FORMULÁRIO – CONTROLE ESTATÍSTICO DO PROCESSO

p/ Média	p/ Amplitude
$LCS = \bar{\bar{x}} + A_2\bar{R}$	$LCS = D_4\bar{R}$
$LC = \bar{\bar{x}}$	$LC = \bar{R}$
$LCI = \bar{\bar{x}} - A_2\bar{R}$	$LCI = D_3\bar{R}$

$$\bar{R} = \frac{\sum_{i=1}^{k} R_i}{k} = \frac{R_1 + R_2 + ... + R_k}{k}$$

$$\bar{\bar{x}} = \frac{\sum_{i=1}^{k} \bar{x}_i}{k} = \frac{\bar{x}_1 + \bar{x}_2 + ... + \bar{x}_k}{k}$$

$$\bar{x}_i = \frac{\sum_{j=1}^{n} x_j}{n}; \qquad R_i = X_j(MAX) - X_j(MIN)$$

$$C_p = \frac{LES - LEI}{6\hat{\sigma}}$$

$$C_{pk} = \min\left\{\frac{LES - \bar{\bar{x}}}{3\hat{\sigma}}, \frac{\bar{\bar{x}} - LEI}{3\hat{\sigma}}\right\}$$

$$\hat{\sigma} = \frac{\bar{R}}{d_2}, \qquad \hat{\sigma} = \frac{\bar{s}}{c_4}, \qquad z = \frac{LE - \bar{\bar{x}}}{\hat{\sigma}}$$

p/ Média	p/ Desvio Padrão
$LCS = \bar{\bar{x}} + A_3\bar{s}$	$LCS = B_4\bar{s}$
$LC = \bar{\bar{x}}$	$LC = \bar{s}$
$LCI = \bar{\bar{x}} - A_3\bar{s}$	$LCI = B_3\bar{s}$

$$\bar{s} = \frac{\sum_{i=1}^{k} s_i}{k} \qquad s_i = \sqrt{\frac{\sum_{j=1}^{n}(x_j - \bar{x})^2}{n-1}}$$

$$s = \sqrt{\frac{\sum_{i=1}^{n}(x_i - \bar{x})^2}{n-1}} \qquad s = \sqrt{\frac{\sum_{i=1}^{n} x_i^2 - (n\bar{x}^2)}{n-1}}$$

p/ Valores Individuais	p/ Amplitude Móvel
$LCS = \bar{x} + 3\frac{\bar{R}}{d_2}$	$LCS = D_4\bar{R}$
$LC = \bar{x}$	$LC = \bar{R}$
$LCI = \bar{x} - 3\frac{\bar{R}}{d_2}$	$LCI = D_3\bar{R}$

$$\bar{x} = \frac{\sum_{i=1}^{k} x_i}{k} \qquad \bar{R} = \frac{\sum_{i=1}^{k-n+1} R_i}{k-n+1}$$

p/ Proporção (p) de Não-Conformes

Se n for variável	Se n constante
$LCS = \bar{p} + 3\sigma_{p_i}$	$LCS = \bar{p} + 3\sigma_{\bar{p}}$
$LC = \bar{p}$	$LC = \bar{p}$
$LCI = \bar{p} - 3\sigma_{p_i}$	$LCI = \bar{p} - 3\sigma_{\bar{p}}$
onde	onde:
$\sigma_{p_i} = \frac{\sqrt{\bar{p}(1-\bar{p})}}{\sqrt{n_i}}$	$\sigma_p = \frac{\sqrt{\bar{p}(1-\bar{p})}}{\sqrt{\bar{n}}}$
e	e
$\bar{p} = \frac{\sum_{i=1}^{k} d_i}{\sum_{i=1}^{k} n_i} = \frac{d_1 + d_2 + ...d_k}{n_1 + n_2 + ... + n_k}$	$\bar{p} = \frac{\sum_{i=1}^{k} p_i}{k}$
	$p_i = \frac{d_i}{n_i}$

p/ o Número (np) de Não-conformes

$LCS = n\bar{p} + 3\sigma_{np}$	onde:
	$\sigma_{np} = \sqrt{n\bar{p}(1-\bar{p})}$
$LC = n\bar{p}$	
	$n\bar{p} = \frac{\sum_{i=1}^{k} d_i}{k} = \frac{d_1 + d_2 + ...d_k}{k}$
$LCI = n\bar{p} - 3\sigma_{np}$	

p/ Número (c) de Não-conformidades

$LCS = \bar{c} + 3\sigma_c$	onde:
	$\sigma_c = \sqrt{\bar{c}}$
$LC = \bar{c}$	
	$\bar{c} = \frac{\sum_{i=1}^{k} c_i}{k} = \frac{c_1 + c_2 + ... + c_k}{k}$
$LCI = \bar{c} - 3\sigma_c$	

p/ o Número (u) de Não-conformidades por Unidade

Se n for variável	Se n constante
$LCS = \bar{u} + 3\sigma_{u_i}$	$LCS = \bar{u} + 3\sigma_u$
$LC = \bar{u}$	$LC = \bar{u}$
$LCI = \bar{u} - 3\sigma_{u_i}$	$LCI = \bar{u} - 3\sigma_u$
onde:	onde:
$\sigma_{u_i} = \sqrt{\frac{\bar{u}}{n_i}}$ e	$\sigma_u = \sqrt{\frac{\bar{u}}{\bar{n}}}$, $\bar{n} = n$
$\bar{u} = \frac{\sum_{i=1}^{k} c_i}{\sum_{i=1}^{k} n_i} = \frac{c_1 + c_2 + ... + c_k}{n_1 + n_2 + ... + n_k}$	$\bar{u} = \frac{\sum_{i=1}^{k} u_i}{k}$
	$u_i = \frac{c_i}{n_i}$