



GLASS STANDARDS & TOLERANCES

Guidelines for ordering glass, taking measurements, and tolerance ranges

Ordering Glass

In an effort to better serve our customers, we have compiled the following information on our operating procedures in regards to heavy glass orders. We have refined this process and feel it works best to ensure our customers receive the glass they need.

- We request all heavy glass orders be faxed or emailed to us to help prevent any misunderstanding in what you are ordering. Call-in orders are not accepted.
- We assume center line measurements where applicable, unless you state otherwise. (See page 4)
- We assume dimensions you provide are opening sizes (we make glass deductions), unless you state otherwise.
- Our units include all necessary polycarbonates (and the appropriate deductions are made to the glass) unless you state otherwise.
- We will fax or email a confirmation to you that we request you review, sign and fax or email back before we process your order. This gives the opportunity for you to ensure we are providing you what you have requested.
- Unless specified by you on each order, we will use whatever hardware we feel is appropriate. Should you request another manufacturer's hardware (i.e. CRL) there may be an additional cost to you.
- In most cases unless you tell us otherwise on the order, we will use U-Channel vs. Clips if appropriate. If you desire a certain set-up (clips rather than u-channel, header vs. no header, and or specific placement of any hinges or clips), please indicate this on your initial faxed/emailed order.
- Glass ordered from our factory is inspected at the factory for correctness to specifications, and for any defects in the glass (seeds, scratches and chips).

- Once the glass passes inspection it is wrapped for protection. You should be able to transport your glass directly to the job site before unwrapping it.
- We follow the standard industry guidelines as far as acceptable tolerances and defects. Enclosed is an outline of these standards for your reference.

Note: Towel bars, handles and knobs on doors may hit walls and other bathroom fixtures when the door is open. Please take this into consideration when working with a customer to design their shower enclosure.

Industry Standards

HMI Cardinal strives to provide shower door glass that not only meets industry standards, but exceeds them wherever possible. We utilize state of the art fabrication equipment and glass industry best practices to consistently produce high quality fabricated glass enclosures. When glass products are subjected to inspection under conditions outside of the normal use, flaws and imperfections can be observable. Due to the wide range of fabrication and handling processes required to add strength, function and beauty to fabricated glass products an acceptable amount of flaws are to be expected in a finished glass piece. Industry standards are outlined as a guide to what is and is not acceptable as well as to define known elements that occur within Heat tempered glass. Observable flaws allowed under this standard will not cause glass products to break or fail.

All inspections outlined below are done with the viewer's angle at 90 degrees to the glass surface with uniform diffused background lighting that simulates daylight. Q3 glass is inspected as laid out on the following page:



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LINEAR BLEMISHES (scratches and "rubs").

- Place specimen approximately 160" from view (about 13').
- Move toward specimen until blemish is detected. The distance between the specimen and the viewer when the blemish is first detectible is the "detection distance."

If the detection distance is:	the blemish is:
> 132"	Heavy
132" - 40"	Medium
39" - 8"	Light
< 8"	Faint

Evaluate defects using this chart	Q3 GLASS
Faint Blemish <3"	Allowed
Faint Blemish >3"	Allowed
Light Blemish <3"	Allowed
Light Blemish >3"	Allowed
Medium Blemish <3"	Allowed w/24" Separation
Medium Blemish >3"	Not Allowed
Heavy Blemish	Not Allowed

In summary...

if a scratch is visible at 11', it's a cause for rejection. If a scratch is visible from between 132" - 40" AND it's over 3" long, it's a cause for rejection. If it's visible from between 132" - 40" AND it's under 3" long, it's allowable as long as it's separated by a

POINT BLEMISHES (bubbles, pits, knots, dirt) are inspected as follows:

- Place specimen 39" from viewer.

If defects are observed, evaluate using the chart:	GLASS
Blemish < .02" (1/64")	Allowed
.02" < .03" (1/32")	Allowed
.03" < .05" (1/16")	Allowed
.05" < .06" (1/16")	Allowed with 24" Separation
.06" < .08" (3/32")	Allowed with 24" Separation
> .08"	Not Allowed

NOTE:

- This chart applies to glass < 1/4" thick. 3/8" and 1/2" glass contain proportionally larger blemishes at the same separation distances.
- Stock sheets < 75 square feet add one (1) rejectable point blemish, > 75 square feet add two (2).
- See ASTM Standard for Evaluation of Rolled Pattern Glass Products.

ALLOWABLE EDGE CHIPS (Unless edges are ground or polished):

- Chip Depth - Measured from the face of the glass into the thickness. Allowed up to 50% of the glass thickness.
- Chip Width - Perpendicular distance from the edge of the glass to the inner edge of the chip. Allowed up to half the glass thickness or 1/4" whichever is greater for glass.
- Chip Length - Distance parallel to edge of glass from one edge of a chip to the other. Allowed up to two (2) times the chip width.



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Dimensional Tolerance for Rectangles
+ 0 - 1/16"

Bath and Shower Enclosures are fabricated to Tight Tolerances
+ 0 - 1/16"

HOLE AND NOTCH TOLERANCES

- For dimensions of hole center from specified edge +/- 1/16"
- For dimensions between hole centers +/- 1/16"
- Chips and flakes will not exceed 1/16"
- Notch dimensions for glass 1/4" and under +/- 1/16"
- Notch dimensions for glass 3/8" and 1/2" +/- 1/16"

TEMPERED GLASS BOW AND WARP TOLERANCES

This chart lists bow allowed over entire dimension. Localized warp will not exceed 1/16" over any 12" span.

EDGE DIMENSIONS	GLASS THICKNESS					
	1/8"	3/16"	1/4"	5/16"	3/8"	1/2"
0 - 20"	1/8"	1/8"	5/64"	5/64"	5/64"	5/64"
>20" - 35"	5/32"	5/32"	1/8"	1/8"	5/64"	5/64"
>35" - 47"	13/64"	13/64"	5/32"	5/32"	5/64"	5/64"
>47" - 59"	9/32"	9/32"	13/64"	13/64"	13/64"	5/64"
>59" - 71"	23/64"	11/32"	9/32"	9/32"	13/64"	5/32"
>71" - 83"	15/32"	15/32"	11/32"	11/32"	15/64"	13/64"
>83" - 94"		17/32"	15/32"	15/32"	9/32"	13/64"
>94" - 106"		21/32"	17/32"	17/32"	11/32"	9/32"
>106" - 118"		3/4"	21/32"	21/32"	15/32"	3/8"
>118" - 130"			3/4"	3/4"	9/16"	15/32"
>130" - 144"			13/16"	13/16"	21/32"	17/32"

TEMPERED SIZE RANGE - 4" x 10" minimum up to 84" x 144" maximum. 1/8" tempered maximum 40" x 80". Excessive warping can occur in larger pieces of 1/8" tempered glass.

STRAIN PATTERN - Tempered glass contains a strain pattern or "Quench Marks" that appear as areas of shadows in a pattern that corresponds to the location of air nozzles in the tempering furnace quench process. This condition becomes more visible in certain conditions.

- Under certain lighting conditions, like polarized sunlight.
- When the glass is viewed at glancing angles
- With tinted glass, especially when multiple lites are combined in laminated and insulating constructions

The Strain Pattern is not considered a defect in tempered glass products.

SPONTANEOUS BREAKAGE - Tempered glass is subject to rare spontaneous breakage, where the glass will break for no apparent reason. For applications where additional glass strength is required due to thermal stress and safety glass is not mandated, heat strengthened glass is recommended.

INSPECTION - Tempered glass is inspected in accordance with ASTM C1048.

FABRICATION - All fabrication that penetrates the glass (i.e. holes, notches) must take place PRIOR to tempering.



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GLASS THICKNESS	DECIMAL EQUIVALENT	METRIC EQUIVALENT	WEIGHT
5/32"	0.156"	4.0 mm	2.02 lb per square foot
3/16"	.1875"	5.0 mm	2.43 lb per square foot
1/4"	0.25"	6.0 mm	3.24 lb per square foot
5/16"	0.3125"	7.9 mm	4.06lb per square foot
3/8"	0.375"	10.0 mm	4.87 lb per square foot
1/2"	0.50"	12.0 mm	6.49 lb per square foot

