ИТЕЙНОЕ
ПРОИЗВОДСТВО

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PATTERN RECOGNITION SYSTEM

The RFI tag itself is approximately 32 mm long, 5 mm diameter and can be positioned anywhere in the pattern impression or box frame. Situated close to the mixer is the read wire antenna, which will read the RFI tag as soon as it enters the signal radius.

Once the antenna reads the RFI tag, the information is passed to the PLC in the mixer control panel and the mixer starts the automatic cycle. Firstly, the type of sand required is selected (new reclaim or blend), the mixer then starts and mixes the required quantity of sand and at the correct resin and catalyst percentage for that particular mould. Near to the end of the pattern filling the compaction table will start and vibrate for the set time and frequency determined by the tag.

As you do not require line of sight to read the RFI tag it could be drilled and sealed in the pattern thus eliminating the chance of mechanical damage or wear.

The main benefit of pattern recognition is to reduce the chances of human error, maximize mould-making efficiency, reduce costs and improve production record keeping.

INTRODUCTION

RFI, which stands for Radio Frequency Identification, is a system in use for tagging a component so information can be read from this at a relevant point in the operation. This information can then be used in a variety of ways.

The system works by storing a recipe name on to a microchip, which we call a tag. This recipe name can then be read back at any time using an antenna; the recipe name is then passed onto a PLC control system. Within the control system there is a HMI (Human/Machine Interface), which is used for recipe handling. The recipe name on the tag is matched to the recipes stored in the control system, and the machine then runs to that recipe.

A good example of this system is airport baggage handling, as one can imagine it must be very difficult to keep track of all the baggage going through an airport, but now some airlines are using tagging

systems for managing the handling of the baggage. By using tags on each bag it becomes very easy to read information relating to the correct flight the bag should be going to.systems for managing the handling of the baggage. By using tags on each bag it becomes very easy to read information relating to the correct flight the bag should be going to.

The mould recognition system comprises of three main items these are: the RFI tag, which is 32 mm in length and 4mm in diameter. You then require an antenna to read and write information to the tag. And finally there is the PLC/HMI control system used for recipe handling and full control of the system.

We can see major advantages in using this system in the Foundry industry. This is why we have developed a system using RFI tagging for pattern recognition. This allows the system to automatically deliver the correct sand recipe into a pattern.

RFI TAGGING VS BARCODES

The advantages of RFI tagging over barcodes are plain too see. The main benefit with tagging is no direct line of site is required, the tag and easily be read through most objects, whereas barcodes need to be within line of site of the reader, they also need to be in the correct position on the box. The tag can be mounted in the centre of the box so the orientation of the box is not relevant, with the barcode systems a barcode would be needed on all four sides of the box.

Due to the fact the tag is mounted inside the wood of the pattern it is protected from damage, and the harsh environment, with barcodes they are subject to the damage from being knocked and getting covered in dirt and dust, causing miss-readings.

The risk of human error is greatly reduced with RFI tagging as once the tag is programmed and mounted it will stay with that box, removing the risk of an incorrect recipe being delivered to the pattern, causing sand and chemicals wastage. Barcodes are easy to get mixed up and put onto the wrong pattern.

Maintenance of the tagging system with reference to the tags is non-existent once they are mounted

and programmed they can be left alone. Barcodes on the other hand need regular replacement, meaning extra costs of manufacturing barcodes.

FOUNDRY APPLICATION

By using this system, running in conjunction with a mixer and an optional table it is possible to control the recipe of sand that fills each individual pattern box.

Firstly a RFI tag must be mounted into a pattern, this is easily done, as the tag can be mounted anywhere on the pattern, or box as long as there is no metal between the antenna and the tag. This is due to the fact the system can read through most materials except for metallic items. It is best to mount the tag horizontal for a good real distance.

The antenna then needs to be mounted near the discharge of the mixer; the pattern is then moved under the discharge of the mixer. At this point there are numerous ways of the machine being told to read the tag:

• The easiest method is a push button, which the operator pushes when the pattern is in place, the tag is then read and the sand recipe is run into the box.

• The semi automatic system would use a sensor so when the operator moves the box into place the sensor is actuated and the machine runs.

• The automatic system is similar to the semi automatic system but uses powered rollers to move the pattern box on and off the compaction table.

Once the machine has read the tag the correct recipe of sand is delivered to the pattern box.

CREATING A RECIPE AND PROGRAMMING A TAG

The recipe can have a variety of different options; here is a selection of the more common variables:

• Run times for facing and backing sand allowing precise control of the sand usage in each pattern

• Resin addition %

• Sand type

• Set time when the system incorporates a temperature sensitive blender

• Compaction table vibration level

• Compaction table lift time at the end of the cycle

All these variables can be set for each individual recipe and the system can store thousands of recipes.

The recipes themselves are easily entered through the user interface and the whole recipe is stored within the interface with only the recipe name being written to the tag, this means it is possible to edit the recipe without the need to reprogram the tag each time.

Once a recipe is made, the tag can be programmed by moving into the vicinity of the antenna. Once in position pressing the program key on the interface, will write the recipe name to that tag. This pattern is now ready to run.

The recipe name will stay on the tag permanently, but if at an time the box needs a different recipe name, or the pattern box is being destroyed the tag can be remove and reprogrammed and used again.

BENEFITS

One of the main benefits of the RFI tagging system is cost savings, this is due to the correct amount of sand being delivered into each pattern with a minimal amount of wastage. This in turn can have large saving on sand and chemical usage,

The system should also increase the production rate, as the operator is led by the machine rather than the other way around.

Another major benefit is data retrieval, information can easily be accessed through the user interface at any time. Windows based software has also been developed so that the information can be directly accessed by foundry personnel at their PC. Because the information is gathered in real-time it is possible to see the actual production as it is happening and "interrogate" the programme for various information.

With this system it is possible to get data on:

• Production Data

• Sand usage

• Resin usage

• Catalyst usage

• Average sand Kg per mould

• Average resin Kg per mould

• Average catalyst g per mould

• Number and moulds produced

USER FRIENDLY

The engineering side *of* the system is very complex, but this by no way means it is complex to use, on the contrary in fact the system is very user friendly. This is mainly due to the HMI interface being the central control of the whole machine. This means every aspect of the machine and recipes can easily be accessed at any time.

Programming the tag once the recipe is written is a case of pressing one button, and the same for running the machine in automatic mode, all that is needed is one button press to make the machine run.

The data on the HMI interface is all password protected so only people with access permission can alter it. There can be up to nine levels of passwords.

One major problem could be if a fault was to occur on the HMI interface and all the entered recipes were lost. Due to this it is possible to backup the recipes onto computer using a very simple software utility called FILE TRANSFER, this can be done from the link to the computer in the offices.

It is very important foundry's look at technology as a serious option for saving money, pattern recognition is just one of many systems that is capable of this and hopefully this paper has some insight into this new technology.