

### **How are control limits calculated for an attribute p-chart?**

- A p-chart displays the percentage of nonconforming (defective) units. This chart is available in WinSPC to an attribute that is configured with an 'Attribute Counts' of 'Defective Units'.

An attribute displaying a p-chart in WinSPC (configured to recalculate the control limits every 5 subgroups) can be seen here:

The statistic plotted on a p-chart is

where  $n_k$  is the number of nonconforming units in the k-th subgroup, and  $n$  is the lot size for that subgroup.

The following equations are used to calculate the control limits for the k-th subgroup:

Where:

$\bar{p}$  is either

the average of a set of plotted p values (taking into account the 'All Data', 'Last N subgroups', and 'Use local data only' options on the 'Control Limits' tab of the attribute properties), if the 'Est. based on process variables' option is selected under the 'Chart Statistic' area. or, the value entered for the 'Constant' option, if it is selected under the 'Chart Statistic' area.

$\sigma$  is the 'Number of sigma' option under the 'Control Limit Spread' area on the 'Control Limits' tab of the attribute properties. By default, this is 3.0.

$n$  is the lot size for the subgroup.

If the calculation for LCL results in a value less than zero, the LCL is set to zero.

Note that the control limits will recalculate at the interval defined by the 'Calculated every k subgroups' option (25 by default).

For reference for the above control limit settings, here is a sample 'Control Limits' tab of the attribute properties:

<https://knowledgebase.winspc.com/questions/195/>