New billet casting line under control

Anker-Cast of Ontario, Canada completed the installation of its most recent billet casting equipment for Hydro Aluminium Henderson in Kentucky, USA. The casting process was a joint installation between Hycast and Anker-Cast. The Anker-Cast equipment controls the casting process to very tight tolerances imposed by Norsk Hydro.

Initial requirements for the casting equipment examined the robustness of the equipment and service life capabilities. Hydro Aluminium Henderson relied on Anker-Cast's experience in casting technology to provide input in building the most modern casting facility known. The plant will produce 90,000 t/yr of high quality billet. The plant goal is to contribute to the recycling effort in the USA and reduce power consumption to 10% of the energy consumed in typical casting plants. Anker-Cast's partnership with Hydro Aluminium Henderson will result in the latest technological advances in the industry to convert scrap into premium grade product. The control system specifically designed for the application will guarantee tight tolerance, accuracy and flexibility for expansion and modifications in the future.

To facilitate unloading and rapid preparation for the next cast a tilt carriage arrangement was selected. The stainless steel carriage design is fabricated to provide no flexing or plastic deformation over a span of 3556 mm from the center of the pivot point to rigidly support the mould tooling. The frame incorporates eight heavy-duty halogen lights to illuminate the billets during casting as well as cooling water delivery to the moulds. The cooling water delivery to the tooling is controlled in an adjacent pit by a magnetic flow meter and control valve assembly. The cooling water travels through large rotary joints at the pivot point of the tilt carriage.

ADDED FEATURES

An added feature to improve safety is a service platform, to be used for stripping the pit and protecting personnel while servicing the moulds and maintaining equipment. At first glance when entering the plant with the tilt carriage in the open position, one is led to wonder about the pit. The casting pit is at floor level. With the platform in the closed position there is free access around the entire casting area with no concern for an open pit. The service platform is propelled by means of a hydraulic cylinder and guided on steel keyed rails. The operator has complete control over movement as they stand on the platform. A control stand connected to the PLC is mounted on the platform that will determine the position of the associated equipment and the billets and prevent accidental damage to equipment. The service platform is a feature that addresses that ongoing concern for safety around the pit and improves the ability to safely and quickly strip the pit and turn it around for the next cast.

SURFACE QUALITY

Billet surface quality is dependent on many factors, one of which is the casting cylinder movement. Achieving a smooth, steady descent is dependent on numerous considerations, all of which are controllable from the design phase of the project. There were no compromises made at Hydro Aluminium Henderson. The ram provides extremely low horizontal movement at full extension of 8500 mm. Deflection is only one of the considerations when designing the cylinder. The deflection is directly proportional to the ram diameter and its wall thickness. Tight tolerances and advanced seal and bearing design are the key to success. The casting cylinder installed at Hydro Aluminium Henderson in Kentucky allows sufficient gap for free movement without drag, while keeping the horizontal movement to a minimum. The drag is often what creates the jerky vibration in casting cylinders. This drag can also be caused by seal design. The casting cylinder at Hydro Aluminium Henderson has a floating low friction seal that has the lowest drag coefficient offered. This casting cylinder was vibration-free on its maiden descent.

STRINGENT REQUIREMENTS

The casting cylinder is coupled with a hydraulic control valve designed for the stringent casting requirements. The pressure compensated valve, equipped with a servo controller and zero backlash actuator works in conjunction with the mass flow meter and PLC to provide high-resolution speed control. Filtering the signal is essential to smooth transition.

The control system uses an Allen Bradley PLC with a Wonderware HMI providing the operator complete control over every functon of the process. Anker-Cast's Auto-Cast Control System was modified to suit the requirements of Hydro Aluminium Henderson in the joint casting process. The main overview screen provides animated details of the process. This includes an overview of the casting machine and process parameters.

PLC troubleshooting can be a difficult task. To simplify user interface, an overview screen of the PLC is shown as a graphic image. The status lights and I/O lights on this graphic image will turn on and off, to reflect the actual operation of the PLC. Other useful diagnostic information such as data communication information, analog signal levels and last scan time will also be displayed simply by clicking on the analog card.

All analog and digital inputs and outputs (I/O) are filtered, this way the code for the PLC does not address actual I/O but rather its filtered internal data. Bits and analog signals are separated into unique rungs. This has a number of advantages. Any rewiring of the I/O will not result in having to go through the code and change it. Filtering of the input will not have to be reflected throughout

the code. The actual code will be modular and can be applied in all similar situations in the same way with changes only to the I/O sections. All high level emergency interlocks go into the output section to be part of the filtering. All race situations or ambiguous internal logic will be sorted out in the output section so that the safest output will occur.

Input filtering will be done in a fashion that will allow the main code to run properly and not operate unless all the conditions are correct. For example, the code filters the cylinder advance limit switch using a timer for de-bounce or dwell. It then checks that the solenoid that actuates it is on and that there are no ambiguous conditions before accepting that the cylinder has advanced. This prevents erratic behavior due to bouncing inputs or stuck limit switches. This prevents the software from responding to false data.

SAFETY FEATURES

To improve casting safety Anker-Cast designed a smart computer system with fault annunciation. A fault condition could be just a bit, a combination of bits or even a comparison of numeric values. The flag fault will come on and will be sealed in. The operator must clear the fault flag, but it will only reset if the actual fault condition has cleared.

Anker-Cast manufactures non-ferrous casting facilities and automation packages for customers worldwide. The system provided Hydro Aluminum Henderson in Kentucky one of the most sophisticated and advanced systems in the D.C. Casting industry. The Auto-Cast Control System is a flexible and adjustable automation package that could be implemented in any new or existing non-ferrous casting facility within a minimal amount of down time.