MUELLER

Tank Head Tolerances Guide

As an industry leader in tank component fabrication, Paul Mueller Company holds itself to high quality standards. The standards for tank head fabrication detailed in this white paper may not be the same standards used by other tank component fabricators. Mueller® tank head tolerances are calculated to meet the needs of the complete vessel fabricators we serve while taking into consideration modern tank head fabrication techniques and procedures.

Note: *These tolerances apply to austenitic (300 series) material only. Any tolerances for special or non-standard material should be discussed with your salesperson. When products are designed as ASME, the configurations and tolerances set forth in Division 1, Section VIII shall take precedence over all other tolerances.*

STRAIGHT FLANGE

Both straight flange and finished inside depth cannot be held simultaneously; therefore, tank heads will be trimmed to comply with overall depth tolerances, as long as the minimum straight flange is held as follows:

Head Thickness	Standard Straight Flange	Minimum Straight Flange
12 gauge or less	1″	.5″
10 gauge or greater	1.5″	.5″

If the standard straight flange length must be held, please notify your sales representative of the requirement in advance of fabrication, and Paul Mueller Company will apply a tolerance of ±.125″ and allow the depth to become a reference dimension. The maximum straight flange we offer is 3″ and is special order only.

The toe-out and toe-in tolerances for typical flanged-and-dished heads will be ±.0625″ as measured at 90° from the machined edge. There shall be a maximum of a 2″ straight flange for all heads and cones with a knuckle radius under 2″ and material thickness 10 gauge and thicker*. A tolerance of .09375″ on the toe-out and .0625″ on the toe-in shall be applied to all heads with less than a 2″ knuckle radius as described above.

***Note:** Material thicknesses of 12 gauge and thinner cannot be flanged with a 2″ straight flange using a small knuckle radius.*

CIRCUMFERENCE AND FINISHED INSIDE DEPTH

The following tolerances apply to all typical flanged-and-dished tank heads.
Please consult your sales representative for specialized head tolerances.

Head Diameter	Circumference	Finished Inside Depth
35″ or less	±.125″	+.5″ to –.125″
36″ through 96″	±.125″	+.5″ to –.125″
97″ through 144″	±.125″	+.75″ to –.125″
145″ and above	±.125″	+1″ to –.125″

Note: *Out-of-round shall not exceed 1% of the outside diameter.*

Tank Head Tolerances Guide

CIRCUMFERENCE AND FINISHED INSIDE DEPTH (CONTINUED)

If the finished inside depth must be held, please notify your sales representative of the requirement in advance of fabrication; Mueller will apply a tolerance of ±.125″ on the depth and there will not be any tolerance, except minimum, held on the straight flange.

All toriconical heads have a circumference tolerance of ±.5″. Cones that are not flanged do not have a circumference tolerance and will require trim and fit at time of installation by the customer. All cones have a finished inside depth (FID) tolerance of ±1″.

Cones that are swaged at the bottom end may have an additional height tolerance of –0″/+.5″ above the typical tolerance.

MINIMUM THICKNESS

Forming Allowances

Minimum thickness of material after forming, but not including polishing, for typical flanged-and-dished heads:

ASME Flanged-and-Dished Tank Heads

Head Diameter	.5″ Thick or Less	Greater Than .5″ Thick
16″ to 300″	Add .03125″	Add .625″

80:10 Tank Heads

Head Diameter	.5″ Thick or Less	Greater Than .5″ Thick
20″ to 2200″	Add .0625″	Add 15%

2:1 Elliptical Tank Heads

Head Diameter	.5″ Thick or Less	Greater Than .5″ Thick
20″ to 168″	Add .0625″	Add 15%

EXAMPLE: *A .375″ thick ,ASME flanged-and-dished tank head, with an AS IS/AS IS material finish and a #2/#2 weld finish, has a .375″–.03125″ forming allowance to equal .3437″ total minimum thickness after forming, but before polishing.*

Non-code heads with minimum thickness requirements must be special ordered and noted in advance of fabrication for assurance and verification. For custom flanged-and-dished, toriconical, or other designs with special order geometry, please contact your sales representative for minimum thickness after forming.

Tank Head Tolerances Guide

MINIMUM THICKNESS (CONTINUED)

Grinding Allowances

Due to the custom nature of fabricating components, Paul Mueller Company recommends contacting your sales representative to review your specific application and assess an agreed upon final minimum thickness with your quotation.

Reverse Dish

Typical dished and flanged heads will have a tolerance for reversed conditions as follows:

Head Diameter	Maximum Reverse
0″ through 100″	.125″
101″ through 144″	.1875″
145″ and above	.25″

Measurement of reverse will be accomplished by the placement of a 12″ straight edge from the knuckle to dish tangent toward the center hole and measuring the gap between the straight edge and the outer surface of the head. For specialized head types (specifically toriconical heads), contact your sales representative for additional tolerance information.

Flatness

When laid on a flat surface, the head (squared or beveled edge) will not exceed a maximum gap of .25″ across a 48″ distance, and will not have an abrupt change greater than .0625″ over a 12″ distance along the surface. This tolerance does not apply to flanged-only heads (specifically with welded seams) or specialized head types. For additional clarification, please consult your sales representative.

Dish Radius (Crown Radius)

The dish radius (crown radius) tolerance for dished heads will be in compliance with ASME, Section VIII, Div 1, UG-81(a), unless the order specifically states that the head must meet UG-81(b) for external pressure designed heads.

Tank Head Tolerances Guide

MINIMUM THICKNESS (CONTINUED)

Grinding Allowances

Flared and Dished Heads

Flared and dished heads shall have the following tolerances:

Diameter	Outside Diameter	Inside Diameter	Out-of-Round
All	+.5″ through –0″	±.5″	Not to exceed 1% of outside diameter.

Note: *Inside diameter tolerance is for reference only.*

Dished-Only Heads

Dished-only heads shall have the following tolerances:

Diameter	Outside Diameter	Inside Diameter	Out-of-Round
All	N/A	+.5″ through –0″	Not to exceed 1% of outside diameter.

Note: *Dished-only heads will be sold on the basis of outside diameter only.*

Flanged-Only Heads

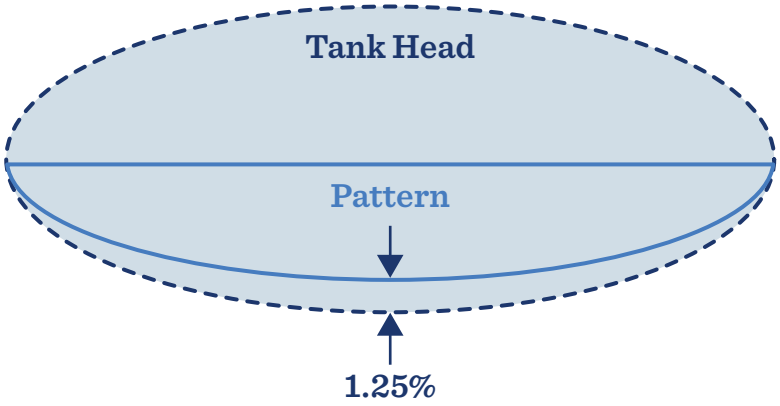
Flanged-only heads shall have a circumference tolerance of ±.125″. Some warpage of the flat portion may be expected depending on the diameter, material thickness, and knuckle radius. Manual pressure to obtain flatness is acceptable.

Head Diameter	Flatness Tolerance
60″ or less	±.1875″
61″ through 95″	±.25″
96″ through 120″	.±.5″

Note: *Flanged-only head flatness tolerances do not apply to heads with weld seams.*

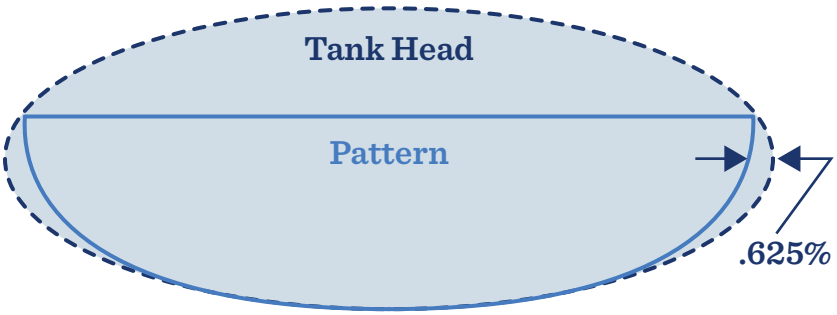
Tank Head Tolerances Guide

ASME Code Pattern Tolerances



DEEP TANK HEADS

ASME Code heads are allowed a 1.25% radius tolerance per drawing.



SHALLOW TANK HEADS

ASME Code heads are allowed a .625% radius tolerance per drawing.

PAUL MUELLER COMPANY

Who We Are

At Paul Mueller Company, we are united by a belief that the only quality that matters is quality that works for life. With every piece of processing equipment we build, our goal is to have lasting impact. This collective vision has led us from a small sheet metal shop to a global supplier of heating, cooling, processing, and storage solutions. Our equipment allows farmers, brewers, and engineers to keep their products fresh and their inventory strong. Whether our equipment preserves milk in rural areas or helps manufacture medicine with broad health benefits, we are making an impact across the globe.

Creating Quality for *Life*

Our Products and Services

Skids and Integrated Systems
- Small Scale to Custom Automated Systems
- Modular Process Systems
- Water-for-Injection Distribution Skids

Custom Tanks and Vessels
- Mixing, Storage, and Process
- Design and Fabrication
- Routine to Extreme Specialty Process

Refrigeration Solutions
- Falling Film Chillers
- Batch Chillers
- Packaged Chillers
- Air-Cooled Condensing Units
- Heat Recovery
- Controls

Clean Utilities
- Pure Steam Generators
- Multiple-Effect Stills
- Water-for-Injection Distribution Systems

Heat Transfer Solutions
- Heat Transfer Surfaces
- Preformed Heat Transfer Panels
- Plate Heat Exchangers
- Replacement Parts
- Service and Repair

Component Products
- Tank Heads
- Tank Shells
- Manways
- Agitators

Cleaning Systems
- Clean-in-Place (CIP) Systems
- Chemical Dosing Systems

Specialty Hauling with Mueller Transportation, Inc.
- Door-to-Door Specialty Handling
- Oversized Hauling Capabilities

Industries We Serve

- Animal Health
- Battery Production and Recycling
- Beverage
- Brewing
- Chemical
- Dairy Farm
- Dairy Processing
- Food
- Heat Transfer
- HVAC
- Mining
- Oil and Gas
- Personal Care
- Pharmaceutical
- Refrigeration
- Tank Fabrication
- Wine
- And More

Facilities and Resources

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- Expert Fabricators and Manufacturing Staff
- Onsite, Experienced Engineering Department

Project Support Services

- Comprehensive, Customizable Documentation Packages
- IQ/OQ Protocols and Execution
- Seamless Shipping with Mueller Transportation, Inc.
- Expanded Scope Facility Construction and Expansion
- Installation Supervision and Site Acceptance Testing

Quality and Process Certification

- ASME (American Society of Mechanical Engineers)
- ASME BPE (American Society of Mechanical Engineers Bioprocessing Equipment Standard)
- API (American Petroleum Institute)
- UL (Underwriters Laboratories)
- CSA (Canadian Standards Association)
- PED CE (Pressure Equipment Directive Certification)
- UKCA (United Kingdom Conformity Assessed)
- CRN (Canadian Registration Number)
- TSSA (Technical Standards and Safety)

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