LASER LIFE

Laser life is rightfully a concern when making any CTP purchase. At BWI, we try to provide our customers with reliable information on the prior usage of the platesetters we have available, and a reasonable idea of the future life of these machines. Unfortunately, it is impossible to provide a definitive answer to the much-asked question by CTP buyers, “how long will the laser last”. Part of the reason for this is the nature of lasers themselves. Lasers are sensitive to static, temperature, power settings, and other variables that can affect the life of a given laser. Furthermore, platesetter manufacturers may provide statistical odds of laser life, but nothing “set in stone” that you can rely on. However, there are some factors that effect laser life that are quantifiable, and which can be used to try to predict the estimated remaining life of a laser. These factors include:

Hours of Use — Obviously, how much the laser has already been used will affect its remaining life. Most platesetters are designed so that the laser is in “standby mode” when the machine is turned on to avoid a warm-up period. The laser only emits and registers usage when the machine is actually imaging a plate. It is this actual imaging time that is of importance.

Wattage — The wattage setting of a laser head also affects its potential life. As a rule, the higher the wattage of the laser, the lower its potential life.

Output Power — If a laser is operated above or below the recommended power settings, its life will be reduced or extended accordingly. There are power settings within the machine parameters on most platesetters.

When a customer asks how long a laser will last, we also look to our own experience with that equipment. We’ve seen many Creo Trendsetters and Screen PT-Rs, thus we have a relatively good sense of what can be expected with these machines as it relates to laser life. We will try to impart some of our experience later in this section. Unfortunately, we have little or no experience with some other models, such as Agfa Xcaliburs and Avalons, Heidelberg Suprasetters, etc. What little information we have on these particular machines as it relates to their laser life was included in the “Laser Design” section. Details on how to access the usage logs for various machines are listed at the end of this section on page 25.

Thermal Lasers

The following are the odds, represented by one diode manufacturer, for the life expectancy of an 830 nm laser diode when operated at normal power. We suspect that these odds are conservative, as it is unlikely the manufacturer’s legal department would have allowed any risk of exaggeration in this area.

Hours Laser has Imaged	Failure Rate	Survival Rate
2,500	3%	97%
5,000	25%	75%
7,500	65%	35%
8,700	80%	20%
10,000	100%	0%

Although this table of “odds” provides guidance for what might be expected as a loss factor, it still does not answer the question of how long the average 830 nm laser diode can be expected to last. To answer this question, we applied these odds to a theoretical population of 100 laser diodes. According to our calculations, the average life of a single diode is approximately 6,000 hours.

Our calculation method follows: (for simplicity, we assumed the diodes failed halfway through each incremental period.)

Calculation of the average life of a population of 100 laser diodes

			History of 100 Diodes		**History of Exposure Hours**		**Total Exposure Hours**	
Exposure Hours	**Failure Rate**	**Survivors**	**Failures**	**Survivors**	**Failures**	**Survivors**	**Failures**	**Survivors**
0 - 2,500	3%		3.00	97.00	1,250	2,500	3,750	242,500
2,500 - 5,000	25%	x 97	24.25	72.75	1,250	2,500	30,312	181,875
5,000 - 7,500	65%	x 72.75	47.29	25.46	1,250	2,500	59,113	63,650
7,500 - 8,700	80%	x 25.46	20.37	5.09	600	1,200	12,222	6,108
8,700 - 10,000	100%	x 5.09	5.09		650	-0-	3,309	-0-_
			100.0				108,706	494,133

108,706 + 494,133 = **602,839 TOTAL HOURS**

We then took the total hours exposed as calculated (602,839) and divided by the quantity of diodes (100) to arrive at the average exposure hours for each diode of 6,028 hours. While these results of approximately 6,000 hours are credible based on our experience with Trendsetters and PT-Rs, it is unclear whether these results would be repeated using the “real world” data most likely known to manufacturers that BWI cannot obtain. In all likelihood, this 6,000 hour life will produce 100,000 to 200,000 8 up plates over the average laser’s life, depending on the speed of the platesetter and sensitivity of the media being imaged.

Creo Laser Head - Estimating Remaining Life

When attempting to determine the remaining life of a Trendsetter laser head, it is helpful to possess an understanding of the engineering of this head. The laser portion of the head is actually an interlocking chain of 19 laser diodes, which are molded to form a single bar. This arrangement does not permit the replacement of individual diodes, unlike equipment engineered with laser diode array technology. Rather, replacing a laser requires replacement of the entire laser head. While this is extremely costly (approximately $32,500), on the flip side, the loss of a single diode does not hinder the operation of the head. It is possible to lose up to five diodes before the laser head fails. Each time a diode fails, this loss has the effect of placing more burden upon the remaining diodes, requiring them to pull more amperage to maintain a constant level of laser intensity. While the laser will continue to operate fully, this additional burden shortens the life of the remaining diodes. This amperage pull measure can be accessed along with other laser data, and is a reliable measure of the number of failed diodes. Therefore, the amperage reading on a Creo laser head is an important factor in predicting remaining laser life.

The amperage reading is also affected by the “Setpoint Power” of the head. The Setpoint Power is the output power of the laser, and is measured in Watts. The normal setting on the Trendsetters is between 8 and 10 W. Operating a machine with a setting above 10 W can lead to reduced laser life, while settings below 8 W can be expected to prolong the life of the laser. This setting usually varies depending on the media being imaged.

For a 20 W laser head, with a Setpoint Power between 8 and 10 W, a reading of 18 to 20 amp is evidence that all 19 diodes are functioning. A reading of 30 amp is evidence that 4 or 5 diodes have failed and the remaining life is tentative at best. Intermediate amp reads are a fair estimate of the remaining life of the head. For the 40 W heads, the amperage is slightly higher when the Setpoint Power is at 8 to 10 W. For these heads, a 22 to 25 amp reading is typical of a fully functioning laser, and a 40 amp reading is an indication of minimal remaining life.

Laser hours are also a gauge for estimating laser life. A 20 W laser head can reasonably be expected to have a life of 6,000-8,000 hours. The 40 W head has a slightly shorter life expectancy of 5,000-7,000 hours. However, the actual laser life can deviate from these expected norms considerably, depending on the Setpoint Power settings. For example, BWI recently received a 20 W laser head with 13,000 hours and an amperage reading of 15.9 amps. This is [redacted]letely con[redacted]y to wha[redacted]w t[redacted]rma[redacted]y e[redacted]tion[redacted]ddi[redacted]an ex[redacted]low output power setting of 3 W, compared to the usual 8 to 10 W. In another instance, we encountered the opposite. In this case, we encountered a 40 W Spectrum Proofsetter with 2,500 hours but an amperage reading of 37.6 amps. Based on the hour reading, we would expect this head to have a remaining life of 3,500 hours. However, the 37.6 amp reading indicates that as many of 4 of the 19 diodes in the head have failed, and it is nearing the end of its life-span. This head had a Setpoint Power setting of 15 W, well above the 8 to 10 W usually encountered on 40 W Trendsetters. However, this setting is not unusual on the Spectrum proofers, since proofing media is less sensitive than a normal plate.

Since laser heads are interchangeable, laser hours can be misleading if the remarketer has replaced the original laser head with that of a Spectrum, or if a Trendsetter with the Spectrum option has a history of being used extensively as a proofing device. In both instances, the hours without a corresponding amp reading taken at a normal 8 to 10 W Setpoint Power can be deceptive. Although a high wattage setting is a requirement on a Spectrum Proofsetter, it is only required on a Trendsetter with the Spectrum option when that option is being employed. Therefore, the Spectrum option can affect the remaining life of a laser head, depending on the amount of proof production that occurred with the previous owner. Fortunately, this will generally be nominal, since half-tone dot proofers have lost favor to soft and inkjet proofs.

Premature failure of a Creo head is usually not a laser diode problem at all. The odds of 5 of 19 diodes failing prematurely are low. In all probability, the failure can be attributed to dust or humidity residue, or even something as simple as a fuse. To repair a premature Creo head malfunction requires an experienced technician, but the cost is far less than the cost of a new laser head.

It is important to take caution when purchasing a pre-owned Trendsetter, as it is possible to “turn back” the hours clock in the head, and only a complete audit of the machine’s log will reveal such a transgression. This is where the amperage can be a useful tool for verification. Our contacts in Europe tell us this type of tampering is prevalent in their market. We have no knowledge of any prevalence of this tampering in the U.S. market, but with the shrinking world, there are no barriers to a rogue dealer from taking advantage of the expertise reportedly available in the European market.

Screen Laser Arrays - Estimating Remaining Life

Screen is just one manufacturer that provides a wide array of historical data about their equipment. They have engineered data storage for various historical data that can be very useful to those considering the purchase of a pre-owned platesetter. It not only allows full knowledge of the past usage of the equipment, but it also provides a basis for estimating the future cost of ownership. It further allows both the purchaser and the reseller to establish a value for the equipment that reflects the estimated remaining life of components that have a finite life, such as the laser diodes, clamps, and punches. Once the age and engineering features are known and acceptable, the past usage of these components can be used to determine the machine’s value.

For the Screen PT-R platesetters, data on prior usage of the machine can easily be obtained through the keypad. The procedure for accessing this data can be found at the end of this section. The usage data available includes:

Running Time Records the total hours the equipment is switched on.

Commentary *This meter serves very little purpose for evaluating the usage of the platesetter. It is simply a record of the hours the unit has been switched on. Some users leave the machine on all the time, others may turn off the machine when not in use, and others may follow the practice of turning the machine off after each 8 hour day. One has no way of knowing what these hours represent, so for all practical purposes, they are meaningless.*

Actual Running Time Records the hours the machine has actually been in operation, i.e. loading and unloading plates and imaging. It also includes non-productive time.

Commentary	*We use these hours to audit against the manufacturer's rated plate production per hour. To do this we simply divide the plate cycles by the actual running hours to determine the actual plate production per hour. This result is of little value other than to raise questions should the result be completely outside the expected plates per hour range.*

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Exposure Time Records the number of hours the lasers have actually been imaging plates.

Commentary *This is the most important number in the machine database, as this number is the actual laser "burn" time. Also, we can, by dividing the plate count into the exposure hours (converted to minutes) calculate the expose minutes per plate. From our experience we would expect to see times as follows for a full size plate:*

PT-R 4000/4300	*2.2 - 2.4 minutes*
PT-R 8000	*3.4 minutes*
PT-R 8100	*6.8 minutes*
PT-R 8600	*2.0 minutes*
PT-R 8800	*1.2 minutes*

Deviations would be an indicator of smaller than full size plates, processless plates, or plates with less sensitive emulsions.

We recommend cross-referencing the exposure time number with the hour log of the individual diodes in the machine, as the exposure time is part of the "consumables" menu, which can be reset to zero. More information on this follows later in this section.

Plate Winding Cycles Records the quantity of plates exposed over the life of the machine.

Commentary *The number of plates produced over the life of the platesetter is of secondary importance to the exposure time. Smaller plates will obviously require fewer hours to image than full size plates, and there is no way to determine the plate sizes used by the previous owner from the information contained in the database.*

Another important consideration is the number of diodes in the platesetter. Keep in mind that the fewer the diodes in the machine, the longer it takes the machine to expose a plate. It takes approximately 2.0 minutes for a 64 diode PT-R 8600 to image a full size plate, compared to 3.4 minutes for a 32 diode PT-R and 6.8 minutes for a 16 diode machine. It will take double the laser exposure time for a 16 diode PT-R 8100 to image an equal number of plates as a 32 diode PT-R 8000. While the life of the individual diodes in the PT-R 8100 will be about the same as those in the PT-R 8000 in terms of hours, they will be able to image only about half as many plates over their life-span. More information on this topic can be found in the "Laser Operating Cost" section - page 26.

Clamp Cycles Records the number of plates that have exposed using the current set of clamps.

Commentary *This counter is reset by the technician whenever the clamps are replaced. The platesetter displays a warning on the display panel after 30,000 plates have cycled since the last replacement. It is our observation that 30,000 is a conservative replacement threshold, as the clamps are still viable well beyond this number of plate cycles. However, this threshold does merit a thorough cleaning and evaluation for wear by a trained technician. As a comparison, the Trendsetter purports a clamp life of between 200,000 and 1,000,000 plates. This disparity can probably be explained by the difference in drum speed between the PT-Rs and Trendsetters. The drum of the PT-R diode array models rotates at 800 to 1,000 RPM, compared to 150 to 200 RPM on the Trendsetters. The damage caused by a plate flying off a drum rotating at 800 to 1,000 RPM would undoubtably cause considerable more damage than on drum that rotates at 150 to 200 RPM.*

Unfortunately, all of the aforementioned registers are part of the “consumables” menu, which can be reset to “zero”. A PT-R 4000II purchased by BWI bears witness to this fact. The machine was manufactured in December 2001. It was resold by a dealer in 2005 to a company that went out of business soon thereafter. When BWI received the machine, the register displayed 25 hours of laser running time and 531 plates produced. Obviously, the register was reset by the dealer prior to remarketing it.

In addition to the consumables menu, there is a menu with data on the individual diodes in the machine, which is very helpful in auditing the information contained in the consumables menu. Data available includes the hour log for individual diodes and their milliamp readings.

The individual diode readings can be used to audit the exposure time and also determine if any lasers have been replaced. We’ve encountered several machines with much lower exposure time than the hour readings for each individual diode. For example, we recently encountered a machine with 3,027 exposure hours, but the majority of the individual diodes had approximately 6,734 hours logged. Clearly, the consumable menu was reset at about 3700 hours. The individual diode hour log will also show you how many lasers have been replaced over the life of the machine, and approximately when they were replaced. Please note though that the hours for each individual diode can be reset. In fact, this is done by a technician whenever a diode is replaced and he will reset the hours for that diode.

There is, however, a value that cannot be tampered with, since it is a real-time calculation made by the machine each time the register readings are accessed. This value is the laser power measured in milliamps (mA).

Each new PT-R diode has an “IOPD” value, which is a measure of the current that the diode can hold. A new diode will have an IOPD number between 300 and 500 mA, with the number varying between diodes. The diode manufacturer will supply the IOPD value with the diode, and this is entered in the machine database when a diode is replaced. A milliamp reading between 300 and 500 mA will indicate that the diode is healthy and strong. Diodes between 200 and 300 mA are showing wear but are still good and viable. Diodes under 200 mA are starting to show a half life or less status. A diode with a milliamp reading under 100 should be considered critical, and a diode with a reading of 50 mA or below should be considered dead and must be replaced.

On the PT-R 8600, another value is calculated by the platesetter whenever the IOPD screen is displayed. The PT-R 8600 will display the original IOPD value, along with the current measured strength. A third value is displayed upon that same screen which represents the % of life that the machine computer calculates as remaining for each diode. This percentage is not the comparison of the two IOPD values as one might suspect, but is a calculation made within the platesetter operating system representing the remaining life of each diode.

Since the mA values cannot be tampered with, and since they show the approximate strength of each diode, these values are perhaps the most important figures to consider when evaluating a PT-R platesetter.

SUMMARY COMMENTS

Besides providing an audit of the extent of use by a prior owner, this data can also be useful as a management tool for gauging the operating efficiency of an individual platesetter by calculating the percentage of un-utilized time to the actual running time. An example of how this percentage is calculated follows. The data below is taken from a PT-R 8000 in BWI’s inventory. The cycle time is estimated, but in an actual working environment, it should be possible to determine cycle time accurately with a stop watch.

PT-R 8000 calculations:

Actual running time (time the switch is “on”)			6,958 hours
Exposure time		-	3,691 hours
Time not exposing			3,267 hours
Plate winding cycles	80,716		
	X		
Estimated cycle time	1.75 minutes		
Minutes of cycle time	141,253 divided by 60		
	= 2,354 hours	-	2,354 hours
Un-utilized time			913 hours
Percentage to running time =			13.1 %

Violet Lasers

BWI does not have as much experience with violet laser machines as we do with the thermal Trendsetters and PT-Rs. Manufacturers represent that violet diodes should work for somewhere between 5,000 - 10,000 hours. We have no data or experience to dispute this information. To this point, we have never had to replace a laser in a violet machine, but by the same token, the violet platesetters have been on the market for less time than the thermal platesetters, and we have worked with fewer of these machines. Overall though, given the low power usage of the violet diodes, we believe the estimate of 10,000 hours, or even higher, to be entirely feasible.

Even though the violet lasers can be expected to have considerable life and hence the usage is of far less concern than with thermal platesetters, it can still be comforting to know the prior usage. Unfortunately, this information is unavailable on many violet platesetters. For example, we know of no way to access this information with Agfa Galileos and Palladios, or Escher Grad Cobalts. This information is available on ECRM Makos, Fuji violet devices, and Heidelberg Prosetters. The Prosetter actually has a very extensive amount of information available.

Heidelberg, in addition to supplying the usage image time and plate count, actually also tells you the square meters of material exposure. To illustrate this somewhat complex calculation, we will start with the information made available to us from an actual platesetter in our inventory - a Heidelberg Prosetter 74. This machine was manufactured in 2005. This information was obtained from the serial number of 05404096. The first two digits represent the year of manufacture, the next three digits are a product code, and the balance of the number represents the consecutive number assigned to that specific machine.

The information contained in the machines memory can be accessed by following the procedure outlined at the end of this section. The information for this Prosetter is as follows:

Operator Resettable Job Counter		
Material Counter	8307.61	m^2
Plate Counter	38456	pieces
Exposing Counter	38332	pieces
Recorder Life History		
Sum of Material Used	9874.13	m^2
Total Plate Count	46030	pieces
Sum of All Exposures	46081	pieces
Sum of All Punches	45957	pieces
Sum of Power on Time	13959.53	hours
Sum of Exposure Time	842.37	hours

This data can be used to analyze the following elements valuable for evaluating past and future usage of the machine as well as its productivity.

To avoid describing the methodology of these calculations for each equipments' analysis presented on our website, we will describe the logic herein for those who seek more background. From this data we can calculate the information to assist you with determining if this equipment is right for your needs.

Sum of Material Used	Records the area imaged on a cumulative basis for the life of the machine. It is reported in square meters. For those accustomed to the imperial measure used in the USA, meters can be converted to square inches by multiplying the meters by 1550 or if square feet are desired, multiply by 10.76.
Total Plate Count and Sum of All Exposures	These two registers should normally be close to identical. We have chosen to use Total Plate Count for the purpose of calculating historical production data.
Sum of All Punches	We find this register of value for determining the likelihood of the punches coming close to needing replacement and thus a factor when determining market value.
Sum of Time On	This is simply the hours the machine's switch is in the "on" position. Some users leave the machine on 24 hours a day regardless of use and others turn the machine off when not in use. It has little useful purpose for evaluating the past usage or anything else.
Sum of Exposure Time	In addition to being used in the calculation of time required to image a plate, this value aids in the estimate of the remaining life of the laser. Since violet was not in volume production until 2002, few devices outside of the newspaper industry have accumulated hours that are a concern to the buyer of pre-owned violet platesetters. Nevertheless, this is a value that should be of concern at least from the standpoint of the offer price of the unit.

The following is the information we can create from this data when combined with other data provided in the remaining counters.

1) Average plate size produced by the prior owner(s).
2) Square inches of exposure per minute previously produced by this machine.
3) Historical average of minutes per plate imaged can be calculated by converting the hours to minutes and dividing the product by the "sum of all exposures."

These separate calculations can then be combined for perhaps a more useful calculation to estimate how many plates you can expect to realize from whatever you estimate to be the useful life of the platesetter for your purpose. Or perhaps more realistic is the number of hours you estimate are required to produce your requirements over what you consider to be its remaining useful life for your needs.

The simplest method for determining this is to multiply the actual minutes per plate for the history of the platesetter, times the ratio that your actual plate size is to the historical average plate size. This will give you the minutes per plate for your average plate size. These minutes divided into whatever number of hours (converted to minutes) you choose to assign to the machine when you are contemplating the purchase will result in the number of plates you can expect based upon the laser life estimate you choose. In most cases, the result will far exceed the quantity of plates you will produce over what you may consider to be its life span.

If the above discourse thoroughly confused you, the following is a step-by-step procedure for making this calculation. This illustration uses actual data from a Prosetter 74 combined with substitutes for amounts you may calculate for your plate size and your estimates of future useful life and plate requirements. (Note: This calculation will also appear in the FAQ section of our website, at a later date, for individual Prosetters we are inventorying. You will be able to substitute your estimates and recalculate each model if you choose, to determine the balance between price and future needs that fit your circumstances.)

Actual minutes per plate:

Sum of exposure time	842.3	hours
Conversion factor to minutes	x 60	minutes equals
Exposure time minutes	50,542	minutes divided by
Total plate count	46,030	equals
Exposure time per plate	1.10	minutes

Historical average plate size:

Sum of materials used	9874	m^2 divided by
Total plate count	46,030	equals historical plate sizes as follows
Square meters per plate	.2145	m^2
Conversion to sq. ft. (x 10.76)	2.31	sq. feet
Conversion to sq. in. (x 1550)	332	sq. in.

Calculation for converting historical plate size to maximum plate size:

Historical plate size	332	sq. in.
[1] Maximum plate size (25.4 x 29.5)	749	sq. in.
Ratio of maximum plate size to historical	2.257	(749 divided by 332) times
X Historical minutes per plate	1.10	minutes equals
[1] Minutes per maximum size plate	2.48	minutes

[1] *Note: You should substitute your estimated plate size useful life and future annual production and recalculate to create the laser hours estimated over the useful life you choose*

The following is an illustration of how the preceding calculations can be used to determine the "fit" of this machine for your future needs. This calculation is based upon using the maximum size plate. This and other data must be substituted with your estimates to fit the computation to your needs.

	Example to use as a guide	**Your estimates for your needs**
Estimated useful life for your purpose	9 yrs.	____________ yrs.
times	X	X
Estimated average annual plates needed	12,000 plates	____________ plates
equals	=	=
Plates required over useful life	108,000 plates	____________ plates
times	X	X
Minutes to produce plate of max. std. size	2.48 minutes	____________ minutes
equals	=	=
Minutes required to produce your est. future requirements	267,840 minutes	____________ minutes
divided by	/	divided by
Conversion factor for minutes to hours	60 minutes	60 minutes
equals	=	=
Hours to produce future requirements	4,640 hours	____________ hours
plus	+	+
Exposure hours on existing counter	842 hours	842 hours
equals	=	=
Estimated hours at end of estimated useful life	5,482 hours	____________ hours

Probable total life of laser should be in the range of 8 - 10,000 hours for a 5 mW laser and 6 - 8,000 hours for a 30 mW laser.

Procedures to access various laser usage databases on platesetters:

Procedure to Access Trendsetter Laser Database:

-- Disconnect front end or CRI
-- Connect Trendsetter (diagnostic port) to a Windows PC with serial cable
-- Setup Hyperterminal on Windows PC (under Programs - Accessories - Communication)
-- Start a new connection in Hyperterminal - the settings should be Baud Rate 9600, 8 bit, no parity, 1 stop, Flow control XON/XOFF
-- Power up Trendsetter
-- At a prompt, type “laser on”
-- When reported that command was executed, type “laser”
-- Trendsetter should report back laser stats, including amperage, hours, power, etc.
-- At a prompt, type “set config” (this will give you the machine configuration and serial number)
-- At a prompt, type “list stats” (this will give you the machine history)
-- At a prompt, type “list version” (this will give you the version of pcb and head data)
-- Save this log file

Procedure to Access Screen PT-R Usage Data:

-- On the display panel go to User Maintenance - hit OK
-- Choose ETC - hit OK
-- Next choose the Consumable Timer Menu - hit OK to access display usage data
-- Return to ETC. - hit OK
-- Choose Laser Power Measure - hit OK
-- Next choose 2400 DPI - hit OK
-- (On a PT-R 8600 only) Read remain % of laser life for each diode
-- Hit next to get to next set of diode readings

Procedure to Access Agfa Xcalibur Usage Data:

-- Locate the unidiag program on your console computer
-- Click on Tools
-- On the drop down menu - click on “Operational Statistics”
-- A screen will appear that indicates “Plates Used” and “Laser Usage” (hours used)

Procedure to Access Heidelberg Prosetter Usage Data:

-- From the GUI of the machine (on RIP or Tiff Catcher/Shooter) - go to Device
-- Choose Recorder
-- Choose Operator Counter -- this is where you’ll find Sum of Material Used, etc.

Procedure to Access Fuji Violet Platesetters Usage Data:

-- Hook the platesetter up in terminal mode to access hours, usage, etc.