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Tables of Constants for Control charts

Table 8A - Variable Data

ref : AIAG manual for SPC

	X bar and R Charts				X bar and s charts			
	Chart for Averages	Chart for Ranges (R)			Chart for Averages	Chart for Standard Deviation (s)		
	Control Limits Factor	Divisors to Estimate σ_x	Factors for Control Limits		Control Limits Factor	Divisors to estimate σ_x	Factors for Control Limits	
Subgroup size (n)	A_2	d_2	D_3	D_4	A_3	c_4	B_3	B_4
2	1.880	1.128	-	3.267	2.659	0.7979	-	3.267
3	1.023	1.693	-	2.574	1.954	0.8862	-	2.568
4	0.729	2.059	-	2.282	1.628	0.9213	-	2.266
5	0.577	2.326	-	2.114	1.427	0.9400	-	2.089
6	0.483	2.534	-	2.004	1.287	0.9515	0.030	1.970
7	0.419	2.704	0.076	1.924	1.182	0.9594	0.118	1.882
8	0.373	2.847	0.136	1.864	1.099	0.9650	0.185	1.815
9	0.337	2.970	0.184	1.816	1.032	0.9693	0.239	1.761
10	0.308	3.078	0.223	1.777	0.975	0.9727	0.284	1.716
15	0.223	3.472	0.347	1.653	0.789	0.9823	0.428	1.572
25	0.153	3.931	0.459	1.541	0.606	0.9896	0.565	1.435

	Centerline	Control Limits		σ_x
X bar and R Charts	$CL_{\bar{X}} = \bar{\bar{X}}$	$UCL_{\bar{X}} = \bar{\bar{X}} + A_2\bar{R}$	$LCL_{\bar{X}} = \bar{\bar{X}} - A_2\bar{R}$	$\frac{\bar{R}}{d_2}$
	$CL_R = \bar{R}$	$UCL_R = D_4\bar{R}$	$LCL_R = D_3\bar{R}$	
X bar and s Charts	$CL_{\bar{X}} = \bar{\bar{X}}$	$UCL_{\bar{X}} = \bar{\bar{X}} + A_3\bar{S}$	$LCL_{\bar{X}} = \bar{\bar{X}} - A_3\bar{S}$	$\frac{\bar{s}}{c_4}$
	$CL_s = \bar{s}$	$UCL_s = B_4\bar{s}$	$LCL_s = B_3\bar{s}$	

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Tables of Constants for Control charts

Table 8B Variable Data — ref : AIAG manual for SPC

	Median Charts				Charts for Individuals			
	Chart for Medians	Chart for Ranges (R)			Chart for Individuals	Chart for Moving Range (R)		
	Control Limits Factor	Divisors to Estimate σ_x	Factors for Control Limits		Control Limits Factor	Divisors to Estimate σ_x	Factors for Control Limits	
Subgroup size	$\tilde{A}_2$	d_2	D3	D4	E_2	d_2	D_3	D_4
2	1.880	1.128	-	3.267	2.660	1.128	-	3.267
3	1.187	1.693	-	2.574	1.772	1.693	-	2.574
4	0.796	2.059	-	2.282	1.457	2.059	-	2.282
5	0.691	2.326	-	2.114	1.290	2.326	-	2.114
6	0.548	2.534	-	2.004	1.184	2.534	-	2.004
7	0.508	2.704	0.076	1.924	1.109	2.704	0.076	1.924
8	0.433	2.847	0.136	1.864	1.054	2.847	0.136	1.864
9	0.412	2.970	0.184	1.816	1.010	2.970	0.184	1.816
10	0.362	3.078	0.223	1.777	0.975	3.078	0.223	1.777

	Centerline	Control Limits	
Median Charts	$CL_{\tilde{X}} = \overline{\tilde{X}}$	$UCL_{\tilde{X}} = \overline{\tilde{X}} + \overline{\tilde{A}}_2\overline{R}$	$LCL_{\tilde{X}} = \overline{\tilde{X}} - \overline{\tilde{A}}_2\overline{R}$
	$CL_R = \overline{R}$	$UCL_R = D_4\overline{R}$	$LCL_R = D_3\overline{R}$
Charts for Individuals	$CL_X = \overline{X}$	$UCL_X = \overline{X} + E_2\overline{R}$	$LCL_X = \overline{X} - E_2\overline{R}$
	$CL_R = \overline{R}$	$UCL_R = D_4\overline{R}$	$LCL_R = D_3\overline{R}$

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Tables of Formulas for Control charts

Table 8 C Attribute Data

ref : AIAG manual for SPC

	Centerline	Control Limits	
p chart for proportions of units in a category	$CL_p = \bar{p}$	**Samples not necessarily of constant size**	
		$UCL_{p_i} = \bar{p} + 3\frac{\sqrt{\bar{p}(1-\bar{p})}}{\sqrt{n_i}}$	$LCL_{p_i} = \bar{p} - 3\frac{\sqrt{\bar{p}(1-\bar{p})}}{\sqrt{n_i}}$
		If the Sample size is constant (n)	
		$UCL_p = \bar{p} + 3\frac{\sqrt{\bar{p}(1-\bar{p})}}{\sqrt{n}}$	$LCL_p = \bar{p} - 3\frac{\sqrt{\bar{p}(1-\bar{p})}}{\sqrt{n}}$
np chart for number / rate of units in a category	$CL_{np} = \overline{np}$	$UCL_{np} = \overline{np} + 3\sqrt{\overline{np}(1-\bar{p})}$	$LCL_{np} = \overline{np} - 3\sqrt{\overline{np}(1-\bar{p})}$
c chart for number of incidences in one or more categories	$CL_c = \bar{c}$	$UCL_c = \bar{c} + 3\sqrt{\bar{c}}$	$LCL_c = \bar{c} - 3\sqrt{\bar{c}}$
u chart for number of incidences per unit in one or more categories	$CL_u = \bar{u}$	Samples not necessarily of constant size	
		$UCL_u = \bar{u} + 3\sqrt{\frac{\bar{u}}{n_i}}$	$LCL_u = \bar{u} - 3\sqrt{\frac{\bar{u}}{n_i}}$
		using average sample size	
		$UCL_u = \bar{u} + 3\sqrt{\frac{\bar{u}}{\bar{n}}}$	$UCL_u = \bar{u} - 3\sqrt{\frac{\bar{u}}{\bar{n}}}$
		If the sample size is constant (n)	
		$UCL_u = \bar{u} + 3\sqrt{\frac{\bar{u}}{n}}$	$UCL_u = \bar{u} - 3\sqrt{\frac{\bar{u}}{n}}$