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General Tolerances for Linear and Angular Dimensions

Purpose:

This document outlines Alpha Technologies Ltd. (“ATL”) standard requirements related to dimensional tolerance values for custom manufactured, fabricated or otherwise processed parts.

Scope:

This document applies to all suppliers who supply to ATL manufactured, fabricated or processed parts as part of meeting the contractual requirements of an ATL-issued and supplier-accepted Purchase Order. Specific requirements within this document apply as appropriate to the parts or services being supplied to ATL.

Definitions:

ATL: Alpha Technologies Limited.

CAD Model: The CAD Model provides a complete definition of the part; it represents ideal geometry and perfect dimensionality (BASIC size) and shape of the part. It is generally understood that basic dimensions not shown on the drawing can be obtained by querying the associated CAD model.

Dimension: A numerical value expressed in appropriate units of measure and used to define the size, location, geometric characteristic, or surface texture of a part or part feature.

Dimension, Basic: A numerical value used to describe the theoretically exact size, profile, orientation, or location of a feature or datum target. Dimensions that are extracted from CAD models are basic dimensions.

General Tolerance (aka “Title Block Tolerance”): The tolerance to be applied to all dimensions on the face of the drawing that do not have specifically indicated individual tolerance values.

ISO 2768-1: “General Tolerances — Part 1: Tolerances for Linear and Angular Dimensions without Individual Tolerance Indications”; a standard which establishes general (title block) tolerances based on tolerance “classes” (fine, medium, coarse and very coarse) and dimension size. If used, the ISO 2768 standard and the applicable tolerance class needs to be so referenced in the title block – tolerance block. (e.g. “GENERAL TOLERANCE ISO 2768 - m”)

Size, Basic: The theoretical and perfect size of a feature. The feature sizes extracted from CAD models can be considered to be basic sizes of said features.

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Tolerance: The total amount that a dimension is permitted to vary. The tolerance is the difference between the maximum and minimum limits. If a tolerance is not explicitly stated next to a dimension, refer to the tolerance block in the title block or check the general notes. A MIN or MAX dimension does not have a tolerance.

1.0 Tolerances for Linear and Angular Dimensions without Individual Tolerance Indications

All dimensions of parts prescribed by production documentation must be specified using tolerances to avoid any uncertainty and dispute during production, checks and assembly. Important functional dimensions (particularly those that could cause confusion in mounting of the parts) are usually tolerated individually by the addition of a tolerance mark or numerical value of the deviation to the respective basic size. Other dimensions where high precision of production is not required may be tolerated using general tolerances as specified on the drawing (typically via a note on the title block – tolerance block).

The present document is based off the ISO 2768-1 standard, which is an internationally recognized standard for general tolerancing of linear and angular dimensions. ISO 2768-1 prescribes general tolerances of linear and angular dimensions in four classes of accuracy: fine, medium, coarse, and very coarse. ISO 2768-1 is mainly geared for tolerancing of dimensions of parts produced using cutting operations or forming of sheets, but it is advisable and acceptable to also use the limit deviations defined in this standard with non-metallic materials and alternate fabrication processes, such as injection molding.

The general tolerances according to ISO 2768-1 are provided for 3 types: limit deviations for linear dimensions (see Table 2.1), limit deviations for broken edges (see Table 2.2) and limit deviations for angular dimensions (see Table 2.3).

There are certain limits when adopting ISO 2768-1. One of them is not applicable to sheet metal parts bending, ATL modified Table 2.3 to exclude sheet metal parts and added Table 2.4.

The other limit of ISO 2768-1 is that it only provides tolerances for metric dimensions. In order to apply the same methodology to decimal-inch dimensioned drawings, the three tables from ISO 2768-1 and the modified table 2.4 have to be converted to inch format. The present document also includes the four decimal-inch based tables presented in Tables 3.1 through 3.4.

In ISO 2768-1, angle unit is in degree and minutes, to be consistant with ANSI standard that ATL adopted, angle unit in the present document is converted to decimal degree.

This document may be referenced in a drawing either via the title block – tolerance block or via a general note. As an example, if medium tolerance class limit deviations are desired for the general tolerances to be applied to a drawing, the title block – tolerance block may include the note “GENERAL TOLERANCES PER ATL DOCUMENT 0700028, TOLERANCE CLASS: MEDIUM,” as shown in Figure 1.0.

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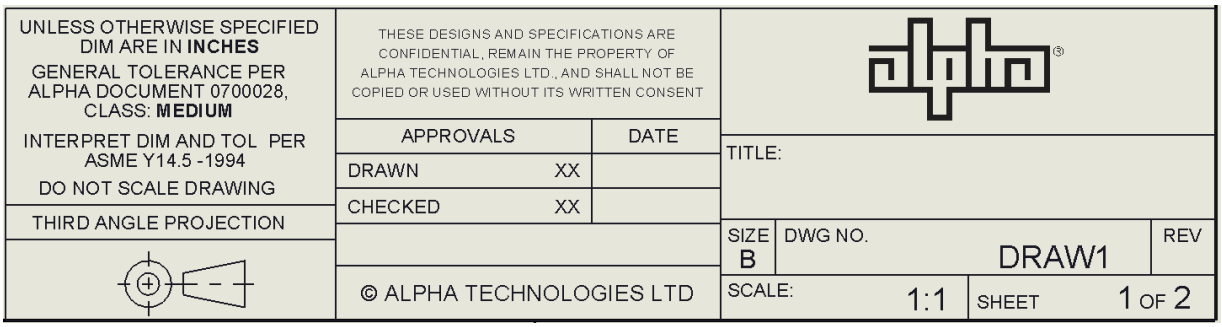

Figure 1.0: Drawing Title Block Showing Callout of General Tolerances per Present Document

2.0 General Tolerance Tables – Metric Dimensions

Table 2.1: General Tolerances for Linear Dimensions (Metric Dimensioning)

Limit Deviations in mm for Basic Dimension Ranges – Linear Dimensions							
Basic dimension range in mm				Tolerance class			
				f (fine)	m (medium)	c (coarse)	v (very coarse)
				Tolerances in mm	Tolerances in mm	Tolerances in mm	Tolerances in mm
	0.50	-	3.00	±0.05	±0.10	±0.15	-
>	3.00	-	6.00	±0.05	±0.10	±0.20	±0.50
>	6.00	-	30	±0.10	±0.20	±0.50	±1.00
>	30	-	120	±0.15	±0.30	±0.80	±1.50
>	120	-	400	±0.20	±0.50	±1.20	±2.50
>	400	-	1000	±0.30	±0.80	±2.00	±4.00
>	1000	-	2000	±0.50	±1.20	±3.00	±6.00
	2000		4000	-	±2.00	±4.00	±8.00

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Table 2.2: General Tolerances for Radii and Chamfers (Metric Dimensioning)

Limit Deviations in mm for Basic Dimension Ranges – Radii and Chamfers							
Basic dimension range in mm				Tolerance class			
				f (fine)	m (medium)	c (coarse)	v (very coarse)
				Tolerances in mm	Tolerances in mm	Tolerances in mm	Tolerances in mm
	0.50	-	3.00	±0.20		±0.40	
>	3.00	-	6.00	±0.50		±1.00	
>	6.00			±1.00		±2.00	

Table 2.3: General Tolerances for Angular Dimensions (Metric Dimensioning) except sheet metal bending

Limit Deviations in degrees for Basic Dimension Ranges – Angular Dimensions							
Basic dimension range in mm				Tolerance class			
				f (fine)	m (medium)	c (coarse)	v (very coarse)
				Tolerances		Tolerances	Tolerances
	up to		10	±1°		±1.5°	±3°
>	10	-	50	±0.5°		±1°	±2°
>	50	-	120	±0.33°		±0.5°	±1°
>	120	-	400	±0.17°		±0.25°	±0.5°
>	400			±0.08°		±0.17°	±0.33°

Table 2.4: General Tolerances for Angular Dimensions (Metric Dimensioning), sheet metal bending

Limit Deviations in degrees for Basic Dimension Ranges – Angular Dimensions							
Basic dimension range in mm				Tolerance class			
				f (fine)	m (medium)	c (coarse)	v (very coarse)
				Tolerances	Tolerances	Tolerances	Tolerances
	up to		400	±0.5°	±1°	±1.5°	±2°

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3.0 General Tolerance Tables – Imperial Dimensioning

Table 3.1: General Tolerances for Linear Dimensions (Decimal-Inch System)

Limit Deviations in inches for Basic Dimension Ranges - Linear Dimensions							
Basic dimension range in inches				Tolerance class			
				f (fine)	m (medium)	c (coarse)	v (very coarse)
				Tolerances in inches	Tolerances in inches	Tolerances in inches	Tolerances in inches
	.025	-	.125	±.002	±.004	±.006	-
>	.125	-	.25	±.002	±.004	±.008	±.020
>	.25	-	1	±.004	±.008	±.020	±.040
>	1	-	5	±.006	±.013	±.035	±.060
>	5	-	15	±.008	±.020	±.050	±.100
>	15	-	40	±.013	±.035	±.080	±.160
>	40	-	80	±.020	±.050	±.130	±.250
>	80	-	160	-	±.080	±.160	±.350

Table 3.2: General Tolerances for Radii and Chamfers (Decimal-Inch System)

Limit Deviations in inches for Basic Dimension Ranges – Radii and Chamfers							
Basic dimension range in inches				Tolerance class			
				f (fine)	m (medium)	c (coarse)	v (very coarse)
				Tolerances in inches	Tolerances in inches	Tolerances in inches	Tolerances in inches
	.025	-	.125	±.008		±.016	
>	.125	-	.25	±.020		±.040	
>	.25	-		±.040		±.080	

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Table 3.3: General Tolerances for Angular Dimensions (Decimal-Inch System) except sheet metal bending

Limit Deviations in degrees and minutes for Basic Dimension Ranges – Angular Dimensions							
Basic dimension range in mm				Tolerance class			
				f (fine)	m (medium)	c (coarse)	v (very coarse)
				Tolerances		Tolerances	Tolerances
	up to		.5	±1°		±1.5°	±3°
>	.5	-	2	±0.5°		±1°	±2°
>	2	-	5	±0.33°		±0.5°	±1°
>	5	-	20	±0.17°		±0.25°	±0.5°
>	20			±0.08°		±0.17°	±0.33°

Table 3.4: General Tolerances for Angular Dimensions (Decimal-Inch System), sheet metal bending

Limit Deviations in degrees and minutes for Basic Dimension Ranges – Angular Dimensions							
Basic dimension range in mm				Tolerance class			
				f (fine)	m (medium)	c (coarse)	v (very coarse)
				Tolerances in ° and ‘	Tolerances in ° and ‘	Tolerances in ° and ‘	Tolerances in ° and ‘
	up to		400	±0.5°	±1°	±1.5°	±2°

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