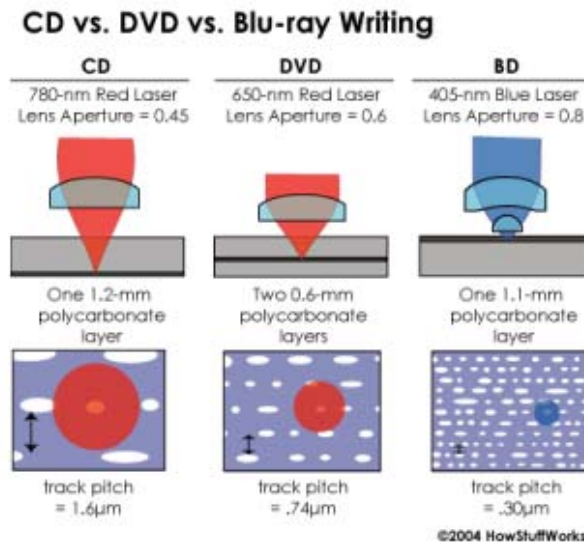


Blu-Ray Wins Format War



Blu-Ray Scratch Repair FAQ's

The Blu-Ray Disc has now been declared the winner in the new High Definition Disc format Battle. Toshiba Corporation officially announced they are withdrawing the competing format HD-DVD. What does this mean to you? How is this going to affect the Disc Repair Business? We have put together some frequently asked questions, and information regarding Blu-Ray to help you understand what this means to your business and disc collections.

Frequently Asked Questions:

Q: Are Blu-Ray Discs made the same as other discs such as DVDs and CDs?

A: Yes and No, Yes they are made using nearly the same manufacturing process, and no the data is not stored in the disc the same as CDs & DVDs. The main difference is the data layer is very close to the read side of the disc, 8% deep in fact. Compared to a DVD where the data layer located 50% deep. Music CDs have the data stored just below the Printed Label, or 99% deep from the reading side. This means a Music CD can be scratched and repaired far more times than any other format. A DVD can be repaired half as much, and now the Blu-Ray disc, has a narrow window of plastic that can be scratched and repaired... scratch them too deep, and you hit the data layer....

Q: Do Blu-Ray Discs Get Scratched?

A: Yes, they still get scratched, although not as often when compared to a softer Music CD, or DVD. Deep Scratches in Blu-Ray Discs can permanently ruin the disc. Mostly due to the fact that the information is VERY close to the reading surface, if a scratch is as deep as 7-8% it can actually penetrate the data layer, ruining it forever! Deep Scratches on Blu-Ray Discs can be Fatal to the disc!

Q: Is it true that Blu-Ray Discs are hard coated?

A: Yes, turns out it is a great protector against the casual "light" scuffs & light abrasions.

Q: Are Blu-Ray Discs Repairable? If yes...How Deep of a Scratch can you repair?

A: Yes, however it is important to know how Blu-Ray differs from other discs.

Note that the Blu-Ray has the least amount of protection when compared to ANY other format FAR LESS!

1) A Blu-Ray disc has only an 8% Protection layer before you can scratch (from read side) into the actual data layer. This layer is Pure Hard Coat material, and is not made from standard polycarbonate like all other disc formats, since it is hard coated and must be repaired differently.

2) DVDs & HD-DVDs Have up to a 50% Polycarbonate protection layer (from read side) that can be scratched and repaired. (Double sided DVDs have 25% per side)

3) CD-ROMs and CDR discs, have a 99% Polycarbonate protection layer (from read side) that can be scratched and repaired.

Q: Can you remove the hard coat & then repair the disc?

A: No, once you understand how Blu-Ray discs are made, you will see that the 8% coating layer is a single layer of hard coating laid directly onto the data layer. Therefore if you remove the hard coated layer you have reached the data, keep removing material and you will wipe the data off the disc completely.

Q: Can you use HEAT and PRESSURE to remold or smooth the scratches out?

A: NO! Although there are companies claiming to do so, they are distorting the facts, they are not directly applying heat, or even pressure, what they are doing is dry or damp buffing, buffing does create heat, and too much heat warps the data layer by distorting the pits and lands that make up the data layer. Too much heat, you ruin a disc permanently. A true Pressure / Heat Design would work like an Iron, it would heat up a smooth surface, and apply pressure with that hot smooth surface. Dry or Damp buffing creates uneven heat, where the disc gets hot in spots, and cooler in others, causing warping of the microscopic pits (data layer). This is why a disc can look ok, but won't read after repair in a dry or damp buffing machine. Our first design machines used this technology way back in 1995, it was invented and patented by Jason Bauer, and has since evolved to a much more detailed science.

Q: How do you PROPERLY repair a Blu-Ray Disc?

A: Scratches in the hard coat of the disc needs to be buffed out smoothly and evenly. This is done by using a liquid polishing compound mixture that contains lubricants and cooling agents. The polish compound contains microscopic abrasives which polish the surface down slowly (just like toothpaste does to your teeth) it's not aggressive like sandpaper. A constant stream embedded in a liquid coolant keeps the heat down and the disc at an even temperature throughout the entire cycle. The lubricants prevent biting into the scratches which cause burnishing... or flash overheating of a spot. The lubricants also break down grease and oils that come from peoples fingers, allowing the surface to be polished to a mirror like quality. Blu-Ray Polishing takes longer because of the hard coat, it has to be done smoothly and evenly. The only way to speed this process up, is to use a constant flow of blended polish with coolant and lubricants. Azuradisc invented just such a product, called POLICOOL (TM), it will keep the disc cool, lubricated, break down the oils, and allow faster RPMS so the disc can be repaired in a much shorter period of time.

Pressure is also key, too much, and heat builds, not enough and the time cycle gets ridiculous long. Azuradisc Patented the process, and is the only company to develop this liquid specifically for Hard Coated discs such as the BLU-RAY. Other buffing machines can repair these discs too, but will take significantly longer, and cost a lot more to repair. Most companies use only polish compound, and do not add lubricants, or coolants, and use buffing pads that overheat the surface. The Most Advanced systems use Policool with a Radiator, that also removes heat from the Policool... this reduces repair times by large margins. Additionally these liquids have a specific useful life, go past it, and you start damaging discs, change it too soon and you waste money. This is why Azuradisc uses smart chip technology that measures the useful life of the liquid, to ensure you get the maximum useful life out of the liquid. It eliminates the guess work. You change your oil in your car at intervals for the same reason, it breaks down overtime, go too long and damage occurs, change it too soon, and you waste money. Policool with Microchip technology makes it a no brainer, just change the cartridge when the light comes on... no tracking or guessing or ruining \$50-\$60 discs before realizing your liquid is not affective and has burned up a disc or two. Smart cartridges make this super easy to work with.

Q: Can you use Paper or Fixed Abrasives on BLU-RAY Discs?

A: It's possible, but none have been found to be efficient enough yet. Fixed abrasives remove material quickly, and often fight against the hard coat on Blu-Ray Discs.... liquid cooled buffing is the current recommended method for repairing BRD.

Q: Are Blu-Ray Discs readable in DVD or CD Players?

A: No, they are not compatible with any other player, however Blu-Ray players will play DVD discs. Also the Play station 3 video game console can play PS3, DVD and Blu-Ray discs all in one drive. However the newest generation of the PS3 Consoles have removed the ability to play older PS1 & PS2 discs.... so if an older video game disc is not loading in your new PS3 console, it may still be a good disc, that just needs to be played on an older console.

May 4th 2007

Blu-Ray Update concerning Disc Repairs.

As the new Blu-Ray Disc is now beginning to penetrate the market place, there are many questions and concerns regarding its properties, specifically if it scratches and if they are repairable with Azuradisc Disc Repair machines. To date we have seen very few of these discs come to us in need of repair, therefore our testing of repairing these scratched discs is limited.

There are some key Differences about Blu-Ray when compared to other formats and repair ability. Below I will post several frequently asked questions and our current answers.

Q: Are Blu-Ray Discs made the same as other discs or HD-DVD discs?

A: No, Blu-Ray Discs use a different frequency of light to read discs, they are not compatible with HD-DVD disc players or any other non Blu-ray Disc readers. See more details below regarding the specifications.

Q: Is it true that Blu-Ray Discs are hard coated?

A: Yes, turns out it is a great protector against the casual "light" scuffs other light abrasions however they do still get scratched. *Much of what appears to be scratches on these discs, are truly only marks on the hard coat and therefore can easily cleaned with a proper Anti-Static Wiping cloth and good spray cleaner such as the Azuradisc Spray cleaners and wipes.*

Q: Are Blu-Ray Discs Repairable? If So...How Deep of a Scratch can you repair?

A: Yes, however it is important to know how Blu-Ray differs from other discs.

Note that the Blu-Ray has the least amount of protection when compared to ANY other format FAR LESS!

- 1). A Blu-Ray disc has only an 8% Protection layer before you can scratch (from read side) into the actual data layer. This layer is Pure Hard Coat material, and is not made from standard polycarbonate like all other disc formats it is hard coated and must be repaired differently.
- 2) DVDs & HD-DVDs Have up to a 50% Polycarbonate protection layer (from read side) that can be scratched and repaired.
- 3) CD-ROMs and CDR discs, have a 99% Polycarbonate protection layer (from read side) that can be scratched and repaired.

Q: Can you remove the hard coat & then repair the disc?

A: No, once you understand how Blu-Ray discs are made, you will see that the 8% coating layer is a single layer of hard coating. Therefore if you remove the hard coated layer you have reached the data layer.

Q: How do you repair a Blu-Ray Disc?

A: essentially it must be repeatedly buffed, the hard coat must be re-smoothed back out. This requires using professional grade disc repair machines, and takes much longer since the hard coat is the layer that you are actually repairing. Currently Using abrasive steps is not recommended, because they can further scratch the disc, and make polishing steps even longer. We are researching additional methods to repair these discs faster, however it can take up to 5 times longer to repair a Blu-Ray disc compared to a CD or DVD.

To see how Blu-Ray Discs are made, scroll down...

Building a Blu-ray Disc

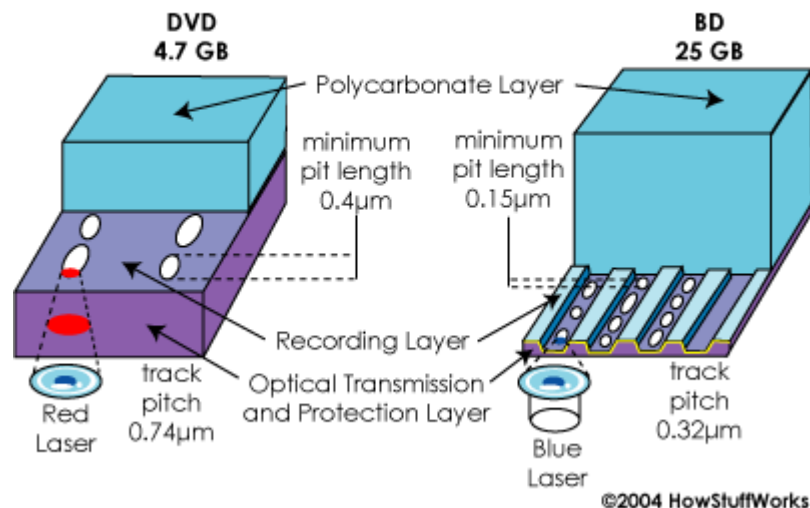
Blu-ray discs not only have more storage capacity than traditional DVDs, but they also offer a new level of **interactivity**. Users will be able to **connect to the Internet** and instantly download subtitles and other interactive movie features. With Blu-ray, you can:

- **record high-definition television (HDTV) without any quality loss**
- **instantly skip to any spot on the disc**
- **record one program while watching another** on the disc
- **create playlists**
- **edit or reorder programs** recorded on the disc
- **automatically search for an empty space on the disc** to avoid recording over a program
- **access the Web to download subtitles and other extra features**

Discs store digitally encoded video and audio information in **pits** -- spiral grooves that run from the center of the disc to its edges. A **laser** reads the other side of these pits -- the **bumps** -- to play the movie or program that is stored on the DVD. The more data that is contained on a disc, the smaller and more closely packed the pits must be. The smaller the pits (and therefore the bumps), the more precise the reading laser must be.

Unlike current DVDs, which use a **red laser** to read and write data, Blu-ray uses a **blue laser** (which is where the format gets its name). A blue laser has a **shorter wavelength (405 nanometers)** than a red laser (650 nanometers). The smaller beam focuses more precisely, enabling it to read information recorded in pits that are only **0.15 microns (μm)** (1 micron = 10^{-6} meters) long -- this is more than twice as small as the pits on a DVD. Plus, Blu-ray has reduced the **track pitch** from 0.74 microns to **0.32 microns**. The smaller pits, smaller beam and shorter track pitch together enable a single-layer Blu-ray disc to hold more than 25 GB of information -- about five times the amount of information that can be stored on a DVD.

DVD Vs. Blu-Ray Construction



Source: Blu-ray Disc Association

Each Blu-ray disc is about the same thickness (**1.2 millimeters**) as a DVD. But the two types of discs store data differently. In a DVD, the data is sandwiched between two polycarbonate layers, each 0.6-mm thick. Having a polycarbonate layer on top of the data can cause a problem called **birefringence**, in which the substrate layer refracts the laser light into two separate beams. If the beam is split too widely, the disc cannot be read. Also, if the DVD surface is not exactly flat, and is therefore not exactly perpendicular to the beam, it can lead to a problem known as **disc tilt**, in which the laser beam is distorted. All of these issues lead to a very involved manufacturing process.

Learn how Blu-ray overcomes these obstacles in the next section.

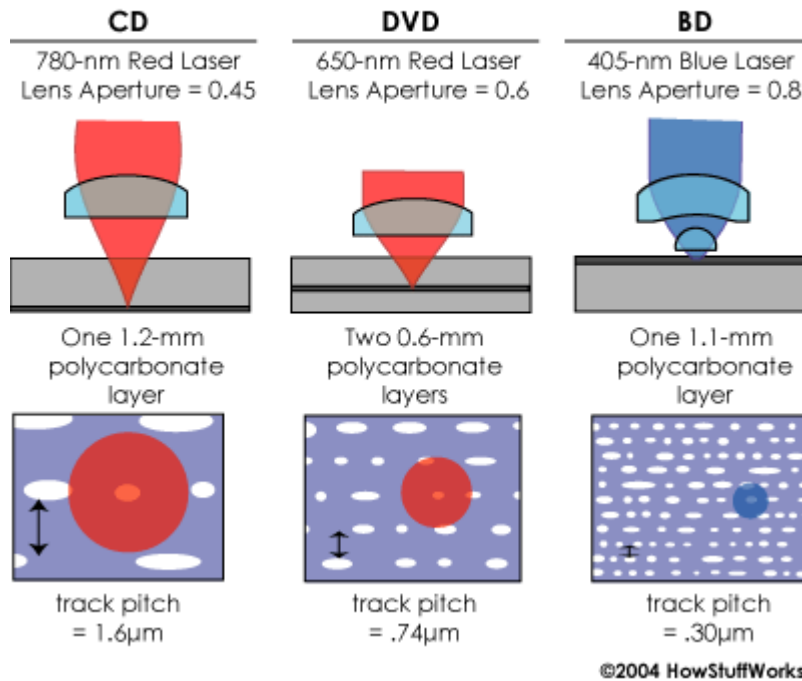
How Blu-ray Reads Data

The Blu-ray disc overcomes DVD-reading issues by placing the data **on top of a 1.1-mm-thick polycarbonate layer**. Having the data on top prevents birefringence and therefore prevents readability problems. And, with the recording layer sitting **closer to the objective lens** of the reading mechanism, the problem of disc tilt is virtually eliminated. Because the data is closer to the surface, a hard coating is placed on the outside of the disc to protect it from scratches and fingerprints.

On Guard

Blu-ray discs are better armed than current DVDs. They come equipped with a **secure encryption system** -- a unique ID that protects against video piracy and copyright infringement.

CD vs. DVD vs. Blu-ray Writing



Source: Blu-ray Disc Association

The design of the Blu-ray discs saves on manufacturing costs. Traditional DVDs are built by injection molding the two 0.6-mm discs between which the recording layer is sandwiched. The process must be done very carefully to prevent birefringence.

1. The two discs are molded.
2. The recording layer is added to one of the discs.
3. The two discs are glued together.

Blu-ray discs only do the injection-molding process on a single 1.1-mm disc, which reduces cost. That savings balances out the cost of adding the protective layer, so the end price is **no more than the price of a regular DVD**.

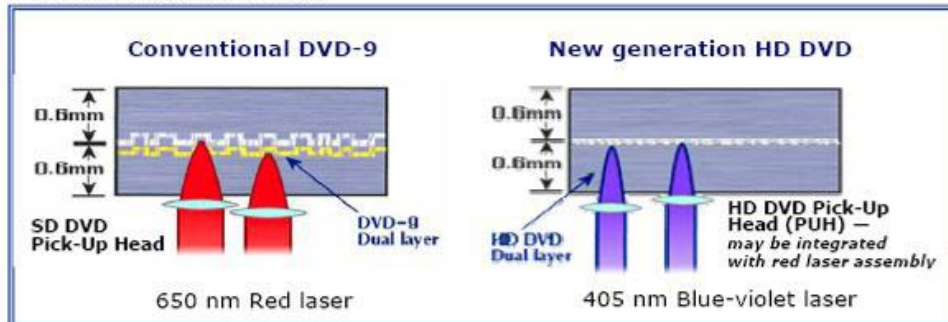


Photo courtesy [Blu-ray Disc Association](#)

A BD-ROM disc researcher holds a disc up to the light.

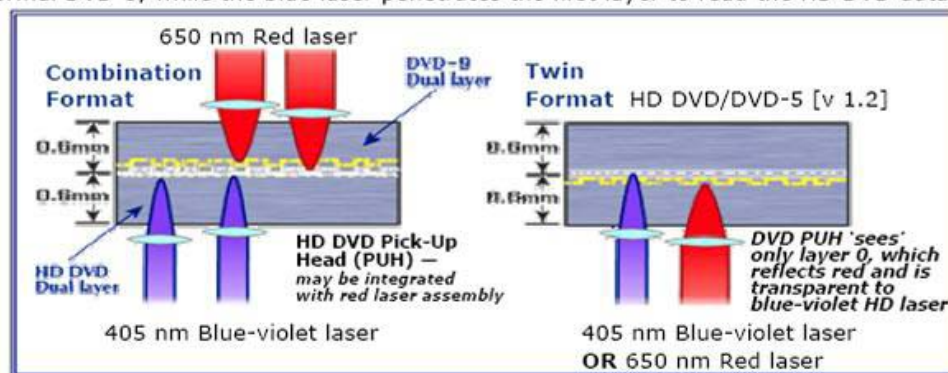
Blu-ray also has a **higher data transfer rate -- 36 Mbps** (megabits per second) -- than today's DVDs, which transfer at 10 Mbps. A Blu-ray disc can record 25 GB of material in just over an hour and a half.

Note: In the following illustrations, multiple laser beams are shown for convenience, both above and below the disc. In actual HD DVD drives there is a single laser beam, which illuminates the disc from below.



Although the data density is much greater in HD DVD discs, the structure is very similar to existing DVDs. Discs may be single or double-sided, giving a total storage potential of 60GB on a single disc.

Alternative architectures include the 'Combination' disc, in which one side may be a conventional DVD-9 and the other a dual layer HD DVD. This offers a single inventory product for retailers and a future-proof acquisition for consumers. There is also a technology proposal, approved by the DVD Forum as a format option in HD DVD-ROM version 1.2, for a 'Twin format' disc, in which the layer closest to the pick-up head is reflective to red and transparent to blue-violet light. With this structure, a conventional DVD video player 'sees' the disc as a normal DVD-5, while the blue laser penetrates the first layer to read the HD DVD data behind.



To summarize the family of HD DVD discs:

- **HD DVD-ROM** is a 12cm disc, 1.2mm thick, replicated as either single or dual layer, with a storage capacity of 15GB for a single layer and 30GB for a dual layer disc. Double sided versions increase capacity to 30GB and 60GB respectively.
- **3X DVD-ROM** Brings the higher data rate of HD DVD to the conventional format, enabling 135 minutes of HD content to be placed on a DVD-ROM, using AVC or VC-1 codecs.
- **8 cm mini HD DVD** offers 4.7GB in single layer form and 9.4GB as dual layer. A double-sided disc is part of the standard.
- **HD DVD-R** write once discs can hold 15 GB per side, 30GB total.
- **HD DVD-RW** re-writable discs store 20GB on each side, 40GB total.

Parameters	Blu-ray	DVD
Storage capacity	25GB (single-layer) 50GB (dual-layer)	4.7GB (single-layer) 8.5GB (dual-layer)
Laser wavelength	405nm (blue laser)	650nm (red laser)
Numerical aperture (NA)	0.85	0.60
Disc diameter	120mm	120mm
Disc thickness	1.2mm	1.2mm
Protection layer	0.1mm	0.6mm
Hard coating	Yes	No
Track pitch	0.32µm	0.74µm
Data transfer rate (data)	36.0Mbps (1x)	11.08Mbps (1x)
Data transfer rate (video/audio)	54.0Mbps (1.5x)	10.08Mbps (<1x)
Video resolution (max)	1920×1080 (1080p)	720×480/720×576 (480i/576i)
Video bit rate (max)	40.0Mbps	9.8Mbps

Parameters	Blu-ray	HD-DVD
Storage capacity	25GB (single-layer) 50GB (dual-layer)	15GB (single-layer) 30GB (dual-layer)
Laser wavelength	405nm (blue laser)	405nm (blue laser)
Numerical aperture (NA)	0.85	0.65
Disc diameter	120mm	120mm
Disc thickness	1.2mm	1.2mm
Protection layer	0.1mm	0.6mm
Hard coating	Yes	No
Track pitch	0.32µm	0.40µm
Data transfer rate (data)	36.0Mbps (1x)	36.55Mbps (1x)
Data transfer rate (video/audio)	54.0Mbps (1.5x)	36.55Mbps (1x)
Video resolution (max)	1920×1080 (1080p)	1920×1080 (1080p)
Video bit rate (max)	40.0Mbps	28.0Mbps
Video codecs	MPEG-2	MPEG-2
Audio codecs	MPEG-4 AVC SMPTE VC-1 Linear PCM Dolby Digital Dolby Digital Plus Dolby TrueHD DTS Digital Surround DTS-HD	MPEG-4 AVC SMPTE VC-1 Linear PCM Dolby Digital Dolby Digital Plus Dolby TrueHD DTS Digital Surround DTS-HD
Interactivity	BD-J	HDi