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Participant Handbook

Sector
Gems and Jewellery

Sub-Sector
Diamond Processing

Occupation
Assorting

Reference ID: **G&J/Q3603, Version 4.0**
NSQF Level 3

Assorter (Advanced)

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Disclaimer

Skilling is building a better India.
If we have to move India towards development then Skill Development should be our mission.

Shri Narendra Modi
Prime Minister of India

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Certificate

COMPLIANCE TO QUALIFICATION PACK – NATIONAL OCCUPATIONAL STANDARDS

is hereby issued by the

GEM AND JEWELLERY SKILL COUNCIL OF INDIA

for

SKILLING CONTENT : PARTICIPANT HANDBOOK

Complying to National Occupational Standards of

Job Role/ Qualification Pack: **'Assorter'(Advanced)** QP No. **G&J/Q3603/NSQF Level 3'**

Date of Issuance: November 17th,2022

Valid up to*: November 17th,2025

*Valid up to the next review date of the Qualification Pack or the 'Valid up to' date mentioned above (whichever is earlier)

A. K. Kotwal

Authorised Signatory

(Gem and Jewellery Skill Council of India)

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Sincerely,

Adil Kotwal

Chairman, GJSCI

About this book

1. This Participant Handbook is designed to enable training for the specific Qualification Pack(QP).
2. Each National Occupational (NOS) is covered across Unit/s.
3. Key Learning Objectives for the specific NOS mark the beginning of the Unit/s for that NOS.
4. The symbols used in this book are described below.
5. This book is about assorting diamonds.
6. This book will introduce assorters to mining, 4Cs of diamond and it sorting steps.

Symbols Used

Key Learning Outcomes

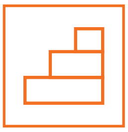

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Table of Content

It is recommended that all the trainings include the appropriate Employability Skills Module.

Content for the same is available here:
https://www.skillindiadigital.gov.in/content/list

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1. Introduction, Diamond Formation and Mining

Unit 1.1 - Introduction, Diamond Formation, Mining and Sources

G&J/N3604

Key Learning Outcomes

At the end of this module, you will be able to:

1. Know the derivation of the word diamond.
2. Understand the formation of diamonds in nature.
3. Know the various properties of diamond.
4. Understand the types of sources.
5. Know the various types of diamond rough.
6. Understand the various types of mining.
7. Understand the concept of recovery.
8. Know the various historical and current sources.
9. Know the various mining companies.

Unit 1.1: Introduction, Diamond Formation, Mining and Sources

Unit Objectives

At the end of this unit, you will be able to:

1. Understand the evolution of the word diamond.
2. Understand in detail the formation of diamond.
3. Understand the properties of diamond.
4. Understand the Various types of sources.
5. Know the different types of diamond rough.
6. Understand the various types of mining techniques.
7. . Understand the concept of recovery from ore.
8. Know the various traditional and current sources of diamonds.
9. Know the various mining companies.

1.1.1 The Word Diamond

Unit Objectives Diamond is derived from 'adamas' - a Greek word , Adamas in greek language means unbreakable and its lustre is called as adamantine, adamantine means unconquerable.

1.1.2 Formation of Diamonds

Formation of diamonds requires the following:

High temperature (1500 to 1800C)

High pressure (45,000 to 60,000 kilobar)

Most important, Carbon (99.95%)

Diamonds are formed at high temperature and high pressure at an approximate depths of 120 to 190 kilometres in the Earth's mantle.eclogite and peridotite are Carbon containing minerals which provide the carbon source, and the growth occurs over long period from 1 billion to 3.3 billion years (which is approx 25% to 75% of the age of the Earth). Diamonds are transported close to the Earth's surface through deep volcanic eruptions by magma, which cools into rocks termed as kimberlites and lamproites. They have form a carrot shaped structure called diamond pipes. Very few rocks in these diamond pipes have diamonds.

1.1.3 Diamond Properties

Properties of diamond:

- Chemical composition: Carbon
- Hardness: 10 on Mohs scale (Hardest Mineral on earth crust) .
- Specific gravity: 3.52.
- Refractive index (RI - it is the ratio of speed of light in air to speed of light in gem): 2.417

1.1.4 Various Types of Sources

Following are the types of sources:

1. Primary

- · Once diamonds have been transported to the surface by magma through volcanic pipe, they may erupt and be distributed over a large area. A volcanic pipe which contains diamonds is known as a primary source of diamonds. For example, - dykes and veins.

2. Alluvial source

- Also known as secondary sources of diamonds include all areas where a significant number of diamonds have been eroded out of their kimberlite or lamproite block area, and accumulated because of water or wind action.
- These include alluvial deposits and deposits along existing and ancient shorelines, river beds, where loose diamonds tend to deposit because of their size and density.
- Marine source is a type of alluvial source.

1.1.5 Types of Rough Diamond

Following are the types of diamond rough:

1. Gem quality:

- These are those roughs which are used in jewellery.

2. Near gem quality:

- They are those diamonds roughs which have borderline colour and clarity and can be used both in jewellery and industry depending on market conditions.

3. Industrial:

- They are those roughs which are used for industrial purpose like cutting, polishing purpose.

1.1.6 Types of Mining

Following are the types of mining:

1. Open pit

- It is also called as surface mining.
- The ground is removed/ dug in layers to create a pit.
- Example: Big hole at Kimberley in South Africa. Measuring 1 mile in circumference and 440 yards deep.

2. Shaft

- These are Deep or underground mining.
- These are vertical stopes around the perimeter and pipe with horizontal shafts leading into pipe.

3. Alluvial

- Secondary mining is done in rivers, streams, dry beds and ocean shores.
- Primitive mining: Done with panning with pie thins and plastic buckets.
- Mechanized mining: Done with giant earth movers to help shift over burden.
- Marine mining is done in Namibia.

Fig. 1.1.6.1 Open pit mines

1.1.6 Types of Mining

Fig. 1.1.6.2 Open pit mines

1.1.6 Types of Mining

Fig. 1.1.6.3 Shaft / Underground mines

1.1.6 Types of Mining

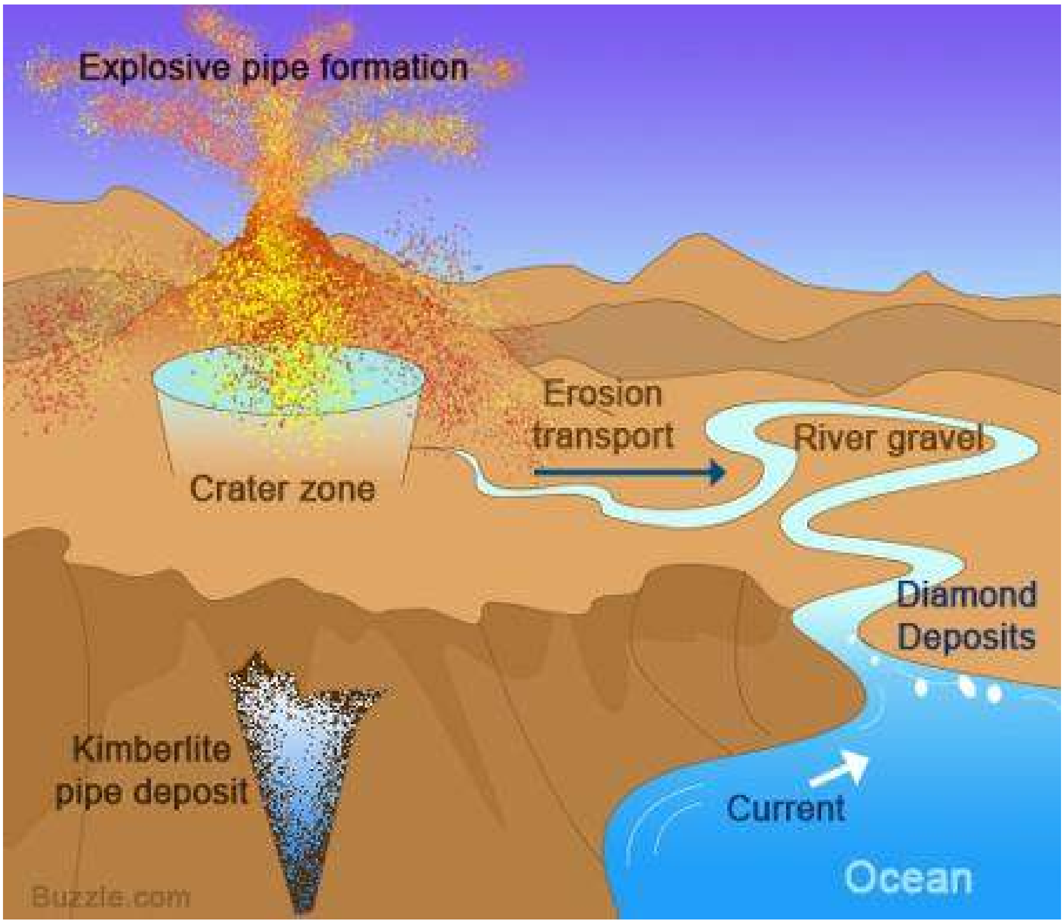

Fig. 1.1.6.4 Alluvial

1.1.7 Recovery Methods

Recovery means extracting diamonds from ore.

1. Early methods:

- In early days, we used to let blue ground weather into yellow ground, then using water and/or grease table diamonds were recovered.

2. Modern trend:

- Mechanical: Crushes to break up the ore.
- Water or heavy liquid to wash away gravels to concentrate higher sg materials.

3. Grease tables:

- Taking advantage of diamond's natural affinity for grease.

4. Sortex machines:

- Sorting diamond using x-ray fluorescence.

Fig. 1.1.6.5 Grease table

1.1.8 Historical / Traditional Sources

1. India:

- Golconda area was the only source from 500 BC to early 18th century.
- Earlier only wealthy people used to wear jewellery.
- Several important diamonds were found here like the Kohinoor and Hope.

2. Brazil:

- Found at the time when Indian mines were becoming exhausted.
- Early 18th century (1725), lasted for 100 years.
- Lot of Brazilian stones were sent to India and sold as Indian goods.

1.1.9 Current Sources

1. South Africa:

- Some famous South African mines are Kimberley, Bloemfantein, and Wesselton.
- South Africa is one of the only countries where all types (pipe, alluvial and marine) of deposits are found.
- Eureka (Meaning-I have found it), is the first authentic diamond discovered in 1886, weighed 21.25 cts.
- Here official mining began in 1870 creating mass market for diamonds.
- The Cullian rough (3106ct - World's largest ever rough diamond) was found in premier mine in South Africa and was cut into several pieces.
- · Cullian I (also konwn as star of Africa) 530.20.

Fig. 1.1.9.1 Kimberley mines

1.1.9 Current Sources

Fig. 1.1.9.2 Kimberley mines

1.1.9 Current Sources

2. Botswana:

- Deposits is Botswana were found post World War II with approximately 73% gem quality.
- 3 major pipes being mined here.

Fig. 1.1.9.3 Diamond mines in Botswana

1.1.9 Current Sources

3. Zaire (Congo):

- Zaire (Congo) is known for 20% gem quality, approximately 12% of worlds gem diamond production.

Fig. 1.1.9.4 Diamond deposits in Zaire (Congo)

4. Namibia:

- "Skeleton coast"- a marine alluvial source, where 95% gem quality recovery is got.

Fig. 1.1.9.5 Nambia's marine deposit

1.1.9 Current Sources

5. Australia:

- The Argyle mine is located in North West part of Australia.
- It Started in 1980 and is the world's largest producer in quantity.
- Approximately 5% gem quality to 35% near gem quality.
- Large source of fancy intense pinked brown, (natural pink)
- Turned India into major diamond cutting centre.

Fig. 1.1.9.6 Argyle mines of Australia

1.1.9 Current Sources

6. Russia:

- Generally, 95% of very high colour diamonds come from Siberia.
- The Mir mine in East Siberia, Russia is 525 meters in depth and 1200 meters in diameter.
- The air zone above this mine is closed for helicopters - as few accidents happened when they were sucked in" by downward air flow.

Fig. 1.1.9.7 Russian mine

1.1.9 Current Sources

7. Canada:

- Ekati
- Cowley
- Diavik

Fig. 1.1.9.8 Canadian mines

1.1.10 Mining Companies

Following are the few world-famous diamond mining companies:

- De Beers
- Dominion Diamond Corporation
- Rio Tinto
- Debswana
- Alrosa

Notes

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Gem & Jewellery industry Orientation

Click Here
About Diamond Mining
(Source : Science channel)

Click Here
Most Beautiful and Famous Golconda Diamonds from India
(Source : Andrew Pidor)

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2. Facets

Unit 2.1 - Facet and Facet Arrangement

Unit 2.2 - Facet Arrangement of Standard Round Brilliant Cut

G&J/N3604

Key Learning Outcomes

At the end of this module, you will be able to:

1. Know what is a facet.
2. Know the various types of cuts.
3. Understand the arrangement of standard round brilliant cut.
4. Understand the various parts of a diamond.
5. Understand the various facet names and their arrangement.

Unit 2.1: Facet and Facet Arrangement

Unit Objectives

At the end of this unit, you will be able to:

1. Understand the concept: what facets are.
2. Understand in detail the various parts of a diamond.
3. Understand the difference between Brilliant Cut, Step Cut and Mixed Cut.

2.1.1. What is a Facet?

Facets are flat faces with polished surfaces on the cut and polished diamond.

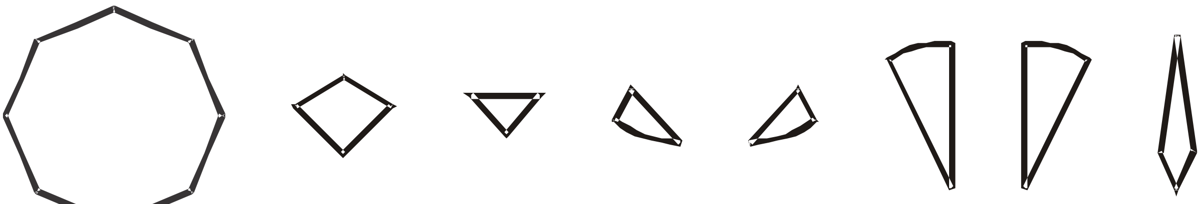

Fig. 2.1.1.1 Different types of Facets

2.1.2 What is a Brilliant Cut?

A type of arrangement of facet in a cut and polished diamond which has triangular or kite shaped facets is termed as a Brilliant Cut.

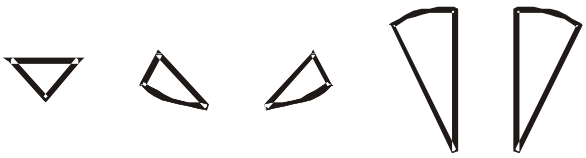

Fig. 2.1.2.1 Triangular facets

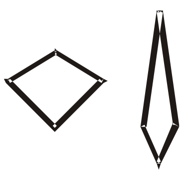

Fig. 2.1.2.2 Kite shaped facets

2.1.3 What is a Step Cut?

A type of facet arrangement in a cut and polished diamond which does not have triangular or kite shaped facets rather has long narrow facets in a row is called a Step Cut.

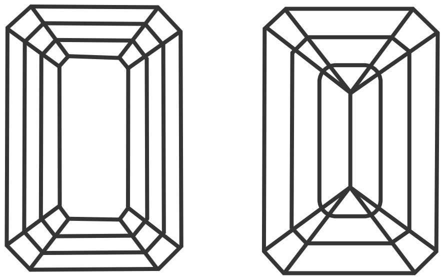

Fig. 2.1.3.1 Step Cut

2.1.4 What is a Mixed Cut?

A type of facet arrangement in a cut and polished diamond which has both arrangement of Brilliant cut on one side and Step cut on the other side is called a Mixed Cut.

Notes

Unit 2.2: Facets Arrangement of Standard Round Brilliant Cut

Unit Objectives

At the end of this unit, you will be able to:

1. Understand in detail the parts of a diamond.
2. Understand in detail the concept of facet arrangement of standard round brilliant cut.
3. Understand the role of girdle.

2.2.1 Parts of A Standard Round Brilliant Cut

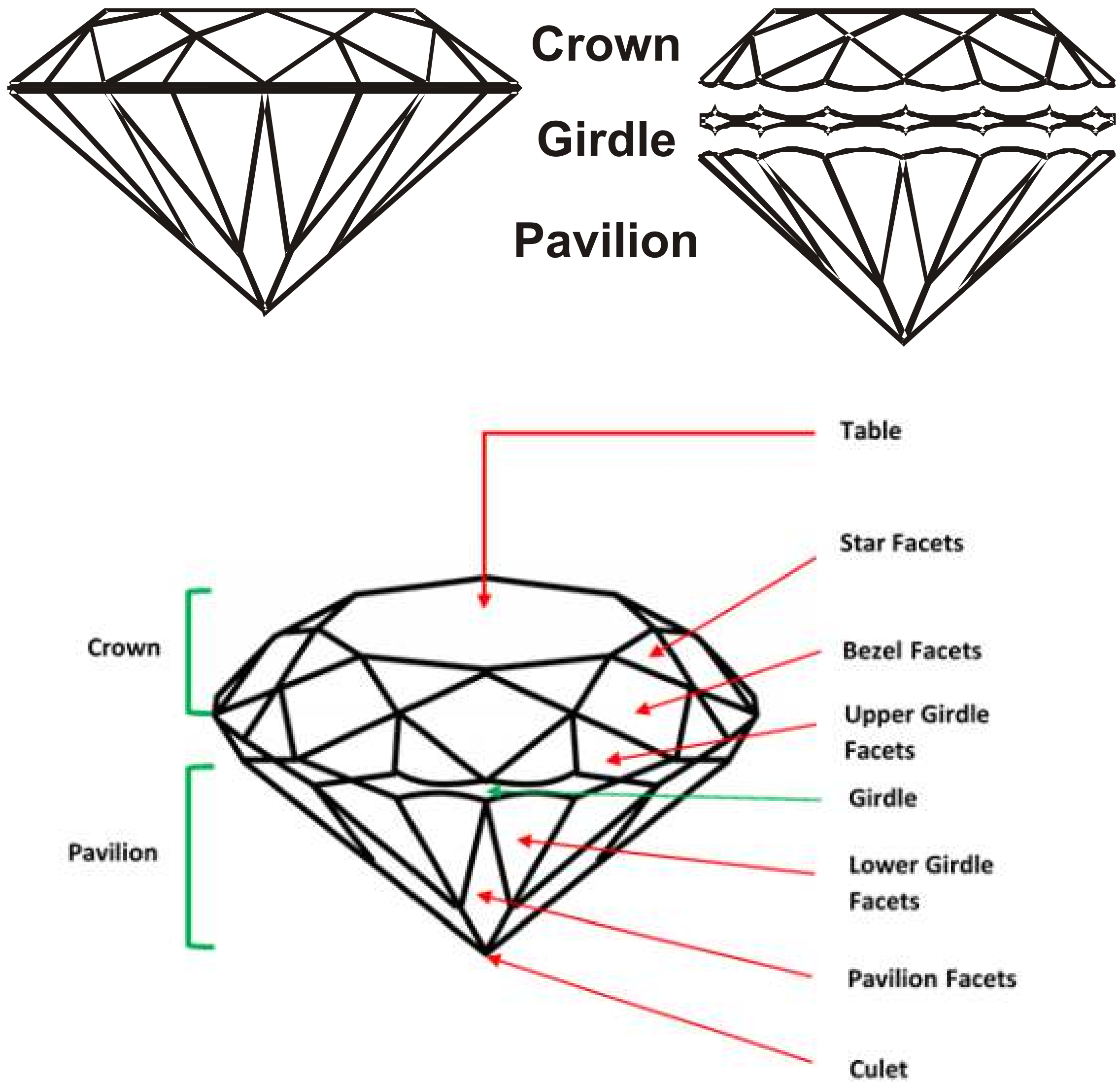

Fig. 2.2.1.1 Parts of standard round brilliant cut diamond

2.2.2 Crown

Crown: Top part of the diamond above the girdle

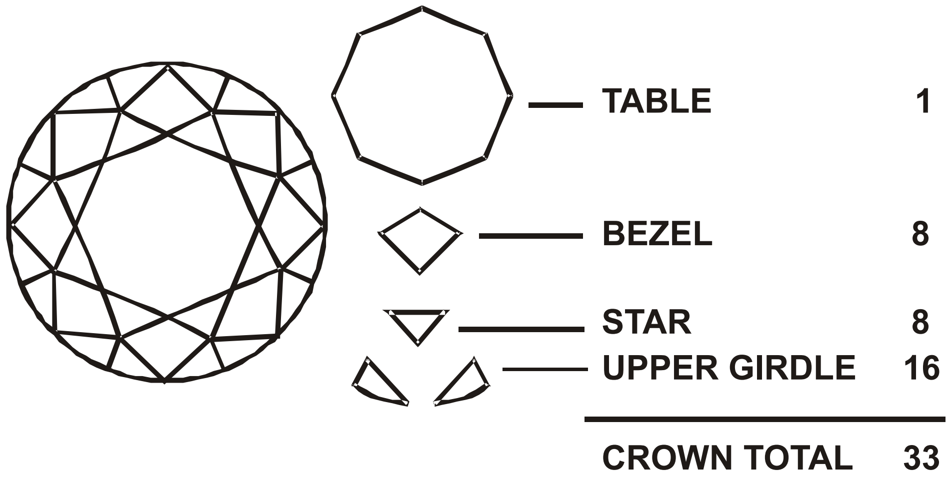

Fig. 2.2.2.1 Facets arrangement in crown

2.2.3 Pavilion

Pavilion: Lower part of the diamond below the girdle

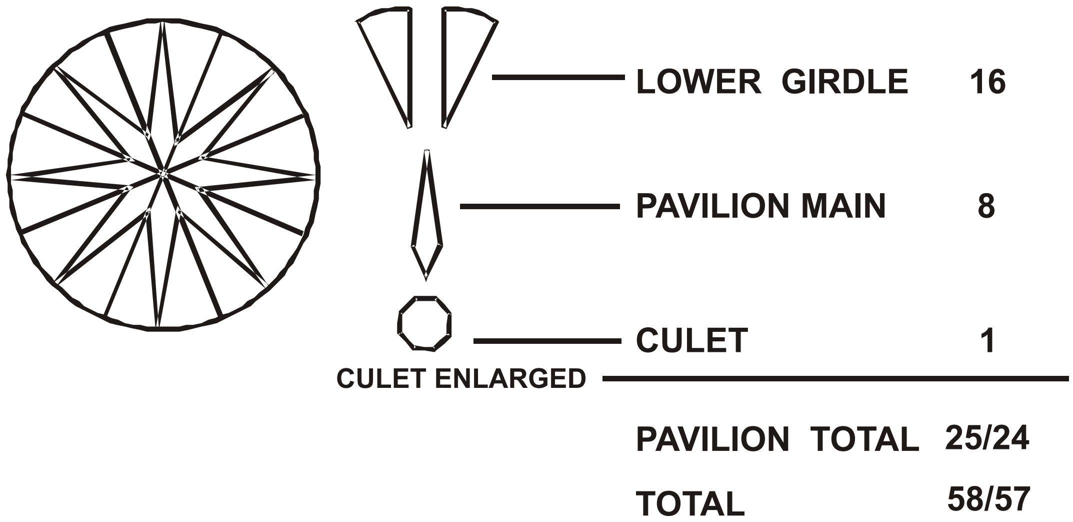

Fig. 2.2.3.1 Facets arrangement in pavilion

The sharp point at the center of the pavilion or bottom of the gem is known as CULET. To avoid abrasion or chipping of the diamond from the culet area, the culet is sometimes polished which in return creates an optional extra facet. Thus this optional facet on the pavilion, when present, changes the pavilion total from 24 to 25 and grand total from 57 to 58 facets.

Culet should be just large enough to prevent chipping. Very large culet becomes responsible for undesired light leakage from diamond.

2.2.4 Girdle

Girdle is the narrowest section between the crown and pavilion. It provides a setting edge to the diamond to be studded in a piece of jewellery.

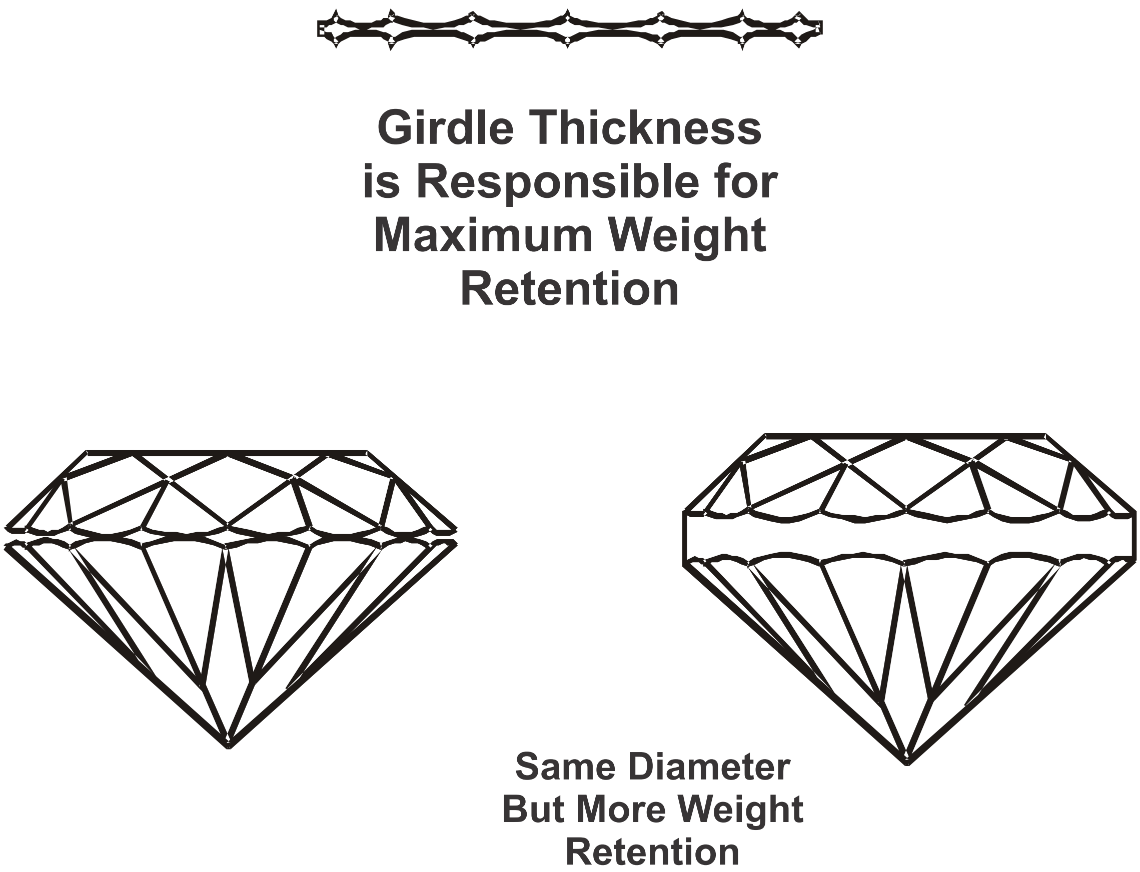

Fig. 2.2.4.1 Girdle

Two diamonds with same crown and same pavilion, the diamond with the thicker girdle has more weight retention. Thicker girdle not only adds undesired weight to the diamonds but also creates condition of undesired light leakage.

Types of Girdle

Most common girdle appearance in round brilliant cut are:

1. FACETED

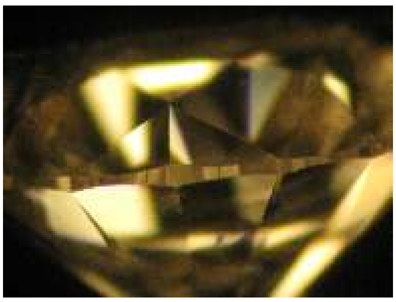

Fig. 2.2.4.2 Faceted Girdle

2.2.4 Girdle

2. WAXY

Fig. 2.2.4.3 Waxy Girdle

LASER INSCRIPTION

With the help of laser we can inscribe anything on the diamond. The safest being the girdle area we can laser inscribe some quotes on the girdle.

Few Laboratories offer a service to Laser Inscribe the certificate number on the girdle of the diamond.

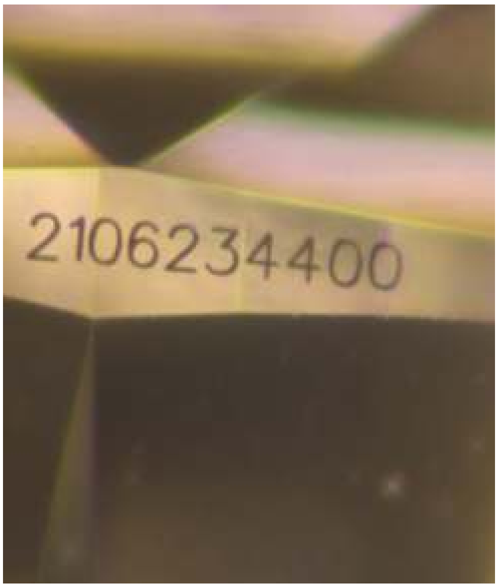

Fig. 2.2.4.4 Laser Inscription

Notes

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3. Concept of 4Cs

G&J/N3604

Key Learning Outcomes

At the end of this module, you will be able to:

1. Understand the meaning of 4Cs.
2. Know the various 4Cs.
3. Know and understand the term carat.
4. Know and understand the term clarity.
5. Know and understand the term colour.
6. Know and understand the term cut.

Unit 3.1: What is 4Cs

Unit Objectives

At the end of this unit, you will be able to:

1. Understand the concept of 4Cs.
2. Understand basics of value factors.

3.1.1 Concept of 4Cs?

Diamond Valuation is based on some features which are referred to as **VALUE FACTORS**.

Diamond professionals not only understand but also value the diamonds using the system of **Four Value Factors.** All these value factors starts from the third letter of english language that is letter 'C' namely:

*** CARAT**

*** CLARITY**

*** COLOUR**

*** CUT**

These four value factors describe the quality of a finished diamonds, which directly relates to the value of diamonds.

Fig. 3.1.1.1 4Cs

Notes

Unit 3.2: Concept of Carat

Unit Objectives

At the end of this unit, you will be able to:

1. Understand the basic concept of Carat.

3.2.1 What is Carat ?

Carat is a unit of weight which is derived from the carob seed. A diamond's weight is the simplest of its characteristics to measure, and from the earliest times has been used to calculate one factor of the value of a diamond.

In earlier days carob seed (Ratti) was used to measure the light weight products. Nature defined all carob seeds with almost constant weight.

In the metric system of weight, carat weight is defined as the system of weighing major gemstones including diamonds.

Fig. 3.2.1.1 Carob Seeds

3.2.2 Carat Weight Calculations

1 Kilogram (Kg) = 1000 grams (gms)

1 Gram (gm) = 1000 milligrams (mg)

1 Gram (gm) = 5 Carats (ct)

Thus

5 Carats (cts) = 1000 milligrams (mg)

1 carat (ct) = 200 milligrams (mg)

Also

1 carat (ct) = 100 points (pt)

3.2.3 Carat Weight Vs Carat Rate

- Diamonds are sold by weight, thus they are quoted as -per carat rate.
- Example: A Diamond weighs 1.03 carat and per carat rate is Rs. 2,10,000/-, then the total value of diamond will be 1.03 X 2,10,000 = Rs. 2,16,300/-.

Considering all other value factors as constant, the per carat rate increases faster than the rate at which diamond weight increases.

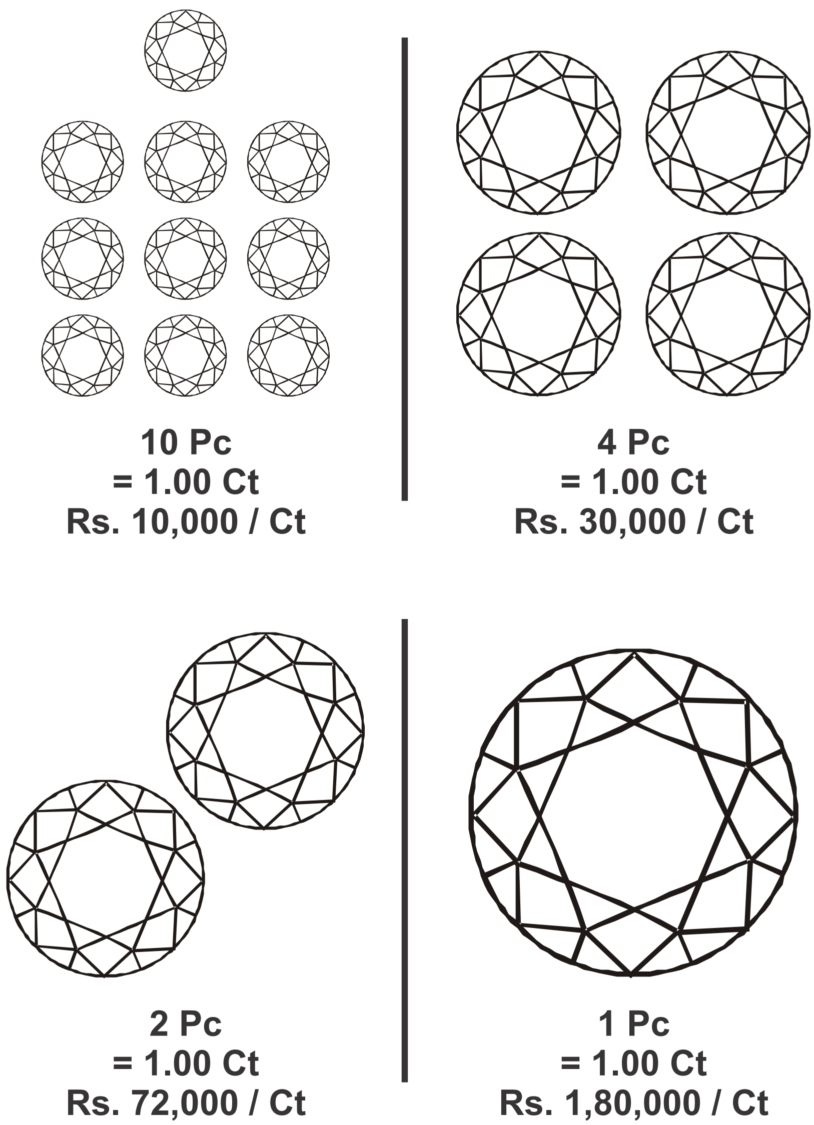

Fig. 3.2.3.1

Considering all other value factors as constant, the per carat rate increases faster than the rate at which diamond weight increases.

Notes

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Click Here

Diamond Carat Weight Grading by GIA

Unit 3.3: Concept of Clarity

Unit Objectives

At the end of this unit, you will be able to:

1. Understand the basic concept of Clarity.

3.3.1 Clarity

- The surface features/ characteristics known as Blemishes and internal features/ / characteristics known as Inclusions are collectively termed as Clarity Characteristics.
- Thus, the relative absence of blemishes or inclusions is referred to as Clarity.

3.3.2 Blemishes

Blemishes:
These are external characteristics found on the surface, which can be removed by re-polishing (except for surface graining). They rarely determine clarity grade.

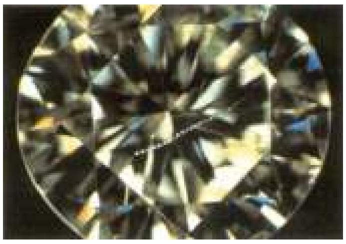


Fig. 3.3.2.1 Blemishes

3.3.3 Inclusions

Inclusions:
These are internal characteristics found in the stone, which determine clarity grade. These can be breaking on the surface or extend into the stone.

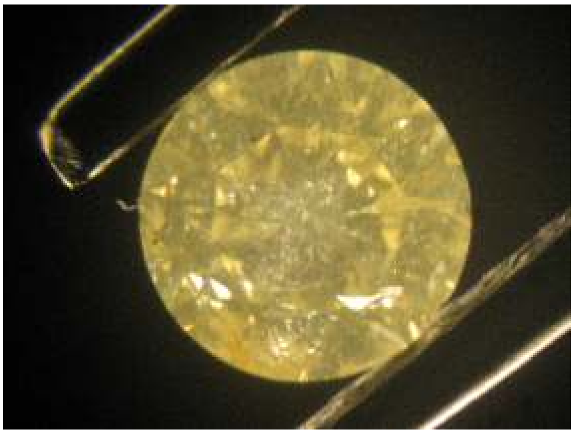
Fig. 3.3.3.1 Inclusions

3.3.4 Clarity Vs Carat Rate

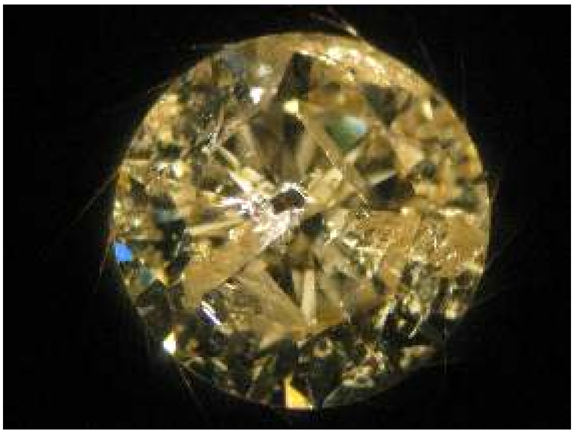
Clarity characteristics have an inverse relationship with regard to diamond's value. Thus more the inclusions and blemishes lower is the per carat rate. Compared to blemishes, inclusions have more impact on the diamond’s value. Blemishes being surface features are easy to remove by re-polishing and can often increase the diamond value.
On the other hand, inclusions can be removed only when they are close to the surface. This will cause weight loss.

Thus the loss of weight due to re-cutting or re-polishing has to be set off against improvement in the clarity.

No two diamonds can have exactly the same clarity characteristics, thus the clarity characteristics helps in identifying individual diamonds also.

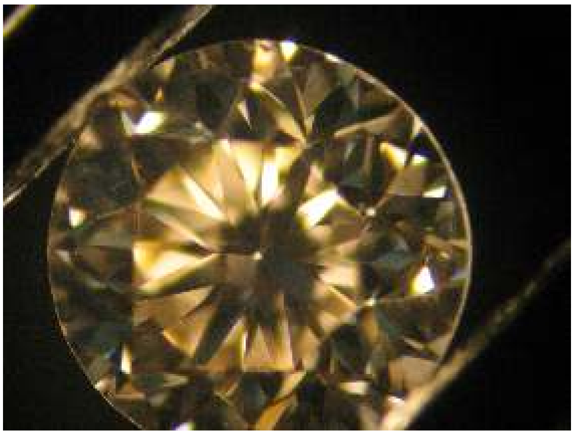


Highly Included



Included

Slightly Included



Very Slightly Included

Fig. 3.3.4.1

Considering all other value factors as constant, cleaner the diamond, higher the diamond value.

Notes

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Click Here

Diamond Clarity Grading by GIA

Unit 3.4: Concept of Colour

Unit Objectives

At the end of this unit, you will be able to:

1. Understand the basic concept of Colour

3.4.1 Colour

The most common available colours are near colourless with a yellow or brown tint.

Colourless diamonds are also available but they are quit rare thus are expensive.

Other than colourless and near colourless (with a tint of yellow or brown), diamonds are also available in other colours like green, blue, purple and red also. These are very rare.

3.4.2 Colour Grading Scale

Normal colour range:

- Diamonds ranging from colourless to near light yellows and browns fall in normal colour range.
- He described the colour of diamonds in the normal range from D (colourless diamonds) to Z (light yellow or brown diamonds), where each letter from D to Z represents a range of colour.

This scale is called as D to Z scale.

First row shows colours ranging as L, E, F, G, H, I, J, K where first two colours L and E shows a clear difference

Second row shows colours ranging as E, F, G, H, I, J, K, L where colour ranges from colourless to near colouless to faint yellow

Third row shows colours ranging as F, G, H, I, J, K, L where colour ranges from colourless to near colouless to faint yellow

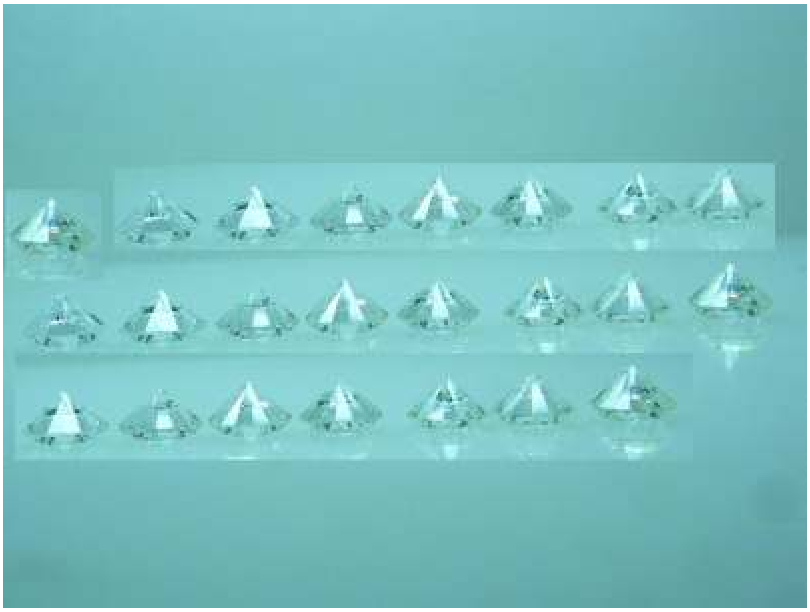


Fig. 3.4.2.1 normal colour range

3.4.3 Colour Vs Value

Keeping all other value factors constant, in the normal colour range as we move from colourless diamonds to near colourless diamonds the value or the per carat rate of diamonds falls.

Ranging from colourless to near colourless range, the fall in per carat rate is quite noticeable, whereas the fall in the rate slows down between near colourless and faint colours.

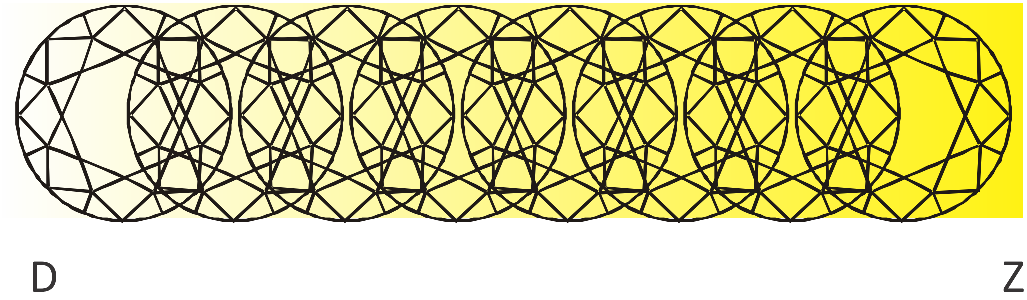


Fig. 3.4.3.1 Normal colour range (D to Z)

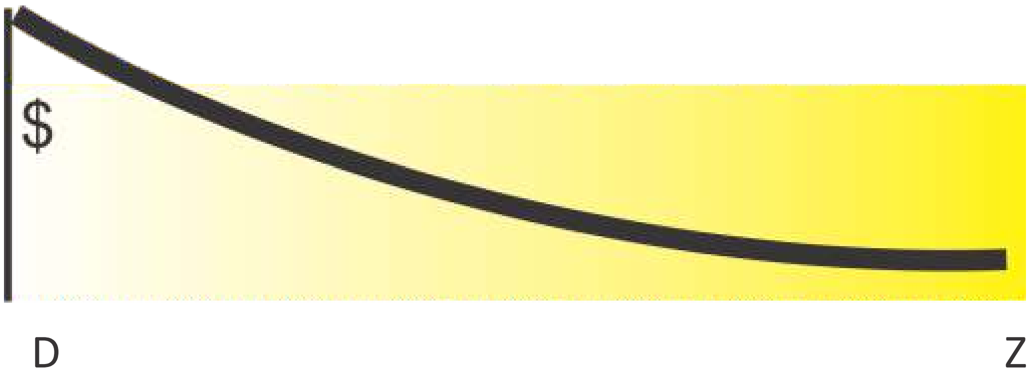


Fig. 3.4.3.2 Average price movement in normal colour range

3.4.4 Fancy Colour

Other than colourless and near colourless (with a tint of yellow or brown), diamonds in nature are also available in other colours like green, blue, purple and red which are beyond the normal colour range**.** These are called as '**Fancies**' or **Fancy Coloured Diamonds**.

On face up view these Fancy coloured diamonds display more colour in yellow and brown than the 'Z' colour or any other hue.

The price movement in fancy coloured diamonds are just the opposite of price movement in normal colour range. Diamond value decreases moving from D to Z, but in case of fancy coloured diamonds the value increases as the colour becomes more obvious.

Notes

Scan the QR Code to watch the related video or click on link

Click Here
Diamond Color Grading by GIA

Click Here
Coloured diamond
(Source :GIA)

Unit 3.5: Concept of Cut

Unit Objectives

At the end of this unit, you will be able to:

1. Understand the basic concept of Cut.

3.5.1 Cut

Out of all the 4C's **'CUT'** is the only valuable factor that is totally a human contribution to a diamond's beauty. It not only modifies the stone value but affects the stone beauty. An excellent finish grade is very hard to get & thus it will have higher price. It is normally seen in better quality stones.

A well cut diamond displays the best performance of light also referred to as **optical properties of diamond.**

These optical properties of diamond together scientifically define the beauty of diamonds.

Optical properties of diamond can be defined by the following four attributes:

- **Dispersion or fire**
- **Brilliance or life**
- **Scintillation or sparkle**
- **Lustre or shine**

3.5.2 Proportions

Proportions are the various angles and relative measurements of the cut and polished diamond and relationship between them.

Proportion of the diamond affects the performance of light which in turn affects the overall beauty of the diamond.

If a diamond is not well proportioned, all the light entering the diamond through the crown might leak or exit from an undesired area like pavilion or girdle, which in turn makes the diamond look ugly, unattractive or dark.

To best understand the diamond beauty and interaction of light with diamond it is important to understand the various angles and relative measurements of the cut and polished diamond and relationship between them.

Fig. 3.5.2.1 An ideal cut Diamond

3.5.3 Elements of Proportion

Following are the various elements of a diamond's proportion:

- **Table Size / Table Percentage**
- **Crown angle**
- **Crown height**
- **Girdle Thickness**
- **Pavilion Depth Percentage (or Pavilion Angle)**
- **Total Depth percentage**
- **Culet Size**

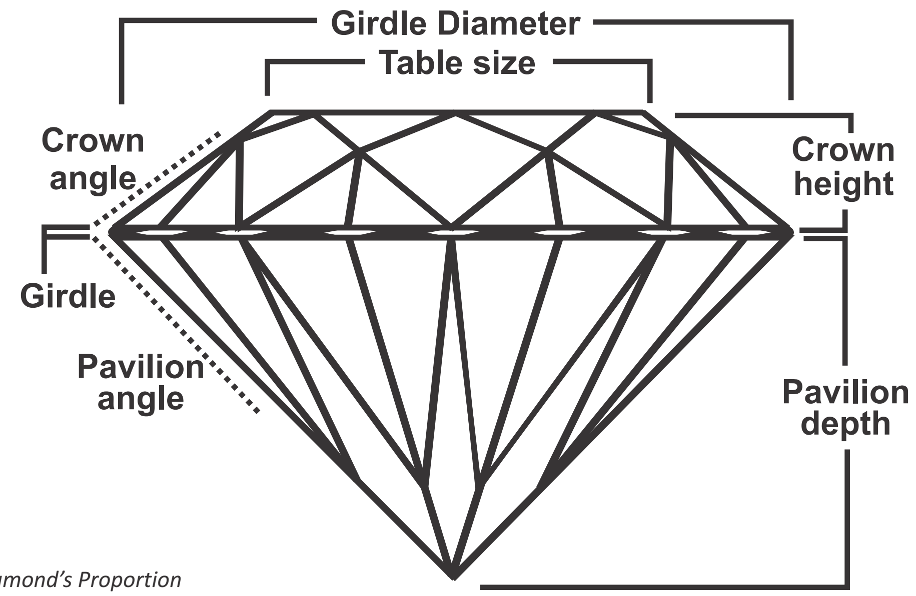


Fig. 3.5.3.1 Diamond's Proportion

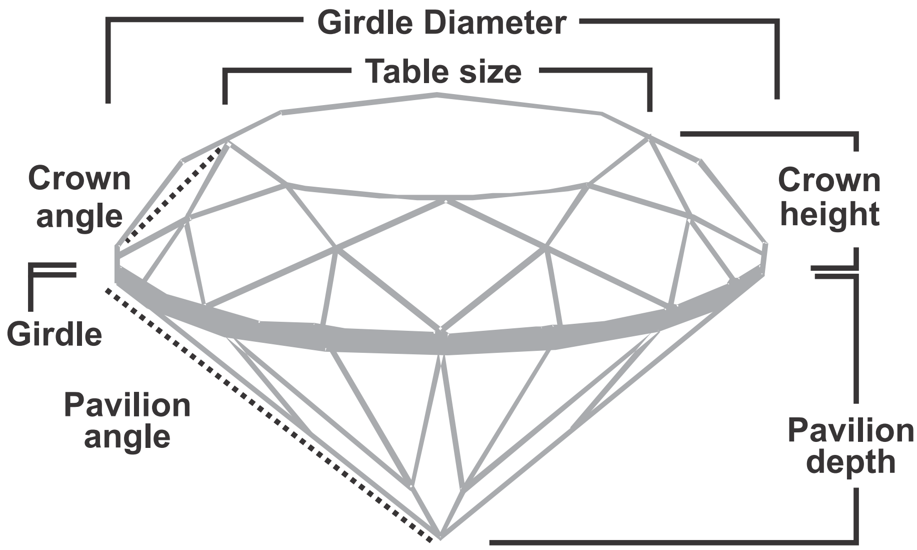


Fig. 3.5.3.2 Diamond's Proportion in 45 degree tilted view

3.5.3 Elements of Proportion

Girdle Diameter

- To understand the relationship between all the proportions of diamond we consider girdle diameter as 100 or 100%. Thus, all proportions are expressed as percentage of the average girdle diameter.

Average Girdle Diameter

- Measuring various diameters of the diamond from several directions and then averaging the smallest and the largest girdle diameter.
- Avg. Girdle Diameter = $\dfrac{\text{Maximum Diameter} + \text{Minimum Diameter}}{2}$

Table Size / Table Percentage

- Table Size / Table Percentage defines how large is the table in relationship to the average girdle diameter of the stone.

Crown Angle

- It is the angle formed by the bezel facet to the girdle of the diamond.
- Measured in degree.

Crown Height

- Always Expressed in percentage in relation to average girdle diameter of the stone.
- Crown height is in relation to the crown angle of the diamond.
- Being part of the crown if table size is constant then it has a direct relationship with crown angle.
- More the crown angle more the crown height.

Girdle Thickness

- Expressed in percentage in relation to average girdle diameter of the stone.
- It is measured at the narrowest section where the upper and the lower girdle facet meet.

Pavilion Depth Percentage (or Pavilion Angle)

- Measured from the bottom of the girdle plane to the culet expressed in percentage in relation to average girdle diameter of the stone.

Total Depth Percentage

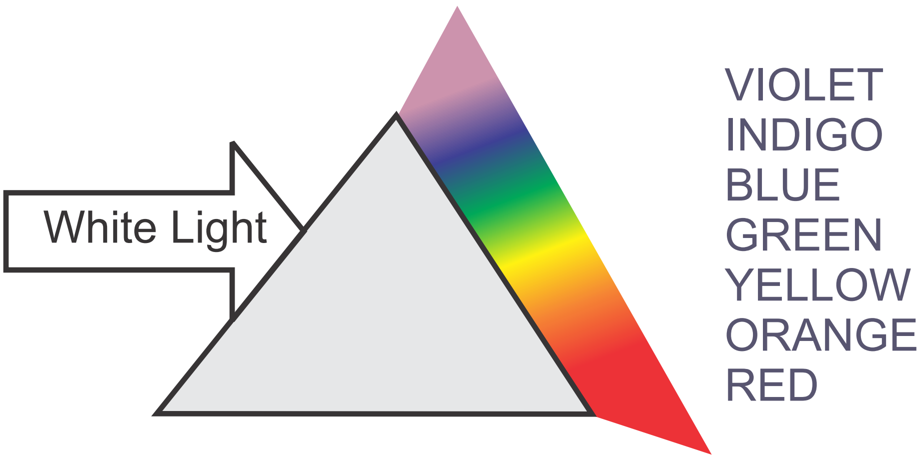
- Measured from the table to the culet expressed in percentage in relation to average girdle diameter of the stone.
- It describes the final story of all the proportions.

Culet Size

- Culet is created by polishing the bottom tip of the pavilion to avoid chipping or abrasions.
- Culet should be just large enough to prevent chipping.
- A very large culet becomes responsible for undesired light leakage from diamond.
- It represents the 58th facet of the round brilliant cut.

3.5.4 Dispersion or Fire

Dispersion is the breaking up of white light into its constituent spectral colours. Eye visibility of these colours in the form of VIBGYOR is termed as fire.



Breaking up of light into its constituent spectral colours.

Fig. 3.5.4.1 Breaking up of the light into its constituent spectral colours

- Dispersion can be judged by naked eye, only few stones show dispersion.
- It can be seen through side crown facets.
- **Crown Angle** is one of the most important proportion of diamond which creates dispersion.

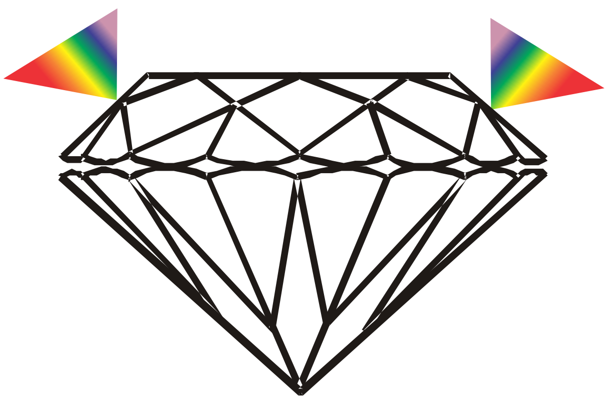


Fig. 3.5.4.2 Dispersion or fire can be seen through side crown facets

3.5.4 Dispersion or Fire

Crown angle affects dispersion.

Good dispersion depends upon crown angle.

Look at the illustration below, all three diamonds have the same basic proportions like Girdle diameter, Pavilion Depth, Table size.

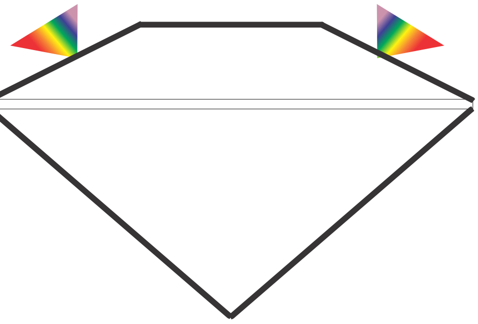


Fig. 3.5.4.3 Diamond with a shallow crown angle does not create good dispersion

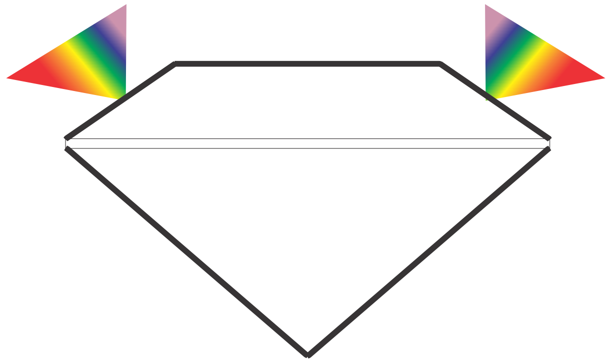


Fig. 3.5.4.4 Diamond with the standard crown angle creates good dispersion

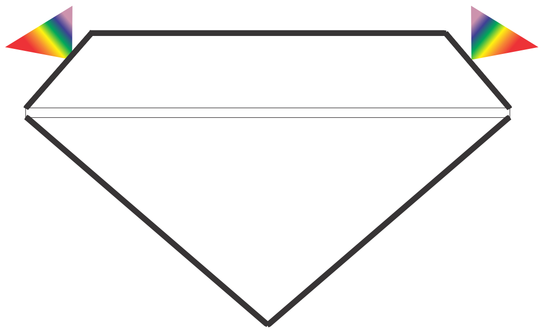


Fig. 3.5.4.5 Diamond with a steep crown angle does not create good dispersion

3.5.4 Dispersion or Fire

Size of the side crown facets affects dispersion.

Quantity of dispersion depends upon size of the side crown facets.

Look at the illustration below, all three diamonds have the same basic proportions like Girdle diameter, Pavilion Depth, and even the crown angle.

It is the size of the side crown facets which provides more surface area for light to fall and disperse into spectral colours.

In both the diamonds shown below good dispersion is created as a result of standard crown angle.

Same crown angle but different size of the side crown facets changes the table size in the diamond.`

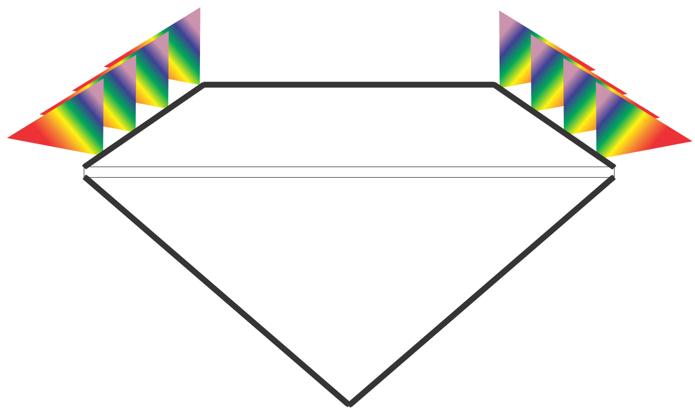


Fig. 3.5.4.6 Standard size of side crown facets provides reasonable area for light to fall and disperse

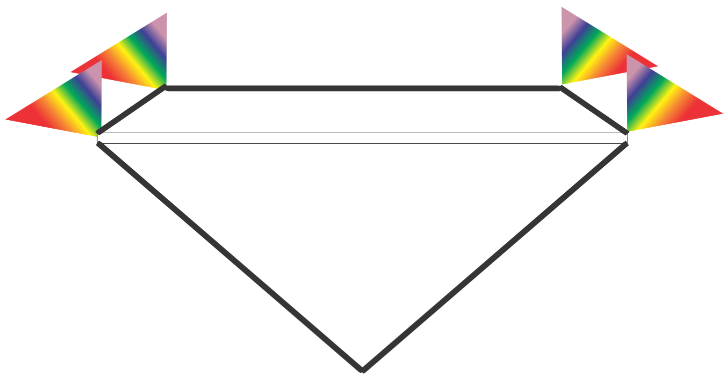


Fig. 3.5.4.7 Smaller size of side crown facets provides less area for light to fall and disperse. This also chages the table size.

3.5.5 Brilliance or Life

- Brilliance is the total light coming from within the stone.
- Diamond is potentially the most brilliant gemstone.
- Brilliance can also be defined as total amount of white light seen through the crown from internal and external reflections.
- Brilliance is best observed from table.
- Can be affected by the cut, pavilion depth and size of the table of the diamond.

Fig. 3.5.5.1 Total amount of light seen thru the crown from internal & external reflections.

Brilliance is also referred to as **Brightness.**

Table percentage, Crown angle, Pavilion depth plays a major role in determining diamond's brightness.

3.5.5 Brilliance or Life

Pavilion depth affects brilliance / brightness.

Good brilliance depends upon pavilion depth.

Look at the illustration below, all three diamonds have the same basic proportions like Girdle diameter, Crown angle, Table size.

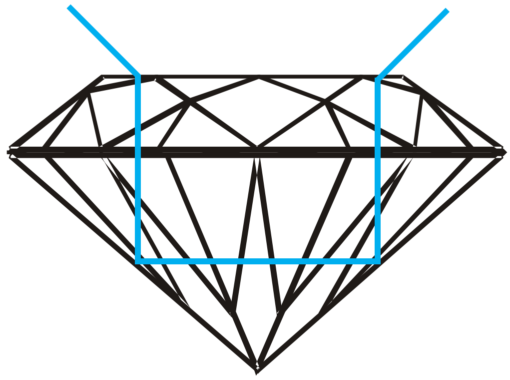


Fig. 3.5.5.2 Diamond with standard pavilion depth creates good brilliance

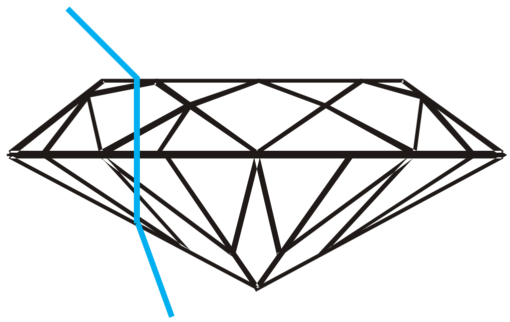


Fig. 3.5.5.3 Diamond with shallow pavilion depth causes light leakage thus no brilliance

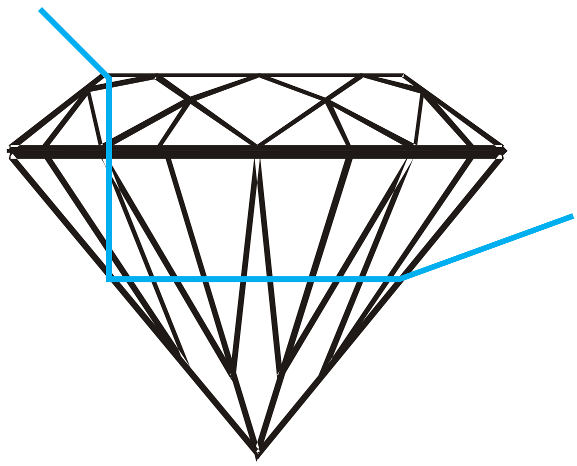


Fig. 3.5.5.4 Diamond with deep pavilion depth causes light leakage again thus no brilliance

3.5.5 Brilliance or Life

Visual differences between diamonds with standard, shallow, deep pavilion depth

Standard Cut

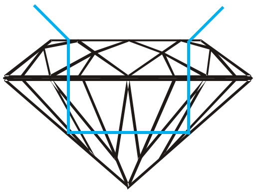


Fig. 3.5.5.5 Diamond with standard pavilion depth creates good brilliance / brightness

Fish Eye

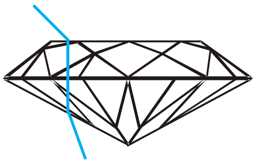


Fig. 3.5.5.6 Diamond with shallow pavilion depth causes light leakage thus no brilliance

Nail Head

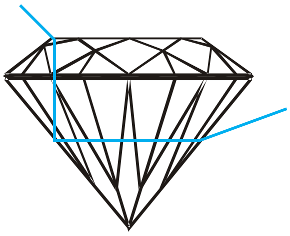


Fig. 3.5.5.7 Diamond with deep pavilion depth causes light leakage again thus no brilliance

3.5.5 Brilliance or Life

Size of Table affects brilliance / brightness.

Table is the most important facet which allows light to enter the diamond and further if the pavilion depth is standard it creates good brilliance / brightness.

Increasing the table size allows more light to enter the diamond, thus larger the table more the brilliance.

But a larger table in contrary reduces dispersion to a great extent.

Look at the illustration below, both diamonds have the same basic proportions like Girdle diameter and Pavilion depth.

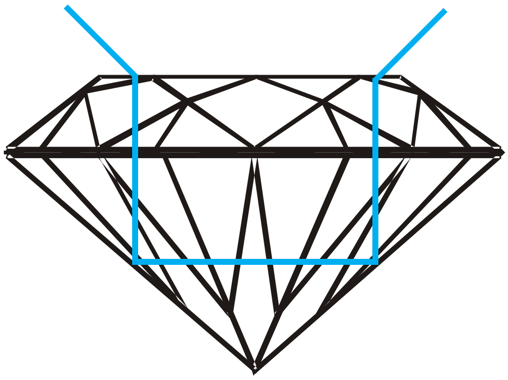


Fig. 3.5.5.8 Diamond with standard pavilion depth and table size creates good brilliance

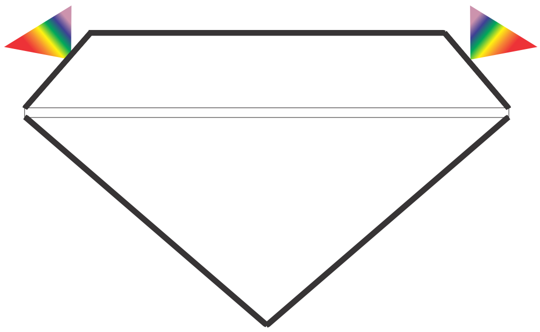


Fig. 3.5.5.9 Diamond with larger table allows more light to enter but changes the crown angle in return. This change in the crown angle causes less dispersion.

Thus there should be a balance between the various proportion of the diamond to create balance between dispersion and brilliance.

3.5.6 Luster or Shine

Lustre is the surface reflection of light. Or in other words lustre is the Quantity & quality of light reflected off the surface.
Diamond lustre is called **adamantine** (derived from the Greek word 'adamas' which means unconquerable, diamond lustre is reffered to as unconquerable).

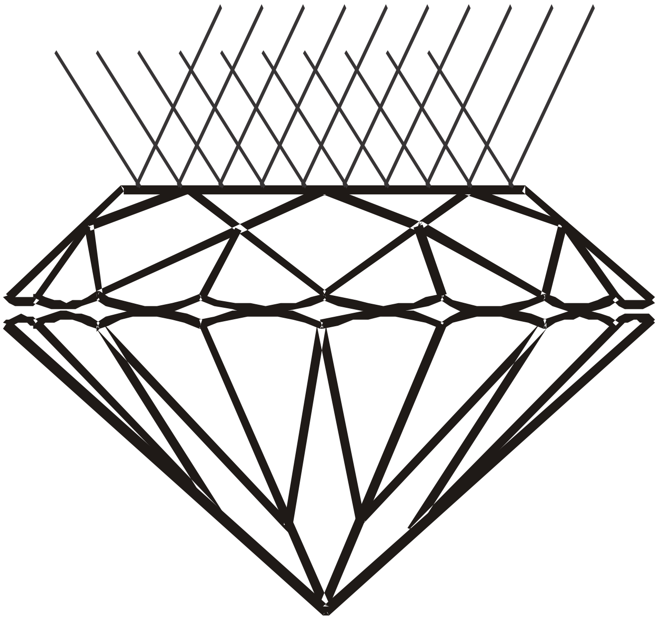


Fig. 3.5.6.1 Surface reflection of light is called as luster

Table being the largest facet of the diamond is the best facet to view the lustre.

3.5.7 Scintillation or Sparkle

Scintillation is the flash of light seen with the contrast of bright and dark areas due to the movement of the diamond, light source or the observers eye.
The external and internal reflection of light causes the contrast of dark and bright areas to create a pattern.

Scintillation is created by movement of the diamond , the light source or the observers eye.

Scintillation is affected by both size and number of facets.

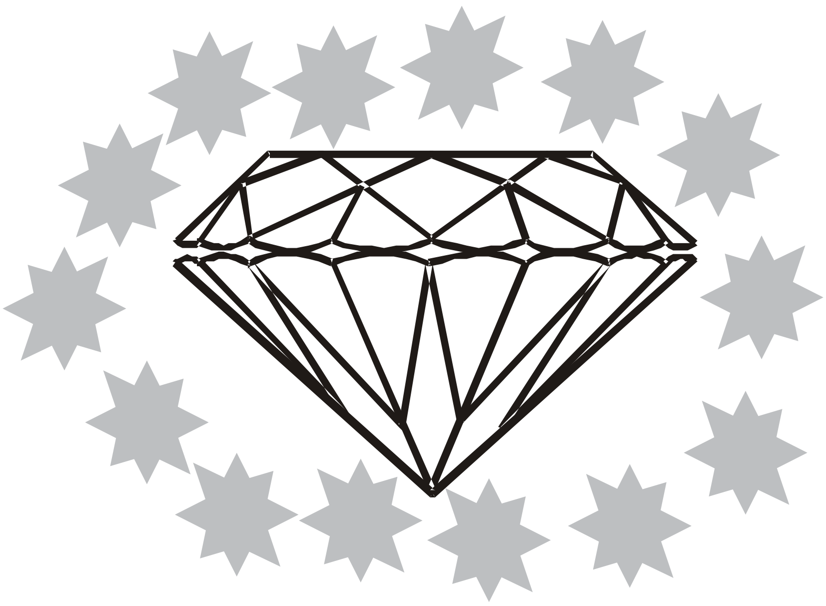


Fig. 3.5.7.1 Flashes of light seen due to movement

Balance of both size and number of facets has to be maintained to create a balanced scintillation.

Scan the QR Code to watch the related video or click on link

Click Here Diamond Cut Grading by GIA	Click Here How to Read a GIA Grading Report Video by GIA	Click Here Diamond Grading Sample Reports

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4. Clarity

Unit 4.1 - Clarity and its Concepts

G&J/N3604

Key Learning Outcomes

At the end of this module, you will be able to:

1. Know what is clarity.
2. Know and understand the various clarity characteristics in detail.
3. Understand the role of clarity on carat rate.
4. Understand the basics of clarity grading procedure.
5. Learn the international grading standards.

Unit 4.1: Clarity and its Concepts

Unit Objectives

At the end of this unit, you will be able to:

1. Understand the concept of clarity.
2. Understand the concept of clarity characteristics.
3. Understand the concept of blemishes.
4. Understand the concept of inclusions.
5. Understand the concept of clarity vs carat rate.
6. Understand the concept of types of lighting.
7. Understand the concept of clarity grading.
8. Understand the factors of clarity grading.
9. Understand the international standard of clarity grading.
10. Understand the use of loupe and tripod.
11. Understand inclusions in detail.
12. Understand blemishes in detail.
13. Understand the various clarity grades.
14. Understand clarity as a value factor.

4.1.1 What is Clarity?

As discussed in unit 3.3 clarity is the relative absence of clarity characteristics like blemishes or inclusions.

4.1.2 What are Clarity Characteristics?

The surface features/ characteristics known as Blemishes and internal features/ characteristics known as Inclusions are collectively known as Clarity Characteristics.

4.1.3 What are Blemishes?

These are external characteristics found on the surface, which can be removed by re-polishing (except for surface graining). They rarely determine clarity grades. Thus the key points for blemishes are:

- External characteristics
- Found on the surface
- Can be removed by re-polishing
- Rarely determine clarity grade

4.1.4 What are Inclusions?

These are internal characteristics found in the stone, which determine clarity grade. These can be breaking the surface or extend into the stone.

E.g.: intended naturals, cavity, chip, and knots.

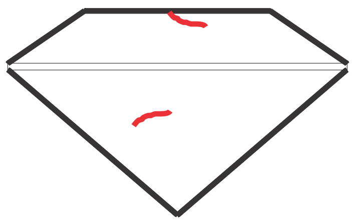


Fig. 4.1.4.1 Inclusions can be breaking the surface or extended into the diamond

Thus the key points for inclusions are :

- Internal characteristics
- Found in the diamond
- Determine clarity grade
- These can be breaking the surface or extend into the diamond

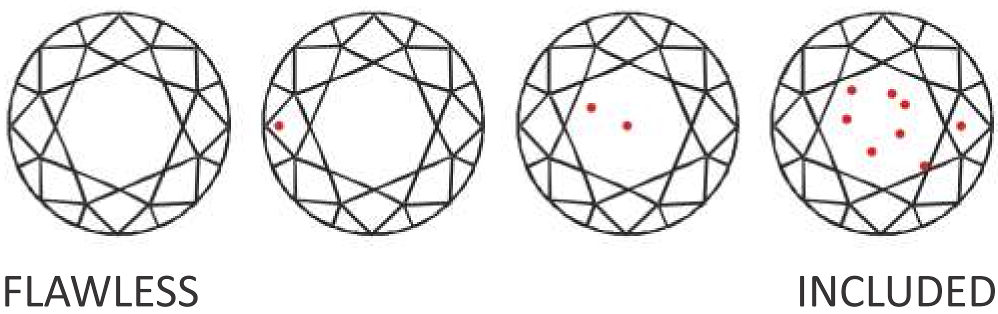
4.1.5 The Concept of Clarity vs Carat Rate

Clarity characteristics have an inverse relationship with diamond's value. Thus, more the inclusions and blemishes, lower is the per carat rate. Compared to blemishes, inclusions have more impact on the diamond's value. Blemishes being surface features are easy to remove by re-polishing. Re-polishing can often increase the diamond's value.

On the other hand, inclusions can be removed only when they are close to the surface. This will cause weight loss.

Thus, the loss of weight by re-cutting or re-polishing has to be set off against improved clarity.

No two diamonds have exactly the same clarity characteristics, thus the clarity characteristics help in identifying individual diamonds also.



4.1.5.1 Clarity Grade vs Inclusions

4.1.6 Types of Lighting

To look at diamonds and analyze its clarity grade, light and lighting techniques play a very important role. Following are the two types of lighting techniques to view a diamond:

Dark-Field

- Light enters from the side through the pavilion. Best for viewing inclusions. Stone appears white on black background.

Reflected Light

- Good for seeing surface characteristics and finished details. Good for seeing chips, cavities and intended natural at the girdle edge.ails. Good for seeing chips, cavities & intended natural at the girdle edge.

4.1.7 Clarity Grading Concepts and Protocols

- Clarity grading scale has eleven (11) grades ranging from Flawless, Internally Flawless, VVS1, VVS2, VS1, VS2, SI1, SI2 to included I1, I2, I3.
- These grades are widely accepted internationally.
- We are supposed to determine a diamond's position on FL-I scale (consider size, nature, number, location and colour/ relief).
- Make sure to analyse the overall impact of characteristics, not individual ones.
- Most of the diamonds have grade setters that is the most prominent inclusion, try and look for grade setters.
- Blemishes rarely effect the clarity grade lower than IF.
- Clarity grade is usually set by most prominent inclusions.

4.1.8 Clarity Grading Scale

No blemishes and inclusions	FL
Only blemishes and no inclusions	IF
Inclusions are always present	VVS1
	VVS2
	VS1
	VS2
Inclusions are always present and inclusions are visible to the naked eye	SI1
	SI2
	I1
	I2
	I3

Fig. 4.1.8.1

4.1.8 Clarity Grading Scale

Clarity Grading Scale

Clarity Grading System has 11 (eleven) Grades in total.

The scale on the right shows two important concerns:

1. Every garde is a range and as we go down the scal,e the range size of the grade increases.

2. The range size also depicts the total quantity of diamonds falling in every garde. As we go down the total availability of diamonds increases with lower grade.
Thus higher the grade, more rare are the diamonds.

Fig. 4.1.8.2

4.1.9 Factors of Clarity Grading

To determine a diamond position on FL-I scale one should consider size, nature, number, location & colour/ relief.

1. Size

Size refers to the size of clarity characteristics in the diamond. Bigger the clarity characteristics more it will effect the clarity grade of the diamond. Bigger the size of inclusion easier it is to locate. At the same time if the inclusion is too large it will effect the durability of diamond also.

If a diamond has multiple inclusions of different sizes, then the larger inclusions will be the grade setters and the smaller ones will rarely effect the clarity grade.

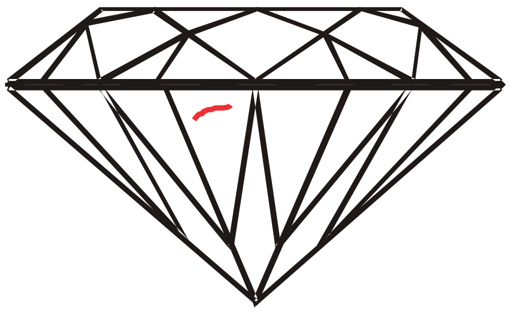


Fig. 4.1.9.1 Size as a clarity grading factor

2. Number

Number refers to the quantity or counts of clarity characteristics in the diamond. More the clarity characteristics, more it will effect the clarity grade of the diamond.

Clarity grading is not done by counting the inclusions, but rather how easily one can see the inclusions.

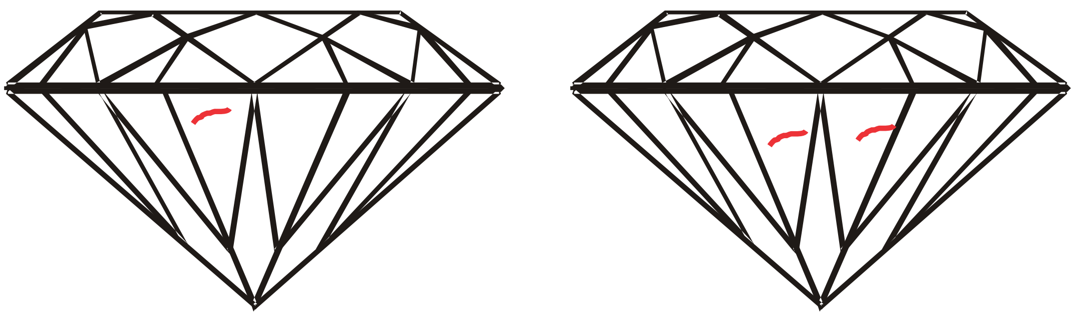


Fig. 4.1.9.2 Number as a clarity grading factor

4.1.9 Factors of Clarity Grading

3. Position / Location

Location / Position refers to where the clarity characteristic is located in the diamond. The area under the table of the diamond is also referred to as the heart of diamond. It makes a lot of difference that the inclusion is in the center of the diamond (under the table area) or is it under the side crown facets. More the clarity characteristics in the center of the diamond, more it will effect the clarity grade of the diamond.

Factor termed as position can be easily understood by comparing the same to the human face. If there is any characteristic in the center of the face it will be more prominent rather than the one on the side.

Sometimes the inclusion is at such a position that it starts reflecting in the other facets. All these facts in the pavilion act as a mirror and start reflecting multiple images of the inclusion. These are known as reflectors.

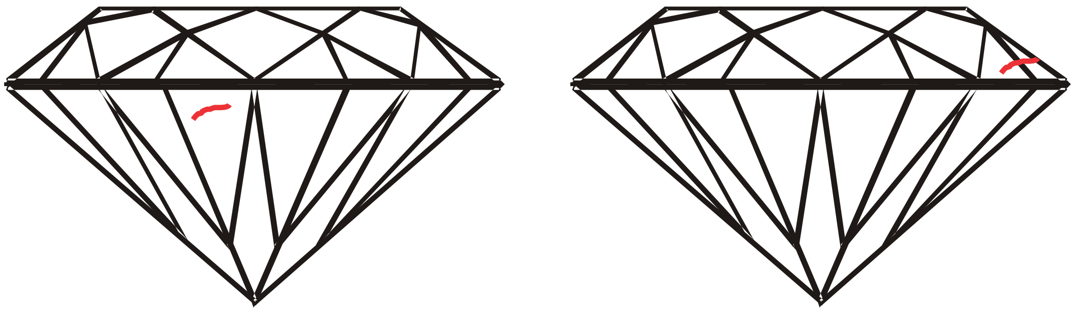


Fig. 4.1.9.3 Position of the clarity characteristics as a clarity grading factor

4. Nature

Nature refers to the type of clarity characteristics in the diamond. Comparing all the clarity characteristics in the diamond, there are some clarity characteristics which are more prominent than the others. As we shall be learning about these clarity characteristics in detail, clarity characteristics like cavities and large feathers have more impact on the clarity grade of the diamond.

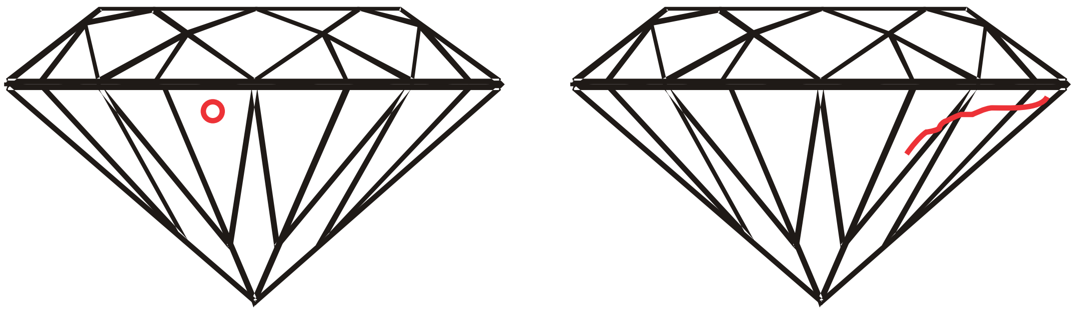


Fig. 4.1.9.4 Nature of the clarity characteristics as a clarity grading factor

4.1.9 Factors of Clarity Grading

5. Colour/ Relief

Colour and relief is as important as size of the clarity characteristics because of the visibility. Whenever the colour of the clarity characteristics will be different or in contrast with the colour of the diamond, it will be more prominent. Hence, it will increase the relief and will be more prominent, thus reducing the clarity grade.

In the normal range of diamonds, the coloured inclusions are easy to see, thus, will lower the grade.

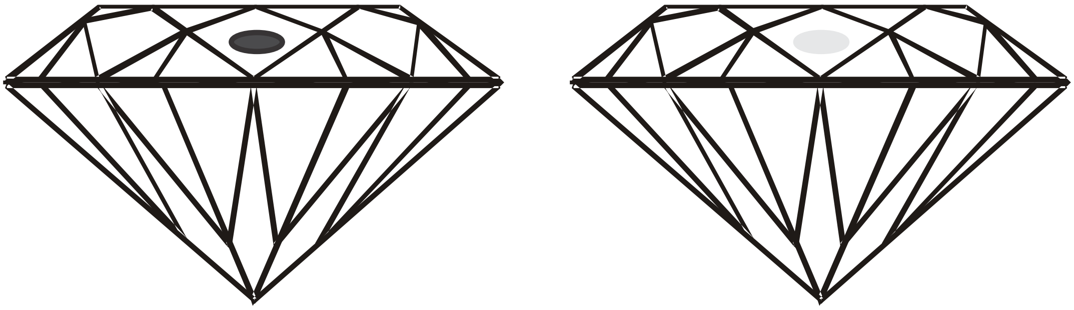


Fig. 4.1.9.5 Colour/relief of the clarity characteristics as a clarity grading factor

Notes

4.1.10 Summarizing the Procedure

Three main steps

- **Find identifying characteristics**
- **Assess their visibility**
- **Assign the grade**

4.1.11 International Standard of Clarity Grading

10X Fully corrected loupe (corrected for spherical& chromatic aberrations).

Fig. 4.1.11.1 Triplet 10X loupe 20.5mm Diameter

Fig. 4.1.11.2 Triplet 10X loupe 20.5mm Diameter from popular brands

Fig. 4.1.11.3 Triplet 10X loupe 18mm Diameter from popular brands

4.1.11 International Standard of Clarity Grading

TRIPOD

Fig. 4.1.11.4 Triplet 10X Tripod for sorting

4.1.12 Clarity Characteristics in Detail

Following is the list of all the inclusions and blemishes commonly found in the diamond:

Inclusions

Bearding: tiny feathers extending in form of a bruited girdle

Bruise: surface crumbling, often accompanied by tiny feathers

Cavity: a large or deep opening

Chip: often a small or shallow opening usually on girdle edge

Cloud: a hazy or milky area made up of number of very small inclusions

Feather: a break due to either cleavage or fracture often white or feathery in appearance

Included crystal: a mineral crystal contained in diamond

Dark Included crystal: a mineral (black or grey) crystal contained in diamond

Internal graining: internal indication of irregular crystal growth

Knot: an included crystal that reaches the surface of the cut stone

Laser drill hole: a tiny tube made by laser, it usually resembles a needle

Needle: a long, thin included crystal which looks like**a** tiny rod

Pinpoint: a very small inclusion, under 10X, normally seen as a tiny dot

Percussion mark: small feather resulting from blow on the surface

Indented natural: a natural that penetrates the stone

Blemishes

Abrasions: tiny nicks along facet junctions

Extra facet: a facet placed without regard to symmetry

Natural: a part of original crystal surface remaining on the polished stone

Nick: a notch near the girdle or facet edge

Pit: a tiny opening

Polish lines: parallel lines left by polishing**;** fine parallel ridges confined to a single facet

Polish marks: surface clouding caused by excessive heat (also called burn marks or burnt facet)

Rough girdle: a grainy or pitted girdle surface

Scratch: a linear indentation, normally seen as a fine white line

Surface graining: surface indication of structural irregularity, often crosses facet junctions

4.1.12 Clarity Characteristics in Detail

Inclusions

Bearding / Bearded Girdle

These are tiny feathers extending into the girdle due to the bruiting process in the cutting procedure. Bruiting is when a diamond held in a lathe machine is rubbed against another diamond to gain round shape.

It also describes the skill of the bruiter. More skilled the bruitter is, less chances of bearded girdle.

Abbreviation: **BG**

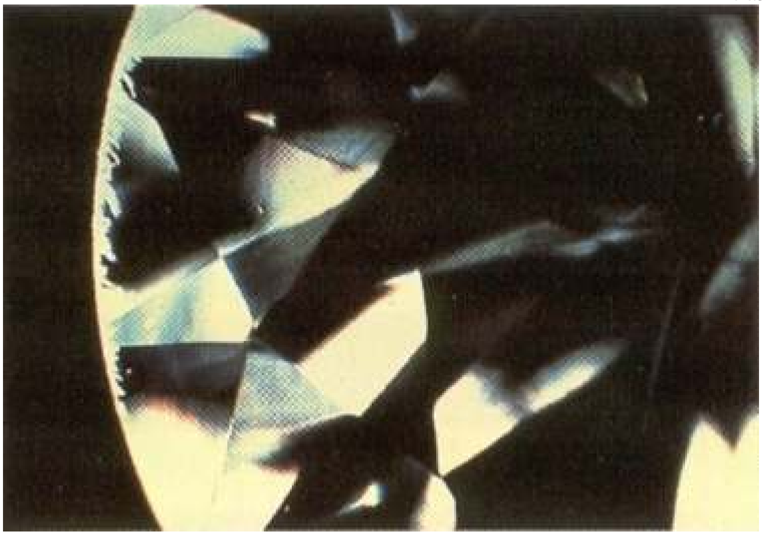


Fig. 4.1.12.1 Bearding / Bearded Girdle

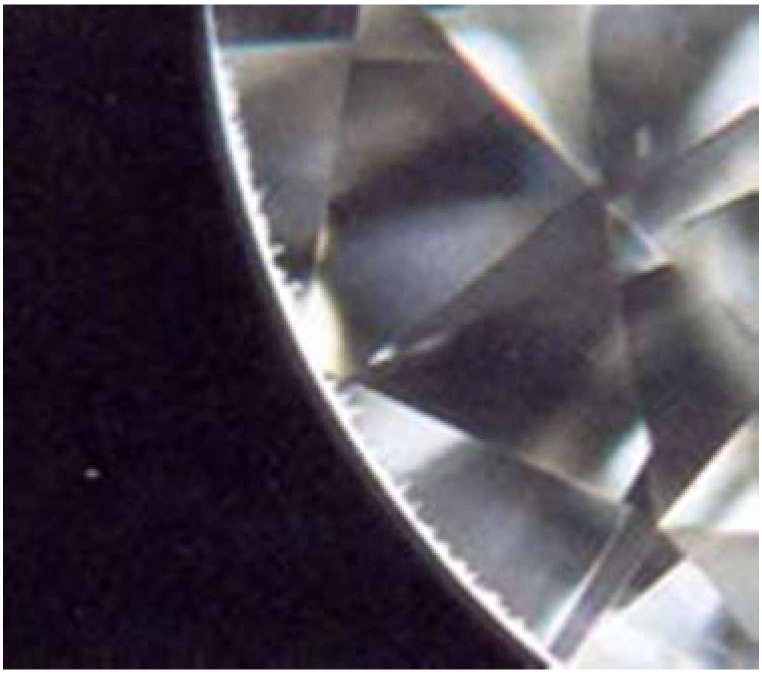


Fig. 4.1.12.2 Bearding / Bearded Girdle

4.1.12 Clarity Characteristics in Detail

Cavity

Cavity is a large or deep opening. Cavity is usually angular and this opening gets created when the feather breaks away. It can also be formed when a mineral inclusion breaking the surface falls off.

Abbreviation: **Cv**

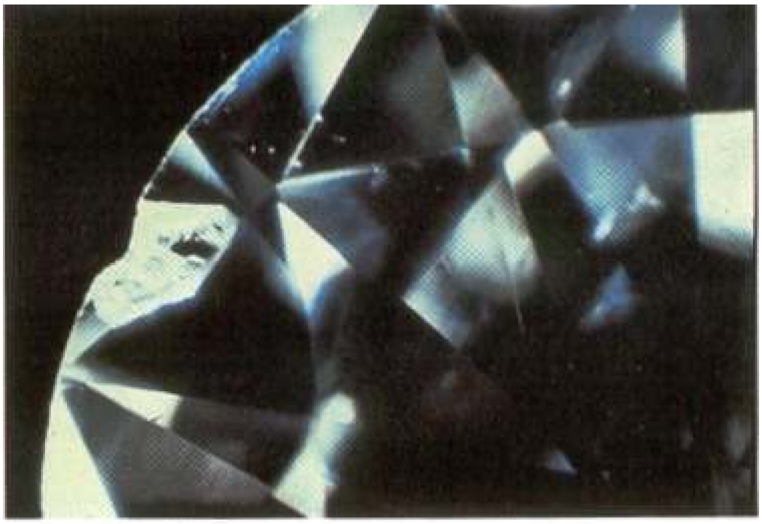


Fig. 4.1.12.3 Cavity

Chip

Chip is often a small or shallow opening usually on girdle edge. Chip can also be caused due to damage on the stones surface creating a small and a shallow opening

Abbreviation: **Ch**

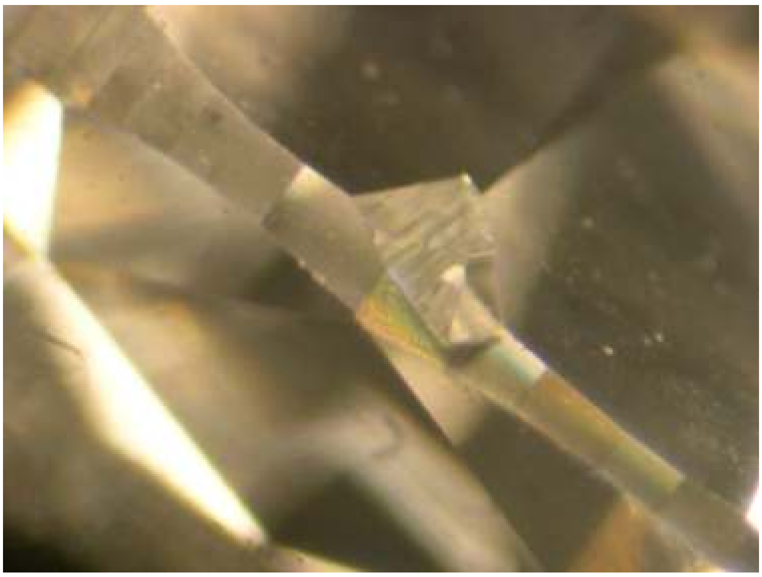


Fig. 4.1.12.4 chip

4.1.12 Clarity Characteristics in Detail

Cloud

A milky, hazy or cloudy area created by tightly packed pinpoints. The pinpoints are too small to distinguish them individually. Thus, a hazy or milky area made up of number of very small inclusions is called as cloud.

Abbreviation: **Cld**

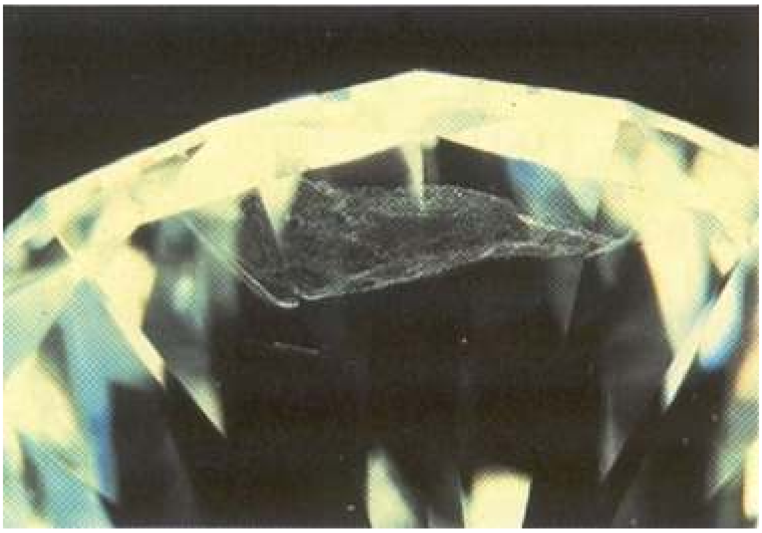


Fig. 4.1.12.5 cloud

Fig. 4.1.12.6 cloud

4.1.12 Clarity Characteristics in Detail

Feather

Feather is a break due to either cleavage or fracture, often white or feathery in appearance. Thus, a white and feathery in appearance feather is a general term used to describe a break in the diamond.

Abbreviation: **Ftr**

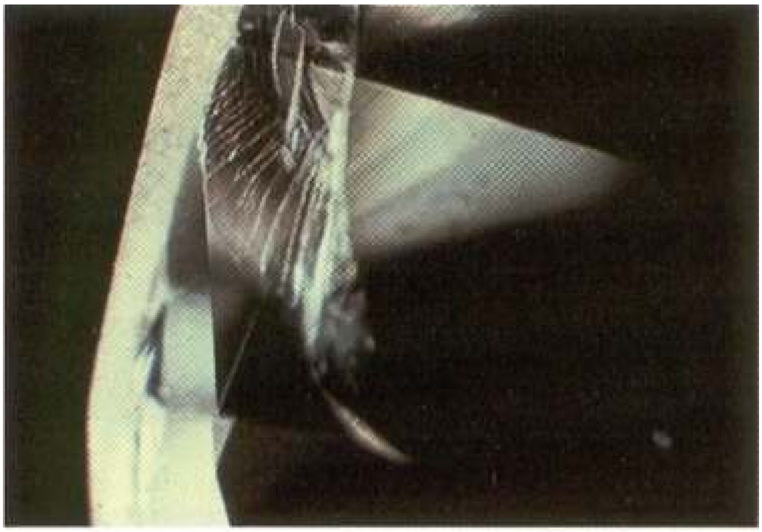


Fig. 4.1.12.7 Feather

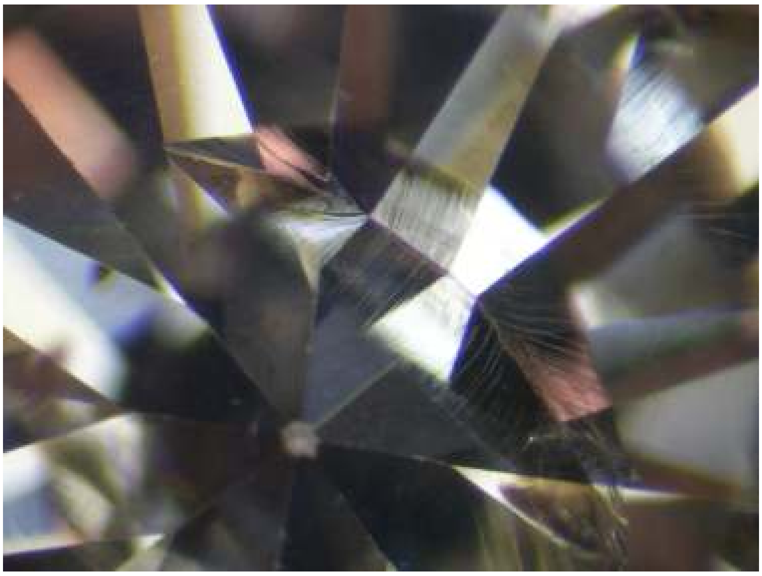


Fig. 4.1.12.8 Feather

4.1.12 Clarity Characteristics in Detail

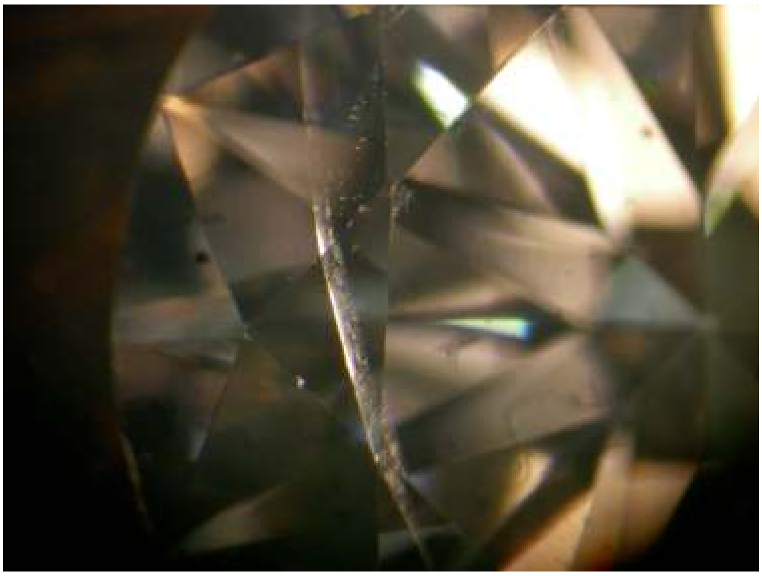


Fig. 4.1.12.9 Feather

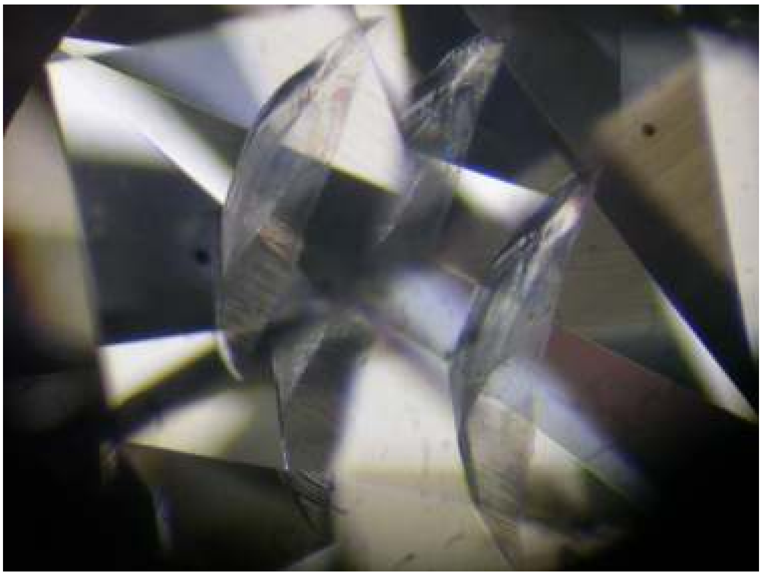


Fig. 4.1.12.10 Feather

4.1.12 Clarity Characteristics in Detail

Included Crystal

Included crystal or a crystal is a mineral crystal within a diamond. A mineral trapped in a diamond is termed as Included crystal.

Abbreviation: **Inx or Xtl**

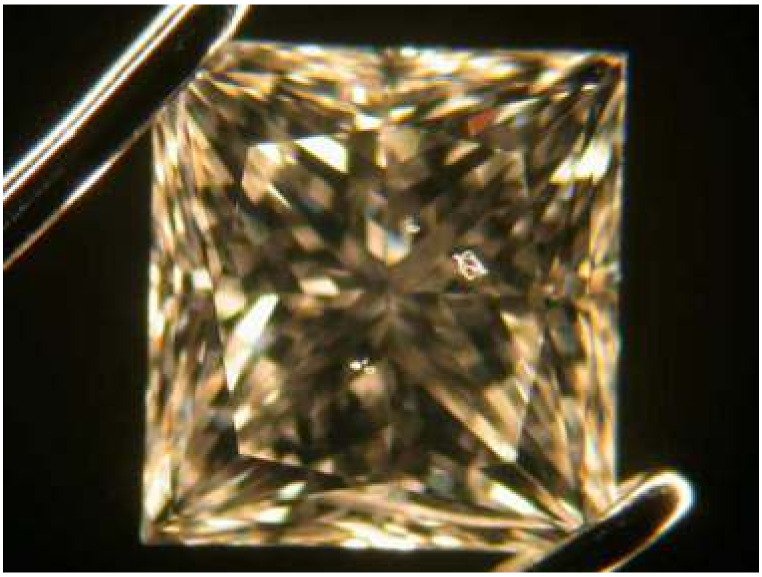


Fig. 4.1.12.11 Included Crystals

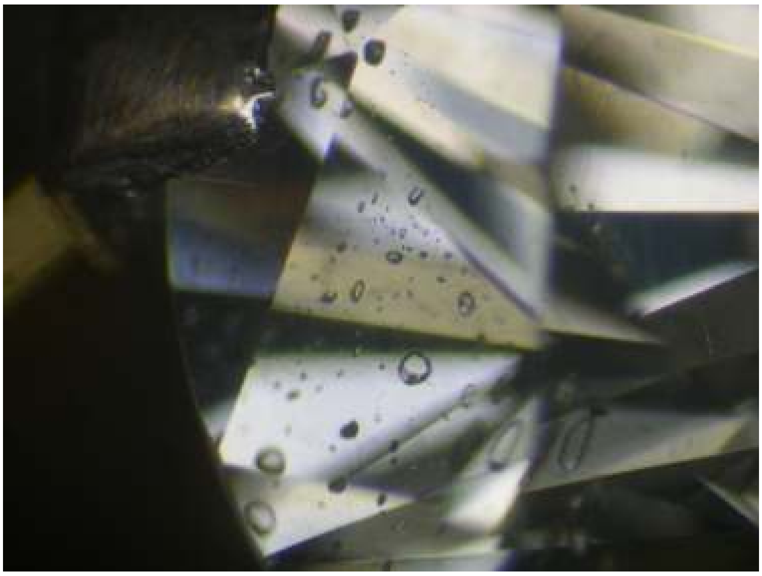


Fig. 4.1.12.12 Included Crystals

4.1.12 Clarity Characteristics in Detail

Dark Included Crystal

Dark Included crystal or a dark crystal is the same mineral crystal within a diamond but in black or grey colour. A dark coloured mineral trapped in a diamond is termed as dark Included crystal.

Abbreviation: **Dinx**

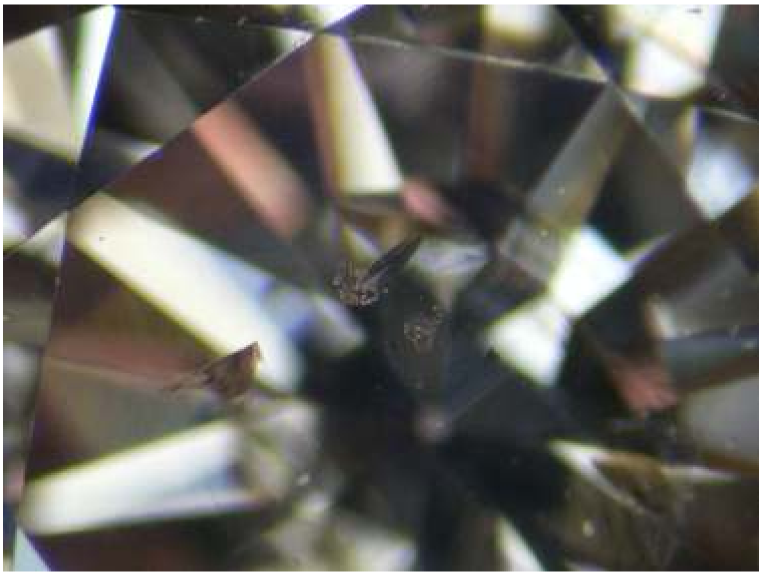


Fig. 4.1.12.13 Dark Included crystals

Internal Graining

Internal graining is the internal indication of irregular crystal growth. These are straight, angular or curved lines which look coloured, white or reflective under 10X. Some times under magnification they effect the transparency also.

Abbreviation: **Int Gr**

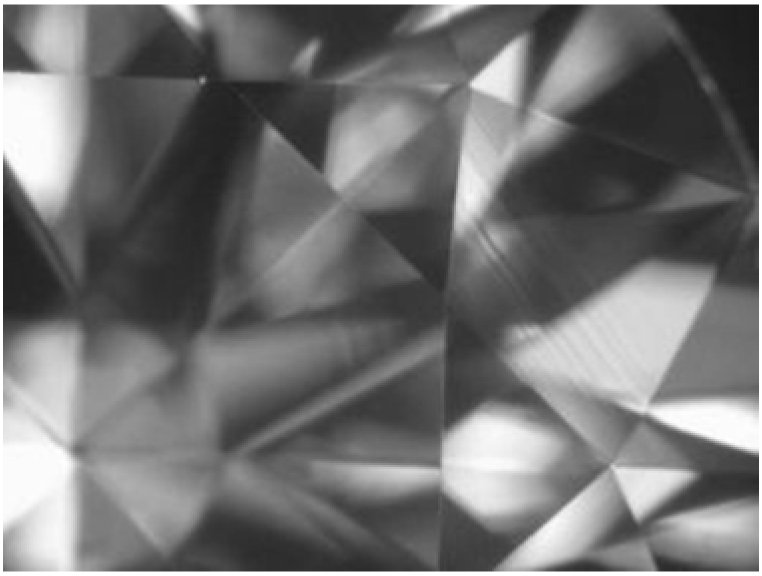


Fig. 4.1.12.14 Internal Graining

4.1.12 Clarity Characteristics in Detail

Laser Drill Hole

A Laser drill hole is a tiny tube made by laser, it usually resembles a needle. A laser drill hole is a tunnel created by a laser light beam to burn a dark included crystal.

Abbreviation: **LDH**

Fig. 4.1.12.15 Laser Drill Hole

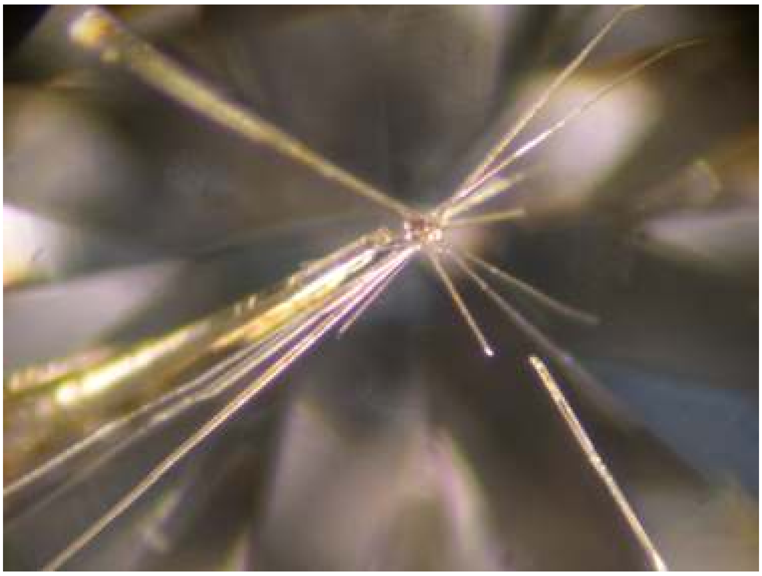


Fig. 4.1.12.16 Laser Drill Hole

4.1.12 Clarity Characteristics in Detail

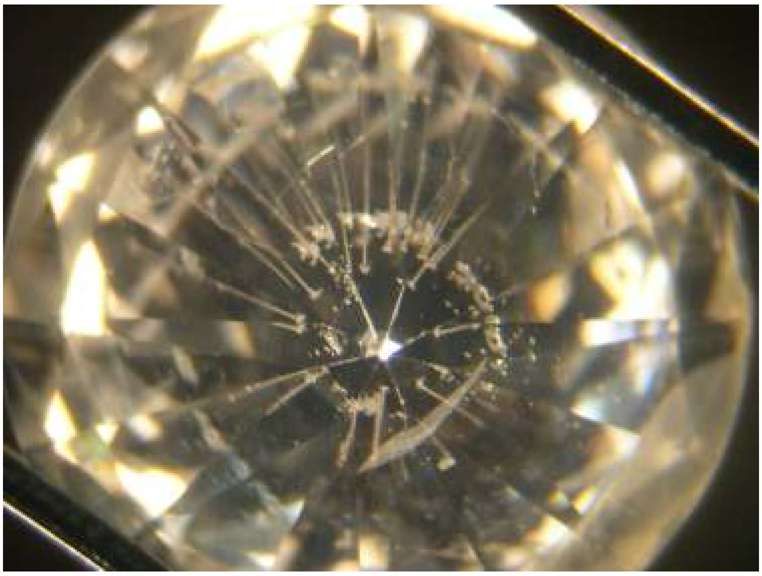


Fig. 4.1.12.17 Laser Drill Hole visible from Pavilion

Fig. 4.1.12.18 Laser Drill Holes

4.1.12 Clarity Characteristics in Detail

Pinpoint

Pinpoint is a very small included crystal, under 10X, normally seen as a tiny dot.

Abbreviation: **Pp**

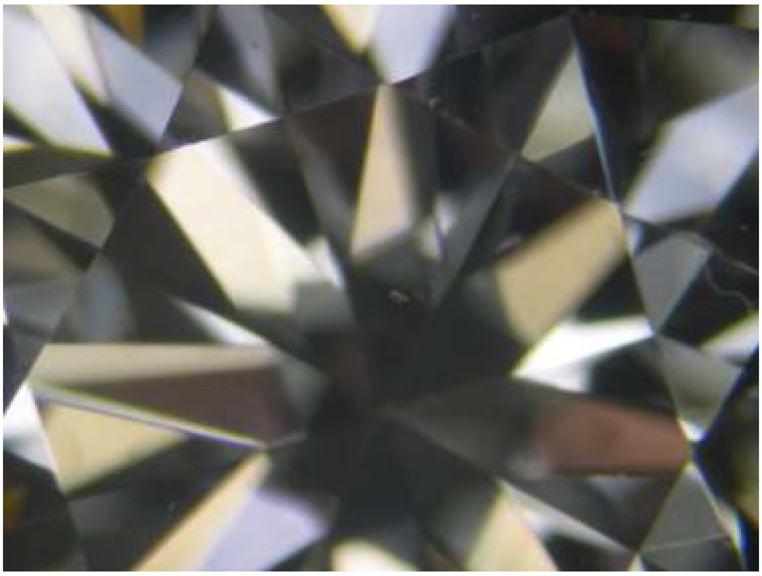


Fig. 4.1.12.19 Pinpoint

Bruise

Surface looks crumbled and accompanied by tiny feathers due to impact. Can also be described as blow on the surface resulting in root like feathers.

Abbreviation: **Br**

Knot

A knot is an included crystal that reaches the surface of the cut and polished stone. Any crystal in the diamond rough which falls in between the cutting edge of a cut and polished gem is termed as a knot.

Abbreviation: **K**

Needle

A Needle is a long, thin included crystal which looks like tiny rod. It can also be defined as an elongated crystal.

Abbreviation: **Ndl**

Indented Natural

Indented Natural is a natural that penetrates the stone. It is part of the original rough's surface that dips below the cut and polished diamond's surface.

Abbreviation: **IndN**

4.1.12 Clarity Characteristics in Detail

Blemishes

Abrasions

Abrasions are tiny nicks along facet junctions of a cut and polished diamond. Facets look white or fuzzy due to excessive abrasions.

Abbreviation: **Abr**

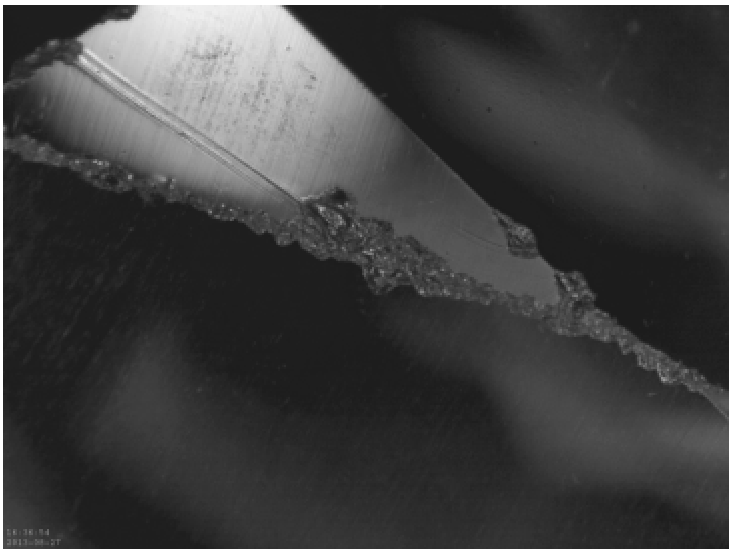


Fig. 4.1.12.20 Abrasions

Extra facet

An extra facet is a facet placed without regard to symmetry commonly found near the girdle.

Abbreviation: **EF**

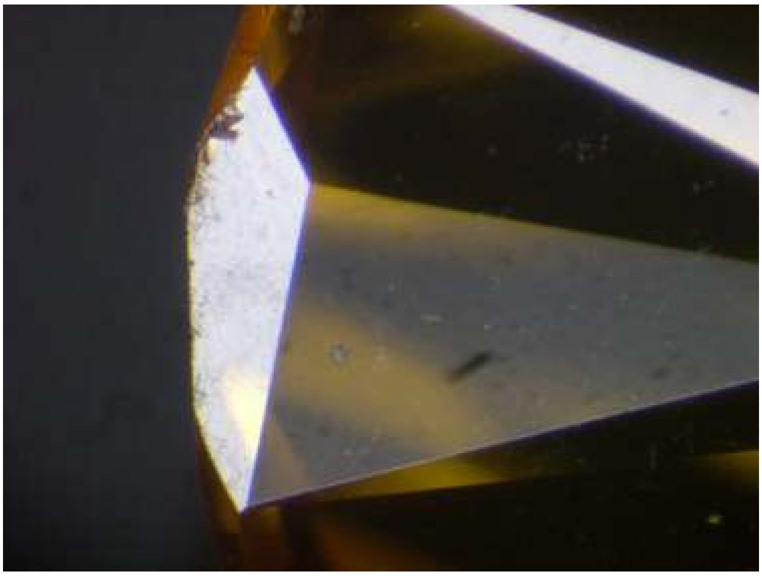


Fig. 4.1.12.21 Extra Facet

4.1.12 Clarity Characteristics in Detail

Natural

Natural is a part of original crystal surface remaining on the polished stone. Naturals are generally found near the girdle.

Abbreviation: **N**

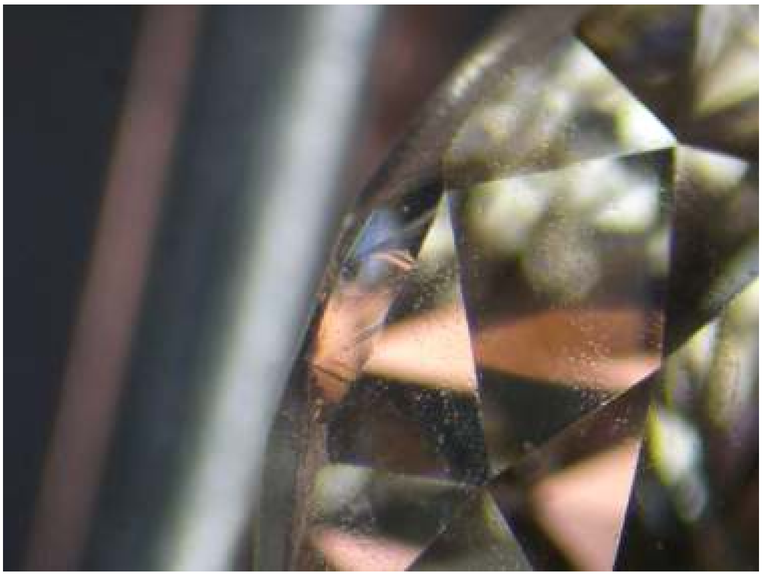


Fig. 4.1.12.22 Natural

Fig. 4.1.12.23 Natural

4.1.12 Clarity Characteristics in Detail

Scratch

Scratch is a linear indentation, normally seen as a fine white line across the diamond surface. Scratch does not have apparent depth

Abbreviation: **S**

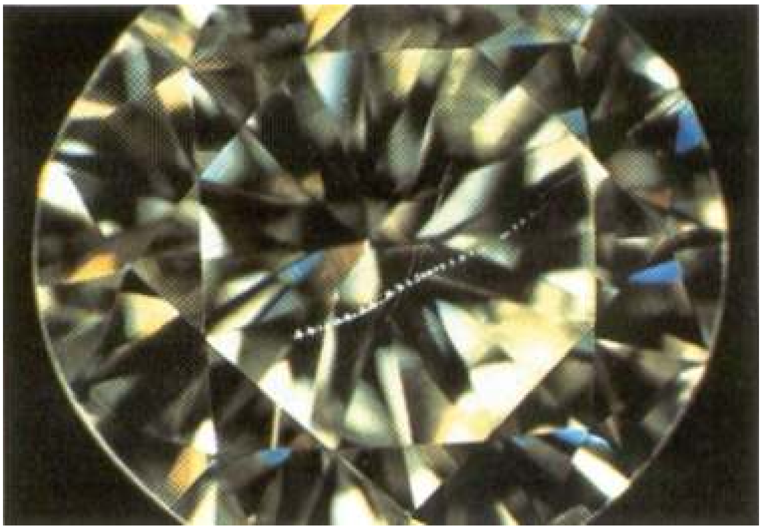


Fig. 4.1.12.24 Scratch

Nick

Nick is a notch near the girdle or facet edge

Abbreviation: **Nk**

Pit

Pit a tiny opening that appears to be a white dot.

Abbreviation: **Pit**

Polish Lines

Polish Lines are parallel lines left by polishing. Fine parallel ridges confined to a single facet, it does not crosses the facet.

Abbreviation: **PL**

Polish Marks

Polish marks are surface clouding caused by excessive heat. Polish marks are also called burn marks or burnt facet.

Abbreviation: **PM / Bm**

4.1.12 Clarity Characteristics in Detail

Rough Girdle

Rough Girdle is a grainy or pitted irregular girdle surface

Abbreviation: **RG**

Surface Graining / External Graining

Surface Graining or external graining is surface indication of structural irregularity, often crosses facet junctions just like Internal graining, except it is on the surface

Abbreviation: **SGr / EXT**

Notes

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4.1.13 Plotting

In clarity grading diamonds we use a plot, which is a map of inclusions and blemishes. There are various standardized coloured symbols used to mark various inclusions and blemishes.

Why plot?

- To identify the stone.
- To document its present condition.
- To support and explain its grade.

What to plot?

Plot everything (do not plot abrasion, polish lines and pits unless severe).

Where to plot?

Plot on a facet diagram, which represents the shape of the diamond you are grading.

Plot on the crown

- Characteristics that reach/break the crown surface.
- Characteristics totally inside the stone visible through the crown.
- Natural confined to the girdle.

Plot on the pavilion

- Characteristics that reach the pavilion surface. Even if it is seen through the crown, it is plotted on the pavilion only.
- Characteristics within the stone visible thru the pavilion only.
- Characteristics that reach both the surfaces.

Note

- Crown pavilion orientation
- Start by plotting a characteristic close to the girdle as landmark.
- Use this landmark for crown pavilion orientation
- For plotting we use fine- tipped ball pen with green, red and black ink.

4.1.14 Plotting Symbols

Plotting symbols & abbreviations

Characteristic	Symbol	Abbreviations
Blemishes		
Extra facet		EF
Natural		N
Abrasion		Abr
Nick		Nk
Scratch		S
Surface graining		Sgr
Polish lines		PL
Polish marks		PM
Inclusions		
Bruise		Br
Cavity		Cv
Chip		Ch
Cloud		Cld
Feather		Ftr
Included crystal		Xtl
Dark Included crystal		Dinx
Percussion marks		Pm
Knot		K
Laser drill hole		LDH
Needle		Ndl
Pinpoint		Pp
Group of pinpoint		GPP
Bearded girdle		BG
Indented natural (Black represent girdle outline)		Ind N
Structural phenomenon		
External graining		Ext Gr
Internal graining		Int Gr

4.1.15 Clarity Grading Diamonds

Most of the following descriptions are most applicable to round brilliants. Clarity characteristics may be more visible in large stones and fancy shapes.

When you assign a clarity grade, consider the size, number, position, nature and colour or relief of the characteristic.

Summarize the factors and do not analyze them separately.

Blemishes usually affect the top two grades, whereas inclusions affect all other grades.

Flawless (FL)

Flawless diamonds show no blemishes or inclusions of any kind when examined by a skilled and experienced grader under 10X.

The following do not disqualify a stone from flawless category:

- An extra facet on the pavilion which cannot be seen face up.
- Naturals totally confined to the girdle without thickening the girdle and without distorting the girdle outline.
- Internal graining which is not reflective, white or coloured and does not effect the transparency.
- Inscription that does not penetrate the surface under 10x.

<u>Things to remember:</u>

Extra facet

An extra facet is a facet placed without regard to symmetry commonly found near the girdle.

Abbreviation: **EF**

Natural

Natural is a part of original crystal surface remaining on the polished stone. Naturals are generally found near the girdle.

Abbreviation: **N**

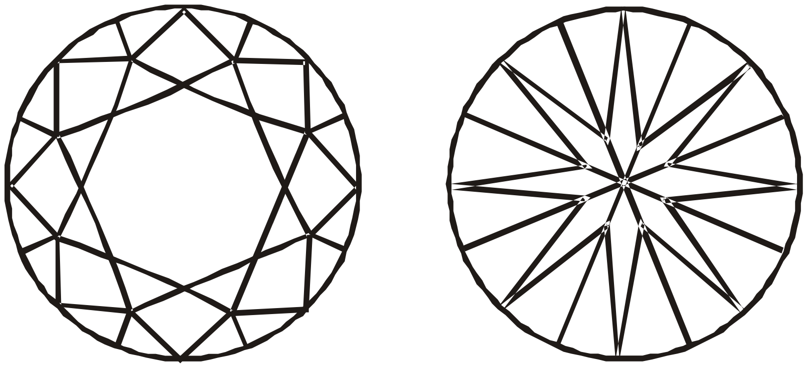
Internal Graining

Internal graining is the internal indication of irregular crystal growth. These are straight, angular or curved lines which look coloured, white or reflective under 10X. Sometimes under magnification they affect the transparency also.

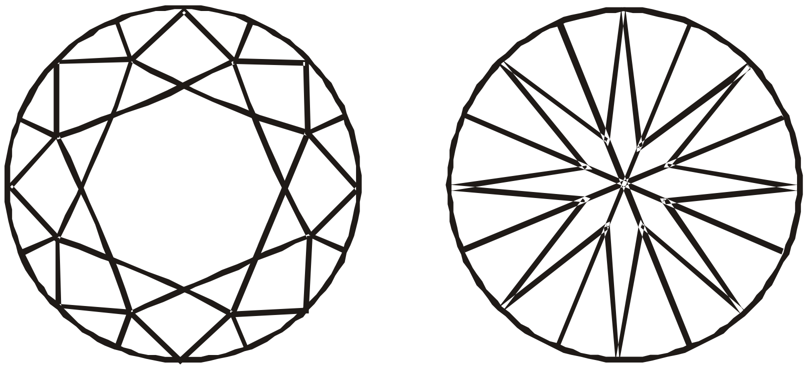
Abbreviation: **Int Gr**

4.1.15 Clarity Grading Diamonds

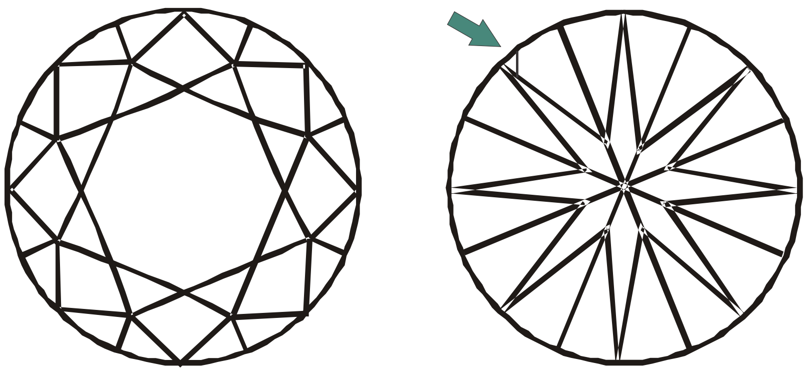
Flawless (FL)



No Inclusions or blemishes



Small Pinpoint not apparent in 10X



Extra facet on pavilion cannot be seen face up

Fig. 4.1.15.1 Flawless (FL)

4.1.15 Clarity Grading Diamonds

Internally Flawless (IF)

If a diamond shows no inclusions and only significant blemishes under 10X (blemishes that can be removed by minor re-polishing, like naturals and extra facet).

Re-polishing though increases an Internally Flawless diamond's clarity grade to Flawless, but it is rarely done.

The following do not disqualify a stone from internally flawless category:

- Surface graining

<u>Things to remember:</u>

All Blemishes

Abrasions: tiny nicks along facet junctions

Extra facet: a facet placed without regard to symmetry

Natural: a part of original crystal surface remaining on the polished stone

Nick: a notch near the girdle or facet edge

Pit: a tiny opening

Polish lines: parallel lines left by polishing. Fine parallel ridges confined to a single facet

Polish marks: surface clouding caused by excessive heat (also called burn marks or burnt facet)

Rough girdle: a grainy or pitted girdle surface

Scratch: a linear indentation, normally seen as a fine white line

Surface graining: surface indication of structural irregularity, often crosses facet junctions

4.1.15 Clarity Grading Diamonds

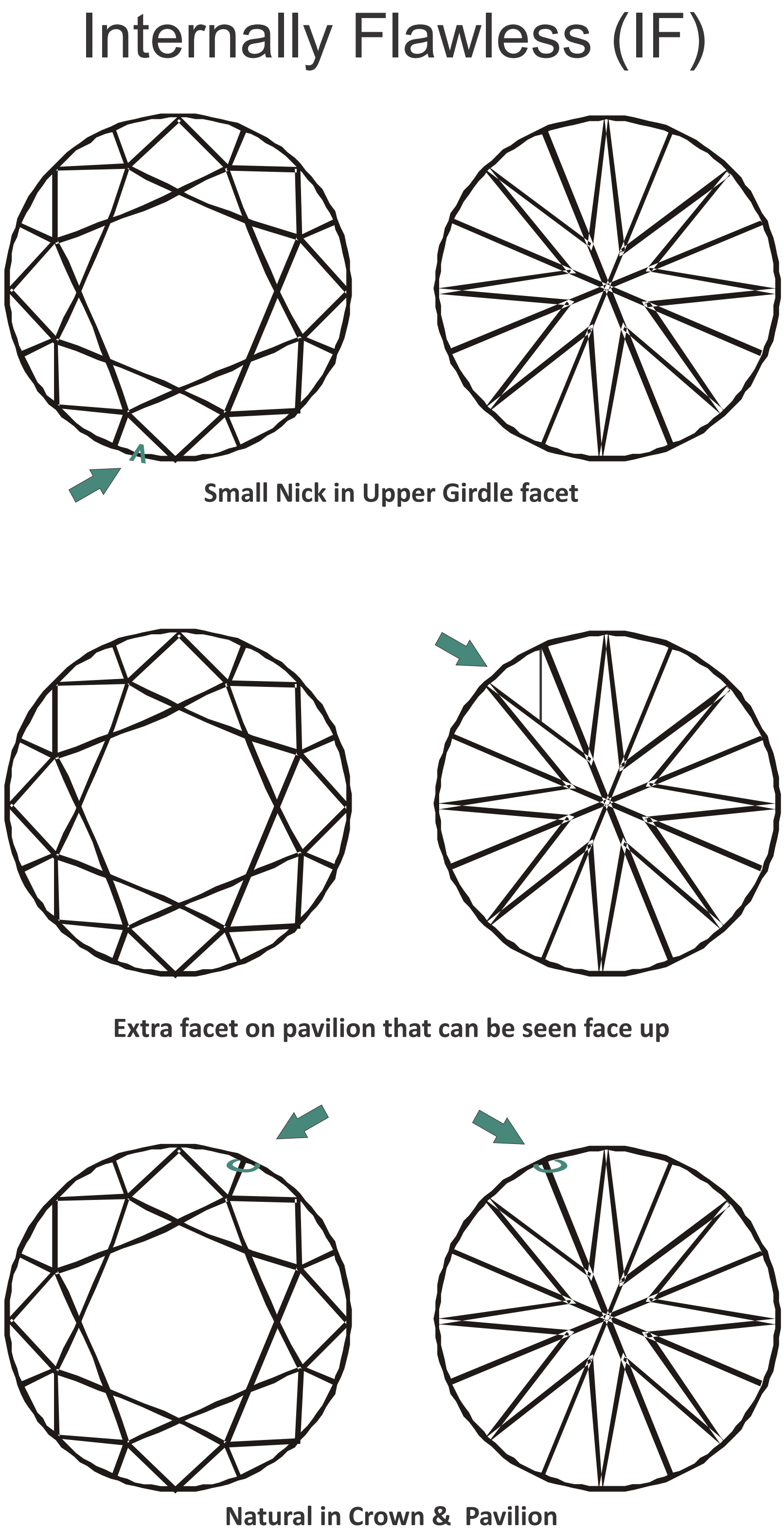


Fig. 4.1.15.2 Internally Flawless (IF)

4.1.15 Clarity Grading Diamonds

Very Very Slightly Included (VVS1, VVS2)

VVS diamonds include minute inclusions that are difficult to locate by even a skilled and experienced grader under 10X.

In VVS1, they are extremely difficult to see.

Visible only from the pavilion or small or shallow enough to be removed by minor re-polishing.

In VVS2 they are very difficult to see.

Key word: extremely difficult and minute

Things to remember:

Bearding / Bearded Girdle

These are tiny feathers extending into the girdle due to the bruiting process in the cutting procedure. Bruiting is when a diamond held in a lathe machine is rubbed against another diamond to gain round shape.

It also describes the skill of the bruiter. More skilled the bruitter is least chances of bearded girdle.

Abbreviation: **BG**

Internal Graining

Internal graining is the internal indication of irregular crystal growth. These are straight, angular or curved lines which look coloured, white or reflective under 10X. Sometimes under magnification they effect the transparency also.

Abbreviation: **Int Gr**

Pinpoint

Pinpoint is a very small included crystal, under 10X, normally seen as a tiny dot.

Abbreviation: **Pp**

Bruise

Surface looks crumbled and accompanied by tiny feathers due to impact. Can also be described as blow on the surface resulting in root like feathers.

Abbreviation: **Br**

Needle

A Needle is a long, thin included crystal which looks like a tiny rod. It can also be defined as an elongated crystal.

Abbreviation: **Ndl**

4.1.15 Clarity Grading Diamonds

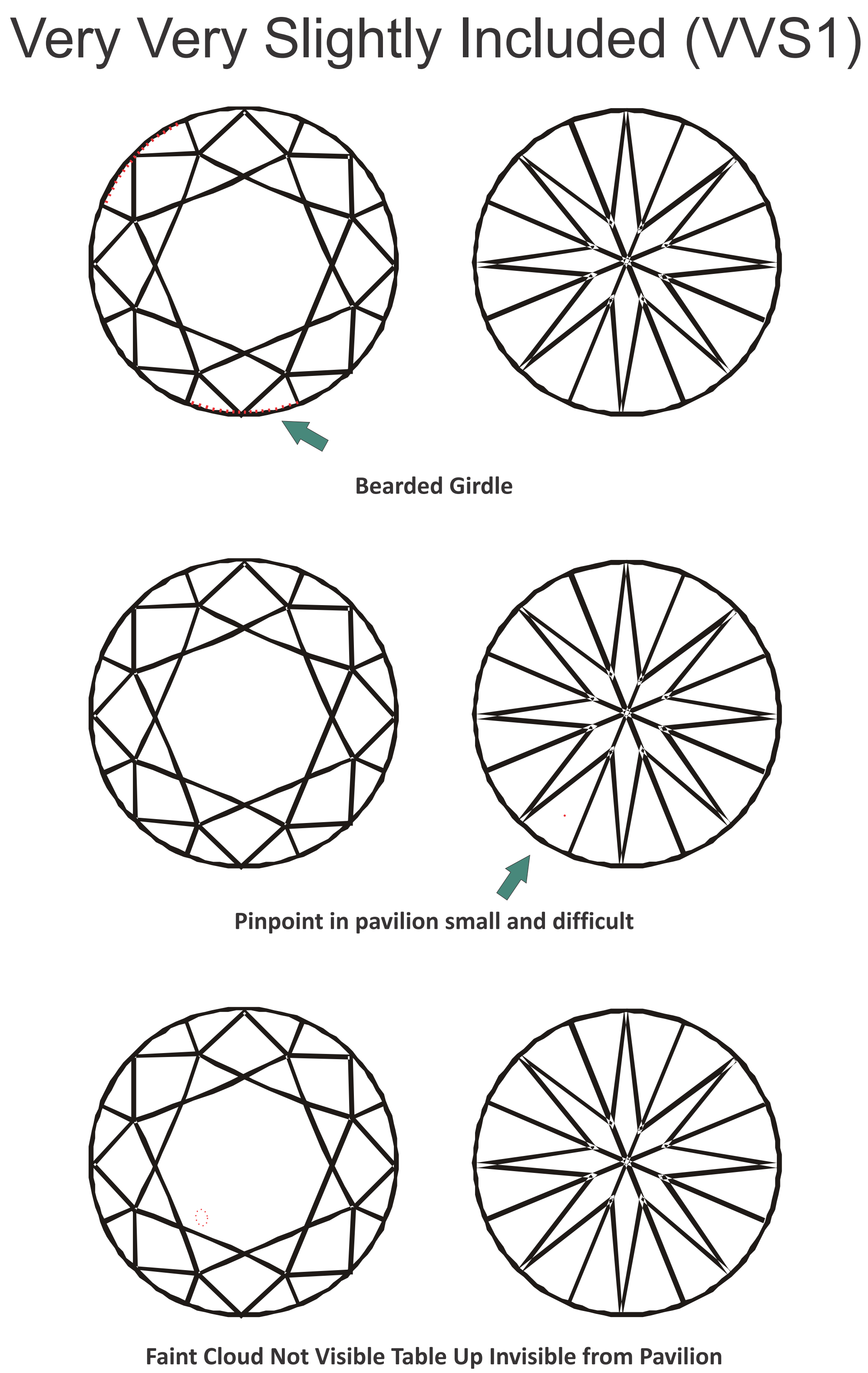
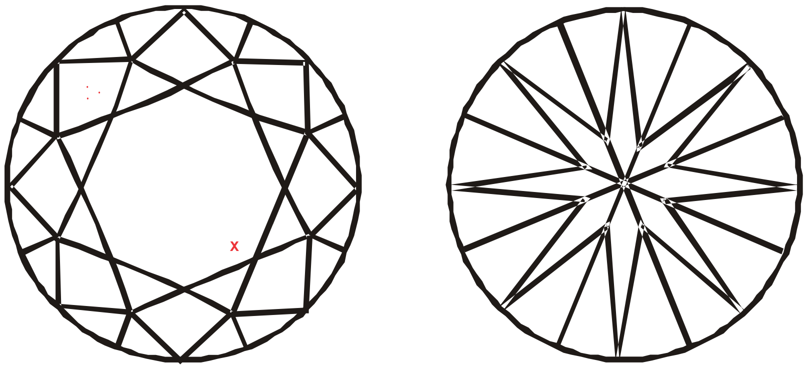


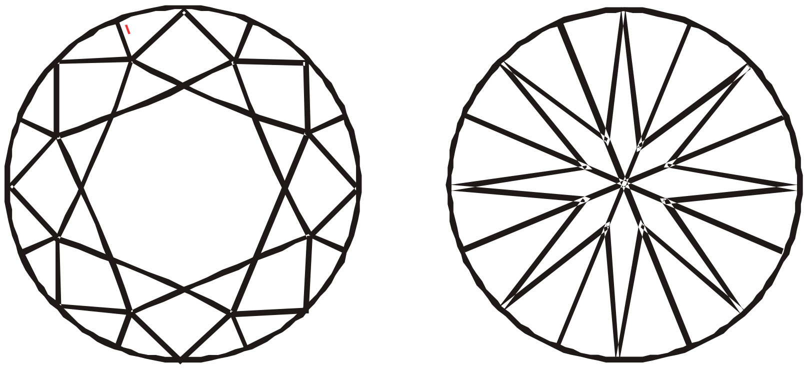
Fig. 4.1.15.3 Very Very Slightly Included 1 (VVS 1)

4.1.15 Clarity Grading Diamonds

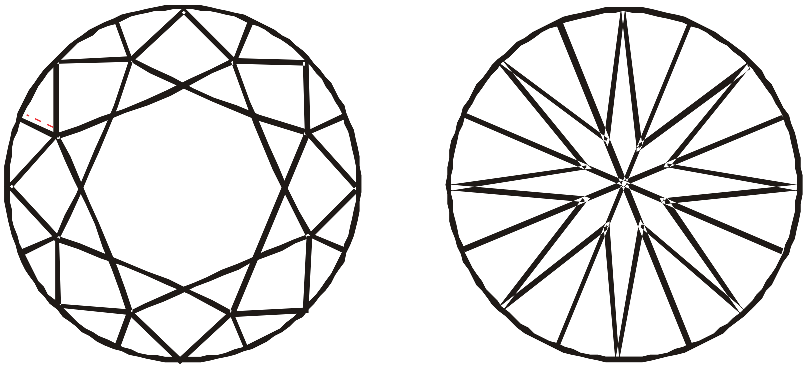
Very Very Slightly Included (VVS2)



Group of Pinpoints in bezel facet, Bruise at table corner



Needle like Inclusion parallel to facet junction



Fine Internal Twinning

Fig. 4.1.15.4 Very Very Slightly Included 2 (VVS 2)

4.1.15 Clarity Grading Diamonds

Very Slightly Included (VS1, VS2)

VS diamonds contain minor inclusions ranging from difficult (VS1) to somewhat easy (VS2) to see by a skilled and experienced grader under 10X.

Small-included crystal, small feather & distinct cloud are typical. They don't affect the beauty of the stone.

Crystal -VS

Key word: difficult and minor

Things to remember:

Cloud

A milky, hazy or cloudy area created by tightly packed pinpoints. The pinpoints are too small to distinguish them individually. Thus a hazy or milky area made up of number of very small inclusions is called as cloud.

Abbreviation: **Cld**

Feather

Feather is a break due to either cleavage or fracture often white or feathery in appearance. Thus, a white and feathery in appearance for a general term used to describe a break in the diamond.

Abbreviation: **Ftr**

Included crystal

Included crystal or a crystal is a mineral crystal contained in diamond. A mineral trapped in a diamond is termed as Included crystal.

Abbreviation: **Inx or Xtl**

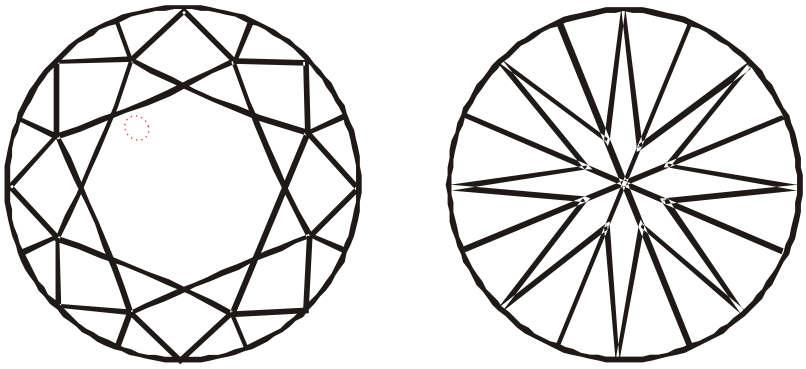
Dark Included crystal

Dark Included crystal or a dark crystal is the same mineral crystal contained in diamond but in black or grey colour. A dark coloured mineral trapped in a diamond is termed as Included crystal.

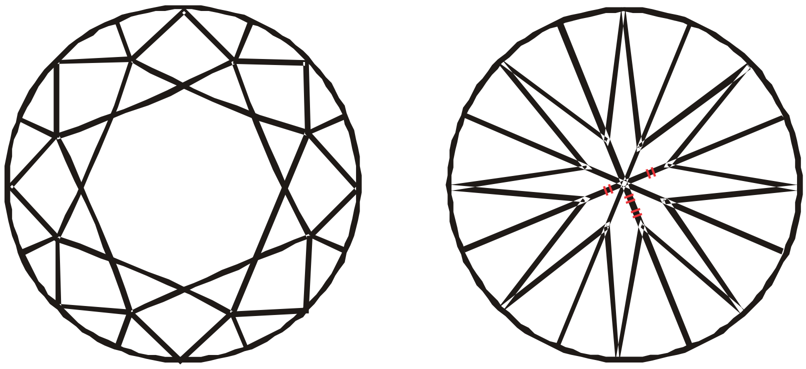
Abbreviation: **Dinx**

4.1.15 Clarity Grading Diamonds

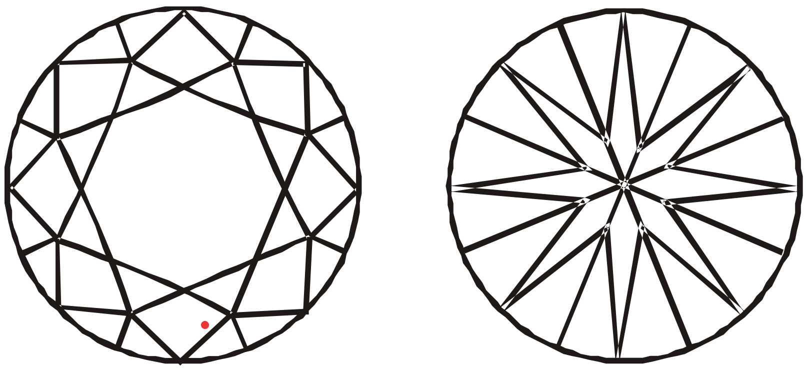
Very Slightly Included (VS1)



Hazy cloud



Small Percussion mark on pavilion facet Junction

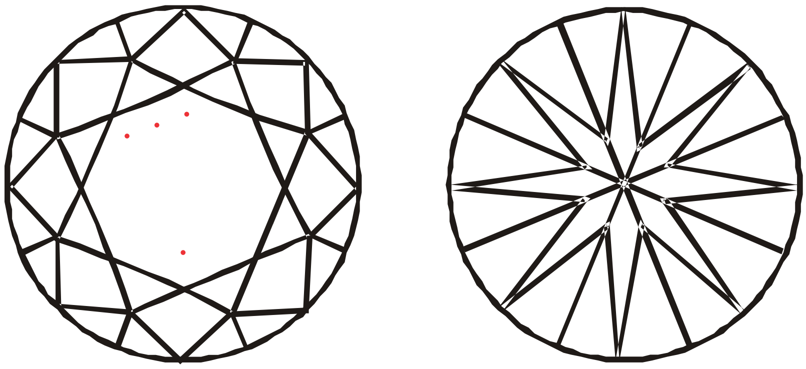


Dark included Crystal

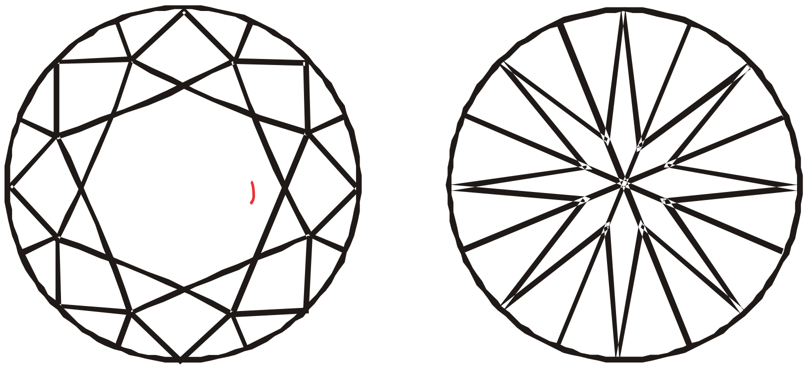
Fig. 4.1.15.5 Very Slightly Included 1 (VS 1)

4.1.15 Clarity Grading Diamonds

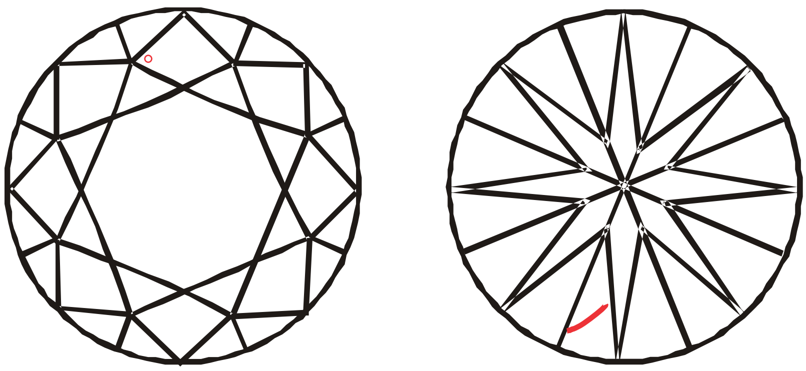
Very Slightly Included (VS2)



Dark Included Crystals



Feather



Included Crystals, Feather

Fig. 4.1.15.6 Very Slightly Included 2 (VS 2)

4.1.15 Clarity Grading Diamonds

Slightly Included (SI 1, SI 2)

SI diamonds contain noticeable inclusions which are easy (SI1) or very easy (SI2) to see by a skilled and experienced grader under 10X.

In some SI diamonds inclusions, can be seen with the unaided eye. Naked eye inclusions are more often visible in SI 2 stone.

SI2 diamonds can have reflecting inclusions also.

Keyword: easy and noticeable

Things to remember:

Cavity

Cavity is a large or deep opening. Cavity is usually angular and this opening gets created when the feather breaks away. It can also be formed when a mineral inclusion breaking the surface falls off.

Abbreviation: **Cv**

Laser Drill Hole

A Laser drill hole is a tiny tube made by laser. It usually resembles a needle. A laser drill hole is a tunnel created by a laser light beam to burn a dark included crystal.

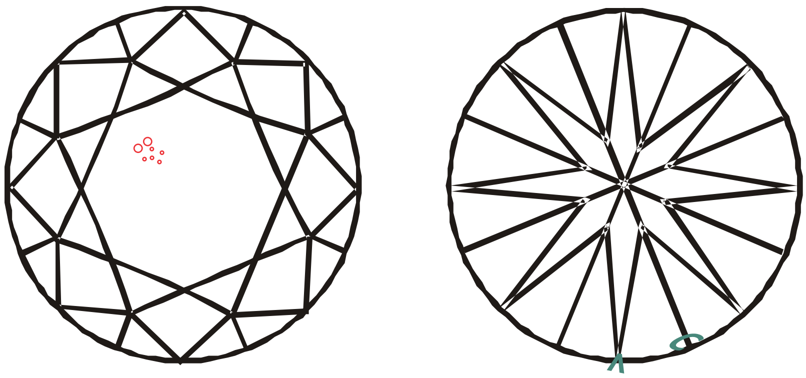
Abbreviation: **LDH**

Colour/ Relief

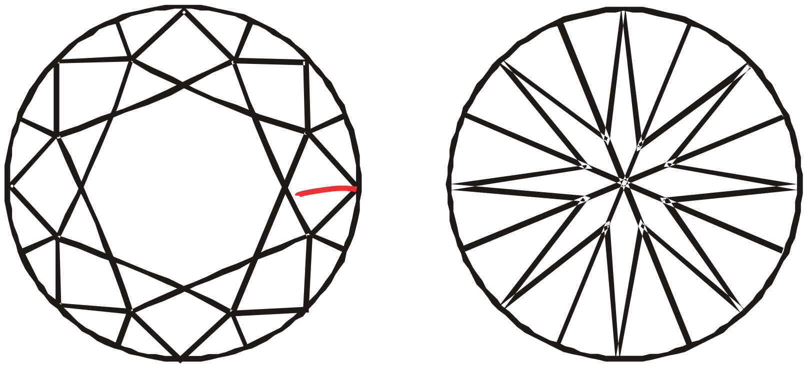
Colour and relief is as important as size of the clarity characteristics because of the visibility. Whenever the colour of the clarity characteristics will be different or in contrast with the colour of the diamond, it will be more prominent. Hence. it will increase the relief and will be more prominent, thus reducing the clarity grade.

4.1.15 Clarity Grading Diamonds

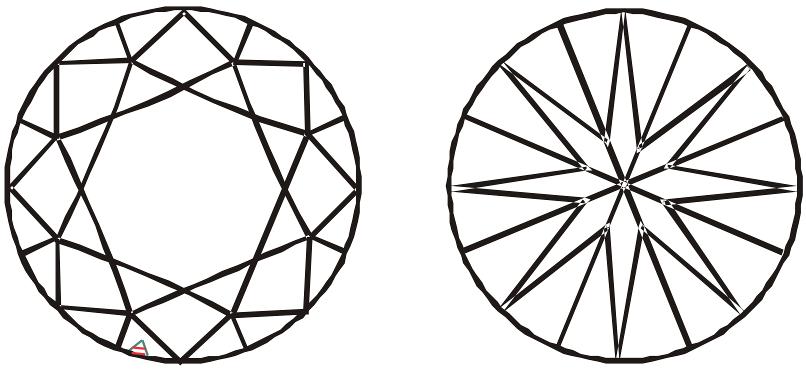
Slightly Included (SI1)



Group of Included Crystals, Nick and Natural



Feather

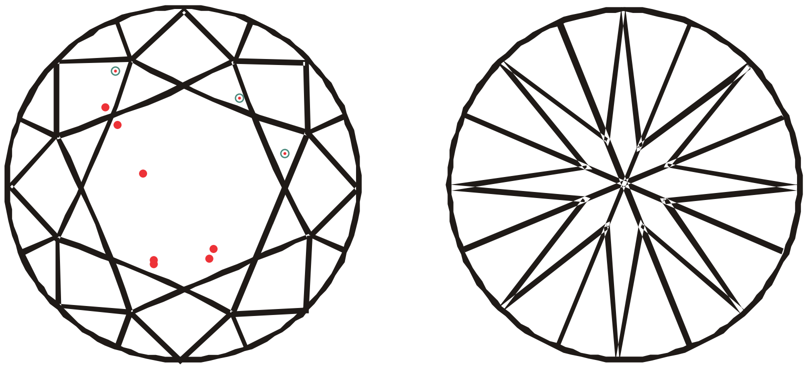


Cavity

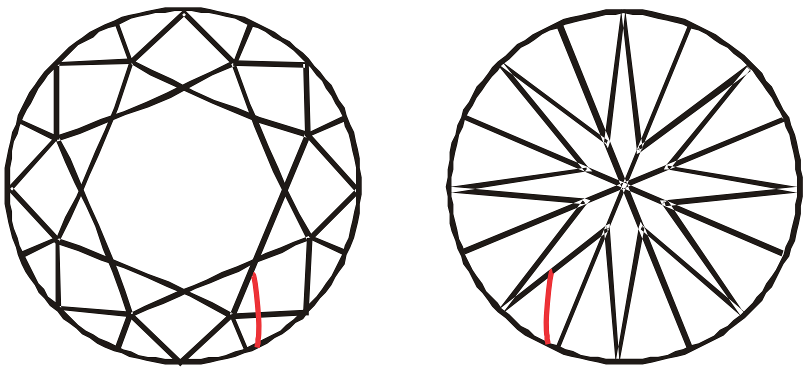
Fig. 4.1.15.7 Slightly Included 1 (SI 1)

4.1.15 Clarity Grading Diamonds

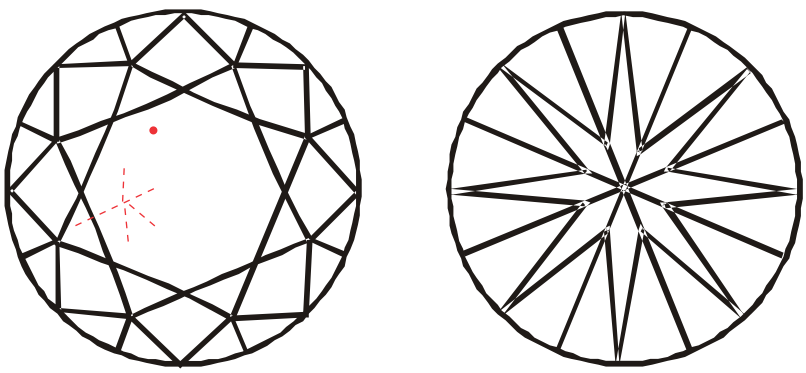
Slightly Included (SI2)



Laser Drill Holes, Dark Included Crystals



Feather



Cloud, dark Included Crystals

Fig. 4.1.15.8 Slightly Included 2 (SI 2)

4.1.15 Clarity Grading Diamonds

Included (I1, I2, I3) /Pique (P1, P2, P3)

I grade diamonds contain inclusions which are obvious to a trained grader under 10X magnification, which can often be seen face up with the unaided eye.

It seriously affects the diamonds potential durability or are so numerous that they effect transparency and brilliance.

Keyword: obvious, generally visible to naked eye.

They can be seen face-up with unaided eye.

They are numerous or large to affect transparency and brilliance.

They seriously affect the diamonds durability also.

I 1

Moderate effect on durability or brilliance

I 2

Severe effect on durability or brilliance

I 3

Severe effect on durability and brilliance

Things to remember:

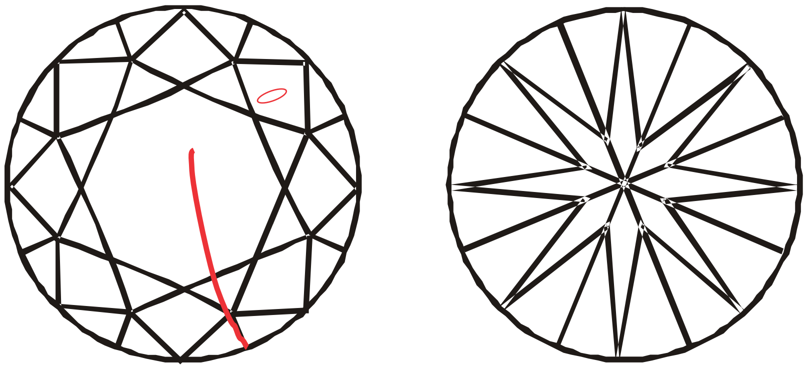
They can be seen face-up with unaided eye.

They are numerous or large to affect transparency and brilliance.

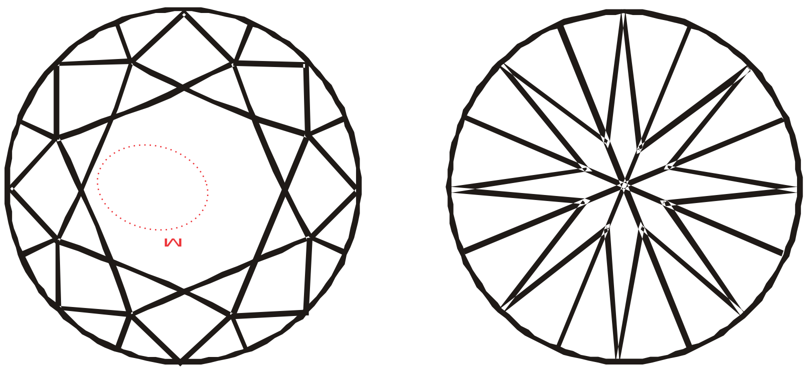
They seriously affect the stone's durability also.

4.1.15 Clarity Grading Diamonds

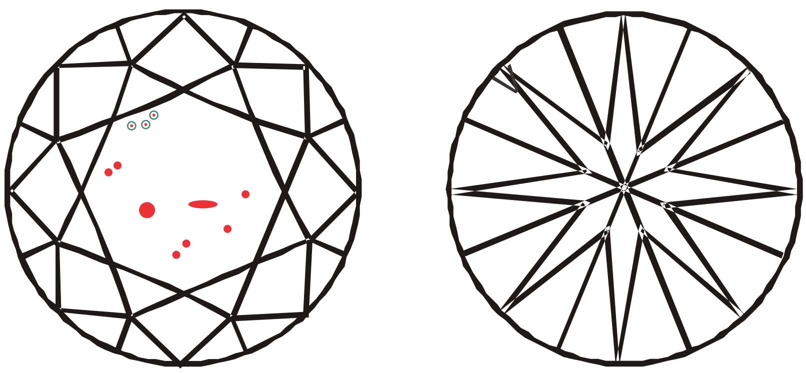
Included / Pique (I1)/ (P1)



Feather, Large Included Crystals



Feather, Cloud

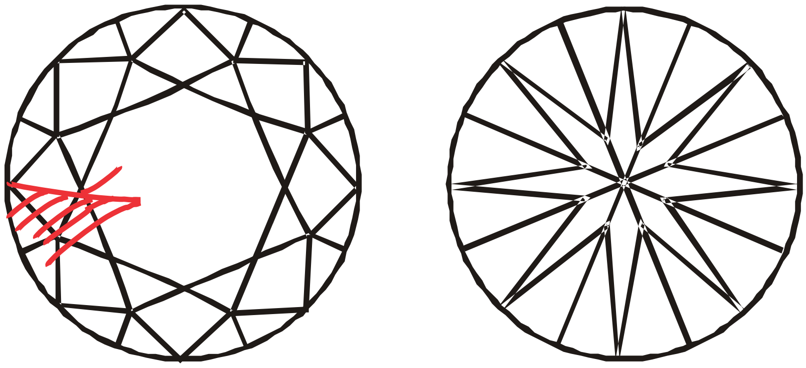


Laser drill Holes, Dark Included Crystals, Extra facet

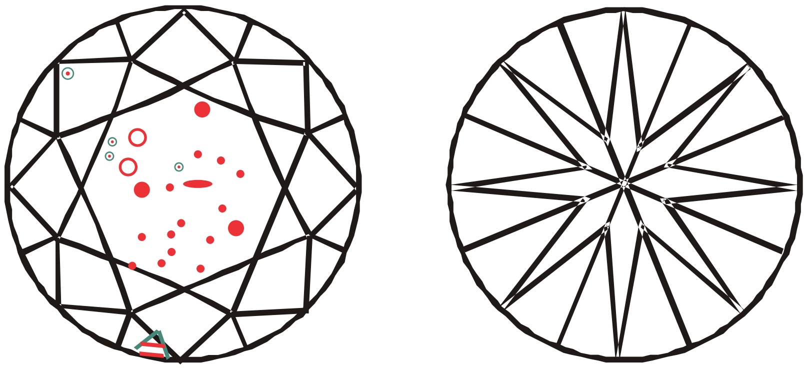
Fig. 4.1.15.9 Included 1 (I 1)

4.1.15 Clarity Grading Diamonds

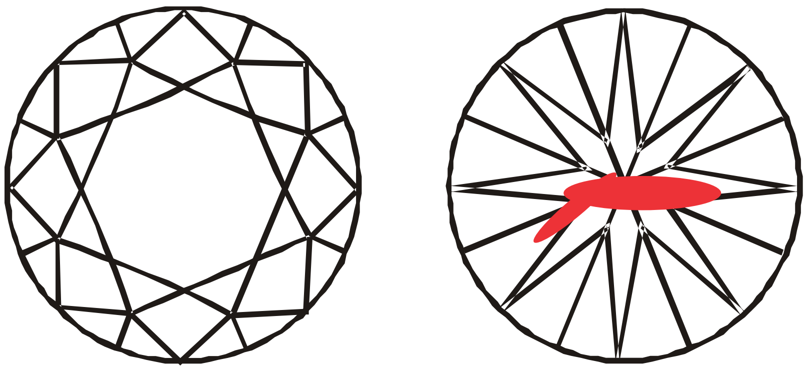
Included / Pique (I2)/ (P2)



Large Feather, Opaque



Included Crystals, Laser drill hole, Cavity

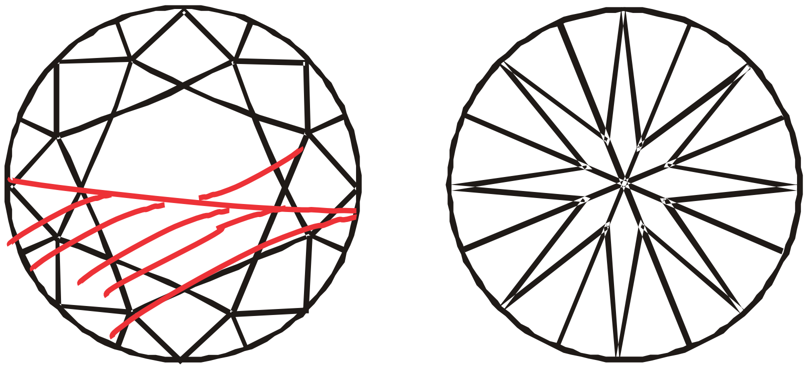


Dark Included Crystal, Visible from Top, Reflective

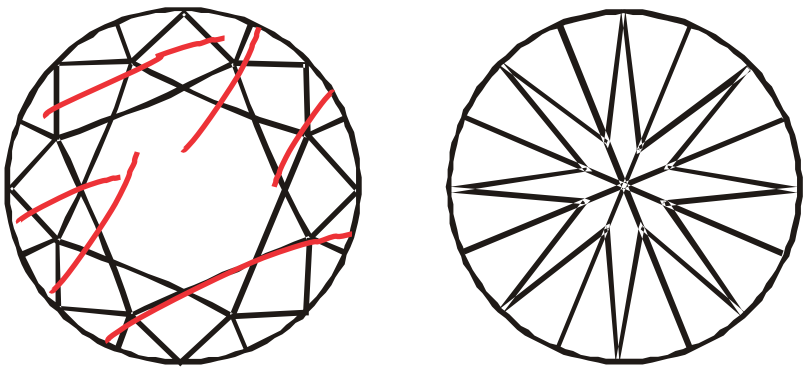
Fig. 4.1.15.10 Included 2 (I 2)

4.1.15 Clarity Grading Diamonds

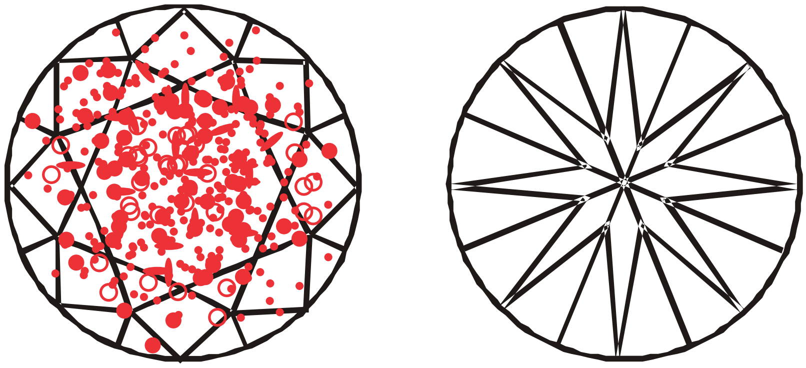
Included / Pique (I3)/ (P3)



Large Feather, Opaque



Numerous Feathers



Dead Stone
Cloud, Included Crystals

Fig. 4.1.15.11 Included 3 (I 3)

4.1.16 Clarity as a Value Factor

As **understood in the previous units, considering all other value factors as constant, higher the clarity grade, higher the per carat rates of diamonds.**

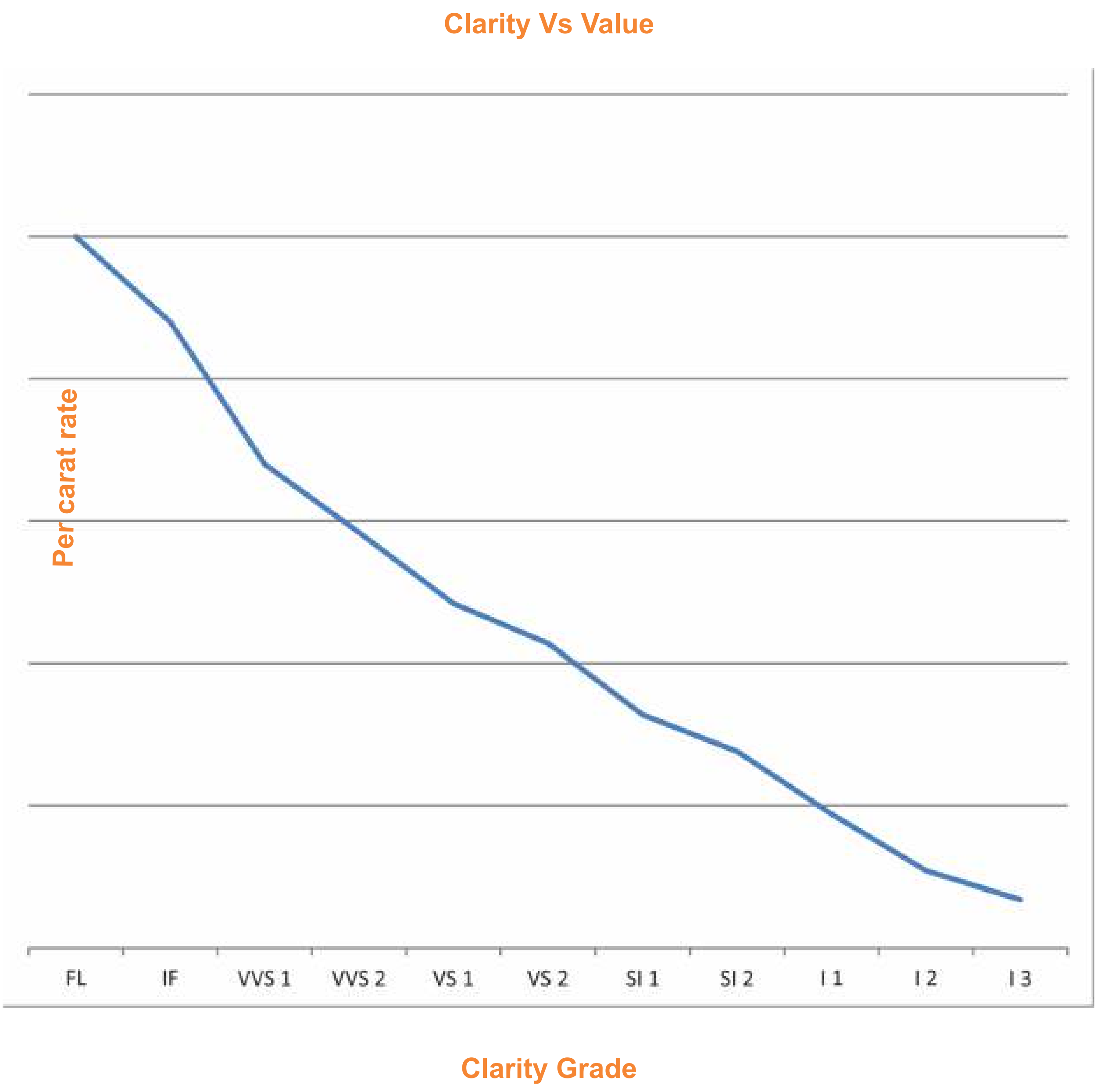


Fig. 4.1.16.1 Clarity vs value

Notes

Skill India
कौशल भारत-कुशल भारत

सत्यमेव जयते
GOVERNMENT OF INDIA
MINISTRY OF SKILL DEVELOPMENT
& ENTREPRENEURSHIP

N·S·D·C
National
Skill Development
Corporation
Transforming the skill landscape

GJSCI
Gem & Jewellery Skill Council of India

5. Carat

Unit 5.1 - Carat and its Concepts

G&J/N3604

Key Learning Outcomes

At the end of this module, you will be able to:

1. Know what is carat.
2. Know the various terms related to carat.
3. Understand the technique to measure the diamond.
4. Understand in detail the calculations related to carat.
5. Learn the concept of sieves.
6. Know the various gauges and instruments used.

Unit 5.1: Carat and its Concepts

Unit Objectives

At the end of this unit, you will be able to:

1. Understand the concept of carat in detail.
2. Understand the derivation of carat and other terms.
3. Understand the concept of carat as a value factor.
4. Understand the concept of measurement.
5. Understand the concept of diameter measurement.
6. Understand the concept of depth measurement.
7. Understand the weight and measurement analysis.
8. Understand the concept of measurement vs identification.
9. Understand the concept of measurement vs cut.
10. Understand the concept of sieves.
11. Understand how to use sieves.
12. Understand the sieve reference chart.
13. Understand various types of gauges.

5.1.1 What is Carat?

As discussed in unit 3.2 **carat** is a unit of weight which is derived from the carob seed. Carat is the most obvious 'C' amongst all the 4Cs. A diamond's weight is the simplest of its characteristics to measure, and from the earliest times has been used to calculate one value aspect of the value of a diamond.

In earlier days carob seeds (Ratti) was used to measure the light weight products. Nature has defined all carob seeds with almost constant weight.

In the metric system of weight, carat weight is defined as the system of weighing major gemstones

5.1.2 What is Carob Seed (Ratti)?

Ceratonia siliqua (Scientific name), commonly known as the carob tree is a species of evergreen flowering shrub or tree in the pea family.

Fig. 5.1.2.1 Carob seed

5.1.3 Derivation of Carat Weight

When we talk about weight, units like **kilogram** and **gram** are the most common units we are aware of.

We talk about our own body weight in terms of kilograms. On an average basis, weight of an adult male varies from 65 kilograms to 90 kilograms.

In case of diamonds the weight measurement used is not kilogram but carat.

As discussed in unit 3.2 carat derivation is mentioned below:

1 Kilogram (Kg) = 1000 grams (gms)

1 Gram (gm) = 1000 milligrams (mg)

1 Gram (gm) = 5 Carats (ct)

Thus

5 Carats (cts) = 1000 milligrams (mg)

1 carat (ct) = 200 milligrams (mg)

One carat can further be divided into 100 equal parts (just the same way as one rupee is divided into 100 equal parts known as paisa).

Therefore

1 carat (ct) = 100 points (pt)

Another common term used in trade **is grain.**

One carat has four grains (equivalent to a quarter of a carat).

Therefore

1 carat (ct) = 4 grains

Thus

1 grain = 25 points

All what we have learned above can also be summed up into one formula:

1 Carat = 200 mg = 0.2 gm = 100 points = 4 Grains

In the local Indian trade we refer points as 'cents'.
{ 1 carat = 100 cents }

5.1.4 Carat as a Value Factor

As discussed in unit 3.2 carat weight vs carat rate, **considering all other value factors as constant, the rate at which diamond weight increases, the per carat increases faster than that.**

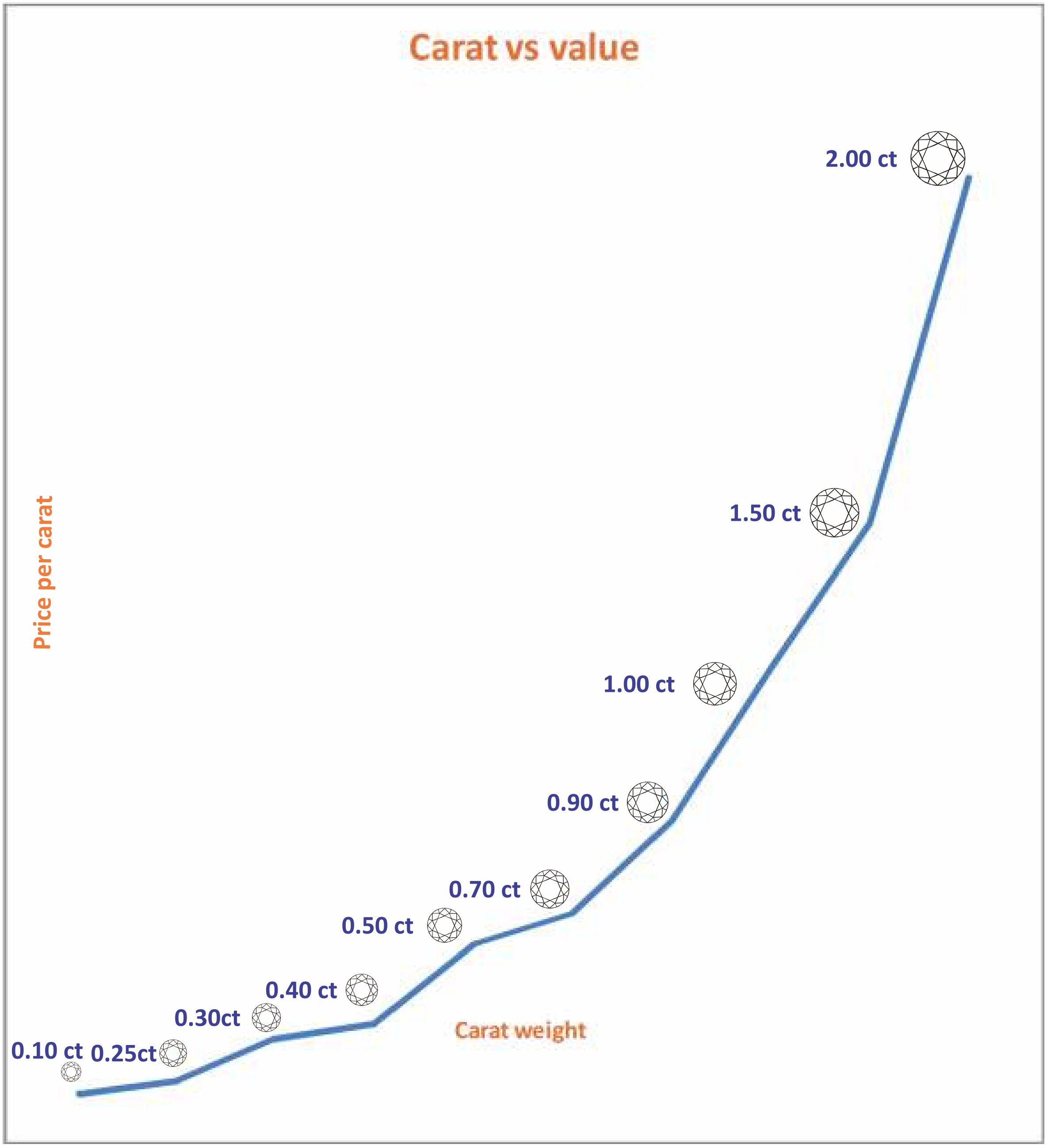


Fig. 5.1.4.1 Considering all other value factors as constant, the rate at which diamond weight increases, the per carat increases faster than that.

5.1.5 Trade Terms

In jewellery, most of the diamonds are under one carat.

Thus they are very small and very small diamonds studded in jewellery are commonly called as **melee.**

In **Indian market** melee generally means diamond weighing more than two points and less than eight points.

Melee = 0.02 carat to 0.08 carat

In the **international market** melee has different meaning for different people. The understanding of melee varies from two points to eighteen points.

Melee = 0.02 carat to 0.18 carat

Fig. 5.1.5.1 Melee size Diamonds

Light Half: A market trade term for diamonds weighing **between 0.45 ct and 0.49 carat.**

Light Carat: A market trade term for diamonds weighing **between 0.96 ct and 0.99 carat.**

Diamonds are small though valuable.

In India charges for a letter to be posted by Indian mail system is Rs 5 per 20 grams. That means we can send or post 100 carat (20*5) in an envelope with just Rs 5 stamp on it.

Fig. 5.1.5.2 Indian postage stamp

5.1.6 Measuring Dimensions of Diamonds

Expertise and professional skills are required to measure the dimensions of the diamond.

There are two important dimensions of the diamond, one is the diameter and the other is the depth.

Diamond dimensions are measured and expressed i**n millimeter (mm) till hundredth of the millimeter.**

Diamond Diameter: As shown in the image below diameter(s) are the sets of measurement of the girdle diameter.

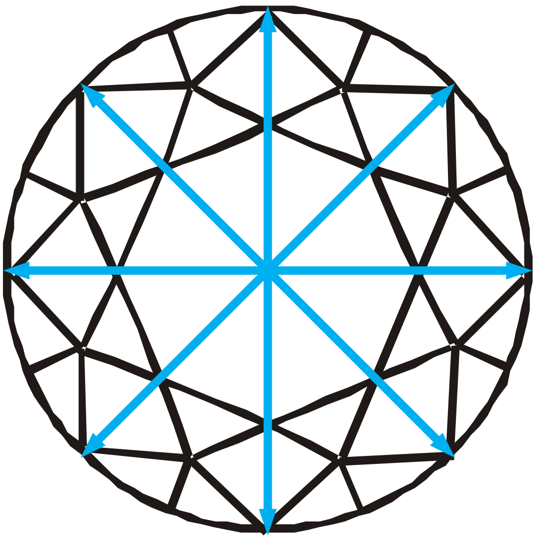


Fig. 5.1.6.1 Different Diameters of Diamond

Diamond Depth: As shown in the image below depth is the vertical distance between table and culet. Also popularly called as table to culet measurement.

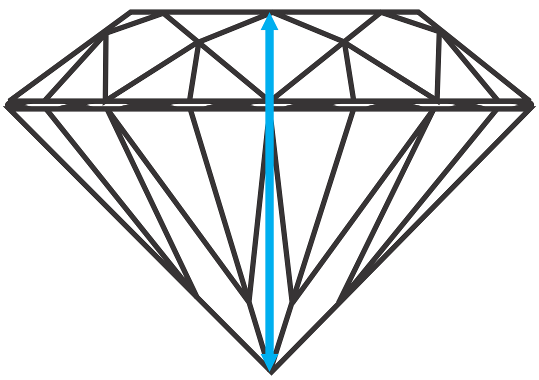


Fig. 5.1.6.2 Depth of Diamond

5.1.7 Calculating Average Girdle Diameter

As learnt in 5.6 about the girdle diameter, we should measure minimum **four** girdle diameter.

Amongst the four diameters identity minimum and maximum diameter and take there average. This will be the average girdle diameter of the diamond**.**

. Let us assume that in the image shown in fig 5.6.1 the diameter are as follows:

Diameter A: 6.51 mm

Diameter B: 6.52

Diameter C: 6.49 mm

Diameter D: 6.48 mm

Thus **average girdle diameter =** $\mathbf{\dfrac{\text{minimum diameter + maximum diameter}}{2}}$

i.e. **average girdle diameter =** $\mathbf{\dfrac{6.48mm + 6.52mm}{2}}$

= 6.50 mm

5.1.8 Carat Weight Calculations

Estimated Weight of Standard Round Brilliant cut

Ø x Ø x h x 0.0061= Approximate weight in carat

Ø= Average diameter (mm)
h= Height (mm)

Thus, using the figures in 5.1.7 in the above-mentioned formula following will be the result:

6.50 * 6.50 * 3.90 *0.0061 = **Approximate weight in carat**

1.0051275 = **Approximate weight in carat**

Now as we have the weight in decimals, how do we round it off to two decimals places?

5.1.9 Carat Weight Rounding Off Procedure

FTC's (US Federal Trade Commission) rounding off procedure:

Compared to the jewellery industry the **FTC's** procedure of rounding off decimals of carat weight is different.

As per the **FTC's** procedure if the third figure after the decimal (thousandth position) is 5 or more then round it off to the higher side, whereas if the third figure after the decimal (thousandth position) is less than 5 then round it off to the lower side.

Weight in Carat Up to Third Decimal	FTC (US Federal Trade Commission procedure of rounding off)
1.000	**1.00**
1.001	**1.00**
1.002	**1.00**
1.003	**1.00**
1.004	**1.00**
1.005	**1.01**
1.006	**1.01**
1.007	**1.01**
1.008	**1.01**
1.009	**1.01**

Fig. 5.1.9.1 US Federal Trade Commission (FTC) rounding off chart

Thus as per the results in section 5.1.8 the weight of 1.0051275 carat as per the FTC's procedure should be rounded off as follows to 1.01 carat.

1.0051275 carat

1.005128 carat

1.00513 carat

1.0051 carat

1.005 carat

1.01 carat

Other than FTC's procedure there is another procedure of World Federation of Diamond Bourses for weight round off. 5.1.9 Carat Weight Rounding Off Procedure.

5.1.9 Carat Weight Rounding Off Procedure

World Federation of Diamond Bourses rounding off procedure:

Jewellery industry generally follows the **World Federation of Diamond Bourses** procedure of rounding off decimals of carat weight.

As per the **World Federation of Diamond Bourses** procedure if the third figure after the decimal (thousandth position) is **9** then round it off to the higher side, whereas if the third figure after the decimal (thousandth position) is less than **9** then round it off to the lower side**.**

Weight in Carat Up to Third Decimal	World Federation of Diamond Bourses (procedure of rounding off)
1.000	1.00
1.001	1.00
1.002	1.00
1.003	1.00
1.004	1.00
1.005	1.00
1.006	1.00
1.007	1.00
1.008	1.00
1.009	1.01

Fig. 5.1.9.2 World Federation of Diamond Bourses rounding off chart

Thus as per the results in section 5.1.8 the weight of 1.0051275 carat as per the **World Federation of Diamond Bourses** procedure should be rounded off as follows to 1.0**0** carat.

1.0051275 carat

1.005127 carat

1.00512 carat

1.0051 carat

1.005 carat

1.00 carat

Only if it would have been 1.009 carat then as per **World Federation of Diamond Bourses** procedure, it would be rounded off to 1.01 carat.

5.1.9 Carat Weight Rounding Off Procedure

Comparison between **FTC's** and **World Federation of Diamond Bourses rounding off procedure:**

Weight in Carat Up to Third Decimal	World Federation of Diamond Bourses	FTC (US Federal Trade Commission procedure of rounding off)
1.000	1.00	1.00
1.001	1.00	1.00
1.002	1.00	1.00
1.003	1.00	1.00
1.004	1.00	1.00
1.005	1.00	1.01
1.006	1.00	1.01
1.007	1.00	1.01
1.008	1.00	1.01
1.009	1.01	1.01

Fig. 5.1.9.3 World Federation of Diamond Bourses Vs US Federal Trade Commission in rounding off chart

Notes

5.1.10 Measurements and Weight Analysis

As we learnt in the previous section a round brilliant cut diamond with an average diameter of 6.50mm and standard depth of 3.90 mm weighs around 1 carat.

If we compare the calculated weight with the actual weight of diamond it helps us in analyzing few properties of diamond.

With the help of the following illustration we can understand how does the actual and calculated weight variation help us in **Identification of Diamond.**

IIn the following illustration, we have three specimens with same girdle diameter and same depth, also we are assuming that all the proportions of these three specimens are same. In such a case where all measurements and proportions are same, their actual weight should also be same. Look at the illustration below:

Specimen A	Specimen B	Specimen C	
6.50	6.50	6.50	Girdle Diameter (mm)
3.90	3.90	3.90	Total depth (mm)
1.00	0.90	1.70	Actual weight in carat

Fig. 5.1.10.1

Their actual weight varies from their calculated weight.

Considering their all measurement and proportions same and variation in the actual weight depicts some thing unusual. **This unusual concern with specimen B and C is probable because they are not Natural Diamonds.**

Specimen A	Specimen B	Specimen C	
6.50	6.50	6.50	Girdle Diameter (mm)
3.90	3.90	3.90	Total depth (mm)
1.00	0.90	1.70	Actual weight in carat
Diamond	Sythetic Moissanite	Cubic Zirconia	RESULT
3.52	3.22	5.8	Specific Gravity

Fig. 5.1.10.2

Any specimen with same measurement and proportions and different weight means variation in the density / specific gravity of the specimen.

Common simulants in the market like Synthetic Moissanite has specific gravity approximately 10% lower than that of diamond (Specimen B).

Whereas simulant known as cubic zirconia (CZ) has specific gravity approximately 70% higher than that of diamond (Specimen C).

This is how analysing of weight and measurements helps one in the identification of Diamonds.

5.1.10 Measurements and Weight Analysis

Similarly if we compare the calculated weight with the actual weight of diamond it helps us in analysing another property of diamonds.

With the help of the following illustration we can understand how does the actual and calculated weight variation help us in **Analyzing the cut of Diamond.**

In the following illustration we have three diamonds with same girdle diameter. Look at the illustration below:

Specimen A	Specimen B	Specimen C	
6.50	6.50	6.50	Girdle Diameter (mm)
1.00	0.90	1.10	Actual weight in carat

Fig. 5.1.10.3

Their actual weight varies from their weight represented by girdle diameter.

Considering their girdle diameters same and variation in the actual weight depicts some thing unusual. **This unusual concern with specimen B and C is because of variations in the proportions like girdle thickness or pavilion depth.**

Specimen A	Specimen B	Specimen C	
6.50	6.50	6.50	Girdle Diameter (mm)
1.00	0.90	1.10	Actual weight in carat
Diamond	Diamond	Diamond	Identification
3.52	3.52	3.52	Specific Gravity
Standard Cut	Shallow pavilion	Deep Pavilion or Thick Girdle	Analysis

Fig. 5.1.10.4

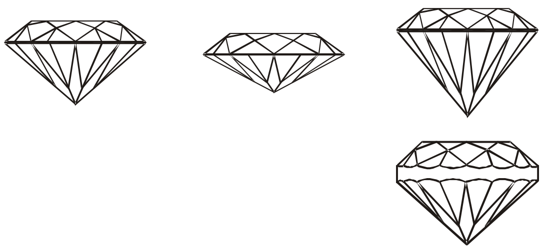


Fig. 5.1.10.5 Diamonds with same diameter but variable proportions

Diamonds with same girdle diameter and different weights means variation in the proportions of the diamonds.

This is how analyzing of weight and Girdle Diameter helps one in the analyzing cut of Diamonds.

5.1.11 Concept of Sieves

What are sieves?

Sieves are plates with holes of different sizes that are in relation with diameter of diamonds/stones.

There are two attachable cups and two lids generally supplied with the whole set of sieves.

Sieve plates are made up of brass or steel and some manufacturers make professional sieves out of titanium. Titanium sieves are resistant to normal wear and tear and has more number of wholes per sieve. This provides professionals to work fast and accurately.

Sieves have number starting from 000 to 20, 000 being the smallest hole size sieve and 20 being the biggest hole size sieve.

Full set of sieves has 42 plates numbered as 000, 00, 0, 1, 1.5, 2, 2.5, 3, 3.5, ... 18, 18.5, 19, 19.5, 20.

Fig. 5.1.11.1 Diamond Sieves

Fig. 5.1.11.2 Working with Diamond Sieves

5.1.11 Concept of Sieves

How does sieve work?

To get one size of stones or one range of size of stones we use combination of two sieves.

Following is the illustration which shows how the combination of two sieves gives you one size or range of size of stones.

Big Size

Sieve No. A

You get one range of stones i.e. size between two sieves.

Stones that come out are smaller than the sieve No. A Stones that remain are bigger than sieve No. B

Small Size

Sieve No. B

Stones that come out are Smaller than sieve B

Fig. 5.1.11.3 Working with Diamond Sieves set

5.1.11 Concept of Sieves

Some sieves plates are very important as they define the range of loose diamond lots as per sieve sizes sold in the domestic market.

Diamonds which pass from sieve no 20 but do not pass through sieve no 15 are called as *plus 15*.

Diamonds which pass from sieve no 15 but do not pass through sieve no 11 are called as *plus 11.*

Diamonds which pass from sieve no 11 but do not pass through sieve no 6.5 are called as *mellee.*

Diamonds which pass from sieve no 6.5 but do not pass through sieve no 2 are called as *stars.*

Diamonds which pass from sieve no 2 but are bigger than sieve no 000 are called as *minus 2.*

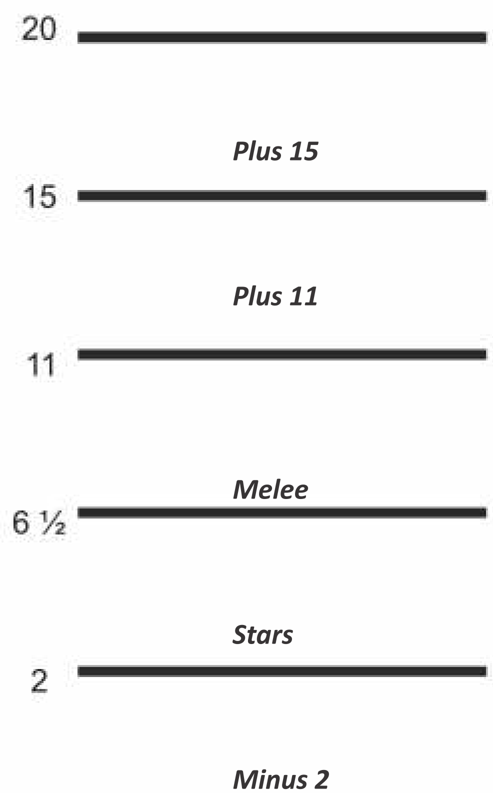


Fig. 5.1.11.4 Diamond Sieves grouping system

5.1.11 Concept of Sieves

Diamond Sieve Reference Chart

Sieves are given numbers as per diameter. Charts are supplied to find out which sieve is for which diameter and corresponding weight of diamond.

SIEVE SIZES	PCS/Ct.	WEIGHT (ct)	DIA (mm)
000-0	1/200	0.005	0.90-1.10mm
0-1	1/175	0.006	1-10 – 15mm
1-1.5	1/150	0.007	1-15 – 1.20mm
1.5-2	1/120	0.008	1-20 – 1.25mm
2-2.5	1/110	0.009	1-25 – 1.30mm
2.5-3	1/100	0.010	1-30 – 1.35mm
3-3.5		0.011	1-35 – 1.40mm
3.5-4	1/80	0.012	1-40 – 1.45mm
4-4.5		0.013	1-45 – 1.50mm
4.5-5	1/70	0.014	1-50 – 1.55mm
5-5.5	1/60	0.016	1-55 – 1.60mm
5.5-6		0.018	1-60 – 1.70mm
6-6.5	1/50	0.021	1-70 – 1.80mm
6.5-7	1/40	0.025	1-80 – 1.90mm
7-7.5	1/30	0.029	1-90 – 2.00mm
7.5-8		0.035	2-00 – 2.10mm
8-8.5	1/25	0.039	2-10 – 2.20mm
8.5-9		0.044	2-20 – 2.30mm
9-9.5	1/20	0.052	2-30 – 2.40mm
9.5-10		0.058	2-40 – 2.50mm
10-10.5	1/15	0.069	2-50 – 2.60mm
10.5-11		0.074	2-60 – 2.70mm
11-11.5	1/15	0.078	2-70 – 2.80mm
11.5-12		0.086	2-80 – 2.90mm
12-12.5	1/10	0.095	2-90 – 3.00mm
12.5-13		0.108	3-00 – 3.10mm
13-13.5	1/8	0.116	3-10 – 3.20mm
13.5-14		0.125	3-20 – 3.30mm
14-14.5	1/7	0.135	3-30 – 3.40mm
14.5-15		0.146	3-40 – 3.50mm
15-15.5	1/6	0.159	3-50 – 3.60mm
15.5-16		0.175	3-60 – 3.70mm

Fig. 5.1.11.5 Diamond Sieves Reference

5.1.12 Diameter Vs Ideal Weight

Diameter (mm)	Carat	Diameter (mm)	Carat
9.00	2.50	5.6	0.65
8.6	2.25	5.20	0.50
8.20	2.00	4.80	0.40
7.80	1.75	4.40	0.33
7.40	1.50	4.10	0.25
7.00	1.25	3.80	0.20
6.50	1.00	3.40	0.15
6.20	0.85	3.00	0.10
5.90	0.75	2.70	0.07

Fig. 5.1.12.1 Diameter of Round Brilliant cut Vs ideal weight

5.1.13 Gauges and Instruments

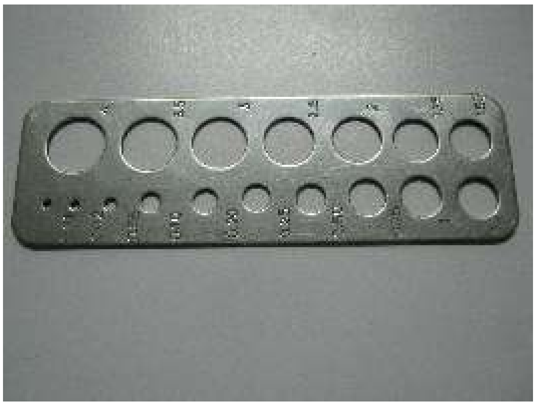


Fig. 5.1.13.1 Rectangle Hole Gauge

Fig. 5.1.13.2 Oval Hole Gauge

Fig. 5.1.13.3 Hole Gauge

5.1.13 Gauges and Instruments

Fig. 5.1.13.4 Fan Gauge

Fig. 5.1.13.5 Fan Gauge round

Fig. 5.1.13.6 Brass Gauge

5.1.13 Gauges and Instruments

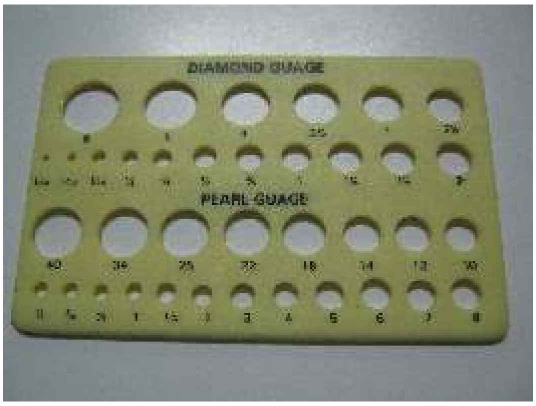


Fig. 5.1.13.7 Plastic Gauge

Fig. 5.1.13.8 Stone Gauge

Fig. 5.1.13.9 Moe Gauge

5.1.13 Gauges and Instruments

Fig. 5.1.13.10 Electronic Gauge

Fig. 5.1.13.11 Electronic Weighing scale

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6. Colour

Unit 6.1 - Colour and its Concepts

G&J/N3604

Key Learning Outcomes

At the end of this module, you will be able to:

1. Know what is colour.
2. Know the colour nomenclature.
3. Understand the role of colour on carat rate.
4. Understand in detail the colour grading procedure and fluorescence.
5. Learn to grade colour practically, complying to the international grading standards.

Unit 6.1: Colour and its Concepts

Unit Objectives

At the end of this unit, you will be able to:

1. Understand the concept of colour.
2. Understand the components of colour.
3. Understand the causes of colour.
4. Understand the concept of trace element.
5. Understand the concept of diamond types.
6. Understand the colour nomenclature and master stones.
7. Understand the colour grading procedure.
8. Understand the master eye effect.
9. Understand the international standard of colour grading.

6.1.1 Concept of Colour

As learnt in unit 3.4, diamonds come in many colours naturally. The most common available colours are near colourless with a tint of yellow or brown.

Colourless diamonds are also available, but they are quite rare and expensive.

Other than colourless and near colourless (with a tint of yellow or brown), diamonds are also available in other colours like green, blue, purple and red. These are very rare.

Normal colour range: Diamonds ranging from colourless to near light yellows and brown fall in normal colour range.

Colour grading scale was developed by Richard T. Liddicoat way back in 1950's.

He described the colour of diamonds in the normal range from D (colourless) to Z (light yellow or brown). Where each letter from D to Z represents a range of colour.

This scale is called as D to Z scale.

6.1.2 Components of Colour

Components of colour includes the following three components:

- **HUE:** Hue is the basic sensation of spectral colour; V, I, B, G, Y, O, R.
- **TONE:** Tone refers to lightness to darkness of a hue, very light to very dark.
- **SATURATION:** Saturation means the strength or purity of a hue, dull to vivid.

6.1.2 Components of Colour

Depth of colour:

Depth of colours refers to the combination of tone and saturation in case of normal colour range.

6.1.3 Causes of Colour

CAUSES OF COLOUR

Selective absorption

- Selective absorption · One of the most common reasons of colour is Selective absorption, It is the ability of a transparent substance to absorb some wavelengths of light while transmitting others.
- The wavelength of light which is returned by the diamond and is observed by a viewer's eye is the colour of diamond.
- If little or no wavelength is absorbed, then all spectral colours are returned and the diamond would be colourless.
- Transmitted light is required.
- Thicker the material, more light it absorbs.

Causes of selective absorption:

- Trace elements
- Structural distortion

Trace elements

- **Nitrogen** is the most common trace element or impurity in case of diamonds. (Almost 95% plus of diamonds). It causes yellow colour.
- Another trace element is **Boron** which causes blue colour. But they are very rare.

Structural distortions

- Graining causes brown and pink colours in diamond.
- Such diamonds are generally difficult to cut.

Natural irradiation

When in nature diamonds are deposited near radioactive rock inside the earth crust , as a result of the radiation the surface of the rough of diamonds becomes green. These radiations have a very shallow penetration. That is why the cutters try and leave maximum natural area on the girdle to give more green colour to a cut and polished diamond.

Thus,

Natural irradiation produces a 'green skin' on surface of the crystal.

Cutters leave green naturals to produce a darker green stone.

6.1.4 Diamond Types

On the basis of presence or absence of trace elements gemology divides diamonds into different types.

DIAMOND TYPES

Type IA:

They are the most abundant type. 95% plus of all diamonds fall in this category. Most common basic yellow (other than fancy). Thus, near colourless to yellow diamonds fall in this category.

Type IB:
They are quite rare. Only 1% of all diamonds falls under this type.
They are more yellow than type 1A, thus, majority falls under fancy yellow

Type IIA:
They are the purest diamonds with almost no trace element. Thus, they are colourless and some are brown.

Type IIB:
These diamonds have boron, thus have blue colour.
They are excellent conductors of electricity.

6.1.5 Colour Nomenclature

Colour nomenclature was originally designed to avoid confusion with other grading terms.

Now is internationally recognized.

Grading scale is D-Z.

Fancy yellow (darker than Z).

Every colour depicts a range of colour.

6.1.6 Master Stones

Master stones are a set of colour comparisons specimens that defines a grade from D to Z in the normal colour range.

Fig. 6.1.6.1 Master stones from E to L

6.1.6 Master Stones

1. Master stones

- Humans have limited colour memory, so they need a colour comparator.
- Master comparator represents a range of colours. In the range, they are the highest end / lightest colour.

2. Requirements of master stones

- **Weight and Cut:** Each master stone should be weighing minimum 0.25 ct. and should be a round brilliant cut
- **Fluorescence:** Each master stone used for colour garding should have none to weak fluorescence only.
- **Clarity:** Each master stone should be of SI1 or higher clarity and should be free from coloured inclusions.
- **Colour:** Master stones should be from colourless to light yellow with no brown or grey tints.

6.1.7 Colour Grading Procedure

Colour grading procedure

- First step is to clean the diamond to be graded.
- Grade the diamond for clarity along with plotting, so you can identify the diamond later.
- Check the fluorescence, note as strong, medium, faint or none.
- Always use cool white fluorescent light (UV free) in a dark room.
- Use a dull white background like shade card.
- For setting up the master stones, arrange them from left to right, lightest to darkest colour.
- Place the master stone on the grading surface so that you can look at their pavilions either parallel to girdle or perpendicular to pavilion facets.
- To colour grade a stone, place the stone in the face down position place and compare the colours from the pavilion.
- Keeping the stone in the face down position, move it as close as possible to the master stone, but do not let them touch.
- Compare the stones by placing them on both sides of the master stones; find the master stone with colour closest to that of the stone and assign a colour grade.
- Check the stone with the plot to be sure that the stone has not be exchanged with the master stone.

6.1.8 The Master Eye Effect

The master eye effect says, when comparing two stones, if the stone looks:

Dark on left, light on right = SAME

Dark on left, same on right= DARKER

Same on left, light on right= LIGHTER

6.1.9 Colour Grading Scale

Colour Grading Scale

DESCRIPTION	COLOUR GRADE	TERMINOLOGY
Face up and table down (from pavilion) – no colour seen	D, E, F	Colourless
Face up – no colour seen; table down (from pavilion) – slight tint seen	G, H, I, J	Near Colourless
Face up – slight tint seen; table down (from pavilion) – obvious colour seen	K, L, M	Faint Yellow
Face up and table down (from pavilion) – obvious colour seen	N, O, P, Q, R	Very Light Yellow
	S, T, U, V, W, X, Y, Z	Light Yellow
	More than Z	Fancy

Fig. 6.1.9.1 Colour grading scale

6.1.10 Colour as a Value Factor

As understood in the previous units, considering all other value factors as constant, higher the colour grade, more is the per carat rate of diamond .

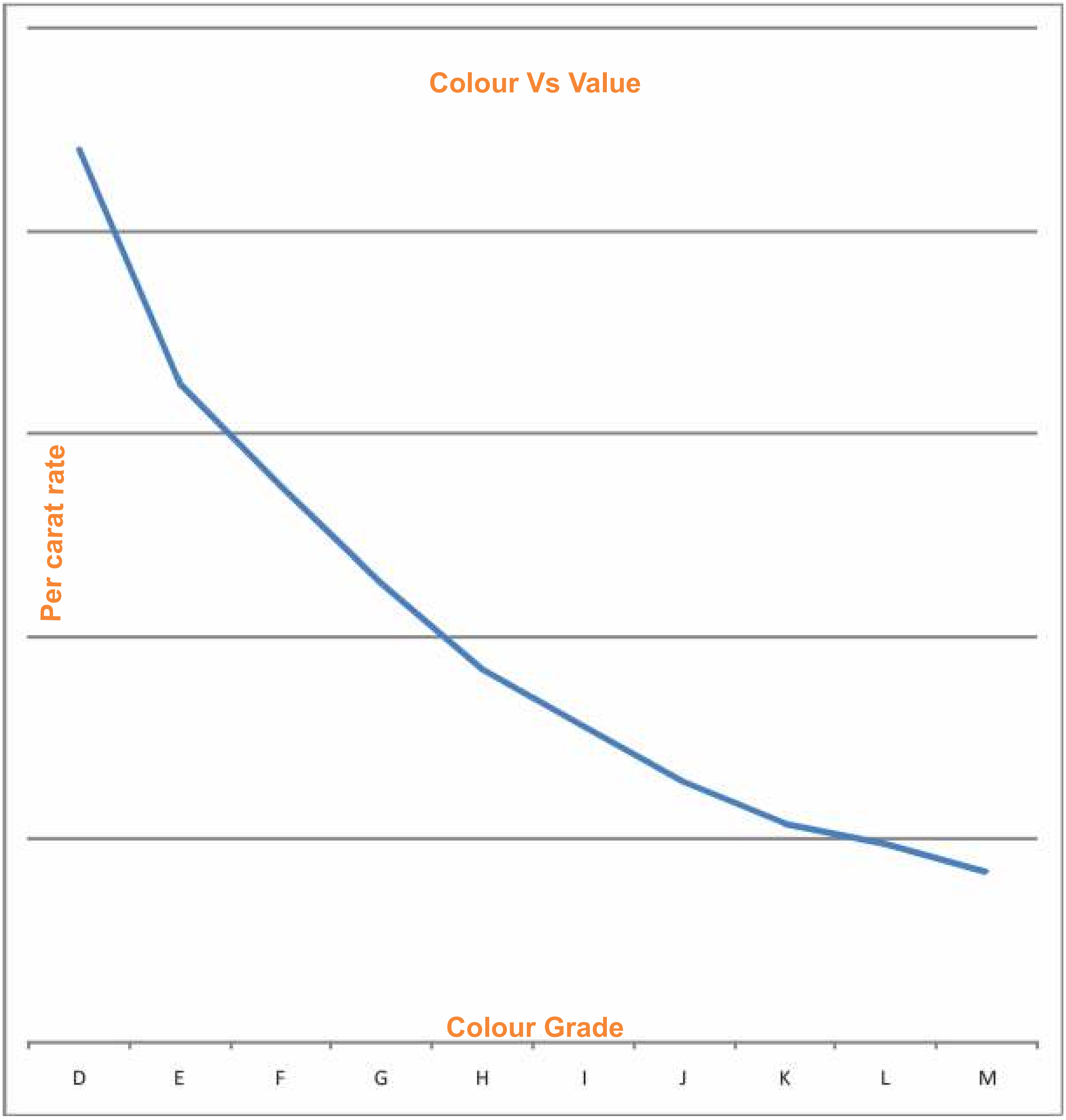

Fig. 6.1.10.1 Colour vs value

6.1.11 Fluorescence

Fluorescence is the emission of visible light stimulated by invisible radiation.

LWUV- Long wave ultra violet is used to check fluorescence. The most common colour is blue and not all diamonds fluoresce (only 30-50% of all daimonds fluoresce).

We should record strength and colour.

Fluorescence sometimes affects diamond in adverse way by making it look milky / oily and sometimes fluorescence is so good that it makes a yellow tint diamond look less coloured.

Fig. 6.1.11.1 Different intensity of fluorescence

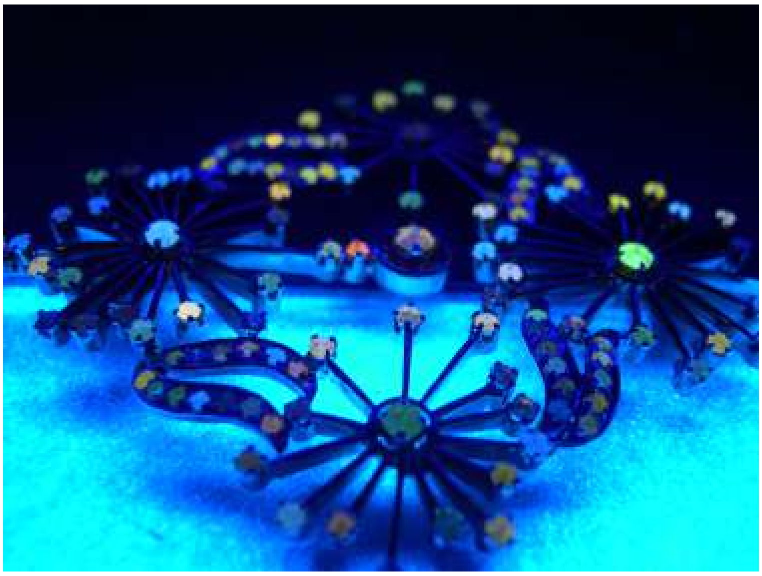

Fig. 6.1.11.2 Different colours of fluorescence

Notes

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7. Cut

Unit 7.1 - Cut Grading and its Concepts

G&J/N3604

Key Learning Outcomes

At the end of this module, you will be able to:

1. Know what is cut.
2. Know and understand the various cut grading proportions in detail.
3. Understand the role of proportions on cut grade.
4. Understand in detail the various proportions and their grading procedures.
5. Know and understand the various cut grading proportions in detail.

Unit 7.1: Cut Grading and its Concepts

Unit Objectives

At the end of this unit, you will be able to:

1. Understand the concept of Cut Grading.
2. Understand diamond proportions in detail.
3. Understand the concept of average girdle diameter.
4. Understand the concept of total depth.
5. Understand the concept of table percentage.
6. Understand the estimation of table percentage.
7. Understand the concept of crown angle.
8. Understand the estimation of crown angle.
9. Understand the concept of girdle thickness.
10. Understand the estimation of girdle thickness.
11. Understand the concept of pavilion depth.
12. Understand the estimation of pavilion depth.
13. Understand the concept of pavilion angle.
14. Understand the concept of culet size.
15. Understand the concept of crown height.
16. Understand the concept of total depth percentage.
17. Understand the analysis of cut.
18. Understand the concept of symmetry.
19. Understand the concept of polish.
20. Understand the concept of fancy shapes.
21. Understand the grading systems of fancy shapes.

7.1.1 Cut Grading

- It's the human contribution to a diamond's beauty.
- It only modifies the stone value & affects the stone beauty.
- An excellent finish grade is very hard to get & thus it will have higher price.
- It is normally seen in better quality stones.
- Face-up Appearance: Every facet and its angle affects the total amount of light returning to the observer's eye when the light interacts with diamond.

7.1.2 Modern Cut

It was derived from a **two-dimensional mathematical calculation** tthat considered both brilliance (Total light coming from within the stone) and fire (Dispersion) of the stone. Marcel Tolkowsky found that **if a diamond was cut too deep or shallow then light would escape out from the sides or bottom of the diamond, resulting in a loss of brilliance (white light reflected up through the top of a diamond), fire (coloured light reflected from within a diamond), and sparkle (combination of fire and brilliance).**

The modern research on dimond cut grade owes a debt of gratitude for paving the way of diamond cut.

TOLKOWSKY PROPOTIONS IDEAL BRILLIANT

Table = 53%

Crown angle = 34 ½

Girdle = thin - medium

Crown height = 16.2% Based on girdle Diameter 100%

Pavilion depth = 43.1%

Pavilion angle = 40 ¾

Culet = small

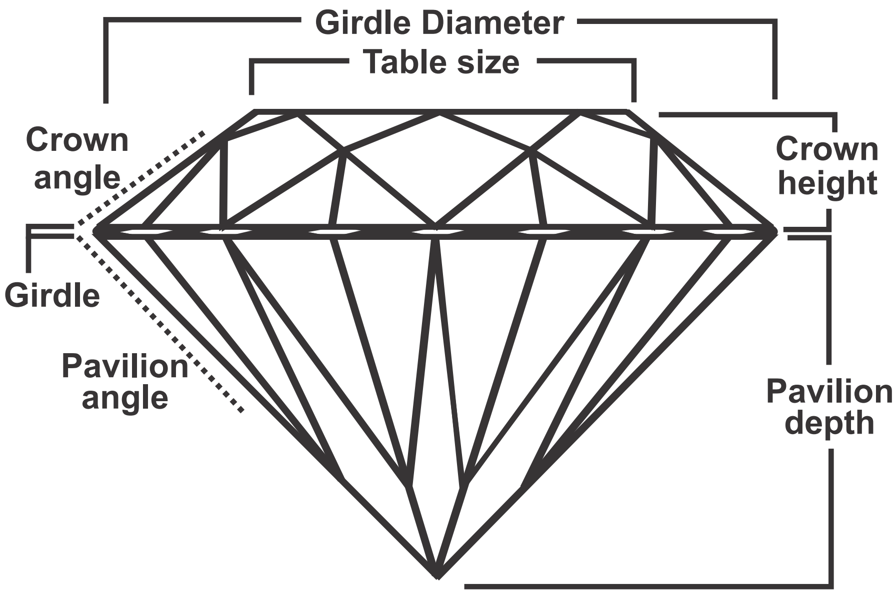


Fig. 7.1.2.1 Diamond's Proportion

7.1.3 Diamond Proportions

Girdle Diameter

To understand the relationship between all the proportions of diamond we consider girdle diameter as 100 or 100%. Thus, all proportions are expressed as percentage of the average girdle diameter.

Average Girdle Diameter

Measuring various diameters of the diamond from several directions and then averaging the smallest and the largest girdle diameter.

$$\text{Avg. Girdle Diameter} = \frac{\text{Maximum Diameter} + \text{Minimum Diameter}}{2}$$

Table Size / Table Percentage

Table Size / Table Percentage defines how large is the table in relationship to the average girdle diameter of the stone

Crown Angle

It is the angle formed by the bezel facet to the girdle. Measured in degree.

Crown Height

Expressed in percentage in relation to average girdle diameter of the stone.

Crown height is in relation to the crown angle of the diamond. Being part of the crown, if table size is constant, then it has a direct relationship with crown angle, that is more the crown angle more the crown height.

Girdle Thickness

Expressed in percentage in relation to average girdle diameter of the stone. It is measured at the narrowest section where the upper and the lower girdle facets meet.

Pavilion Depth Percentage (or Pavilion Angle)

Measured from the bottom of the girdle plane to the culet expressed in percentage in relation to average girdle diameter of the stone.

Total Depth Percentage

Measured from the table to the culet expressed in percentage in relation to average girdle diameter of the stone. It describes the final story of all the proportions.

Culet Size

Culet is created by polishing the bottom tip of the pavilion to avoid chipping or abrasions. Culet should be just large enough to prevent chipping. A very large culet becomes responsible for undesired light leakage from diamond. It represents the 58th facet of the round brilliant cut.

7.1.4 Average Girdle Diameter

As we have understood various diamond proportion in section 7.3, all the other measurements are in relation to the average girdle diameter.

The result is achieved by adding the smallest and the largest girdle measurements of a round brilliant cut and th dividing the sum by 2.

Thus

$$\textbf{Avg. Girdle Diameter} = \frac{\textbf{Maximum Diameter + Minimum Diameter}}{\textbf{2}}$$

Example: Following are the different diameter of a round brilliant cut:

Diameter 1 : 6.52 mm

Diameter 2 : 6.51 mm

Diameter 3 : 6.49 mm

Diameter 4 : 6.47 mm

Thus

Minimum diameter is the diameter 4 that is 6.47 mm

Maximum diameter is the diameter 1 that is 6.52 mm

Average girdle diameter = (6.47+6.52) / 2

=6.495, round it off to 6.50 mm

Fig. 7.1.4.1 Diamond millimeter gauge

7.1.5 Total Depth Percentage

Total depth percentage is measured as the relative measurement of the total depth to average girdle diameter.

Continuing the same example, let us assume the depth of diamond is 3.91 mm

Thus

The average girdle diameter is 6.50 mm

$$\textbf{Total Depth percentage} = \frac{\textbf{depth}}{\textbf{average girdle diameter}} * \textbf{100}$$

$$= \frac{3.91}{6.50} * 100$$

Total Depth percentage = 60.1538 %, Rounded off to 60.2 %

In case of round brilliant cut, diamonds which are well proportioned should have total depth around 60%.

Round brilliant cut diamonds with total depth more than 65% are generally overweight**.**

This excess weight can be because of various cut based options.

Thick girdle

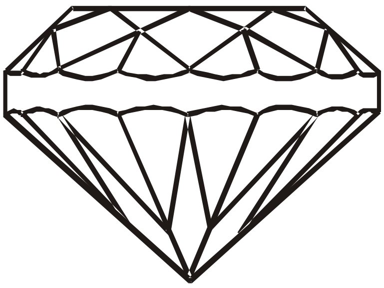


Fig. 7.1.5.1 Thick Girdle

Steep Crowns

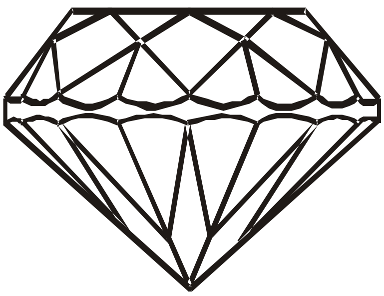


Fig. 7.1.5.2 Steep crown

7.1.5 Total Depth Percentage

Deep pavilion

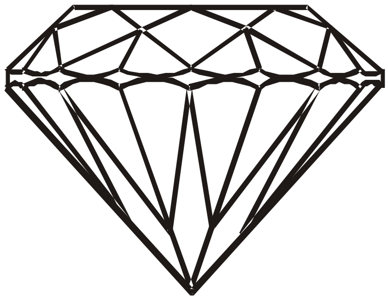


Fig. 7.1.5.3 Deep Pavilion

Shallow crown with large table but exceptionally deep pavilion

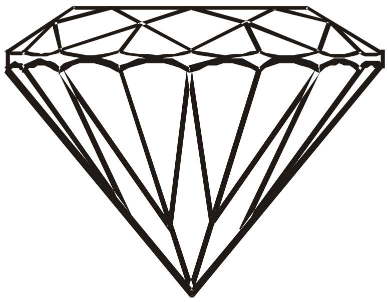


Fig. 7.1.5.4 Shallow crown with large table but exceptionally deep pavilion

Steep crown angle with moderate thick girdle and moderately steep pavilion

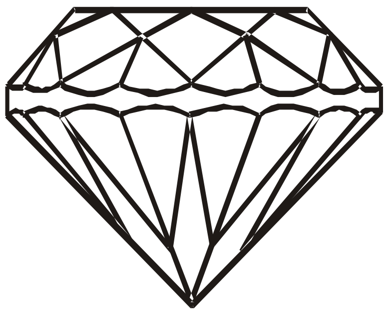


Fig. 7.1.5.5 Steep crown angle with moderate thick girdle and moderately steep pavilion

7.1.5 Total Depth Percentage

Round brilliant cut diamonds with total depth less than 55% are generally underweight.

This reduced weight can be because of various options.

Shallow crown

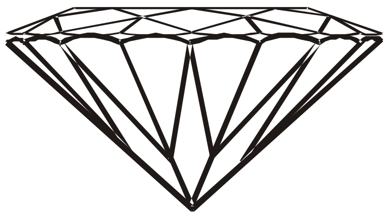


Fig. 7.1.5.6 Shallow Crown

Shallow Pavilion

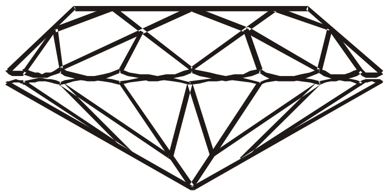


Fig. 7.1.5.7 Shallow pavilion

Shallow Crown and shallow pavilion

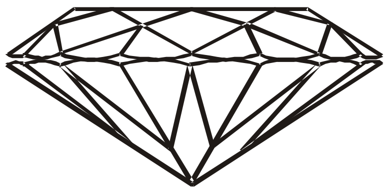


Fig. 7.1.5.8 Shallow pavilion and shallow crown

7.1.5 Total Depth Percentage

It is also very important to know and understand that 60% total depth is one of the excellent proportion, the same time a diamond having a total depth of 60% does not always guarantee a perfect cut

Please look at the diagram below of few diamonds having total depth of 60% (different profile images).

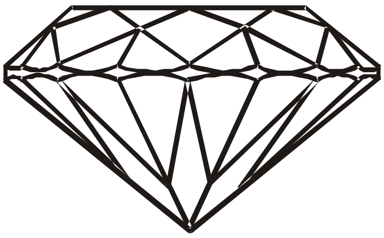


Fig. 7.1.5.9 well proportioned

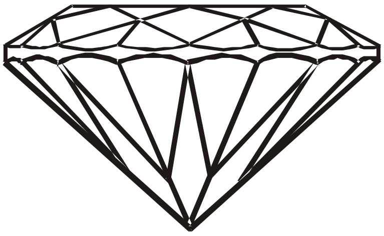


Fig. 7.1.5.10 Shallow crown, steep pavilion

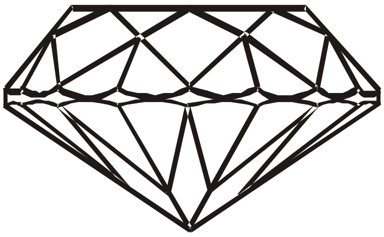


Fig. 7.1.5.11 Deep crown , shallow pavilion

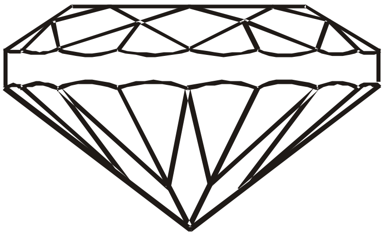


Fig. 7.1.5.12 Thick girdle

7.1.6 Table Percentage

Table Size / Table Percentage

Table Size / Table Percentage defines how large is the table in relationship to the average girdle diameter of the stone.

Majority of the cutters in the trade make a table between 55% to 65%.

Table size, in relation to the other proportions of the diamond, effects brilliance and the fire of the diamond. (As learnt in module 3.5).

Throughout the world market, people have different choice of table size, still a small table that is below 50% and a large table that is above 70% gives a negative effect to cut grade and diamond's face up appearances.

Measuring table percentage

Direct measurement

This is the most accurate method to measure the table size by using a table gauge and a mathematical formula.

Table has to be measured one corner to the other corner that is the diagonal of the octagon shaped table. (As shown in the figure).

Table has four such diagonals, all have to be measured and then all added together and then dividing it by four to get the average table size.

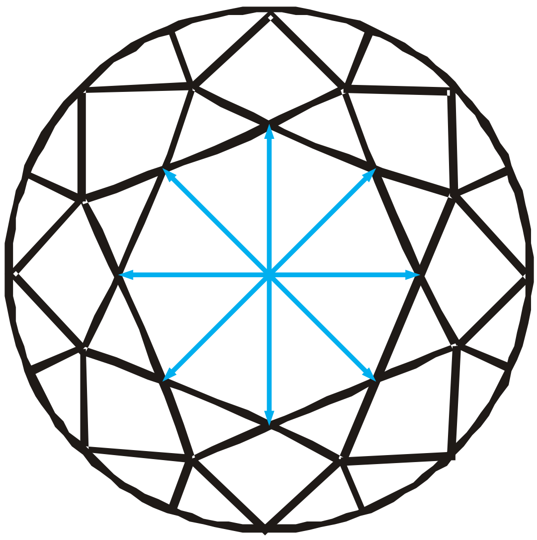


Fig. 7.1.6.1 Table measurements

Example: The four table measurements are:

3.75 mm

3.80 mm

3.80 mm

3.75 mm

7.1.6 Table Percentage

Thus,

The average table size = (3.75 + 3.80 + 3.80 + 3.75) / 4

= 3.775 mm

Rounded off to **3.78 mm**

Section 7.1.4 has given us an average girdle diameter as **6.50 mm**

Therefore,

$$\textbf{Table Size percentage} = \frac{\textbf{Average table size}}{\textbf{Average girdle diameter}} \times 100$$

$$= \frac{3.78}{6.50} \times 100$$

$$= 58.15$$

Rounded off to **58 %**

Notes

7.1.6 Table Percentage

Ratio Method

This is a sight estimation method in which diamond has to viewed face up. The face up position should be such that the culet should be placed right in the center of the table under 10x magnification.

Imagine a horizontal line running from the girdle, through middle of the table edge, to the culet.

The table edge divides the line in two parts.

The outer part has a value of 1(girdle to table edge)

Compare the inner part of the line to the outer part to estimate how many times the inner part is longer than the outer part.

Adjustments required:

Add 1-2% if the table is not regular octagon.

Always center the culet to check ratio on opposite side before setting your estimate.

Use line ratio to estimate the table% using the chart.

Ratio chart

RATIO	TABLE%
1:1	54
1:1/ ¼	60
1:1/ ½	65
1:1/ ⅔	69
1:2	72

Interpolate between factors as and when required.

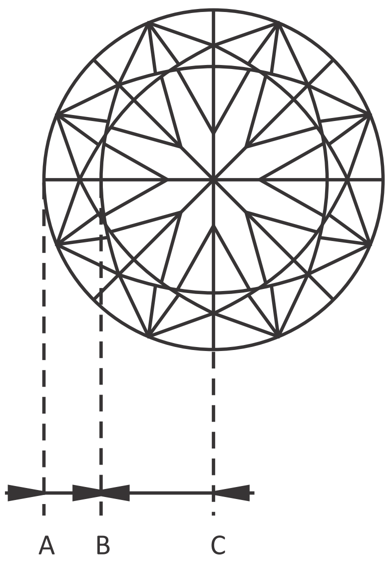


Fig. 7.1.6.2 Understanding the ratio method

7.1.6 Table Percentage

Ratio Method

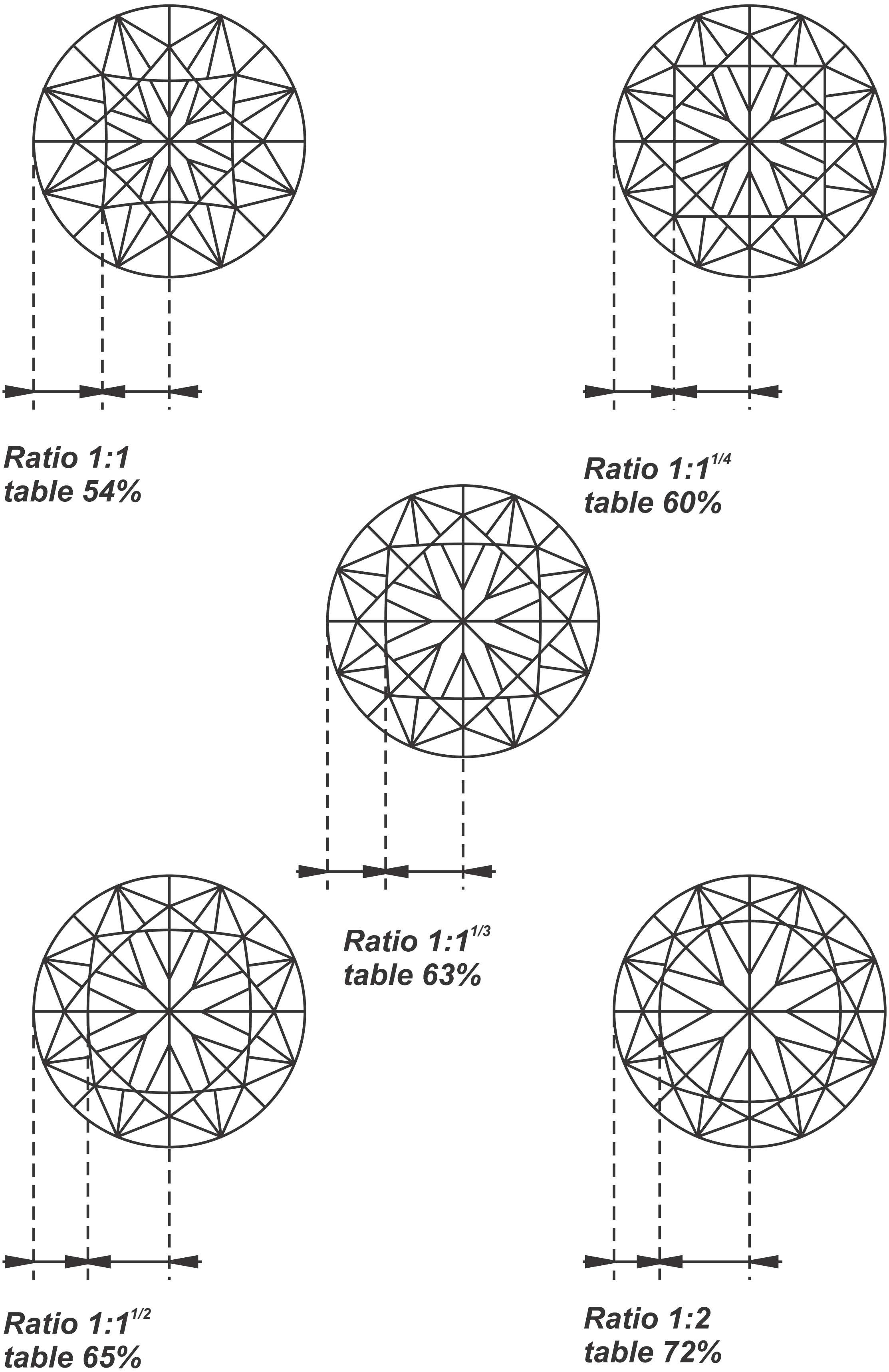


Fig. 7.1.6.3 Understanding the ratio method chart

7.1.6 Table Percentage

Bowing Method

This is another sight estimation method in which diamond has to viewed face up. The face up position should be such that one should be able to see stars and table.

Identify the line running from the point of one star, along the straight table edge to the point of another star facet.

Estimate the table percentage according to how the line bows, interpolating as necessary.

Adjustments Required:

Add 1-2% if the table is not regular octagon.

And

Cutters do usually make Bigger or Smaller STAR FACETS, to hide very big or small table.

By doing this they give the illusion of having a normal table formed by square polygons.

Thus,

Add 1-6% if the star facets are long: reaching more than half way of girdle.

Or

Subtract 1-6% if the star facets are short; reaching less than half way to the girdle.

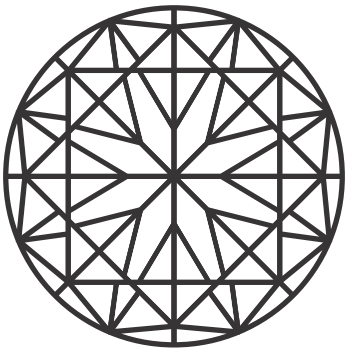


Fig. 7.1.6.4 Star facet adjustments

60+6

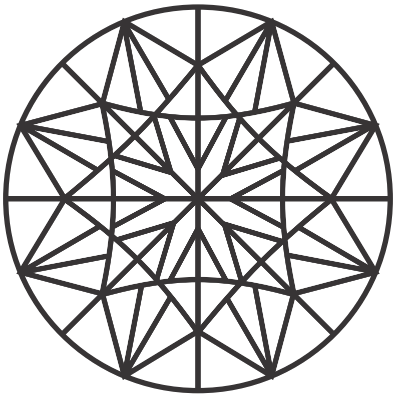
Note: When working with unsymmetrical stone, make estimates at different places and average them.

BOWING CHART

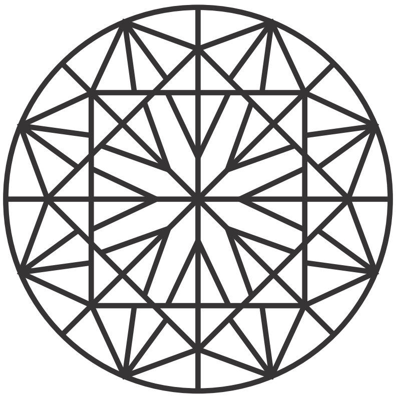
BOW	TABLE%
In noticeable	53
In slightly	58
Straight	60
Out slightly	63
Out noticeably	67

7.1.6 Table Percentage

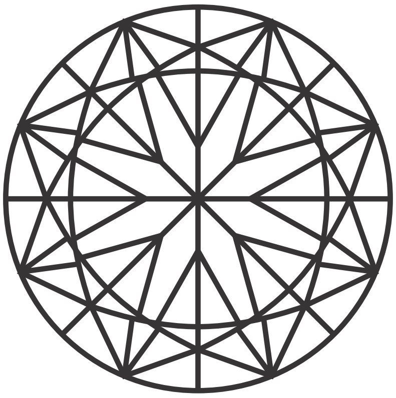
Bowing Method



Concave edges



Straight edges



Convex edges

Fig. 7.1.6.5 understanding the bowing method

7.1.6 Table Percentage

Bowing Method

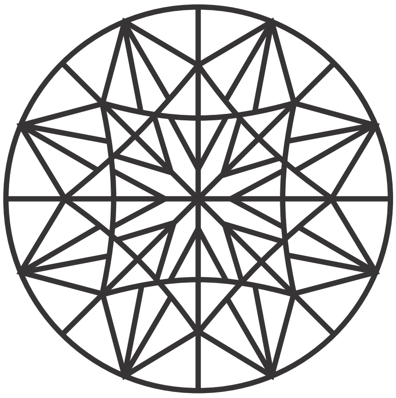


table 53%

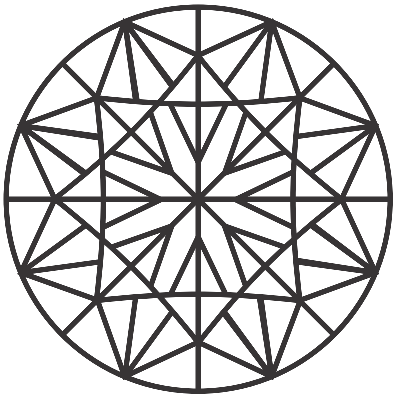


table 58%

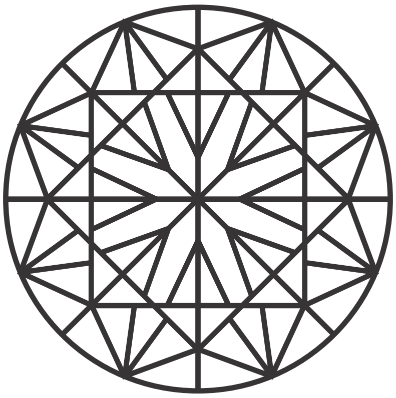


table 60%

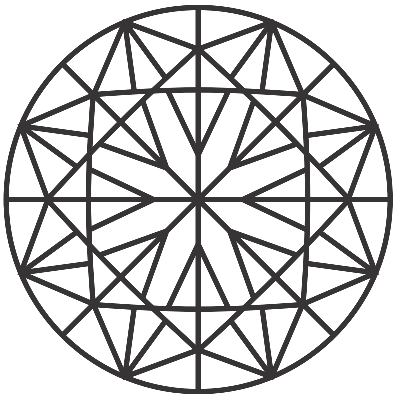


table 63%

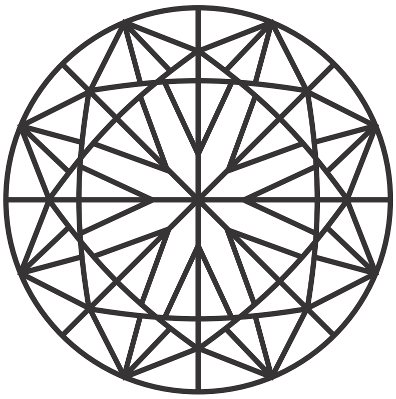


table 67%

Fig. 7.1.6.6 Understanding the bowing method chart

7.1.7 Crown Angle

Crown angle is the angle formed by the bezel facet to the girdle plane.

Crown angle is one of the most important proportion responsible for dispersion and fire.

Majority of the cutters in the trade make crown angle between 25 degree to 40 degree

Crown angle in relation to the other proportions of the diamond effects the fire of the diamond. (As learnt in module 3.5).

Though cutters make different crown angles, a shallow crown angle can cause durability concern whereas a steep crown angle affects diamond's appearance.

Measuring Crown Angle

Profile

Hold the stone table to culet.

Estimate the angle formed by the bezel facet to the girdle.

Do not estimate the crown angle by looking at the outline of the table, stars to upper girdle facet.

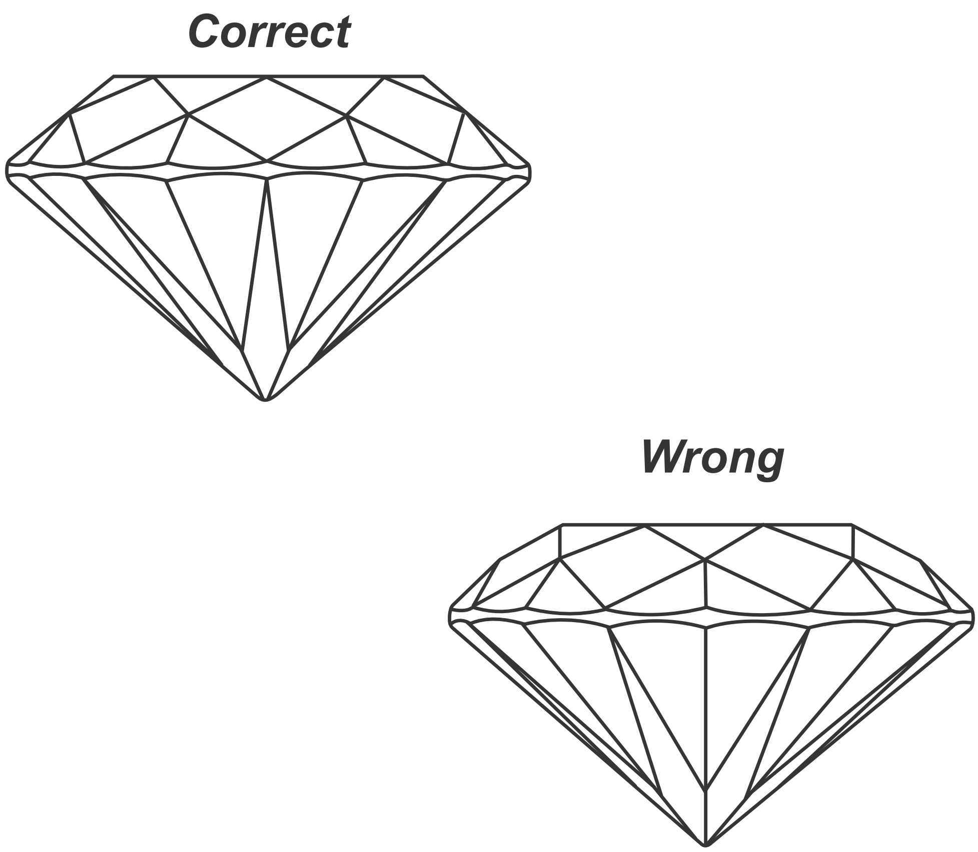


Fig. 7.1.7.1 Profile view of correct crown angle

7.1.7 Crown Angle

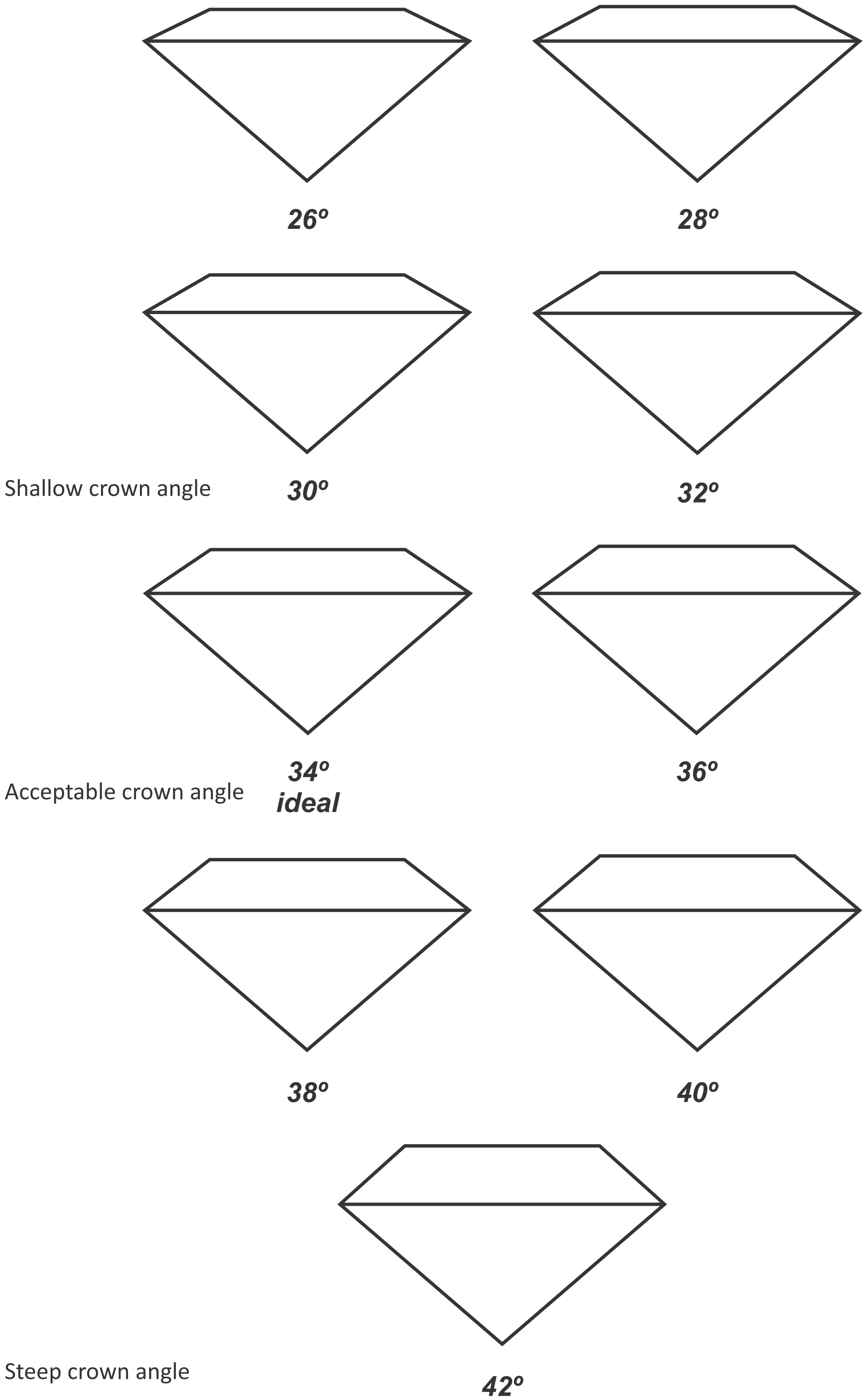


Fig. 7.1.7.2 Profile view of crown angle with same pavilion depth, girdle diameter and table size at 60%

7.1.7 Crown Angle

Face Up Method

- Magnification of pavilion mains through table and bezel.
- Estimate the crown angle while viewing the stone face up.
- Look through the crown to compare the pavilion main's width at table corner to its width at the top point of the bezel.

Note: Small tables and large tables can give wrong results.

When bezel facets are not aligned directly over pavilion mains, the images of the pavilion mains through the bezel may be tilted to one side. This makes estimating crown angle by the face up method more difficult.

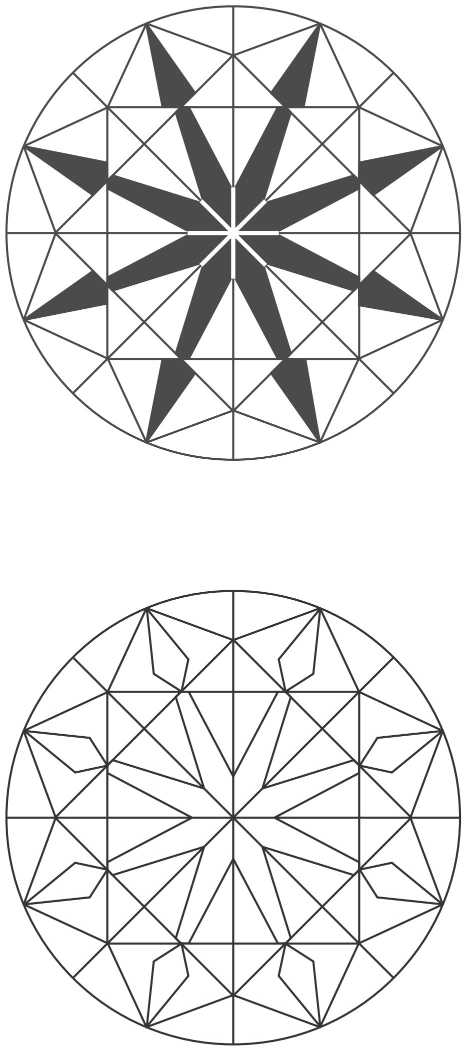


Fig. 7.1.7.3 Face up view of crown angle

7.1.7 Crown Angle

Face Up Method

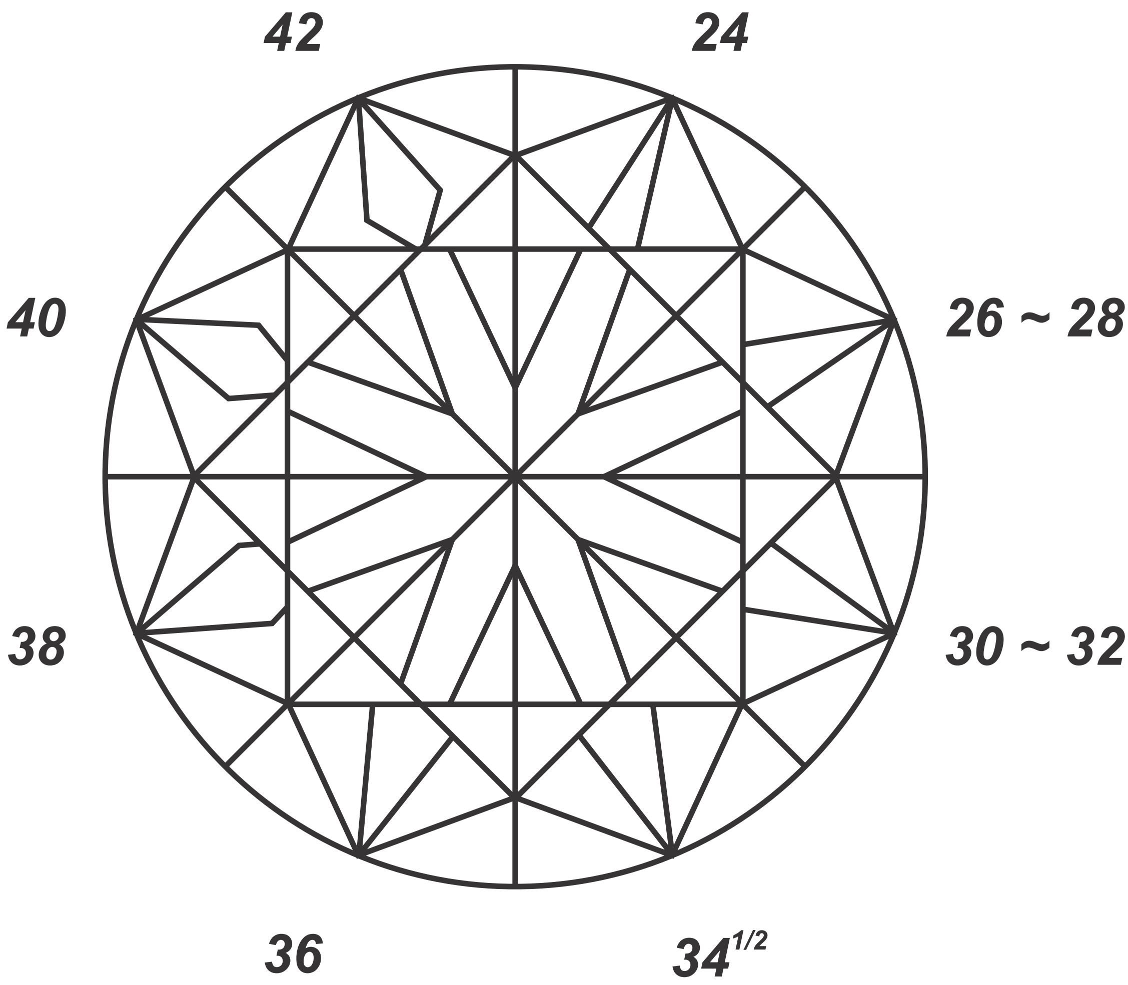


Fig 7.1.7.4 Face up view of crown angle

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7.1.8 Crown Height

Expressed in percentage in relation to average girdle diameter of the stone.

Crown height is in relation to the crown angle of the diamond. Being part of the crown, if table size is constant, it has a direct relationship with crown angle.

More the crown angle, more the crown height.

Measuring Crown Height

As we have learnt how to calculate table percentage and crown angle, based on certain geometry and trigonometry we can calculate crown height. We don't have to work like a mathematician, rather just follow the following chart.

The crown height (%) depends on the crown angle (º) and the table size (%).

$$\textbf{Crown height} = \frac{\textbf{tangent crown angle x (100 - table size (\%))}}{\textbf{2}}$$

CROWN ANGLE(º) / TABLE SIZE(%)	24	26	28	30	32	34 1/2	36	38	40	42
52	10.7	11.7	12.8	13.9	15	16.5	17.4	18.8	20.1	21.6
53	10.5	11.5	12.5	13.6	14.7	16.2	17.1	18.4	19.7	21.2
54	10.2	11.2	12.2	13.3	14.4	15.8	16.7	18	19.3	20.7
55	10	11	12	13	14.1	15.5	16.3	17.6	18.9	20.3
56	9.8	10.7	11.7	12.7	13.7	15.1	16	17.2	18.5	19.8
57	9.6	10.5	11.4	12.4	13.4	14.8	15.6	16.8	18	19.4
58	9.3	10.2	11.2	12.1	13.1	14.4	15.3	16.4	17.6	18.9
59	9.1	10	10.9	11.8	12.8	14.1	14.9	16	17.2	18.5
60	8.9	9.8	10.6	11.5	12.5	13.7	14.5	15.6	16.8	18
61	8.7	9.5	10.4	11.3	12.2	13.4	14.2	15.2	16.4	17.6
62	8.5	9.3	10.1	11	11.9	13.1	13.8	14.8	15.9	17.1
63	8.2	9	9.8	10.7	11.6	12.7	13.4	14.5	15.5	16.7
64	8	8.8	9.6	10.4	11.3	12.4	13.1	14.1	15.1	16.2
65	7.8	8.5	9.3	10.1	10.9	12	12.7	13.7	14.7	15.8
66	7.6	8.3	9	9.8	10.6	11.7	12.4	13.3	14.3	15.3
67	7.3	8	8.8	9.5	10.3	11.3	12	12.9	13.8	14.9
68	7.1	7.8	8.5	9.2	10	11	11.6	12.5	13.4	14.4
69	6.9	7.6	8.2	8.9	9.7	10.7	11.3	12.1	13	14
70	6.7	7.3	8	8.7	9.4	10.3	10.9	11.7	12.6	13.5
71	6.5	7.1	7.7	8.4	9.1	10	10.5	11.3	12.2	13.1
72	6.2	6.8	7.4	8.1	8.7	9.6	10.2	10.9	11.7	12.6

CROWN HEIGHT

Fig. 7.1.8.1 Crown height chart

7.1.9 Girdle Thickness

Girdle is the narrowest section between the crown and pavilion. It provides a setting edge to the diamond to be studded in a piece of jewellery.

Girdle Thickness

Expressed in percentage in relation to average girdle diameter of the stone.

It is measured at the narrowest section where the upper and the lower girdle facet meet.

Examine the entire circumference of the girdle.

Record minimum, maximum and overall average girdle thickness.

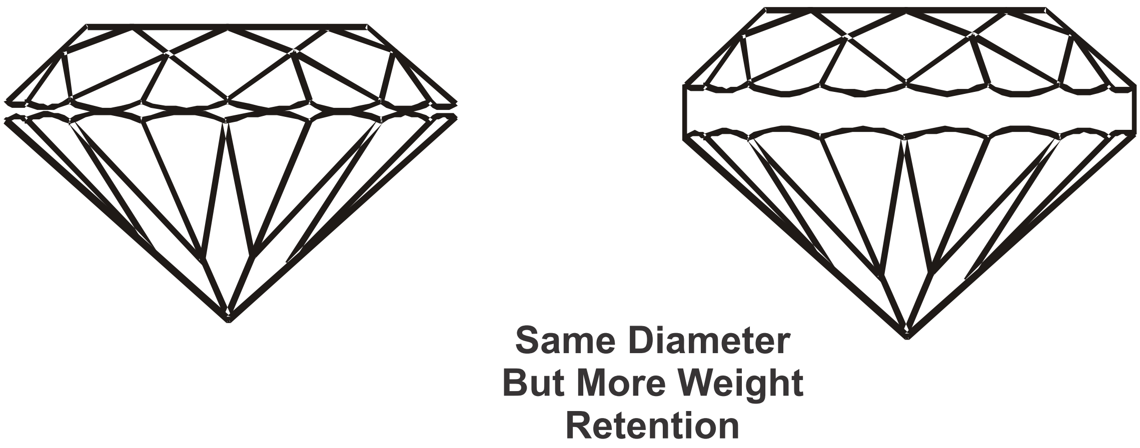

Fig. 7.1.9.1 Girdle thickness

Two diamonds with same crown and same pavilion, the diamond with the thicker girdle has more weight retention. A thicker girdle not only adds undesired weight to the diamond but also creates a condition of undesired light leakage.

Measuring Girdle Thickness

· Hold the stone table to culet.

· Analyse the whole circumference of the girdle.

Note the following:

- Minimum Girdle Thickness
- Maximum Girdle Thickness
- Overall Girdle Thickness

Average Girdle thickness = $\frac{\text{Minimum Girdle Thickness + Maximum Girdle Thickness}}{2}$

Girdle Thickness Range= Minimum Girdle Thickness to Maximum Girdle Thickness

7.1.9 Girdle Thickness

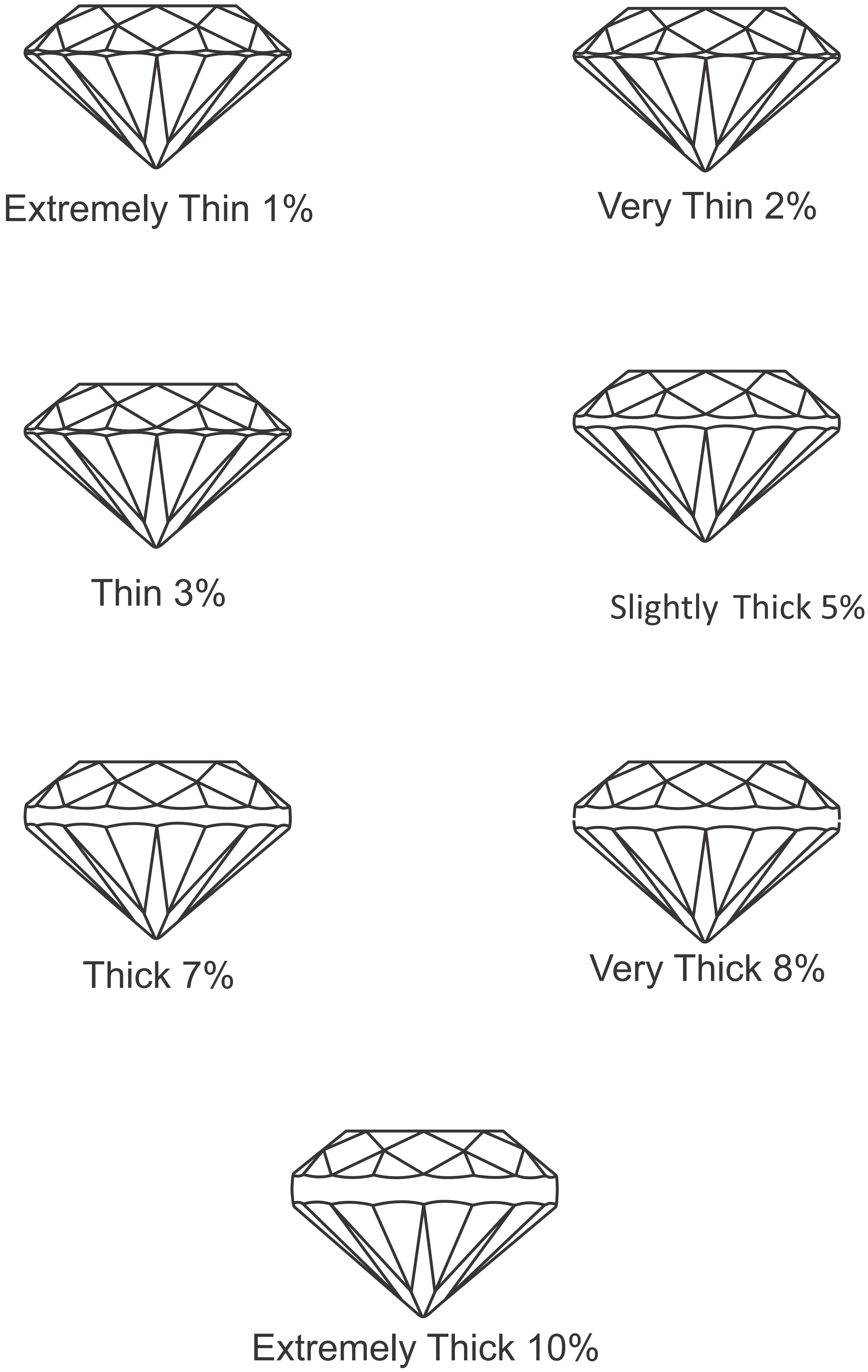

Fig. 7.1.9.2 Girdle thickness chart

7.1.10 Pavilion Depth Percentage

Pavilion Depth Percentage

Measured from the bottom of the girdle plane to the culet expressed in percentage in relation to average girdle diameter of the stone.

Pavilion depth is the most important proportion which is directly responsible for the brilliance of the diamond.

Measuring Pavilion Depth Percentage

- Look for the reflection of star facets (bow ties), then form a ring around the culet in the pavilion main.
- Use the distance from the culet to the corner of actual table to judge pavilion depth.
- Estimate how far the table reflection extends towards the corner of actual table itself.

APPEARANCE	**DEPTH (%)**
1. Girdle reflection clearly visible through table (fish eye)	35-38
2. Girdle reflection just inside the table	39-40
3. Table reflection ¼ culet to table corner (reflections break)	41
4. Table reflection ⅓ culet to table corner	43
5. Table reflection ½ culet to table corner	44.5
6. Table reflection ⅔ culet to table corner	45.5
7. Table reflection ¾ culet to table corner	47
8. Table reflection almost reaches table corner	48
9. Dark table and star facet (nail head)	49-51

Note: Remember to center the culet in the table.

-For large culet subtract 1-3% from pavilion depth.

-Pavilion depth is the most important proportion of a diamond.

Fig. 7.1.10.1 Pavilion depth appearance

7.1.10 Pavilion Depth Percentage

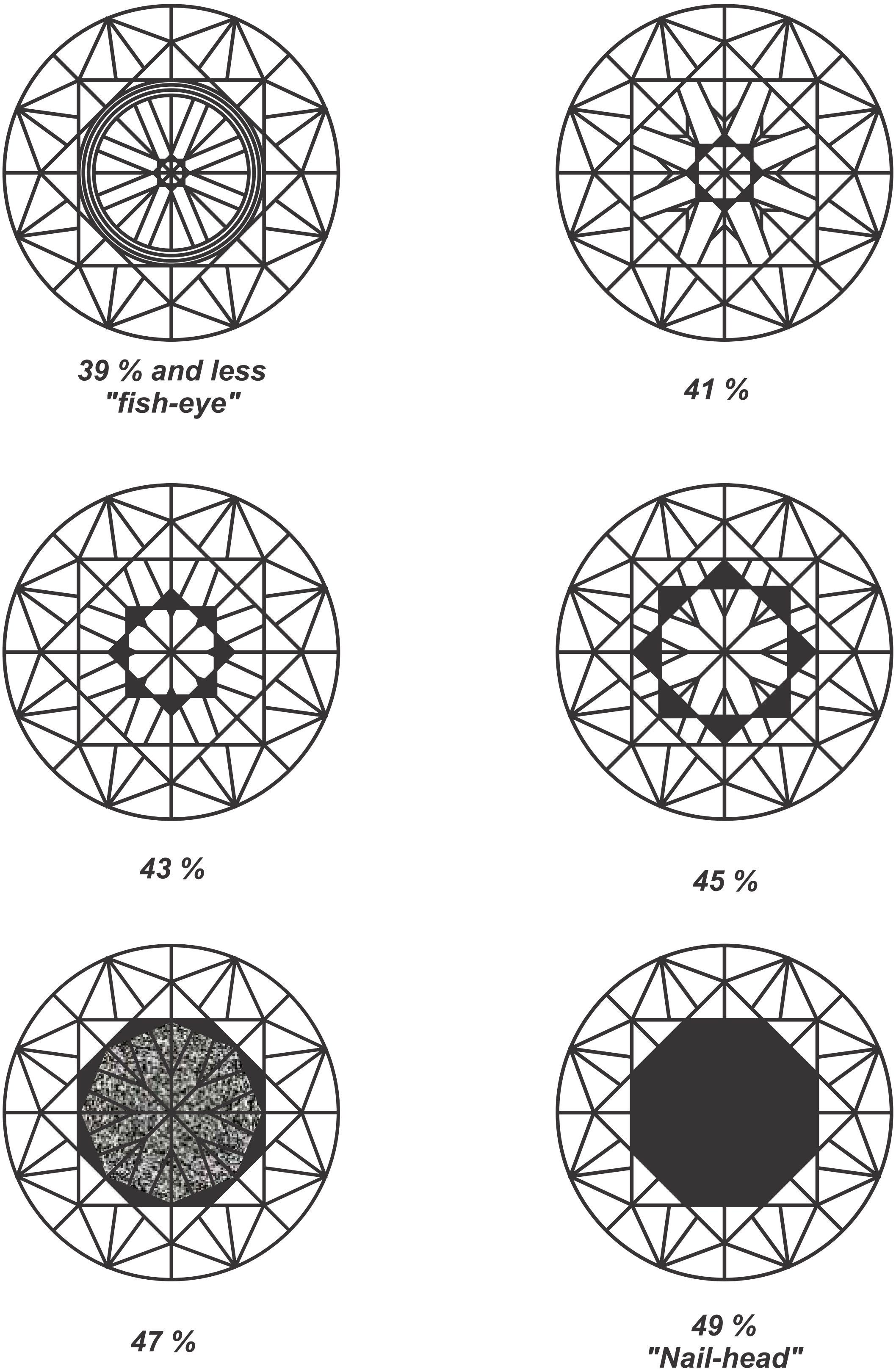

Fig. 7.1.10.2 Pavilion depth appearance chart

7.1.10 Pavilion Depth Percentage

Visual differences between diamonds with standard, shallow, deep pavilion depth.

Standard Cut

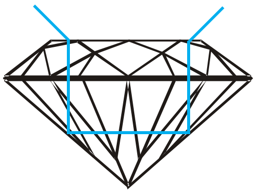

Fig. 7.1.10.3 Diamond with standard pavilion depth creates good brilliance / brightness.

Fish Eye

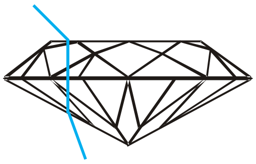

Fig. 7.1.10.4 Diamond with shallow pavilion depth causes light leakage thus, no brilliance.

Nail Head

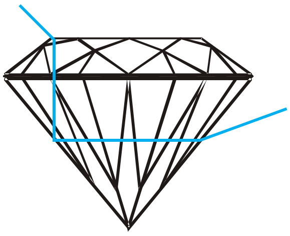

Fig. 7.1.10.5 Diamond with deep pavilion depth causes light leakage again, thus no brilliance.

7.1.11 Pavilion Angle

Pavilion angle is in relation to the pavilion depth of the diamond. Being part of the pavilion if culet size is constant then it has a direct relationship with pavilion depth.

More the pavilion depth more the pavilion angle.

Measuring Pavilion Angle

As we have learnt how to calculate pavilion depth %, based on certain geometry and trigonometry, we can calculate pavilion angle. We don't have to work like a mathematician, rather just follow the following chart.

Pavilion depth (%)	Pavilion angle
39.0%	38
39.5%	38.4
40.0%	38.8
40.5%	39
41.0%	39.4
41.5%	39.8
42.0%	40
42.5%	40.4
43.0%	40.8
43.5%	41
44.0%	41.4
44.5%	41.8
45.0%	42
45.5%	42.4
46.0%	42.8
46.5%	43
47.0%	43.4

Fig. 7.1.11.1 Pavilion angle chart

7.1.12 Culet Size

The culet of all well-made diamonds should be just large enough to prevent abrasions or chipping.

If the culet is very large, it will cause light leakage from the bottom and create an unattractive spot in the diamond.

Estimate culet size by examining the stone face up under 10X.

- **NONE:** Absent or a white abraded point seen.
- **VERY SMALL:** Barely seen under 10X.
- **MEDIUM:** Octagonal outline visible only under 10X.
- **SLIGHTLY LARGE:** Very apparent under 10X.
- **LARGE:** Visible to unaided eye.
- **VERY LARGE:** Obvious to unaided eye.
- **EXTREMELY LARGE:** Octagonal outline obvious to unaided eye.

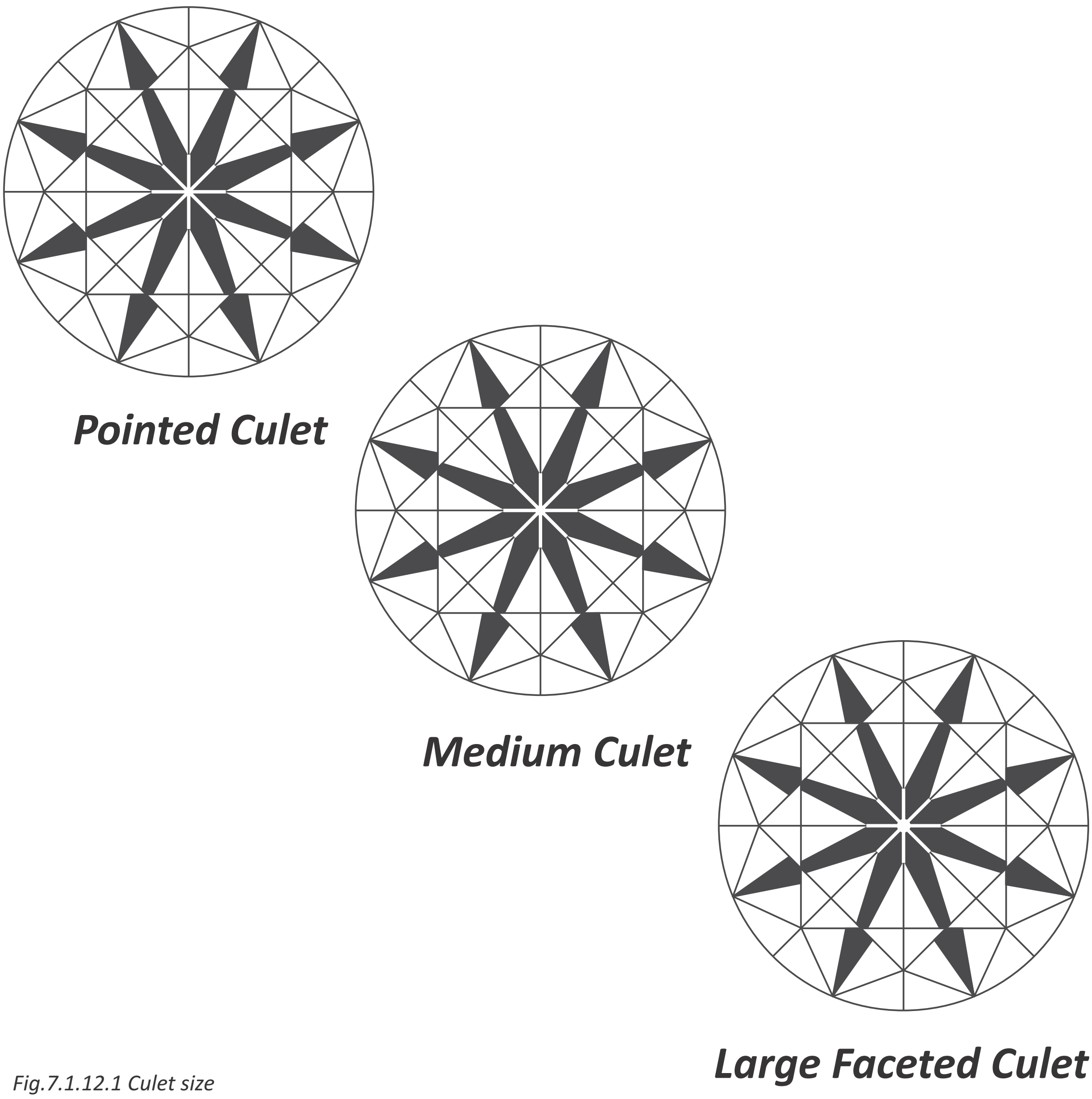

Fig.7.1.12.1 Culet size

7.1.13 Total Depth Percentage

As we learnt total depth percentage in section 7.5, with the help of measurements, we can also calculate the total depth percentage without measuring average girdle diameter and total depth.

Measuring Total Depth Percentage

Total depth can be calculated by adding the crown height as learnt in section 7.1.8, girdle thickness as learnt in section 7.1.9 and pavilion depth as learnt in section 7.1.10.

Examples:

Table size: 57%

Crown angle: 36 degree

Girdle thickness: 5%

Pavilion depth: 43%

With the given table size and crown angle, using the reference chart in section 7.1.8, crown height is 15.6%.

Now,

Total depth = Crown Height

+ Girdle thickness

+ Pavilion depth

Thus,

Total depth = 15.6 %

\+ 5.0%

\+ 43 %

63.6%

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7.1.14 Symmetry

A round brilliant diamond is considered to be symmetrical when every section looks symmetrical and repeatable. When seen face up a section is defined as a part of the crown which consists of one complete bezel, pair of upper girdle facets with pavilion main and pair of lower girdle facets.

Following is the list of symmetry variations:

DESCRIPTION	ABBREVIATION
• Table or culet off centre at 10x	T/oc, C/oc
• Girdle out of round to unaided eye	OR
• Table and girdle not parallel at 10x	T/G
• Girdle wavy under 10x	WG
• Facets not pointing properly	Ptg
• Misalignment of crown & pavilion facet	Aln
• Table not regular octagon	T/oct
• Misshapen facet	Fac
• Wavy girdle	WG
• Extra facet	EF

Fig. 7.1.14.1

Notes

7.1.15 Polish

Diamond being the hardest gemstone, takes the polish better than any other gemstone.

Diamond must have sharp reflections and least distorted light refraction, which is created by good polish.

Following is the list of some characteristics which affects the polish of the diamond:

POLISH CHARACTERISTICS
Abrasions
Nick
Pit
Polish lines
Rough Girdle
Scratch
Burn mark or Burnt Facet also known as polish mark

Fig. 7.1.15.1

Notes

7.1.16 Cutting Deviation

When we change the proportions from the set of good proportions, the following concerns are noticed:

Larger Table

- More weight retention.
- More brilliance.
- No effect on durability.

Smaller Table

- No weight retention.
- Dispersion increases, while brilliance decreases.
- No effect on durability.

Shallow Crown Angle

- Weight is increased.
- No effect on brilliance.
- No effect on durability, but if less than 25 degree, there is a risk of cleaving.
- If crown angle is less than 25 degree it becomes parallel to the cleavage direction causing a durability problem.

Steep Crown Angles

- Weight is increased.
- No effect on brilliance (never decreases).
- No effect on durability.
- Looks ugly.

Deep Pavilion

- Weight is increased.
- Beauty is affected.
- No effect on durability.
- Nail head, looks dark.

Shallow Pavilion

- Weight is increased/ reduced.
- Beauty is affected.
- No effect on durability.

7.1.16 Cutting Deviation

Thick Girdle

- Weight is increased.
- Beauty is affected.
- No effect on durability.

Thin Girdle

- Weight is reduced.
- No effect on beauty and durability.

Large Culet (Choti Cut)

- Weight is increased.
- Beauty is affected.
- No effect on durability.

Pointed Culet

- No weight retention.
- No effect on beauty.
- Effect on durability, may get chipped.

Notes

7.1.17 Analysing Cut Grade

As we have already learnt in clarity grading in section 4, there are eleven grades ranging from Flawless to Included 3.

Similarly, in colour grading we learnt in section 6, the grades range from D to Z.

As we have learnt in this whole section how to measure various proportions of a diamond, now with their relations to each other we have to analyze the cut grade.

Cut grading system has five grades:

Excellent **EX**

Very Good **VG**

Good **G**

Fair **F**

Poor **P**

Following are the various charts and references to assign a cut grade to the diamond.

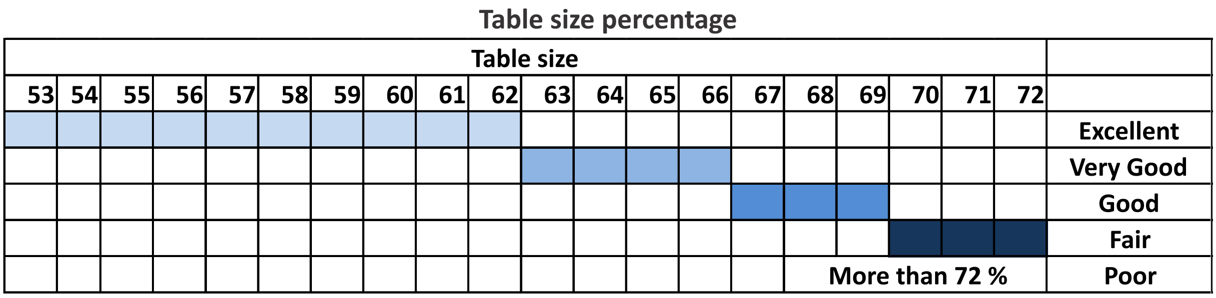

Fig. 7.1.17.1 Cut Grade as per Table Size

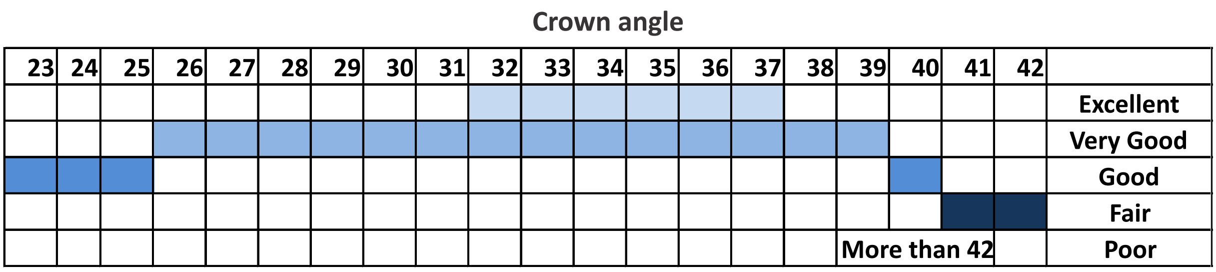

Fig. 7.1.17.2 Cut Grade as per Crown Angle

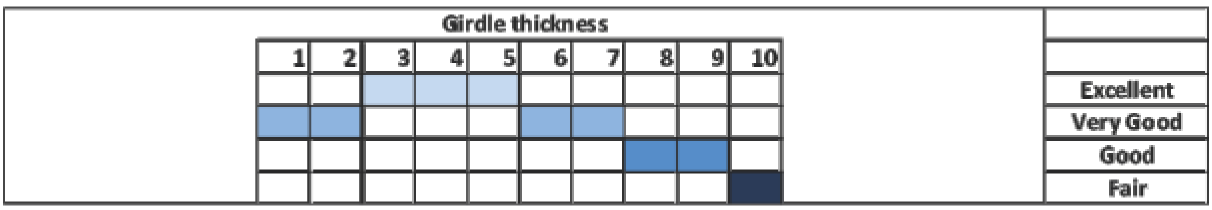

Fig. 7.1.17.3 Cut Grade as per Girdle thickness

7.1.17 Analysing Cut Grade

Pavilion Depth																				
39.0	39.5	40.0	40.5	41.0	41.5	42.0	42.5	43.0	43.5	44.0	44.5	45.0	45.5	46.0	46.5	47.0	47.5	48.0	48.5	
																				Excellent
																				Very Good
																				Good
																				Fair
															More than 49 %					Poor

Fig. 7.1.17.4 Cut grade as per pavilion depth

Notes

Skill India
कौशल भारत-कुशल भारत

सत्यमेव जयते
GOVERNMENT OF INDIA
MINISTRY OF SKILL DEVELOPMENT
& ENTREPRENEURSHIP

N·S·D·C
National
Skill Development
Corporation
Transforming the skill landscape

GJSCi
Gem & Jewellery Skill Council of India

8. Fancy Shapes

Unit 8.1 - Fancy Shapes and its Grading Concepts

G&J/N3604

Key Learning Outcomes

At the end of this module, you will be able to:

1. Know about fancy shapes.
2. Know the various components of fancy shapes.
3. Understand in detail the grading procedure of fancy shapes.

Unit 8.1: Fancy Shapes and its Grading Concepts

Unit Objectives

At the end of this unit, you will be able to:

1. Understand the concept of fancy shapes.
2. Understand the names of most popular fancy shapes.
3. Understand the various components of fancy shapes.
4. Understand the grading concept of fancy cut.
5. Understand the symmetry issues in fancy cuts.
6. Understand the shape appeal of fancy cuts.

8.1.1 What is Shape?

The face up outline of the diamond is known as shape.

8.1.2 What is a Fancy Cut?

Fancy Cut: Shape of a diamond other than round is known as fancy cut.

8.1.3 What Are Fancy Shapes?

Today with laser technology, diamonds can be cut into almost all desired shapes, be it abstracts or alphabets or any symbol.

Some most popular fancy shapes are

Oval

Princess

Emerald

Marquise

Pear

Triangle

Heart

8.1.4 Components of Fancy Shapes

Now as we are aware of the most popular fancy shapes, it is important for us to understand the name of the components of various fancy shapes.

Emerald Cut

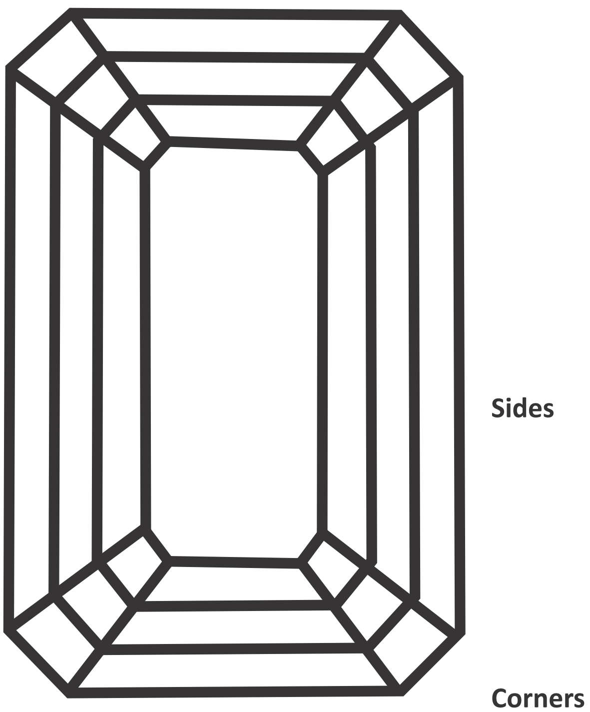

Fig. 8.1.4.1 Emerald Cut

Princess cut

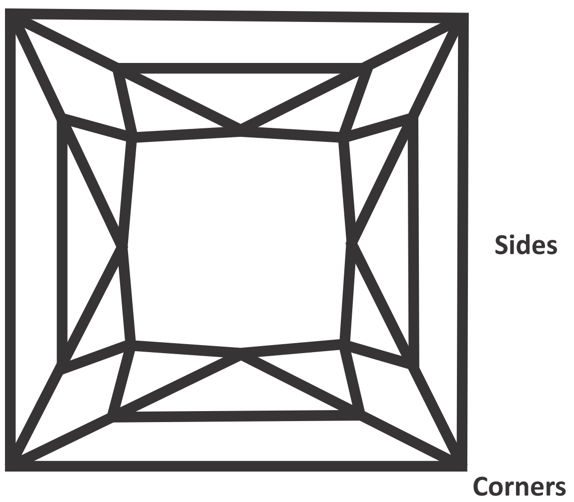

Fig. 8.1.4.2 Princess cut

8.1.4 Components of Fancy Shapes

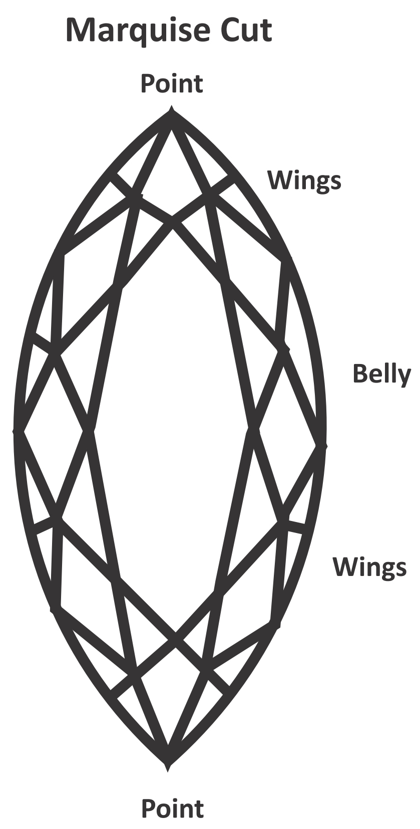

Fig. 8.1.4.3 Marquise Cut

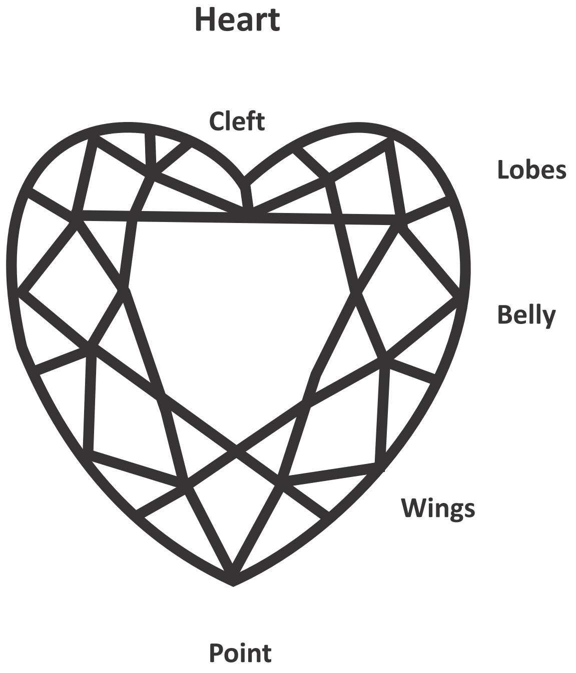

Fig. 8.1.4.4 Heart

8.1.4 Components of Fancy Shapes

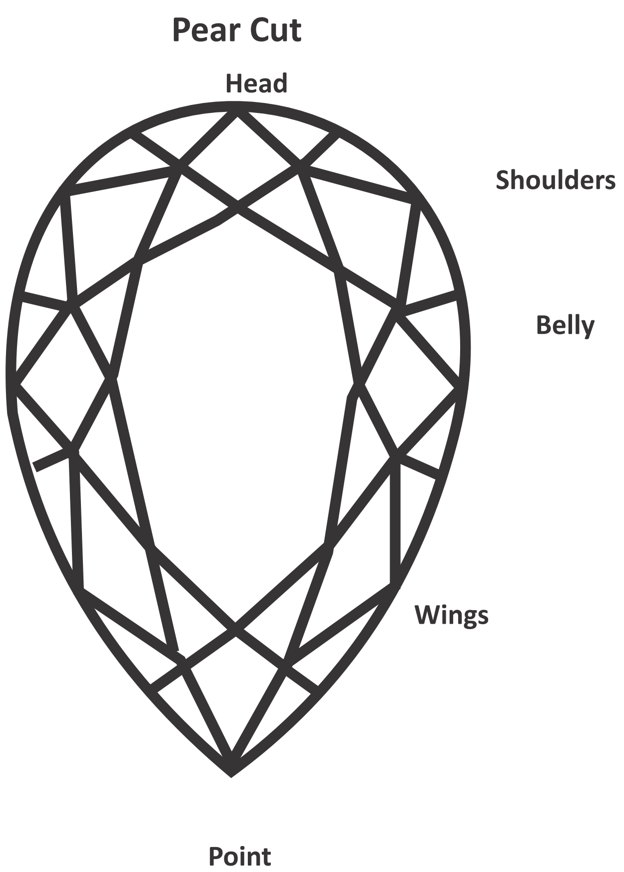

Fig. 8.1.4.5 Pear cut

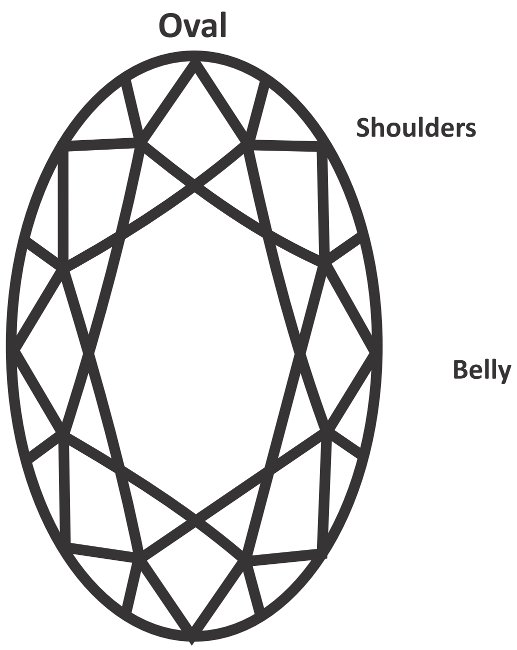

Fig. 8.1.4.6 Oval

8.1.4 Components of Fancy Shapes

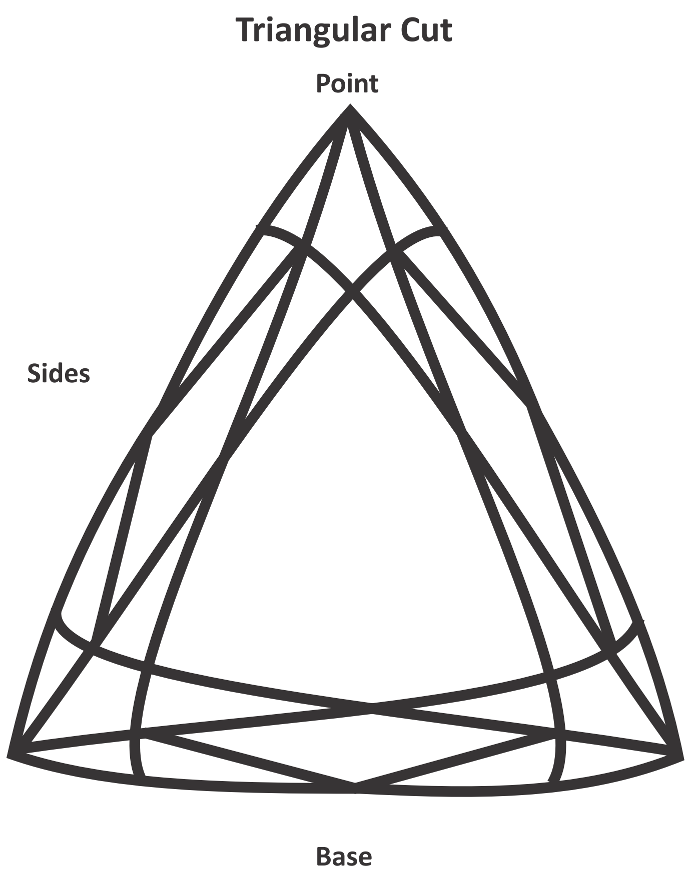

Fig. 8.1.4.7 Triangular Cut

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8.1.5 Grading Fancy Shapes

Grading fancy shapes is very similar to grading rounds, except that a few concepts are to be taken care of while grading fancy shapes.

8.1.6 Clarity Grading of Fancy Shapes

- Grade clarity like rounds.
- Inclusions may be easy to see in step cuts, but is difficult to see in shapes with corners and points.
- Plot fancy shapes similar to round plotting.

8.1.7 Colour Grading of Fancy Shapes

- Place the stone face down similar to round diamond colour grading method and estimate the colour grade through the pavilion facets.
- Round master stones can be used to grade colour of fancy shapes.
- Colour grading length wise will make the colour look dark and grading from the width will make it look light.
- Hence, place the stone diagonally to grade the colour.

8.1.8 Cut Grading of Fancy Shapes

Table Size:

Measure the table width to calculate table %.

$$\text{Table \%} = \frac{\text{table width}}{\text{stone width}} \times 100 \qquad \text{(Round to nearest 1\%)}$$

Crown Angle

Estimate the crown angle by looking at the stones length wise in profile:

On step cuts look at the center row of facets.

Describe the crown angles as:

- Acceptable
- Slightly Shallow
- Very Shallow
- Slightly Steep
- Very Steep

8.1.8 Cut Grading of Fancy Shapes

Girdle Thickness

Assess girdle thickness like round, **but allow for greater thickness in cleft and points.**

Pavilion Depth

To assess pavilion depth look at the stone face up to get on impression of its brilliance. Then view the stone in profile to describe pavilion depth as:

- Acceptable
- Slightly Shallow
- Very Shallow
- Slightly Deep
- Very Deep

Check for brilliance by looking at the bow tie (face up, unaided eye) and step cuts for bulge. Describe them as slightly noticeable or obvious.

Culet Size:

Judge culet size like rounds, unless it is long such as in emerald cut, then judge only the width.

Notes

8.1.9 Evaluating Symmetry

To evaluate the major symmetry, look for similar features as in rounds, plus additional features seen in fancy.

- **Sides not parallel in step cuts.**
- **Uneven corners in step cut.**
- **Uneven lobes in hearts.**
- **Uneven wings in pear, marquise and heart.**
- **Uneven shoulders in pear and ovals.**

8.1.10 Shape Appeal

Assess shape appeal by looking face up at the diamond's girdle outline:

- **Narrow corners or no corners on step cut (NC).**
- **Wide Corners on step cut (WC).**
- **High shoulders on pears and ovals (HS).**
- **Flat wings on pear, marquise and heart (FW).**
- **Bulged wings on pear, marquise and heart (BW).**
- **Undefined point in pear, marquise and heart (UP).**
- **Misshapen lobes of heart (ML).**

8.1.11 Length to Width Ratio

To estimate the length to width ratio of a fancy shape, divide length by width.

Example: L = 8.26mm

W = 5.41mm

Length to width ratio = 8.26 / 5.41 = 1.5268:1

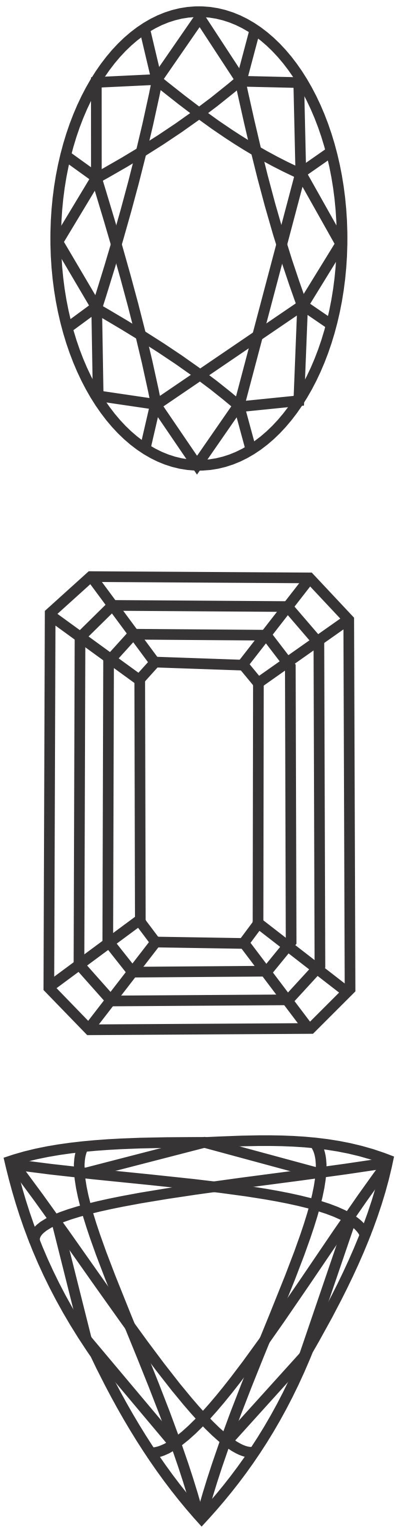
Round off to 1.53:1

(Note: round the ratio to nearest hundredth)

All fancy shapes have a given length to width ratio as an important part of the shape appeal.

Emerald cut with a proportionately longer length than width, takes away the bold look of an emerald cut. Similarly, marquise with a proportionately longer length than width, looks skinny and less durable. Also, in heart shape a proportionately longer length than width, takes away the true heart shape. Oval with a proportionately shorter length than width gives it an off-round shape rather than the oval look.

8.1.11 Length to Width Ratio



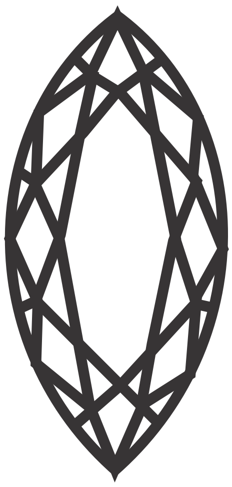
OVAL
1.33:1.66:1

EMERALD
1.50:1.75:1

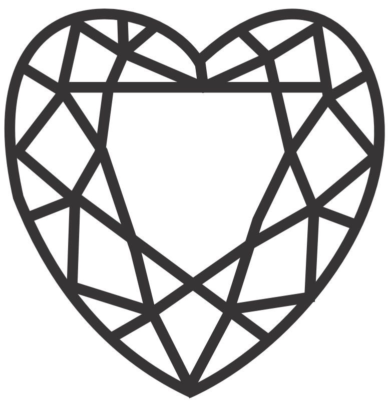
TRIANGULAR
1.00:1.00

Fig. 8.1.11.1 Length to width raio

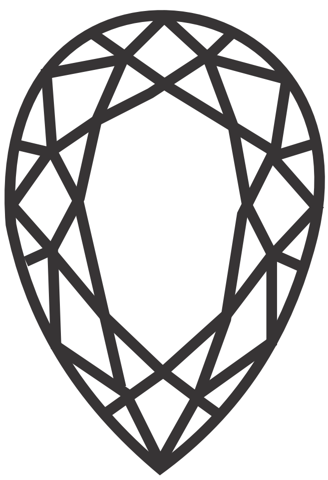
8.1.11 Length to Width Ratio



MARQUISE
1.75:2.25:1



HEART
1.00:1.00



PEAR
1.50:1.75:1

Fig. 8.1.11.2 Length to width ratio

Notes

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9. Fancy Colour

Unit 9.1 - Fancy Colour Diamonds

G&J/N3604

Key Learning Outcomes

At the end of this module, you will be able to:

1. Know what is fancy colour.
2. Know the various characteristics and features of fancy colour.

Unit 9.1: Fancy Colour Diamonds

Unit Objectives

At the end of this unit, you will be able to:

1. Understand the concept of fancy colour.
2. Understand the various colour options in diamond.
3. Understand rarity and colour.
4. Understand the grading concepts of fancy colour.

9.1.1 What is Fancy Colour?

Fancy Colour

Other than colourless and near colourless (with a tint of yellow or brown), diamonds in nature are also available in other colours like green, blue, purple and red which are beyond the normal colour range. **These are called as 'Fancies' or Fancy Coloured Diamonds.**

Face up these fancy coloured diamonds display more colour in yellow and brown than the 'Z' colour or any other hue.

The price movement in fancy coloured diamonds is just the opposite of the price movement of the normal colour range. Diamond value decreases moving from D to Z, but in case of fancy coloured diamonds the value increases as the colour becomes more obvious.

Prerequisites

Darker than Z master stones for yellow, brown, and grey hues.

Exceptions: Attractive brown and grey (face up) may receive a fancy designation even if lighter than Z master stones.

Other hues designated fancy if any amount of colour is perceived face-up.

9.1.2 Rarity and Colour

Rarity is one of the most important factor that affects the diamond value.

In case of fancy coloured diamonds, colours like fancy yellow and fancy browns are comparatively common than colours like green, blue and reds.

Diamonds in the reddish tone are the rarest in the world.

Blue diamonds are also rare.

In 1980's brown diamonds were considered as industrial diamonds. As they were found in good quantities in Australia, they were named and marketed as cognac and champagne diamonds.

These are quite popular in the medium priced jewellery.

9.1.2 Rarity and Colour

Order of Rarity of Fancy Colour Diamonds

1. Brown (champagne/ cognac) – common
2. Yellow – common
3. Grey
4. Orange
5. Light Blue
6. Green
7. Medium Blue
8. Pink
9. Purple
10. Red - rare

9.1.3 Causes of Fancy Colours

Brown

Brown diamonds are the most common fancy colour diamonds in the jewellery industry. It is the most recently added colour to be sold as fancy colour diamond. It used to be considered in industrial quality lots.

When these diamonds started appearing in quantity in Argyle, the Australians marketed them as champagne and cognac diamonds.

It is the internal graining present in the diamond which creates the brown colour.

They can be very light to very dark brown.

They can be available in different shades like yellowish, greenish, orangish modifying colours also.

Yellow

Being the second most common colour, it is marketed as canary.

Diamonds are yellow because of nitrogen. More than 99% of diamonds have nitrogen in them.

Grey

There are grey diamonds also, which are probably grey because of high hydrogen content.

Blue

Blue diamonds are quite rare.

Blue is caused due to the presence of boron as the trace element.

Boron in diamonds makes them conduct electricity.

9.1.3 Causes of Fancy Colours

Green

When in nature diamonds are deposited near radioactive rocks, the radiation causes the surface of the rough diamonds to become green. These radiations have a very shallow penetration. That is why the cutters try and leave maximum natural areas on the girdle to give more green colour to a cut and polished diamond.

Pink

Pink diamonds also called as rose diamonds, were very rare before the Australian Argyle mines. Pink diamonds are pink due to the **presence of pink graining**. More the pink graining more saturated the pink colour.

Diamonds with purple tone are called as mauve diamonds.

Red

Distortion in the crystal lattice can produce a red diamond.

Fig. 9.1.3.1 Fancy yellow colour

Fig. 9.1.3.2 Fancy brown

9.1.3 Causes of Fancy Colours

Fig. 9.1.3.3 Fancy Green

Fig. 9.1.3.4 Famous Blue Hope Diamond

Fig. 9.1.3.5 Fancy Pink

9.1.3 Causes of Fancy Colours

Fig. 9.1.3.6 Fancy Orange

Fig. 9.1.3.7 Fancy Red

Notes

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10. Sorting Small Diamonds

Unit 10.1 - Sorting Small Diamonds and its Steps

G&J/N3604

Key Learning Outcomes

At the end of this module, you will be able to:

1. Understand the concept of sorting.
2. Know the various equipment used for sorting.
3. Understand in detail the steps of sorting.

Unit 10.1: Sorting Small Diamonds and its Steps

Unit Objectives

At the end of this unit, you will be able to:

1. Understand the concept of sorting.
2. Understand the classification of diamonds based on size.
3. Understand the company policy to distribute diamonds in groups.
4. Understand the concept of whites and natts.
5. Understand the concept of LB and LC.
6. Understand the concept of OWLB and OWLC.
7. Understand the concept of TTLB, TLB, LB, DB.
8. Understand the concept of TTLC, TLC, LC.
9. Understand the correlation between grading and sorting.
10. Understand the clarity divisions of loose small diamonds in whites.
11. Understand the clarity divisions of loose small diamonds in natts.
12. Understand the use of tripod, sieve, scoop and optivisor.

10.1.1 Sorting Diamonds

Whenever diamonds are cut and polished in factories, especially small size diamonds, there is usually a mixed lot of diamonds.
These mixed lots of diamonds contain almost every combination of colour and clarity.
In this assignment of sorting of diamonds, we shall be starting with a mixed lot of diamonds and eventually categorizing it into 600 packets based on colour, clarity and carat.

10.1.2 Sorting Equipment

In sorting, we use the following equipment:

Tweezers: To hold diamonds.
Scoop: To pick loose diamonds safely and mobilize in the working area.
Sieves: As learnt in carat, for categorizing in sizes namely minus 2, stars, melee, plus eleven and plus 15.
Optivisor: Used for faster magnifying concepts.
Tripod: Three-legged stand with a triplet lens of 10x to magnify and sort the diamonds.

10.1.2 Sorting Equipment

Fig. 10.1.2.1 Tweezers and scoop to handle small diamonds

Fig. 10.1.2.2 Tripod

10.1.2 Sorting Equipment

Fig. 10.1.2.3 Sieves

Fig. 10.1.2.4 Optivisor

10.1.3 Sorting Steps

Sorting Steps

Step 1

Diamond lot:

This is the mixed lots of diamond which has all mixed combination of diamonds. Generally the sorter uses optivisor to magnify the whole diamond lot with great speed.

At stage 1, we only divide the diamond lot into two categories, that is:

whites (diamond with no dark inclusions)

natts (diamond with dark inclusions)

Fig. 10.1.3.1 Diamond Lot into whites and natts

Step 2

In step 2 the lot named white above goes to the sorter who is skilled to divide this into four further lots as per colour group with naked eye.

In step 2 we only divide the white / natts lot into four categories, that is:

White:

These are those diamonds which are of F,G,H,I colours. Usually in the market, diamonds with D and E colour are sold separate from big lots. Thus, they are cut and polished on a parallel setup. Thus D and E colour diamonds usually does not fall into this category.

Off White:

These are those diamonds which are of I, J, K colours. As these sorters don't use masters to colour group these diamonds, diamonds with colour grade I, being on the border of white and off white, tend to fall in both the groups.

LB: Light Brown

L is a colour in diamonds from where the hue in diamonds is clearly visible. Diamonds with colour grade L and below with brown tint fall under this category.

LC: Light Colour, Light Cream

Diamonds with colour grade L and below with yellow tint fall under this category.

10.1.3 Sorting Steps

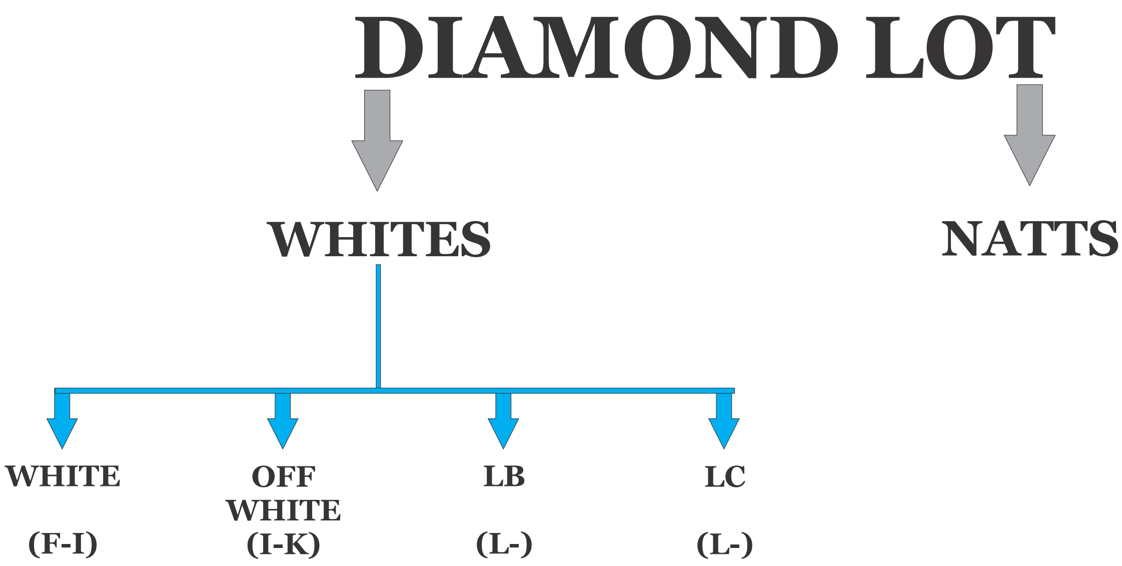

Fig. 10.1.3.2 whites lot into white, off-white, L.B, L.C

Thus, the lot of white diamonds in stage two is divided into four groups as per the hue.

Same process is also repeated in Natts.

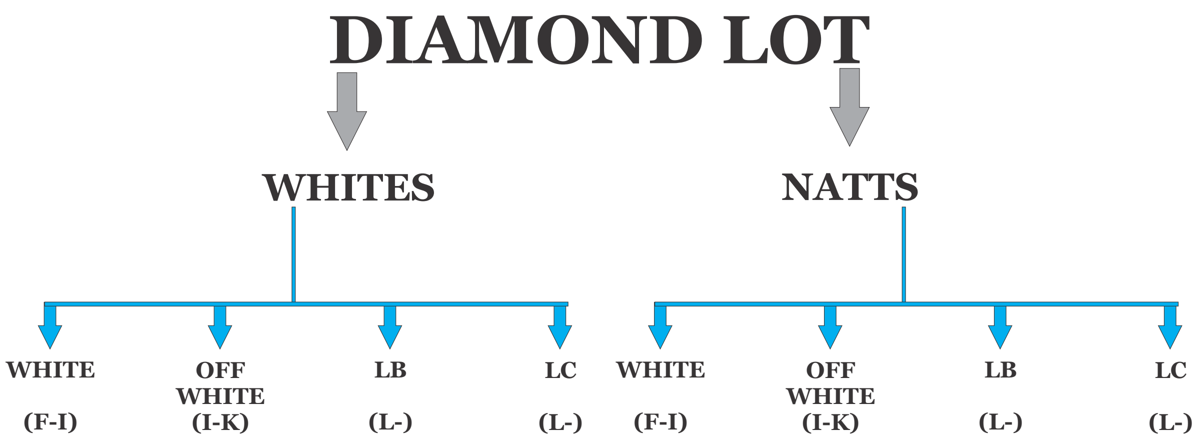

Fig. 10.1.3.3 whites and natts lot into white, off-white, L.B, L.C

10.1.3 Sorting Steps

Step 3

In step 3 the lot named off-white above goes to the sorter who is skilled to divide this into two further lots as per colour hue present in the I,J,K (off-white diamonds).

Since these are with high colour grades, it is difficult to see the colour hue face up.

Thus, the sorter is skilled to look at the colour hue at the girdle to check whether these off white diamonds are near colourless because of **yellow or brown tint.**

Thus, they are divided into following categories:

OWLB (Off White Light Brown):

These are those diamonds which are of I, J, K colours. Diamonds with colour grade I, J, K with brown tint falls under this category.

OWLC (Off White Light Colour/ Light Cream):

These are those diamonds which are of I, J, K colours. Diamonds with colour grade I, J, K with yellow tint falls under this category.

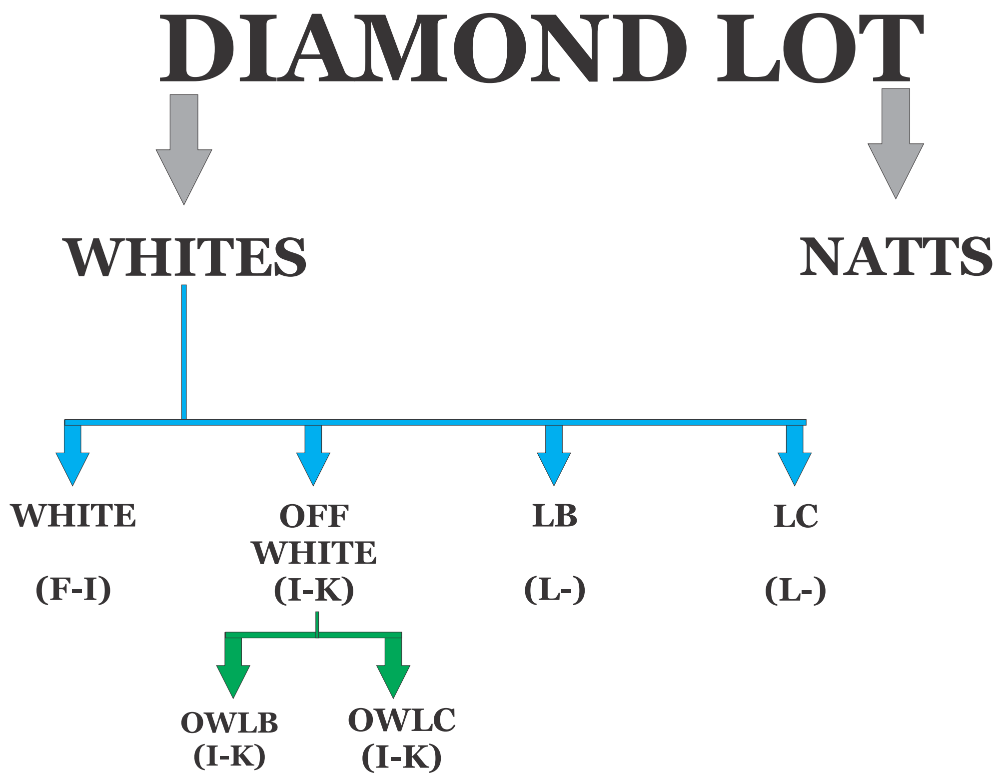

Fig. 10.1.3.4 Off-white into OWLB and OWLC

10.1.3 Sorting Steps

Thus, the lot of off-white diamonds in stage three is divided into two groups as per the hue. Same process is also repeated in Natts.

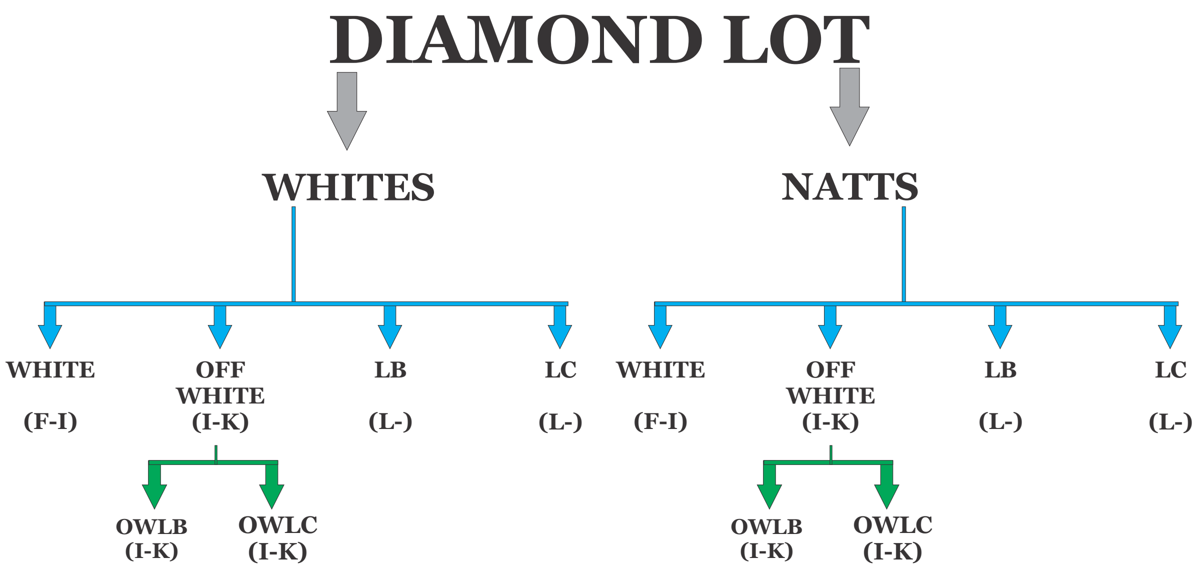

Fig. 10.1.3.5 Off-white lot into OWLB and OWLC in whites and natts

Step 4

In step 4 the lot named LB above goes to the sorter who is skilled in defining LB further into four groups as per colour grading standards of L and below.

Thus, they are divided into following four categories:

TTLB: Top Tinted Light Brown:

Colour L

TLB: Tinted Light Brown:

Colour M

LB: Light Brown:

Colour N

DB: Dark Brown:

Colour OP and below

10.1.3 Sorting Steps

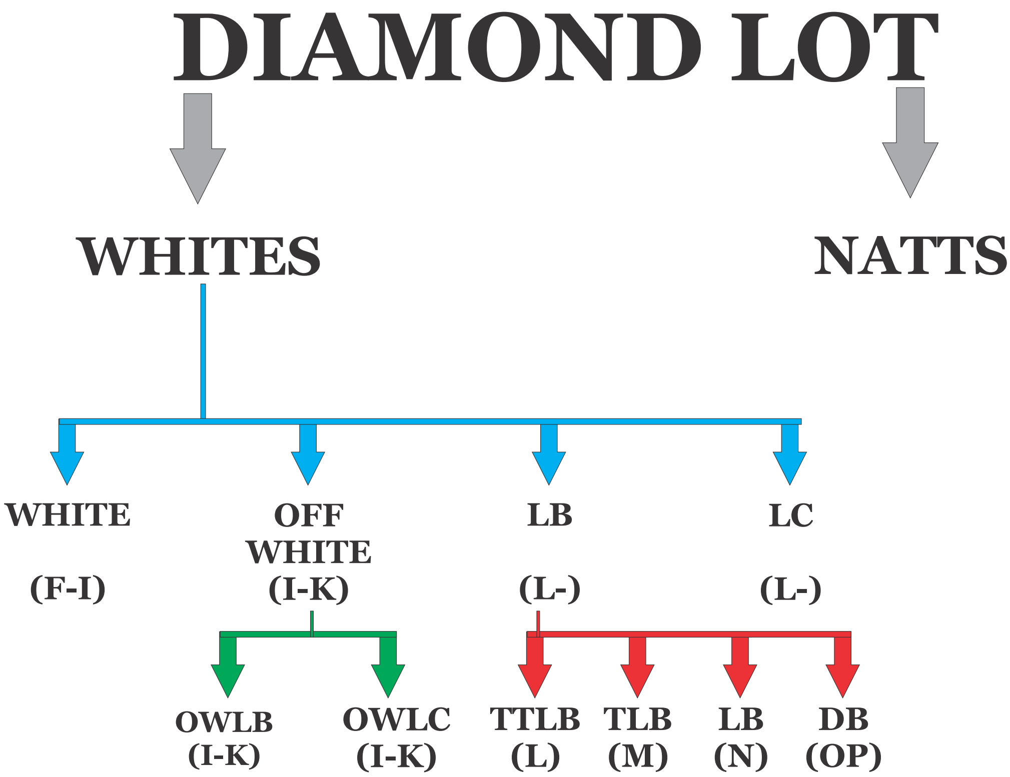

Fig. 10.1.3.6 LB into TTLB, TLB, LB, DB

Thus, the lot of LB diamonds in stage four is divided into four groups as per the colour grade. Same process is also repeated in Natts.

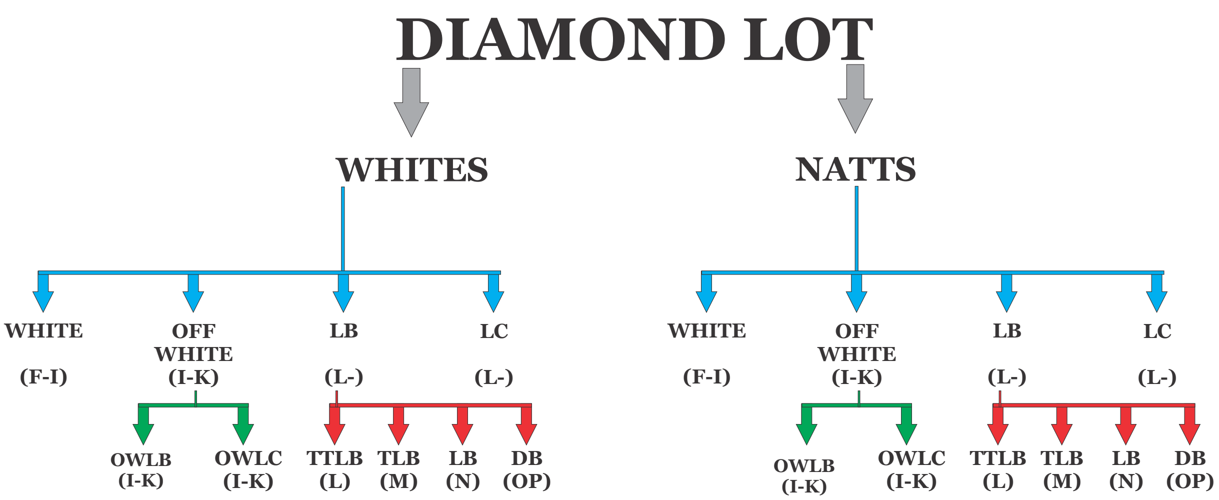

Fig. 10.1.3.7 LB into TTLB, TLB, LB, DB in whites and natts

10.1.3 Sorting Steps

Step 5

As done in step 4, repeat similar step in step 5, the lot named LC above goes to the sorter who is skilled in defining LC further into three groups as per colour grading standards of L and below.

Thus they are divided into following three categories:

TTLC: Top Tinted Light colour / cream:

Colour L

TLC: Tinted Light colour / cream:

Colour M

LC: Light colour / cream:

Colour N and below

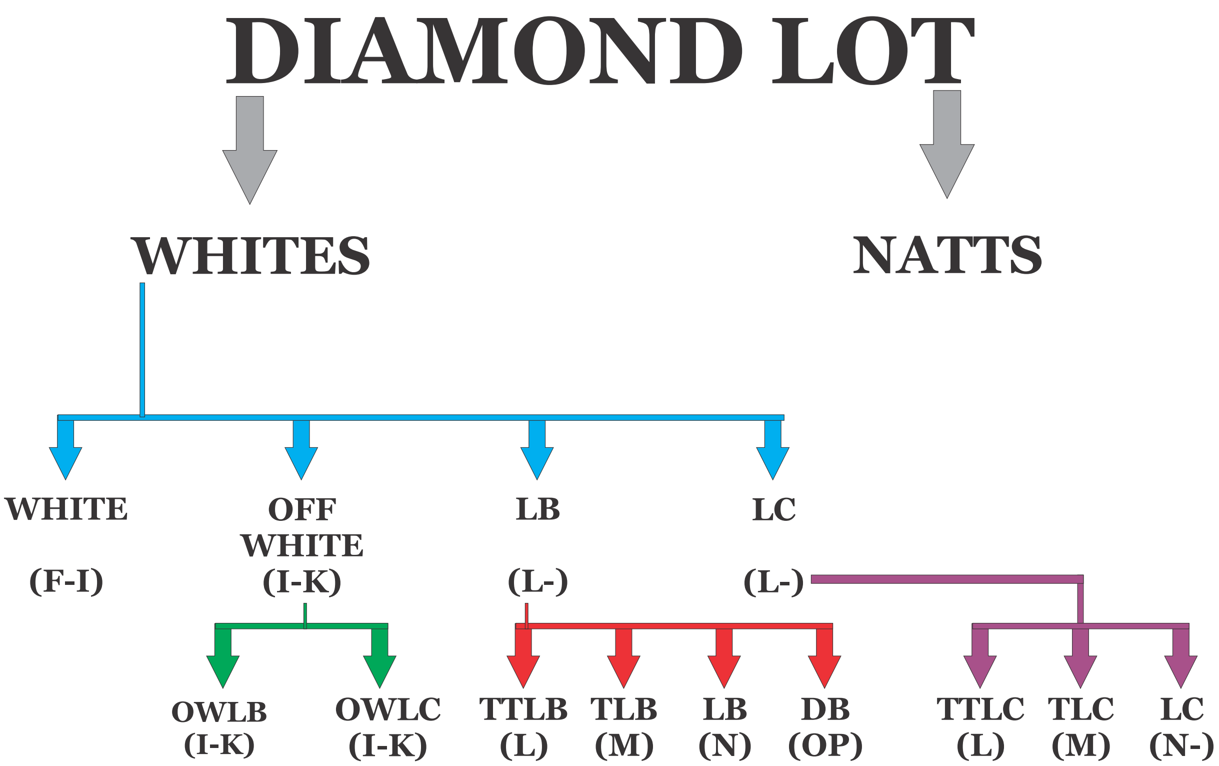

Fig. 10.1.3.8 LC into TTLC, TLC, LC

10.1.3 Sorting Steps

Repeating the same process in Natts, now we have 10 lots each in whites and in natts.

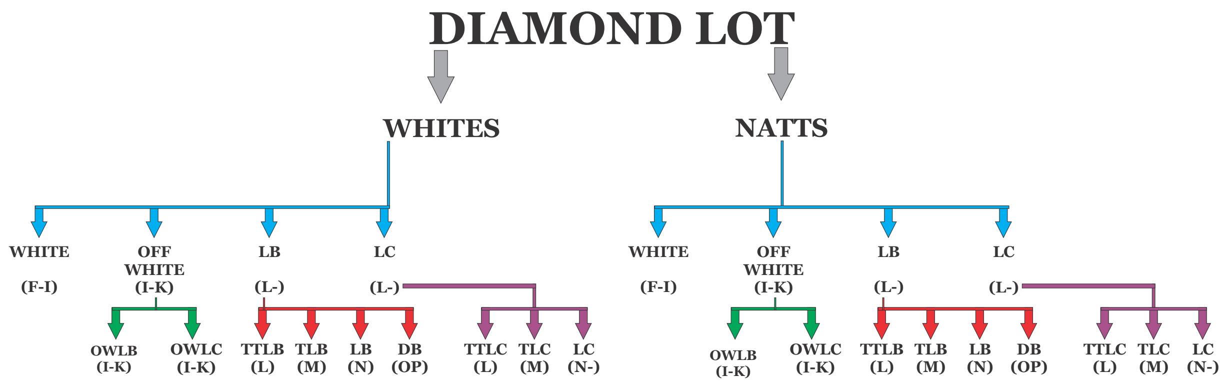

Fig. 10.1.3.9 LC into TTLC, TLC, LC in whites and natts thus categorizing into 20 lots

Step 6

As learnt in unit 5 - carat, use sieves to divide these 20 lots each in 5 lots each.

Minus 2

Stars

Melee

Plus 11

Plus 15

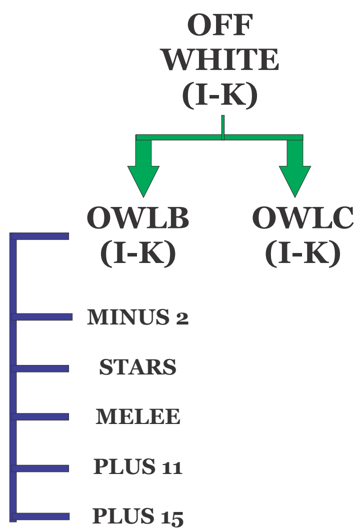

Fig. 10.1.3.10 All 20 lots are sieved into 5 lots

10.1.3 Sorting Steps

Stage 7

Using tripod (Three legged stand with a triplet lens of 10x to magnify and sort the diamonds) and check for clarity and divide the lots further as per chart below for white.

Fig. 10.1.3.11 Tripod

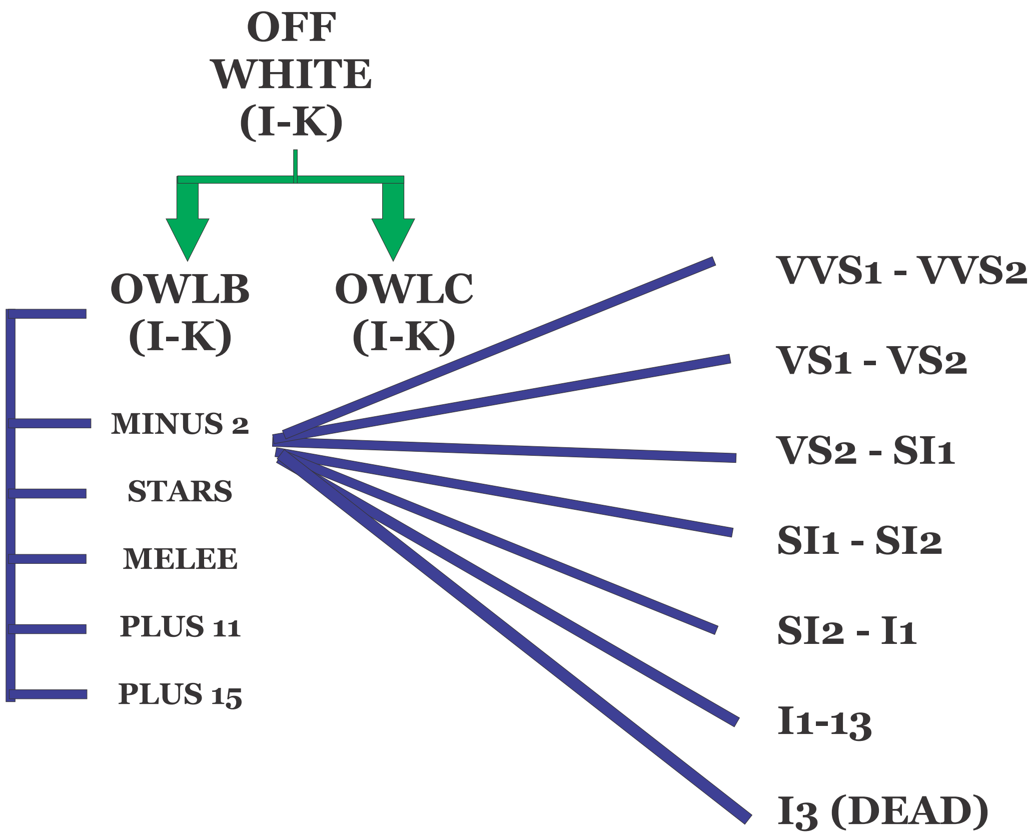

Fig. 10.1.3.12 Every sieve size is magnified separately and categorized into seven clarity groups as shown above

10.1.3 Sorting Steps

As natts lot has dark included crystals option of top two grades is not there. Thus instead of seven there are five clarity groups in natts.

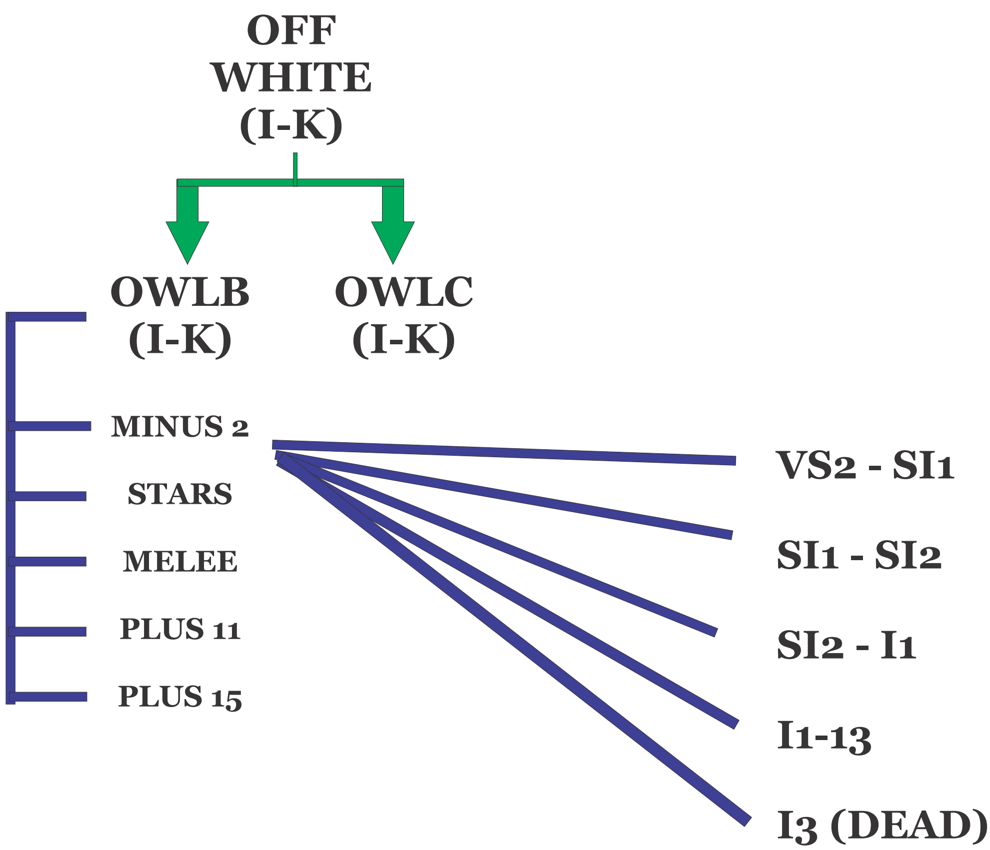

Fig. 10.1.3.13 every sieve size is magnified separately and categorized into five clarity groups as shown above in natts

Now, as you apply the whole system, whites has 350 (50*5*7) options.

Whereas, natts has 250 (50*5*5) options.

So, now we have in total 600 packets options available.

10.1.3 Sorting Steps

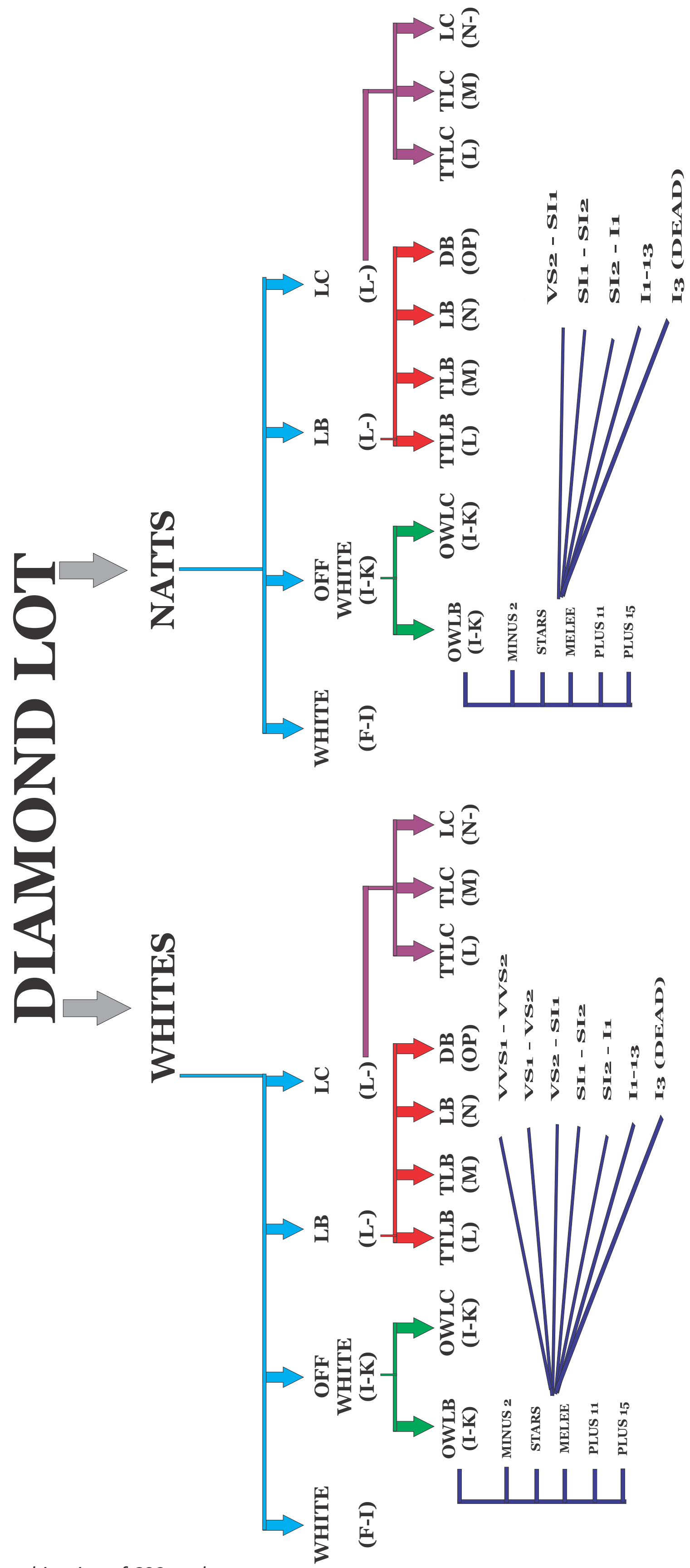

Fig. 10.1.3.14 combination of 600 packets

Notes

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11. Treatments

Unit 11.1 - Diamond Treatments and its Identification

G&J/N3604

Key Learning Outcomes

At the end of this module, you will be able to:

1. Know what are treatments.
2. Understand clarity and colour based treatments.
3. Understand how to identify treated diamonds.

Unit 11.1: Diamond Treatments and its Identification

Unit Objectives

At the end of this unit, you will be able to:

1. Understand the concept of treatment.
2. Understand the various types of treatments.
3. Understand the differentiation technique to identify treatments.

11.1.1 What is Treatment?

Treatments in diamond means that we take a natural diamond from nature and expose it to some controlled environment to change/ alter its colour or clarity appearance.

Thus, treatments can be divided into two categories - clarity treatment and colour treatment.

11.1.2 Clarity Treatments

There are two most common and popular treatments in the market in which the clarity or apparent clarity of diamonds is improved. Thus, the stone looks much cleaner than before.

These common treatments are:

Fracture filling (also termed as crack filling)

Laser drill hole (LDH)

Crack Filling/ Fracture Filling

What is Fracture filling?

Fracture filling is a process during which a high refractive glass material such as lead glass, which has high refractive index, fills the surface breaking feathers (locally in trade called as cracks/ JHIRAM).

If such material penetrates the cracks they become practically less visible. As the filling material has a high refractive index, so the light refracts at a similar speed and the stone looks much cleaner than before.

Generally this treatment is done on bigger stones due to the cost factor. But such treated / fracture filled diamonds of size as small as 0.075 carats have also been seen.

This is a very common size used in jewellery.

Star sizes have also been observed to be treated.

Such treated (fracture filled) diamonds are not clarity graded.

11.1.2 Clarity Treatments

Advantages of Fracture Filling

Since such material penetrates the cracks, the feathers become practically less visible.

Such diamonds fetch better prices in comparison to the price before doing the treatment by quoting it at a higher grade or they are mixed with a similar looking grade packet of melee or higher size pointers.

It has also been observed that this material is also used to fill the laser drill treated diamonds.(see picture)

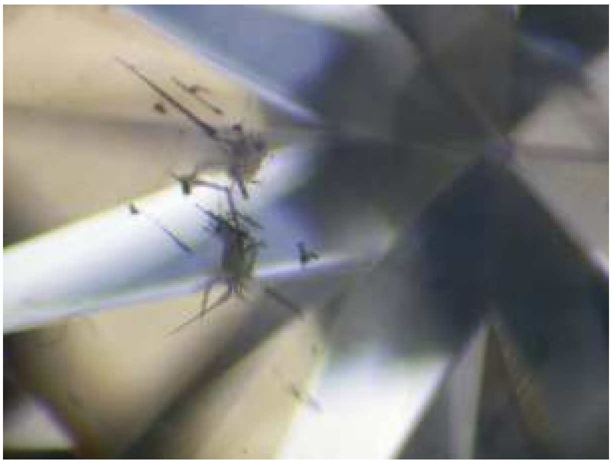

Fig. 11.1.2.1 Laser drill after filling

Disadvantages of Fracture Filling

Unfortunately the treatment is not a permanent change since slight heating of the stone during repairs of the jewellery piece can make this filled material darker and the cracks become quite visible.

But the treatment is considered much better than the regular oil filling.

That is why this method is also popular with emerald and other precious stones.

Identification:

1) Under magnification the cracks appear to be completely filled, except near the surface, which appears like a thin scratch on the surface. Sometimes the filled material also shows some hazy or cloudy appearance.

Occasionally, this filled material also shows flow texture. (see picture)

2) Another effect shown by this material is known as flash effect. The typical flash effect shown by the material is violet-blue in bright field illumination and yellow to reddish-orange in dark field. (See picture)

3) Gas bubbles were also noticed, which were distributed evenly throughout the filling.

11.1.2 Clarity Treatments

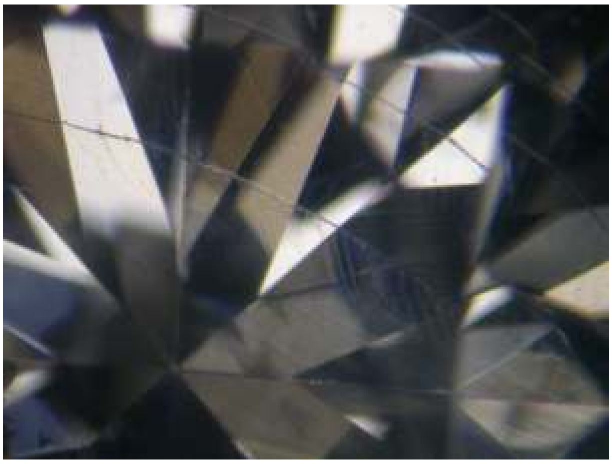

Fig. 11.1.2.2 Flow texture

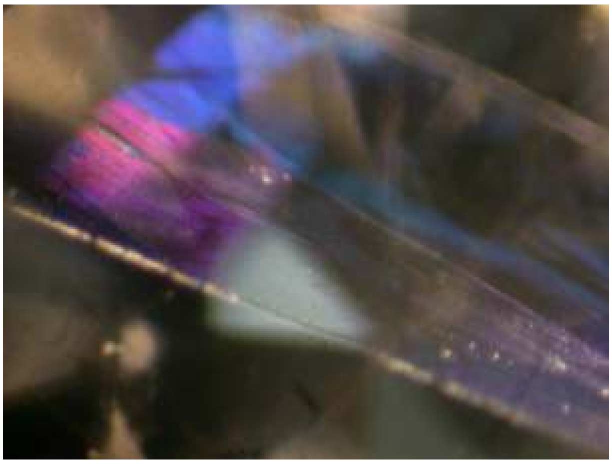

Fig. 11.1.2.3 Flash effect

Fig. 11.1.2.4 Flash effect

11.1.2 Clarity Treatments

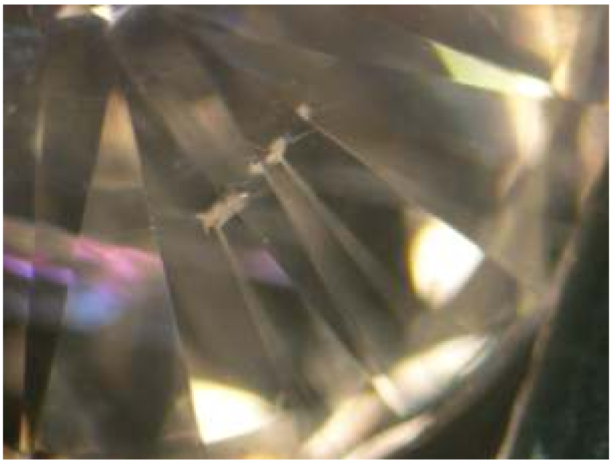

Fig. 11.1.2.5 Flash effect

Recommendations:

It is recommended that diamonds identified with filled material should be removed from the setting before doing any repair work.

While sorting, diamond packets a blue or a bluish reflection indicates flash effect of fracture filling, keep them separate.

The price range for any size is approximately 25% to 55% cheaper than the non treated diamonds of similar looking grade.

Such treatments are not easily identified by diamond traders/ jewellers unless they are aware or they have learnt about the same.

Laser Drill Hole(LDH)

As learnt in clarity, a Laser drill hole is a tiny tube made by laser, it usually resembles a needle. A laser drill hole is a tunnel created by a laser light beam to burn a dark included crystal.

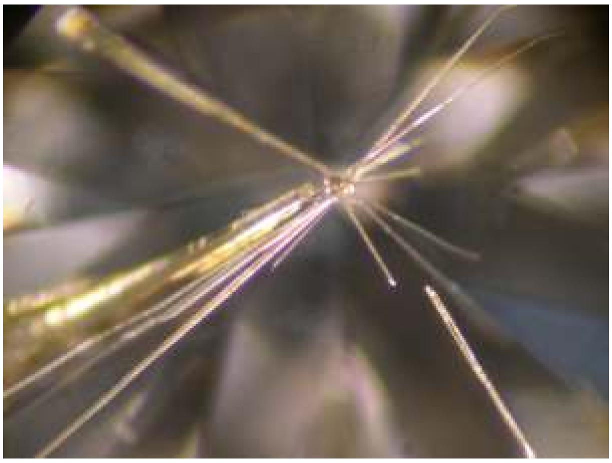

Fig. 11.1.2.6 LDH

11.1.2 Clarity Treatments

Fig. 11.1.2.7 Laser drill hole

11.1.3 Colour Treatments

There are few most common and popular treatments in the market in which the colour of diamonds is altered.

Irradiation:

It is the most common method till today to enhance or to change the colour of the diamonds to better shades. The colour of the diamonds is enhanced by bombarding them in nuclear reactors by electron, proton or neutron radiation.

One must make sure that irradiated diamonds are radiation free before it is used in jewellery.

To reduce the radiation and to make the colour change permanent irradiation is generally followed by heat treatment.

Heat treatment is also done at different temperatures to get different shades of fancy colours.

Cyclotron process

Also different shades of yellow can be achieved by irradiation and heating the diamonds to different temperatures. Diamonds are either treated from the table or pavilion side.

Previously when the diamonds were irradiated with the cyclotron process from the pavilion side, an umbrella shape optical effect could have been seen around the culet when observed through the table facet.

If treatment is done from table side uneven colour concentration is seen in various positions and sometimes a dark ring is seen when viewed from the pavilion side.

Recently neutron and electron bombardment has been frequently used for uniform colouration due to their greater penetration and because the colour is stable.

11.1.3 Colour Treatments

Van de Graff generator

- Bombards stone with electrons.
- Colour produced: blue.
- Does not conduct electricity like natural blue coloured diamond with presence of boron.

Notes

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12. Simulants and Synthetics

Unit 12.1 - Simulants, Synthetics and its Identification

G&J/N3604

Key Learning Outcomes

At the end of this module, you will be able to:

1. Know the various synthetics and simulants of diamond.
2. Understand how to identify them.

Unit 12.1: Simulants, Synthetics and its Identification

Unit Objectives

At the end of this unit, you will be able to:

1. Understand the concept of simulants.
2. Understand the identification techniques to distinguish between diamonds and simulants.
3. Understand the difference between synthetic diamond and natural diamond.

12.1.1 What are Simulants?

We are aware that diamonds are one of the most popular gemstone of the world. Lot of people are inspired by its beauty and appeal. This has inspired people to create less expensive look alikes. These look alike or imitations are called simulants.

These simulants are less priced and available in abundance.

In case of simulants, the physical, chemical and optical properties vary a lot.

Thus, its properties help us to distinguish between diamonds and its simulants.

12.1.2 Simulants and Its Properties

SYNTHETIC RUTILE

- Very strong doubling
- Very strong dispersion

Fig. 12.1.2.1 Doubling

Fig. 12.1.2.2 High Dispersion

12.1.2 Simulants and Its Properties

STRONTIUM TITANATE (ST)

- Strontium Titanate has a strong dispersion.
- Scratches, abrasions, chips, etc. are all indication of Strontium Titanate's low hardness.

Fig. 12.1.2.3 Scratches, Chips, Abrasions

GADOLINIUM GALLIUM GARNET (GGG)

- Feels very heavy.
- When placed table down on a line, the line is visible.

ZIRCON

- Double refractive, look for doubling.
- When placed table down on a line, the line is clearly visible.
- Zircon is very brittle, and therefore usually has severely abraded facet junctions.

Fig. 12.1.2.4 Abrasions

12.1.2 Simulants and Its Properties

YTTRIUM ALUMINIUM GARNET (YAG)

When placed table down on a line, the line is clearly visible.

SYNTHETIC SAPPHIRE

When placed table down on a line, the line is clearly visible.

SYNTHETIC SPINEL

When placed table down on a line, the line is clearly visible.

QUARTZ

When placed table down on a line, the line is clearly visible.

GLASS

When placed table down on a line, the line is clearly visible.

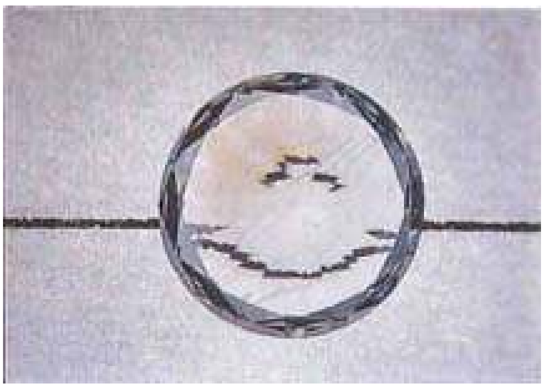

Fig. 12.1.2.5 Line visibility in line test

12.1.2 Simulants and Its Properties

CUBIC ZIRCONIA

- When placed table down on a line, the line is visible.
- CZ has a strong dispersion; it shows orange yellow and in a lesser extent blue violet colour flashes best from the pavilion.
- CZ may show scratches on the surface.
- The girdle is often chipped and sugary (coarse-grained).
- Sometimes the girdle is flat polished.
- The fluorescence of CZ is typically yellowish orange or greenish yellow.

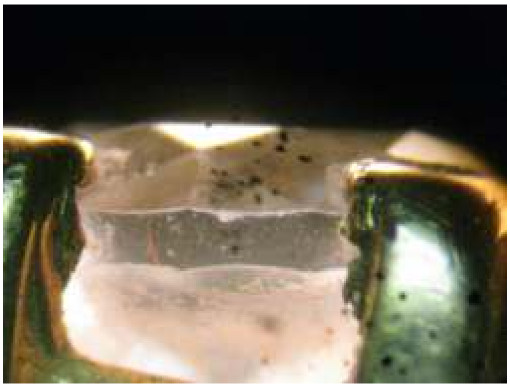

Fig. 12.1.2.6 Polished girdle

Fig. 12.1.2.7 Polished girdle

12.1.2 Simulants and Its Properties

SYNTHETIC MOISSANITE

Diamond vs Moissanite

A new diamond simulant called synthetic moissanite- a new diamond substitute has caused considerable concern in the jewellery trade all over the world. Hence, it is necessary to be aware of its identification without the use of sophisticated instruments:

Chemical and Physical Properties:

Chemical Composition: Silicon Carbide

As recent as 1990, the controlled growth of synthetic moissanite was achieved and near colourless material was available for gem purpose by a company called C.R.E.E Research Inc. in Durham North Carolina U.S.A. The gem substitute was distributed by C 3 Inc.

Crystal System:

Hexagonal crystal system 'polytypes' which stacks in hexagon layers of atoms.

Hardness:

9¼ on Mohs scale. It can scratch a corundum plate.

Refractive Index:

- 2.648 to 2.691 and birefringence is 0.043.
- Because of such high DR, doubling of back facets is seen clearly, especially in big stones.
- Thus, its double refraction is one of the most important properties to differentiate Moissanite from diamonds.

Dispersion:

Very very high dispersion as compared to diamond.

- Moissanite 0.104
- Diamond 0.044

Polariscope Test:

Moissanite shows the uniaxial cross figure, while diamond shows only strain effect.

Specific Gravity:

Moissanite SG is 3.24 - floats on methylene iodide solution.

12.1.2 Simulants and Its Properties

Diamond SG is 3.52 - sinks in the liquid. Thus, a 6.5 mm diameter will weigh 1 ct. Whereas a 6.5 mm diameter Moissanite will weigh 0.91 ct.

Note: For parcel of melees mixed with synthetic Moissanite it is best to use heavy liquid (m.i).

Magnification:

- Rounded facet junctions instead of sharp facets of diamond.
- Frosted girdle instead of waxy or sugary as in diamonds.
- Polishing lines run in the same direction unlike in a diamond, which move in all directions.
- Inclusions - white needle like sub-parallel to one another or stingers oriented perpendicular to the table.
- Doubling of back facets.

Longwave Ultraviolet:

- Under the UV, it glows moderate orange.
- Diamonds are generally blue or inert.
- Fluorescence is evenly spread, while in a diamond it is unevenly spread.

X-Ray:

- Moissanite fluoresces yellow but, diamond fluoresces blue.
- Diamonds are transparent under x-ray, while synthetic Moissanite is opaque.

Stability:

- Synthetic Moissanite - 1700º c in air and 2000º c in vacuum.
- Diamonds - 800º c in air and 1900º c in vacuum.
- Its distributors M/s C3 Incorporation has developed an instrument called Moissanite / diamond tester model 590.

Marketing and Sales:

- December 1997 onwards synthetic Moissanite started appearing in the markets world over in stars, melee and carat sizes.
- The biggest so far is 380 carats.
- The range of colours being near colourless to light yellow green and grey.
- The price range of brilliant cut and polished Moissanite being 5% to 10% of average retail price of comparable diamonds.
- Weight ranging from 0.75 cts. to 1.25 cts.
- Are available in round brilliant cut and shapes.

12.1.2 Simulants and Its Properties

Fig. 12.1.2.8 Doubling

Fig. 12.1.2.9 Polished Girdle

Fig. 12.1.2.10 Doubling

12.1.2 Simulants and Its Properties

Fig. 12.1.2.11 Doubling

Scan the QR Code to watch the related video or click on link

Click Here

Synthetic diamonds and it's use

(Source : National Geographic)

12.1.3 Synthetic Diamonds

Synthetic diamonds are man made diamonds which uses carbon from graphite, which are crystallized into diamonds by using High Pressure and High Temperature.

Physical, chemical and optical properties are same as natural.

There are technologies like HPHT (High pressure and high temperature) and CVD (Chemical vapour deposition) used to manufacture these.

MAGNIFICATION (if inclusions are present)

- Metallic platelet- remnants of metallic solutions.
- Dark, opaque, black, grey in colours.
- Very rarely seen as clouds of very small pinpoints.
- High metallic lustre.
- Test for magnetism, since inclusions are magnetic.

If there are no identifiable inclusions

- Focus on growth features rather than inclusions.
- Distinct colour zoning along internal growth, with highly coloured areas separated by sharp boundaries.
- An hour glass pattern proves synthetic origin.

ULTRA VIOLET FLUORESCENCE

- Strong yellow to yellowish green under SWUV.
- Pattern or zoning of fluorescence is more important than colour of fluorescence itself.

To maintain HPHT is difficult, thus we need nitrogen's help for diamonds to synthesize.

Metallic inclusions occur due to nickel and yellow colour occurs due to nitrogen.

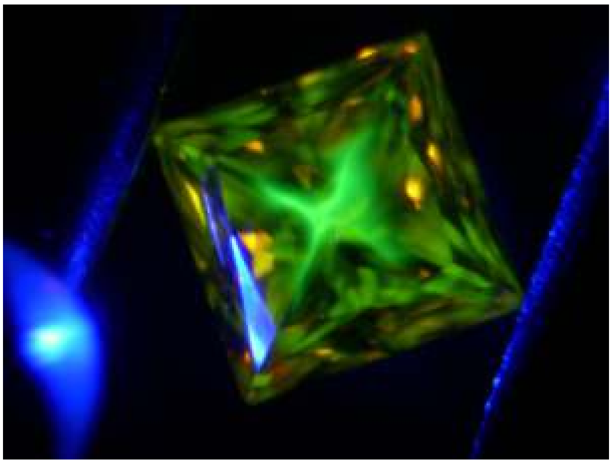

Fig. 12.1.3.1 Hour glass pattern under UV

12.1.3 Synthetic Diamonds

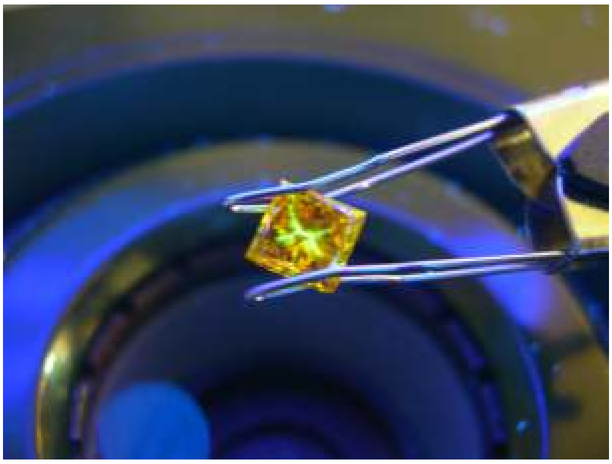

Fig. 12.1.3.2 Hour Glass pattern

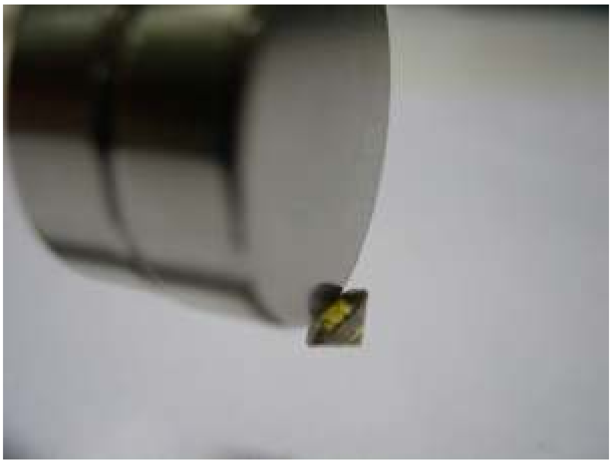

Fig. 12.1.3.3 Magnetic inclusion

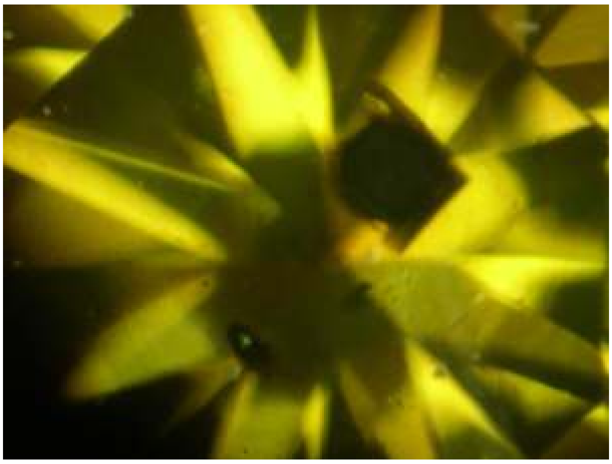

Fig. 12.1.3.4 Nickel Inclusions

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13. Pricing

Unit 13.1 – Understanding Pricing and its Concepts

G&J/N3604

Key Learning Outcomes

At the end of this module, you will be able to:

1. Understand the pricing system and price guide.
2. Understand the various calculation systems.

Unit 13.1: Understanding Pricing and its Concepts

Unit Objectives

At the end of this unit, you will be able to:

1. Understand the concept of pricing.
2. Understand the concept of price guides.
3. Understand the difference between stone value and stone rate / per carat rate.

13.1.1 Introduction of Pricing

To start pricing:

- Be able to grade stones (identification and 4Cs).
- If you are working in the industry, you have an access to market rates.
- If you have ever had a direct experience in buying, you understand the base value of diamonds.
- Knowing the 4Cs grading system is very important to understand pricing.

13.1.2 Getting Prices / Price Guides

Price Guides

There are price guides available in the market (some of them are subscribed and paid for) which usually states only 3Cs, that is clarity, colour and carat weight.

These price guides describe the rate depending on the market conditions at the time when they are printed.

These rates mentioned in the price guides tend to fluctuate on regular basis.

Rapaport is one of the most acceptable and followed price list issued every Friday from New York (U.S.A).

Rapaport shows a tabular chart rate stating carat, colour and clarity. The figures mentioned in the list are in hundred US dollars per carat.

Thus if a combination of carat, colour and clarity shows '60' in the chart, it means the rate per carat is $6000 (60 x 100).

Now let us assume that the carat weight of diamond is 1.06 ct, then the diamond value would be calculated as below:

$ 6000 x 1.06

= $ 6360 which is the stone value.

Let us now understand the difference between stone rate and stone value.

13.1.3 Stone Rate Vs Stone Value

Quoting rates in wholesale to the trader:

Quote price per carat, do not quote the stone value.

Per carat rate = Stone value / carat weight

Example:

Stone value = $ 6360

Stone weight = 1.06 carat

Per carat rate = $ 6360 / 1.06

= $ 6000

Similarly,

Quoting rates to public / customer in retail business

Quote the stone value.

Stone value = Per carat rate x carat weight of the stone

Example:

Per carat rate = $ 6000

Stone weight = 1.06 carat

Stone value = $ 6000 x 1.06

= $ 6360

Pick Price (High Grading)

- Customers / jewellers pick stones out of a parcel.
- They select the best stones.
- It will be charged at a premium price.

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14. Assort Diamonds for Jewellery Manufacturing

Unit 14.1 - Assorting Diamonds for Jewellery Manufacturing

G&J/N3603

Key Learning Outcomes

At the end of this module, you will be able to:

1. Know the system of receiving diamond packets and the chain involved in the work flow.
2. Know the concepts of facets.
3. Know the basic concepts of 4Cs.
4. Know the concept of clarity.
5. Know the concept of carat.
6. Know the concept of carat with respect to assorting diamonds for different types of jewellery.
7. Know the concept of colour.
8. Know the concept of cut.
9. Know the concept of fancy shapes.
10. Know the concept of assorting diamonds for jewellery.
11. Identify common simulants of diamond like Cubic Zirconia and Synthetic Moissanite.
12. Know the concept of pricing and value determination after sorting.

Unit 14.1: Assorting Diamonds for Jewellery Manufacturing

Unit Objectives

At the end of this unit, you will be able to:

1. Understand the system of receiving diamond packets and the chain involved in the work flow.
2. Understand the concepts of facets.
3. Understand the basic concepts of 4Cs.
4. Understand the concept of clarity with respect to assorting diamonds for jewellery.
5. Understand the concept of carat with respect to assorting diamonds.
6. Understand the concept of carat with respect to assorting diamonds for different types of jewellery.
7. Understand the concept of colour with respect to assorting diamonds for jewellery.
8. Understand the concept of cut with respect to assorting diamonds for jewellery.
9. Understand the concept of fancy shapes with respect to assorting diamonds for jewellery.
10. Understand the concept of assorting diamonds for jewellery.
11. Identify common simulants of diamond like Cubic Zirconia and Synthetic Moissanite.
12. Know the concept of pricing and value determination after sorting.

14.1.1 Receiving Diamond Packets

An assorter of diamonds for jewellery manufacturing serves as one of the important roles in jewellery manufacturing.

Assorting is one of the process in the workflow of diamonds received from the processing unit or trader and after completion of the job the same has to be returned / transferred to the next department fo setting diamonds into jewellery.

Diamond packets are always mentioned with **minimum one of the following** on it:

- **The total weight of diamonds in that packet and / or**
- **The total number of diamonds in that packet**

Some companies also mention **some packet code depicting cost or trader code** from whom these diamonds are purchased.

It is the internal policy of the company whether this information is to be shared with the assorter or not.

Always verify the total weight and / or total number of pieces in the packet before starting the work on the same. If in any case there is discrepancy in the total weight or number of pieces, the same should be communicated to the supervisor or processing unit or trader as applicable .

14.1.1 Receiving Diamond Packets

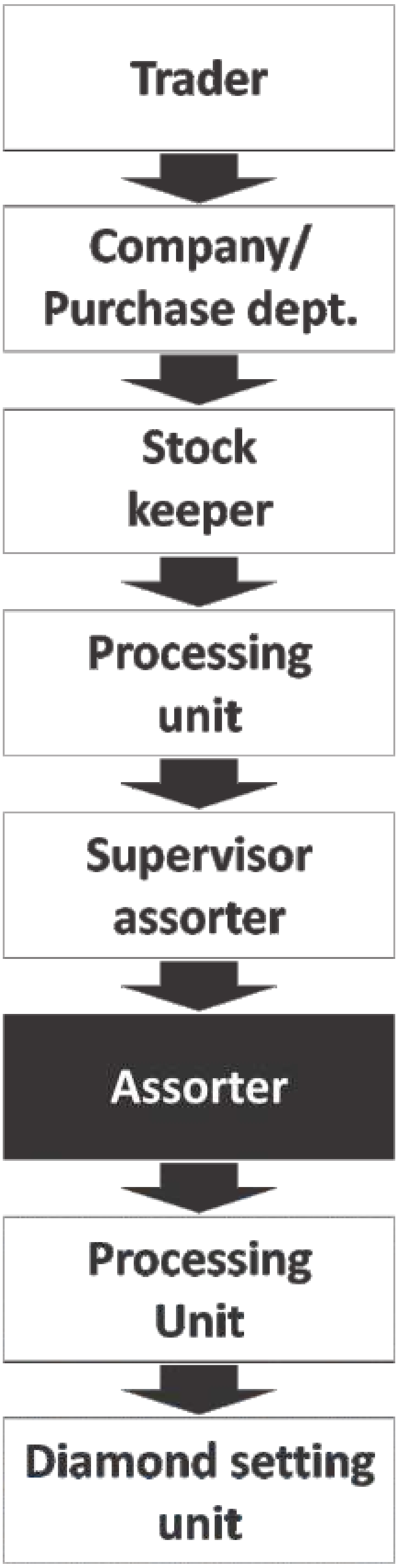

Fig. 14.1.1.1 Work flow

14.1.2 Facets

For Facets module refer to **UNIT 2.1.1** and **UNIT 2.1.2**.

After reading the above-mentioned units you will be able to:

1. Know what is a facet.
2. Know the various types of cuts.
3. Understand the arrangement of facets in the standard round brilliant cut.
4. Understand the various parts of a diamond.
5. Understand the various facet names and their arrangement.

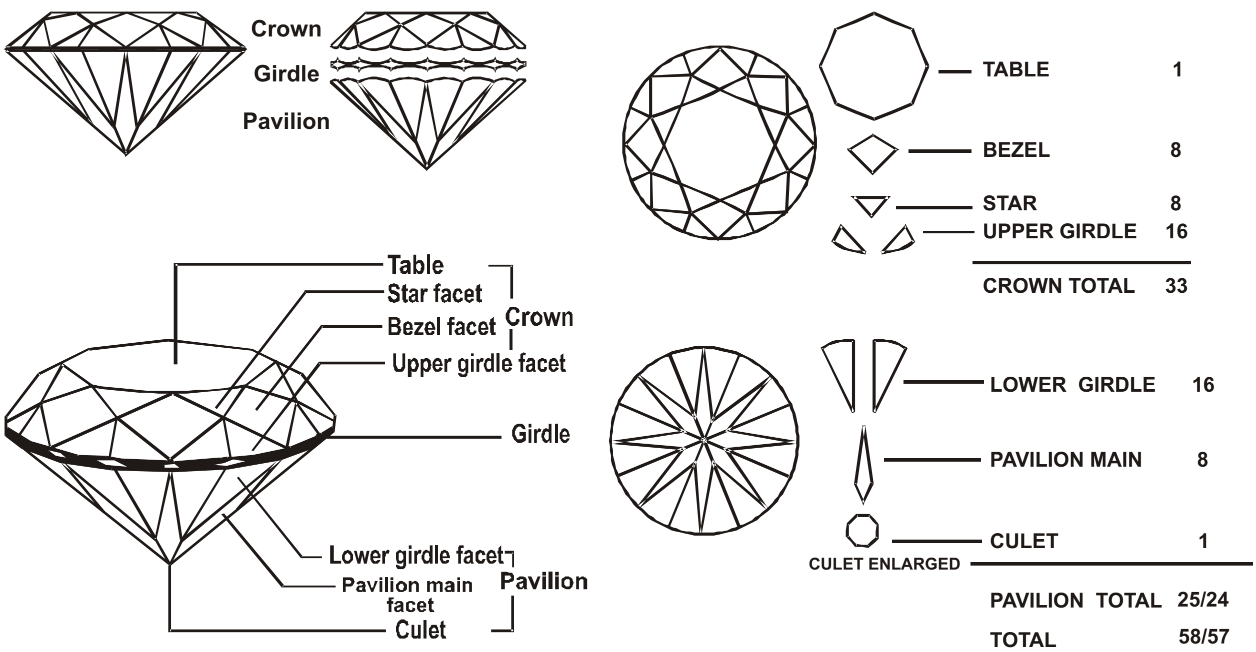

Fig. 14.1.2.1 Facet Arrangement of the standard round brilliant

14.1.3 Concept of 4Cs

For Concept of 4Cs module refer to **UNIT 3.1** with the following sub-units:

UNIT 3.1.1
UNIT 3.1.2
UNIT 3.1.3
UNIT 3.1.4 and
UNIT 3.1.5

After reading the above-mentioned units you will be able to:

1. Understand the concept of 4Cs.
2. Understand the basics of the value factors.
3. Understand the basic concept of Carat.
4. Understand the basic concept of Clarity.
5. Understand the basic concept of Colour
6. Understand the basic concept of Cut.

Fig. 14.1.3.1 4Cs

14.1.4 Clarity

For Clarity module refer to **UNIT 4.1** with the following sub-units:

UNIT 4.1.1
UNIT 4.1.2
UNIT 4.1.3
UNIT 4.1.4
UNIT 4.1.5
UNIT 4.1.6
UNIT 4.1.7
UNIT 4.1.8
UNIT 4.1.9
UNIT 4.1.10
UNIT 4.1.11
UNIT 4.1.12 and
UNIT 4.1.16

After reading the above-mentioned units you will be able to:

1. Understand the concept of clarity.
2. Understand the concept of clarity characteristics.
3. Understand the concept of Blemishes.
4. Understand the concept of Inclusions.
5. Understand the concept of clarity Vs carat rate.
6. Understand the concept of types of lighting.
7. Know the clarity grades and factors determining them.

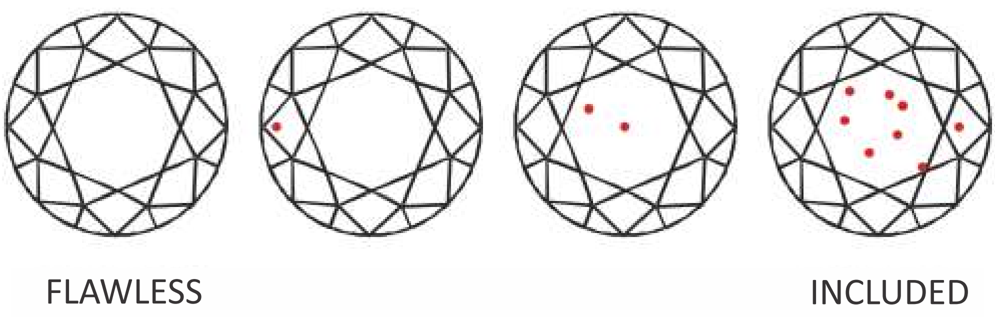

*Fig. 14.1.4.**1** Clarity grade vs Inclusions*

14.1.5 Carat and Application as per Jewellery Types

For Carat module refer to **UNIT 5.1** with the following sub-units:

UNIT 5.1.1
UNIT 5.1.2
UNIT 5.1.3
UNIT 5.1.4
UNIT 5.1.5
UNIT 5.1.6
UNIT 5.1.7
UNIT 5.1.8 (UNIT 5.1.9, 5.1.10 and 5.1.13 are not required for this NOS)
UNIT 5.1.11 and
UNIT 5.1.12

After reading the above-mentioned units you will be able to:

1. Understand the concept of carat in detail and derivation of carat with other terms.
2. Understanding the concept of carat as a value factor.
3. Understand the concept of measurement and calculation of carat.
4. Understand the concept of sieves and how to use them.
5. Understand the diamond diameter vs carat weight.

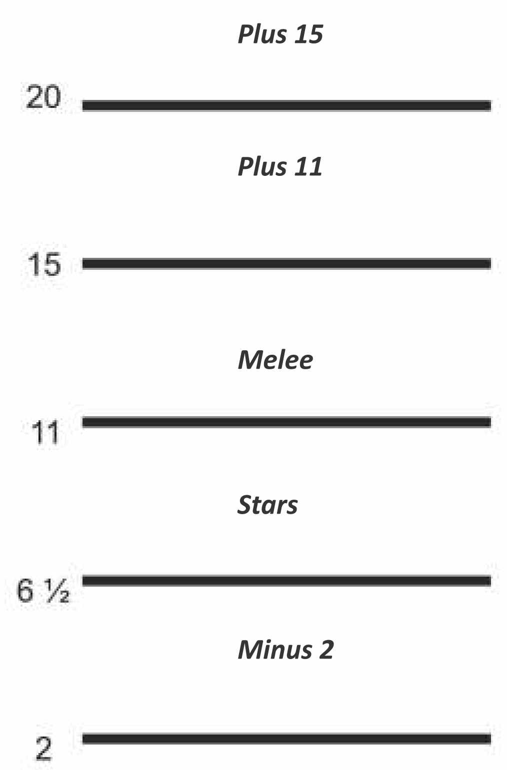

Fig. 14.1.5.1 Diamond Sieves grouping system

14.1.5 Carat and Application as per Jewellery Types

Diamond Sieve Reference Chart

Sieves are given numbers as per diameter. Charts are supplied to find out which sieve is for which diameter and corresponding weight of diamond.

SIEVE SIZES	PCS/Ct.	WEIGHT (ct)	DIA (mm)
000-0	1/200	0.005	0.90-1.10mm
0-1	1/175	0.006	1-10 – 15mm
1-1.5	1/150	0.007	1-15 – 1.20mm
1.5-2	1/120	0.008	1-20 – 1.25mm
2-2.5	1/110	0.009	1-25 – 1.30mm
2.5-3	1/100	0.010	1-30 – 1.35mm
3-3.5		0.011	1-35 – 1.40mm
3.5-4	1/80	0.012	1-40 – 1.45mm
4-4.5		0.013	1-45 – 1.50mm
4.5-5	1/70	0.014	1-50 – 1.55mm
5-5.5	1/60	0.016	1-55 – 1.60mm
5.5-6		0.018	1-60 – 1.70mm
6-6.5	1/50	0.021	1-70 – 1.80mm
6.5-7	1/40	0.025	1-80 – 1.90mm
7-7.5	1/30	0.029	1-90 – 2.00mm
7.5-8		0.035	2-00 – 2.10mm
8-8.5	1/25	0.039	2-10 – 2.20mm
8.5-9		0.044	2-20 – 2.30mm
9-9.5	1/20	0.052	2-30 – 2.40mm
9.5-10		0.058	2-40 – 2.50mm
10-10.5	1/15	0.069	2-50 – 2.60mm
10.5-11		0.074	2-60 – 2.70mm
11-11.5	1/15	0.078	2-70 – 2.80mm
11.5-12		0.086	2-80 – 2.90mm
12-12.5	1/10	0.095	2-90 – 3.00mm
12.5-13		0.108	3-00 – 3.10mm
13-13.5	1/8	0.116	3-10 – 3.20mm
13.5-14		0.125	3-20 – 3.30mm
14-14.5	1/7	0.135	3-30 – 3.40mm
14.5-15		0.146	3-40 – 3.50mm
15-15.5	1/6	0.159	3-50 – 3.60mm
15.5-16		0.175	3-60 – 3.70mm

Fig. 14.1.5.2 Diamond Sieves Reference

14.1.5 Carat and Application as per Jewellery Types

Some jewellery designs are very unusual because of the size of diamonds to be used with them.

Diamond jewellery like the following requires *plus 15.*

- Single line bangle is also called as running diamond bangle
- Tennis Bracelet
- Diamond strings etc.

Fig. 14.1.5.3 Plus 15 size Diamonds in jewellery

14.1.5 Carat and Application as per Jewellery Types

Diamond jewellery like the following requires *plus 11.*

- **Single line bangle is also called as running diamond bangle**
- **Wedding rings**
- **Gents rings with 9 or 12 diamonds**
- **Nakshatra style tops etc.**

Fig. 14.1.5.4 Plus 11 size Diamonds in jewellery

14.1.5 Carat and Application as per Jewellery Types

Diamond jewellery like the following requires melee.

- **Regular rings, pendants, necklace sets, tops etc.**
- **These are one of the hottest selling sizes in the market**

Fig. 14.1.5.5 Melee size Diamonds in jewellery

14.1.5 Carat and Application as per Jewellery Types

Diamond jewellery like the following requires *stars.*

- **Light weight jewellery with more design oriented concepts**
- **All types of jewellery are available in this size**
- **After melee, this is the next hottest selling size**

Fig. 14.1.5.6 stars size Diamonds in jewellery

14.1.5 Carat and Application as per Jewellery Types

Diamond jewellery like the following requires *minus 2.*

Fine jewellery, god and goddess pendants etc.

Fig. 14.1.5.7 Minus 2 size Diamonds in jewellery

14.1.6 Colour

For Colour module refer to **UNIT 6.1** with the following sub-units:
UNIT 6.1.1
UNIT 6.1.5
UNIT 6.1.9 and
UNIT 6.1.10

After reading the above-mentioned units you will be able to:

1. Understand the concept of colour.
2. Understand the colour nomenclature.
3. Understand the colour grading scale.
4. Understand colour as a value factor.

DESCRIPTION	COLOUR GRADE	TERMINOLOGY
Face up and table down (from pavilion) – no colour seen	D, E, F	Colourless
Face up – no colour seen; table down (from pavilion) – slight tint seen	G, H, I, J	Near Colourless
Face up – slight tint seen; table down (from pavilion) – obvious colour seen	K, L, M	Faint Yellow
Face up and table down (from pavilion) – obvious colour seen	N, O, P, Q, R	Very Light Yellow
	S, T, U, V, W, X, Y, Z	Light Yellow
	More than Z	Fancy

Fig. 14.1.6.1 Colour grading scale

Fig. 14.1.6.2 Diamond colour grading

14.1.7 Cut

For Cut module refer to **UNIT 7.1** with the following sub-units:

UNIT 7.1.1
UNIT 7.1.2
UNIT 7.1.3
UNIT 7.1.4 and
UNIT 7.1.5

After reading the above-mentioned units you will be able to:

1. Understand the concept of cut grading.
2. Understand the concept of diamond proportion.
3. Understand the concept of average girdle diameter.
4. Understand the concept of total depth and its analysis.

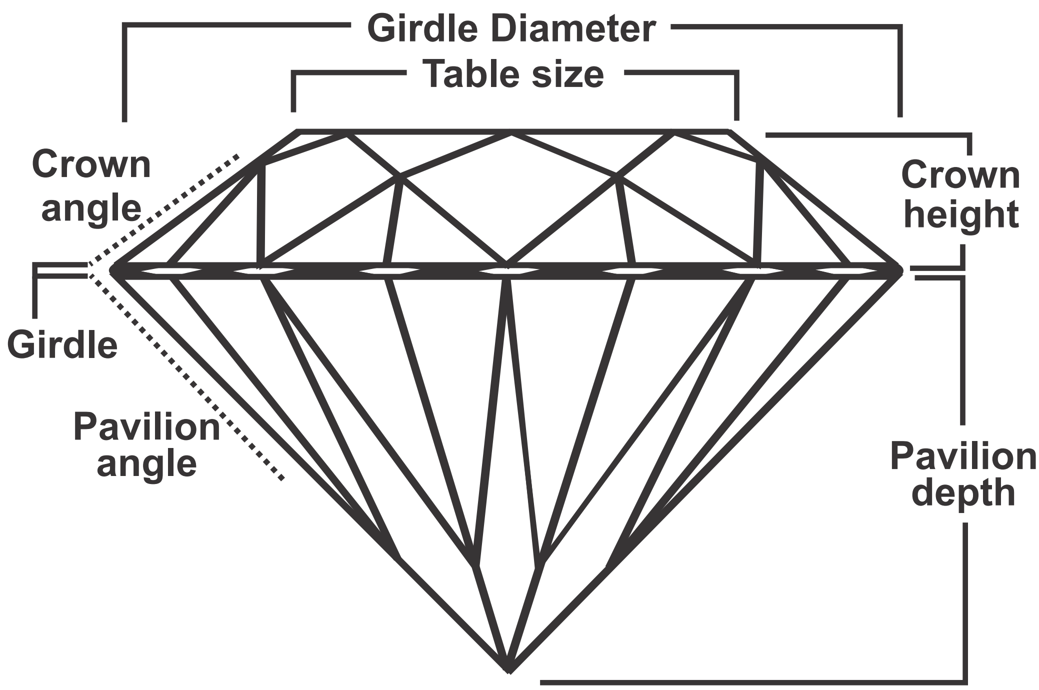

Fig. 14.1.7.1 Diamond Proportions

14.1.8 Fancy Shapes

For Fancy Shapes module refer to **UNIT 8.1** with the following sub-units:

UNIT 8.1.1
UNIT 8.1.2
UNIT 8.1.3
UNIT 8.1.4 (UNIT 8.1.5, 8.1.6 and 8.1.7 are not required for this NOS)
UNIT 8.1.8

After reading the above-mentioned units you will be able to:

1. Understand the concept of fancy shapes.
2. Understand the names of the most popular fancy shapes.
3. Understand the various components of fancy shapes.
4. Understand the length to width ratio.

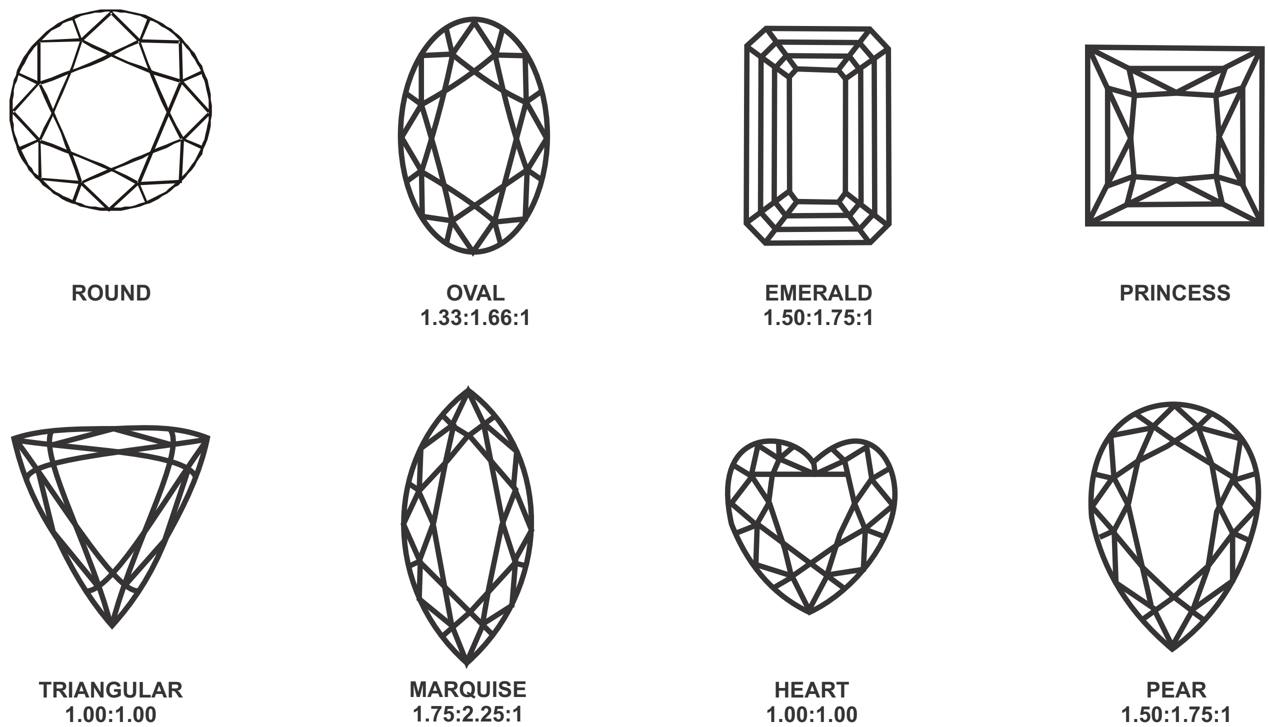

Fig. 14.1.8.1 Fancy shapes

14.1.9 Assorting Small Diamonds

For assorting small diamonds module refer to **UNIT 10.1** with the following sub-units:
UNIT 10.1.1
UNIT 10.1.2 and
UNIT 10.1.3

After reading the above-mentioned units you will be able to:

1. Understand the concept of sorting.
2. Understand the classification of diamonds based on size.
3. Understand the company policy to distribute diamonds in groups.
4. Understand the concept of whites and natts.
5. Understand the concept of LB and LC.
6. Understand the concept of OWLB and OWLC.
7. Understand the concept of TTLB, TLB, LB, DB.
8. Understand the concept of TTLC, TLC, LC.
9. Understand the correlations between grading and sorting.
10. Understand the clarity divisions of loose small diamonds in whites.
11. Understand the clarity divisions of loose small diamonds in natts.
12. Understand the use of tripod, sieve, scoop and optivisor.

Fig. 14.1.9.1 Assorting small diamonds

14.1.9 Assorting Small Diamonds

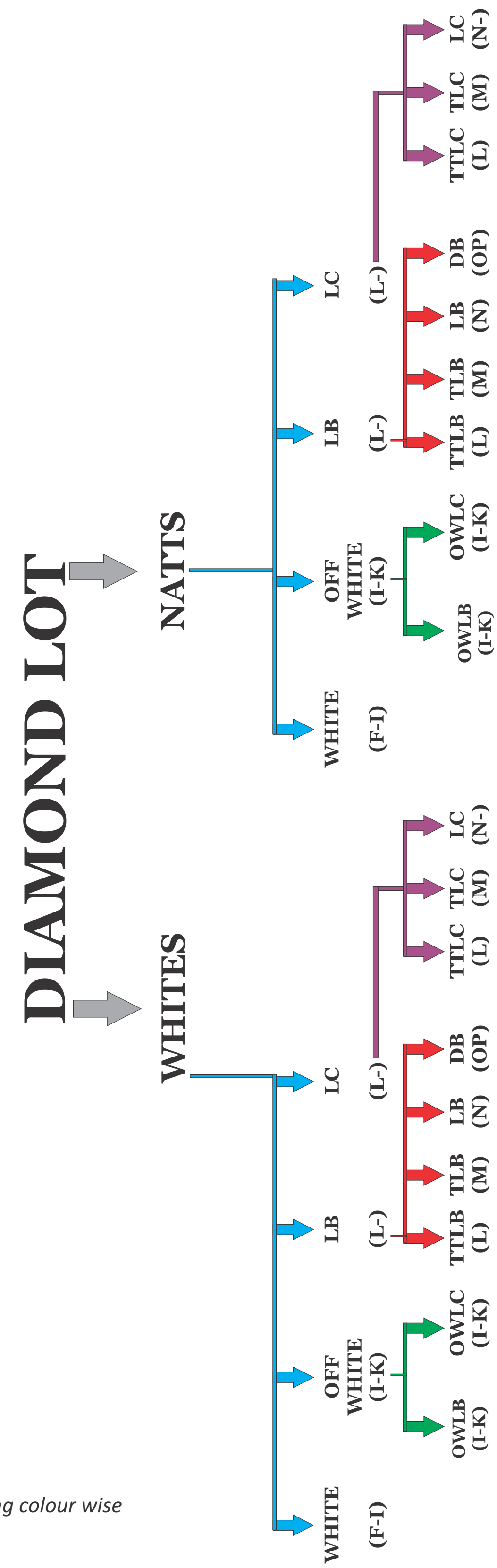

Fig. 14.1.9.2 Diamond shading colour wise

14.1.10 Simulants

For simulants module refer to **UNIT 12.1** with the following sub-units:
UNIT 12.1.1 and
UNIT 12.1.2 (only cubic zirconia and synthetic Moissanite)

After reading the above-mentioned units you will be able to:

1. Identify difference between diamonds and common substitutes like cubic zirconia and synthetic Moissanite.

Fig. 14.1.10.1 Doubling

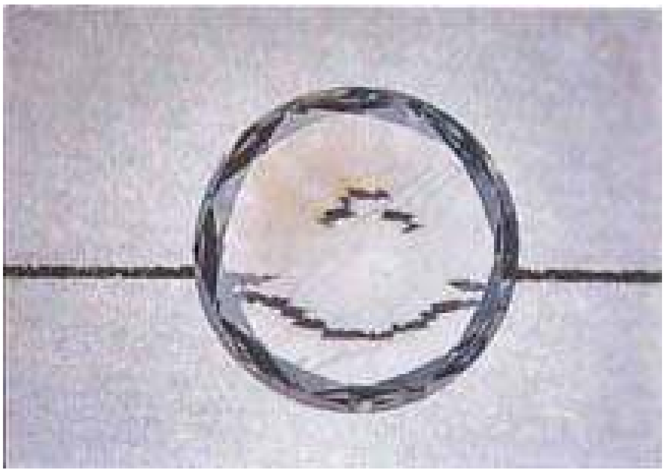

Fig. 14.1.10.2 Line visibility in line test

14.1.11 Pricing

For pricing module refer to **UNIT 13.1** with the following sub-units:

UNIT 13.1.1
UNIT 13.1.2 and
UNIT 13.1.3

After reading the above-mentioned units you will be able to:

1. Understand the concept of pricing.
2. Understand the concept of price guides.
3. Understand the difference between stone value and stone rate / per carat rate.

You are issued with a packet of diamonds with total weight of 34 carats priced at Rs. 12000 per carat. There was another packet of diamonds with total weight of 16 carats priced at Rs 15000 per carat. Both these packets got mixed. What shall be the new average price of the mix packet?

Value of Packet A = Weight X Rate

Thus,

Value of Packet A = 34 x 12000

= Rs 4,08,000

Similarly,

Value of packet B = 16 x 15000

= Rs 2,40,000

Therefore the **average price of mixed packet shall be**

$$\frac{\textbf{Value of packet A + Value of packet B.}}{\textbf{Weight of packet A + Weight of packet B}}$$

Thus,

$$\text{Average price} = \frac{\text{Rs } 4{,}08{,}000 + \text{Rs } 2{,}40{,}000}{34+16}$$

= Rs 12,960 per carat

That means the mixed packet of total weight of 50 carat is priced at Rs 12,960 per carat.

14.1.11 Pricing

Similarly,

You are issued with a packet of diamonds with total weight of 50 carat priced at Rs 12000 per carat.

You sorted this packet into three lots as per colour shading. The first packet (top colour) lot weighed 15 carat and was priced at Rs 15000 per carat. Whereas the second lot weighed 25 carat and was priced at Rs 13000 per carat. What shall be the new price of the balance packet?

Value of Packet A (Top colour) = Weight x Rate

Thus,

Value of total packet = 50 x 12000

= Rs 6,00,000

and

Value of Packet A = 15 x 15000

= Rs 2,25,000

Similarly,

Value of packet B = 25 x 13000

= Rs 3,25,,000

Now,

The balance weight of third packet will be:

50 carat - 15 carat - 25 carat = 10 carat

And the value of third packet will be:

Rs 6,00,000 - Rs 2,25,000 - Rs. 3,25,000 = Rs 50,000

Therefore the **new price of third packet shall be**

Value of third packet

Weight of third packet

Thus,

New price = Rs 50,000

10

= Rs 5,000 per carat

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National
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Corporation
Transforming the skill landscape

GJSCI
Gem & Jewellery Skill Council of India

15. Assort Rough Diamonds

Unit 15.1 - Assorting Rough Diamond and its Concepts

G&J/N3605

Key Learning Outcomes

At the end of this module, you will be able to:

1. Know the system of receiving diamond packets and the chain involved in the work flow.
2. Know the concepts of formation and mining.
3. Know the concepts of hardness, toughness and facets.
4. Know the basic concepts of 4Cs.
5. Know the concept of clarity.
6. Know the concept of carat and cut.
7. Know the concept of colour.
8. Know the concept of crystal system, diamond rough and cutting steps.
9. Know the concept of fancy shapes.
10. Know the concept of assorting.
11. Know the concept of Kimberley process.

Unit 15.1: Assorting Rough Diamond and its Concepts

Unit Objectives

At the end of this unit, you will be able to:

1. Understand the system of receiving diamond packets with number and weight mentioned.
2. Understand the concepts of formation and mining of diamond roughs.
3. Understand the concepts of crystal system.
4. Understand the concepts of facets.
5. Understand the basic concepts of 4Cs.
6. Understand the concept of clarity.
7. Understand the concept of carat.
8. Understand the concept of colour.
9. Understand crystal habit and growth marks.
10. Understand the diamond rough classification and its sorting.
11. Understand the types of rough before cutting.
12. Understand the cutting steps of diamond rough.
13. Understand the concept of cut.
14. Understand the concept of fancy shapes and fancy colour.
15. Understand the process of rough procurement.

15.1.1 Receiving Diamond Packets

An assorter of rough diamonds plays an important role in the diamond manufacturing industry.

Diamond packets are always mentioned with **minimum one of the following** on it:

- **The total weight of diamonds in that packet and / or**
- **The total number of diamonds in that packet**

Some companies also mention **some packet code depicting cost or trader code** from whom these diamonds are purchased from.

It is the internal policy of the company whether the information are to be shared with the assorter or not.

Always verify the total weight and or total number of pieces in the packet before starting working on the same. If in any case there is a discrepancies in the total weight or number of pieces, the same should be communicated to the supervisor or processing unit or trader as applicable

15.1.1 Receiving Diamond Packets

Fig. 15.1.1.1 Work flow

15.1.2 Formation and Mining

For Mining module refer to **UNIT 1.1** - complete unit

After reading the above mentioned unit you will be able to:

1. Understand the evolution of the word diamond.
2. Understand in detail the formation of diamond.
3. Understand the properties of diamond.
4. Understand the types of diamond sources.
5. Understand the types of diamond rough.
6. Understand the types of mining.
7. Understand the recovery procedure of diamonds from ore.
8. Know the various traditional and current sources of diamonds.
9. Know the various mining companies.

Fig. 15.1.2.1 Grease table

15.1.2 Formation and Mining

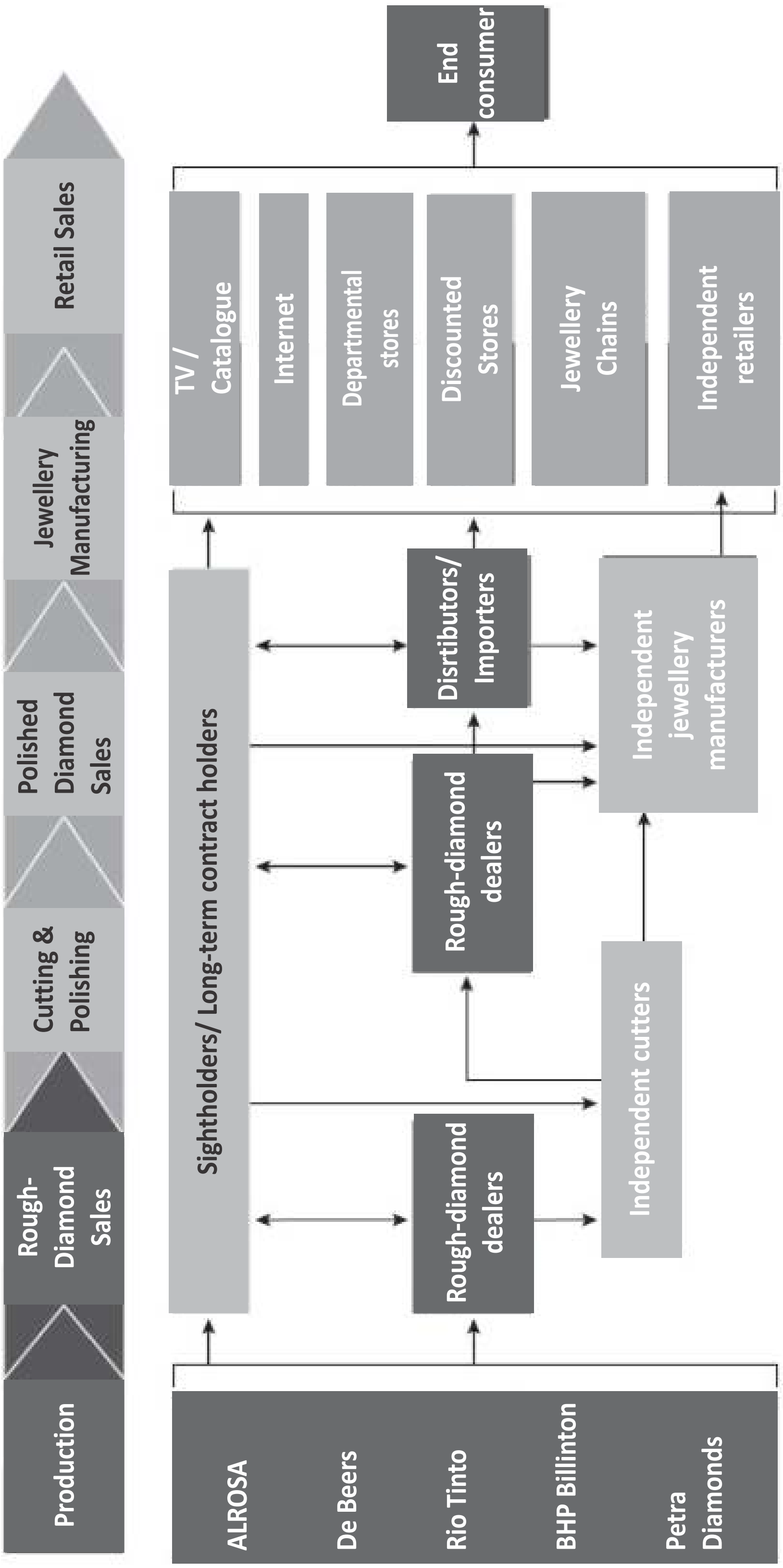

Fig. 15.1.2.2 Rough and polished diamonds distribution systems

15.1.3 Concept of Hardness and Toughness in a Crystal

Hardness and toughness are the evaluating factors of the durability of diamonds.

TOUGHNESS

Toughness is the resistance of a stone towards:

- breaking or
- chipping or
- cracking

i.e. the internal strength of a material

Diamond is very tough. It is rated as exceptional but excellent in the cleavage / grain direction.

Cleavage Direction

The point at where a single blow of force is applied in certain preferential direction, to break into two with plane surfaces. There is almost no weight loss. It is due to weakness in crystal structure.

For example wood (you can see eye visible grains). Wood breaks easily from the grain direction when a single blow of force is applied in a certain preferential direction.

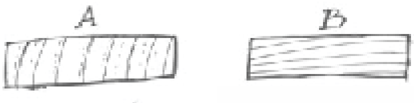

Fig. 15.1.3.1 Grain direction/ cleavage direction in wood

Scale of Toughness

- Exceptional- diamond (all directions other than cleavage direction)
- Excellent- diamond (cleavage direction)
- Good
- Fair
- Poor

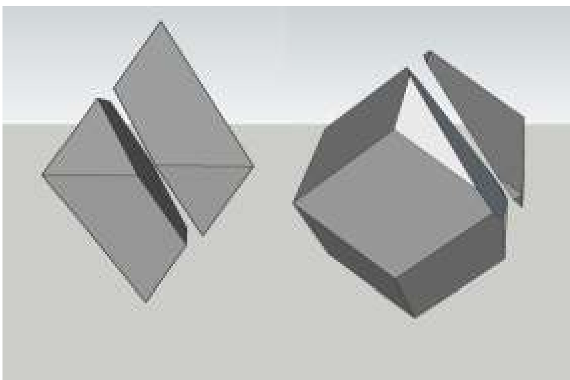

Fig. 15.1.3.2 Cleavage direction in diamond

15.1.3 Concept of Hardness and Toughness in a Crystal

HARDNESS

Hardness is the resistance of a stone to a scratch.

It affects the lustre of a stone i.e. quality of polish a stone gets.

It is measured on the Mohs scale. Diamond's hardness is 10 on the Mohs scale.

Diamond is the hardest substance on the earth's crust because of its closely packed molecular structure.

Mohs Scale of Hardness

• **Talc**	**1**
• **Gypsum**	**2**
• **Calcite**	**3**
• **Fluorite**	**4**
• **Apatite**	**5**
• **Feldspar**	**6**
• **Quartz**	**7**
• **Topaz**	**8**
• **Corundum (Ruby and Sapphire)**	**9**
• **Diamond**	**10**

The scale is non-linear.

It is directional dependent.

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15.1.4 Facets

For Facets module refer to **UNIT 2.1.1** and **UNIT 2.1.2**.

After reading the above mentioned unit you will be able to:

1. Know what is a facet.
2. Know the various types of cuts.
3. Understand the arrangement of standard round brilliant cut.
4. Understand the various parts of a diamond.
5. Understand the various facet names and their arrangement.

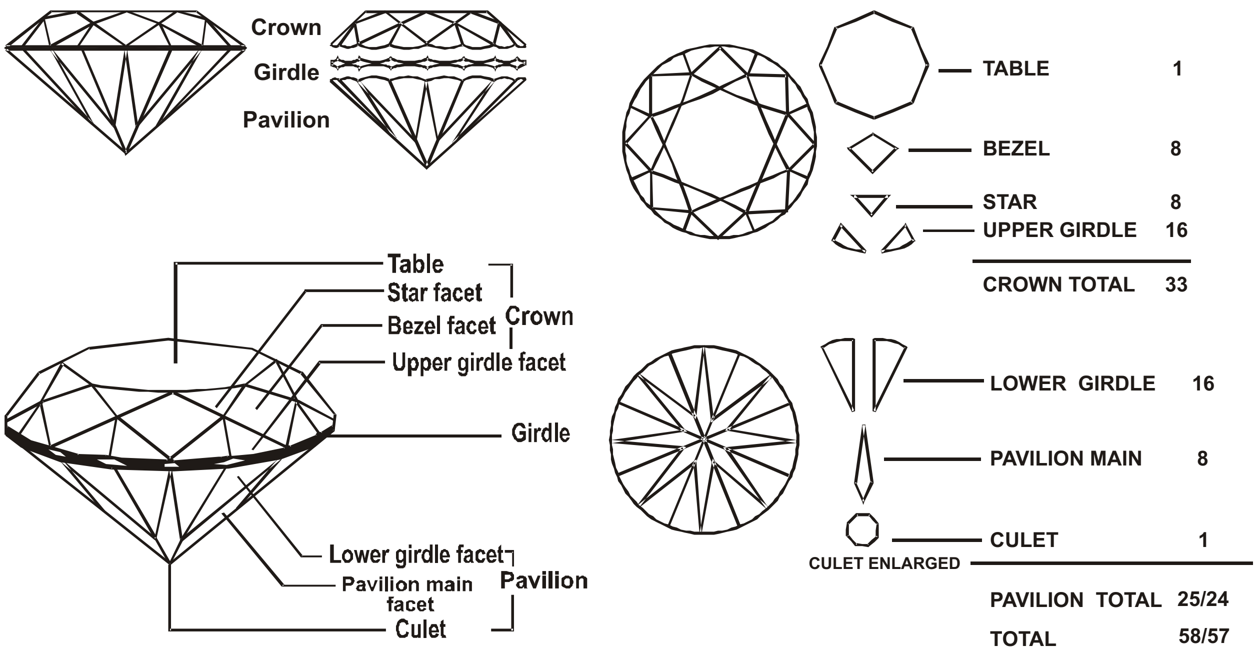

Fig. 15.1.4.1 Facet arrangement of a standard round brilliant

15.1.5 Concept of 4Cs

For Concept of 4Cs module refer to **UNIT 3.1** with the following sub-units:

UNIT 3.1.1
UNIT 3.1.2
UNIT 3.1.3
UNIT 3.1.4 and
UNIT 3.1.5

After reading the above-mentioned units you will be able to:

1. Understand the concept of 4Cs.
2. Understand the basics of the value factors.
3. Understand the basic concept of Carat.
4. Understand the basic concept of Clarity.
5. Understand the basic concept of Colour.
6. Understand the basic concept of Cut.

Fig. 15.1.5.1 4Cs

15.1.6 Clarity

For Clarity module refer to **UNIT 4.1** with the following sub-units:

UNIT 4.1.1
UNIT 4.1.2
UNIT 4.1.3
UNIT 4.1.4
UNIT 4.1.5
UNIT 4.1.6
UNIT 4.1.7
UNIT 4.1.8
UNIT 4.1.9
UNIT 4.1.10
UNIT 4.1.11
UNIT 4.1.12 and
UNIT 4.1.16

After reading the above-mentioned units you will be able to:

1. Understand the concept of clarity.
2. Understand the concept of clarity characteristics.
3. Understand the concept of Blemishes.
4. Understand the concept of Inclusions.
5. Understand the concept of clarity Vs carat rate.
6. Understand the concept of types of lighting.
7. Understand the clarity grades and factors determining them.

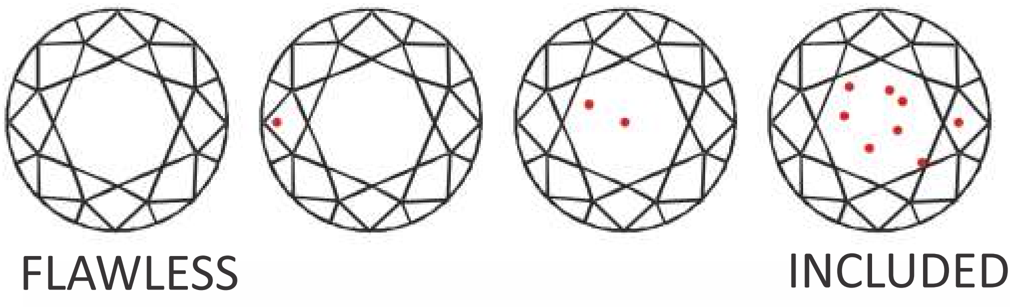

Fig. 15.1.6.1 Clarity grade vs Inclusions

15.1.7 Carat

For Carat module refer to **UNIT 5.1** with the following sub-units:

UNIT 5.1.1
UNIT 5.1.2
UNIT 5.1.3
UNIT 5.1.4
UNIT 5.1.5
UNIT 5.1.6
UNIT 5.1.7
UNIT 5.1.8 (UNIT 5.1.9, 5.1.10 and 5.1.13 are not required for this NOS)
UNIT 5.1.11 and
UNIT 5.1.12

After reading the above-mentioned units you will be able to:

1. Understand the concept of carat in detail and derivation of carat with other terms.
2. Understanding the concept of carat as a value factor.
3. Understand the concept of measurement and calculation of carat.
4. Understand the concept of sieves and how to use them.
5. Understand the diamond diameter vs carat weight.

Special Stones: 10.8 carats and above

Large Stones: 1.8 carats to 10.79 carats

Grainers: 0.66 carats to 1.79 carats

Smalls: 0.65 carats & below

Fig. 15.1.7.1 Diamond rough grouping system

15.1.7 Carat

Diamond Sieve Reference Chart

Sieves are given numbers as per diameter. Charts are supplied to find out which sieve is for which diameter and corresponding weight of diamond.

SIEVE SIZES	PCS/Ct.	WEIGHT (ct)	DIA (mm)
000-0	1/200	0.005	0.90-1.10mm
0-1	1/175	0.006	1-10 – 15mm
1-1.5	1/150	0.007	1-15 – 1.20mm
1.5-2	1/120	0.008	1-20 – 1.25mm
2-2.5	1/110	0.009	1-25 – 1.30mm
2.5-3	1/100	0.010	1-30 – 1.35mm
3-3.5		0.011	1-35 – 1.40mm
3.5-4	1/80	0.012	1-40 – 1.45mm
4-4.5		0.013	1-45 – 1.50mm
4.5-5	1/70	0.014	1-50 – 1.55mm
5-5.5	1/60	0.016	1-55 – 1.60mm
5.5-6		0.018	1-60 – 1.70mm
6-6.5	1/50	0.021	1-70 – 1.80mm
6.5-7	1/40	0.025	1-80 – 1.90mm
7-7.5	1/30	0.029	1-90 – 2.00mm
7.5-8		0.035	2-00 – 2.10mm
8-8.5	1/25	0.039	2-10 – 2.20mm
8.5-9		0.044	2-20 – 2.30mm
9-9.5	1/20	0.052	2-30 – 2.40mm
9.5-10		0.058	2-40 – 2.50mm
10-10.5	1/15	0.069	2-50 – 2.60mm
10.5-11		0.074	2-60 – 2.70mm
11-11.5	1/15	0.078	2-70 – 2.80mm
11.5-12		0.086	2-80 – 2.90mm
12-12.5	1/10	0.095	2-90 – 3.00mm
12.5-13		0.108	3-00 – 3.10mm
13-13.5	1/8	0.116	3-10 – 3.20mm
13.5-14		0.125	3-20 – 3.30mm
14-14.5	1/7	0.135	3-30 – 3.40mm
14.5-15		0.146	3-40 – 3.50mm
15-15.5	1/6	0.159	3-50 – 3.60mm
15.5-16		0.175	3-60 – 3.70mm

Fig. 15.1.7.2 Diamond Sieves Reference

15.1.8 Colour

For Colour module refer to **UNIT 6.1** with the following sub-units:
UNIT 6.1.1
UNIT 6.1.5
UNIT 6.1.9 and
UNIT 6.1.10

After reading the above-mentioned units you will be able to:

1. Understand the concept of colour.
2. Understand the colour nomenclature.
3. Understand the colour grading scale.
4. Understand colour as a value factor.

DESCRIPTION	COLOUR GRADE	TERMINOLOGY
Face up and table down (from pavilion) – no colour seen	D, E, F	Colourless
Face up – no colour seen; table down (from pavilion) – slight tint seen	G, H, I, J	Near Colourless
Face up – slight tint seen; table down (from pavilion) – obvious colour seen	K, L, M	Faint Yellow
Face up and table down (from pavilion) – obvious colour seen	N, O, P, Q, R	Very Light Yellow
	S, T, U, V, W, X, Y, Z	Light Yellow
	More than Z	Fancy

Fig. 15.1.8.1 Colour grading scale

Fig. 15.1.8.2 Diamond colour grading

15.1.9 Crystal System

Crystal System

This describes the internal symmetry of a crystal/ crystalline material.

- It uses the length of angles called axis (imaginary).
- Diamond crystallizes in the Cubic system.

There are 3 axes, which are all equal and perpendicular to each other at 90°.

This is a system with the highest/ best symmetry.

External Shapes

Habit: It is the most common crystal form of a mineral.

Diamond Habit

Following are the most common crystal shapes of diamond rough:

Octahedron = 8 faces

Dodecahedron = 12 faces

Cube = 6 faces

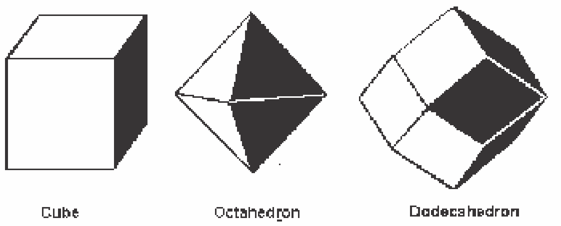

Fig. 15.1.9.1 Crystal shapes

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15.1.9 Crystal System

Crystallographic Planes (Internal)

Regardless of the crystal form (external shape), the internal structure for all diamonds is the same.

Cubic Plane

- 3 directions
- Best sawing direction for weight retention
- Not the softest direction

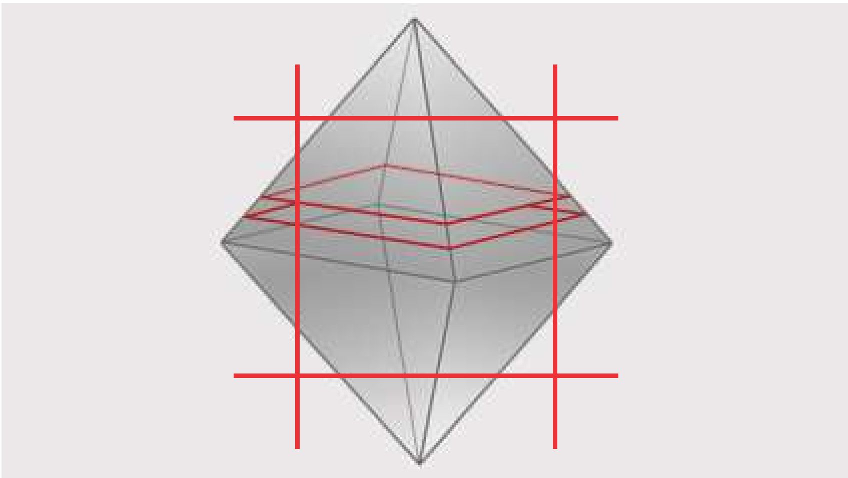
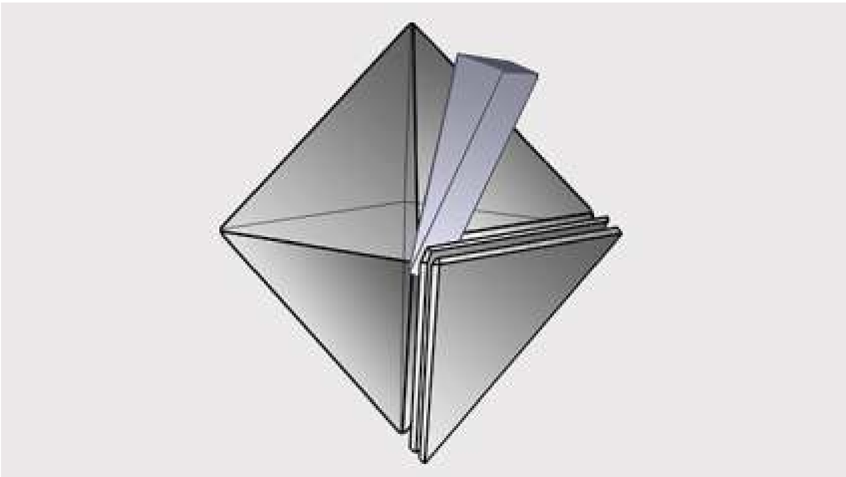


Fig. 15.1.9.2 Cubic Plane

15.1.9 Crystal System

Octahedral Plane

- 4 directions
- Primary cleaving plane
- Also, called grain/ cleavage direction
- Impossible to saw unless with laser
- Hardest direction, cannot polish



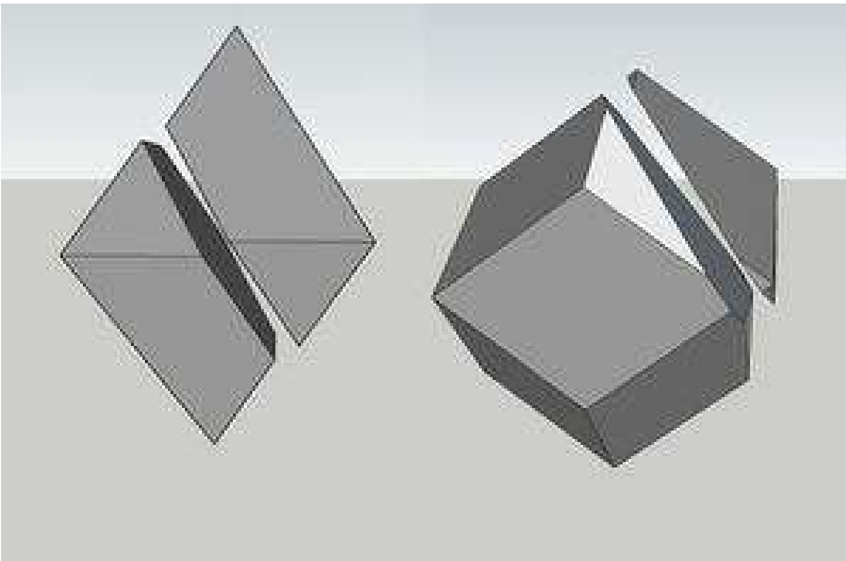


Fig. 15.1.9.3 Octahedron plane

15.1.9 Crystal System

Dodecahedral Plane

- 6 directions
- Softest direction inside the stone
- Secondary sawing direction (easy to saw, not used often because of less weight retention)

Note: Always polish to the nearest dodecahedral direction

Growth Marks

Occurs on certain crystal faces (external) and indicates structural orientation (internal). It helps the cutter to find the grain.

Growth Marking

When found on naturals, it helps in identification of diamonds.

Types of Growth Marks

Trigons

- Triangular depressions
- Found on octahedral face

Parallel grooves

Parallel lines running along the dodecahedral face

Square / rectangle

- Depression on cube faces
- Oriented 45° to face
- Rare in gem quality

Some Crystal Properties

Hardness

- 10 on Mohs scale
- Diamond's hardness is directional dependent
- Octahedron direction hardest
- Dodecahedron direction softest

15.1.10 Diamond Rough

Diamond Rough Classification

Gem Quality:

These are those roughs which are used in jewellery.

It must be of good color and of good clarity, its shape is not very important because the diamond must be cut.

Approximately 20 % of the world production of rough diamonds are intended for the jewellery (gem quality).

Fig. 15.1.10.1 Gem quality rough Diamonds

Industrial Quality

As its name indicates, it is the quality of diamond which is reserved for industry.

Industrial diamonds must nevertheless be of good quality.

They are those roughs which are used for industrial purposes like cutting and polishing.

One classifies them according to the weight, lower than 3 carats, but also according to their number of point. One uses them for example for the manufacture of dies, the tools for drilling, etc.

15.1.10 Diamond Rough

Fig. 15.1.10.2 Industrial rough Diamonds

Crushing Boart or Bort

Bort or boart is a term used for non-gem-quality diamonds. In the manufacturing and heavy industries, "bort" is used to describe dark, imperfectly formed/crystallized diamonds of varying levels of opacity. The lowest grade, "crushing bort", is crushed by steel mortars and used to make industrial-grade abrasive grits. Small bort crystals are used in drill bits.

Balance Approximately 80 % of the world production of rough diamonds are intended for industrial usage.

There would be more than 1,000s of possible rough diamond classifications.

Fig. 15.1.10.3 Bort Diamond

15.1.10 Diamond Rough

After diamond roughs are sorted into gem quality and other categories, gem quality can be further classified into the following groups:

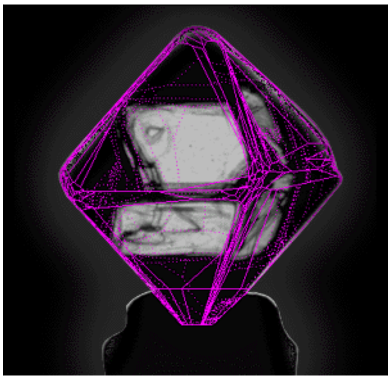
Diamonds for **Sawing**

A sawable is diamond rough that will yield more weight if it's divided to produce two stones. Sawable rough is usually more valuable than makeable rough.

Sawable diamonds generally have a more crystalline shape, much like a diamond shape on a deck of playing cards. It is usually more profitable to saw these stones into two pieces that will each produce one polished diamond (two from the total piece of rough). A sawable diamond generally produces a higher polished yield upon manufacture as the shape lends itself to less loss of material.

A good model of sawable diamond usually produces yields of 45% - 50%, and can exceed 65% in ideal circumstances or even above 70% when cutting square stones. Usually the value of the two diamonds will be higher than the value of one diamond from an irregular shaped stone. This is why sawable diamonds command a price premium in the rough and are the most sought after diamond models.

The actual process of sawing the diamond must be closely controlled to avoid damaging the stone or the equipment.In the past, this was done using copper saw blades impregnated/ coated with diamond tips that would spin at high speed as the stone was gently applied at the correct angle. Now a days the sawing process is almost entirely done by sophisticated laser cutting machines that reduce the loss of diamond material and can complete the task much faster than before. This method can, occasionally, saw through internal inclusions in the diamond that can be polished away at a later stage.



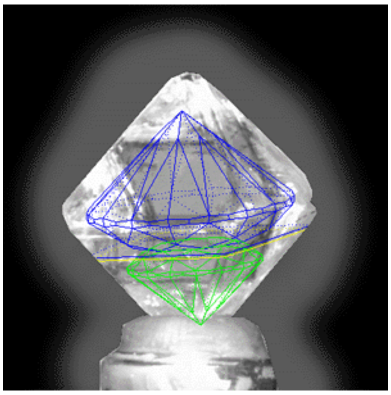


Fig. 15.1.10.4 Octahedral shaped roughs, ideal for sawing

15.1.10 Diamond Rough

Diamonds for **Cleaving**

Cleaving is a method of splitting the stone in two or more parts with a single hit along the cleavable lines in a certain direction. This technique was used in India hundreds of years ago and it required great skill. Cleaving is always done parallel in the direction of the grain / cleavage of the crystal. The stone is fastened in a wooden holder and opposite it another holder holds a second sharp diamond to make a slit into the stone. It splits after hitting a tool of steel with a hammer.

This is done to shape a distorted crystal or to remove inclusions.

Fig. 15.1.10.5 Cleaved rough

Diamonds for **Cutting/ Makeable**

A makeable or whole stone is diamond rough that can be polished without sawing, cleaving or splitting.

Makeable diamonds get their name because they are “made” into a single polished gem.

These stones tend to be more irregular in shape. While this often results in a larger finished stone, all else being equal, it would result in greater loss of material, which would lower the final yield of the rough stone, Size (carat) becomes a principal consideration in planning, which means that any inclusions in the rough stone are often left in the finished gem in order to maximize size.

Makeable stones tend to produce polished yields in the 30% - 40% range and tend to be priced below the sawables ones.

Unfortunately, not all diamonds are created equal. Nature delivers many diamonds with imperfections and inclusions, and the transportation process of bringing diamonds to the surface of the earth many millions of years ago caused damage to many of them as well.

Cleavage stones are those that must be cleaved, or split, one or more times, usually because of internal stress, inclusions, or cracks that penetrate the diamond and would significantly lower the polished value if left inside.

Essentially, the goal of manufacturing a cleavage stone is to split it into smaller pieces that can then be made into single polished diamonds of better quality than the original rough stone.

15.1.10 Diamond Rough

Technology has been critical in transforming the way these more difficult and speculative diamonds can be profitably manufactured. Manufacturers can now earn a profit on diamonds that might previously were used for industrial purposes.

Fig. 15.1.10.6 Makeable Roughs

Macle

- A type of twinned crystal
- Flattened triangular rough
- A crystal with 60° or 180° rotation
- Cut into fancy shapes (Triangular, Pear and Hearts)

Fig. 15.1.10.7 Macle

15.1.10 Diamond Rough

Other Categories

Fancy Colours stones are those with colour that do not lie between the bluish white and the yellowish. The colour of fancy colours diamonds (coloured diamonds) is blue, green, pink, yellow, brown, etc...

Closed stones: Are monocrystals, beautiful shapes, good for sawing and polishing.

Spotted stones: Are monocrystals, beautiful shapes, these stones have inclusions but it is possible to make them disappear with the cutting.

Naats: Are deformations of crystallizations, they must be cleaved or bruted.

Irregular stones: Are octahedral or dodecahedral (irregular shapes), they are directly cut.

Cleavable stones: They must be cleaved.

Coated stones: The industry has named coated stones « speculation stones ». A gangue or a film covers them hiding the interior of the stone. They can remain opaque or can appear as a beautiful stone.

Frosted stones: Are identical to coated, but the film is translucent.

Milky stones: As its name indicates, this stone has a milky aspect.

Blocks: They are of a particular shape; their crystallographic orientation is difficult to see.

Plats: In fact, generally macles are very often used for rose cuts.

Sands: They are very small stones (less than 0.10 carat), mostly used for the size 8/8.

Commons Goods: They are of a very poor quality and they are the extreme product of the gem quality.

Rejections Stones: They are of very bad quality and therefore must be eliminated.

15.1.10 Diamond Rough

MARKING / PLANNING

This is also one of the most important phases of the entire manufacturing process. It can also be known as the brain department of the entire process. This is so because in this department the in-charge has to decide as to which shape the diamond shall finally assume and as to what is going to beits cut and its weight. Here the person doing the planning, after he plans as to what is going to be the final product, has to mark the diamond from where the diamond is to be sawn or cleaved or to point out where top bottom table is to be kept.

The first step in diamond cutting is the examination of the stone in the rough form. Each stone is totally unique and so must be studied in detail in order to determine the finished shape that will retain as much weight as possible. The stone is then marked with India ink to indicate how it must be divided.

- May polish the stones to see inside (Windowing).
- Marks for cleaving or sawing.
- Consideration:
  - a) Weight retention
  - b) Removal of inclusion
  - c) Style of cut

Thus this process involves diamond professionals marking the diamond, to explain how it is going to be cut or shaped after which the diamond is sent to the shaping division. Indian diamonds wholesale industry has highly skilled professionals for marking.

Fig. 15.1.10.8 Marking

15.1.10 Diamond Rough

CLEAVING AND SAWING

Cleaving and sawing are two simple processes by which a diamond rough can be divided into 2 pieces.(Now in diamond there are different planes on the basis of which a diamond is marked to either be cleaved or sawn.) If the marking is done along with or parallel to its outer planes then the diamond has to be cleaved. Cleaving is simply done by a chisel and hammer, wherein the hardest material available is split into 2 pieces at the blow of the hammer.

To cut a rough stone, it is first set in a 'dop' or holder using quick drying substance like cement. Then, using another diamond, a small groove is made along the division line. A square-edged knife is then inserted into the groove and tapped sharply with a mallet. It is this action that determines the diamond's future as if the division line has not been placed properly, or followed accurately, the diamond can shatter into small pieces. Cleaving is always done parallel with the grain of the diamond.

If the marking is perpendicular or against the planes then the diamond needs to be sawn i.e. 'cut'. Sawing, in the recent times, has advanced a lot as far as technology is concerned. Earlier, sawing used to be done by sawing machines to cut the diamonds into 2, with blades. This was a very time consuming process usually taking hours to saw a diamond. This process is still very much practiced by the people world-wide. Currently, laser sawing is the latest technology in sawing. The greatest benefit of this system is that, it is very fast and precise. A number of pieces can be sawed using laser technology at the same time by single equipment.

Once the process of Cleaving / Sawing is completed, the diamond is sent back to the planning and marking department for checking / verifying the results of procedures and then passed on to the next process of Bruting.

Fig. 15.1.10.9 Sawing / Cleaving

15.1.11 Cutting Steps and Cut

SAW OR CLEAVE

Sawing – is usually done

- Off centre sawing is usually more desirable.
- One large, one small stone.
    - More weight retention.
- On centre sawing is good for matched sets.

Cleaving – is rarely done

- Shapes up distorted rough.
- Removes inclusions.

Fig. 15.1.11.1 Sawing / Cleaving

15.1.11 Cutting Steps and Cut

BRUTING

Bruting is the process of giving shape to the rough diamond. A person doing this has to take care of many things as the rough diamond is of ' vivid ' shapes and resembles a normal stone. The bruter has to take its utmost care of the diamond at this process so that it does not break. Also, in this process the bruter has to leave as much of natural skin on the piece of diamond as possible. This is because one can check out that the weight loss of the diamond in this process is not more than required. In the whole process of Bruting the main aim of the bruter is to give a shape to the rough diamond in such a way that its optimum effect can be achieved by the polisher, without any extra weight loss than required.

A diamond gets its future shape by bruiting a cleaved or sawn stone. The traditional method is again mounting the diamond to the head of a lathe. By means of another stone mounted opposite it, bruiting is carried out whereby the stone obtains its round shape.

During this stage of the process, the diamond's girdle is formed. This is also known as girdling or rounding. The girdle is the band which is formed around the thickest part of the stone. To form the girdle, the stone is again set in a 'dop' which is in turn fixed on to the centre of a lathe which spins at high speed. Using another diamond set in a long 'bruting stick', the corners of the rough stone are gradually rounded off until the spinning diamond is perfectly round at its thickest part.

- The crystal is held in a lathe and is rubbed with another diamond.
- If the bruter is skilled, we will get a less bruted girdle.
- Gives the crystal its round shape.
- May cause bearding.

Fig. 15.1.11.2 Bruting

15.1.11 Cutting Steps and Cut

BLOCKING OR CROSS WORK

This is the final stage in the making of a polished diamond. It is during this time that the diamond's facets are polished onto the stone. This is done using a horizontally mounted circular cast iron disc known as a scaife. The scaife is of course impregnated with oil and diamond dust.

The diamond to be polished is set in an adjustable dop at a certain angle and lowered onto the plate. The angle of the diamond must be changed for each facet.

After being bruted, a diamond passes to the polishing department where the final work of faceting is done. Polishing means the process of giving the diamond its final look and appearance. Here the artisan has to be very careful at all stages as even a small mistake done by him can make the diamond look poorer than what it might have looked had it been cut properly. This is the last step in the manufacturing process of the diamond from where on it goes to the grading department.

BLOCKING

Place of polishes

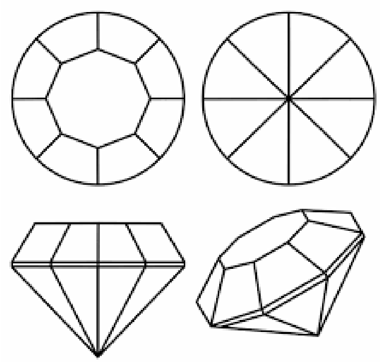
: 8 crown mains

: 8 pavilion mains

: Table

: May be culet

: Stone is now a single cut



BRILLIANTEERING

Place of polishes

: 8 stars

: 16 upper girdle facets (UGF)

: 16 lower girdle facets (LGF)

: There may be a culet

Fig. 15.1.11.3 Blocking and Brilllianteering

15.1.11 Cutting Steps and Cut

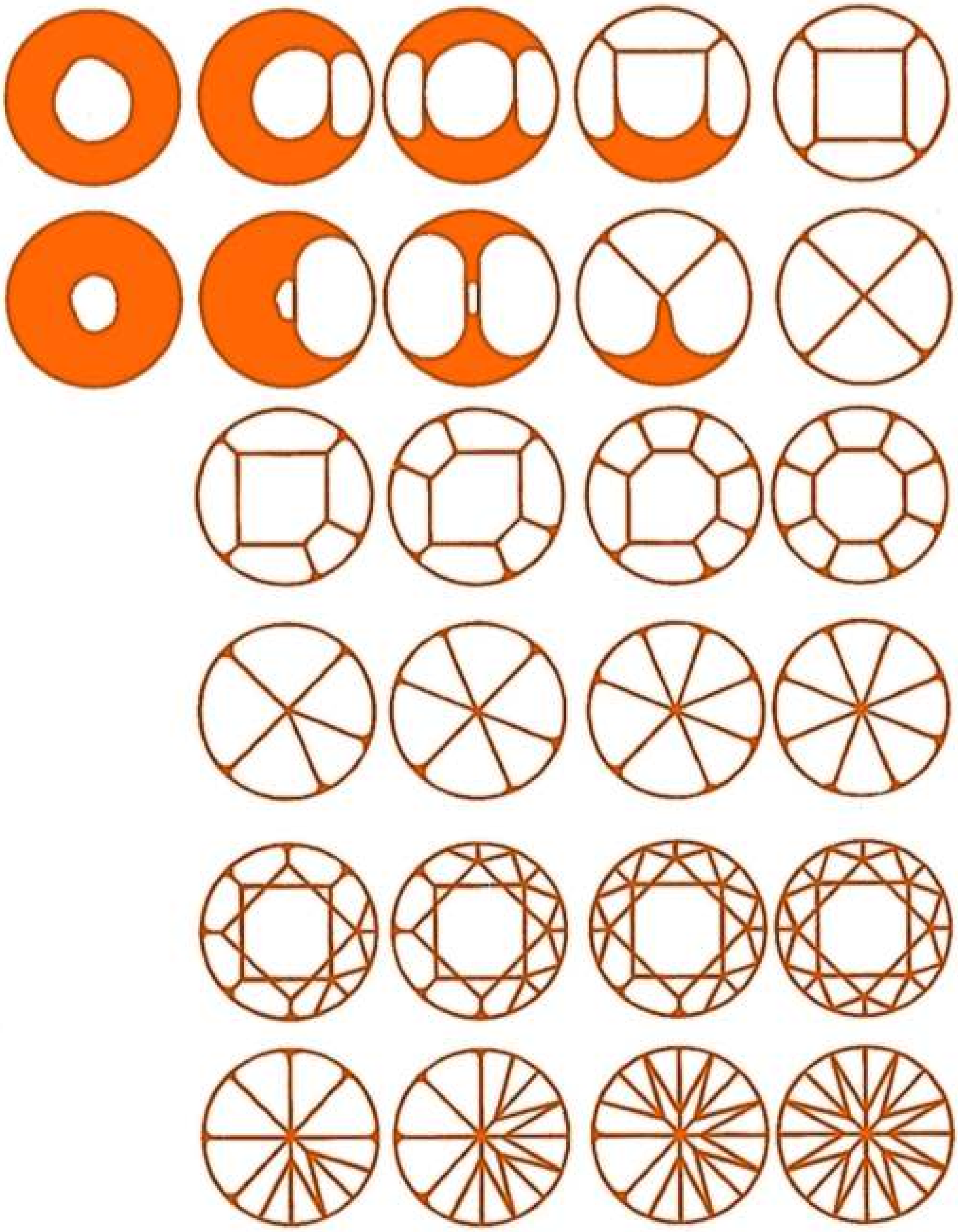


Fig. 15.1.11.4 Blocking and Brilllianteering

15.1.11 Cutting Steps and Cut

CUTTING DEVIATION

When we change the proportions from the set of good proportions, the following concerns may arise:

Larger table

Smaller table

Shallow crown angle

Steep crown angle

Deep pavilion

Shallow pavilion

Thick girdle

Thin girdle

Large culet (choti cut)

Pointed culet

For Cutting Deviation module refer to **UNIT 7.1** with the following sub-unit:

UNIT 7.1.16

15.1.11 Cutting Steps and Cut

For Cut module refer to **UNIT 7.1** with the following sub-units:

UNIT 7.1.1
UNIT 7.1.2
UNIT 7.1.3
UNIT 7.1.4 and
UNIT 7.1.5

After reading the above mentioned units you will be able to:

1. Understand the concept of cut grading.
2. Understand the concept of diamond proportion.
3. Understand the concept of average girdle diameter.
4. Understand the concept of total depth and its analysis.

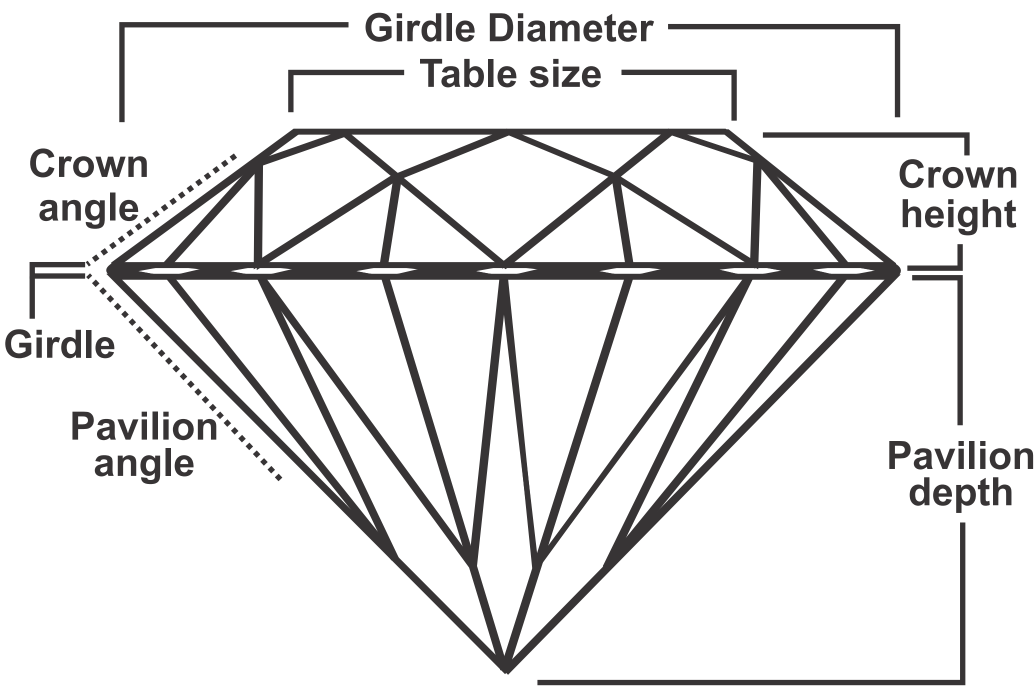


Fig. 15.1.11.5 Diamond Proportions

15.1.12 Fancy Shapes

For fancy shapes module refer to **UNIT 8.1** with the following sub-units:

UNIT 8.1.1
UNIT 8.1.2
UNIT 8.1.3
UNIT 8.1.4 (UNIT 8.1.5, 8.1.6 and 8.1.7 are not required for this NOS)
UNIT 8.1.8

After reading the above-mentioned units you will be able to:

1. Understand the concept of fancy shapes.
2. Understand the names of the most popular fancy shapes.
3. Understand the various components of fancy shapes.
4. Understand the length to width ratio.

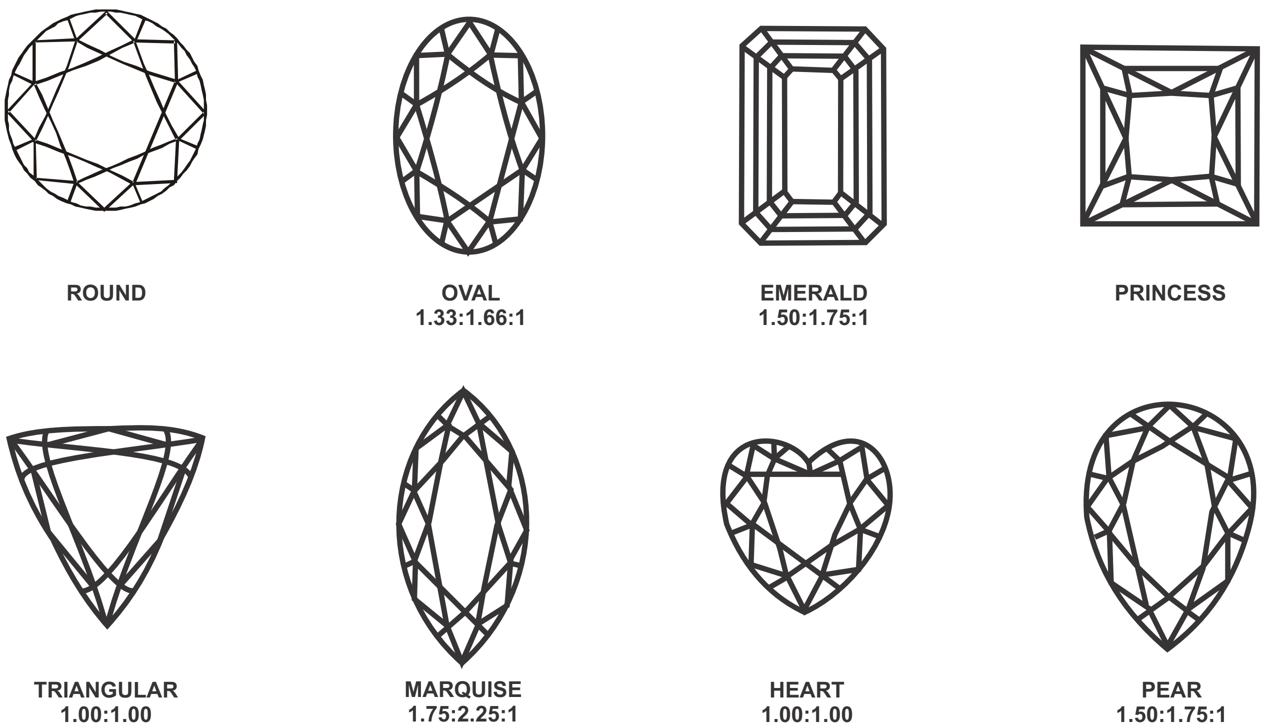


Fig. 15.1.12.1 Fancy shapes

15.1.13 Assorting of Small Diamonds

For assorting module refer to **UNIT 10.1** with the following sub-units:

UNIT 10.1.1

UNIT 10.1.2 and

UNIT 10.1.3

After reading the above-mentioned units you will be able to:

1. Understand the concept of sorting.
2. Understand the classification of diamonds based on size.
3. Understand the company policy to distribute diamonds in groups.
4. Understand the concept of whites and natts.
5. Understand the concept of LB and LC.
6. Understand the concept of OWLB and OWLC.
7. Understand the concept of TTLB, TLB, LB, DB.
8. Understand the concept of TTLC, TLC, LC.
9. Understand the correlation between grading and sorting.
10. Understand the clarity divisions of loose small diamonds in whites.
11. Understand the clarity divisions of loose small diamonds in natts.
12. Understand the use of tripod, sieve, scoop and optivisor.

Fig. 15.1.13.1 Assorting of Small Diamonds

15.1.13 Assorting of Small Diamonds

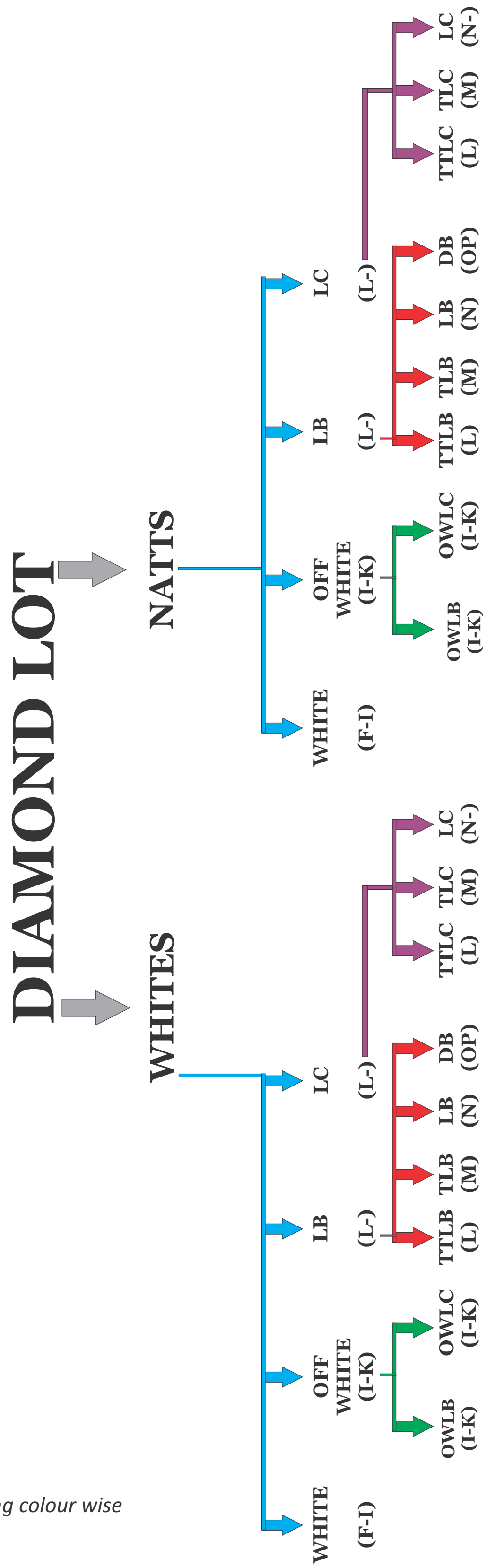


Fig. 15.1.13.2 Diamond shading colour wise

15.1.14 The Kimberley Process

The Kimberly Certification Process

What is the Kimberly Process?

The Kimberly Process is an international initiative aimed at breaking the link between legitimate trade in diamonds and conflict diamonds in the world.

Conflict diamonds are rough diamonds used by rebel movements or their allies to finance conflict aimed at undermining legitimate governments.

The Kimberly Process (KP) represents a unique United Nations mandated joint initiative by approximately 75 countries, the international diamond industry and civil society to stop the flow of conflict diamonds. It imposes extensive legally binding requirements on participants to certify that rough diamonds (both exported and imported) are conflict free.

It was launched in May 2000 in Kimberly, South Africa. The Kimberly Process Certification Scheme (KPCS) was adopted at a Ministerial Meeting in Interlaken, Switzerland in November 2002 and implementation began on 1st January 2003.

Why is it needed?

Consumer awareness endangered the diamond industry, thereby jeopardizing the many countries which rely heavily on the diamond trade.

The trade in polished diamonds will be more transparent and secure, thereby giving consumers the confidence that the diamonds they buy are clean.

The KPCS also provides a greater regulatory framework for the diamond industry, something which gives the industry credibility.

It provides a platform for countries to promote conflict-free diamonds e.g. Botswana's Diamond for Development campaign.

The World Diamond Council governs the process and is made up of State representatives, non-government organizations, and diamond companies.

What is the 'System of Warranties'?

This requires that every time diamonds (rough, polished or in Jewellery) change hands, the seller must affirm on the invoice that the diamonds have been purchased through official channels and therefore, not involved in conflict funding.

All members of the trade who provide such assurances have promised to keep records of their diamonds' clean roots (and therefore their clean path to the market). Those records will be monitored by companies' individual auditors as part of their regular duties.

The appropriate government authorities may request to see the report on warranties issued and received.

All DTC clients subscribe to Diamond Best Practice Principles (BPPs). BPPs stipulate that all clients must adhere to the KP; furthermore, 10% of all clients are audited annually to ensure that such standards are met.

15.1.14 The Kimberley Process

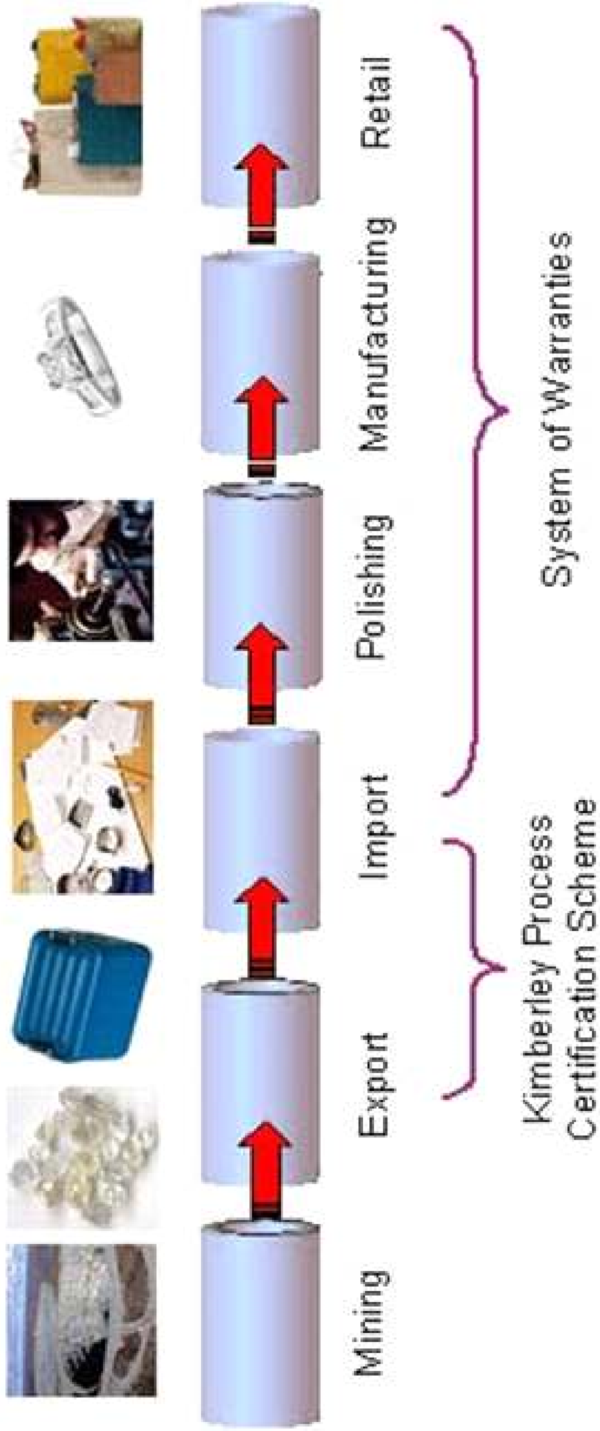


Fig. 15.1.14.1 How does the Kimberly Process work

Notes

Skill India
कौशल भारत - कुशल भारत

सत्यमेव जयते
GOVERNMENT OF INDIA
MINISTRY OF SKILL DEVELOPMENT
& ENTREPRENEURSHIP

N·S·D·C
National
Skill Development
Corporation
Transforming the skill landscape

GJSCi
Gem & Jewellery Skill Council of India

16. Assort Gemstones

Unit 16.1 - Assorting Gemstones and its Concepts

G&J/N3606

Key Learning Outcomes

At the end of this module, you will be able to:

1. Know the system of receiving gemstone packets and the chain involved in the work flow.
2. Know the concepts of precious gemstones.
3. Know the names of common semi-precious gemstones.
4. Know the basic identification techniques between precious and semi-precious gemstones.
5. Know the concept of facets.
6. Know the concept of carat and clarity.
7. Know the concept of colour with respect to gemstones.
8. Know the concept of transparency.
9. Know the concept of measurement.
10. Know the different types of cutting styles.
11. Know the concept of sorting of gems by picture illustrations.

Unit 16.1: Assorting Gemstones and its Concepts

Unit Objectives

At the end of this unit, you will be able to:

1. Understand the system of receiving gemstone packets and the chain involved in the work flow.
2. Understand the concepts of precious gemstones.
3. Understand the names of common semi-precious gemstones.
4. Understand the basic identification techniques between precious and semi-precious gemstones.
5. Understand the concept of facets.
6. Understand the concept of carat.
7. Understand the concept of clarity.
8. Understand the concept of colour with respect to gemstones.
9. Understand the concept hue, tone and saturation.
10. Understand the concept of evaluating gemstones by colour.
11. Understand the concept of transparency.
12 Understand the concept of measurement.
13. Understand the different types of cutting styles.
14. Understand the sorting technique in gemstones.
15. Understand the concept of sorting of gems by picture illustration.

16.1.1 Receiving Gemstone Packets

An assorter of gemstones plays an important role in the gem industry.

Gemstone packets are always mentioned with **minimum one of the following** on it:

- **The total weight of gems in that packet and / or**
- **The total number of gems in that packet**

Some companies also mention **some packet code depicting cost or trader code** from whom these gems are purchased.

It is the internal policy of the company whether the information is to be shared with the assorter or not.

Always verify the total weight and or total number of pieces in the packet before start working on the same. If in any case there is a discrepancy in the total weight or number of pieces, the same should be communicated to the supervisor or processing unit or trader as applicable.

16.1.2 Precious Gemstones

Precious Gemstones

The gemstones other than diamond like Ruby, Emerald, Sapphire are called as precious gemstones as they are generally rarer than the other gemstones.

16.1.3 Ruby

The word Ruby comes from the Latin word 'ruber' meaning red. They are the red coloured variety of the mineral species corundum (Al_2O_3).

Corundum in any other colour is termed as sapphire (another precious gemstone).

Corundum being the second hardest mineral, ruby has the hardness of 9 under Mohs scale of hardness.

Ruby is traditionally termed as **King of Gems.** Indian Name: ***Manak***

The red colour of ruby can have colour modifiers like orange, purple, brown or pink colour.

Generally, rubies come from Burma, Sri Lanka, India and Thailand / Cambodia. Burmese rubies are considered to the best because of their purplish red colour defined as '*pigeon's blood red colour*'.

Rubies are red due to the presence of Chromium.




Fig. 16.1.2.1 Rubies

16.1.4 Sapphire

The word Sapphire comes from the Greek word 'sappheiros' meaning blue. They are the variety of the mineral species corundum (Al_2O_3) other than red.

Corundum being the second hardest mineral, sapphires also have the hardness of 9 under Mohs scale of hardness.

The non-blue sapphires are called as Fancy Sapphires.

Generally, sapphires come from Burma, Sri Lanka, India (Kashmir) and Thailand/Australia. Kashmir sapphires are considered to be the best because of their blue colour defined as '*cornflower blue*'.

Fancy sapphires are available in many colours like yellow, pink, orange, purple etc.

The medium toned orange-pink coloured sapphires are called as Padparadscha.

Sapphires are blue due to the presence of iron and titanium.

Indian Name of blue sapphire is ***Neelam.***

Indian Name of yellow sapphire is ***Pukhraj.***

Fig. 16.1.3.1 Sapphires

16.1.4 Sapphire

Fig. 16.1.3.2 Sapphires

16.1.5 Emerald

The word Emerald comes from the Latin word 'smaragdus' meaning green. It is the variety of the mineral species beryl.

Emerald has the hardness of 7.5 - 8 under Mohs scale of hardness.

Generally, emeralds come from Columbia, Brazil, Zambia, Russia, Afghanistan. Columbian emeralds are considered to be the best because of their green colour defined as *'parrot green'*.

Emeralds are green due to the presence of chromium / vanadium.

Most emeralds are highly included.

The green colour of emerald can have colour modifiers such as yellow or blue colour.

Indian Name of emerald is ***Panna.***

Fig. 16.1.5.1 Emeralds

16.1.6 Semi-Precious Gemstones

Semi-Precious Gemstones

The term semi - precious is used for all naturally occurring coloured gemstones other than ruby, sapphire and emerald.

Semi - precious gemstones can fetch high prices if found in a rare size and near perfect clarity and colours.

16.1.7 Iolite

Iolite is a blue colour gem specie. It is also called as water sapphire as it resembles natural blue sapphire. Its Indian name is *Kaka Neeli*.

India is the largest producer of iolite.

Iolite is a very close simulant of natural blue sapphire.

The best identification of iolite is blue, violet and brown pleochroic colours. As you turn iolite by 90° it colur changes between blue , violet and brown.

Also it has a low luster compared to blue sapphire.

Iolite is also light in heft compared to natural blue sapphire.

Fig. 16.1.7.1 Iolite

16.1.8 Amethyst

Amethyst is the purple coloured variety of quartz.

Commonly it has zoning of light and dark shades of purple colour.

Its Indian trade name is *Kataila* or *Jamuniya*.

It can be confused with sapphire.

But it's purple colour and zoning with low luster and light heft can distinguish it from sapphire.

The best amethyst is from Siberia.

Fig. 16.1.8.1 Amethyst

16.1.9 Kyanite

Kyanite is a blue coloured stone which closely resembles blue sapphire.

Its Indian trade name is *Neeli*.

It has a strong colour zoning, as shown in pictures below with needles as common inclusions which is one of the best ways to distinguish between kyanite and sapphires.

Fig. 16.1.9.1 Kyanite

16.1.10 Citrine

Citrine is the yellow colour variety of quartz.

Like amethyst, it also shows distinct colour zoning of yellow colour.

Its Indian trade name is *Sunehla* and misnomer is golden topaz.

It can be confused with yellow sapphire but colour zoning with low luster and light heft can distinguish it from sapphire.

Fig. 16.1.10.1 Citrine

16.1.11 Aventurine

Aventurine is another variety of quartz .

It is actually a colourless stone with funchsite mica inside which is a green colour disc shape inclusions.

When light falls on the stone, the disc like inclusions present inside glitters. This phenomena is called as aventurescence which is a distinction factor to separate it from emerald.

Its Indian trade name is *Margaj* or *Indian Jade*.

Fig. 16.1.11.1 Aventurine

16.1.12 Chrysophrase

It is popularly called as green onyx. It is quite evenly translucent compared to emerald.

Fig. 16.1.12.1 Chrysophrase

16.1.13 Peridot

Fig. 16.1.13.1 Peridot

16.1.14 Other Stones

Semi-precious have a long list of gemstones. Few of the more commonly available gemstones are:

- Tourmaline
- Turquoise
- Coral
- Garnet
- Pearl
- Lapis Lazuli
- Malachite
- Amber
- Tanzanite
- Chalcedony
- Cats eye quartz
- Moonstone
- Hematite etc

Notes

16.1.15 Facets

For Facets module refer to **UNIT 2.1.1** and **UNIT 2.1.2**.

After reading the above-mentioned units you will be able to:

1. Know what is a facet.
2. Know the various types of cuts.
3. Understand the arrangement of facets in standard round brilliant cut.
4. Understand the various parts of a gemstone.
5. Understand the various facet names and their arrangement.

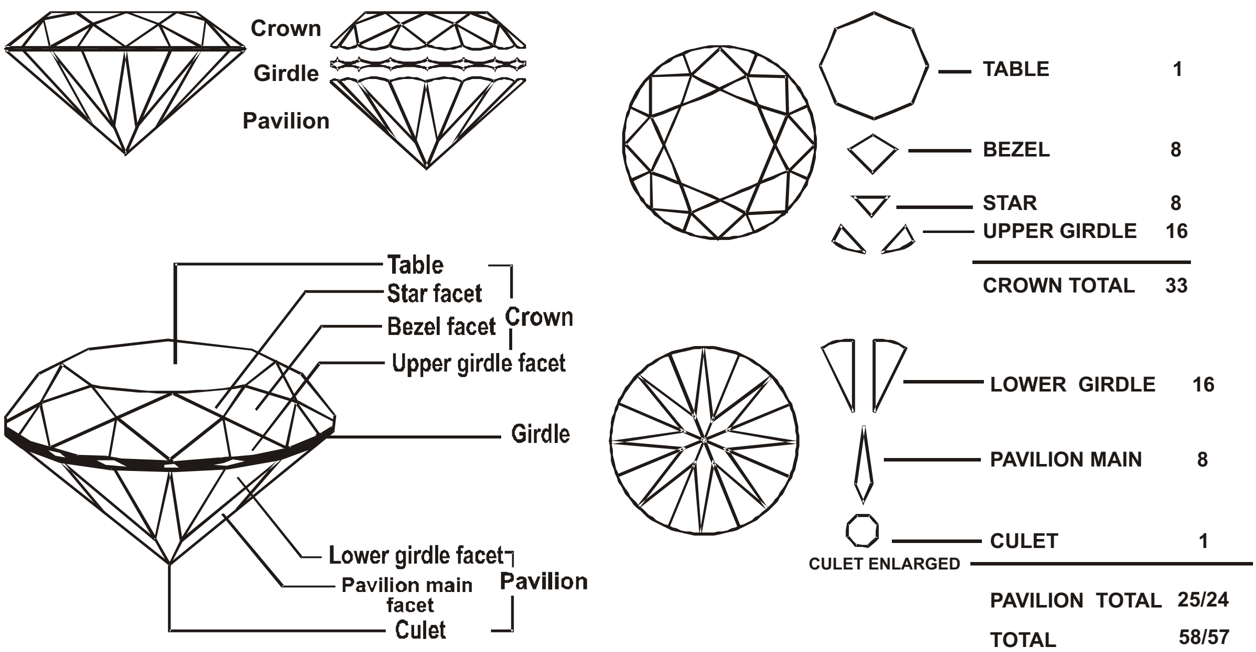


Fig. 16.1.15.1 Facet Arrangement of standard round brilliant

16.1.16 Concept of 4Cs

For Concept of 4Cs module refer to **UNIT 3.1** with the following sub-units:
UNIT 3.1.1
UNIT 3.1.2
UNIT 3.1.3
UNIT 3.1.4 and
UNIT 3.1.5
After reading the above-mentioned units you will be able to:

1. Understand the concept of 4Cs.
2. Understand the basics of the value factors.
3. Understand the basic concept of Carat.
4. Understand the basic concept of Clarity.

Fig. 16.1.16.1 4Cs

16.1.17 Colour

Components of Colours

Colour in gemstones is the combination of hue, tone and saturation.

Hue:

- It refers to the basic colour of violet, indigo, blue, green, yellow, orange, red or purple.
- Also, there are some transition colours like bluish green and yellowish green.
- Colours like brown, black, white and grey are not considered as hue.

Tone:

- It refers to the lightness and darkness of the colour. It can be classified as:
  - Very Light
  - Light
  - Medium
  - Dark
  - Very Dark

Saturation and Intensity:

The colour is termed as saturated when it has the least presence of grey or brown in the hue.

Green

Bluish Green

Yellowish Green

Fig. 16.1.17.1 Transition colours in green

16.1.17 Colour

Evaluating Gemstone Colour

Following is the colour tone to understand the value vs colour in gemstones.

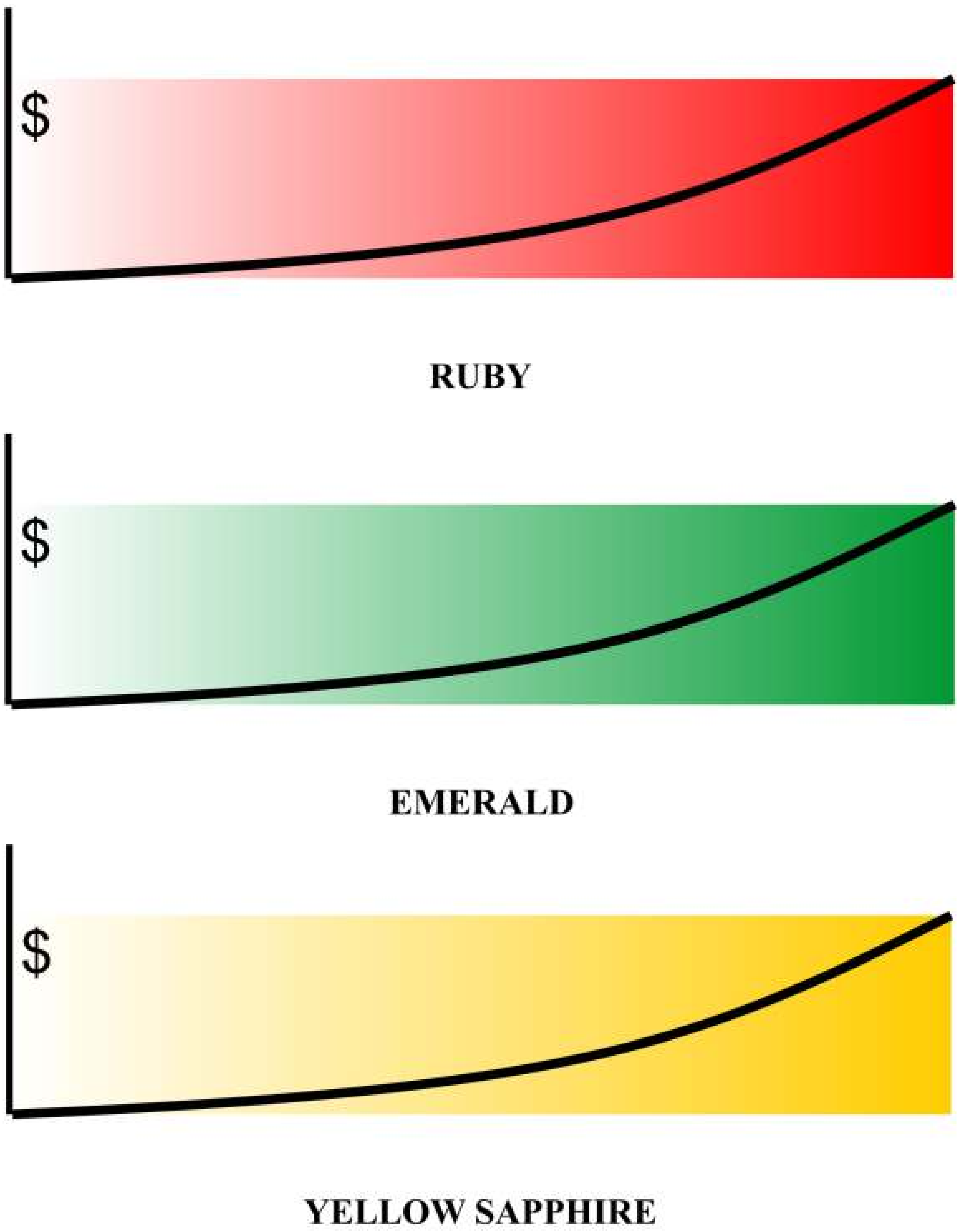


Fig. 16.1.17.2

16.1.17 Colour

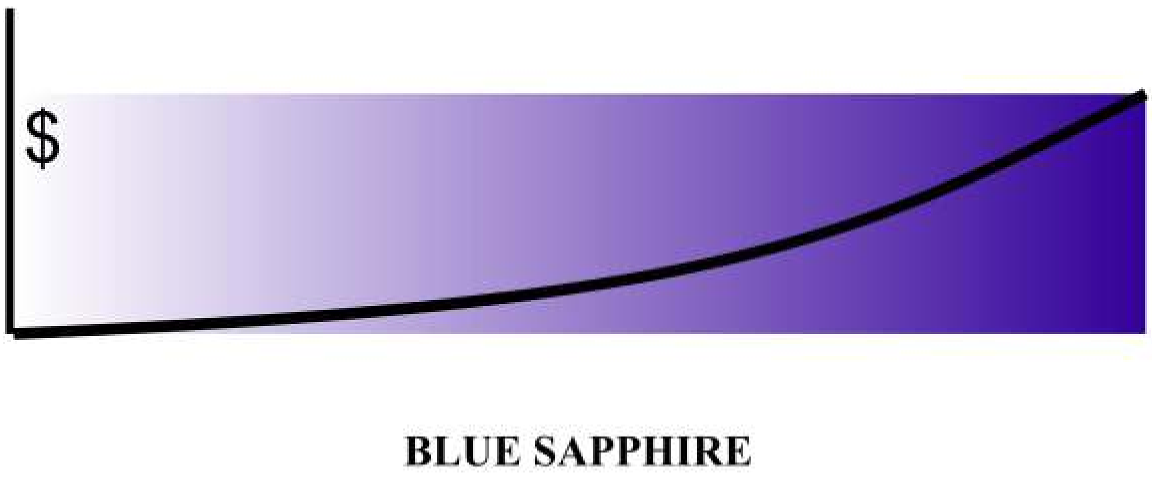


Fig. 16.1.17.3 Evaluating colour tone

In all these hues (with different tones), the value would fall when they become too dark like Navy Blue, Bottle green, Maroon etc.

Thus,

It is the combination of hue, tone and saturation created by various light wavelengths a stone absorbs, transmits or reflects.

Light the gemstone with daylight equivalent reflected light and look at it face up against white background. Never light a stone from behind to judge its colour

Describe the hue and tone of the stone

Record the presence of any colour zoning or bonding as an inclusion (only if beauty is affected)

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16.1.18 Transparency

Transparency

It is the degree to which a mineral can transmit light

Shine a bright light through the stone (torch, fibre optic)

Classify the gem transparency in the following word terms:

a. **Transparent:** Capable of transmitting light with little distortion.

b. **Semi-Transparent (STP):** Capable of transmitting light with some distortion.

c. **Semi Translucent (STL):** Capable of transmitting light only to thin areas which are usually the edges.

d. **Translucent (TL):** Capable of transmitting and diffusing light.

e. **Opaque (O):** Incapable of transmitting any light.

Notes

16.1.19 Measurement

For Measurements module refer to **UNIT 7.1.4** and **UNIT 7.1.5.**

After reading the above-mentioned units you will be able to:

1. Know how to measure gems.
2. Know the use of gauge.

Fig. 16.1.19.1 Gem millimeter gauge

16.1.19 Measurement

Shape & approx weight of calibrated corundum and emeralds								
shape	mm	weight			shape	mm	weight	
Faceted		Corundum	Emeralds		Faceted		Corundum	Emeralds
Rounds	2	0.04	0.03		Emerald cut	5x3	0.30	0.25
	2.5	0.07	0.05			6x4	0.65	0.48
	3	0.13	0.10			6.5x4.5	0.90	0.65
	3.5	0.20	0.17			7x5	1.10	0.80
	4	0.30	0.25			7.5x5.5	1.45	1.10
	4.5	0.45	0.33			8x6	1.90	1.42
	5	0.60	0.45			9x7	2.80	2.25
	5.5	0.78	0.58			10x8	4.00	3.20
	6	1.00	0.75					
	6.5	1.25	0.95		Oval	5x3	0.25	0.20
	7	1.60	1.20			6x4	0.50	0.44
	7.5	1.90	1.50			6.5x4.5	0.65	0.50
						7x5	0.85	0.70
Marquise	6x3	0.23	0.20			8x6	1.40	1.10
	8x4	0.60	0.48			9x7	2.40	1.75
	10x5	1.10	0.90			10x8	3.00	2.35
	12x6	2.00	1.50			12x10	5.75	4.50
Square	2	0.06	0.04		Pear	5x3	0.25	0.20
	2.5	0.15	0.12			6x4	0.45	0.35
	3	0.18	0.16			7x5	0.80	0.68
	4	0.40	0.32			8x5	0.90	0.78
	5	0.75	0.57			9x6	1.45	1.25
	6	1.28	1.02			10x7	2.10	1.85

Fig. 16.1.19.2 Approx weight in carat of calibrated and faceted gems

16.1.20 Cutting Styles

The shape and / or style of fashioned gemstone.

Faceted: Flat geometric patterns or polished surfaces done by man.

Fig. 16.1.20.1 Faceted

Cabochon: Dome like surface.

Single cab: Convex top with flat base (some synthetic stones are found in this cutting style).

Double cab: Convex top with base (indicates natural origin).

Fig. 16.1.20.2 Cabachon

Cameo: A gemstone carved on the surface; preferably on different layers of colour. E.g.: coral, chalcedony.

Fig. 16.1.20.3 Cameo

16.1.20 Cutting Styles

Bead: A gem with a drill hole.

Fig. 16.1.20.4 Bead

Sphere: Round shape with no drill hole.

Fig. 16.1.20.5 Sphere

Tumbled: The stone has been polished and rounded in a mechanical tumbler.

Fig. 16.1.20.6 Tumbled

16.1.20 Cutting Styles

Rough: Natural crystal form with unpolished surfaces.

Fig. 16.1.20.7 Rough

Carving: Free standing carving engraved on all sides, usually to bring up 3-D form.

Fig. 16.1.20.8 Carving

Notes

16.1.21 Sorting of Gemstones

Firstly, one should sort the lot as per the cutting shapes.

Secondly, according to the requirement of the design, one should sort the size of the gems.

Once we have required the shape(s) and size(s) out of the lot then we should sort by colour. Below is a good example of a lot with the same shape (oval) in different sizes:

Fig. 16.1.21.1 Different transitional shades in the lot

If you look at the above lot you will find gems with different shades and transparency.

Now we should sort these gems as per colour and transparency.

See below

Fig. 16.1.21.2 Different transitional shades in the lot divided into groups

16.1.21 Sorting of Gemstones

Similarly,

For emeralds, look at the below gems with different transition colours:

Fig. 16.1.21.3 Bluish green emeralds

Fig. 16.1.21.4 Less bluish tint seen in the emerald compared to the above three specimens

16.1.21 Sorting of Gemstones

Fig. 16.1.21.5 Yellowish green emeralds

Notes

16.1.21 Sorting of Gemstones

Similarly,

For ruby, look at the below gems with different transition colours:

Fig. 16.1.21.6 Dark red ruby

Fig. 16.1.21.7 Pinkish red ruby

Fig. 16.1.21.8 Look at the circled gem, it has orange as transition colour

16.1.21 Sorting of Gemstones

Fig. 16.1.21.9 Different transitional shades in the lot

Flat stones tend to be more transparent, thus should be considered as a different group. See below

Fig. 16.1.21.10 Different transitional shades in the lot divided into groups

16.1.21 Sorting of Gemstones

Find below some more examples of sorted lots of gems considering the colour and transparency.

Fig. 16.1.21.11 Sorted lots as per colour and transparency

16.1.22 IPR Policy

WHAT IS IPR ?

Intellectual property rights (IPR) gives exclusive rights to a company or person to use its intellectual property without the threat of competition, atleast for a specific time period.

Intellectual Property (IP) refers to creations of mind: plans, ideas, designs, inventions and other intangible assets.

IPR are protections granted by law to the creators of IPR, and include patents (for inventions), copyright (for creative, intellectual or artistic forms or works: usually for a limited time), trademarks (for recognizable sign, design or expression), trade secrets(for formula, process, pattern, etc giving an economic edge over competitors or customers), etc.

The main reason for granting IPR is to encourage innovators and promote progress without the fear of competition.

A lot of effort, time and money go in to develop new designs, processes and strategies. This gives companies an edge over competitors.

Financial incentives are directly linked to protection of these intangible assets.

If the manufacturing process designed by a company (on its own) is leaked, it may result in loss of competitive edge over those who copy the process.

Exclusive or unique designs should not be copied or shared with unauthorized persons without the company's approval.

Other business information, inclusive of but not limited to plans, ideas, concepts, formulae, trade secrets, employee data, etc, the sharing of which makes a company lose its economic edge over others, therefore should be kept confidential.

The gem grader should have complete knowledge of the company's IPR like patents, copyrights, trademarks and other intellectual property rights.

He should be able to identify the information that needs to be prevented from being leaked to competitors in the market.

He/she should protect IPR in the following manner:

Prevent leakage of new orders of the company to its competitors: This may lead to loss of profit that the company can earn from its innovative and unique designs.
Prevent leakage of company's manufacturing process and policies: Every company has a particular manufacturing process as well as policies. This information should not be leaked.
Should not be involved in IPR violations and should report IPR violations, if any: He/ She should not disclose any confidential information and should report IPR violations to the management.
Should be aware of company's intellectual property rights: This is essential in order to prevent intellectual property of the company and be able to identify violations.
The diamond grader should know his/ her role and importance in the organization. Also, he/ she should know the patents and IPR laws.
In case of violations, he/ she should know how to effectively communicate the same to the concerned person in the management so that adequate action may be taken against the violator.

16.1.22 IPR Policy

He/ she should be able to identify possibilities of violation and be able to correct the same and learn from past mistakes.

Thus, he/ she should be aware of:

- The company's policies.
- The company's patented products.
- IPR laws.
- Importance of IPR protection.
- Reporting structure in case of possible or actual violation.

Notes

GOVERNMENT OF INDIA
MINISTRY OF SKILL DEVELOPMENT & ENTREPRENEURSHIP

17. Coordinate with Others

Unit 17.1 - Importance of Interaction and Coordination
Unit 17.2 - Interacting with Supervisor
Unit 17.3 - Interacting with Colleagues and Other Departments
Unit 17.4 - Interacting with Outside Parties

G&J/N9901

Key Learning Outcomes

At the end of this module, you will be able to:

1. Understand how to coordinate with supervisor, colleagues and others.
2. Understand the importance of interaction and coordination for personal growth.

Unit 17.1: Importance of Interaction and Coordination

Unit Objective

At the end of this unit, you will be able to:

1. Understand the importance of interaction and coordination.

17.1.1 Answer these Questions (Exercise)

Sr. No.	Question	Tick the Answer as per your opinion
1	How **Often** do people in your team or department speak with you about the job work or process?	○ Never ○ Sometimes ○ Always
2	How **Much Time** do people in your team or department take to solve an issue or get new information to you about the job work or process?	○ Never on time ○ Sometimes on time ○ Always on time
3	How **Precise** is their communication with you about the issue or the new information given to you?	○ Never Precise ○ Sometimes Precise ○ Always Precise
4	When there is a **Problem** do people in your department or team blame each other	○ Never ○ Sometimes ○ Always
5	How many of the people in your team or department **Share the Same Goals** as you regarding the progress of the company?	○ None ○ Some ○ All
6	How many of the people in your team or department know what your **Job Work Actually** is?	○ None ○ Some ○ All
7	Do these people **Respect** you for the work you are doing?	○ Never ○ Sometimes ○ Always

17.1.2 Solving the Gap Areas

1. If you have ticked"Never","None", "Sometimes" or "Some" in most of the questions then we need to solve the gap areas.
2. To solve the gap areas, we need to:
   - Provide honest opinions
   - Report problems early
   - Focus on defect prevention than detection
   - Give appropriate feedback
   - Respect for ourselves, others and their time
   - Be friendly and a team player
   - Be problem solving
   - Have determination
   - Have willingness to learn and volunteer
   - Be accountable and take responsibility for our mistakes
   - Deliver work on time
   - Work well under pressure
   - Meet deadlines
   - Be open to ideas and suggestions
   - Keep personal information personal
   - Restrict ourselves from giving out company information to others
   - Focus on quality and quantity of work
   - Create a clear cut division between personal and work life
   - Communicate differences respectfully and in an appropriate manner

17.1.3 Importance of Interaction and Coordination

Fig. 17.1.3.1

Tips

1. It's always important to be honest about your thoughts, suggestions, opinions when it is concerning the company.
2. Do not involve personal opinions with professional opinions.

Notes

Unit 17.2: Interacting with Supervisor

Unit Objectives

At the end of this unit, you will be able to:

1. Understand the importance of interacting with your supervisor.

17.2.1 Interaction with Supervisor

1. Interaction with supervisor is about communicating with supervisor in order to achieve a smooth and hazard – free work flow.

2. Interaction includes:

- Raw material and work instructions by supervisor
- Communication regarding improvements required in working process or defects received from previous process
- Communication with supervisor on maintenance of tools and machinery, if required
- To resolve conflicts
- Informing about potential hazards in work place
- Reporting about operation details
- To know company's policies on language of communication, reporting and escalation policies, quality delivery standards and personnel management

3. Facial expressions and body language are non-verbal and indicate if information received by worker is understood or not.

4. If you do not understand a part of the work instruction, always ask your supervisor for more information

17.2.2 Try the PDCA Method with Your Supervisors Help

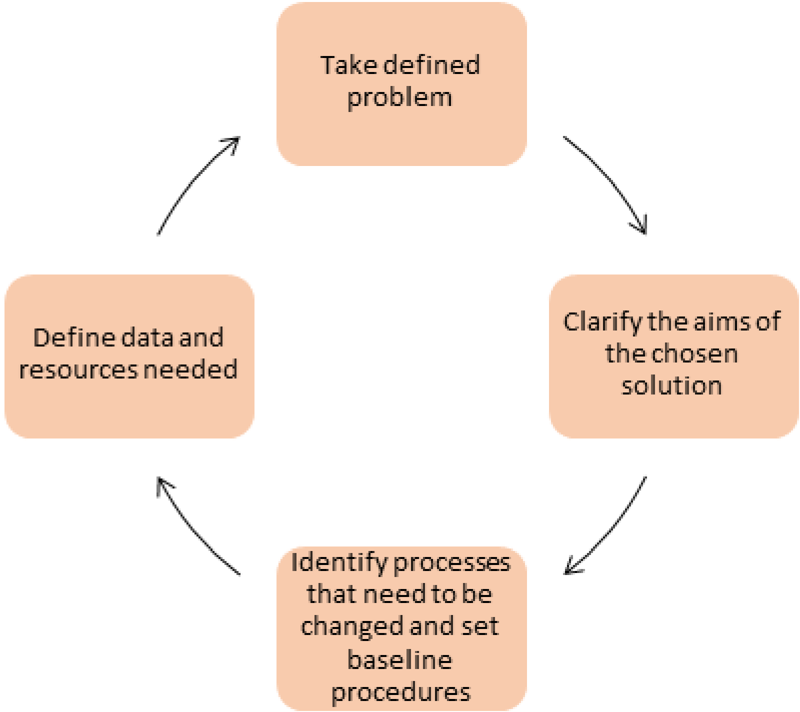

Fig 17.2.2.1

This can help you with improvements in the process flow, reporting product defects, informing about repairs and maintenance of equipment and tools.

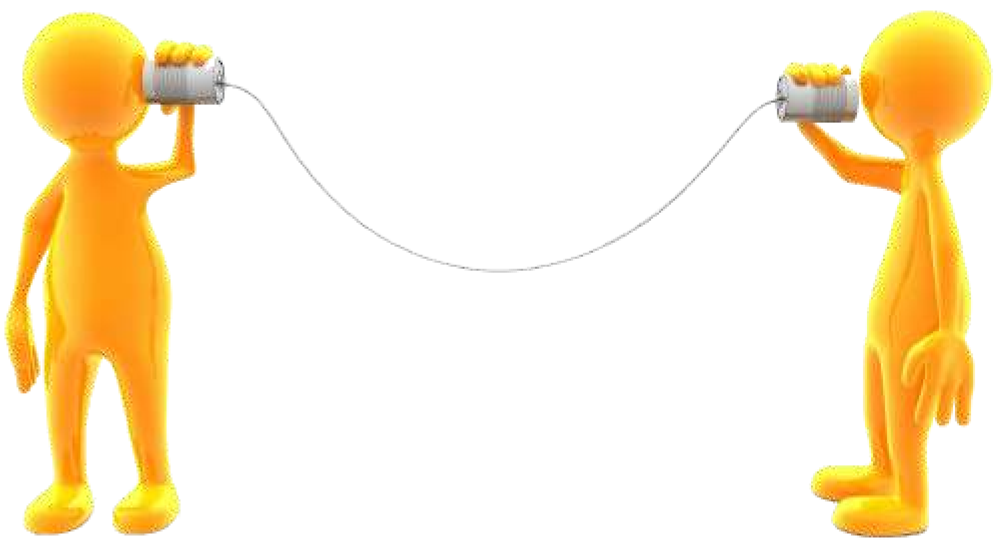

Fig 17.2.2.2 Listen, understand and ask questions if not understanding the job work

Tips

1. Respect your supervisor and learn to trust him/her.
2. If there is any conflict of thoughts, discuss the same with the supervisor in a humble manner and do not spread bad rumours about your supervisor because of this conflict.

Notes

Unit 17.3: Interacting with Colleagues and Other Departments

Unit Objectives

At the end of this unit, you will be able to:

1. Understand the importance of interaction with colleagues of your department and other departments.

17.3.1 Interact with Colleagues Within and Outside the Department

1. Interaction with colleagues and other departments is about working as a team with colleagues and sharing work and work load.
2. It also means:
   - Sharing team and individual goals
   - Sharing proper communication regarding work flow and finding out solutions for problems occurring in working together
   - Communication with each other, receiving feedback from Quality checker in order to achieve best work in time
   - Team coordination
   - Proper work process by interacting with others and adopting best practices

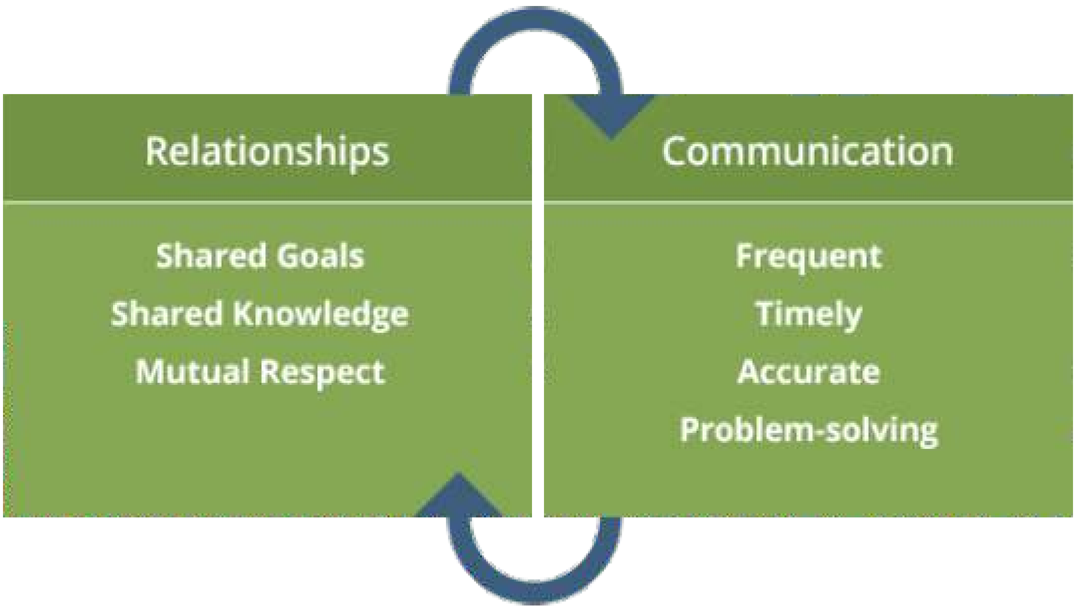

Fig 17.3.1.1 Interaction with colleagues and other departments

17.3.2 Non-Verbal Communication

1. When interacting with colleagues and other department personnel, we should also remember the non- verbal communication or body language that we are portraying to them.
2. Sometimes, a wrong body language sign might create conflicts or create opinions about you and others.
3. Always remember, what you do not speak may show in your actions, so be careful about what body language sign you are communicating to others.

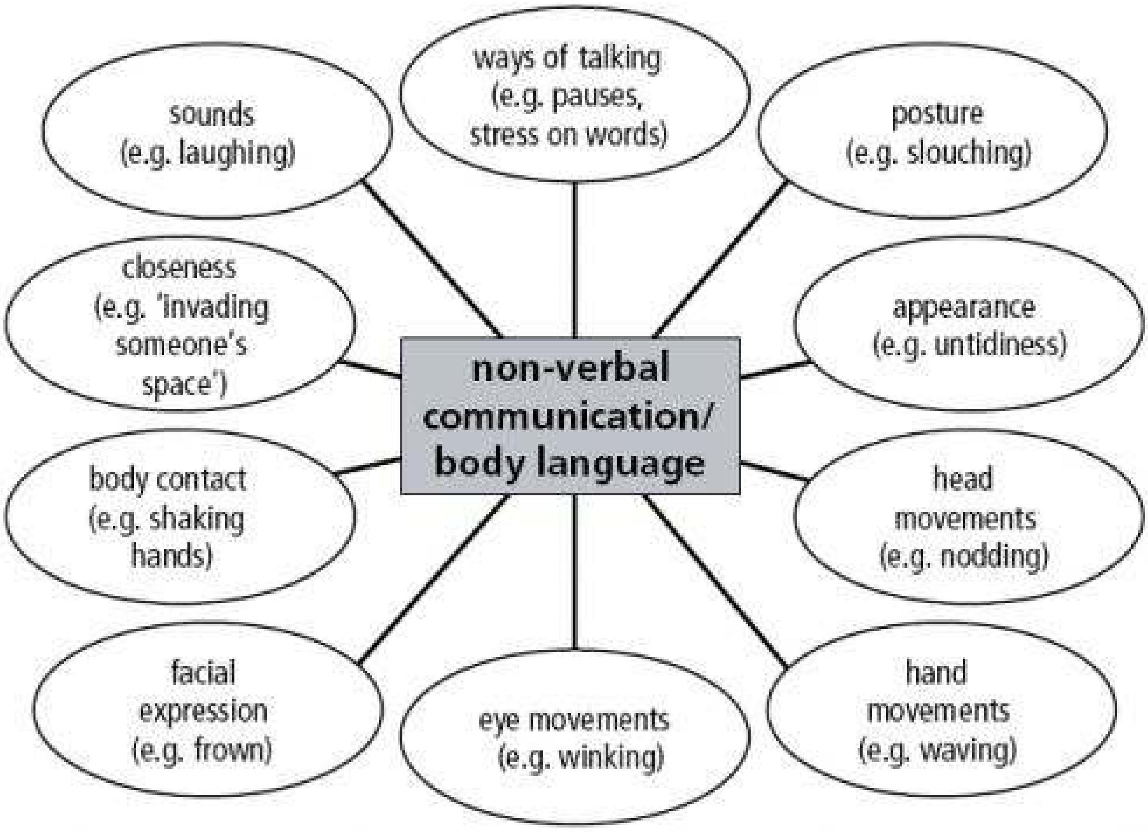

Fig 17.3.2.1 Non-verbal communication or body language

Tips

1. The wrong body language can create a different impression on your colleagues and other departments.
2. If there is something that you would like to share with them but cannot due to certain reasons, inform your supervisor to communicate the same.

Notes

Unit 17.4: Interacting with Outside Parties

Unit Objectives

At the end of this unit, you will be able to:

1. Understand the interaction level with outside parties.

17.4.1 Intellectual Property (IPR)

1. Intellectual Property or IPR is very important for an organization.
2. One should restrict or avoid giving such information to outsiders including customers of the company unless decided by the management otherwise.

Type of Intellectual Property	Rights Covered
Copyright	Use or performance of original works of any type including any form of expression and literature
Patent	The use, manufacture or the sale of company inventions
Trademark	The use of symbols, words, names, pictures, designs, logo or combination of all the above used by companies to identify particular products, brands or services
Trade Secrets	The privacy of data, documents, formulas or anything that is mentioned or maintained as confidential information

Fig. 17.4.1.1

17.4.1 Intellectual Property (IPR)

Fig. 17.4.1.2 Doubling

Tips

1. Any information that is the company's confidential material should not be discussed with outsiders.
2. Outsiders can include customers, family members, friends and competitors.
3. If you leave the company, then too you are required to follow the confidential agreement of not sharing information about the company with your new employer.
4. In case, you find someone leaking confidential information, inform your supervisor or a higher authority in the company.
5. Non-disclosure policy of the company.

Notes

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18. Maintain Health and Safety at Workplace

Unit 18.1 - Understand Potential Sources of Accidents
Unit 18.2 - Understand Safety Signs and Appropriate Requirements to be Safe
Unit 18.3 - Understand Ergonomics or Bad Posture of Body
Unit 18.4 - Fire Safety Rules
Unit 18.5 - Understand how to deal With Emergency Situations

G&J/N9902

Key Learning Outcomes

At the end of this module, you will be able to:

1. Understand safety procedures.
2. Understand potential hazards.
3. Understand what to do in an emergency situation.
4. Understand how to use the fire extinguisher by identifying the appropriate fire.
5. Understand how complying with company safety rules and regulations can be safe for you.

Unit 18.1: Understand Potential Sources of Accidents

Unit Objective

At the end of this unit, you will be able to:

1. Understand the potential sources of accidents in a workplace.

18.1.1 Understand Potential Sources of Accidents

1. Accidents or hazards mean an incident involving loss of life inside or outside the workplace, suffering injuries internally and/or externally, or release of toxic chemical or explosion or fire, or spilling of hazardous chemical resulting in 'on-site' or 'off-site' emergencies or damage to equipment leading to stoppage of process or adverse effects to the environment.

2. Accidents or hazards usually occur due to:
   - Faulty equipment
   - Improper working conditions
   - Faulty inspection or repairing an equipment or tool without the proper instructions
   - Irregular maintenance of equipment and tools
   - Repairing of faulty equipment by someone who is not qualified to repair
   - Lack of concentration or bringing personal tensions to work
   - Unsafe practices such as plugging wires directly into sockets without a plug
   - Not reading voltage instructions for imported equipment
   - Improper or insufficient safety training
   - Smoking in non-smoking zones
   - Storage of chemicals near heat emitting machines
   - Improper storage of chemicals
   - Improper work clothing or lack of protective gears
   - Exposed wire or wires bitten by rats or other animals
   - Wires with bad insulation
   - Improper electric connections
   - Using wrong tools and equipment in wrong place or plugging into wrong socket
   - Using too many wires in one spike guard or electric socket
   - Bad housekeeping which includes wet floors, sweeping not done, papers thrown on floor, dustbins not covered or emptied
   - Tools and equipment not stored properly after work
   - Not unplugging tools and equipment after work or during breaks
   - Leaving main switch ON of tools and equipment after work
   - Non reporting of hazards to supervisor or ignoring potential dangers

18.1.1 Understand Potential Sources of Accidents

Fig 18.1.1.1 *Exposed Wire*

18.1.1 Understand Potential Sources of Accidents

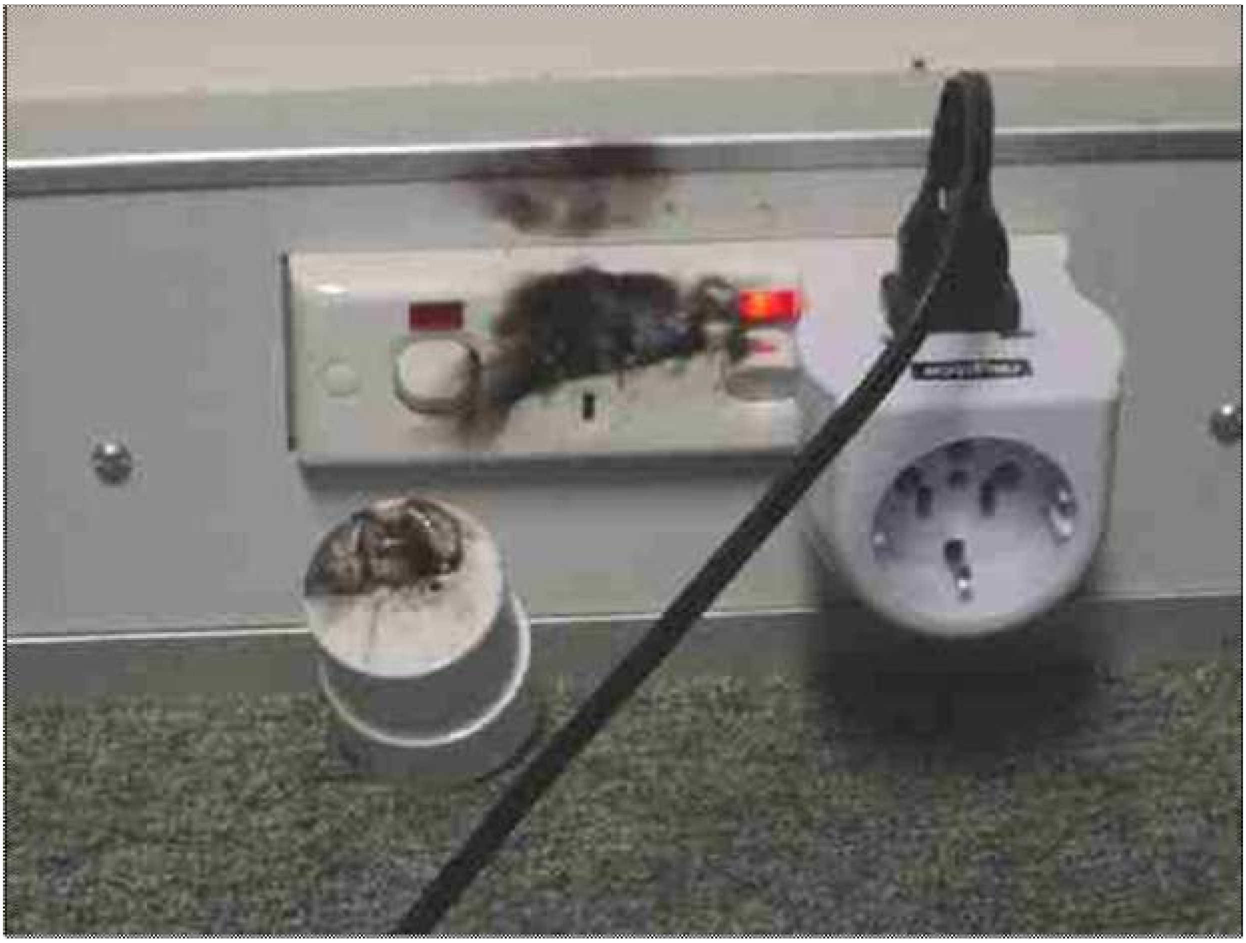

Fig 18.1.1.2 Burned Socket – Not advised to use the working plug

18.1.1 Understand Potential Sources of Accidents

Fig 18.1.1.3 Liquid spilled on carpet floor with tools and equipment around

18.1.2 Understand Potential Sources of Accidents

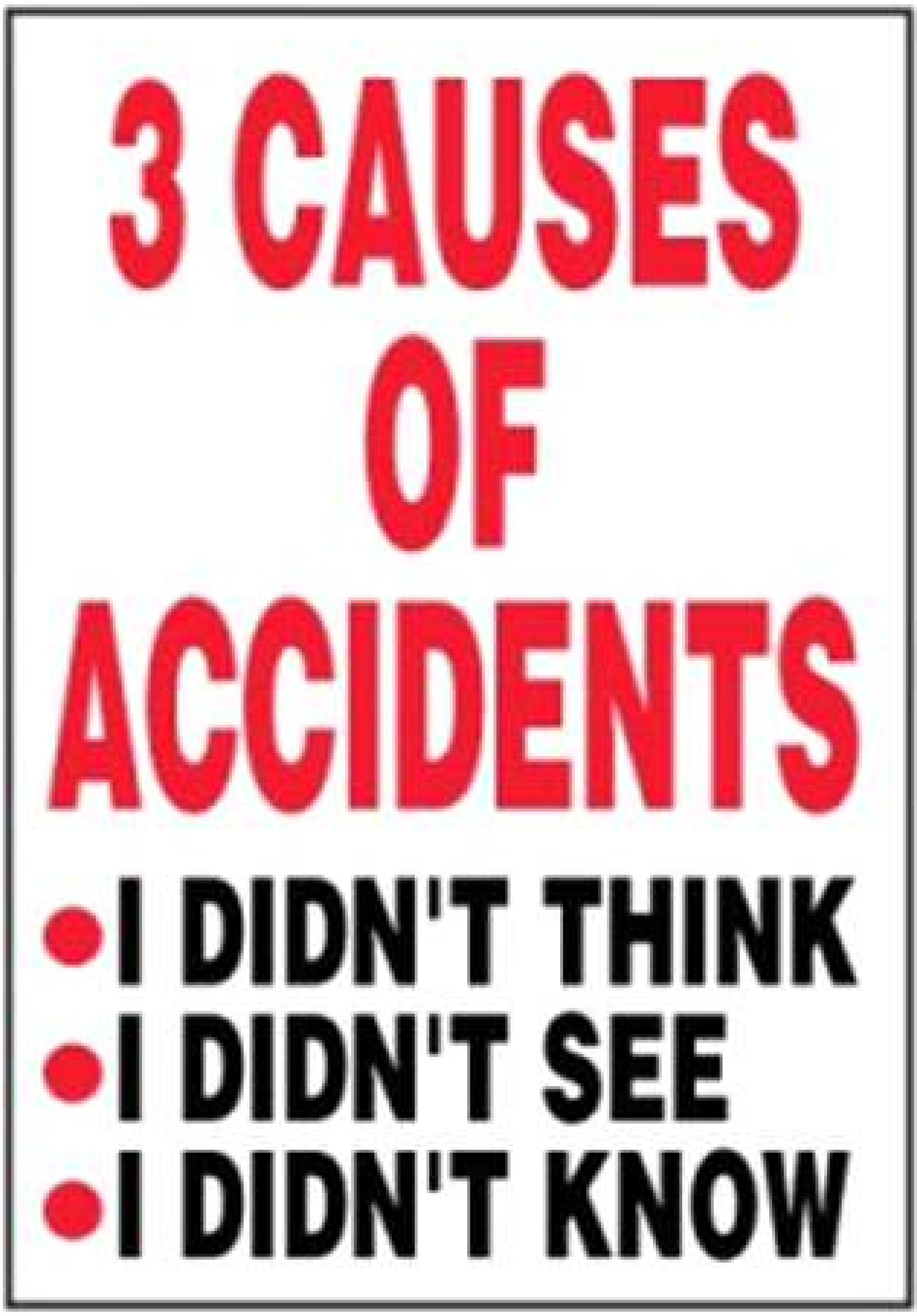

Fig 18.1.2.1 Causes of Accidents

Tips

1. Check your surrounding areas for any live wires, cables that are exposed or any chemical spill which may cause a fire.
2. Always check that equipment and tools are switched OFF before you leave for a break and after your work has ended.
3. It is better to be safe than sorry as it could cost you your life or put others in danger.
4. If there is a potential hazard waiting to happen inform your supervisor to have the same checked as soon as possible.

Notes

Unit 18.2: Understand Safety Signs and Appropriate Requirements to be Safe

Unit Objective

At the end of this unit, you will be able to:

1. Understand the safety signs and appropriate requirements to be safe and to make the workplace safe for yourself and others.

18.2.1 Understanding Safety Signs

Fig 18.2.1.1 Safety Sign - 1

18.2.1 Understanding Safety Signs

Fig 18.2.1.2 Safety Sign - 2

18.2.1 Understanding Safety Signs

Fig 18.2.1.3 Safety Sign - 3

Fig 18.2.1.4 Safety Sign - 4

18.2.1 Understanding Safety Signs

Fig 18.2.1.5 Safety Sign - 5

Fig 18.2.1.6 Safety Sign – 6

18.2.1 Understanding Safety Signs

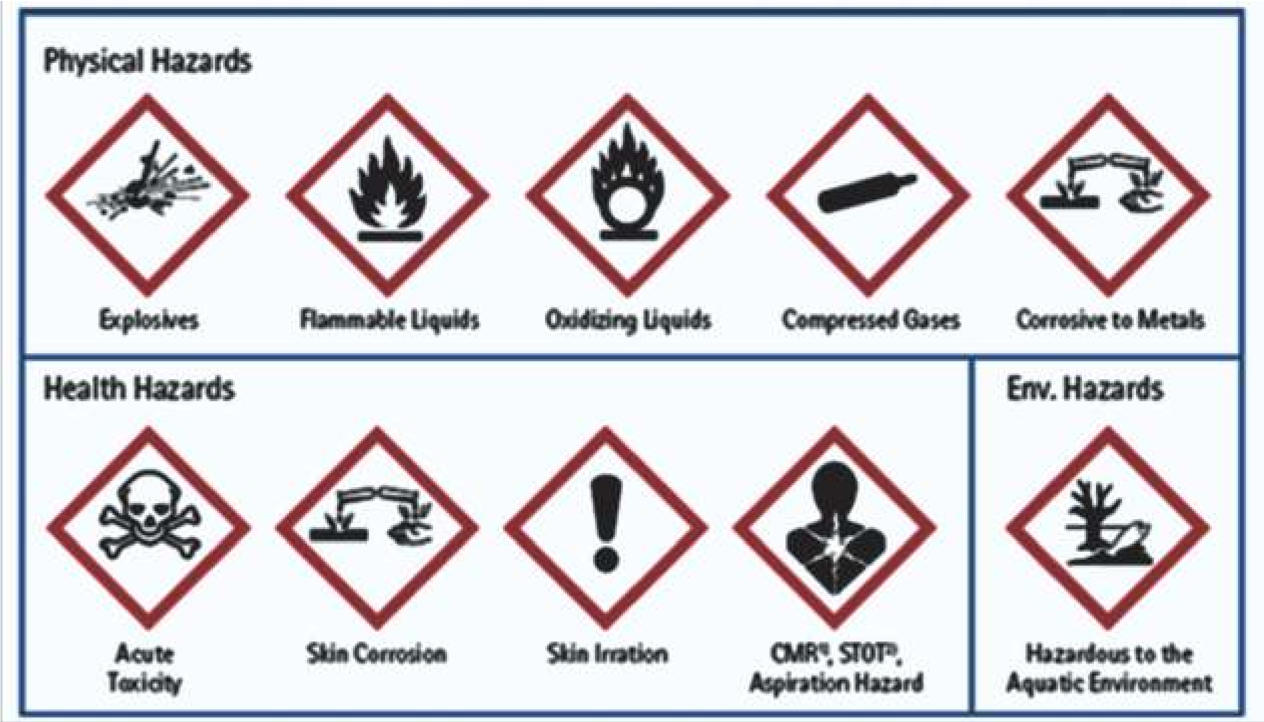

Fig 18.2.1.7 Safety Sign – 7

18.2.2 Safety First

Fig 18.2.2.1 Safety gears to be worn while working with tools and equipment

Fig. 18.2.2.2 Refer to voltage mentioned on equipment and machines before plugging in socket to avoid short circuit

18.2.2 Safety First

Fig 18.2.2.3 Housekeeping rules for every employee

18.2.2 Safety First

Just say no to electrical hazards.
Before you turn it on, make sure that you say no the following:

- Are outlets, motors, or circuits overloaded?
- Are chords running near heat or water sources?
- Are cords twisted or tangled?
- Do I see sparks or smoke?
- Are my hands wet?
- Am I wearing any metal jewellery?

Tips

1. If you follow proper housekeeping rules and the other mentioned rules, you can avoid accidents or hazards in your workplace.
2. Always work as a team when it comes to the workplace.

Notes

Unit 18.3: Understand Ergonomics or Bad Posture of Body

Unit Objective

At the end of this unit, you will be able to:

1. Understand the right body posture required while carrying out any kind of work.
2. Understand how to relax your body more and put less strain on your body.

18.3.1 Understand Ergonomics or Bad Posture of Body

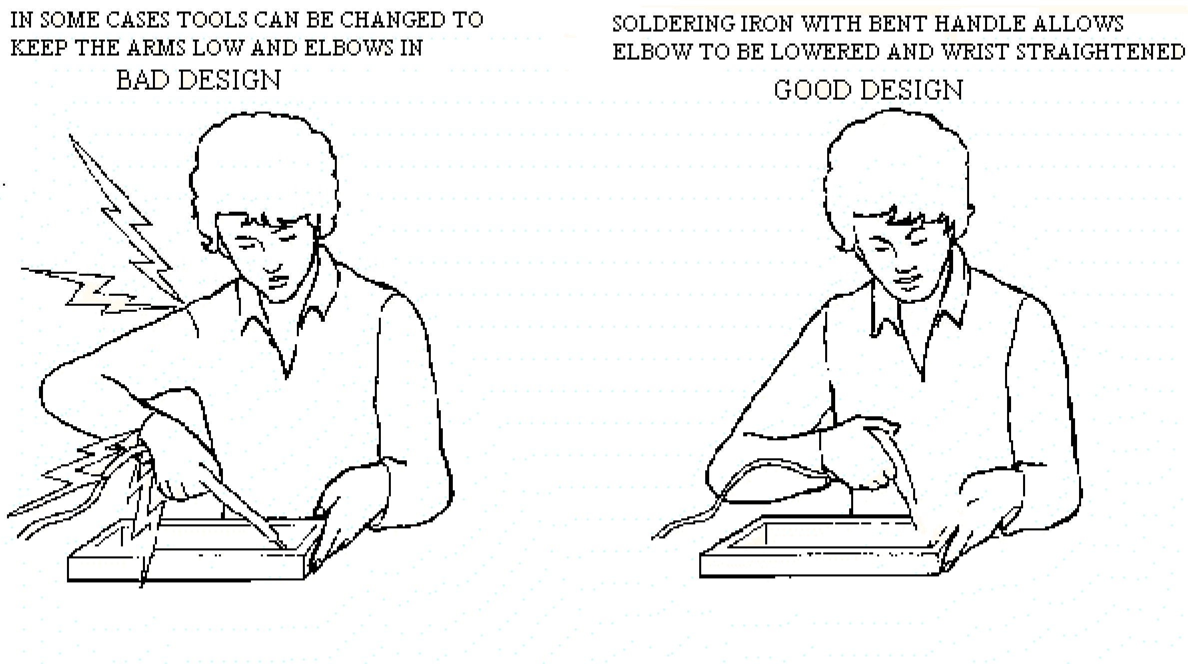

Fig 18.3.1.1 Straining elbows can strain the shoulder leading to body pain

18.3.1 Understand Ergonomics or Bad Posture of Body

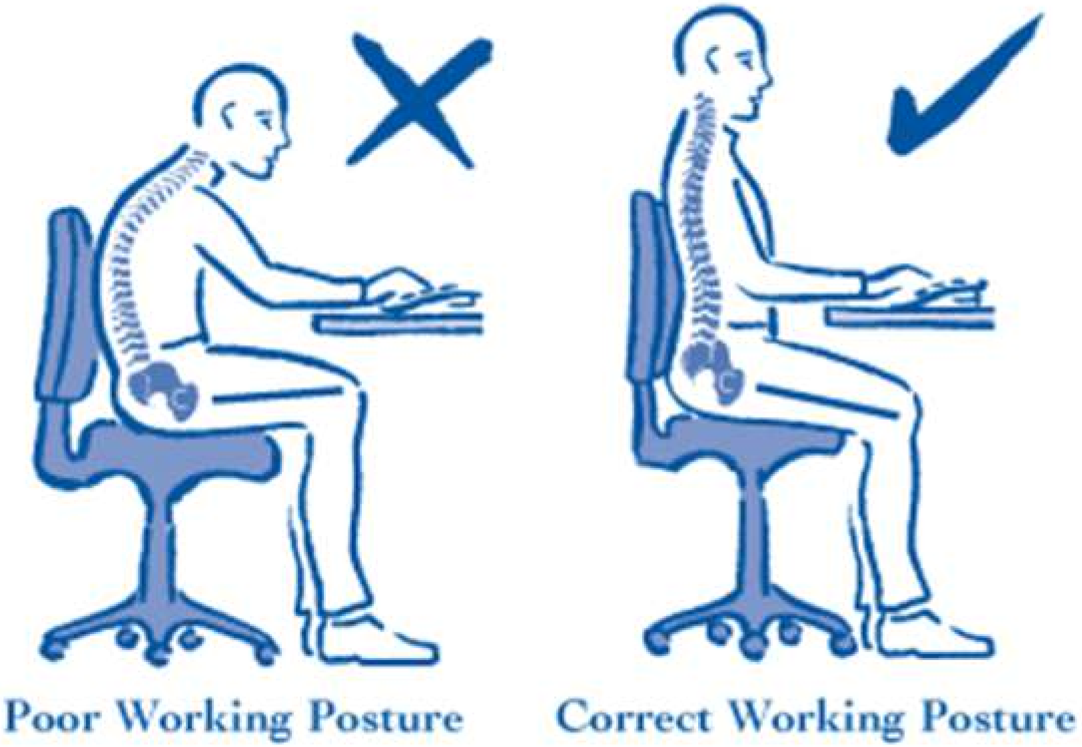

Fig 18.3.1.2 Wrong and right way to sit

Fig 18.3.1.3 Right way to work on computer

18.3.1 Understand Ergonomics or Bad Posture of Body

Fig 18.3.1.4 Problems to avoid

Tips

1. The right body posture will help you keep many health problems away.
2. The wrong body posture can create health problems such as stiff neck, pain in the entire body, stiff shoulders, cervical spondylosis and many other problems.
3. Also drink a lot of water to keep yourself hydrated.

Notes

Unit 18.4: Fire Safety Rules

Unit Objectives

At the end of this unit, you will be able to:

1. Understand the fire safety rules.
2. Understand how to use a fire extinguisher.

18.4.1 Fire Safety Rules

CLASSES OF FIRES	TYPES OF FIRES	PICTURE SYMBOL
A	Wood, paper, cloth, trash & other ordinary materials.	
B	Gasoline, oil, paint and other flammable liquids.	
C	May be used on fires involving live electrical equipment without danger to the operator.	
D	Combustible metals and combustible metal alloys.	
K	Cooking media (Vegetable or Animal Oils and Fats)	

Fig 18.4.1.1 Know the different types of fire with classification codes and symbols

18.4.1 Fire Safety Rules

Fig 18.4.1.2 Know your fire extinguisher code

Fig 18.4.1.3 Know the refill date on the fire extinguisher

18.4.1 Fire Safety Rules

Fig 18.4.1.4 Basic fire fighting steps

Fig 18.4.1.5 Do not use elevator or lift when there is a fire

18.4.2 Using the Fire Extinguisher

Fig 18.4.2.1 Steps to use the fire extinguisher – use the right extinguisher for the fire

Tips

1. Always recognize the type of fire before using the fire extinguisher.
2. The fire extinguisher has a code on it and that code will tell you for which fire that extinguisher can be used.
3. Do not use the lift or elevator when there is a fire.
4. Use wet blankets or napkins to cover your mouth so that you do not inhale the smoke.
5. Call the fire brigade and pull the fire alarm.

Notes

Unit 18.5: Understand How to Deal with Emergency Situations

Unit Objective

At the end of this unit, you will be able to:

1. Understand what is an emergency situation and how to deal with it.

18.5.1 Emergency Situations

Fig 18.5.1.1 Emergency situations

18.5.2 Dealing with Emergency Situations

Evaluate Situation

- Check the surroundings.
- Evaluate the situation.
- Are there things that might put you at risk or harm?
- Are you or the victim threatened by fire, toxic smoke or gasses, an unstable building, live electrical wires or other dangerous scenario?
- Do not rush into a situation where you could end up as a victim yourself.
- If approaching the victim will endanger your life, seek professional help immediately; they have higher levels of training and know how to handle these situations.
- First aid becomes useless if you can't safely perform it without hurting yourself.

Fig 18.5.2.1 Evaluate situation

18.5.2 Dealing with Emergency Situations

Call for Help

- Call for help.
- Call authorities or emergency services immediately if you believe someone to be seriously injured.
- If you are the only person on the scene, try to establish breathing in the patient before calling for help.
- Do not leave the victim alone for an extensive amount of time.

Care for the Person

- Care for the person.
- Caring for someone who has just gone through serious trauma including both physical treatment and emotional support.
- Remember to stay calm and try to be reassuring; let the person know that help is on its way and that everything will be alright.

Check for Response

- Determine responsiveness.
- If a person is unconscious, try to wake them by gently tickling their bare hands and feet or by speaking to them.
- If they do not respond to activity, sound, touch or other stimulation, determine whether they are breathing.

18.5.2 Dealing with Emergency Situations

Conducting CPR OR First Aid

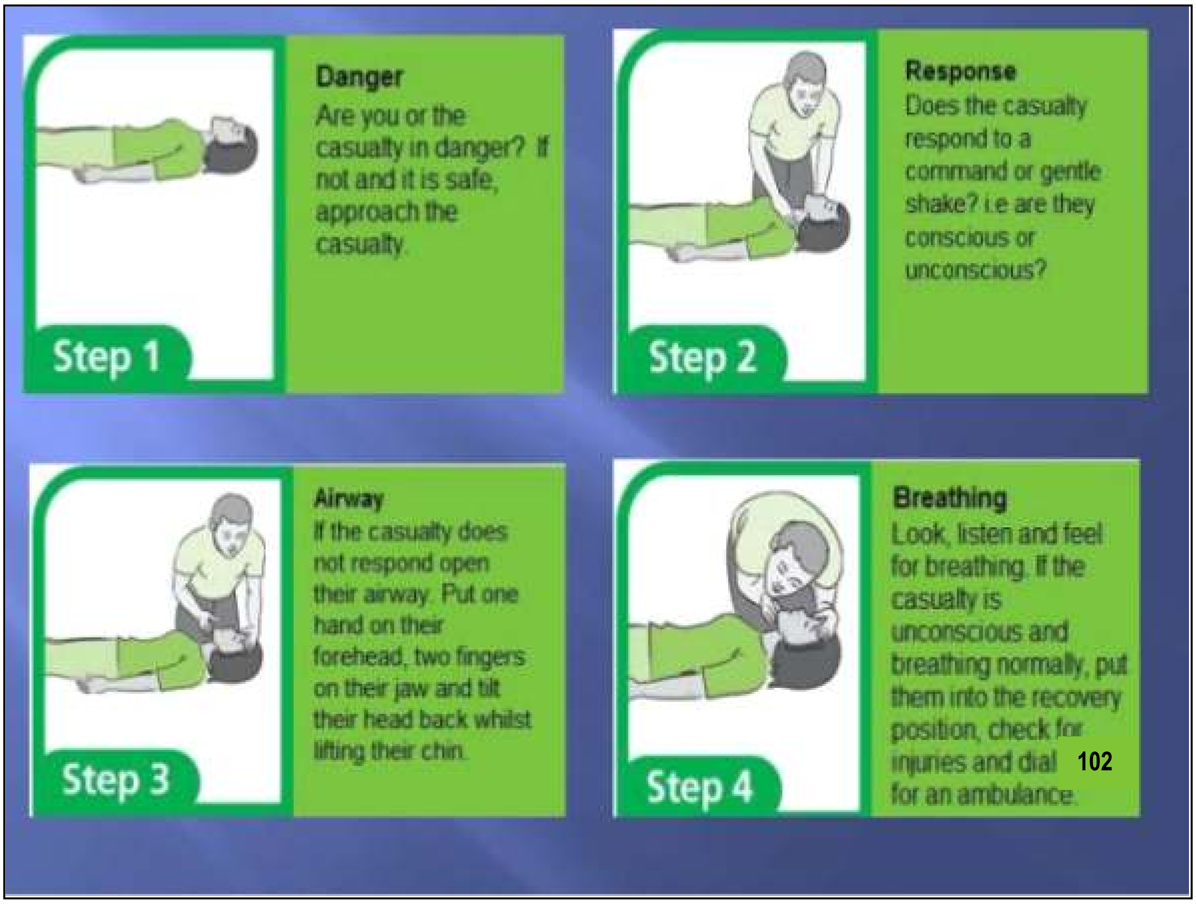

Fig 18.5.2.2 Conducting CPR or first aid

EMERGENCY NUMBERS IN INDIA

- 100 for Police
- 102 for Ambulance
- 101 for Fire
- 108 for Disaster management
- 181 for Women's helpline

18.5.3 Solving the Issue

Fig. 18.5.3.1

Tips

1. Always participate in emergency drills organized by your company, you may never know when the knowledge will come in use.
2. Ask your company for a live demonstration of first aid administration.
3. Check with your company the contents of the first aid box and where it is kept.
4. Always report an incident to your supervisor or others, rather than hiding it.
5. Always care for others in an emergency situation.

Notes

19. Annexure

Annexures 1 - QR codes - Video Link

Annexure: Chapter wise QR codes

Chapter No.	Unit No.	Topic Name	Page No.	Url	QR code (s)
Chapter 1 Introduction, Diamond Formation and Mining	Unit 1.1 - Introduction, Diamond Formation, Mining and Sources	1.1.9 Current Sources	17	https://youtu.be/XEn-Cq2pDLc	Gem & Jewellery industry Orientation
Chapter 1 Introduction, Diamond Formation and Mining	Unit 1.1 - Introduction, Diamond Formation, Mining and Sources	1.1.9 Current Sources	17	https://www.youtube.com/watch?v=ucaVEIjiZ58	About Diamond Mining *(Source : Science channel)*
Chapter 1 Introduction, Diamond Formation and Mining	Unit 1.1 - Introduction, Diamond Formation, Mining and Sources	1.1.9 Current Sources	17	https://youtu.be/A5QV2Q6Kovs	Most Beautiful and Famous Golconda Diamonds from India *(Source : Andrew Pidor)*
Chapter 3 Concept of 4Cs	Unit 3.2 - Concept of Carat	3.2.3 Carat weight Vs Carat Rate	34	https://youtu.be/Wtz0V-XlwzQ	Diamond Carat Weight Grading by GIA
Chapter 3 Concept of 4Cs	Unit 3.3 - Concept of Clarity	3.3.4 Clarity Vs Carat Rate	37	https://youtu.be/IJioSelJOko	Diamond Clarity Grading by GIA

Chapter No.	Unit No.	Topic Name	Page No.	Url	QR code (s)
Chapter 3 Concept of 4Cs	Unit 3.4 - Concept of Colour	3.4.3 Colour Vs Value	40	https://youtu.be/DKm8TXTtN4w	Diamond Color Grading by GIA
Chapter 3 Concept of 4Cs	Unit 3.4 - Concept of Colour	3.4.3 Colour Vs Value	40	https://www.gia.edu/doc/ColDiaChartBklt.pdf	Coloured diamond *(Source :GIA)*
Chapter 3 Concept of 4Cs	Unit 3.5 - Concept of Cut	3.5.7 Scintillation or Sparkle	52	https://youtu.be/nb0DKoRBiSc	Diamond Cut Grading by GIA
Chapter 3 Concept of 4Cs	Unit 3.5 - Concept of Cut	3.5.7 Scintillation or Sparkle	52	https://youtu.be/bZ2UtygPnt4	How to Read a GIA Grading Report Video by GIA
Chapter 3 Concept of 4Cs	Unit 3.5 - Concept of Cut	3.5.7 Scintillation or Sparkle	52	https://www.gia.edu/analysis-grading-sample-report-diamond	Diamond Grading Sample Reports
Chapter 12 Simulants and Synthetics	Unit 12.1 - Simulants, Synthetics and its I	12.1.2 Simulants and Its Properties	224	https://youtu.be/w8cvUd9vTtM	Synthetic diamonds and it's use *(Source : National Geographic)*

Employability Skills	https://www.skillindiadigital.gov.in/content/list	Employability Skills

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