

# CARBIDE

NEW

## Unibody-Design Femtosecond Lasers for Industry and Science

### FEATURES

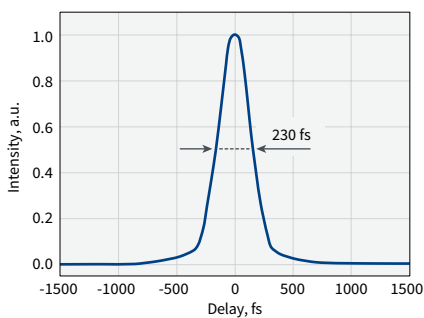
- Tunable pulse duration, 190 fs – 20 ps
- Maximum output of 120 W, 1 mJ or 80 W, 2 mJ
- Single-shot – 2 MHz repetition rate
- Pulse-on-demand and BiBurst for pulse control
- Up to 5<sup>th</sup> harmonic or tunable extensions
- Air-cooled model
- Compact industrial-grade design



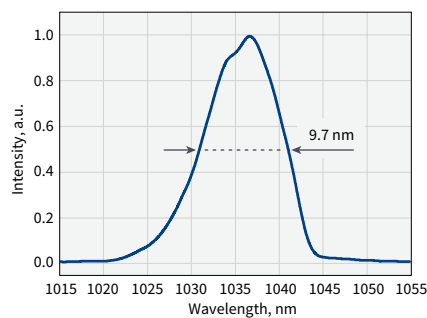
CARBIDE-CB3

CARBIDE is a series of femtosecond lasers combining high average power and excellent power stability. CARBIDE features market-leading output parameters without compromises to beam quality and stability. A compact and robust optomechanical CARBIDE design allows a variety of applications in top-class research centers, as well as display, automotive, LED, medical, and other industries. The reliability of CARBIDE has been proven by hundreds of systems operating 24/7 in the industrial environment.

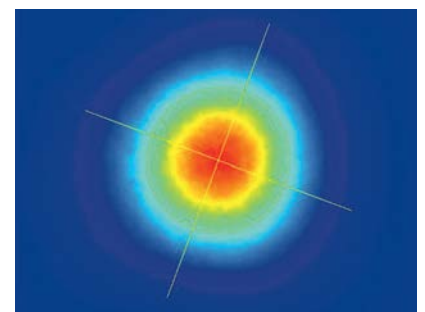
CARBIDE features high-power water-cooled (CB3) and air-cooled (CB5) models. The tunability of CARBIDE lasers enables our customers to discover the most efficient manufacturing processes. Tunable parameters include pulse duration (190 fs – 20 ps), repetition rate (single-shot – 2 MHz), pulse energy (up to 2 mJ), and average power (up to 120 W). A pulse-on-demand mode is available using the built-in pulse picker. The CARBIDE lasers can be equipped with industrial-grade modules, including but not limited to harmonic generators and optical parametric amplifiers.



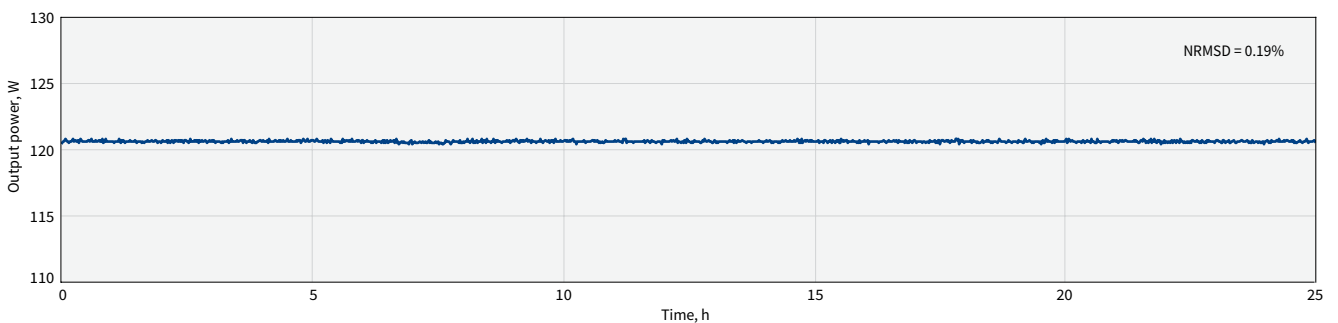
Typical pulse duration of CARBIDE-CB3



Typical spectrum of CARBIDE-CB3



Typical beam profile of CARBIDE-CB3



Long-term power stability of CARBIDE-CB3-120W

# CARBIDE-CB3 SPECIFICATIONS

NEW

Model	CB3-20W	CB3-40W	CB3-80W	CB3-120W
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## OUTPUT CHARACTERISTICS

Cooling method	Water-cooled			
Center wavelength <sup>1)</sup>	1030 ± 10 nm			
Maximum output power	20 W	40 W	80 W	120 W
Pulse duration <sup>2)</sup>	< 250 fs		< 350 fs <sup>3)</sup>	< 250 fs
Pulse duration tuning range	250 fs – 10 ps		350 fs – 10 ps	250 fs – 10 ps
Maximum pulse energy	0.4 mJ		0.8 mJ	2 mJ
Repetition rate	Single-shot – 1 MHz	Single-shot – 1 MHz (2 MHz on request)	Single-shot – 2 MHz	Single-shot – 1 MHz (2 MHz on request)
Pulse selection	Single-shot, pulse-on-demand, any fundamental repetition rate division			
Polarization	Linear, vertical; 1 : 1000			
Beam quality, M <sup>2</sup>	< 1.2			
Beam diameter <sup>4)</sup>	3.9 ± 0.4 mm	4.2 ± 0.4 mm	5.1 ± 0.7 mm	4.5 ± 0.5 mm
Beam pointing stability	< 20 µrad/°C			
Pulse picker	FEC <sup>5)</sup>			
Pulse picker leakage	< 0.25%			
Pulse-to-pulse energy stability, 24 h <sup>6)</sup>	< 0.5%			
Long-term power stability, 100 h <sup>6)</sup>	< 0.5%			

## MAIN OPTIONS

Oscillator output <sup>7)</sup>	< 0.5 W, 120 – 250 fs, 1030 ± 10 nm, ≈ 65 MHz			
Harmonic generator <sup>8)</sup>	515 nm, 343 nm, 257 nm, or 206 nm; see page 23			
Optical parametric amplifier <sup>9)</sup>	320 – 10000 nm; see page 30			–
BiBurst option	Tunable GHz and MHz burst with burst-in-burst capability; see page 17			

## PHYSICAL DIMENSIONS

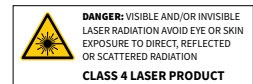
Laser head (L × W × H)	632 × 305 × 174 mm			
Chiller (L × W × H)	585 × 484 × 221 mm	680 × 484 × 307 mm		
24 V DC power supply (L × W × H) <sup>10)</sup>	280 × 144 × 49 mm	320 × 200 × 75 mm		

## ENVIRONMENTAL AND UTILITY REQUIREMENTS

Operating temperature	15 – 30 °C			
Relative humidity	< 80% (non-condensing)			
Electrical requirements	Laser	100 V AC, 7 A – 240 V AC, 3A; 50 – 60 Hz	100 V AC, 12 A – 240 V AC, 5 A; 50 – 60 Hz	
	Chiller	100 – 230 V AC; 50 – 60 Hz	200 – 230 V AC; 50 – 60 Hz	
Rated power	Laser	600 W	1000 W	2000 W
	Chiller	1400 W	2000 W	
Power consumption	Laser	500 W	900 W	1400 W
	Chiller	1000 W	1300 W	1700 W

<sup>1)</sup> Precise center wavelength for specific models available upon request.  
<sup>2)</sup> Assuming Gaussian pulse shape.  
<sup>3)</sup> Pulse duration can be reduced to < 250 fs if pulse peak intensity of > 50 GW/cm<sup>2</sup> is tolerated by the customer setup.  
<sup>4)</sup> FW 1/e<sup>2</sup>, using maximum pulse energy.  
<sup>5)</sup> Provides fast energy control; external analog control input available. Response time – next available RA pulse.

<sup>6)</sup> Under stable environmental conditions. Expressed as NRMSD (normalized root mean squared deviation).  
<sup>7)</sup> Available simultaneously, requires scientific interface. Contact sales@lightcon.com for details or customized solutions.  
<sup>8)</sup> Integrated. For external harmonic generator, refer to HIRO.  
<sup>9)</sup> Integrated. For more options and OPAs for -4mJ and -UP models, refer to ORPHEUS series of OPAs.  
<sup>10)</sup> Power supply can be different if optional 2 MHz version is selected.



## CARBIDE-CB5 (AIR-COOLED) SPECIFICATIONS

Model	CB5		CB5-SP
<b>OUTPUT CHARACTERISTICS</b>			
Cooling method	Air-cooled <sup>1)</sup>		
Center wavelength <sup>2)</sup>	1030 ± 10 nm		
Maximum output power	6 W	5 W	
Pulse duration <sup>3)</sup>	< 290 fs		< 190 fs
Pulse duration tuning range	290 fs – 20 ps		190 fs – 20 ps
Maximum pulse energy	100 µJ	83 µJ	100 µJ
Repetition rate	Single-shot – 1 MHz		
Pulse selection	Single-shot, pulse-on-demand, any fundamental repetition rate division		
Polarization	Linear, vertical; 1 : 1000		
Beam quality, M <sup>2</sup>	< 1.2		
Beam diameter <sup>4)</sup>	2.1 ± 0.4 mm		
Beam pointing stability	< 20 µrad/°C		
Pulse picker	Included	Included <sup>5)</sup>	Included
Pulse picker leakage	< 2 %	< 0.1 %	< 2 %
Pulse-to-pulse energy stability, 24 h <sup>6)</sup>	< 0.5%		
Long-term power stability, 100 h <sup>6)</sup>	< 0.5%		
<b>MAIN OPTIONS</b>			
Oscillator output	n/a		
Harmonic generator <sup>7)</sup>	515 nm, 343 nm, 257 nm, or 206 nm; see page 23		
Optical parametric amplifier <sup>8)</sup>	320 – 10000 nm; see page 30		
BiBurst option	n/a		
<b>PHYSICAL DIMENSIONS</b>			
Laser head (L × W × H)	631 × 324 × 162 mm		
Chiller	Not required		
24 V DC power supply (L × W × H)	220 × 95 × 46 mm		
<b>ENVIRONMENTAL AND UTILITY REQUIREMENTS</b>			
Operating temperature	17 – 27 °C		
Relative humidity	< 80% (non-condensing)		
Electrical requirements	100 V AC, 3 A – 240 V AC, 1.3 A; 50 – 60 Hz		
Rated power	300 W		
Power consumption	150 W		

<sup>1)</sup> Water-cooled version available on request.

<sup>2)</sup> Precise center wavelength for specific models available upon request.

<sup>3)</sup> Assuming Gaussian pulse shape.

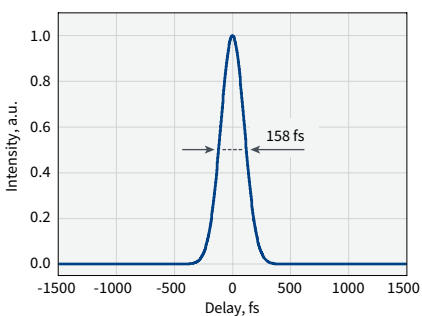
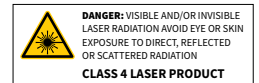
<sup>4)</sup>  $FW\ 1/e^2$ , using maximum pulse energy.

<sup>5)</sup> Enhanced contrast AOM. Provides fast amplitude control of output pulse train.

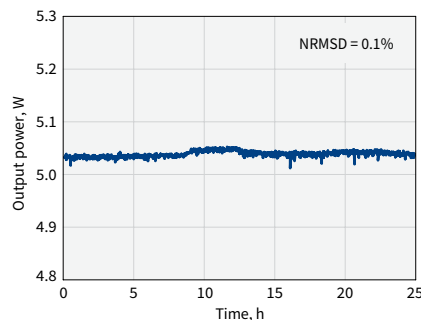
<sup>6)</sup> Under stable environmental conditions. Expressed as NRMSD (normalized root mean squared deviation).

<sup>7)</sup> Integrated. For external harmonic generator, refer to HIRO.

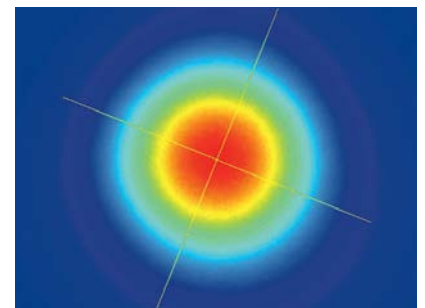
<sup>8)</sup> Integrated. For stand-alone OPAs, refer to ORPHEUS series of OPAs.



Typical pulse duration of CARBIDE-CB5

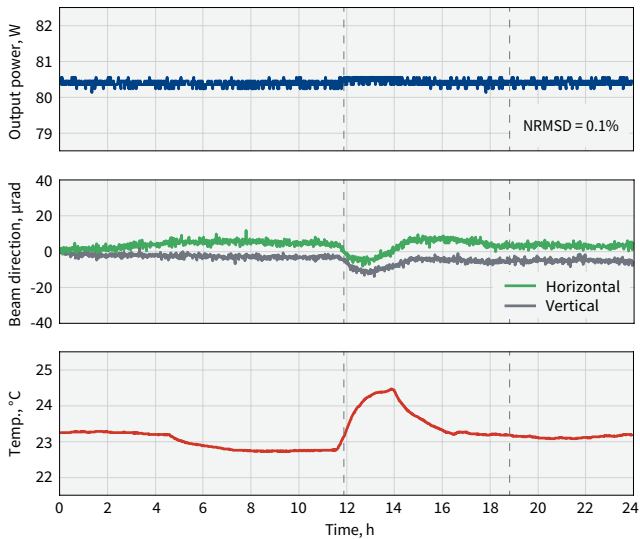


Long-term power stability of CARBIDE-CB5

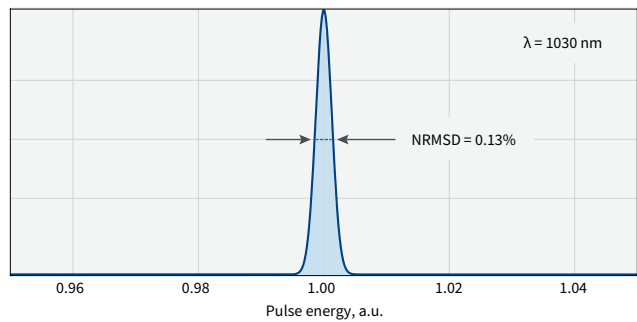


Typical beam profile of CARBIDE-CB5

## STABILITY MEASUREMENTS

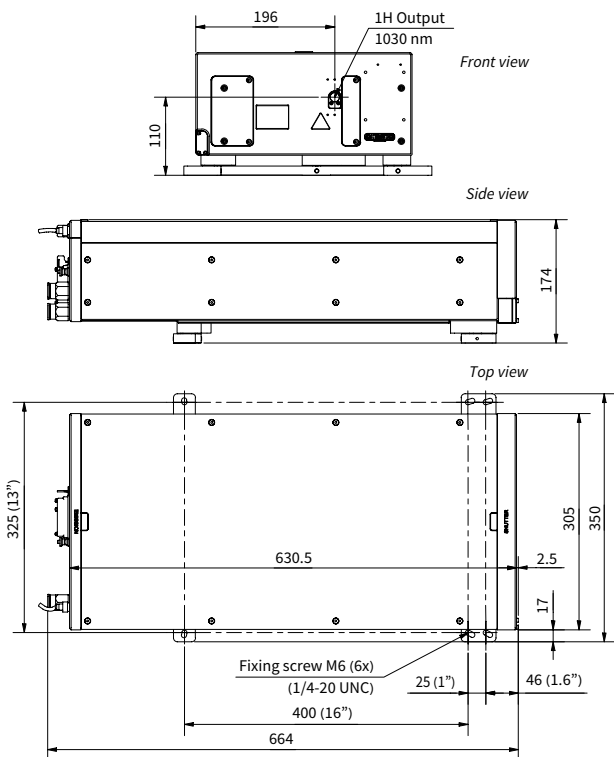


CARBIDE-CB3 output power and beam direction with power lock enabled, under varying environmental conditions

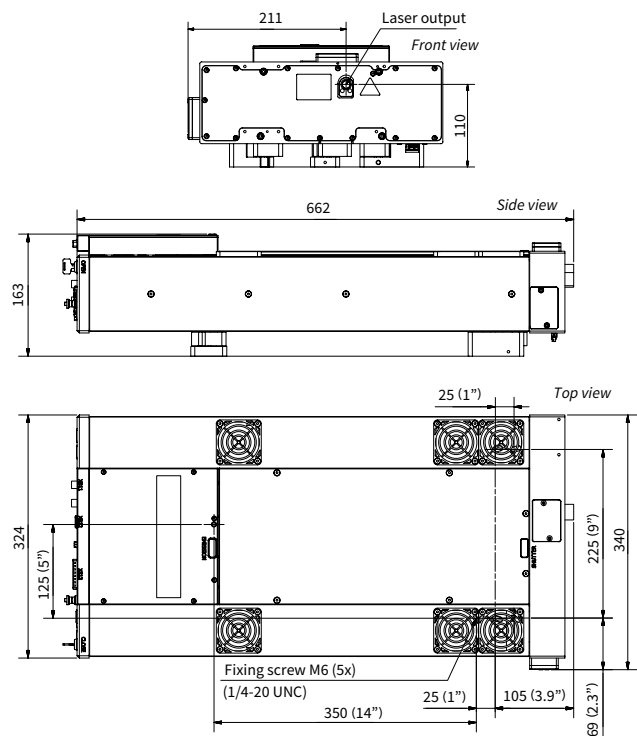


Typical pulse-to-pulse energy stability

## DRAWINGS



Drawing of CARBIDE-CB3



Drawing of air-cooled CARBIDE-CB5 with attenuator

# CARBIDE | CB3-UV

NEW

## High-Power UV Femtosecond Lasers

### FEATURES

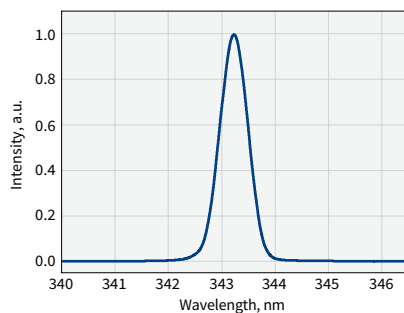
- Maximum output of 50 W
- 500 fs pulse duration
- Up to MHz repetition rate
- High beam quality and stability
- Compact industrial-grade design



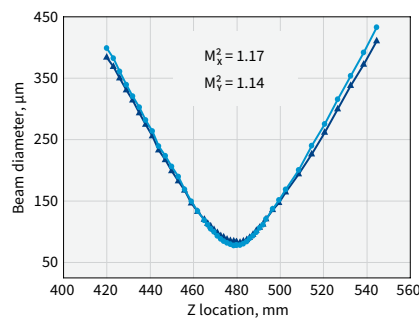
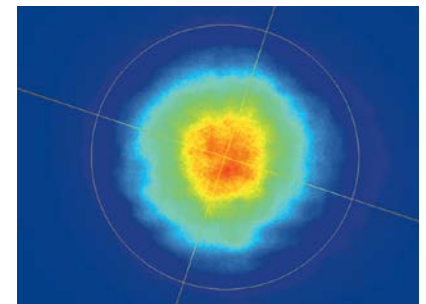
CARBIDE-CB3-UV

CARBIDE-CB3-UV is a series of femtosecond lasers for high-power ultraviolet (UV) applications. As indicated by its name, the CARBIDE-CB3-UV laser is based on a market-proven industrial-grade CARBIDE laser platform. It emits 500 fs pulses at a 343 nm wavelength and fits into the footprint of  $84 \times 35 \text{ cm}^2$ , making it the most compact 50 W UV femtosecond laser currently available in the market.

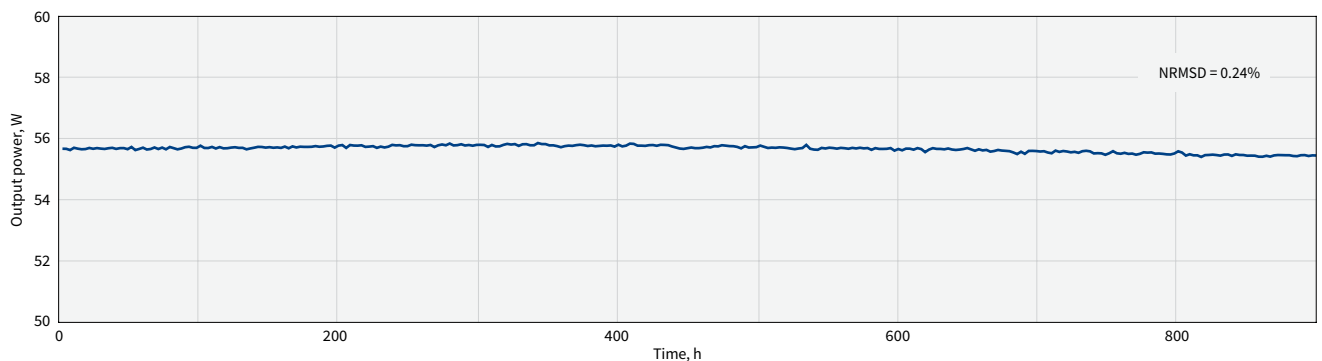
The CARBIDE-CB3-UV ensures long-term performance without the need for user intervention. The high power comes with the advantage of splitting the beam into multiple parts, thereby parallelizing the micromachining processes and subsequently increasing throughput. The CARBIDE platform ensures simple integration into industrial 24/7 workstations.



Typical spectrum of CARBIDE-CB3-UV

Typical  $M^2$  measurement data of CARBIDE-CB3-UV

Beam profile of CARBIDE-CB3-UV-50W



Long-term power stability of CARBIDE-CB3-UV-50W

# SPECIFICATIONS

NEW

Model	<b>CB3-UV-30W</b>	<b>CB3-UV-50W</b>
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## OUTPUT CHARACTERISTICS

Cooling method	Water-cooled	
Center wavelength	343 ± 3 nm	
Maximum output power	> 30 W	> 50 W
Pulse duration <sup>1)</sup>	≈ 500 fs	
Output pulse energy	35 – 150 μJ	
Repetition rate	200 – 800 kHz	300 – 1200 kHz
Polarization	Linear, vertical; 1 : 200	
Beam quality, M <sup>2</sup>	< 1.3	
Beam diameter <sup>2)</sup>	2.5 – 5 mm	
Long-term power stability, 12 h <sup>3)</sup>	< 0.5%	
Lifetime	10000 h or 1 year	

## MAIN OPTIONS

Optional amplifier outputs	1030 nm, 515 nm
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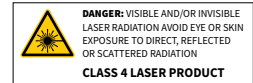
## PHYSICAL DIMENSIONS

Laser head (L × W × H)	832 × 350 × 174 mm
Chiller (L × W × H)	680 × 484 × 307 mm
24 V DC power supply (L × W × H)	320 × 200 × 75 mm

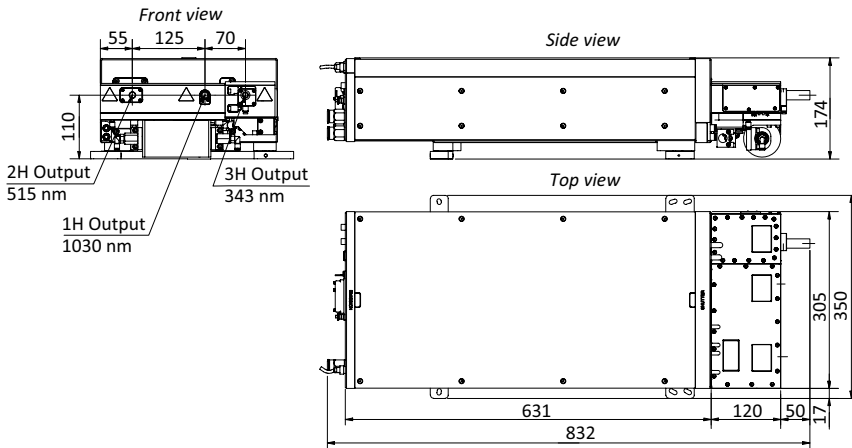
## ENVIRONMENTAL AND UTILITY REQUIREMENTS

Operating temperature	15 – 30 °C	
Relative humidity	< 80% (non-condensing)	
Electrical requirements	Laser	100 V AC, 12 A – 240 V AC, 5 A
	Chiller	200 – 230 V AC; 50 – 60 Hz
Rated power	Laser	1000 W
	Chiller	2000 W
Power consumption	Laser	900 W
	Chiller	1300 W

- <sup>1)</sup> Assuming Gaussian pulse shape.
- <sup>2)</sup> FW 1/e<sup>2</sup>, using maximum pulse energy.
- <sup>3)</sup> Under stable environmental conditions. Expressed as NRMSD (normalized root mean squared deviation).



# DRAWINGS



Drawing of CARBIDE-CB3-UV