Manufacturing System Technology - II
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Lecture - 14

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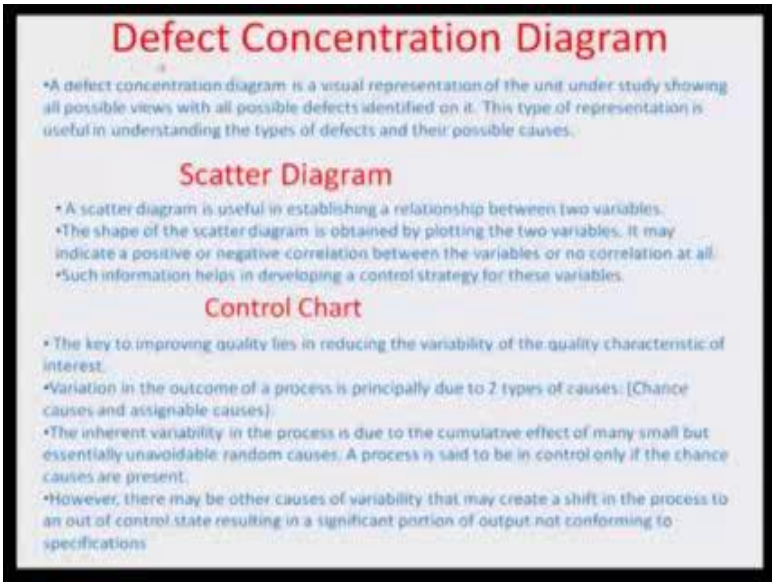

Hello and welcome to this manufacturing systems technology part 2 module 14. We were talking about the seven tools, and we had already discussed earlier the histogram, the pareto diagram, the cause and effect diagram, and the check sheet based methodology of (refer time: 00:30) quality. Today we will focus on three more different aspects; one is the defect concentration diagram, the scatter diagram, and the control charge which again would have a very detailed introduction and analysis as to how these are to be plodded, because this really giving a real time sense of control of quality on the process level. So, let us look at the defect concentration diagram. A defect concentration diagram is a visual representation of the unit under steady, showing all possible views with possible defects identified on it, the type of representation is usefull in understanding the type of defects and their possible causes.

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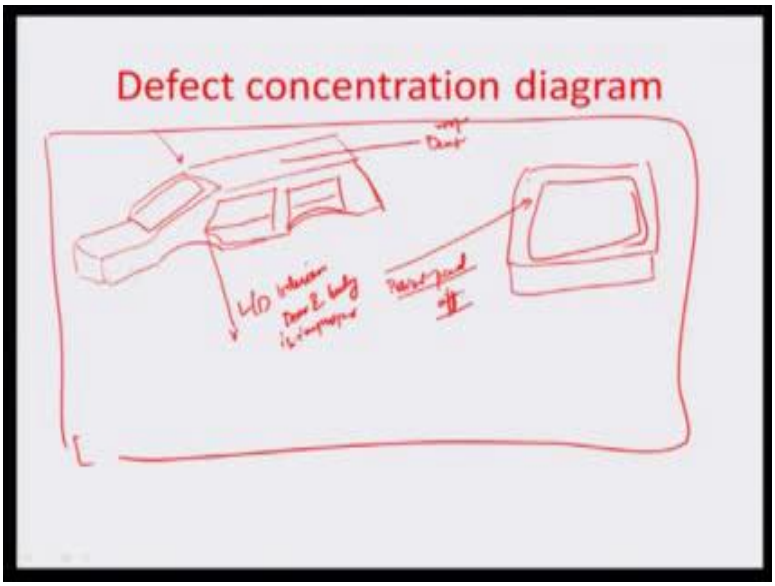

When we look into an automotive unit, we will have different views of the auto wheel. For example, let us say when we are talking about the roof of a particular car, you know this can be related to something like, you know this kind of an aspect, and you know one of the possibilities is to sort of review, the various related areas of this particular, you know module and try to understand the defects in terms of the modules related to this particular car. So, a person may say that there is a dent on the roof for example. So, he will identify this as a roof dent or for example, if he says that the level difference here between the door and the body between door and body is improper.

So, he will represent exactly what area of the car. So, there are many views there may be a view from this site, there may be a view, as you can see from the top or left of the car or even the front body, there can be also a view towards the back door side, you know which talks about something like this kind of a view, and there can be something related to the back door saying let us say if there is some kind of a paint peel of you know in this particular region, so the operator now... So, there would be various views in a check sheet. So, there is a check sheet like this, and there are different views and the operator can actually represent the location of a particular defect, and then you know give that this kind of a record what is really the type of the defect which is recorded on the check sheet.

Then visually it become very easy for the repair man to quickly isolate, and go to that particular area where the particular defect would be present and be able to repair. So, one of the reasons why defect concentration diagrams are given is to really quickly realize,

and identify during the repair stage, the exact location and the exact nature of the defect. Because obviously the repair happens where not within the assembly line, but of off line, and slowly there is a you know there is a initiative within all auto wheel majors to sort of pump in all the inspection as well as repair to online rather than offline. So, that less time can be wasted, but that actually a far-fetched dream from reality. It is really dependent on the correct process quality control. But as of now the situation is that typically all the auto majors have, a they do not jeopardise their production rate, because of the presence of a defect which is there in the system and rather would like to make a separate repair area where these vehicles can be clubbed up slowly repaired before sending to the vehicle inspection of the vi of the particular shop floor.

So, here also and the defect concentration diagram, it is sort of giving an easy way of representation and communication between the inspection representative and the repair representative. So, that there is no time delay, because of non-understanding of whatever has been written by the inspector on the particular check sheet. So, that is about the defect concentration diagram. There are also you know diagrams which are called scatter diagrams. Typically, it is useful in establishing a relation between two variables; the shape of the scatter diagram is obtained by plotting the two variables, it may indicate a positive or negative correlation between the variables or no correlation at all. And such information is helping some times in developing a control strategy for these variables.

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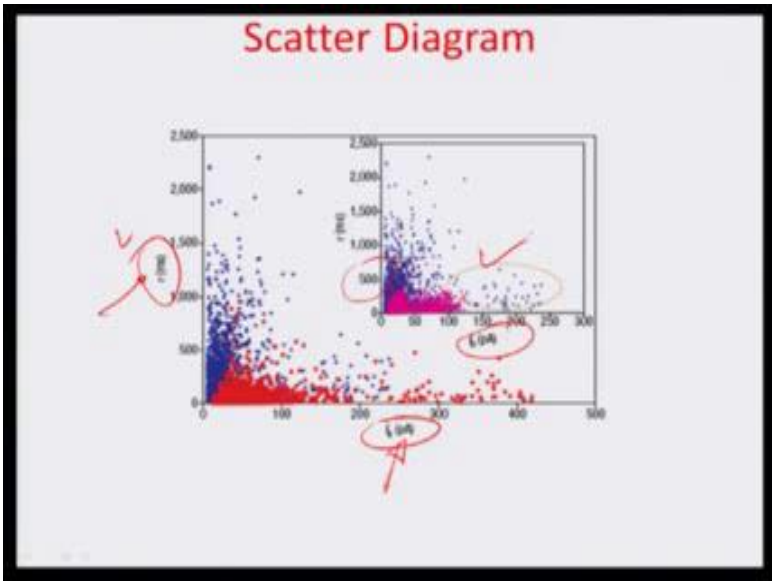

For example Let us say we look at a scatter diagram here, this is actually representing the current versus the time you know of a certain process, let say for example, you can see

that the base current here is in pico amps, and the time of response of the particular circuit is in let say mili seconds. And you can find out that typically there is a lot of scatter on a certain situation, where there is a lower time of response and considerably higher current you know and these are the regions which probably show that there is a trend that the circuit is bleeding more current then is needed. So, you can actually plot this scatter diagram to be able to add a glance, sort of interpret, something about the process from the inspection studies that has been done by the probably an inspector or a person recording this data in a electronics assembly line.

So, these kind of situations are plotted by scattered diagram, there is also a very important aspect to monitor real time the quality which is called the control time, and this is something where we have to emphasize more towards process control or process capability analysis. And the control charts are very very important, because they help in reducing the variability of the quality characteristics, which is of interest. If we really where to classify the overall variability of a process, there may be a situation where the variability causes or arises, because of different aspects related to the process one of them can be the chance causes, there may be some randomness in the way things occur at the process level which may create some kind of variability between the products or the other aspect can be a assignable causes, where there is a certain a reason which can be a framed back for a certain non conformance in a quality characteristic. For example, if in operator is a new on a particular station and he is doing some kind of a fitment where there is a recorded problem, because of his untrained nature he may be able to create this defect in the particular assembly in question. So, the idea is able to identify the operated and train him well. So, that there is a increase in the quality aspects. So, who will control this and therefore there is some times a statistical control which is available along the length and width of the process which is call the control charge.

So, the variability in the process is due to a cumulative effect of many small, but essential, essentially an award able random causes, a process is set to be in only with the chance causes are sort of present in the process; however, there may be other causes of variability that may create a shift in the process to an out of control state resulting in a significant portion of output not conforming to the specifications, which has been laid out the once which are known as the assignable causes, and how do we plot this control chart is a very critical issue.

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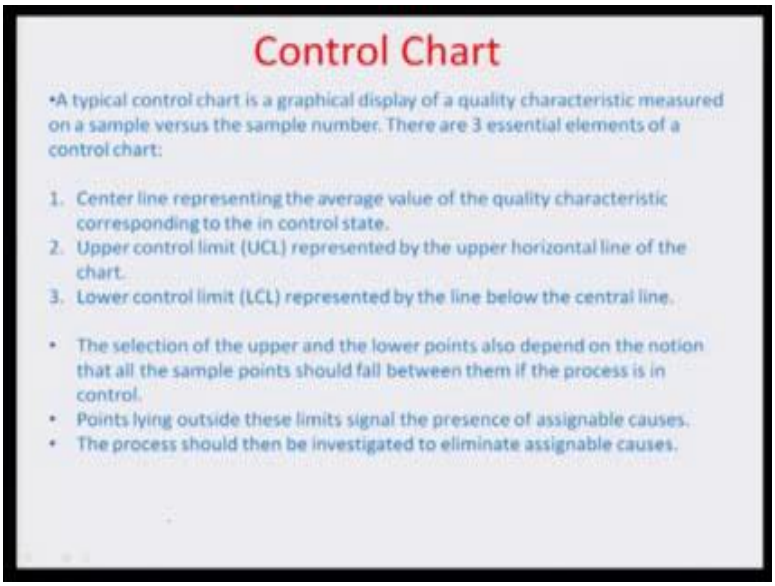

So, here a typical control chart would be a sort of a graphical display, and this would sort of display a certain quality characteristics which is either a measured quality characteristics or may be visually acceptable or unacceptable kind of a quality characteristics. But again you can plot both the aspects in a different manners, you know. Let us talk about let say the measured quality characteristic aspect on a sample. So, there is a sample number and these samples have all been inspected on a quality characteristics has been measured within the samples. And what you know you have to plot on the control chart essentially are three different elements; one of them is a center line which represents the average value of the quality characteristics corresponding to the in control state out of all your observation which is there. Let us say your observing hundred samples out of thousand which have been produced. So, one tenth about tenth percent is inspected.

In this 100 samples you have an average value which is recorded when you are talking about diameter of a shaft, it may be the diameter of the shaft measured in those 100 samples which cause a certain mean or a certain average value of that 100 samples being a recorded as a center line that is the center line. And then you have an upper control limit which is represented by a upper horizontal line probably parallel to the control line of the central line of the chart. And this sort of represents the deviants from the average which are there are or which are present in the distribution, and then there is of course a lower control limit as well which is represented by a line below the central line.

So, the idea is this you have to very clearly understand is related to the process variation or the process capability. So, you have a center line, you have a upper specification limit, you have a lower specification limit related to the production that is been done in the process. And then you when you need to estimate the capability of the process towards a certain design, you have to illustrate this specification on the design and see whether those specifications are line within the process or y server side. This specifications which are mention there out of the process, you can easily say that the process very well controlled and can used very accurately to render the deliverable quality which is been intended in terms of the design specification which are there. So, will come to that comparison a little bit later. But right as of now we have to understand that we are plotting here is only the production related issue that what is the central tendency of the production, what is the mean characteristics of the production, if you are talking about diameters of a shaft, what is a been diameter of that 100 samples that you have recorded.

And then an upper limit which would correspond to the maximum diameter which is recorded in this 100 samples, and a lower limit which is recorded as a minimum sample diameter which is recorded on those 100 samples. So, this why you draw the UCL and LCL . So, the selection of the upper and lower control points also depend on the notion that all sample point should fall between them if the process is in control, the points lying outside these limits signal the presence of assignable causes. So obviously, now you have a control chart in place and your observing the samples for n number for a certain period of time. And the movement there is a deviant or an out lier to this control, you are able to quickly record that there is a reason why, the chance the processes is going out of control and then you take a counter major, so that it is comes back in the control.

So, that is the real time analysis of the process health, you can say it is a process health monitoring system that you are building you know with time. So, that you can always in a very small glass determine with a process is in control or the process need some kind of a quality improvements. So, there it can come in control. So, the process should be investigated from time to time based on the control charge data to eliminate these assignable causes of variation and process back to bring back to the process to normal size.

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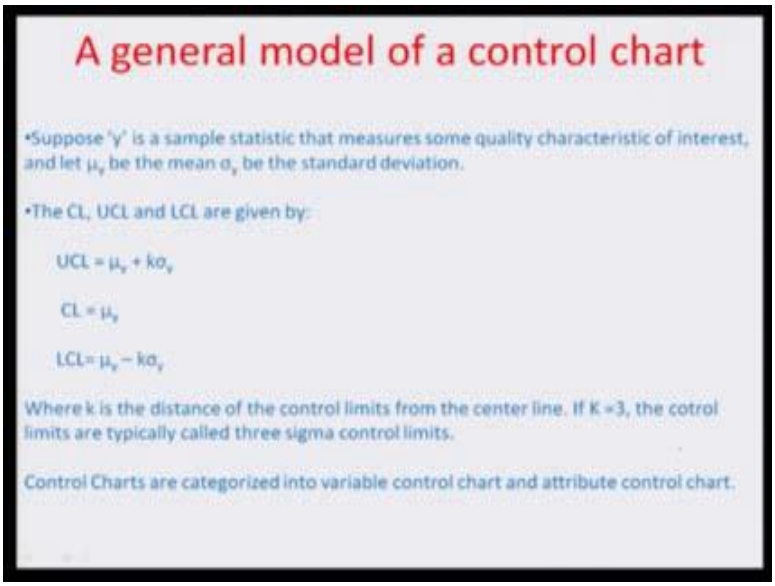

So, how do we really plot, so you have let us say why which is a sample statistic that measures some quality characteristics of interest, and let us say there is a average mu y and us mean sigma y which is the standard deviation. So obviously, the CL the center line would be about the mean and UCL would be about mu y plus some factor k times of sigma y and the LCL similarly would be minus k sigma y on the mu y, and k is actually the distance of the control limits from the center line. So, if I were to say to k is equal to 3, we are talking a control of you know plus minus 3 sigma between which the control is being executed. So, on the upper side you have 3 sigma as your plus 3 sigma as your upper control limit and minus 3 sigma on the lower side as your lower control limit.

So, having said that the control charges are categories into again variable control charts an attribute control charts based on if you are talking about a measurable variable or something which is like a quality attributes which can be recorded as acceptable or not acceptable. So, there are many such quality characteristics, let us say for example, the polish on a surface of an automotive, it cannot be measured by you know directly although it can be probably as a function of the glass of the reflectance of light, but when we are talking about a situation where is a minor variation in policy which only the human eye can record, you will actually qualitatively investigate that as polish being acceptable or not acceptable.

So, there is no measurement as such involved in those kinds of classification. So, they are known as attribute control charts. Variable of course, you have done before is related to let us say the diameter or some other measurable characteristic of the particular

product, and there is a measurement which is involved in the data of the measurement which is involved which is use for a recording the control charge. So, these are the typical classification of the control charts.

So, I think I will stop this discussion here on control charts probably begin again in the next module in the interest of time. So, in the next session we will look at very closely an investigate more related to how do you really statistically find out from a distribution the mean, this kind of deviation so and so forth, for recording and plotting this control chart.

Thank you.