Introduction to Industry 4.0 and Industrial Internet of Things
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Lecture – 59
Milk Processing and Packaging Industries

So, right now we are in the quality checking lab of this particular dairy. So, here I have with me one of the staffs of this dairy, who is going to explain how the quality checking is done. So, basically after the milk sample is brought to this lab, the quality of the milk that is received is checked. So, how it is checked, what are the parameters that are checked is going to be explained. So, ma'am could be please explain what you do over here in this lab?

Hello everyone myself Priyanka Rao and I am working here as training junior executive. So, basically this lab is known as raw milk receiving dock lab, where we are checking the various samples which are received by the bulk milk tankers. So, we are collecting the milk from the society people and they are bringing some samples over here. There are different parameters like fat, SNF and we are also checking the adulteration like water addition or some salt or sugar or sucrose or there are various other parameters. And then since we are directly dealing with the society members, we have to be very careful in regarding checking those parameters. So, some let us show you the various parameters in our machine ok.

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So, once we receive these samples, we are checking these samples over here. This is our FD 1 machine and this machine shows some parameters like fat. SNF, protein, lactose, TS, acidity, salt and these are adulteration. When we move further, there are adulteration parameters.

So, right now we are in the processing and process control plant of this particular diary. So, I have with me two of their executives; on my right is Mister Patel who is the Chief Plant Engineer in this particular lab and on my left I have the Chief Executive Engineer of this diary. So, I am going to request them to speak about this particular lab and the facility that they have, what is the processing that is done, how it is being done; all the details. So, could I request you sir to speak a few words about how it is being done..

Yeah, this is milk processing unit; we have a centralised milk processing unit. Here we have a nine plants and a which we are pasteurising milk. Pasteurising means removing all bacteria or pathogens from milk and make it safe to safe for human consumption. (Refer Time: 03:36) Here we have we are processing; in processing we are having different sections like hot water section resolution section.

Hence in the heating section, we are heating the milk 278 degree centigrade. It will makes all bacteria removed and immediately we are cooling that milk below 4 degree which limits the growth of bacteria (( ))

Ok

Subsequently.

Ok.

So, how is it working over here? You have number of instruments that are there.

Yeah we have nine plants.

9 plants.

Are there. So, we are you are going to explain.

Yes

In site how it is being done.

Yes.

So, I now have with me mister PC Patel who is the instrumentation engineer of this particular plant. So, sir could you please explain about the instrumentation facility that you have in this plant?

Hi myself PC Patels, I am looking afters all the instrumentation related activity for whole the dairy plants. If we talking about this particular plants instrumentations, basically the individual temperature controls loops are installed on each and every pasteurisers the temperature loops includes the Hartley sensors I to P convertors. Then some microprocessors based controllers and finally, for controlling the temperatures, it is pneumatic controls valves ah. Apart from individuals set controls loops , there are certains level sensors are installs on each and every milk silo to see the actuals levels of milk in each silos the levels. Sensors are installs a basically hydro hydrostatic types and working on this strain gauge principles.

Ok. So, how what are different other sensors that are there only level sensors?

No for each and every each and every level sensors are of hydrostatic types.

Hydrostatics types.

Earliers we are installed we were installed infrared type.

Ok.

But there we are facing some level sensing problems due to foaming of a foaming of a foaming happen in the milk.

So these level sensors the sensor data are all available through some console somewhere?

No basically individuals controls levels are installed with the indicators ah.

So, through these indicators basically you are able to see.

Yeah

The scatters of the different instruments.

Yeah.

Ok,thank you so, much.

Thank you.

Now, we are at Alco rooms of a process sections, where we can see the how the hydrostatic level sensors and temperatures sensors are installed on milk silo to see the level of milk and temperatures of milk silos.

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We can first see the see the what temperatures sensors called RTD sensors and this one is a hydrostatic level sensors. From wheres we take the outputs to some indicators to see the actuals level of milk in a milk silo.

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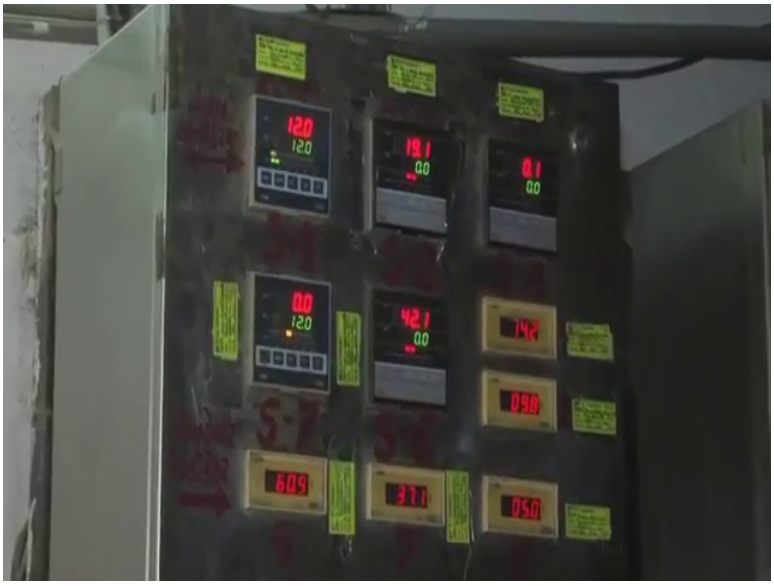

How we install the milk silo indicators and temperature indicators, where we can see the in top of the first row three level indicator indicators are installed. In first one we can see 12 where the

multiplication factors is thousands. So, in the in the silo number ones are there is a 12000 litres milk are theres and in second row some respectively temperatures indications are theres.

And now we are at milk pasteurisation plants, where we can see here too much crowdy area is there. So, I can speak too much loudly so that you can hear so, that here correctly.

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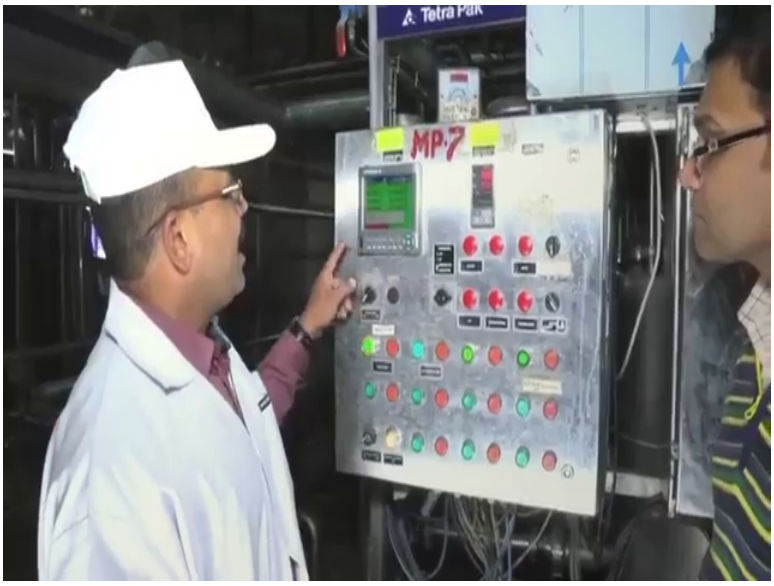

Now this is this is this is the temperature micro processor base level temperature controllers, and these and this is a temperature scanners.

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Here we can see the numbers of different type of temperatures of particular milk pasteurisers we can see and from here we can take the data to our to our computers by ethernet connections.

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Now, here this is a diverter valve. The diverter valve is activated when the particular heating temperatures, goes below the set points ah. So, that it can be it comes into recycle area.

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Now, this is a pneumatic valves by means of pneumatic valves, we can control the temperatures according to set point at controller.

So, right now we are in the powder processing plant. So, from milk to milk powder how things are done that we are going to see in a how it is being done and here it is a very sophisticated plant, that this particular dairy has for this particular you know powder processing. So, I have with me the manager of this plant Mister Parik, Mister Parik could you please explain how the processing is done from milk to milk powder.

Basically milk is a perishable product.If we want to preserve the milk for a longer time, we should convert the milk into the milk powders.

You are right.

(Refer Time: 10:20) is a producing four different kinds of products.

That is skimmed powder.That does not have a any fat.

Ok

That is a less fat.Another one is whole milk powder which directly if we the constituted that powder, it will give the directly the milk which we are taking in day to day life.

Ok.

The another one is infant milk food and the fourth one is (Refer Time: 10:47).

Correct.

The process of milk powder manufacturing is like the way.If we are.

We have to do eliminate the water from the milk.

Right

If we heat continuously and in a open air, then the products different protein and other things are denatured.

correct.

So, to preserve the milk as such in a as such form.

Correct

We are evaporating water.from the milk under the evaporation plant.

Right.

That is under the vacuum.

Correct.

With the help of steam we heat the milk at the lower boiling temperature.

Ok

Then.

And how much is the temperature.

Temperature of a milk is maximum is 72 degree centigrade.

Ok.

And the minimum is 48 we have a different effects in a evaporation plant.

Ok.

So, the basically 1 kg steam is used for 1 kg water evaporation.

Ok.

But we have different effects in a plant, we have a six different plant in which.

We are using only 150 gram steam.

Ok.

To evaporate 1 kg water evaporation.

Ok.

So, in evaporation plant we evaporated water and concentrate milk.

Right.

And concentrated milk into the spray into the spray cart.

Ok.

In spray cart we are spray spraying through a centrifugal atomizer disc. Milk is spraying through the centrifugal atomizer disc.

Ok.

And hot with the help of hot air.

Ok.

Which temperature is around 175 to 200 degree centigrade.

Right.

With help of the hot air we dry them milk.

Ok.

Concentrated milk.

Ok.

Into the powder.

Ok.

Subsequently, we cool it and then we pack into the different types of packets.

Ok.

This is the basic.

All right. So, for this entire process the process control is done from this particular room right.

Yeah.

Ok.

It is a it is the basicconsole.

Right

We have a APV Invensys DCS based system.

Hm.

So, we are in a one screen we summarize the all whatever the required process parameters.

Right.

And we control from there.

Correct ok.

Thank you.

Thank you.

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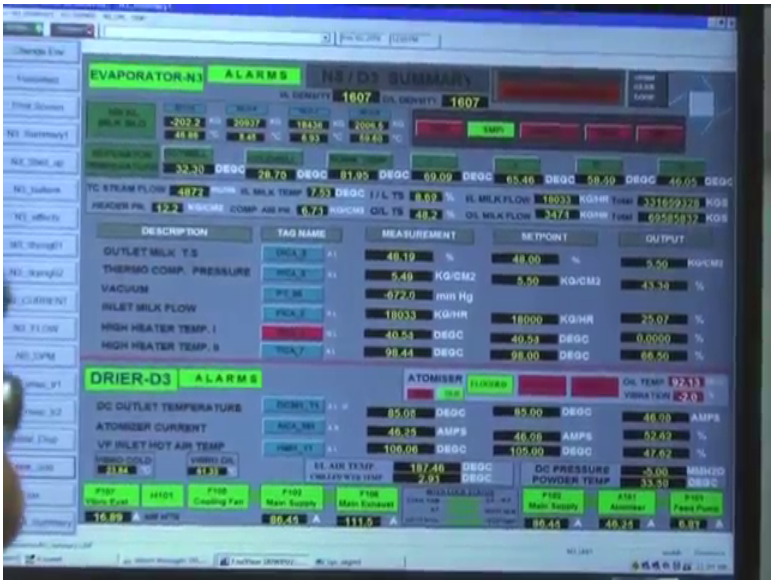

So, this is basically the distributed control system the DCS marshalling rack and here I would request mister Patel to speak about it you know what are the different components. So, some of these important components such as the processor the field bus the node bus these things you have studied when we are talking about the industrial communications systems. So, in that lecture you have already you know learnt about what is field bus what is node bus and so, on. So, these things are going to be explained over here. So, how this is controlling this entire plant this is what mister Patel is going to be explain to us. So, Mister Patel could you please explain how it works.

Yeah. So, we are at marshalling cabinet(Refer Time: 13:38) of whole DCA systems, where we can identify the different type of instruments involved a with a DCA systems.

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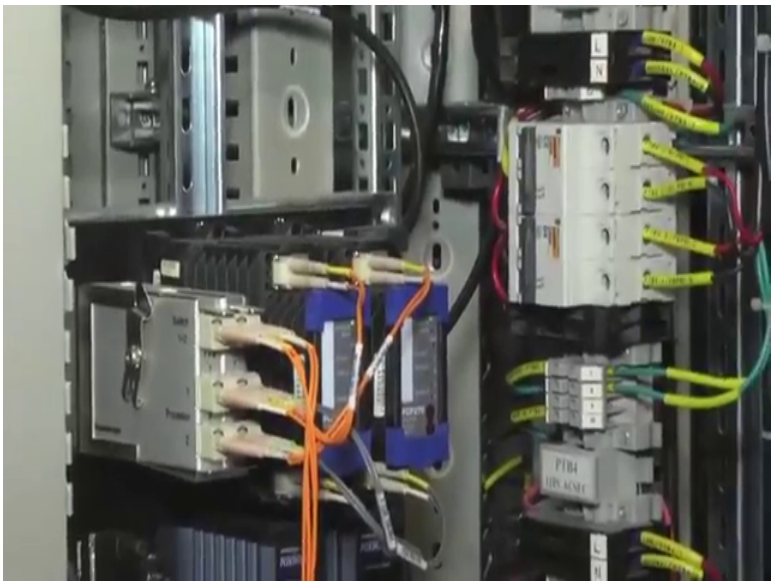

Here we can see the two control processors are there say, one question is there, why two control processors are installed heres. So, in case of one control processor fails the another one take the whole controls automatically.

So, this is basically the fault tolerance basically.

Yeah.

You know if.

Yeah yeah.

If one of these fails the other processor will take over it.

Ah Automatically the.

The transition.

The transfer the controls.

The transition is going to be happen automatically.

Yeah yeah

Ok.

And this is the node bus.

Right.

And this is the, a node bus why means the control processors communicate with the fielding instruments.

Ok.

And these are different type of APMs a the APMs there are two different types of field instruments from which inputs come comes to the DCA systems.

Ok.

One is the analogue input and one is the digital inputs.

Ok.

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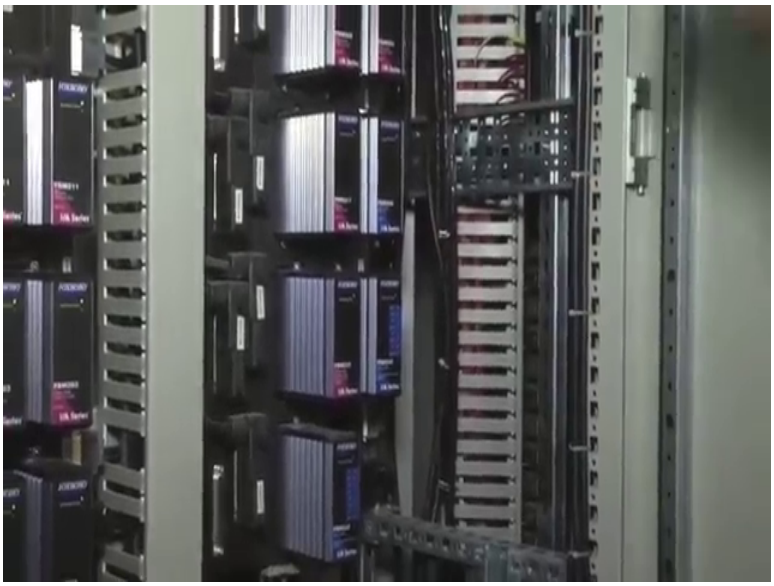

That blue colours a p m s indicates the digital input ah.

Ok.

Come from the field and magenta colours indicates the analogue inputs

Ok

These are the architecter architectures of the dca systems.

Correct.

So, both the analogue as well as the digital inputs are handled in this particular yes

System.

Wonderful thank you.

Manufacturing of milk powder is divided in two process; one is evaporation second one is spray drying. In evaporation plant milk is heating under a vacuum in a different effects and concentration of milk is increased up to the 50 percent in evaporation plant. In a spray drier concentrated 50 percent concentrated milk is sprayed and water is coming in a contact with it is having a around 200 degree centigrade temperature both are coming in a contact and it comes under the drain chamber in a form of powder milk powder, then it is packed into the different type of packing.

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We are packing in a powder in a 1 k g pouch and 500 gram pouches. This one is our infant milk food and this one is our skim milk powder the brand name of infant milk food is Amul spray and skim milk powder is of Sagar smb.

This is our butter section; we will take cream for process section. From cream we will make this is our butter section in this section we will take cream for process section, we will take cream in continuous butter making from this buttering production we will take production daily 100 metric ton and in these 25 ton pack in Amul butter and 75 ton production in white butter. White butter for reconstitution in reseason and Amul butter various size packing 25 gram 100 gram [FL] gram or [FL] kg packing per day.

We will we will collect milk from 1200 societies 25 percent milk in can morning and evening, 75 percent milk collect through BMC, today we will product Amul butter Sagar ghee, sweetened condensed milk and mainly our product with powder. Amul spray skim milk powder whole milk powder or Amulya powder. From these or today we will display for 3 lakh 350000 meter litre [FL] in various places in Mehsana district. Today we will display 5 lakhs litre milk Daryuda and Manasarovar plant. Now in first season we will lease plant 3 lease plant for powder manufacturing plant.

Done.

So, right now we are in the Amul Dudhsagar dairy, which is one of the largest dairies in this particular region of the country, this is basically Mehsana district in Gujarat and so, right from the morning we are witnessing lot of milk coming from the adjacent villages in the form of containers which are loaded in trucks.

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Also trucks loaded with lot of bulk milk is also coming. In the processing of this container based milk and also the bulk milk it is done separately ah. So, you know. So, we have seen that these containers you know how these containers are being brought from the neighbouring villages and then how the milk is basically tested initially and after the initial testing for quality quantity etcetera then what happens is the milk is sent for further processing.

And this processing happens through a very sophisticated system and this system is to a large extent an automated system with high end machinery and instruments ah. So, basically what happens is lot of pasteurisation then processing of the milk packets and so, on packeting of the milk and so, on that is what happens. Also what happens is there are different other products this particular dairy has ah. So, products in the form of butter, then packeting of butter and also packeting of the different you know powder milk all these things are done. So, how it is done this

is what we are going to show you now and as you will see that you know lot of sophisticated system is involved in this processing of the milk to different products.

So, initially you know what happens as I was telling you, the milk is brought in the form of containers then there is some processing that takes place. So, I am going to show you how this processing is done.