

Culet and Girdle Assessment

Assessing culet and girdle in standard round brilliant diamonds at the GIA Laboratory

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Culet size and girdle thickness are important elements in the Gemological Institute of America's (GIA) new Diamond Cut Grading System, as they can affect evaluations of the face-up appearance and design aspects of overall cut quality (see figure 1). This article reviews the criteria and methods used by the GIA Laboratory to assess culet and girdle, explains their role in the new cut grading system and presents specific examples of different culet sizes and girdle thicknesses. It is important to note that there will be no change in the GIA Laboratory's methods for assessing culet size and girdle thickness due to the introduction of the new cut grading system.

In GIA's International Diamond Grading System™, culet size (see figure 2) is described as none, very small, small, medium, slightly large, large, very large or extremely large. Girdle thickness is described as extremely thin, very thin, thin, medium, slightly thick, thick, very thick and extremely thick. Girdle thickness is assessed as a range from the thinnest



Figure 1. Culet size and girdle thickness are considered mainly under the design aspect of the GIA Diamond Cut Grading System, particularly as they affect the weight ratio — a diamond's overall weight in relation to its diameter — and durability — the risk of damage inherent in its proportions — of a standard round brilliant diamond. When they affect face-up appearance, they are considered under that aspect as well.

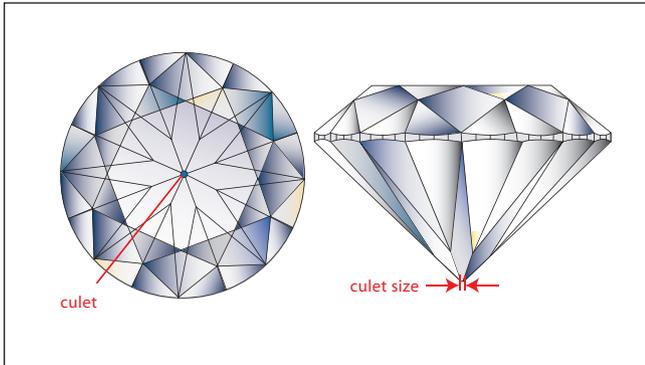


Figure 2. The culet is a facet placed at the tip of the pavilion where the mains meet to reduce the risk of damage on loose diamonds. Although the definition of culet is limited to the facet located at the bottom of the pavilion, this term is commonly used to refer to this area in general.

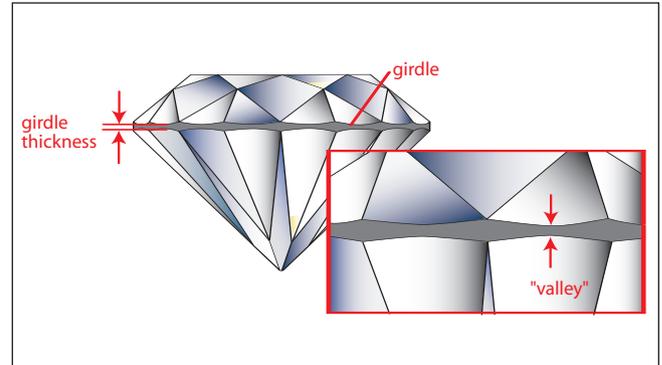


Figure 3. The girdle is a narrow section of the diamond separating the crown from the pavilion and functions as the diamond's setting edge as well as to reduce the risk of damage. Girdle thickness — as described by the GIA Laboratory — represents the thinnest and thickest "valley" positions on the girdle of the round brilliant — i.e., "thin areas" located where the upper and lower half facets meet — relative to the average diameter of the diamond.

to thickest "valley" positions; these "valley" positions — or "thin areas" — are located where the upper and lower half facets come closest to meeting (see figure 3).

Both culet size and girdle thickness can be measured through the use of a noncontact optical measuring device or with the GIA Multi-Purpose Gemological Reticle and a standard gemological microscope. These measurements can be expressed as a percentage relative to the average diameter of the diamond, which graders may use as a guide when making visual assessments. Visual observation, however, remains the final decisive factor. Measured results are susceptible to the variability inherent in measurement device tolerances and clarity characteristics as well as irregularities in shape or angle. This is especially true when distinguishing between none, very small and small culets, and extremely thin and very thin girdles. In many cases, variations between measured values and visually assessed sizes occur at critical culet and girdle category boundaries where they would also affect the diamond's overall cut grade — e.g., the border between a very thin and thin girdle.

Figures 4 and 5, shown on page 72, describe how culet size and girdle thickness are factored into the GIA Diamond Cut Grading System for standard round brilliant diamonds on the D-to-Z color scale and Flawless-to-I3 clarity scale. To determine the significance of culet size and

girdle thickness to the overall cut grade, GIA researchers used computer modeling and visual observations to examine the effects of these proportions on face-up appearance — for example, eye-visible culets that may disrupt the face-up pattern — and also discussed the aspects of weight ratio and durability with diamond manufacturers and retailers to consider the importance of these elements to the end consumer. GIA concluded that a diamond should not weigh more than its face-up appearance warrants and its proportions should not increase the risk of damage when set in jewelry and used for regular wear.

CULET

The culet is a polished facet placed parallel to the table, the purpose of which is to prevent damage to the point. In the GIA Laboratory, graders first assess culet size face-up, looking through the table facet at 10X magnification. The size of this facet is assigned a description from none to extremely large. If there is no culet facet, the size is reported as none. When the culet is at more than a slight angle to the table facet, the size is also reported as none, as it is no longer considered a culet but an extra facet. Graders observe the diamond in profile view to assess this angle.

The grader also considers the presence of any clarity characteristics in his or her assessment. When a chip, cavity or

CULET SIZE AND THE GIA CUT GRADE

CULET SIZE	HIGHEST CUT GRADE OBTAINABLE
none very small small	excellent
medium	very good
slightly large large	good
very large	fair
extremely large	poor

Figure 4. This chart describes the highest obtainable cut grade a diamond may receive with each culet size description. For example, "good" is the highest obtainable cut grade a diamond with a slightly large culet could receive regardless of other relevant cut parameters.

indented natural — each constituting an opening in the surface — is present at the culet, only the remaining portion of the culet facet is considered when assessing culet size (see figure 6; figures 6 to 9 shown on page 76), while the characteristic itself is considered in the diamond's clarity grade.

The culet may also be left as an unpolished natural surface. If nearly parallel to the table facet, it is considered a culet and assigned an appropriate size description (see figure 7); the natural is also considered in the diamond's clarity grade. Abrasion, when present, does not affect the culet size, but prevents a clarity grade of Flawless and is also considered in the diamond's polish assessment (see figure 8).

To support their visual assessment of culet size, graders use photographic references as well as the culet-size percentage. A description of the culet size is assigned based on the visual appearance at 10X magnification. Table 1, GIA Culet Size Descriptions, shown on page 73, provides definitions and typical examples for each description and their relationship to the calculated culet-size percentages.

GIRDLE

The girdle is a narrow section of the diamond separating the crown from the pavilion and functions as the

GIRDLE THICKNESS AND THE GIA CUT GRADE

		THICKEST PORTION								
		extremely thin	very thin	thin	medium	slightly thick	thick	very thick	extremely thick	
THINNESS PORTION	extremely thin	GD	VG	VG	VG	VG	VG	GD	FR	
	very thin		VG	VG	VG	VG	VG	GD	FR	
	thin			EX	EX	EX	VG	GD	FR	
	medium				EX	EX	VG	GD	FR	
	slightly thick					EX	VG	GD	FR	
	thick						VG	GD	FR	
	very thick							GD	FR	
	extremely thick								FR	

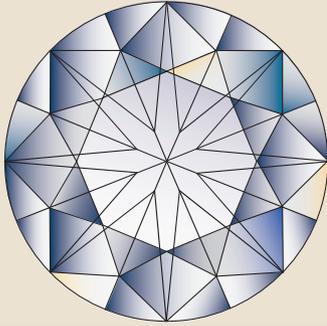
HIGHEST CUT GRADE OBTAINABLE

- EX = excellent
- VG = very good
- GD = good
- FR = fair

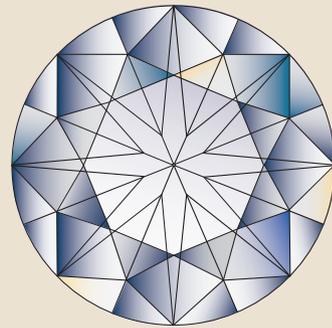
Figure 5. This chart describes the highest obtainable cut grade a diamond may receive with each possible combination of minimum to maximum girdle thickness descriptions. For example, "very good" is the highest obtainable cut grade a diamond with a very thin girdle could receive, regardless of other relevant cut parameters.

GIA Culet Size Descriptions

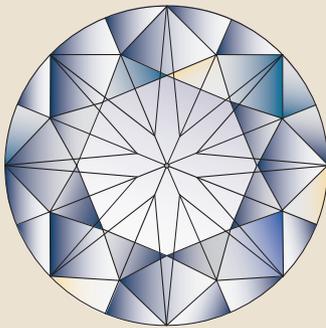
None: No culet facet. When all eight mains meet each other it may be referred to as "pointed."



Very Small

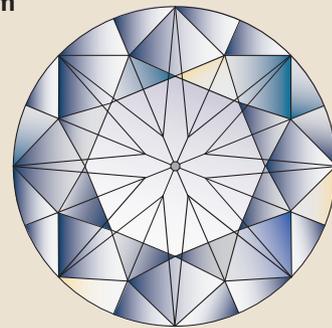


Small



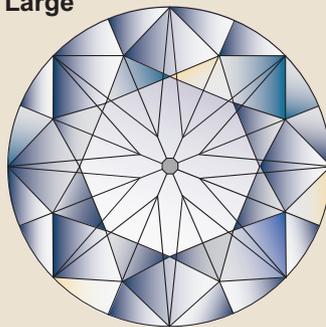
≈ 1.5 %

Medium



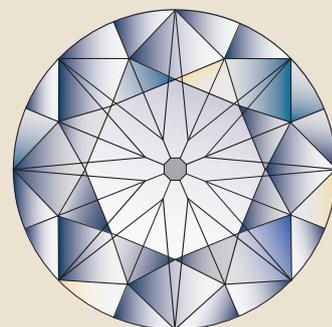
≈ 3 %

Slightly Large



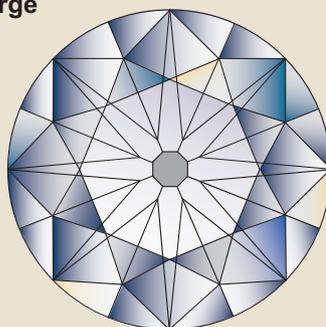
≈ 5 %

Large



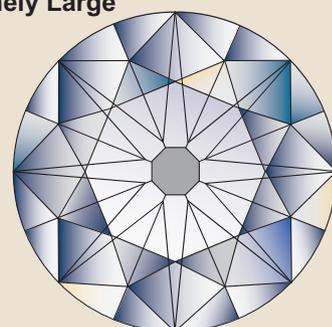
≈ 7 %

Very Large



≈ 11 %

Extremely Large



≈ 15 %

$$\text{Culet Size \%} = \frac{\text{culet size (mm)}}{\text{average diameter (mm)}} \times 100$$

Table 1. This table describes the visual appearances and provides examples for each GIA culet size description. Typical culet-size percentages, shown in blue, are for culets that are nearly parallel to the table facet and octagonal in shape. Distinctions between none, very small and small are best evaluated only on their visual appearance since these fine measurements are more susceptible to measurement device tolerances and the presence of clarity characteristics. For these same reasons, in addition to the fact that the culet may be irregular or not parallel to the table, assessments for all sizes of culet must be verified visually. Images and culet-size percentages represent typical values for each category, not the highest or lowest point of that range.

(Continued on page 76)

Culet and Girdle Assessment

(Continued from page 73)

diamond's setting edge as well as to reduce the risk of damage. The girdle of a standard round brilliant diamond is scalloped and consists of 16 "valley" and 16 "hill" positions created by the final brillianteing of the diamond (see figure 9). Graders visually assess girdle thickness at

10X magnification with the diamond in profile view and consider each of the 16 "valley" positions and their thicknesses relative to the diameter of the diamond. As with culet size, the grader must also consider the presence of clarity characteristics and the angle of the girdle surface in relation to the table plane.

An extra facet, natural, chip, cavity or indented natural located on the crown or pavilion at the girdle edge can



Figure 6. The culet of this diamond has chipped, leaving no flat area parallel to the table; therefore, culet size is reported as none.



Figure 7. The culet of this diamond is a natural. It is nearly parallel to the table facet and is, therefore, considered as a culet; it is assigned a culet size of slightly large based on its relative size.



Figure 8. Abrasion on a culet does not affect the determination of its size. In the image on the left, although the abrasion, in effect, replaces the whole culet, it still would be described as none. In the image shown right, the abrasion along the edge of the culet also would not affect the description of its size.

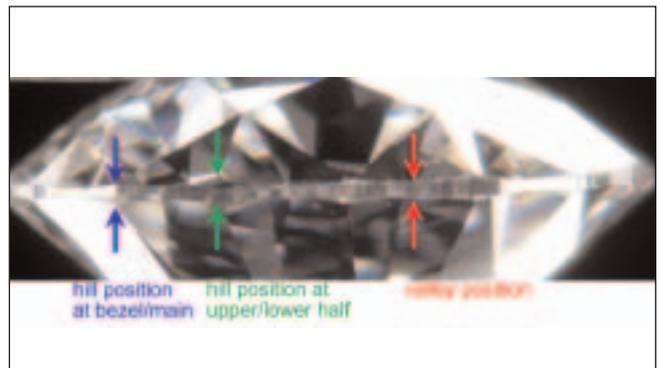


Figure 9. The girdle of a standard round brilliant is scalloped with eight "hill" positions at bezel-main locations, shown in blue, eight more "hill" positions at upper-lower half facet locations, shown in green, and 16 "valley" positions in between, shown in red. When the round brilliant is fully symmetrical, hill positions are roughly 1.7 percent thicker than valley positions — e.g., if the girdle thickness percentage is 3.7 percent at the hills, it would be 2.0 percent at the valleys. However, this relationship can change dramatically when the girdle is irregular, as caused by various symmetry features, the presence of naturals or extra facets at the girdle, the application of painting or digging-out or combinations of these aspects.

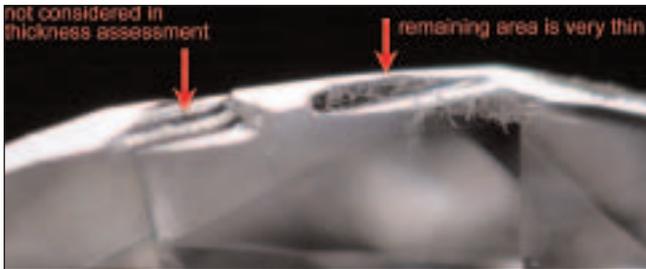


Figure 10. The indented natural on the left breaks through both the crown and pavilion and is, therefore, not considered in the girdle thickness. The indented natural located on the right, however, breaks through the pavilion side only and thins the girdle; the remaining portion of the girdle in this example is considered very thin. Both indented naturals are considered in the diamond's clarity grade.



Figure 11. An extra facet on the pavilion side of this diamond narrows the girdle at a "hill" position. The girdle thickness in this example would be reported as a range from thin — at the location of the extra facet — to slightly thick — the thickest "valley" position present.

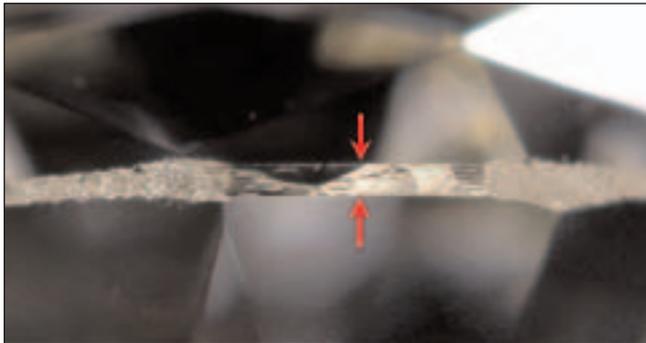


Figure 12. The natural located on this girdle, indicated by red arrows, extends from the crown to the pavilion and lies in the girdle surface, nearly perpendicular to the table. It is considered part of the girdle and is included in assessing its thickness.

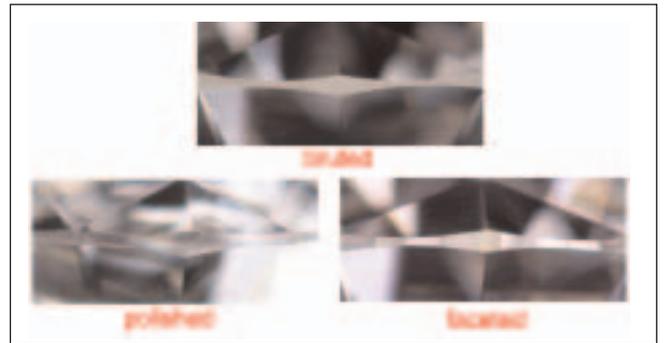


Figure 13. The girdle surface of a round brilliant diamond is initially bruted to obtain its round shape. The girdle may retain this bruted condition on a polished diamond, shown top, or it may be polished, bottom left, or faceted, bottom right.

narrow the girdle at this location. In these cases, the remaining area is considered in the thickness assessment even when the feature is located at a "hill" position (see figures 10 and 11). If a "knife-edge" is created, the girdle thickness is reported as extremely thin. If a chip, cavity or indented natural breaks through the girdle onto the crown and pavilion, the effect on girdle thickness is not considered in the assessment (see figure 11). All of these characteristics are accounted for in the diamond's clarity grade.

When a natural lies in the girdle and is nearly perpendicular to the table plane, it is considered part of the girdle and included in the thickness assessment (see figure 12). Conversely, if the natural is tilted so that it is no longer perpendicular to the table plane, it is excluded from any girdle thickness

consideration. In this case, if only a knife-edge is remaining, the thickness is reported as extremely thin; otherwise, any remaining perpendicular area is assessed. Naturals are considered in the diamond's clarity grade and symmetry evaluation.

To support their visual assessment of girdle thickness, graders use photographic references as well as the girdle-thickness percentages of the "valley" positions. A description of the girdle thickness is assigned based on the visual appearance at 10X magnification. When both the thinnest and thickest results fall in the same category, a single description is reported, such as very thin. More often, however, thickness is reported as a range from the thinnest to thickest "valley" areas, e.g., very thin to medium. Variation in girdle thickness is also accounted for in the assessment of the

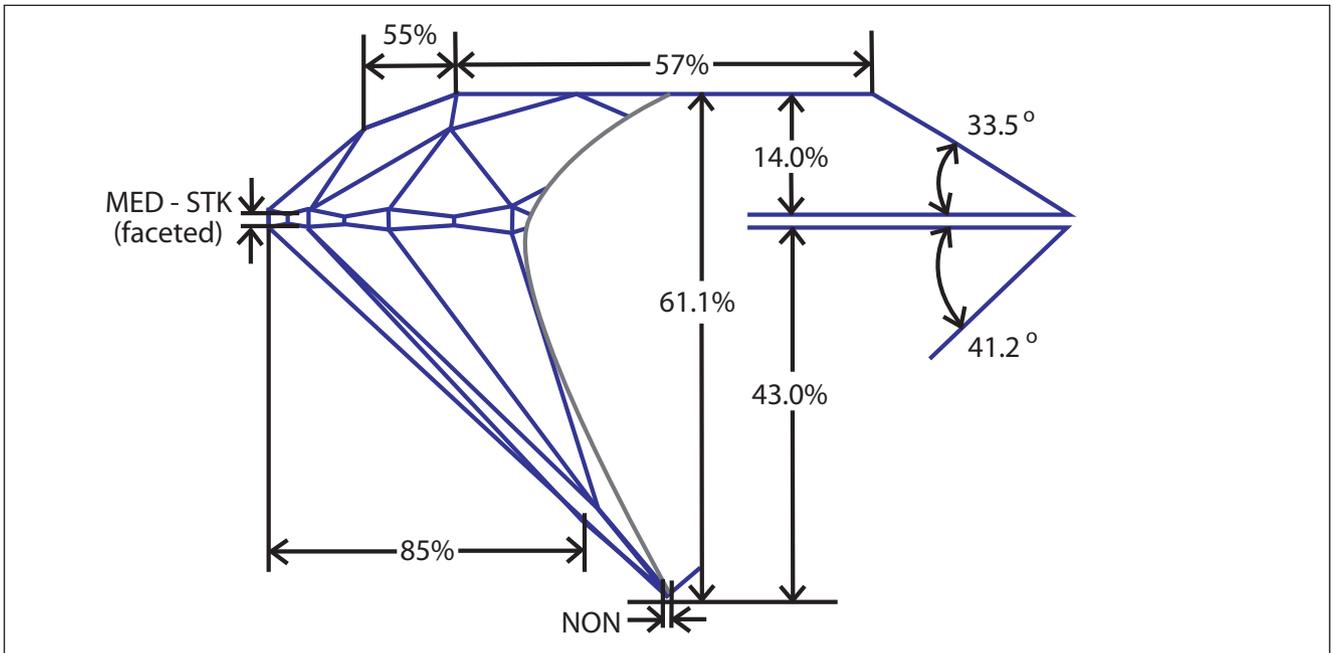


Figure 14. Culet size and girdle thickness appear on each new GIA Diamond Grading Report and Diamond Dossier® within a graphic representation of the diamond — a sample of which is shown here — along with the other proportions used to determine the cut grade.

diamond's symmetry (see "Polish and Symmetry" by Gillen et al. in *Rapaport Diamond Report*, October 2005). Table 2, GIA Girdle Thickness Descriptions, shown on page 79, provides definitions and examples for each description and their relationships to calculated girdle-thickness percentages at the "valley" and "hill" positions.

The girdle's condition may be bruted — the surface produced by the process used to shape the round diamond — or it may be polished or faceted (see figure 13, shown on page 77). The girdle's thickness is assessed the same, regardless of its condition.

CONCLUSION

Girdle thickness and culet size have always been part of GIA's International Diamond Grading System as it is practiced in the GIA Laboratory and taught in GIA's educational courses. Beginning January 1, 2006, each GIA Diamond Grading Report and Diamond Dossier® for a standard round brilliant diamond also will include a cut grade that, along with proportions and finish, takes into consideration the effects of culet size and girdle thickness

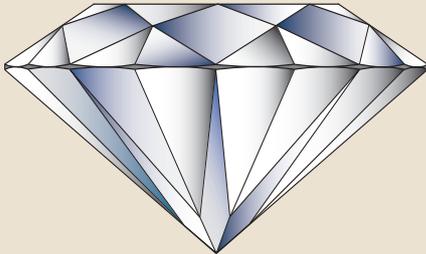
on diamond cut quality. The Laboratory's methods for assessing culet size and girdle thickness will remain the same. These elements will appear on the new reports within a graphic representation of the diamond along with other proportions used to determine the cut grade (see figure 14).

The series of articles presented in the *Rapaport Diamond Report* over the last several issues has been offered to help diamond dealers, manufacturers and retailers alike understand the factors involved in GIA's cut grading as well as the methods used by the GIA Laboratory in the overall grading process. Additional information on the GIA Diamond Cut Grading System, including access to GIA Facetware™, can be found on GIA's website, www.diamondcut.gia.edu. In addition, related articles can be found in past issues of *Gems & Gemology* (Fall 1998, Fall 2001 and Fall 2004). An article that specifically addresses the evaluation of culet and girdle for fancy shapes is planned for future publication. ♦

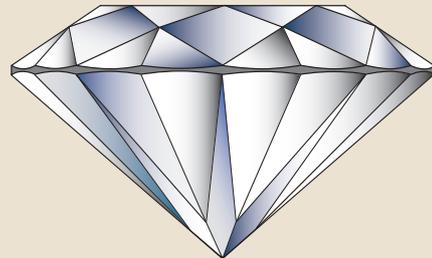
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GIA Girdle Thickness Descriptions

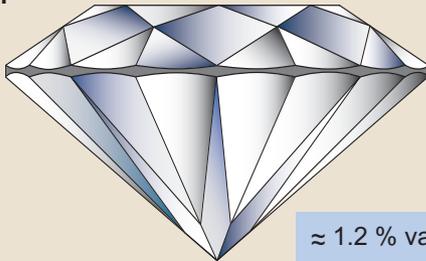
Extremely Thin: Crown and pavilion meet with no girdle in between, creating a sharp edge; may be referred to as a "knife-edge."



Very Thin

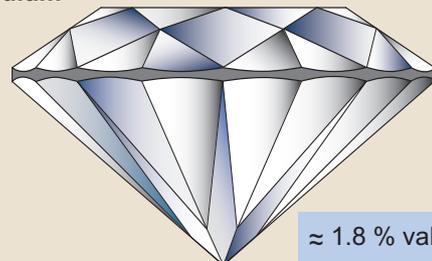


Thin



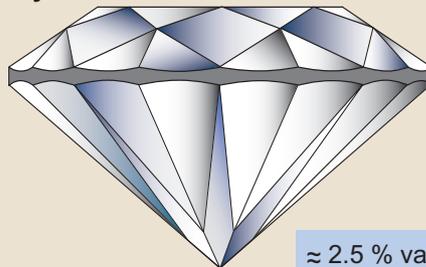
≈ 1.2 % valley
 (≈ 2.9 % hill)

Medium



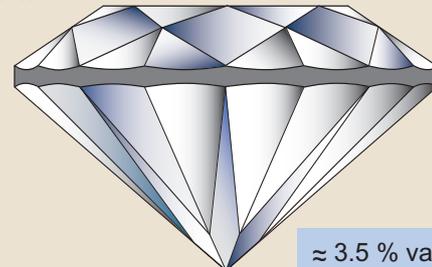
≈ 1.8 % valley
 (≈ 3.5 % hill)

Slightly Thick



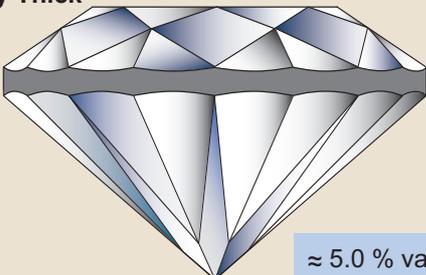
≈ 2.5 % valley
 (≈ 4.2 % hill)

Thick



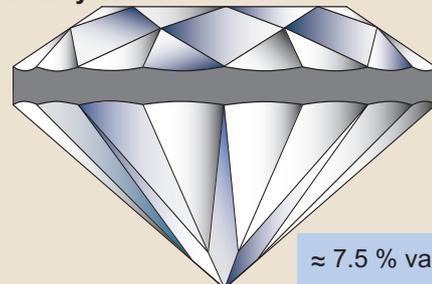
≈ 3.5 % valley
 (≈ 5.2 % hill)

Very Thick



≈ 5.0 % valley
 (≈ 6.7 % hill)

Extremely Thick



≈ 7.5 % valley
 (≈ 9.2 % hill)

$$\text{GirdleThickness \%} = \frac{\text{girdle thickness (mm)}}{\text{average diameter (mm)}} \times 100$$

Table 2. This table describes the visual appearances and provides examples for each GIA girdle thickness description. Girdle-thickness percentages, shown in blue, hold true for symmetrical diamonds with evenly scalloped girdles that are nearly perpendicular to the table facet. Distinctions between extremely thin and very thin are best evaluated only on their visual appearance since these fine measurements are more susceptible to measurement device tolerances and the presence of clarity characteristics. For these same reasons, in addition to the fact that the girdle may be irregular or not perpendicular to the table, all results must be verified visually. Images and approximate girdle-thickness percentages represent typical values for each category, not the highest or lowest point of that range.