



# Tolerance analysis of 2-D and 3-D dimensional chains

| Calculation units       | Tolerances ISO 286 | Tolerances ANSI B4.1 | Fits ISO 286 | Fits ANSI B4.1 | ISO 2768 |
|-------------------------|--------------------|----------------------|--------------|----------------|----------|
| SI Units (N, mm, kW...) | 11                 | 7                    | h 7          | H 7            | LC 3 m   |

i  Project information

## ? Input section

### 1.0 Definition of input dimensions

#### 1.1 Table of input dimensions

| Label | Component name | Angle                                     | Component size |                      |           |           |           | Distribution       |
|-------|----------------|---|----------------|----------------------|-----------|-----------|-----------|--------------------|
|       |                |   | Nominal        | Tolerance            | Minimum   | Maximum   | Mean      |                    |
| ▲ A   |                | <input checked="" type="checkbox"/> [deg] | 30.000         | +0.20000<br>-0.20000 | 29.80000  | 30.20000  | 30.00000  | Normal (3 Sigma) ▼ |
| B     |                | <input type="checkbox"/> [mm]             | 120.000        | +0.08000<br>-0.14000 | 119.86000 | 120.08000 | 119.97000 | Normal (3 Sigma) ▼ |
| C     |                | <input type="checkbox"/> [mm]             | 120.000        | +0.08000<br>-0.14000 | 119.86000 | 120.08000 | 119.97000 | Normal (3 Sigma) ▼ |
| D     |                | <input type="checkbox"/> [mm]             | 25.000         | +0.21000<br>0        | 25.00000  | 25.21000  | 25.10500  | Normal (3 Sigma) ▼ |
| E     |                | <input type="checkbox"/> [mm]             | 25.000         | +0.21000<br>0        | 25.00000  | 25.21000  | 25.10500  | Normal (3 Sigma) ▼ |
| F     |                | <input type="checkbox"/> [mm]             | 45.000         | 0<br>-0.10000        | 44.90000  | 45.00000  | 44.95000  | Normal (3 Sigma) ▼ |
| G     |                | <input type="checkbox"/> [mm]             | 45.000         | 0<br>-0.10000        | 44.90000  | 45.00000  | 44.95000  | Normal (3 Sigma) ▼ |
| H     |                | <input type="checkbox"/> [mm]             |                |                      |           |           |           | Normal (3 Sigma) ▼ |
| I     |                | <input type="checkbox"/> [mm]             |                |                      |           |           |           | Normal (3 Sigma) ▼ |
| ▼ J   |                | <input type="checkbox"/> [mm]             |                |                      |           |           |           | Normal (3 Sigma) ▼ |

### 2.0 Definition of resulting dimension, tolerance analysis

#### 2.1 Table of resulting dimensions

| Label | Component name      | Nominal size | Required limit sizes [mm] |             |
|-------|---------------------|--------------|---------------------------|-------------|
|       |                     |              | Lower limit               | Upper limit |
| Z1    | Auxiliary dimension | 154.77241    |                           |             |
| Z2    | Auxiliary dimension | 41.47114     |                           |             |
| Z3    | Spacing of holes    | 160.23219    | 159.70000                 | 160.30000   |
| Z4    |                     |              |                           |             |
| Z5    |                     |              |                           |             |
| Z6    |                     |              |                           |             |
| Z7    |                     |              |                           |             |
| Z8    |                     |              |                           |             |

#### 2.2 Tolerance analysis

- 2.3  "Worst case" method
- 2.4 Division of toler. interval  ▼
- 2.5  "Monte Carlo" method
- 2.6 Number of simulations  ▼
- 2.7 Start of calculation

Z9

3.0  Results of tolerance analysis

3.1 Summary table of resulting dimensions

| Label | Component name      | Nominal size | Limit sizes |          | Worst Case       |                  | Monte Carlo |         |      |
|-------|---------------------|--------------|-------------|----------|------------------|------------------|-------------|---------|------|
|       |                     |              | LL          | UL       | Z <sub>min</sub> | Z <sub>max</sub> | μ           | σ       | DPPM |
| Z1    | Auxiliary dimension | 154.77241    |             |          |                  |                  | 154.5455    | 0.12183 | 0    |
| Z2    | Auxiliary dimension | 41.47114     |             |          |                  |                  | 41.4103     | 0.07725 | 0    |
| Z3    | Spacing of holes    | 160.23219    | 159.7000    | 160.3000 |                  |                  | 159.9973    | 0.10604 | 4600 |

3.2 Detailed description of resulting dimension Z3

Trend connecting line

3.3 Required limit sizes

|                 |    |            |      |
|-----------------|----|------------|------|
| 3.4 Lower limit | LL | 159.700000 | [mm] |
| 3.5 Upper limit | UL | 160.300000 | [mm] |
| 3.6 Mean        |    | 160.000000 | [mm] |

3.7 "Worst case" method

|                   |                  |  |      |
|-------------------|------------------|--|------|
| 3.8 Mean          | μ                |  | [mm] |
| 3.9 Tolerance     | ±T               |  | [mm] |
| 3.10 Minimum size | Z <sub>min</sub> |  | [mm] |
| 3.11 Maximum size | Z <sub>max</sub> |  | [mm] |

3.12 "Monte Carlo" method

|                         |                  |            |       |
|-------------------------|------------------|------------|-------|
| 3.13 Mean               | μ                | 159.997276 | [mm]  |
| 3.14 Standard deviation | σ                | 0.106039   | [mm]  |
| 3.15 Productive yield   | Y                | 99.540     | [%]   |
| 3.16 Reject             | R                | 4600       | [PPM] |
| 3.17 Minimum size       | Z <sub>min</sub> | 159.540095 | [mm]  |
| 3.18 Maximum size       | Z <sub>max</sub> | 160.483978 | [mm]  |

