

Specification Sheet

MARCTM

Patient Simulator

Beta Version 2.0

Managing Accurate Resin Curing



Laboratory-grade
energy measurement

—
Clinically relevant

—
Manages the four
CORE variables:

- *Curing light*
- *Operator technique*
- *Restoration characteristics*
- *Energy requirement*



CuringResin.com

About MARC™

The MARC™ Patient Simulator (PS) is a scientifically accurate and clinically relevant intraoral energy measurement system. MARC™-PS enables dental researchers, manufacturers, educators and clinicians to better understand the amount and type of energy a resin restoration may actually receive, and then compare those findings to the amount and type of energy needed by each brand and shade of resin. MARC™-PS can be used to gather the information necessary to inform dental manufacturers, researchers, educators and clinicians as to the amount and type of energy is delivered to their dental resins.

The MARC™ Resin Calibrator (MARC™-RC) has been developed to measure how much energy resins actually need to be properly cured.

Applications

MARC™-PS enables dental researchers, manufacturers and educators to better understand and manage the four CORE variables that determine intraoral energy delivery during the dental resin light curing process. Specifically, MARC™-PS enables the following:

Dental Researchers – MARC™-PS enables you to:

- Understand the amount and type of energy clinicians are delivering to their resins while using their curing light in on a simulated patient.
- Conduct research on the ability of a clinician to deliver useful energy to simulated restorations using various types of curing lights.
- Accelerate the pace of research because MARC™ is easy-to-use and provides immediate, exportable and accurate results on the performance of the lights.
- Conduct research on composite resins after they receive clinically relevant amounts and types of energy, as determined using the MARC™-RC.

Dental Educators – MARC™-PS enables you to:

- Provide immediate and scientifically accurate results to students showing them how much useful energy they are actually delivering to various simulated restorations.
- Monitor the progress of individuals and groups over time.
- Evaluate and demonstrate how different light curing techniques deliver different amounts of energy.
- Enhance Continuing Education programming by using MARC™ interactively so professionals can learn about the characteristics of different curing lights and techniques.

Dental Manufacturers – MARC™-PS enables you to:

- Provide clinicians with a powerful illustration of the useful energy delivered by your curing light(s) to a given restoration.
- Provide clinicians with clinically relevant curing times for restorations in different locations in the mouth.
- Offer Continuing Education programs that highlight the effectiveness of your curing lights.
- Design and test the performance of prototype curing lights based on the scientifically accurate results from, potentially, hundreds of users.

Components



Mannequin Head*

Adult fibreglass reinforced plastic head. Includes a rubber mask which allows the user to practise light curing in a clinically relevant manner.



Typodont*

The typodont includes upper and lower jaw with teeth, soft silicone tissues and metal pole mount. The inter incisal opening can be adjusted from 28 – 45mm. Also includes an oral cavity cover and tongue to better simulate a patient.



Bench Mount*

The compact bench mount firmly attaches the mannequin head to a bench or dental chair (with a flat metal neck) and includes a swivel joint that quickly rotates 360 degrees for exact positioning of the head in a clinically relevant position for training or testing.

* Kilgore or equivalent



Sensors

The sensors are 3.9 mm in diameter and are similar in diameter to a Class I preparation. The sensors are fixed in two teeth in the maxilla of the typodont. The first is in a posterior Class I restoration at a depth of 4mm and the second in an anterior Class III restoration at a depth of 1mm. These sensors are connected to the spectrometer with a bifurcated fibre optic cable.



Spectrometer

A NIST referenced USB4000™ spectrometer (Ocean Optics) that features a 3648-element Toshiba linear CCD array for increased signal-to-noise and enhanced electronics for controlling the spectrometer and accessories. The USB4000™ is custom configured to the specifications required by BlueLight™ and optimized to measure wavelengths between 360 – 540 nm. It is mounted inside the mannequin head and connects to a computer using an USB connection. As with all laboratory grade spectrometers, the USB4000™ requires periodic recalibration in order to maintain NIST referenced accuracy.



Laptop Computer

MARC™ comes equipped with pre-configured laptop computer using Microsoft Windows 7® operating system. The laptop is preloaded with the custom MARC™ software that fully integrates data gathering, storage, exporting and reporting into one easy-to-use graphical user interface. This laptop is dedicated to running the MARC™ software and is specially configured to manage the large volumes of data that are produced during testing.

MARC™ Software

The fully integrated MARC™ software controls the spectrometer and includes a simple, easy-to-use graphical user interface. The user interface provides the operator with the ability to individually control and assess “the four CORE variables” that determine intraoral energy delivery during the resin curing process:

- 1) Curing light
- 2) Operator technique
- 3) Restoration characteristics
- 4) Energy requirement

MARC™ Software has the following features:

1 – Easy Data Gathering

Set test parameters then “Confirm”. Then press “Run Test”. MARC™ begins to gather data as soon as the curing light triggers the optical sensor.

2 – Quickly Set Parameters

Auto fill functions help the MARC™ operator to quickly insert the specific curing light and mode (Figure 1). The database includes all test parameter data along with the resulting time, irradiance and spectral emission data. This allows for detailed future analysis.

3 – Scientific Accuracy Made Easy

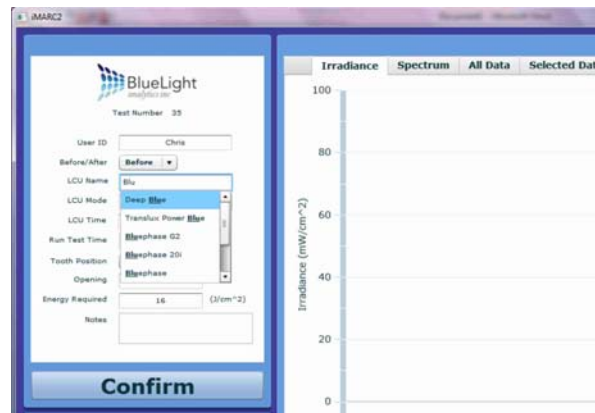
Data collection is automated to ensure scientific accuracy in simple steps. These include:

Automatic zeroing – Immediately prior to each test, the spectrometer is automatically zeroed to account for changes in ambient light (e.g., turning the operatory light on or off).

Optical timer triggers – Time data are calculated using optical triggers that capture the precise start and stop times of the dental curing light.

Disaggregated total energy – The amount of energy delivered in the 380 – 420 nm range and in the 420 – 540 nm range are presented separately, in addition to the total energy delivered between 380 – 540 nm (Figure 2). This is important because some composite resins require specific amounts of energy to be delivered in each of these

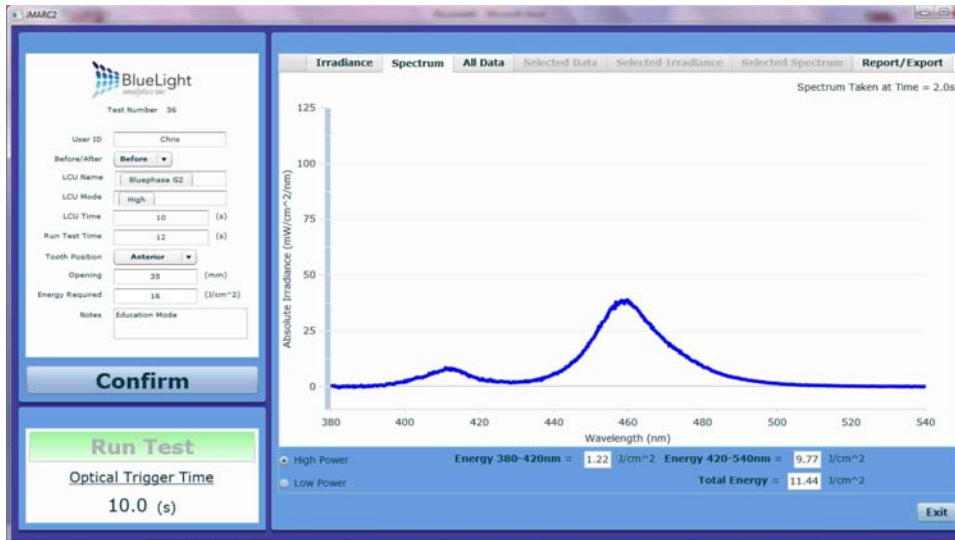
Figure 1



spectral ranges in order for the resin to adequately cured and achieve its desired properties.

Errors can be immediately corrected – Specific test data can be easily removed from the database when errors in data collection occur.

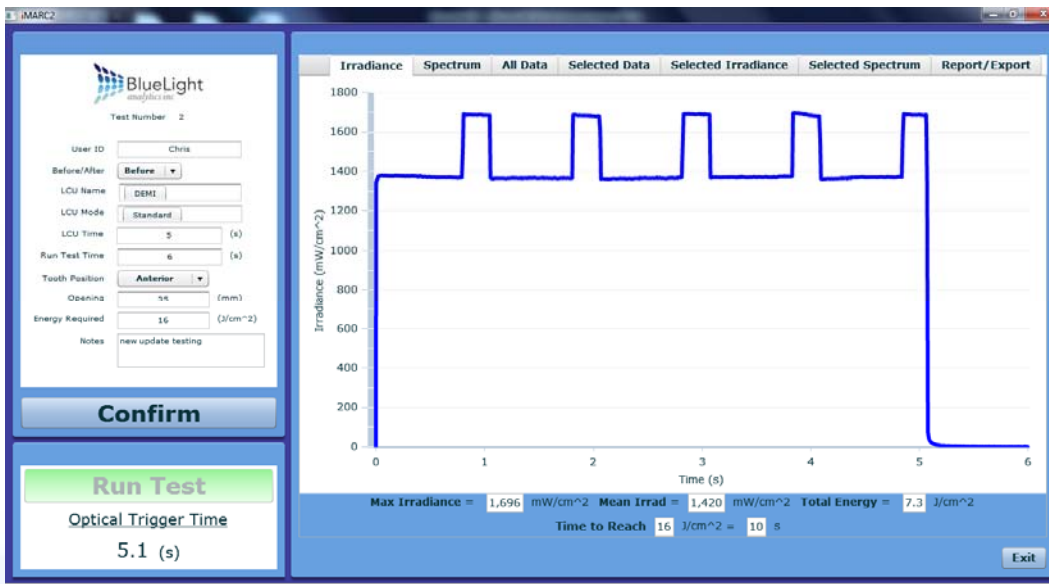
Figure 2



4 – Accurate Data Display

Irradiance and spectral emission data are displayed in a manner that provides immediate feedback on the user's performance. For example, Figure 3 shows a curing light that has a pulsing feature. The optical trigger time (that starts when the curing light hits the sensor and stops the test as soon as the curing light turns off) is displayed in the bottom left corner of the interface and recorded in the data.

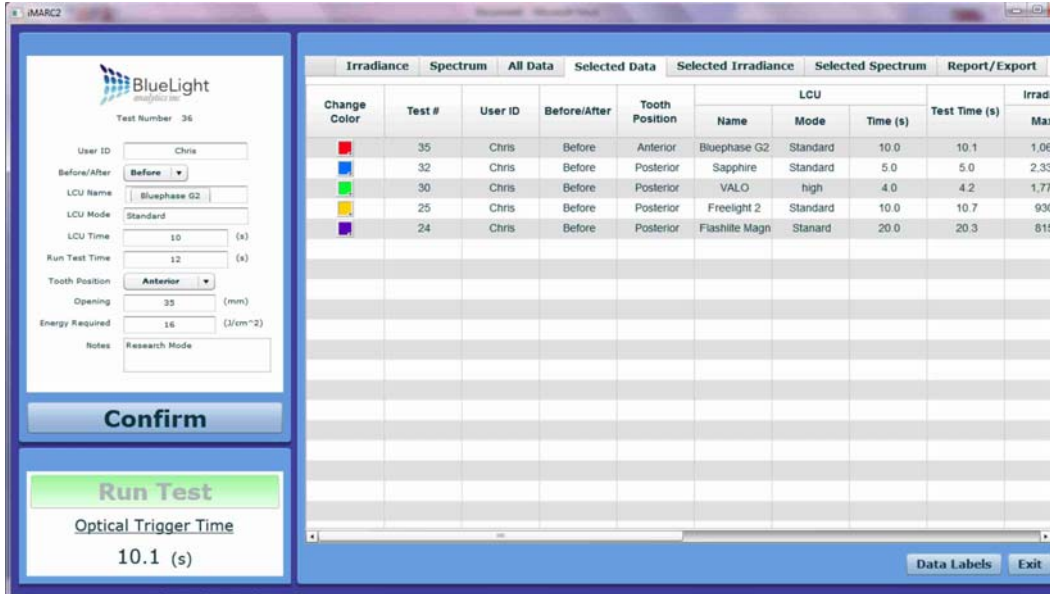
Figure 3



5 – Immediate Data Reporting

Test data can be immediately viewed in a datasheet outlining specific results that can be selected for graphical display by curing light or other parameter (Figure 4).

Figure 4



6 – Simple Data Graphing and Comparisons

Specific selected data can be immediately viewed (Figure 5) with user-defined pop-up data labels (Figure 6) providing reference or additional data as desired. Graphs are immediately available for both irradiance and spectra (Figure 7 on the next page). To accommodate for the wide range in curing light outputs, the Y-axis scale in the spectra view can be adjusted to accommodate low or high power curing lights. In the irradiance view, the Y-axis auto-scales.

Figure 5

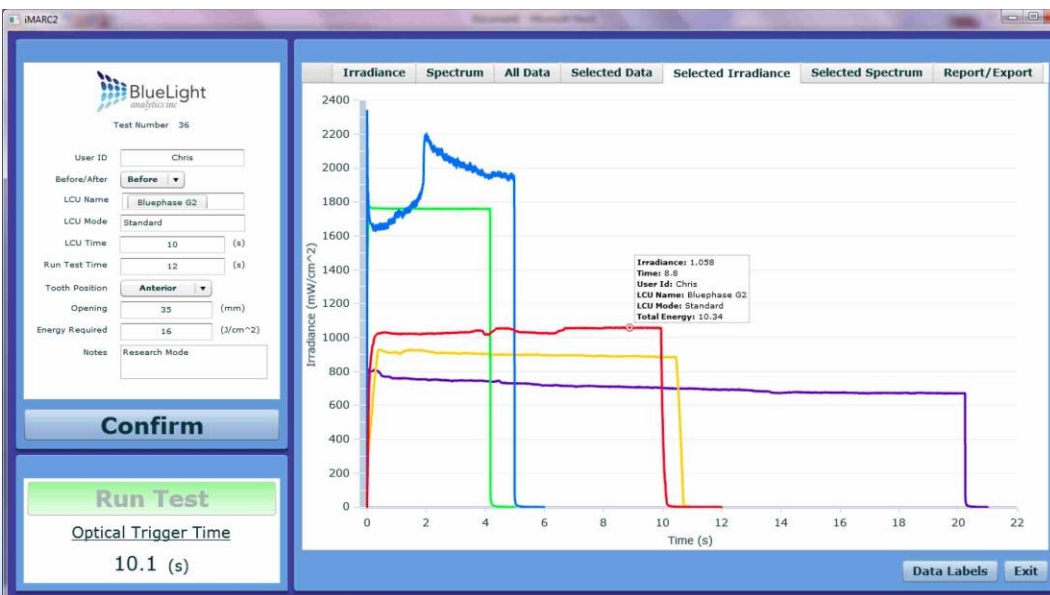


Figure 6

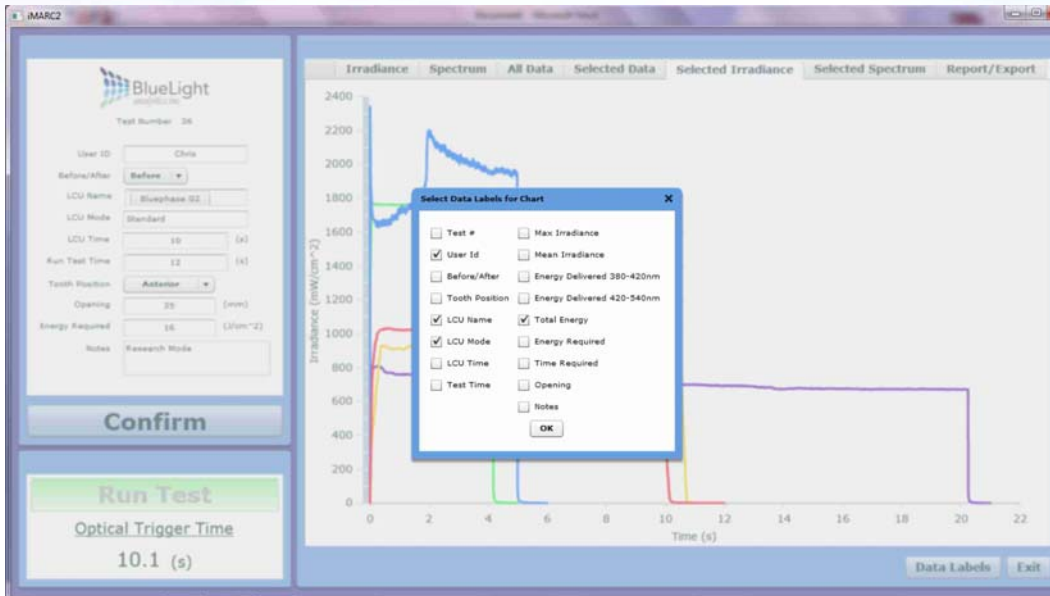
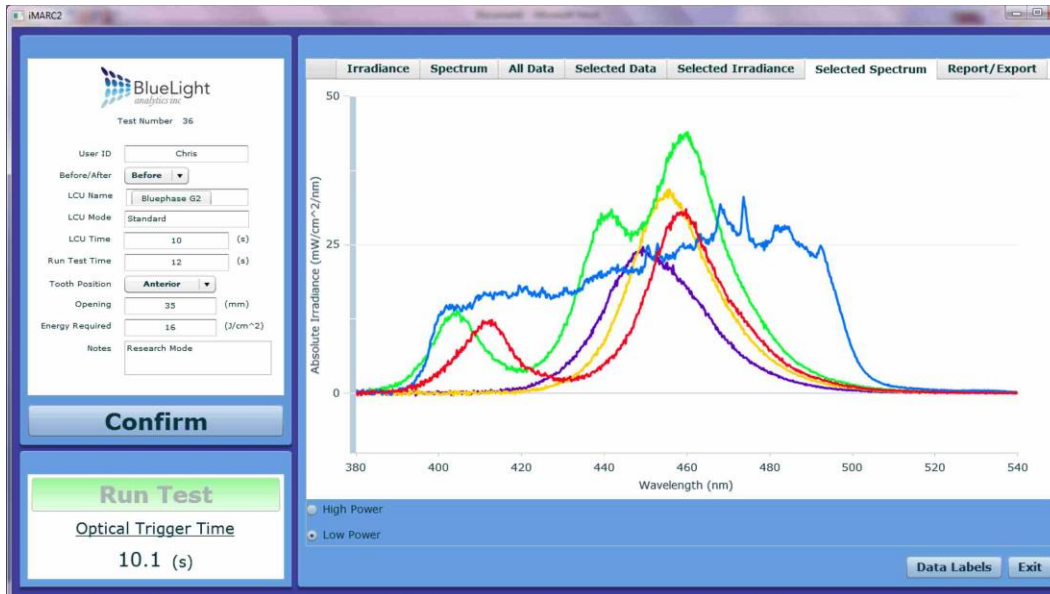


Figure 7



7 – Simple Data & Image Exporting

All data can be quickly and immediately exported to a .CSV file with the click of a button (Figure 8) and can include all of the raw irradiance and spectral emission files if desired. This file type can be opened by most graphical and statistical programs (Figure 9 on the next page). User defined images displaying selected irradiance or spectral emission data can be exported just as quickly and easily.

Figure 8

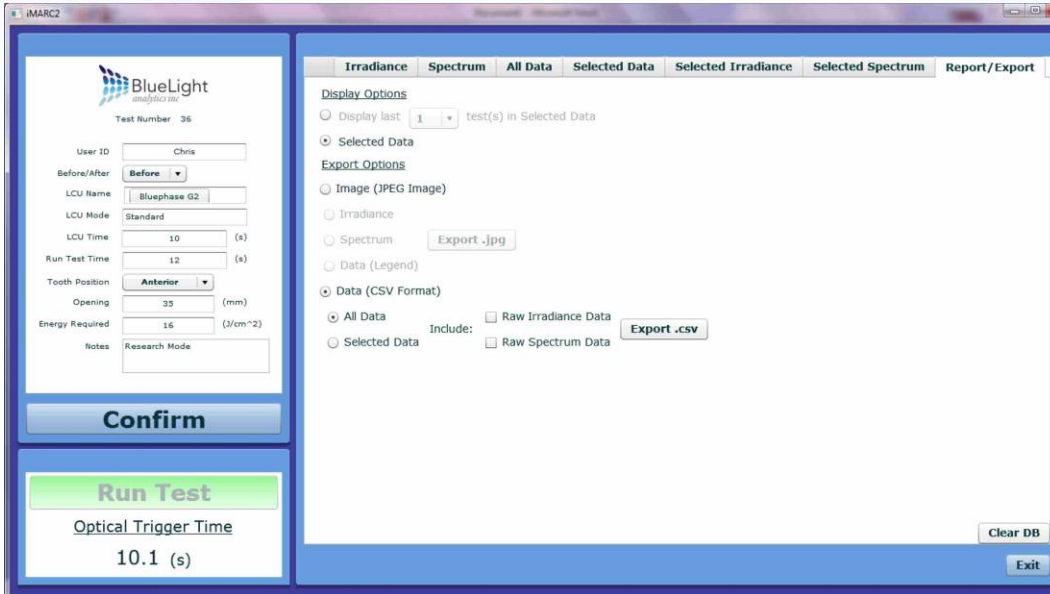


Figure 9

The screenshot shows a Microsoft Excel spreadsheet titled 'CSV Export Startup Testing (raw) - Microsoft Excel'. The spreadsheet contains a table with the following columns: id, testnumber, userid, toothpos, curinglight, mode, curingtime, energytime, runtime, energytotal, energy380, energy420, meanirrad, maxirrad, notes, and time4delivery. The data is organized into rows, with the 9th row highlighted in orange. The 9th row contains the following data: 9, 8, 8, Chris, Anterior, Bluephase 20i, Turbo, 5, 16, 5.105, 10.27466, 1.078872, 9.193598, 2018.999146, 2166.657227, Startup Testing, 7.787809.

id	testnumber	userid	toothpos	curinglight	mode	curingtime	energytime	runtime	energytotal	energy380	energy420	meanirrad	maxirrad	notes	time4delivery	
1	1	1	Chris	Anterior	SmartLite IQ2	Standard	10	16	10.049	9.788321	0.007163	9.778154	974.457458	1005.848389	Startup Testing	16.349352
2	2	2	Chris	Anterior	DEMI	Standard	5	16	5.129	7.363681	0.025143	7.338545	1428.917725	1721.368896	Startup Testing	10.864132
3	3	3	Chris	Anterior	Elipar S10	Standard	10	16	10.201	17.381023	0.16211	17.218906	1701.95166	1836.129883	Startup Testing	9.205441
4	4	4	Chris	Anterior	Bluephase G2	High	10	16	10.194	10.983471	1.071817	9.911654	1078.256104	1116.918335	Startup Testing	14.567345
5	5	5	Chris	Anterior	FlashMax 2	Standard	3	16	3.082	9.647972	0.022594	9.62538	3125.338867	3264.1521	Startup Testing	4.975139
6	6	6	Chris	Anterior	Flashlite Magna	Standard	20	16	20.337	21.583794	0.143694	21.440065	1060.569336	1205.383545	Startup Testing	14.825939
7	7	7	Chris	Anterior	Freelight 2	Standard	10	16	10.781	15.270561	0.04541	15.225157	1422.429321	1572.245239	Startup Testing	10.477676
8	8	8	Chris	Anterior	Bluephase 20i	Turbo	5	16	5.105	10.27466	1.078872	9.193598	2018.999146	2166.657227	Startup Testing	7.787809
9	9	9	Chris	Anterior	Allegro	Standard	10	16	10.013	15.395794	0.121448	15.274351	1536.973999	1644.838013	Startup Testing	10.492648
10	10	10	Chris	Anterior	SmartLite IQ	Standard	10	16	10.013	8.244184	0.011092	8.233084	822.992615	847.372314	Startup Testing	19.407619
11	11	11	Chris	Anterior	SmartLite PS	Standard	10	16	10.154	13.437885	0.036209	13.401677	1329.040771	1407.049561	Startup Testing	11.906635
12	12	12	Chris	Anterior	VALO	Standard	10	16	10.209	12.092614	1.859469	10.233142	1184.039429	1210.243774	Startup Testing	13.231216
13	13	13	Chris	Anterior	VALO	high	4	16	4.301	7.251965	1.062964	6.188993	1682.597534	1754.988281	Startup Testing	8.825194
14	14	14	Chris	Anterior	VALO	plasma	3	16	3.231	9.722626	1.514584	8.208041	3013.620117	3159.497314	Startup Testing	4.936938
15	15	15	Chris	Anterior	Sapphire	Standard	5	16	5.089	9.139135	1.504097	7.635043	1797.319458	2367.734863	Startup Testing	8.735363
16	16	16	Chris	Anterior	Optilux 501	Standard	10	16	10.181	12.58554	2.188578	10.396961	1238.254761	1370.657959	Startup Testing 10mm	12.713002
17	17	17	Chris	Anterior	SmartLite IQ2	Standard	10	16	10.042	6.566069	0.022596	6.543469	653.403137	673.800111	Startup Testing	24.367699
18	18	18	Chris	Posterior	DEMI	Standard	5	16	5.12	6.85295	0.025249	6.827701	1337.863403	1592.959351	Startup Testing	11.673805
19	19	19	Chris	Posterior	Elipar S10	Standard	10	16	10.162	15.062042	0.136255	14.925808	1481.918457	1564.093628	Startup Testing	10.622729
20	20	20	Chris	Posterior	Bluephase G2	High	10	16	10.158	13.811186	1.242915	12.568264	1361.772217	1410.754395	Startup Testing	11.584813
21	21	21	Chris	Posterior	FlashMax 2	Standard	3	16	3.043	6.432592	0.015043	6.41755	2112.842773	2171.849609	Startup Testing	7.461999
22	22	22	Chris	Posterior	Bluephase 20i	Turbo	5	16	5.089	9.467267	1.330033	8.137239	1863.217407	1991.387939	Startup Testing	8.450169
23	23	23	Chris	Posterior	Flashlite Magna	Standard	20	16	20.301001	14.316759	0.115458	14.201311	704.662537	815.159668	Startup Testing	22.351427
24	24	24	Chris	Posterior	Freelight 2	Standard	10	16	10.737	9.435881	0.027273	9.408607	882.255188	930.170288	Startup Testing	16.956551
25	25	25	Chris	Posterior	Allegro	Standard	10	16	9.993	15.164908	0.135931	15.028977	1515.382935	1639.52478	Startup Testing	10.550673
26	26	26	Chris	Posterior	SmartLite IQ	Standard	10	16	10.001	7.137582	0.024395	7.113176	711.948975	865.984802	Startup Testing	22.416555
27	27	27	Chris	Posterior	SmartLite IQ	Standard	10	16	10.001	7.137582	0.024395	7.113176	711.948975	865.984802	Startup Testing	22.416555

***How much energy do you deliver
...and does your resin need?***



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