

QUALITY ASSURANCE

We're here to help with any questions or concerns. If you have questions on your quote before production starts, contact your Account Manager or email sales@yellowhammer.pl. If you need help with your order during production, you can reach out to contact@yellowhammer.pl and our Customer Support or Project Management teams that all always happy to advise you.

Specifications policy

Remember to check your quote, technical drawing and CAD file for consistency before placing your order. This will ensure that any discrepancies are caught before your order goes into production. Please read our general terms of sale and reach out to your account manager or sales@yellowhammer.pl for any questions.

Here we provide a detailed overview of how we prioritize order specifications supplied by our customers.

Primary specifications

The quote and attachments specifies:

- Technology
- Material
- Surface finish
- Tolerances
- Threads
- Custom requests

The CAD file specifies:

- Part design / geometry
- Nominal dimensions

Secondary specifications

The technical drawing provides additional details for:

- **Threads specifications:** If your part contains threads, please mention this in the order details and provide us with more details by providing the technical drawing. If your part contains threads in the 3D CAD file but you didn't mention it in your order or there is no technical drawing provided, then no threads will be applied during production.
- **Tolerance specifications:** If your part requires tighter than standard tolerances, please mention this in the order details and provide us with more details by providing the technical drawing. If your part exceeds standard tolerances and you didn't mention it in your order or there is no technical drawing provided, then standard tolerance will be applied during production.

- **Custom requests:** The quote must already reflect custom requests for corresponding details in the technical drawing or other attachment to be regarded. If the prototype you ordered is to be made of a material similar to the one you want to use in production, let us know when placing the order by sending the TDS of the material and information about which of its parameters are crucial for you in the prototype

Standard tolerances

For every line item of an order the 3 dimensions of the bounding box are measured on the parts using a Digital Caliper. If the dimensions of the part in question do not fall within the defined tolerances specified of the additive process in question, the part is rejected and reprinted. In case this results in a delay, the Yellowhammer team will inform about such event as soon as possible.

If one or more line items within one order have a higher quantity, it is required to do sample measurements. The sample size is determined by the General Inspection Level II, from ISO 2859-1, depending on the number of units:

Part quantity	Sample size
2-8	2
9-15	3
16-25	5
26-50	8
51-90	13
91-150	20
151-280	32
281-500	50
501-1200	80
1201-3200	125
3200+	200

3d printing tolerances

- SLA: Dimensional accuracy of $\pm 0.5\%$ with a lower limit of ± 0.15 mm
 - All parts are printed with a wall thickness at least 1.0 mm
 - Top and bottom layers need to have a minimum thickness of 0.3 mm (6 layers at 50 μ m)
 - All uncured resin will be removed via wash in IPA, post cured using UV light and subjected to additional postprocessing like heating in increased temperature accordingly to material specification
 - For all SLA, mSLA, LFS and DLP materials, some surfaces have the support structures removed (where applicable), and will be cleaned of all excess support/build material. To ensure consistency in higher quantities all parts are printed on the same machine if possible.
- MJF: Dimensional accuracy of $\pm 0.3\%$ with a lower limit of ± 0.3 mm

- o All unfused powder will be removed via bead blasting (first) and air blasted (second)
- SLS: Dimensional accuracy of $\pm 0.3\%$ with a lower limit of ± 0.3 mm
 - o All unfused powder will be removed via bead blasting (first) and air blasted (second)
- FDM: Dimensional accuracy of $\pm 0.5\%$ with a lower limit of ± 0.5 mm
 - o All parts are printed with 3 outline/perimeter shells or a wall thickness at least 1.2 mm
 - o Top and bottom layers need to have a minimum thickness of 0.6 mm (6 layers at 100 μm)
 - o For all FDM materials, all surfaces have a consistent visual appearance, have the support structures removed (where applicable), and will be cleaned of all excess support/build material. To ensure consistency in higher quantities all parts are printed on the same machine if possible.

CNC machining tolerances

For CNC turning, CNC milling , sheet metal bending, waterjet and laser cutting we are following the ISO 2768 standard:

Table 1 - Linear Dimensions

Permissible deviations in mm for ranges in nominal lengths	Tolerance Class Designation (Description)			
	f (fine)	m (medium)	c (coarse)	v (very coarse)
0.5 up to 3	± 0.05	± 0.1	± 0.2	--
over 3 up to 6	± 0.05	± 0.1	± 0.3	± 0.5
over 6 up to 30	± 0.1	± 0.2	± 0.5	± 1.0
over 30 up to 120	± 0.15	± 0.3	± 0.8	± 1.5
over 120 up to 400	± 0.2	± 0.5	± 1.2	± 2.5
over 400 up to 1000	± 0.3	± 0.8	± 2.0	± 4.0
over 1000 up to 2000	± 0.5	± 1.2	± 3.0	± 6.0
over 2000 up to 4000	--	± 2.0	± 4.0	± 8.0

For nominal sizes below 0.5 mm, the deviations shall be indicated adjacent to the relevant nominal size(s).

Table 2 - External Radii and Chamfer Heights

Permissible deviations in mm for ranges in nominal lengths	Tolerance Class Designation (Description)			
	f (fine)	m (medium)	c (coarse)	v (very coarse)
0.5 up to 3	±0.2	±0.2	±0.4	±0.4
over 3 up to 6	±0.5	±0.5	±1.0	±1.0
over 6	±1.0	±1.0	±2.0	±2.0

For nominal sizes below 0.5 mm, the deviations shall be indicated adjacent to the relevant nominal size(s).

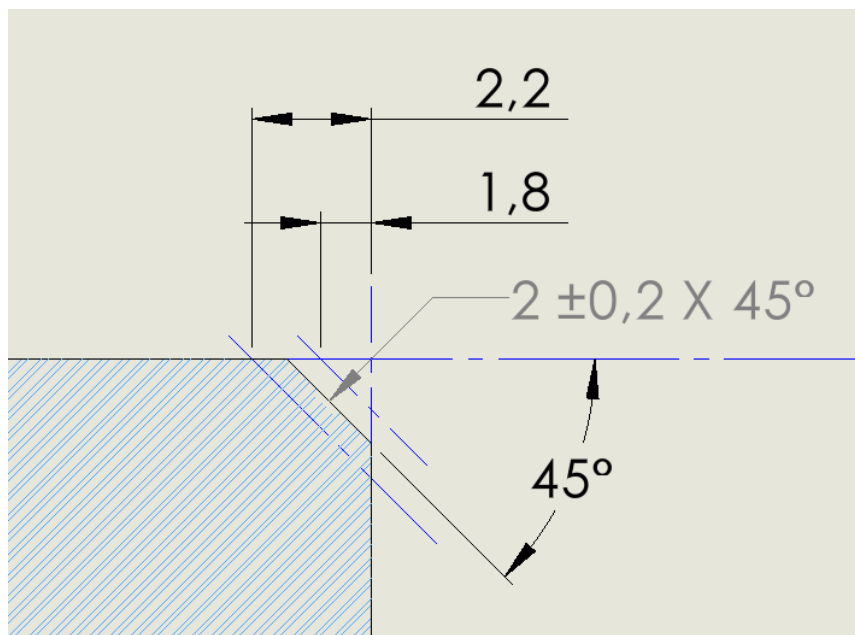


Table 3 - Angular Dimensions

Permissible deviations in mm for ranges in nominal lengths	Tolerance Class Designation (Description)			
	f (fine)	m (medium)	c (coarse)	v (very coarse)
up to 10	±1°	±1°	±1°30'	±3°

over 10 up to 50	$\pm 0^{\circ}30'$	$\pm 0^{\circ}30'$	$\pm 1^{\circ}$	$\pm 2^{\circ}$
over 50 up to 120	$\pm 0^{\circ}20'$	$\pm 0^{\circ}20'$	$\pm 0^{\circ}30'$	$\pm 1^{\circ}$
over 120 up to 400	$\pm 0^{\circ}10'$	$\pm 0^{\circ}10'$	$\pm 0^{\circ}20'$	$\pm 0^{\circ}30'$
over 400	$\pm 0^{\circ}5'$	$\pm 0^{\circ}5'$	$\pm 0^{\circ}10'$	$\pm 0^{\circ}20'$

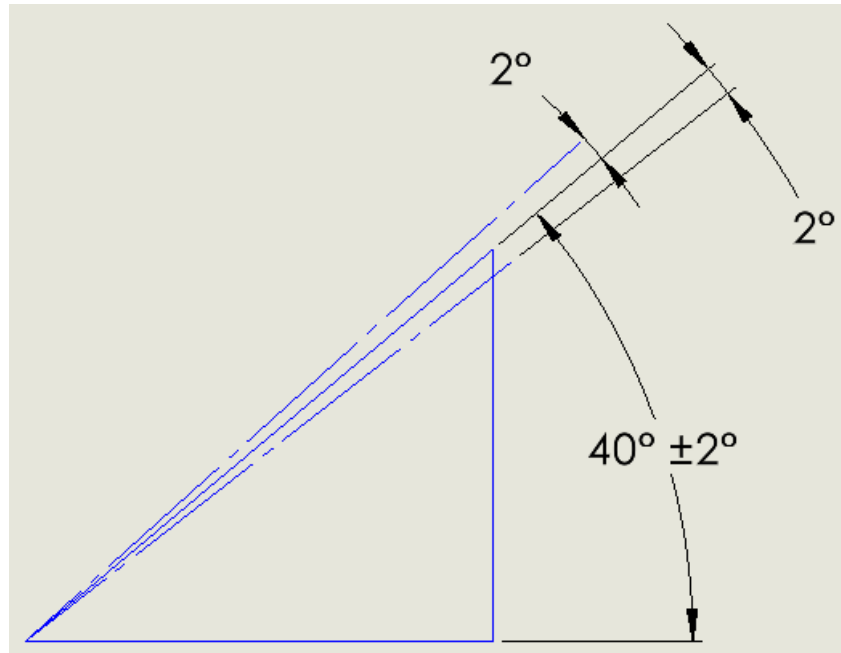


Table 4 - General Tolerances on Straightness and Flatness

Ranges of nominal lengths in mm	Tolerance Class		
	H	K	L
up to 10	0.02	0.05	0.1
above 10 to 30	0.05	0.1	0.2
above 30 to 100	0.1	0.2	0.4
above 100 to 300	0.2	0.4	0.8
above 300 to 1000	0.3	0.6	1.2
above 1000 to 3000	0.4	0.8	1.6

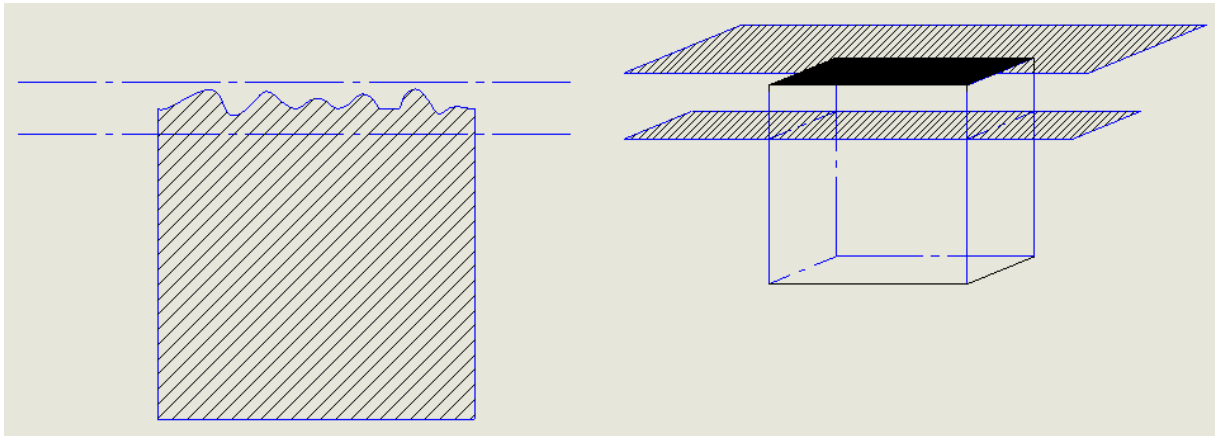


Table 5 - General Tolerances on Perpendicularity

Ranges of nominal lengths in mm	Tolerance Class		
	H	K	L
up to 10	0.2	0.4	0.6
above 10 to 30	0.3	0.6	1.0
above 30 to 100	0.4	0.8	1.5
above 100 to 300	0.5	1.0	2.0

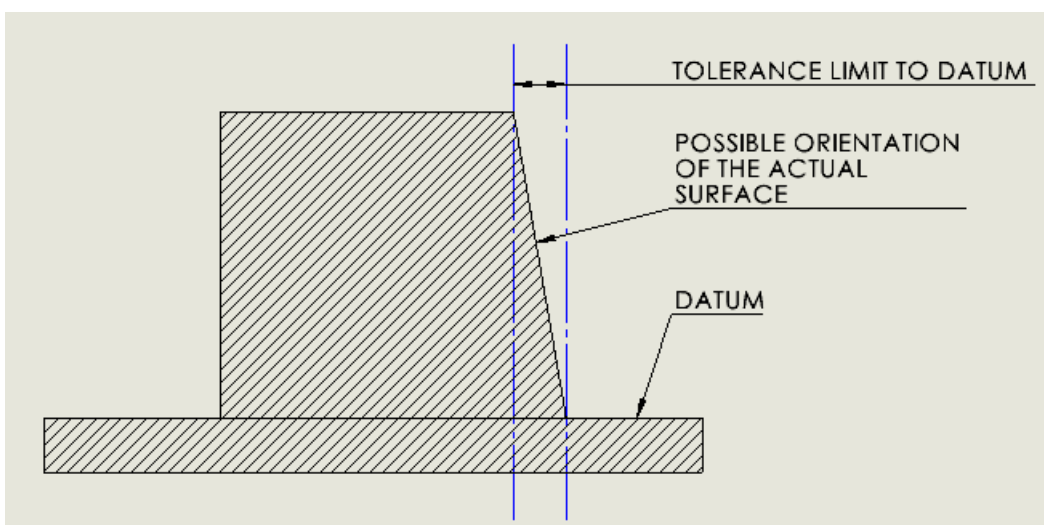


Table 6 - General Tolerances on Symmetry

Ranges of nominal lengths in mm	Tolerance Class		
	H	K	L
up to 10	0.5	0.6	0.6
above 10 to 30	0.5	0.6	1.0
above 30 to 100	0.5	0.8	1.5
above 100 to 300	0.5	1.0	2.0

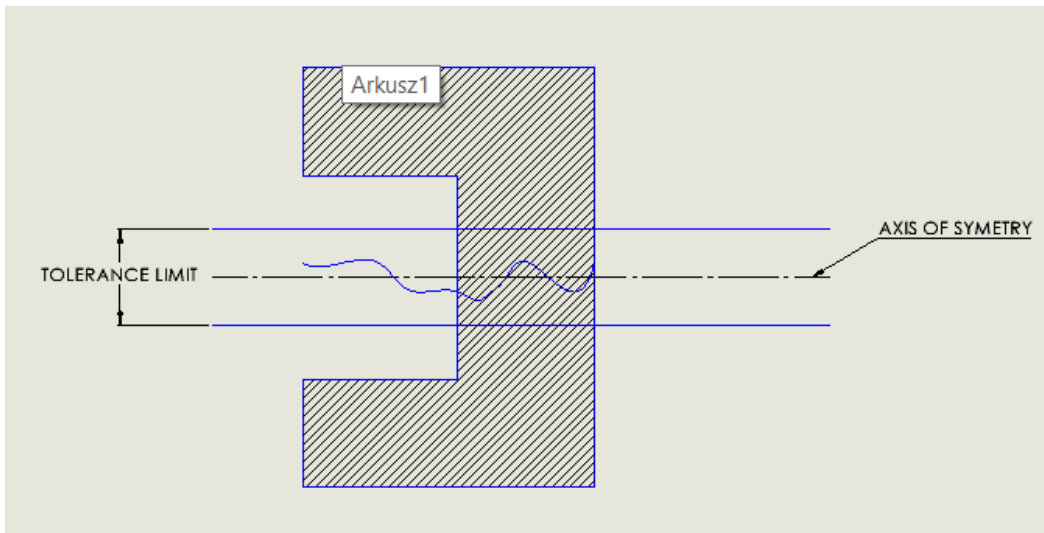


Table 7 - General Tolerances on Circular Run-Out

Ranges of nominal lengths in mm	Tolerance Class		
	H	K	L
	0.1	0.2	0.5

