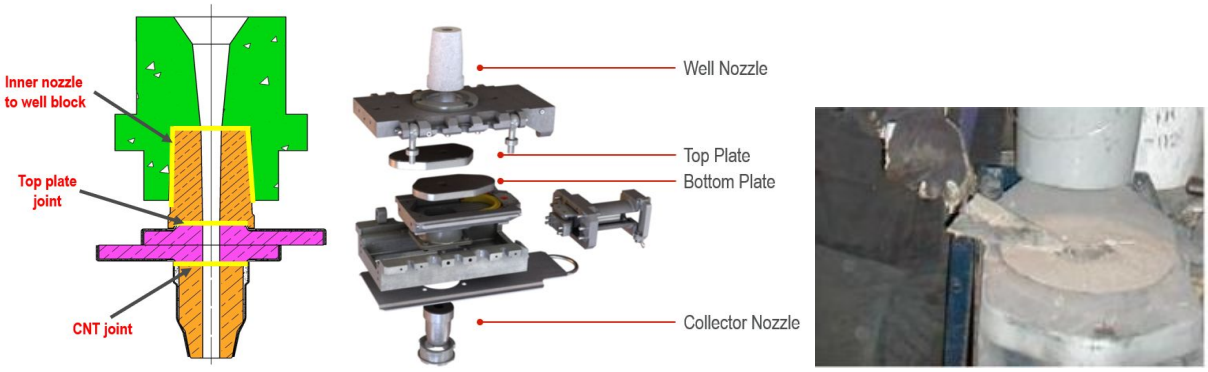
1 Problem statement

Steel producers around the world are more and more looking for automation solutions for high-exposure operations performed on daily basis. Amongst all the development opportunities generated by this shift in the industry, Vesuvius is currently looking for solutions to fully automate preparation of one of our core designs: a proportional valve for molten steel. This equipment is commonly used in steel plants to control flow of steel while transferring the molten metal from one container to another, cast and manufacture final products (beams for construction sector, slabs for naval industry, ...) Preparation and maintenance of those valves are critical, dangerous and labour-intensive operations.

Vesuvius is working on robot-based solutions to automate regular maintenance and replacement of consumable pieces inside the ladle gate during its operation cycle.

Replacement of the refractory pieces (listed below) includes manual setting of mortar to ensure a good tightness between each of the components. This operation is critical, as a bad sealing results in a major incident (molten steel leakage through the valve).



There is no automatic solution for dispense and control of mortar layer available on the market.

2 Objective

The aim is to design and automate a mortar setting machine for refractory components before installation inside the ladle gate. Mortar layer should be controlled through a dedicated inspection system, as it is a safety-critical operation.

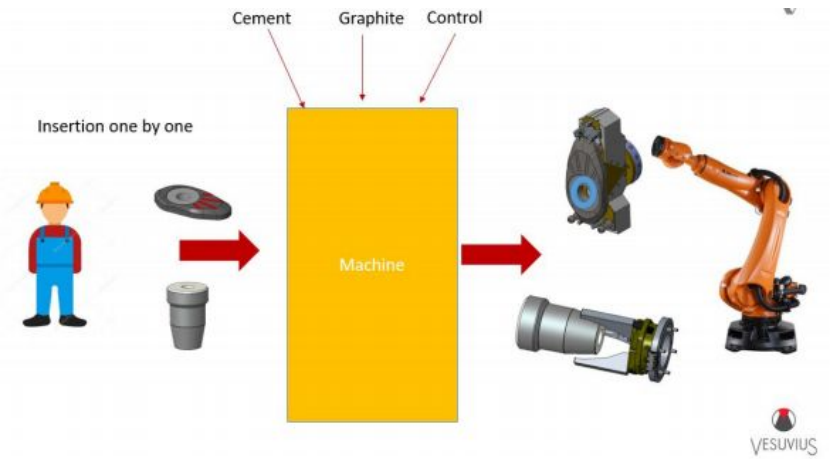
A broader objective will be to analyse commercial viability of the robotization of ladle gate maintenance are through key indicators.

3 Preliminary specification

The machine should be a “standalone system” positioned at robot work cell periphery, and able to drop off a refractory piece cemented as per specification, at a specific location where it can be grabbed by the robot. For process safety, the machine must include a control unit of mortar application. The system must be able to:

1. Ideally grab the refractory from an internal storage magazine (could be a single manual position as well)
2. Apply a mortar on refractory
3. Apply a graphite layer (when applicable)
4. Control the quality of application: thickness shape, colour (graphite applied or not)
5. Deliver the refractory to a robot grabbing position

Priority will be put on applying join on refractory plates versus collector nozzle.



Interface with robot tools should be considered in the study.

4 Deliverables

1. Technical proposal

Technical analysis and solution proposal for plates and collector nozzle mortar setting. Including inspection system.

2. Commercial analysis

The economical contribution will include an analysis of the steel market around the world: business model, world distribution, type of company, industrial culture, environmental, production and safety regulations, future trends, … This analysis will be used to assess the economical viability of ladle maintenance robotization and possibly derive a marketing approach.