

Index for **“Tolerance Stackup, Tolerance Analysis and Tolerancing Manual: Plus and Minus Edition”**

Accuracy and precision	3, 19
Ambiguity	20
ASME Y14.5M-1994	2
rule #1	2
Assembly Process	20, 28, 79-81
Assembly Process Variation	20, 28, 79-81
Assembly shift	20, 28-33, 36, 42-44, 47, 48-51, 53, 63-64, 67-69, 78, 79, 80, 91, 92, 93, 103, 104, 106, 110, 111, 112, 116, 119, 123, 124, 128, 131, 132, 153, 154, 157, 158
calculations	30, 43, 50, 64, 69, 103, 119, 120, 124, 127, 128, 132, 155, 159
fastener diameters used in	29
definition of	28
direction of	110-112
labeling in the tolerance stackup sketch	29, 93
effect of assembly forces on	28, 29, 32, 33, 79-81
effect of mating features on	28-32, 78-81, 85
fixed-fastener calculations and	30, 31, 32, 85
floating-fastener calculations and	30, 32, 78-81
reducing total variation with	31-33
reporting in a tolerance stackup report	29, 103, 104
rotational assembly shift	120-133
formulas and calculations	121-125, 129-133
reporting in a tolerance stackup report	120, 124, 125, 128, 132, 133
rules for	28-33
whether to include in the Tolerance Stackup	31-33
Assumptions	18, 20, 21, 23, 28, 31, 33-35, 42, 52, 54, 55, 56, 78, 81, 85, 88, 96, 102
default conditions in this text	32, 35
framing the problem	35
importance of stating	33
reasons for	33
catalog and purchased parts	34
incomplete drawings	33
missing information	33
relying on manufacturing process tolerances	33-34
Central limit theorem	9-10
Gaussian distribution and	9-10
Chain of dimensions and tolerances	17, 18, 19, 20, 23-27, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 51, 52, 53, 58, 60, 62, 64, 66, 68, 69, 86, 88, 92, 93, 95, 98, 100, 103, 104, 106, 107, 111, 112, 141, 144, 148, 152, 156, 160
definition of	23, 53
moving from one interface to another in	51-53
reason for term	53
Converting plus/minus dimensions and tolerances into equal bilateral format	11-14
limit dimensions	11
and mean shift	15-16
unequal bilateral	12
unilateral negative	14
unilateral positive	13
Dimensions	2, 3, 4-5, 6, 7

types of	4-5
format of	7
metric	7
US inch	7
Direction of dimensions and tolerances in the tolerance stackup	20, 91, 106-115
rules for including	20, 106-107
tolerance stackup direction and	20, 106-107
Features	2-3
Feature of size	2, 34, 52
rule #1 and	2
Fixed fastener situation	29-31, 34, 70-85
assembly process and	85
assumptions	85
assembly shift and	29-31, 34, 85
calculations	72-74, 82-83, 85
defined	70, 81
example of	82
formula	82-83, 85
interrelationship between part tolerances	82-84
Total Location Tolerance and	70-74
projected tolerance zone and	84-85
Fixtures	18, 20, 28, 79
chain of dimensions and tolerances and	18
tolerances of	18
Floating fastener situation	29-31, 34, 70-85
assembly process and	77-81
assumptions	81
assembly shift and	78-81
calculations	72-74, 75-76, 78
defined	70, 75
effect of gravity and	79-80
example of	75
formula	75-76, 78
interrelationship between part tolerances	76-77
Total Location Tolerance and	70-74
Format, plus/minus tolerances	6-10, 11-16
conversion into equal bilateral	11-14
dimensional limits and	6-10
effect on manufacturing process	6-10
effect on target value	6-10
equal bilateral	6, 7
examples of	7
legal differences	6-10
limit dimensions	6, 7
rules for	7
leading zeroes	7
number of decimal places	7
trailing zeroes	7
SPC and	9-10
unequal bilateral	6, 7
unilateral	6, 7
Functional dimensioning and tolerancing	4, 5, 19-20, 29, 36, 88, 134

and arrangement of dimensions	5
Dimensioning strategy	4
justifications for	5, 19-20
tolerance stackups and	19-20
Interchangeability	1
Loop (see Chain of dimensions and tolerances)	
Manufacturing processes	2, 3, 4, 6, 9, 10, 19, 20, 21, 29, 54-57, 158
Mean shift	15-16
calculation of	15-16
definition of	15
effect on Tolerance Stackup	15-16
sign and direction of	16
Moving from one part to another in a tolerance stackup	51-53
complex-curved interfaces	52
disclaimer	53
feature-of-size interface	52-53
planar interface	52
Nominal	1, 2, 3, 4, 6, 9, 10, 11, 54-55, 100
dimension value and	6-10
manufacturing nominal	6-10
math-data/model-data and	2-3
mean shift of	11-16
SPC and	9-10
statistical tolerance stackups and	54-55
Probability	23, 54-57
Root-sum-square (RSS)	55-56
Statistical Process Control (SPC)	9-10, 55-57
Statistical tolerance stackup	19, 20, 21, 54-69, 95, 101
adjusted statistical tolerance stackup	101
appropriateness of	54
number of dimensions and tolerances and	54
conditional assumptions	54
manufacturing process controls and	54-55
Monte-Carlo	55
probability and	54-57
root-sum-square (RSS) and	55-56
definition of	55-56
formula for	56
process related assumptions and	54-57
standards deviations (σ) and	57
statistical process control (SPC) and	55-57
C_p & C_{pk}	55
Tolerances	3, 6-10, 11-16, 21
conversion of +/-	11-16
definition of	3
format of	6-10, 11-16
effect on manufacturing process	6-10
effect on target value	6-10
equal bilateral	6-7
examples of	7
legal differences	6-10
limit dimensions	6, 7

rules for	7
SPC and	9-10
unequal bilateral	6, 7
unilateral	6, 7
importance of specifying	21
types of	5
Tolerance analysis	1, 17-22
computer modeled	20
definition of	17
methods and types of	20-21
reasons for	17-19
statistical	20-21, 54-69
three-dimensional	20, 55
Monte-Carlo	55
worst-case (arithmetic)	20-21, 23-53
Tolerance stackup	17-19
assumptions in	20, 21, 23, 33-35, 52, 54, 55, 56, 78, 81, 88, 96, 102
chain of dimensions and tolerances in	17, 18, 19, 20, 23-27, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 51, 52, 53, 58, 60, 62, 64, 66, 68, 69, 86, 88, 92, 93, 95, 98, 100, 103, 104, 106, 107, 112, 141, 144, 148, 152, 156, 160
and decision making	17-19
definition of	17-18
determining which dimensions and tolerances to include	19-20, 106-115
direction of	20, 106-115
effect of assembly process on	28, 79-81
effect of dimensioning and tolerancing schemes on	19-20
effect of part and assembly geometry on	19, 106
moving from one part to another in	51-53
purpose of	18-19
rotation of parts within a linear tolerance stackup	55, 110, 115, 116-133
comparisons of translational variation versus rotational variation in a linear tolerance stackup	116-133
effect on the tolerance stackup	116-117
locating features closer together	125-133
locating features farther apart	117-125
reporting in a tolerance stackup report	120, 125, 128, 132-133
statistical	19, 20, 21, 54-69, 95, 101
root-sum-square (RSS)	55-56
worst-case (arithmetic)	10, 19, 21, 23-53, 54, 56, 101
Tolerance stackup report	94-105
Advanced Dimensional Management's tolerance stackup report form	36, 94-105
as a communication tool	94-95, 99
consistency and	94-95
data fields in	95-102
decision making and	94-95
general guidelines for description, part number and revision information	103
guidelines for entering dimension and tolerance data	104-105
reasons for	94-95
step-by-step instructions for filling out the Advanced Dimensional Management tolerance stackup report form	95-102
assumptions block	102

data entry block	98-100
notes block	101-102
results block	100-101
suggested action block	102
tracking and title block data	96-98
Tolerance stackup sketch	23-27, 29, 37, 39, 41, 43, 46, 49, 58, 60, 62, 64, 66, 68, 86-93, 106, 108, 111, 141, 144, 148, 152, 156, 160
annotation in	91-93
assembly shift	91-93
contributing dimensions and tolerances	91-93
dimension direction labels	24-27, 91-93
identification of the distance or gap being studied	23, 91-93
item numbers	91-93
part identification	91-93
title and reference information	91-93
tolerance stackup direction	24-27, 91-93
chain of dimensions and tolerances and as a communication tool	86, 88, 91 88, 89, 91, 93
content of	88-90
correlating with the tolerance stackup report	91-93
importance of	86, 106
part and assembly geometry in	88-90
clarity and	89
scale of	89-90
sources of	89
reason for	86, 106
required information	86-88
step-by-step directions for completing	92-93
timing of	86
visualization of the problem and	86, 91-93, 106
Trigonometry	20, 23, 52, 106-133
converting angular dimensions and tolerances into linear units	112-115
like triangles	117
projection into the tolerance stackup direction	20, 52, 106-115
rotation of parts within a linear tolerance stackup	55, 116-133
Units	5, 6, 11, 97, 98, 115-116
determining which units to report in a tolerance stackup	115-116
Variation	1-3, 4, 17-21, 23, 27, 28, 29, 31, 35, 47, 54, 55, 70, 78-81, 86-88, 106, 110, 116-117
prediction of	
by a tolerance stackup	18, 20
reducing predicted	18
fixturing	18
Worst-case tolerance stackup	10, 19, 21, 23-53, 54, 56, 101
conditional assumptions	23, 33-35, 52
step-by-step procedure	23-27
probability and	23