RESEARCH AND STANDARDISATION

RESPONSE FORM for Standardisation groups To contribute to *EMPIR - the European Metrology Programme for Innovation and Research* *

Objective: to collect standardization needs and suggestions to develop research projects in testing and measurements for the upcoming EMPIR calls (2019 and 2020)

In the frame of the between CEN, CENELEC and EURAMET, CEN and CENELEC have been invited by the EURAMET Management to put forward their **testing and measurement needs in research** for consideration by metrology institutes for future calls under EMPIR.

Relevant technical groups (sector fora, advisory boards, coordination groups, TCs, WGs...) **are invited to contribute with**

- a short introduction or an overview paper of their unaddressed standardization needs for testing and measurement, and
- a contact person (secretary, chair, convenor, liaison officer, etc.) whom proposers for the Potential Research Topics can contact,

by using this Response Form and send it at :

STAIR EMPIR secretariat, Mr Ortwin Costenoble: empir@nen.nl

Deadline for the consultation: **14 December 2018**.
Proof of need by the TC/SC is highly recommended for a successful submission.

Source of the identified need (identification of TC, WG, etc, incl. title)	☒ CEN/TC 123 ☐ CLC/TC 0/WG 0 ☒ ISO/TC 172/SC 9 / WG 1 and WG 4 ☐ IEC/TC 0/SC 0 / WG 0 ☐ Other, namely *Identification, Title??*
European entity responsible for submission of the need	*CEN/TC 123 in cooperation with ISO/TC 172/SC 9 according to Vienna Agreement*
Person that can be contacted for more detail	*Lars Jensen* *l.jensen@lzh.de* *+49 511 2788-257* *Germany*
Unaddressed need (short description)	*In 2001 after a long period of experimental work for the preparation of the standardization project EN ISO 11254 finally a test standard was published to layout a fixed test protocol for the qualification of laser-induced damage threshold measurements in optical components. In the years following 2000, laser technology experienced enormous progress and has become an essential component in mass and serial production featuring laser systems with numerous operation modes (wavelength, pulse durations, and pulse repetition frequency) and with increasing higher optical power and energy. Although the*

	standard has been revised in an international effort and published in 2011 as well as renamed to EN ISO 21254, now American, European, and Asian industry and research groups have identified that the theoretical foundations of the processes on a microscale have to be understood in more detail in order to design test methods that offer a high repeatability and low error margin for present and future generations of laser components. *As one of the major aspects propelling the present revision activity of EN ISO 21254, in modern production methods for optical components defects have shifted from the micro-scale to the nano-scale. As a consequence, error margins of threshold measurements according to the present standard have gone up because of the sparse distribution of these defects. At this point, uncertainty of maintenance cycles and actual error margins as part of the given specifications limit a reliable design of any machine or metrology devices involving high power lasers to a level required in the 3rd decade of the 2000s.* *The proposed need is that scientists in the field of optical systems and lasers revisit the issue of finding advanced theoretical models including quantum effects to describe laser-induced damage on the nano scale and validate these models through computer simulation and experimental confirmation. Based in these results, a metrology standard will be derived and experimentally verified with the assistance of international partners. This includes the need to discuss whether the current approaches even address the relevant characteristics for future optical systems in next generation applications.*
Further explanation of need (TC business plan, road map, formal decision, work item, etc.)	*The topic that is addressed in EN ISO 21254 is highly relevant to a large industry. This is emphasized by the fact that the community comprised of industry and academia in roughly equal share has met on a yearly basis for 50 years now, without exception. The proceedings of these meetings (SPIE Laser Damage) of recent years are filled with approaches and concepts to provide a reliable test method for the failure of laser optics during operation. Presently, the laser market alone involves a global turnover of more than 12 billion US$ with high growth rates per year. An enormous multiplication factor in turnover has to be considered for the applications and products driven by laser technology, some of which are semiconductor lithography, material processing, life sciences and fundamental research.* *It is estimated that theoretical scientists and experimentally focused partners in 3 European research institutions will develop an extensive basis for the next generation standard within a 3 year research project. Especially, because standardization for this topic has been present for nearly 2 decades, statistical certainty and the contribution of several experts across Europe is necessary to reach a maturity of the derived physical models that lead to an international metrology standard for this important topic. This will include the Laser Zentrum Hannover e.V. (LZH), which has been part of the national, european and international technical committees on DIN, CEN and ISO level since nearly three*

	decades. Prof. Detlev Ristau, long time department leader at LZH and now member of the scientific advisory board of LZH acts as convener of the relevant working groups. Dr. Lars Jensen and the experts of the Laser Components department at LZH have established a fundamental knowledge of laser-induced damage processes over the full range of pulse durations and the relevant part of the electromagnetic spectrum. *The Institut Fresnel in Marseille, France, with it's distinct scientist in the field of laser-matter interaction is also a firmly established part in the laser-induced damage community. The group around Prof. Jean-Yves Natoli has documented their expertise in numerous journal publications and is one major contributor to the international state-of-the art models in this field.* *A third partner will be the Vilnius University in Vilnius, Lithuania. With Assoc. Prof. Andrius Melninkaitis a well-recognized researcher has been supporting the strong national optics and laser industry as well as the international scientific community. Based on the expertise of him and his team, with Lidars Ltd. a company has been established to commercialize the widely needed expertise in laser damage metrology.* *With this extensive background and scientific track record of these 3 institutions and the close link to the national and international standardization committees the results of this work will directly feedback to foster future versions of this critical standard in nowadays photonics based production.*
Enclosures	☒ Yes ☐ No

*See **more information at** **EMPIR website**
CEN/CENELEC website "Standards and metrology"