Toner based printing refers to the technology Oki Data uses in C900 series of Color LED printers.

As this guide is written for a specific machine / series, other Oki Data engines may not utilize this exact technology.
Many of the problems associated with toner based printing involve output defects. "My paper has a stripe running through it!" or "The print is light / dark / not there." If you understand the basic of xerography you can often explain the problem to the customer and identify the problem component – if there is one!

While the xerographic process is universal – manufacturers use different charge voltages; voltage polarities; light sources; how they charge drums, toners and media – but the theory is the same.
Electrically charged particles will move from a negative charge towards a more positive charge.

This is the foundation of xerographic printing.

In an Oki printer if I want a toner particle to move to the drum surface, I must make the charge on the drum surface more positive than the toner particles charge. To then move that toner particle on the drum to the transfer belt and onto the media (paper) I must make the paper more positive than the drum & toner particle.

With an Oki printer, to prevent toner particles from being transferred to the drum, the drum is made more negative than the toner particles. This prevents the toner particle from being attracted to the drum.
The OPC (organic photo conductor) drum drives the entire print process. The OPC drum consists of a nonconductive (organic) coating on a nonferrous (aluminum) substrate.

The OPC drum has a limited life as it is used in an abrasive environment in which its surface is worn down by toner, cleaning blades, and paper dust. Other life “shortening” events include:

- Physical damage inflicted on the OPC drum.
- Extended exposure to ambient light; the stronger the light or the longer the drum is exposed, the more damage occurs.
- Normal exposure to light and the environment.
- Any foreign substance like fingerprints, dirt, white-out, dust, etc will both act as an abrasive and prevent the OPC drum from acting as the insulator / conductor which is critical in the printers operation.

This will be will be discussed in the next slide.

**NOTE:** OPC Drum Cartridges can be referred to by many names, e.g, Drums, EP Cartridges (Electro Photographic), Drum Cartridges. Whatever they’re called, the function is the same:

*In the dark, the OPC coating is an Insulator. When any area of the OPC coating is exposed to light that specific area becomes a conductor.*
As you saw in the previous slide, the OPC drum has a very thin coating of an Organic Photo Conductor on its surface. The OPC layer exhibits the properties of an insulator (non-conductor) in darkness and a conductor when exposed to light.

Thinking back to the information presented in slide #4, “Electrically charged particles will move from a negative charge towards a more positive charge” - how does the OPC aid in toner transfer?

Oki Data printers place their OPC Drums in a mechanism that keeps them away from extraneous light. The aluminum base tube is connected to electrical ground.

At the start of a print cycle, a highly negative charge is placed on the surface of the OPC drum. As the OPC Drum rotates, it is exposed by the Light Emitting Diodes (LED) that Oki Data uses to “paint” the image on the drum. Wherever the LED’s turn on, they expose that small area of the drum – and the exposed area changes from the properties of an insulator to a conductor. Since the area of the drum that’s been exposed is now a conductor, that area now conducts the surface charge to the aluminum tube – which is connected to electrical ground – and the charge is removed.
When the printer is preparing to print, the Charge Roller Power Supply starts sending a negative 1,000 volts to the Charge Roller. This Charge Roller is located in the OPC Drum Cartridge. As the OPC Drum and Charge Roller rotate together, a thin film of negatively charged particles (Electrons) are deposited on the surface of the drum. As you can see, the center of the drum is connected to ground. As ground is far more positive than the electrons sitting on the surface of the drum, those electrons would love to get to that (more positive) ground but they are blocked as the OPC coating on the drum is acting as an insulator.

As the OPC Drum Cartridge is inside the printer – in the dark – the OPC Drum surface acts as an insulator and these electrons (approximately a negative 900 volt charge) sit on the OPC Drum surface.
The drum continues to rotate as illustrated above. As the negatively charged surface rotates under the Light Emitting Diode (LED) print head that Oki Data uses for exposure, the drum surface is still an insulator. Wherever data is to be printed, the LED’s for that section of the OPC drum will illuminate. This illumination will cause those areas of the drum to become conductive – and the electrons will be conducted to the aluminum base tube and to ground. Those exposed areas of the drum will carry a much less negative voltage (negative 10 volts). Areas that will not be printed continue to carry the negative charge (negative 900 volts).

The exposed area of the OPC Drum now carries a “latent image” – an image that cannot be seen with the human eye – it’s purely an electrostatic image.
The exposed area of the drum rotates to the Developing section. In this section the toner is attracted to a series of foam rollers. The first roller is called the toner supply roller and it has been charged to a negative 450 volts by another Power Supply within the printer. The Toner Supply Sponge Roller is in the toner well and is in contact with the toner particles. As the Toner Supply Roller rotates in the toner, the toner is picked up and charged. The Toner Supply Roller contacts the Development Roller – which is charged to a negative 300 volts. As the Development Roller has a more positive charge than the Toner Supply Roller, the toner particles are attracted to it. At this point the toner particles themselves have been charged with a negative voltage of about negative 250 volts.

The Development Roller is now coated with negatively charged toner particles. Within the drum cartridge is a “doctor blade” whose function is to insure a uniformly thin and even coating of toner on the development roller prior to its contacting the OPC drum surface. These negatively charged toner particles are brought up against the surface of the drum. Areas of the drum that have been exposed via the LED head will be holding a much more positive voltage than the toner particles – and the toner particles will be attracted to that area of the drum.

- Any areas of the drum that have not been exposed will still be carrying a negative 900 volts. As the toner particles are holding a negative 250 volt charge, they will be repelled from this area of the drum.
The drum is now carrying the toner-based image after passing through the Development section. It now contacts the surface of the transfer belt which has passed over a First transfer roller which is located under the belt, directly below the drum. The First transfer roller is charged by a third power supply within the printer to a positive 2,000 volts. When the transfer belt contacts the OPC Drum any toner on the OPC Drum is still carrying a negative charge of about 300 volts. It is strongly attracted to the positive 6,000 volts – and the toner is transferred to the belt.

Areas of the drum that were not exposed are not carrying any toner so there isn’t any toner to attract. The negative charge on those areas of the drum are partially discharged by contacting the positively charged belt.

**NOTE:** If you were to shut down the printer (power off or open a cover) prior to the completion of the transferring of the toner to the transfer belt, take the OPC drum cartridge out and look on the bottom surface of the OPC drum, you would see the image still to be transferred on the drums surface. This is something to remember when troubleshooting an image problem where the complaint is no image or a light image. If the drum surface shows the toner to be dark and saturated, then the first 3 steps of the xerographic process (Charging; Exposing; and Development) are working normally. The problem could then lie either with the transferring stage (poor transfer) or in the next step, fusing.

The transfer belt / First transfer roller is located below the OPC drum and is not part of the OPC drum cartridge.
Now we’ll look at all 4 (or 5) print stations as a unit. As the Transfer Belt is rotating, it picks up the toner from each of the print stations and the image is built color-by-color on the transfer belt. Each of the print stations has its own First transfer roller to successfully “pull” the toner from the drum surface to the transfer belt.

As the transfer belt is being rotated, the media is being pulled into the printer, towards the Second transfer roller unit. The upper roller in the Second transfer roller unit (which is actually under the belt surface, within the Transfer belt) is being charged to a highly negative voltage (-2000 Volts). This will cause the toner on the transfer belt to be attracted to the much more positive lower Second transfer roller (which is actually being held at ground) – but the media will be between the belt / toner and the lower Transfer roller, with the net effect that the toner will be transferred to the media.

**NOTE:** This is the first Oki Data engine to utilize this method of building the image on the belt and then transferring that image to the media – in one direct step.
As the media continues past the OPC Drum cartridge and Transfer Roller, the toner particles are being held to the transfer belt / media by the electrostatic attraction of the negatively charged toner against the more positively charged media. This is a weak attraction that can be broken by a breath of air or a gentle brushing action. What’s needed is a high temperature / high pressure treatment. The printers Fuser performs this action.

The next slide explains the fuser in the C900 series.

What could prevent complete fusing other than a defective fuser?

1. **Incorrect Media Settings.** If the user is printing on heavy stock (card stock, labels, transparencies) and has not changed the media setting in the software driver, the fuser may not be hot enough to completely fuse the toner into the surface of the media selected.

2. **Incorrect Media.** Oki Data makes specific media recommendations for our toner-based printers. Media that has too rough a surface or is out of the media specification could cause incomplete / incorrect media fusing.

In both cases, always check the media / media settings with the customer prior to assuming that the fuser in the problem!
In the C900 series of printers, Oki Data has switched to a solid state heater assembly that heats a fuser belt and fuser roller. In most previous Oki Data engines, there were quartz lamps installed in the Fuser / Pressure Rollers – and those lamps actually heated the rollers to fuse the toner to the media. The downside to that technology is (1) fuser warm up time (2) fuser temperature control and (3) heat distribution.

By utilizing a heater assembly above the rollers, Oki has a much quicker time-to-temperature; has better temperature regulation; and, by using a fuser belt, has a longer contact time for the toner to melt into the media.

In the C900 series, Oki Data is utilizing a segmented heating element to more precisely control where the heat is applied on the roller / belt.

This all adds up to a quicker initial time-to-print; more precise temperature monitoring / control and; delivering the heat across the surface of the fuser where it’s needed.
Waste Toner – Drum:
Any remaining toner on the drum units is removed by a drum cleaning blade within the drum cartridge and deposited into the transfer belt for disposal in the waste toner box.

Waste Toner – Transfer Belt:
Any waste toner from the transfer belt is removed by a cleaning blade within the Transfer belt assembly and then deposited in the waste toner box.

Waste Toner - Second Transfer Roller:
Any waste toner that is deposited on the secondary transfer roller is transferred to the Transfer Belt by reversing the charge on the belt to attract the toner from the roller to the belt and then this toner is disposed of by the cleaning blade within the transfer belt.

The waste toner box is treated as a consumable and is replaced when it is full.
Understanding Self Checks:

1. What would you expect the printed results to be when there is a “dead” Charge Roller power supply?
   a. What other problem / condition could give a similar result as far as printed output
   b. How could you identify which component is responsible for the printed output?

2. In the printed output the black text is uniformly light or washed out. What component(s) would you suspect as being a cause of this problem? How can you prove your theory?

3. The ground contact for the OPC Drum Cartridge is corroded and there is no electrical contact. What would you expect the printed output to look like?

4. The Doctor Blade is defective. What would you expect the output of the Demo Page to look like? What component would you replace to correct the problem?

5. The customer states that they’re printing a large color photograph of their home. On the green grass portion of their picture some of the grass looks more blue than green. When making several prints in a row, the problem in the grass color happens – but in different areas of the picture. What would you suspect the problem to be related to? What would you suggest they check to correct the output problems.
Reviewing the Course Objectives:
This course was designed to give you a better understanding of how toner based printers work as well as some basics for the troubleshooting of image problems.

As you went through the “Understanding Self Checks” at the end of the course it should be apparent that most image problems could be caused by one of several different problems. With a solid understanding of xerographic printing, you should be able to ask “the right questions” to point out the component most likely creating the problem. **Beware: Don’t paint yourself into a corner.** Remember that you’re making a determination on a problem with a customer over the phone! The customer’s interpretation may lead you down the incorrect path and may result in an irate customer calling back, telling you that “you said it was a drum problem” – but a new drum didn’t fix the problem.

A good understanding of xerographic printing will make problem diagnosing much easier. Take your time, draw out the problem and see what components could be causing the output problem. Ask questions, pay attention to the answers and use your knowledge of xerography to point out the likely cause of the problem.