

Laser classification report

Uni-Sonic Laserbooth

Cepro International BV

Chris Nillesen

LAPROCON report number
LPC 240822CN02

Heeze, September 24th 2014



Chris Nillesen
LAPROCON BV

Introduction

This report describes the execution and the result of the laser product classification, according to the international laser safety standard IEC 60825-1:2014 of hand held laser weld enclosure from CEPRO International BV ('Cepro'); the Uni-Sonic Laserbooth.

The Uni-Sonic Laserbooth is a class 4 laser product during normal operating conditions and those of single fault failure. The laser welder, meets with all engineering requirements for a laser class 4 product according to EN IEC 60825-1:2014. The laser stray radiation levels, outside the Uni-Sonic Laserbooth, are by design below accessible emission limit (AEL) for class 1. But due to the fact that the Uni-Sonic Laserbooth is human accessible the classification results in laser product class 4.

Intermezzo

Class 4

Laser products for which intrabeam viewing and skin exposure is hazardous and for which the viewing of diffuse reflections may be hazardous. These lasers also often represent a fire hazard.

The laser product classification is executed on August 22nd, by Chris Nillesenⁱ, LAPROCONⁱⁱ, at the location of Cepro; Provinciebaan 16, 5121 DL Rijen, The Netherlands.

Cepro International BV¹ contact person is Mark Hardeman², who provided all machine information. The laser safety assessment was also hosted by Chris Vrek³ who provided the laser weld equipment for this laser safety assessment.



¹ Provinciebaan 16, 5121 DL Rijen

² Mark Hardeman, Engineer

³ Chris Vrek – hand laser weld specialist

Report Date: August 26th 2024

Test Date: August 22nd 2024

Laser Product Classification to IEC/EN 60825-1

REPORT NUMBER: LPC240822CN02

Uni-Sonic Laser Booth

SUMMARY

The Uni-Sonic Laserbooth is a class 4 laser product. The radiation, outside the Uni-Sonic Laserbooth is not accessible under normal operation and those of single fault failure.

The tested unit of this product meets the requirements for a Class 4 laser product to IEC/EN 60825-1 (2014) under normal operating conditions and those of single fault failure.

During normal operating conditions it is eye safe outside the Uni-Sonic Laser Booth.

1) Product Data

- a) **Client**
Cepro International BV
Provinciënbaan 16, 5121 DL Rijen
The Netherlands
- b) **Manufacturer/Supplier**
Cepro International BV
Provinciënbaan 16, 5121 DL Rijen
The Netherlands
- c) **Product Name(s) / Type Numbers**

Uni-Sonic Laserbooth
- d) **Serial Number (if applicable)**

UNISONIC-0001
- e) **Optical sources (used for laser stray radiation measurements outside the Uni-Sonic Laserbooth)**
 - i) **Manufacturer(s) and type details if different from 1 (b)**

1.5kW laser source - CW
 - ii) **Wavelength(s) (State whether measured or manufacturers data.)**

1080nm (manufacturer's spec).
 - iii) **Pulsed or continuous**
Continuous

iv) **If pulsed (data for each laser):**

Manufacturers stated data:

1.5kW (CW) optical power

Measured data (or reasons for not measuring):

Manufacturers specification / class 4

v) **Other relevant data (e.g. beam diameter, beam divergence)**



vi) **Accessibility of Radiation (Locations for measurements – red arrows)**

The laser weld operator is always inside the Uni-Sonic Laserbooth. Due to the location and aiming of focussing lens, radiation is exclusively accessible inside the borders/covers of hand-held laser Uni-Sonic Laserbooth.



There are labyrinth gaps, air inlet, air/fumes extraction and grid, where laser radiation potentially can escape. Note there is no line of sight in or out this labyrinth gaps.
Laser stray radiation measurement demonstrated that a very low level of laser radiation was present during running machine / laser machining process (\ll AEL 1080nm , class 1)
By design there are no additional gaps in the Uni-Sonic Laserbooth. Potential door gaps are overlapped by metal plating and rubber sealing.



2) Radiation Measurements:

a) Control Settings (give details of settings used to maximize output)

Laser power setting 500 W, laser beam directly aimed inside the Uni-Sonic Laserbooth at labyrinth gaps at approximately 1.5m distance (hand-held optics towards gaps), see green arrows in the photos above.

b) Measured Output (give details of limiting aperture etc.)

i) Meter(s) used for measurement:

Thorlabs PM160
Certificate of calibration - no 23037114951 - SERIAL 401785

LAPROCON's power and energy meters are regularly cross-checked for calibration by Thorlabs, based to DIN EN ISO/IEC 17025, traceable to a standard with DKD or National Metrology Institute.

Apparent Source size/angular subtense.

Manufacturers data.

None.

Measured.

Not applicable / considered as a point source.

Measurement Aperture.

9.5mm

ii) Measurements.

see photo's above.

iii) Corrections, if any.

None applicable.

c) AEL (give details)⁴

Class 1 AEL_{1080nm} = 1.95mW (pass)

d) Reasonably foreseeable failures (effect of failure in drive circuitry etc.)

None

The end-users class 4 laser source must be connected through its remote interlock connector to the internal Uni-Sonic Laserbooth's laser safety circuit. The result is that the laser is only able to operate when this laser safety switch is activated, which controls simultaneously the warning text outside and door is closed.

e) CONCLUSION (tentative classification)

Class 1 based on the laser stray radiation measurements (outside Uni-Sonic Laserbooth)

Class 1 based on single fault condition

Class 4 based on human access

3) Required Accuracy of Measurements, Uncertainties.

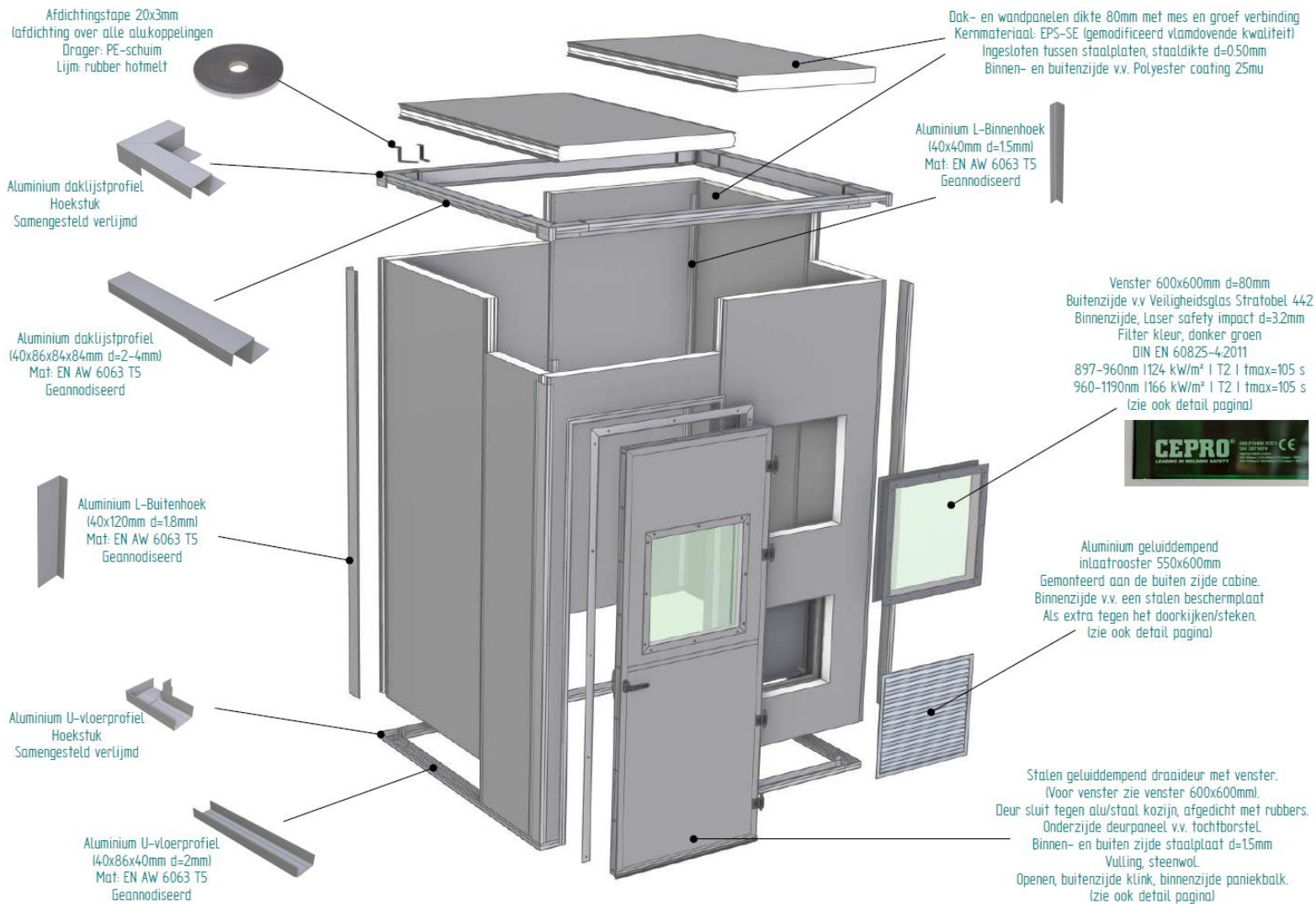
PM160: ±5% (at 1080nm)

⁴ AEL for 1080nm for exposure times exceeding 10s is 1.95mW @7mm diameter (or 3.54mW @9.5mm diameter).

4) Engineering Controls:

- Protective Uni-Sonic Laserbooth

The Uni-Sonic Laserbooth consists of robust, firmly bolted covers. By design there are no gaps where laser radiation levels could exceed the maximum permissible exposure (MPE). The hand held Uni-Sonic Laserbooth consists of ROWA EPS-SE panels with a specified fire class Bs1d0⁵, according to EN 13501-1. Wall thickness of 80mm with 0.50mm steel on both sides.



5 Fire class Bs1d0 means that a product contributes to a fire to a very limited extent, its smoke production is very limited and it does not produce flaming droplets.

specified fire class Bs1d0 / source:
brochure-EPS-SE-brandveilige-toepassingen



EPS **STYBENEX**
VERENIGING VAN FABRIKANTEN
VAN EPS*-BOUWPRODUCTEN

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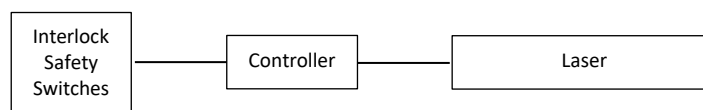
- Viewing optics / laser safety filter window in the door



In the laser filter window

wavelength range 897 – 960 nm damage threshold value is 124 kW/m² the most restrictive
wavelength range 960 – 1190nm damage threshold value is 166 kW/m²

- Safety interlock in protective housing / remote interlock
The entry door is equipped with robust fail safe (PLd), interlock.
Pilz sensors – safety component MN207S
An activated interlock results in the termination of laser radiation / manual reset present inside the Uni-Sonic Laserbooth.



General overview of the interlock system design.



- Manual reset / Key control/ Emission warning / E-stop
Warning text is present at the outside of the Uni-Sonic Laserbooth.



Manual reset button



It is the responsibility of the end-user, who will provide, in all cases the laser hand-held laser welding source, that this is a laser class 4 product, which complies to EN IEC 60825-1:2014 with respect of laser safety engineering precautions. This includes, the manual reset, key control, the emission warning and the e-stop on the laser weld equipment.

5) Labelling

Required labels:

Classification label – class 4 laser product (at the door)



General laser radiation warning label (at the door and inside the Uni-Sonic Laserbooth)

6) User Information:

Preconditions

It is the responsibility of the end-user, who will provide, in all cases the laser hand-held laser welding source, that this is a laser class 4 product and complies to EN IEC 60825-1:2014 with respect of laser safety engineering precautions.

- Hand-held laser welding source must:
 - CE compliant
 - Laser source engineering precautions according class 4 of EN IEC6025-1:2014
 - Laser wavelength somewhere between 897– 1190nm
 - Maximum average laser power of 2.5kW
- Employer / end-user responsibility to incorporate the use of this laser hand-held Uni-Sonic Laserbooth into the company laser hazard and risk assessment
 - Laser safety instructed laser hand-held welding operator
 - Correct use of laser safety personal protective equipment (eyewear and clothing)
- The hand held laser weld torch should not be aimed directly at the Uni-Sonic Laserbooth walls or laser safety filter window in the doors.
- The end-user should inspect the internal Uni-Sonic Laserbooth walls and laser filter window for discolorations an regular bases.

The following information must be present in the user manual:

- Adequate instructions for proper assembly, maintenance and safe use, including clear warnings concerning precautions to avoid possible exposure to hazardous laser radiation.
- A description of all radiation that is above the Class 1 AEL, including wavelength and maximum power.
- For embedded laser products and other incorporated laser products, information to describe the incorporated laser.
- Legible reproductions of all required labels and hazard warnings to be affixed to the laser product. The corresponding position of each label shall be indicated.
- A clear indication in the manual of all locations of laser apertures through which laser radiation in excess of the Class 1 AEL is emitted.
- List of controls, adjustments and procedures for operation and maintenance, including the warning “Caution – Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure”.

7) Service Information

To servicing dealers and distributors, and to others upon request, adequate instructions for service adjustments and service procedures for each laser product model, which must include:

- Clear warnings and precautions to be taken to avoid possible exposure to laser radiation above Class 1 and other hazards;
- A schedule of maintenance necessary to keep the product in compliance; (not required, compliance by Uni-Sonic Laserbooth design)
- A list of those controls and procedures which could be utilized by persons other than the manufacturer or his agents to increase accessible emission levels of radiation;
- A clear description of the location of displaceable portions of the protective housing which could allow access to laser radiation in excess of the accessible emission limits;
- Protective procedures for service personnel;
- Legible reproductions (color optional) of required labels and hazard warnings.

8) Class Awarded:

Class 4, subject to the conditions given in paragraph 6 en 7 and below.

Conditions (state changes required for full conformity)

This classification is based on the performance of the lasers/LEDs supplied to us for testing. The manufacturer is responsible for ensuring that the machine supplied is representative and that sufficient quality control during manufacturing is in place to ensure that the classification is valid.

Signature



Chris Nillesen

ⁱ Chris Nillesen is a laser safety consultant in the employ of LAPROCON. He got his laser safety management education by National Radiological Protection Board (NRPB) & University of Loughborough, England. He has more than 20 years of laser application and laser safety experience, gained among others at Philips Research Laboratories, Philips Centre for Manufacturing Technology and JDS Uniphase, acting as LSO. On behalf of LAPROCON he is currently associated with the Mikrocentrum Nederland; member of the HighTech Platform and lecturer. He gives presentations on laser safety at (inter)national meetings, training courses and acts as a consultant for a wide range of (industrial) companies and SME's.

ⁱⁱ LAPROCON is a laser technology, engineering and consultancy firm and is a laser safety authority in The Netherlands and Belgium . In relation to laser safety LAPROCON classifies laser products according the international laser safety standard IEC-EN60825 and submits on a regular basis laser product reports to the FDA – CDRH with respect to USA federal law. LAPROCON executes laser risks assessments in connection with Dutch ARBO wet, Belgium Welzijnswet and German Arbeitssicherheitsgesetz (referring to 2006/25/EC) and gives advice regarding laser safety precautions: engineering controls, administrative procedures and personal protective equipment.