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diamond certification

D-SCREEN

The most compact **diamond screening** device in the world!

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D-SCREEN

The most compact **diamond screening** device in the world

HRD Antwerp's D-Screen identifies natural diamonds. It can be used for polished diamonds with colour range from D to J.

What you need to know about lab grown and treated diamonds

Up until the sixties, a colourless or nearly colourless diamond was by definition a natural stone. In the eighties the first lab grown gem quality diamonds appeared on the market, HPHT synthesis was used.

This process gained a great deal of attention, as the technique could turn some brown diamonds into colourless diamonds. It was, after all, the very first technique that could 'remove' colour.

In the beginning of the 21st century, the American CVD technique Chemical Vapour Deposition was introduced to produce lab grown diamonds. It also became possible to 'remove' the brownish colour of some CVD lab grown diamonds in order to obtain colourless diamonds by using HPHT treatment.

The arrival of these new techniques brought about enormous challenges for scientists and researchers. They embarked upon an intensive search for new techniques to identify the true nature of a diamond: natural, treated or lab-grown.

These techniques were also to be user-friendly, reliable and economical. Years of research resulted in the launch of a unique device: the 'D-Screen'.

The D-Screen is a practical research device developed by HRD Antwerp.

It distinguishes stones that are not lab grown and have not been HPHT colour enhanced from stones that are potentially lab-grown or may have been colour improved by means of HPHT.

"We believe that a reliable and comprehensive monitoring system of natural diamonds is essential to fulfill our obligation. Undoubtedly, D-Screen is our trusted diamond screening device in differentiating lab-grown diamonds consistently, conveniently and efficiently."

Lawrence Ma
Lee Heng Diamond Group

What you need to know about colour

Types of diamonds

A diamond with a perfect crystal lattice made entirely of carbon is completely colourless. In reality, however, all diamond crystals contain atomic impurities and structural imperfections. We call these 'colour centres' because they are responsible for the colour of a diamond.

The most common atomic impurity in a diamond is nitrogen. Based on the presence of this atom in the diamond lattice, one can classify diamonds into two main groups.

Type I diamonds contain a higher level of nitrogen, while **type II** diamonds contain practically no nitrogen.

Type I diamonds

Type I diamonds account for the large majority of polished diamonds (> 98%). The nitrogen atoms are organised either in 'group' (type Ia) or 'isolated' (type Ib). Because some of these nitrogen groups absorb blue light, type Ia diamonds often have a light yellow colour that can vary to brownish yellow or brown. Diamonds with isolated nitrogen atoms (type Ib) usually have a deep yellow to orange colour.

Natural type Ib diamonds are very rare, accounting for less than 0.1% of the total quantity of natural diamonds of gem quality. Most diamonds remain in the upper part of the earth's mantle for millions of years, where they have grown under high pressure and high temperature. In this environment, the nitrogen atoms in the diamond, gradually group to become aggregates, so the diamonds transform from type Ib to type Ia. Lab grown diamonds on the other hand are always very young, so they usually contain a very high relative level of isolated nitrogen.

Type II diamonds

Type II diamonds contain very negligible levels of nitrogen. In most cases nitrogen is the prevailing impurity, type II diamonds can be considered as the purest form of diamond in terms of atoms.

Type II diamonds can be divided into two subgroups: type IIa and type IIb. The first group is very pure and therefore can be completely colourless. These type IIa diamonds however often contain structural defects that can give them a brown to pink colour.

Type IIa diamonds are very rare in gem quality (approximately 1% to 2% of all diamonds). Some of the most famous colourless diamonds, such as the Cullinan and the Koh-I-Noor, are type IIa diamonds.

Type IIb diamonds (<0.1% of all diamonds) have substitute boron atoms in the crystal lattice. As a result, these diamonds are blue, although they can also be brown and grey to nearly colourless. All natural blue diamonds are type IIb, including the famous Blue Hope diamond.

	Type I		Type II	
	Ia	**Ib**	**IIa**	**IIb**
Colour centres	Groups of nitrogen atoms	Isolated nitrogen	No specific colour centre	Substitute boron atoms
Colour	· Colourless · Yellow	· Orange · Orange - Yellow · Brown	· Colourless · Brownish yellow · Pink · Purple	· Blue · Grey

What you need to know about treatments

HPHT colour treatment

General Electric developed the high pressure (HP) - high temperature (HT) treatment in the mid-nineties with the purpose of improving or changing the colour of light brown diamonds.

How does it work?

The stone is heated to temperatures of over 2100°C. To prevent the diamond from being transformed into graphite, a very high, stabilizing pressure of 75.000 kg/m^3 is needed. The brown colour in some types of diamonds (including type IIa) is associated with the presence of plastic deformation or defects in the crystal lattice. HPHT treatment changes these defects in the crystal lattice. Consequently the cause of the colour disappears.

The whole process takes only a few minutes, but the diamond needs to be polished to remove the mat, corroded surface to regain its sparkle.

The final result of this treatment greatly depends on the initial properties of a diamond and its type. Today a brown, grey or light yellow diamond can be 'transformed' into an intense yellow, to greenish yellow, pink, blue or colourless diamond.

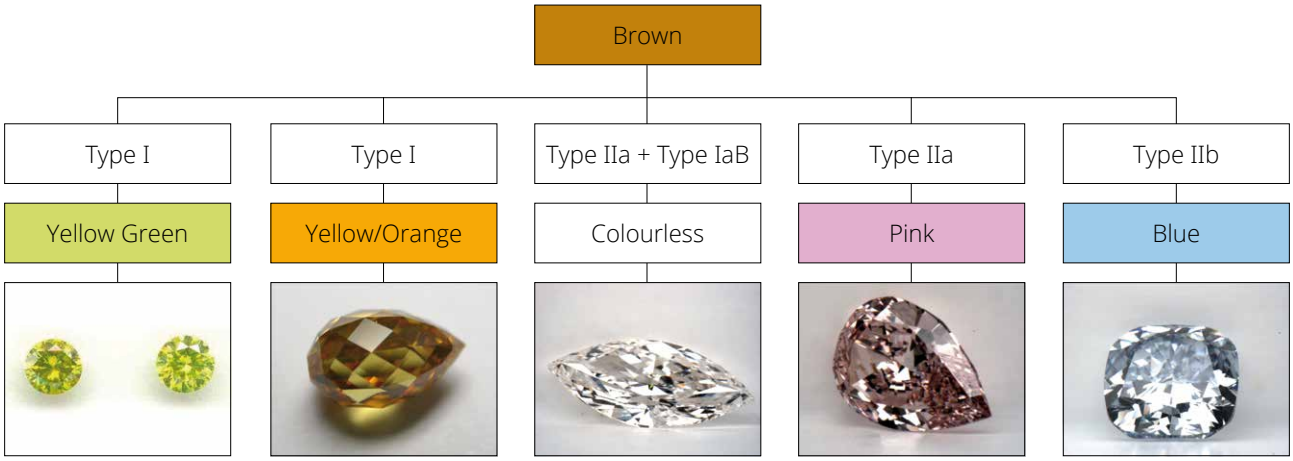
LPHT colour treatment

LPHT (Low Pressure High Temperature) is a colour treatment that just like HPHT(High Pressure High Temperature) treatment aims to decrease the brown colour in type II diamonds. In 2008 a group of scientists at the Carnegie Institution of Washington published their findings on LPHT on CVD lab grown diamonds.

How does it work?

LPHT is a technique performed out of the range of stability of diamond. Diamonds are treated in an hydrogen rich environment at temperatures up to 2200 °C using a microwave plasma at pressures below atmospheric pressure. The advantage of this treatment is that it is no longer required to use expensive and time consuming high pressures up to 60.000 atm and it has the possibility to treat many diamonds in one run.

Although the process is not yet commercially available, detection protocols are being developed to identify diamonds that have been LPHT treated, because any treatment that enhances a diamond's natural properties is a concern to the diamond industry where full disclosure is the fundamental for consumer confidence.



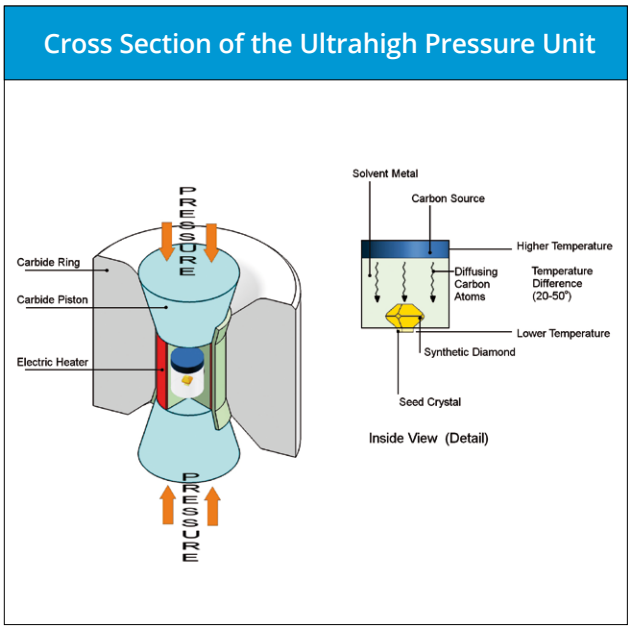
What you need to know about lab grown diamonds

HPHT synthesis

The purpose of this technique is to produce a diamond by simulating the growth conditions of diamonds deep in the earth. By applying a high pressure (HP) and high temperature (HT) to a carbon source, one 'forges' a lab-grown diamond. Since the seventies, gem quality diamonds have been produced by HPHT synthesis.

By keeping the conditions stable for a longer time, one can 'grow' a rough diamond up to 10 carats in just a few days.

The majority of these HPHT stones are bright yellow to orange due to the presence of nitrogen atoms in the crystal lattice. They are type Ib diamonds. It is also possible to grow colourless diamonds.

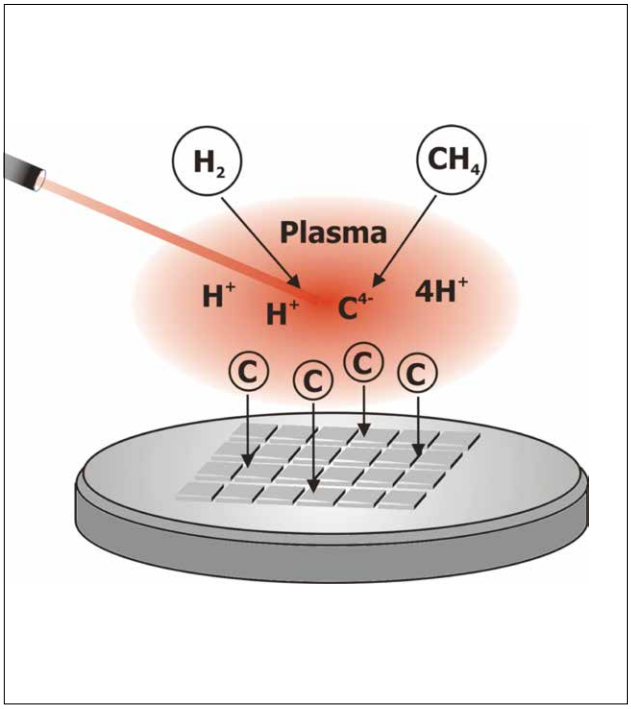


CVD synthesis

Chemical Vapour Deposition is the process through which a diamond is produced from a carbon rich gas. The principle was already known in the nineteen thirties, but it took until the beginning of this century before one succeeded in growing larger single diamond crystals instead of polycrystalline material.

The gas (methane e.g.) is heated to a very high temperature. Atom compounds are then broken down. As a result carbon atoms can be 'precipitated' onto a substrate. Under the right conditions, a single crystal is layer by layer. A gem quality diamond grows half a millimetre a day.

CVD diamonds are - considering the complexity of the process - usually light brown. However, the brown colour can be removed using HPHT treatment.



D-SCREEN

Compact, **reliable** and **fast!**

What you need to know about your D-Screen

A D-Screen is not developed to distinguish simulants such as cubic zirconia (CZ) and moissanite. Non-destructive testing methods are used to distinguish diamond from simulants, based on their different material properties. Amongst the testing methods used are: optical inspection, gem testers, hardness pencils and/or density measurements.

How to use your D-Screen?

Make sure that the stone is a polished diamond (one facet is enough), colour D to J, weighing between 0,20 and 10 carat.
Place the diamond table downwards on the detector. Close the device. After a few seconds, the result appears on one of the indicators:

Green indicator:
the stone is not synthetic and not HPHT colour enhanced.

Orange indicator:
the stone may be synthetic (laboratory grown) or HPHT colour enhanced, the stone requires further examination in a laboratory.

Red indicator:
low battery voltage or defective device.

D-Screen characteristics

Compact size:	40 x 50 x 150 mm
Use:	battery or AC (including cable)
Weight:	325 g, including battery
Power supply:	9 V DC, 250 mA
Adaptor input:	110-230 V, 50/60 Hz
Adaptor output:	9 V DC, 300 mA

The benefits of D-Screen

- Easy check to see if your stones are not lab grown or HPHT colour enhanced
- Fast and correct result
- Compact
- User-friendly
- Ergonomic
- Portable (battery)
- Price/quality
- Suitable for all diamond cuts
- Screening of ± 200 stones/hour

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