Process - Sigma Conversion Table					
Yield %	DPMO	Process Sigma	Yield %	DPMO	Process Sigma
99.9999	1	6.27	92.00	80,000	2.91
99.9997	3	6.04	91.00	90,000	2.84
99.9990	10	5.77	90.00	100,000	2.78
99.99	100	5.22	85.00	150,000	2.54
99.90	1,000	4.59	80.00	200,000	2.34
99.80	2,000	4.38	75.00	250,000	2.17
99.70	3,000	4.25	70.00	300,000	2.02
99.60	4,000	4.15	65.00	350,000	1.89
99.50	5,000	4.08	60.00	400,000	1.75
99.40	6,000	4.01	55.00	450,000	1.63
99.30	7,000	3.96	50.00	500,000	1.50
99.20	8,000	3.91	45.00	550,000	1.37
99.10	9,000	3.87	40.00	600,000	1.25
99.00	10,000	3.83	35.00	650,000	1.11
98.00	20,000	3.55	30.00	700,000	0.98
97.00	30,000	3.38	25.00	750,000	0.83
96.00	40,000	3.25	20.00	800,000	0.66
95.00	50,000	3.14	15.00	850,000	0.46
94.00	60,000	3.05	10.00	900,000	0.22
93.00	70,000	2.98			

Process Sigma: Based on DPMO (More sensitive than % Yield)		
Percent	DPMO	**Φ**
93 %	66,807	3.0
98 %	22,750	3.5
99 %	6,210	4.0
99.87 %	1,350	4.5
99.977 %	233	5.0
99.9997 %	3.4	6.0

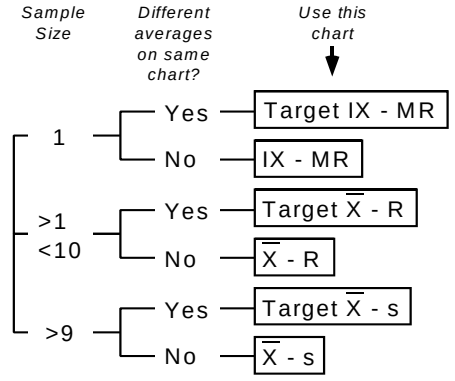
Yield Conversion Table (1.5 Sigma shift)					
Sigma	DPMO	Yield %	Sigma	DPMO	Yield %
6	3.4	99.99966	2.9	80,757	91.9
5.9	5.4	99.99946	2.8	96,801	90.3
5.8	8.5	99.99915	2.7	115,070	88.5
5.7	13	99.99866	2.6	135,666	86.4
5.6	21	99.9979	2.5	158,655	84.1
5.5	32	99.9968	2.4	184,060	81.6
5.4	48	99.9952	2.3	211,855	78.8
5.3	72	99.9928	2.2	241,964	15.8
5.2	108	99.9892	2.1	274,253	72.6
5.1	159	99.984	2	308,538	69.1
5	233	99.977	1.9	344,578	65.5
4.9	337	99.966	1.8	382,089	61.8
4.8	483	99.952	1.7	420,740	57.9
4.7	687	99.931	1.6	460,172	54.0
4.6	968	99.90	1.5	500,000	50.0
4.5	1,350	99.87	1.4	539,828	46.0
4.4	1,866	99.81	1.3	579,260	42.1
4.3	2,555	99.774	1.2	617,911	38.2
4.2	3,467	99.65	1.1	655,422	34.5
4.1	4,661	99.53	1	691,462	30.9
4	6,210	99.38	0.9	725,747	27.4
3.9	8,198	99.18	0.8	758,036	24.2
3.8	10,724	98.9	0.7	788,145	21.2
3.7	13,903	98.6	0.6	815,940	18.4
3.6	17,864	98.2	0.5	841,345	15.9
3.5	22,750	97.7	0.4	864,334	13.6
3.4	28,716	97.1	0.3	884,930	11.5
3.3	35,930	96.4	0.2	903,199	9.7
3.2	44,565	95.5	0.1	919,243	8.1
3.1	54,799	94.5			
3	66,807	93.3			

FORMULAS USED IN SIX SIGMA CALCULATIONS

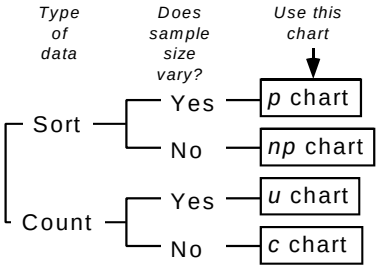
1) $Z = \frac{X - \mu}{\sigma}$	$Z\,u = \frac{usl - \bar{x}}{s}$ $Z\,l = \frac{\bar{x} - ls}{s}$
2) $dpu = \frac{\#\ of\ defects\ found}{\#\ of\ units}$	$dpu = -\ln(\ FTY\ )$
3) DPMO = $\frac{1{,}000{,}000\ x\ dpu}{ave\ opp\ for\ error\ in\ one\ unit}$	DPO = D/(N x O) Yield = (1 – DPO) x 100 (D = # of defects (O = # defect opp per unit) (N = # of units)
4) FTY = e^{-dpu}	Z formula
5) RTY = FTY1 x FTY2 x FTY3….	$e^{-\sum_{i=1}^{n} dpu}$
6) $Takt\ Time = \frac{net\ oper\ time\ per\ period}{Cust\ reqs\ per\ period}$	
7) $Total\ Manpower = \frac{Total\ Cycle\ Time}{Takt\ Time}$	
8) Binomial	$C\frac{n}{r} p^r (\ 1-p)^{n-r}$
9) Poisson	$\frac{(np)^r e^{-np}}{r!}$
10) Hypergeometric	$\frac{\left(\frac{d}{r}\right)\left(\frac{N-d}{n-r}\right)}{\left(\frac{N}{n}\right)}$

Control Chart Selection Trees

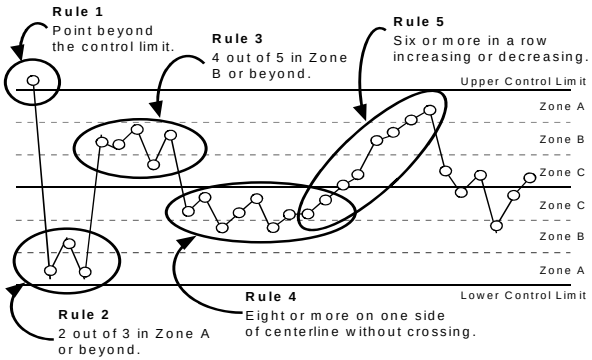
Variable Data Control Charts



Attribute Data Control Charts



Special Cause Rules



The DMAIC Process Flow

D	M	A	I	C
Develop Charter	Collect Baseline data on defects & Possible causes	Develop a focused problem statement	Create possible solutions for root causes	Develop & document standard practices
Map the Process	Plot defect data over time & analyze for special causes	Explore potential causes	Select solution(s)	Train Teams
Under - stand the VOC	Create & stratify freq plots & do Pareto analysis	Organize potential causes	Develop plans	Monitor Perfor-mance
	Calculate Process Sigma	Collect data	Pilot plans	Create process For updating SOPs
	Create detailed process maps	Use Stat methods to quantify a Cause – effect relationship	Imple-ment plans	Lessons Learned
			Mea-sure results	Develop future plans
			Eval-uate benefits	

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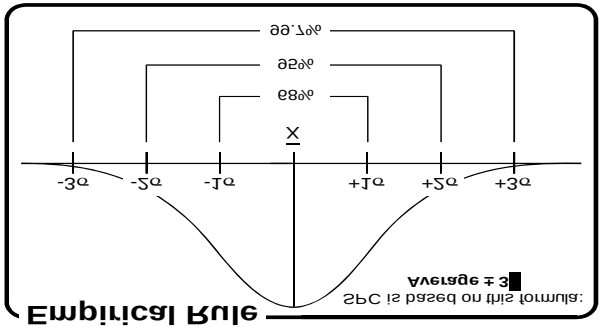
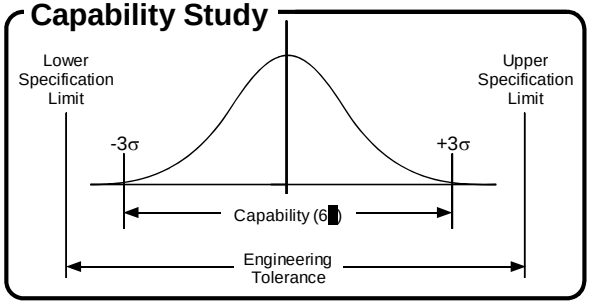
Six Sigma Tri-Fold Card



Capability Study



Capability Study Formulas

$Cp = \frac{USL - LSL}{6\hat{\sigma}}$	$\overline{X} = \frac{\sum X}{n}$
$Cpk_L = \frac{\overline{X} - LSL}{3\hat{\sigma}}$	$\sigma = \sqrt{\frac{\sum (X_i - \overline{X})^2}{n-1}}$ (Root mean square method)
$Cpk_U = \frac{USL - \overline{X}}{3\hat{\sigma}}$	$\hat{\sigma} = \frac{\overline{R}}{d_2}$ (Range control chart method)