

Tender Instructions

Applicable to the European Public Tender for: Scanning Electron Microscope (SEM)

Contracting authority:

The Netherlands Organisation for Applied Scientific Research / TNO

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Definitions

In this document, certain capitalized words have a specific restricted meaning, as given below. In the case of nouns, the specific meaning applies to both singular and plural forms. Terms which do not appear in this list but which are defined by legislation, notably the *Aanbestedingswet* (Procurement Act 2012, amended 2016) take the meaning intended by that legislation.

Aanbestedingswet (Dutch Procurement Act)	: the <i>Aanbestedingswet 2012</i> , effective 1 November 2012, as published in the Government Gazette 2012 no. 542; amended 1 July by Act of 22 June 2016 to amend Netherlands Procurement Act 2012 in connection with the implementation of European Directives 2014/23/EC, 2014/24/EC and 2014/25/EC; commonly referred to in English as the Procurement Act. May be abbreviated to 'AW'.
Appendices	: Appendices to these Tender Instructions, viz. <ul style="list-style-type: none">• A01 to A07 – prescribed templates to be used when preparing and submitting the Tender (bid)• B01 to B04 – prescribed templates to be used for the provision of information by one or more Third Parties e.g. evidential documents to support the Self-Declaration• C01 to C03 – documents and (supplementary) information which form part of the Tender Instructions but are not intended for submission by the Tenderer or the intended beneficiary.• D000 to D008 – technical documents and (supplementary) information which form part of the Tender Instructions but are not intended for submission by the Tenderer or the intended beneficiary.
Award Criteria (singular: criterion)	: the criteria used by TNO to determine which Tenderer has filed the most economically advantageous tender. Further information on the Award criteria can be found in chapter 6.
Award Decision	: the decision taken by TNO whereby the winning Tenderer is to be invited to enter into a Contract; alternatively, the decision not to award the Contract to any party.
Call for Tender	: the announcement of a European (Public) Tender, usually on www.tenderned.nl .
Contracting authority	: The Netherlands Organisation for Applied Scientific Research (TNO).
Combination	: an alliance of companies or legal entities who submit a joint tender as if acting as a single entity. Each member of the alliance is jointly and severally responsible and liable in law for the effective performance of the Contract, if awarded.
Contractor	: the successful Tenderer to whom the Contract is awarded.
Contract	: the legally binding agreement between TNO and the Contractor, effected further to the outcome of the Tender procedure.
Eligibility Requirements	: the requirements imposed by TNO on all tendering parties not automatically excluded (under the Grounds for Exclusion), establishing minimum standards which must be met in order to be considered for the Contract.
Grounds for Exclusion	: reasons whereby a party is automatically deemed ineligible to take part in the Tender procedure. Depending on the contents of the tender documents and description, such reasons may relate to the (personal) circumstances of the Tenderer, an officer of that company and/or a Third Party with a material involvement in the Tender and the proposed Contract. The Grounds for Exclusion are explained in chapter 5.
Minimum Requirements	: the minimum requirements imposed by TNO with regard to the provision of supplies, services or works, i.e. the manner in which the Contractor is to perform the activities specified by the Contract.

Memorandum of Information	: a document providing further information about the Tender procedure and/or the tender documents, compiled by TNO in response to queries it has received from Tenderers. (The queries are anonymized in the interests of confidentiality.)
Self-declaration	: the statement in the meaning intended by Art 2.84 para. 1 of the <i>Aanbestedingswet</i> , produced in accordance with the format of the European Single Procurement Document as given in Appendices A01 , A02 and B01 .
Tender	: the bid submitted by the Tenderer.
Tenderer	: an individual or legal entity submitting a Tender (bid) further to the Tender Procedure; also termed Tendering Party.
Tender Instructions	: the current document in which the Tender procedure is described.
Tender Procedure	: the European tendering procedure through which a Contract is to be awarded.
Third Party	: any natural person or legal entity upon whom a market party (the Tenderer) can call to meet the requirements of financial and economic capacity and/or technical and professional competence, regardless of the nature of the relationship between the market party and the Third Party.

1 Contracting Authority and Contract

1.1 TNO

The Netherlands Organisation for Applied Scientific Research, hereafter referred to as 'TNO', is a modern, theme-led Research & Knowledge organization. It was established in 1932 by Act of Parliament with the intention of maximizing the practical relevance of scientific research to the public sector, industry and society at large.

TNO is a national institution acting in the general interest and, for the purposes of European policy and legislation, is therefore a 'body governed by public law.' Although it operates under the formal responsibility of the Minister for Economic Affairs, TNO enjoys complete independence and autonomy in its day-to-day activities.

TNO conducts contract research on behalf of clients in all sectors, provides specialist advice and consultancy, and licenses the use of its many patents and the specialist software it has developed. TNO also tests and certifies products and services, issuing an independent quality assessment. The organization has spawned numerous commercial spin-offs to bring its innovations to market.

One of TNO's key strengths is that it brings various scientific disciplines together under one roof. Those disciplines combine and interact to create groundbreaking and sustainable new solutions. Increasingly, TNO seeks collaboration with partners in government and industry, working alongside knowledge institutions and societal organizations at home and abroad. Through its varied activities, TNO stimulates economic growth and social renewal. The organization's mission statement (as phrased in its 2022-2025 Strategic Plan) reads, "TNO connects people and knowledge to create innovations that boost the competitive strength of industry and the well-being of society in a sustainable way." Its objectives are encapsulated in the motto, "TNO, Innovation for Life".

For further information, see: www.TNO.nl.

1.2 Organizational structure

TNO's high level of ambition demands an appropriate organizational structure and corporate culture. Staff must be given every support as they pursue innovation and productive cooperation. The current organizational unitstructure is shown below:



All units are concerned with issues which are high on the national and European innovation agenda. The themes form the focus of the organization's nine units, each of which is responsible for acquiring and performing contract research relevant to its specific theme and innovation areas.

1.2.1 Procurement

TNO's Procurement department oversees all purchasing, procurement and tendering procedures on behalf of TNO, doing so in close cooperation for this tender with TNO Nano Instrumentation department.

As part of the Finance, Procurement & Legal (FPL) division, the Procurement Department is responsible for organizing and implementing all procurement processes in keeping with the corporate objectives of the organization.

1.2.2 NanoLabNL

NanoLabNL is the Dutch national facility for nanotechnology research. Its mission is to provide a full-service and Open-Access infrastructure for R&D in nanotechnology. It has an open character and it hosts many public-private partnerships. NanoLabNL is coordinated as one infrastructure while its facilities are distributed over five cities or 'hubs': Groningen, Enschede, Amsterdam, Delft and Eindhoven. NanoLabNL is part of the national programme on quantum technology. In that capacity NanoLabNL is dedicated to

keeping its basic infrastructure 'state-of-the-art' to enable breakthrough-developments in the fabrication of quantum devices. In addition more specific focus is placed on high TRL infrastructure to serve the quantum agenda.

As such NanoLabNL supports scientists in their research and supports companies in improving or renewing their products/production process and/or developing new products. Finally, it aims to contribute to strengthening the Netherlands as a knowledge economy.



The hubs cooperate and share information on all possible activities, such as procurement. As a result a procurement working group has been established, within this working group, documentation, best practices, and investments plans are discussed and shared.

This Tender procedure, on behalf of TNO, contributes to the achievement of this ambitious mission.

1.2.3 Nano Instrumentation

Manufacturing Integrated Circuits requires ultra-clean and high-performance processes. Ultra-clean equipment with high demands on flow and thermal conditioning plays a major role in a manufacturer's ability to achieve high yields. We help to develop and improve manufacturing equipment, so that it lasts longer and performs better.

We have a team of 50 highly qualified Nano Instrumentation technologists and scientists who develop and assemble experimental set-ups on which they carry out experimental test programmes. We develop and own these set-ups, develop them together with our clients, or transfer full ownership to them.

Our aim is to prevent, diagnose, and remediate critical issues. We apply the principles of contamination control to design, build, and validate ultra-clean equipment for lithography. We continue to grow our extensive knowledge of molecular and particle contamination, vacuum and flow technology, and high-energy radiation, and apply this knowledge for our clients.

1.3 Contract description

The purpose of this Tender Procedure is to select one (1) Contractor to supply/provide a scanning electron microscope, hereafter referred to as "SEM". The supplies/services and the manner in which they are supplied/provided must comply with the specifications and criteria given in the Tender documents, and notably the Programme of Requirements (see Chapter 8). There may be a combination of 'hard' and 'soft' requirements. The former are mandatory and must be met. If one or more of the 'hard' requirements are not met, the Tender will be excluded, provided the exclusion is not disproportionate. The 'soft' requirements are in the nature of 'preferences' which should be taken into consideration to the greatest extent possible.

1.3.1 Scope and content of the Contract

The Contract, to supply a SEM, relates to the provision of supplies and services as specified in the Programme of Requirements (Chapter 8) as applicable.

1.3.2 Maintenance/services Contract

System downtime can lead to loss of opportunities and possibly revenue. Therefore, in relation with this Tender procedure, TNO might intend to enter into a contract for maintenance/services for periods of one year, up to and including 2028. In this light, TNO expects to receive a proposal or proposals that minimise such system interruptions.

The intention to enter into a maintenance contract depends on the price and whether it falls within the total available budget. For this reason, and to allow a fair price comparison, TNO will only include the price for a one-year basic maintenance contract

multiplied by five (5) years in the price assessment (para. 6.1). It should be clear to TNO what is covered by the maintenance contract, but also what is not covered by the contract, and thus will result in an additional cost to TNO. Therefore, the Tenderer is requested to provide insight into at least the following elements:

- All activities covered by the contract;
- All activities which are not part of the contract;
- Giving insight into response times (both inside and outside business hours), where we distinguish the following service levels;
 - Service level 1: A complete loss of service in which the SEM is down. A major issue prevent access to the system or the use of significant portions of the system;
 - Service level 2: Users are unable to perform a non-mission critical function, such as change a portion of the system's configuration;
 - Service level 3: The SEM issue is cosmetic in nature and/or displays minor flaws which are easily circumvented with little or no impact on the customer's normal business operations.
- Service-desk reachability (both inside and outside business hours), either by telephone or via an online portal;
- Number of planned maintenance visits;
- Replacement parts prices or discounted prices on Tenderer enlisted selling price.

If you usually offer different types in maintenance contracts, you may present these variations alongside the basic maintenance contract, but know that only the basic maintenance contract and its price will be evaluated. The price for all possible variations in maintenance/services, for a period of one year, up to and including 2028, can be submitted by the Tenderer in Appendix A04.

1.3.3 Optional second SEM

TNO might have the intention to buy a second SEM with the same similar requirements/preferences (chapter 8 and Appendix D000), and this within a period of maximum three years after final award decision and the signing of the Contract. Such a purchase will take place under the same tender conditions. For this reason, Tenderer is asked to fill-in the related line numbers in Appendix A04.

1.3.4 Purpose of functional use of the SEM

The main intended use of the SEM is to investigate a sample surface before and after an experiment, to observe any changes to the surface. Changes in surface which can be expected, among others, are:

- Increase of very fine surface roughness.
- Blistering or delamination of one or more material layers.
- Changes in oxidation state of surface material.
- Increase of contamination on the sample surface.
- Increase in amount of particles.
- Changes in size and shape of particles which have been exposed.

Investigation of presence of materials in coatings and particles is also anticipated, which is done using EDX.

Measuring of features on samples or measuring distances between features with high accuracy will regularly be done. Furthermore, accurately measuring sample sizes of samples up to at least 10 cm in X or Y directions is done regularly. For further information, see Appendix D000, para. 1.2.

1.3.5 Lots

The Contract for the supply of a SEM is solely divided into one lot.

1.4 Socially responsible procurement

Sustainability is an important aspect of TNO's core business. TNO's motto is for reason 'Innovation for life': we connect people and knowledge to create innovations that sustainably boost companies' competitiveness and increase wellbeing across society. As an independent public organisation, we want to do this in a responsible and sustainable way. TNO has adopted a clear policy on Corporate Social Responsibility (CSR) to put its ambitions in this area into practice in its operations. The CSR policy is closely linked to TNO's strategic goals.

TNO's CSR policy focuses on the five key points listed below:

- TNO aims to have made its operations climate-neutral by 2040.

- TNO is committed to the international framework of the UN Global Compact and endorses the ten principles for sustainable operations.
- TNO recognises its supply-chain responsibility with respect to both suppliers and customers.
- In the transition to sustainable business operations, TNO is focusing on the following priorities: integrity, energy and sustainability, diversity and inclusion, and working conditions.
- TNO intends to include the CSR priorities in the annual plans of the relevant departments.

Where relevant and possible, the sustainability aspects will be translated into sustainability requirements and/or preferences which will be included in the Tender Instructions document.

Having said this, TNO expects suppliers to take responsibility in sustainable product development and product use. Therefore we expect suppliers to offer a service for buying back equipment at the end of lifetime or at the end of service at TNO. Please elaborate on the service you will offer to TNO and make your offer explicit in terms of actions and impact (see para. 8.11, Request 8.10.8).

2 The Tender Procedure

The Tender Procedure is conducted in full compliance with the conditions of the Dutch *Aanbestedingswet* (Procurement Act), which in turn is based on relevant European legislation.

TNO has opted for the 'public' tendering procedure. This means that the Call for Tenders will be published on the TenderNed website at www.tenderned.nl.

TNO has opted to apply the European public procurement procedure. This is because, based on the limited competition in the field to which the Contract pertains, a restricted number of Tenders are expected whereupon the public procedure is likely to be more (cost-) efficient.

2.1 Schedule

The proposed schedule for the Tender Procedure is as follows:

No.	Action	Deadline
1.	Publication of Call for Tenders (on www.tenderned.nl)	10-07-2023
2.	Final opportunity for interested parties to submit questions	21-08-2023
3.	Publication of (final) Memorandum of Information	01-09-2023
4.	Final date (and time) for submission of Tenders	18-09-2023; 10:30 hrs (CET)
5.	Announcement of Intention to Award	20-10-2023
6.	Final date for submission of evidential documents by intended Contractor	27-10-2023
7.	Final date for lodging an objection	10-11-2023
8.	Confirmation of Contract Award	Close after 10-11-2023

Dates are indicative. TNO reserves the right to amend the schedule but will of course observe all legislative requirements. Tenderers will be informed about any amendment to the schedule via TenderNed.

2.2 Tender conditions

2.2.1 Acceptance

The submission of a tender is confirmation that the Tenderer accepts all applicable conditions in the Tender Documents.

2.2.2 Formats

The Tenderer must use the prescribed templates and formats provided in the Appendices to the Tender Instructions. It is expressly forbidden to make any alteration to these templates without the prior consent of TNO.

2.2.3 Self-declaration

The Tenderer must complete and submit a Self-declaration (Appendix **A01** and, if applicable, Appendix **A02** and/or **B01**) according to the following instructions.

The Tenderer must use Adobe Reader to open and complete Appendix **A01**, **A02** and **B01** (the European Single Procurement Document; ESPD). Opening Appendix **A01**, **A02** and **B01** in any other program may result in the loss of information that has been pre-entered by TNO. The submission of a Self-declaration in any form other than that included with the original tender will exclude the entire tender from further consideration. The Tenderer bears sole responsibility for opening Appendix **A01**, **A02** and **B01** and for submitting the Self-declaration in the prescribed manner.

2.2.4 Order of precedence

Where any discrepancies between the contents of the various tender documents exists, the following order of precedence applies (in descending order of importance).

- Memoranda of Information, most recent first
- Tender Instructions and Appendices
- Call for Tenders.

2.2.5 Contact person and communication

All communication with respect to the Tender Procedure will only take place through Tendered and in a manner other than prescribed in this Tender Instructions.

If legal contact with TNO is required / necessary, communication only takes place at TNO's contact point below, which communication must always be done in writing via the e-mail address mentioned below.

Name : Arjan Verhoeven
Position : Senior buyer
Department : Procurement
Correspondence : P.O. Box 6235, 5600 HE Eindhoven
Email : **via TenderNed's message ('berichten') module of the related Tender**

Tenderers can not derive rights from verbal statements, promises and suggestions from TNO employees or agents, made in connection with the Tender Procedure and / or tender documents. Tenderers can only rely on written information provided by or on behalf of TNO.

Failure to comply with the above conditions, or any attempt to influence the judgement or decisions of any person involved in the Tender procedure, will result in immediate disqualification.

2.2.6 Language

Tenders must be submitted in the English language. Tenders submitted in other languages than the English language will be excluded from further participation in this Tender procedure. Evidential documents which cannot be submitted in the English language, can be submitted in the original language but the Tenderer should be able to provide a (sworn) translation on request.

2.2.7 Multiple tenders

The submission of multiple Tenders is not permitted. Each interested party may submit only one tender regardless of the capacity in which it does so (independent Tenderer, lead contractor, subcontractor or member of a combination). A group of companies, as defined by Article 2:24b of the Dutch Civil Code, may submit only one tender unless it is possible to show that there is no dependent relationship between the companies, i.e. no company is able to influence the decisions or operations of another. It is only permissible for two or more companies within the same group to submit competing tenders if they can demonstrate their independence and confidentiality of information (the 'Chinese wall' principle) to the satisfaction of TNO by any means they consider appropriate. Companies forming part of the same group can submit a single tender which specifies their respective roles (lead contractor and subcontractor or acting as a Combination).

2.2.8 Combination

A Combination is defined as an alliance of companies which submits a tender as a single party. A Combination must comply with the following criteria

Coordinator

Where a Tender is submitted by a Combination, a Self-declaration (Appendix **A01**) must be completed by its coordinator, who must provide the following required information *with regard to the Combination itself*, in addition to the standard information required by the Self-declaration.

- (i) In Part IIA, under the heading 'Manner of Participation', tick the 'Yes' box to indicate that the Tender is being submitted on behalf of a Combination.
- (ii) In Part IIA, under the heading 'Manner of Participation' at 'If so', subsection a), the coordinator should state which of the eligibility requirements he fulfils (if applicable) and the specific tasks for which he is responsible.
- (iii) In Part IIA, under the heading 'Manner of Participation' at 'If so', subsection b), enter the official name(s) and legal structure of all other members of the Combination.
- (iv) If the Combination has been formalized and has a registered trading name, this should be entered in Part IIA under 'Manner of Participation' at 'If so', subsection c).

Other members

Each of the other Combination members must complete and submit a separate ESPD (Appendix **A01**) to include the following information regarding the Combination itself (in addition to all other required information):

- i) In Part IIA under 'Manner of Participation', tick the 'Yes' box to indicate that the Combination member is taking part in the Tender Procedure alongside other partners.
- ii) In Part IIA, under the heading Manner of Participation, subsection a), the Combination member should state which of the eligibility requirements he fulfils (if applicable) and the specific tasks for which he is responsible.
- iii) In Part IIA, under the heading Manner of Participation, subsection b), enter the official name(s) and legal structure of all other members of the Combination.
- iv) If the Combination has been formalized and has an official trading name, this should be entered in Part IIA under Manner of Participation, subsection c).

By submitting the Tender, all members of the Combination accept joint and individual responsibility and liability for the fulfilment of all obligations and responsibilities of the Contract should this be awarded to the Combination.

All Self-declarations must be duly signed by an authorized company officer.

2.2.9 Subcontractor

A partnership comprising a lead contractor and a subcontractor can submit a single Tender. The lead contractor is at all times responsible and liable in law for the proper performance of the Contract activities, including those delegated to the subcontractor.

A lead contractor can submit a Tender with a subcontractor in one of the following two manners. The signatory's authority must be established by enclosing a certified extract from the Chamber of Commerce Trade Register with the subcontractor's Self-declaration form (Appendix B01).

- Use of subcontractor's credentials to fulfil Eligibility Requirements
If the Tenderer is reliant on the financial, economic, technical and/or professional capacity of a Subcontractor to fulfil the Eligibility Requirements, that subcontractor is also regarded as a Third Party. In such instances, the Tenderer must follow the instructions given in Para. 2.2.10 concerning reliance on the resources of one or more Third Parties.
- Subcontractor's contribution to fulfilment of Contract
Where the Tenderer meets all Eligibility Requirements unaided but nevertheless wishes to deploy a subcontractor for the fulfilment of the Contract or parts of the Contract, the Tenderer must list all subcontractors to be involved in the fulfilment of the Contract in part IID of the Self-Declaration.

Instructions for the Tenderer when completing the Self-declaration (Appendix A01)

The Tenderer should state whether he does or does not intend to involve one or more subcontractors in the performance of the Contract by completing Part II D of the Self-declaration (Appendix **A01**).

- If there is no intention to involve a subcontractor:
The Tenderer should tick the box marked 'No' in Part II D of the Self-declaration (Appendix **A01**).
- If the Tenderer does intend to involve one or more subcontractors:
The Tenderer should tick the box marked 'Yes' Part II D of the Self-declaration (Appendix **A01**), and enter the names of those subcontractors in the space provided beneath 'If so'.

Instructions for submission of evidential documents

At the request of TNO and within the period specified in Para. 7.1., the Tenderer who is identified as the lead Contractor (subject to confirmation by TNO) is required to submit the corresponding information that he submitted about himself (in Parts II A, II B and III of the Self-declaration) for all subcontractors listed in Part II D of the Self-declaration (Appendix **A01**). The Tenderer must provide this information by submitting a Self-declaration form (Appendix **B01**) in which the relevant sections have been completed by each subcontractor.

The subcontractor's Self-declaration (Appendix **B01**) must be duly signed by an authorized company officer. The Tenderer must establish the signatory's authority by enclosing a certified extract from the Chamber of Commerce Trade Register with the subcontractor's Self-declaration form (Appendix **B01**).

Instructions for the Tenderer when completing the Self-declaration (Appendix A01)

The Tenderer should not complete Part II D of the Self-declaration.

➤ **Required action between notification of Award and commencement of Contract**

Where the successful Tenderer intends to involve one or more subcontractors in the performance of the Contract, TNO must be informed, in writing, of the name or names of the subcontractors who are to perform the contract, of the name of the duly appointed legal representative of each subcontractor, as well as the name, telephone number and email address of a contract person for each subcontractor. This information is to be provided no later than seven days prior to the date of commencement of the Contract that was agreed by TNO and the Contractor or subcontractor. No subcontractor may be involved or changed without TNO's prior written consent.

➤ **Required action during performance of Contract**

Any subcontractors engaged by the Contractor during the performance of the Contract must be approved by TNO. Such approval must be confirmed in writing before the subcontractor is permitted to begin work on the contract (or part thereof) assigned to him by the Tenderer. This provision applies where the Contractor was not required to name specific subcontractors during the Tender Procedure and where new subcontractors are recruited after the Contract work has commenced. If there are any changes to the information relating to a subcontractor, the Contractor or subcontractor must inform TNO immediately and in writing.

In order to approve a subcontractor, TNO must ascertain that none of the Grounds for Exclusion listed in the original Tender Procedure apply. TNO may require the Contractor or subcontractor to submit evidential documents to establish that this is the case. The documents to be requested by TNO are limited to those listed in Section 5. 1 of the Tender Instructions.

If TNO determines that one or more Grounds for Exclusion does indeed apply to the subcontractor, approval will not be granted. TNO will allow the Contractor to propose another subcontractor, whereby the same approval procedure will be followed. TNO will hold the Contractor and subcontractor(s) responsible for the correct and timely execution of the Contract, regardless of any delay due to a subcontractor having been excluded from participation.

2.2.10 (no) Reliance on Third Party resources

The Tenderer may call upon the financial, economic, technical and/or professional capacity of one or more Third Parties. Where the Third Party is to provide financial resources, both the Tenderer and that Third Party are jointly responsible and liable in law for the proper execution of the Contract (if awarded).

Where the Tenderer calls upon the technical or professional capabilities of one of more Third Parties, those Third Parties must take an active part in the performance of the Contract activities (assuming that the Contract is indeed awarded to the Tenderer).

No reliance on Third Party resources

A Tenderer who does *not* intend to make any use of the financial, technical or professional capabilities of any Third Party should tick the box marked 'No' in Part II C of the Self-declaration (Appendix A01).

Reliance on Third Party capacity

A) **Instructions for completion of Tender**

If the Tenderer *does* intend to call upon the financial, economic, technical or professional capabilities of one or more Third parties, he should fill in Part II C of the Self-declaration (Appendix A01) as follows:

1. tick 'Yes' in the appropriate section
2. indicate *which* of the Eligibility Requirements will be met further to the involvement of the Third Party
3. state *how* the Third Party's involvement will fulfil the relevant Eligibility Requirement(s).

The Tenderer who intends to call upon the financial, economic, technical and/or professional capacity of one or more Third Parties should also provide:

4. a separate Self-declaration form (Appendix A02) for each such Third Party, in which parts II A, II B and III have been completed. The forms must be signed by the duly authorized legal representative of the Third Party concerned, and this

person's authority to sign must be confirmed by means of a certified extract from the Chamber of Commerce Trade Register. Note that the extract does not have to be submitted at the same time as the Tender itself; TNO will request further information in accordance with the following provisions.

Addition requirement where Tender relies on the technical or professional capabilities of one or more Third Parties

5. Where the Tenderer intends to call upon the technical or professional capabilities of one of more Third Parties, a list of reference projects must be provided for each Third Party (in addition to that relating to the Tenderer). The list of Third Party reference projects should be compiled using the prescribed template provided as Appendix **A03**.

B) Instructions for Provisional Contractors who intend to call up the resources of one or more Third Parties

If the Tenderer selected by TNO and thus identified as the Provisional Contractor (subject to confirmation) intends to call upon the financial, economic, technical or professional capacity of one or more Third Parties, that Tenderer must submit the following documents on request, within the period stipulated in Para. 7.1 of the Tender Instructions:

1. A declaration produced and duly signed by each Third Party confirming that the Tenderer will have access to the resources stated. Where the Tenderer intends to call upon the financial and economic capacity of the Third Party, the declaration must be made using the template provided as Appendix **B02**. In the case of technical and/or professional capacity, the statement should be made using the template provided as Appendix **B03**.
2. A certified extract from the Chamber of Commerce Trade Register pertaining to each Third Party for whom a Self-declaration (Appendix **A02**) is submitted. The extract should confirm that the legal validity of the signature on the Self-declaration (i.e. the signatory is an authorized officer of the company concerned).
3. All evidential documents listed in Para. 5.1 for each of the Third Parties named in the Tender, confirming that none of the Grounds for Exclusion apply.

Supplementary provision for a proposed Contractor intending to call upon the financial and economic capacity of one or more Third Parties

4. If the Tenderer selected by TNO and thus identified as the Provisional Contractor intends to call upon the financial and economic capacity of one or more Third Parties, that Tenderer must, at the request of TNO and within the period stipulated in Para. 7.1 of the Tender Instructions, submit all documents listed in Para B (concerning '*Instructions for provisional contractors*') together with the evidential documents which establish that each of the Third Parties meets the Eligibility Requirements in respect of financial and economic status. (This replaces the requirement for the Tenderer to submit evidence of its own financial and economic status.)

2.2.11 Alternative Tenders

The submission of alternative Tenders is not permitted. Alternative Tenders will be disregarded.

2.2.12 '...or equivalent'

Where the Tender documents, including Appendices, refer to any specific brand name, patent, type, model, manufacturing process, etc., the words '*... or equivalent*' should be understood to follow.

2.2.13 Reserved rights

1. TNO may, at its own discretion and without having to state reasons, decide not to award the Contract to any of the parties from whom Tenders have been received. TNO reserves the right to suspend or cancel the Tender Procedure entirely or partially. Tenderers are not entitled to compensation for any form of loss or damage directly or indirectly incurred as a result.
2. TNO reserves the right to subject all information provided by Tenderers to further scrutiny for the purposes of verification. Referees may be contacted without prior notice to the Tenderer or Third Party.

Providing false or incomplete information will result in exclusion from the Tender Procedure. Any agreements made prior to the discovery of the false or incomplete information will be revoked and contracts will be annulled. No compensation will be paid. TNO expressly disclaims liability for loss or damage howsoever caused.

2.2.14 Confidentiality

The Tenderer undertakes to treat all information which may affect the commercial interests or scientific integrity of TNO in the strictest confidence. Information is provided on a 'need to know' basis and must not be disclosed to any employee or agent of the Tenderer's organization or those of a Third Party (including consultants and subcontractors) unless such disclosure is essential to the effective preparation of the Tender or, where applicable, the proper performance of the Contract. TNO acknowledges the confidentiality of all information provided in support of the Tender and undertakes not to disclose such information to unauthorized parties. However, Tenderers are advised that TNO is under a legal obligation to explain and justify the Award Decision, which may entail the disclosure of information pertaining to the Tenders received, both successful and unsuccessful.

2.2.15 Distortion of competition

Attempts to distort fair competition, such as collusion or cartel-forming, are grounds for disqualification. Where TNO has plausible indicators of any such attempt, the Tenderer will first be given an opportunity to prove otherwise. If, in the sole opinion of TNO, the Tenderer is not able to provide a satisfactory defence, he will be excluded from the remainder of the Tender Procedure.

2.2.16 Withdrawal of Tender

Submitted tenders cannot be withdrawn after the final date to submit a Tender (see paragraph 2.1). The Tender will remain in place throughout its period of validity.

2.2.17 Period of validity

The Tender represents a formal offer which must remain valid for at least sixty (60) calendar days from the final date to submit Tenders (see paragraph 2.1). This period of validity is automatically extended with the Tenderer who emerges as the Provisional Contractor until the point at which the final Contract is signed.

If an objection to the Award Decision is placed before the judicial authorities in accordance with paragraph 6.2.1, the period of validity will (if necessary) be further extended by a period of thirty calendar days following the day on which the court returns its judgment.

2.2.18 Terms and Conditions of Contract

The Award of the Contract is to be effected by means of:

- The Contract entitled 'PURCHASE AND SUPPLY AGREEMENT TNO – [name supplier]', the draft version of which is included as Appendix C02.
- TNO's Purchasing Conditions for Goods, February 2022, as included as Appendix C03, except where the Tender Documents include alternative provisions, in which case the Tender Documents take precedence.

As provided by Para. 2.3 of the Tender Instructions, the Tenderer is able to propose amendments to the current formulation of the Contract and exceptions to the current formulation of TNO's Purchasing Conditions for Goods – February 2022. TNO will confirm the amendments to be made, which will be listed in the final Memorandum of Information.

Acceptance of the final version of the Contract and/or the amended Purchasing Conditions for Goods is to be regarded as a Minimum Requirement. Failure to meet this Minimum Requirement in full will result in exclusion from the remainder of the Tender Procedure.

The submission of a Tender indicates the Tenderer's full acceptance of all terms and conditions applicable at the time of submission.

2.2.19 Suppliers' Terms and Conditions; Provisional Tenders

TNO shall not be bound by any Terms and Conditions of Supply imposed by the Tenderer or by any Third Party, including but not restricted to subcontractors, auxiliaries or agents, at any time during the Tender Procedure or thereafter, during the performance of the Contract and related activities. An attempt to impose Terms and Conditions shall render the Tender provisional and hence invalid. Tenders which are deemed provisional for this or any other reason will be excluded from further consideration.

2.2.20 Legally valid signature

The Tender and all documents included must be duly signed in ink by an authorized representative of the Tenderer organization. The hard copy of each document is then scanned and uploaded to the TenderNed site. The signatory's authorization to sign must be established by means of a certified extract from the Chamber of Commerce Trade Register. If the signatory is not listed as an authorized representative of the Tenderer organization in the Trade Register, a mandate signed by a registered company officer

must be provided. The extract and mandate must be submitted at the first request of TNO in accordance with the instructions and deadline stated in Para. 7.1 of the Tender Instructions.

The signature under the Tender also applies as a signature under the Self-declaration, Article 2.2.3, the form "ESPD".

If a Tender and/ or one or more documents are legally and duly signed, the Tender is invalid and the Tenderer will be excluded, except when this is disproportionate and not contrary to the fundamental principles of procurement law.

2.2.21 Reimbursement of Tender costs

All costs incurred further to the production and submission of the Tender are to be borne by the Tenderer. TNO shall not provide any form of reimbursement.

2.2.22 Statement of prices and costs

Prices and costs must be stated in euros (EUR), excluding Value Added Tax. The prices and costs are to remain applicable throughout the Contract term except where the Contract terms make alternative provisions. TNO wishes to make clear that price negotiations do not form part of the Tender Procedure.

2.2.23 Publicity

The Tenderer and any partners and/or subcontractors of the Tenderer must not make any public statement or comment about the Tender Procedure, except with the prior written permission of TNO.

2.2.24 Intellectual property rights

Except where expressly permitted under Copyright Law or where necessary for the successful preparation of a Tender, no part of the tender documents may be reproduced in any form, by print, photocopy, DVD, CD-ROM, microfilm or other means, without the prior written permission of TNO. Tenders and all accompanying documents submitted further to the Tender Procedure become the property of TNO upon receipt.

2.2.25 Use of TNO logo

It is not permitted to copy, modify or otherwise use the TNO logo on any documents submitted by the Tenderer further to the Tender Procedure.

2.2.26 Defects in the Tender and explanations by the Tenderer

In case a Tender has a defect which makes the Tender invalid, the Tenderer will be excluded, except when this is disproportionate and repair of the defect is in compliance with the fundamental principles of procurement law. TNO has the right, but no legal obligation, to offer a Tenderer the opportunity to repair the defect. For instance by submitting a missing document. Repairing a defect in the Tender is only possible and can only be allowed when this is in accordance with the fundamental principles of procurement law, in particular the principle of equal treatment. Any repair must be made within 48 hours after a written request by TNO. In case a defect is not sufficiently and/ or timely repaired, the Tender will be declared invalid and the Tenderer will be excluded.

Tenderers must draft their Tender as clear and concrete as possible to avoid unclarity. TNO has the right to ask Tenderers for a clarification of their Tender. Tenderers must be aware that if a clarification is asked by TNO, the clarification must be provided within 48 hours after the written request. A clarification may not change the (contents of the) Tender.

2.3 Further information (questions)

The Tender documents, including the Tender Instructions and Appendices, have been drafted with the greatest possible care. Interested parties are entitled to submit questions, remarks and requests for clarification at any time before the deadlines given in the schedule in Para. 2.1. The questions may relate to the contents of the tender documents or to the Tender Procedure itself. Clarification may be sought where there are any apparent ambiguities or discrepancies between documents. Further information should be requested within the stated period and in the manner described in this paragraph. A Tenderer who fails to request information on time and in the prescribed manner will forfeit his right to object to any identified defects at a later date, for instance after the Award Decision has been provided.

During the period between the Call for Tenders and the information deadline, Tenderers may also submit grounded questions, suggestions for amendments to the text of the Tender documents, including the draft Contract included as Appendix C02 and TNO's

General Terms and Conditions of Procurement (Appendix **C03**). Suggestions should be restricted to textual improvements, editorial corrections and clarifications; they may not affect the essence of the Contract or the applicable Terms and Conditions. TNO reserves the right to act upon or reject such suggestions at its sole discretion.

Questions, comments and requests for supplementary information must be in English. They must only be submitted in writing, in the form of an email, and must use the 'editable' MS Excel template provided in Appendix **C01**. The specific aspect of the documents or procedure to which the query refers should be clearly indicated using the drop-down menu in Excel. The file must then be submitted by email to the TNO contact person named in Para. 2.2.5.

If two or more Memoranda of Information are issued, Tenderers may only submit questions, remarks, questions and/ requests for clarification for the second of following Memorandum of Information that concern the immediately preceding Memorandum of Information.

The TNO contact person will compile one or Memoranda of Information which provide the answers to the questions submitted. The source of the questions will not be identified by name. The deadline for submitting questions is given in Para. 2.1.

The Memoranda of Information will be published at www.tenderned.nl in accordance with the schedule in Para 2.1.

All questions and the answers provided are to be regarded as an integral component of the Tender Instructions. In principle, the Tender Instructions document becomes definitive with the publication of the final Memorandum of Information.

TNO advises interested parties to delay submitting a Tender until the final Memorandum of Information has been published since it may include information which affects the content of the Tender.

Responsibility for reading and acting upon the Memoranda of Information in a timely manner rests with the Tenderer. If the production of the final Tender is jeopardized by technical problems affecting the TenderNed site, the Tenderer should contact the TNO contact person named in Para. 2.2.5, and TenderNed, without delay. If the TenderNed site is indeed 'down', TNO will implement an alternative course of action (subject to the provisions of the Procurement Act.)

TNO advises Tenderers to delay submitting a Tender until the final Memorandum of Information has been published. This may include information and details of changes to the Tender Instructions that affect the process of drawing up a Tender.

2.3.1 Information Meeting

TNO has decided that a separate information meeting will not be held as part of this Tender Procedure.

2.4 Disputes and applicable jurisdiction

All aspects of the Tender Procedure are subject to Dutch law. Any dispute concerning the Tender Procedure requiring legal adjudication must in the first instance be placed before the Court in Interlocutory Proceedings in the District of The Hague, Prins Clauslaan 60.

Tenderers who object to (any part of) the Tender Procedure, (any part of) the information provided, or any other aspect directly or indirectly relating to the Tender Procedure and likely to affect its outcome, must bring their objections to the attention of the TNO contact person named in Para. 2.2.5 at the earliest possible opportunity. Before bringing proceeding to the District Court, the concerning Tenderer is required to request the TNO contact for a enumeration of TNO's prevented days from attending.

The period in which a formal objection can be lodged against the Award Decision and/or the Tender Procedure is twenty calendar days from the date on which the Award Decision is issued. The objection must be made in writing and the writ must be served at the registered statutory address of TNO within the twenty-calendar day period. Where formal proceedings have not been instigated within the designated period, lapse Tenderers forfeit their right to do so later ('rechtsverwerking').

Where a court order challenging the Award Decision and/or the Tender Procedure is sought, in a timely and legally valid manner, the Tenderer to whom the Contract has been provisionally awarded is expected to intervene in the proceedings. If the Tenderer fails to do so, they will forfeit their right to a judicial procedure or to third-party proceedings if the judgment in the first instance requires TNO to amend or withdraw the Award Decision. It is in the interests of all parties to create clarity at the earliest possible opportunity and this requires all arguments to be presented openly and without delay.

2.5 Submission of the Tender

2.5.1 Digital submission

The Tender comprises all forms in Appendices **A01 to A07** which must be completed in full and duly signed by a legally authorized representative of the tendering organization. The formats given in the Appendices must be used.

For the signature requirements, see Para. 2.2.20.

For the current tender procedure, TNO has opted to use the online TenderNed system. The completed Tender documents must be uploaded to the TenderNed secure document safe no later than 10:30 hrs. on 18-09-2023.

Tenders which are submitted beyond the published deadline or which are not uploaded to TenderNed's secure document safe in accordance with the instructions given in this document will be excluded from the remainder of the Tender Procedure. Responsibility for the timely and correct submission of documents rests with the Tenderer at all times.

Tenderers are urged to read the instructions on the TenderNed site, particularly those relating to the uploading of documents to the secure document safe. Note that the upload must be confirmed using the 'registration wizard' which has two-factor authentication requiring users to enter a code which has been sent to them as a text (SMS) message.

Tenderers are advised to allow ample time for the uploading of documents. If a technical problem occurs which places the timely submission of the Tender at risk, the Tenderer should immediately report this situation to TenderNed AND to the TNO contact person named in Para. 2.2.5. If TenderNed does experience a technical problem that makes it impossible for tenders to be submitted shortly before the deadline and TNO is unaware of any Tenders that, despite the technical problem, have been successfully uploaded to TenderNed's secure document safe, then TNO will extend the deadline for submission of Tenders, subject to the restrictions imposed by Article 2.109 of the Procurement Act.

TNO advises Tenderers to take note of the contents of Article 2.109a, further to which they should be prepared to submit an encrypted code identifying their Tender should there be any technical problem preventing the full Tender being uploaded to TenderNed.

2.5.2 Structure and presentation

The following instructions apply to the structure and presentation of the Tender submission. The Tender must consist of the following documents:

Part A comprises the following documents (files):

Appendix A01 Self-declaration by Tenderer (European Single Procurement Document; ESPD)

Appendix A02 Self-declaration by Third Parties on whose resources or abilities the Tenderer Relies (European Single Procurement Document;)

Appendix A04 Schedule of prices / charges

Appendix A05 Conformity list Programme of Requirements

Appendix A06 Notification of preferences/answers to questions

Appendix A07 Optional maintenance/services contract

All forms must be completed in full and then printed out. The paper hard copy is to be signed in ink by a legally authorized representative of the Tenderer organization and then scanned to create a digital (PDF) version.

The various PDF files (Appendices **A01 to A07**) are to be placed in a single folder which must then be compressed ('zipped'). This folder should be named xxxx_part A, where xxxx is replaced by (part of) the name of the Tenderer organization. Upload this compressed folder to TenderNed's secure document safe.

If a Tender is incomplete, the Tender is invalid and the Tenderer will be excluded, except when this is disproportionate and not contrary to the fundamental principles of procurement law.

3 Evaluation of Tenders and Tenderers

3.1 Evaluation team

A multidisciplinary team will be assembled to undertake the qualitative evaluation of the Tenders. Its members will include experts in the subject matter and processes involved. The team members evaluate the Tenders on the basis of quality alone; they are not informed of the financial aspects.

Each member of the evaluation team assesses the Tender against the qualitative (sub sub) award criteria, doing so independently and without reference to the other members of the team. A meeting is then held at which the individual evaluations are compared and discussed. The overall score given for each of the (sub sub) award criteria is the average of the individual scores.

3.2 Evaluation procedure

The evaluation procedure consists of the phases, as described in Chapters 4 to 8.

- Chapter 4** : Evaluation with regard to timely submission, form, presentation and completeness
- Chapter 5** : Evaluation against Eligibility Requirements and Grounds for Exclusion. These are mandatory provisions, whereby non-compliance will result in immediate and irrevocable exclusion from the remainder of the Tender Procedure.
- Chapter 6** : Evaluation against the Award Criteria. This is based on a numerical score for each material aspect.
- Chapter 7** : Evaluation of evidential documents which the Provisional Contractor is requested to submit to TNO.
- Chapter 8** : TNO's evaluation against the Minimum Requirements (with regard to Contract performance) and the Programme of Requirements (PoR).

Based on the overall evaluation, TNO will rank the Tenders in order. The Tender in first place is the '*Economically Most Advantageous Tender based on the Price-quality Ratio*' ('Best PQR').

At any time during the evaluation procedure, TNO may contact a Tenderer to request clarification where necessary. Tenderers are expected to provide a response within 48 hours (paragraph 2.2.26).

3.3 Provisional award decision

Once the tenders have been assessed and TNO has upheld the Contract Award recommendation, the intention to award notice shall be issued to notify both the successful and the rejected tenderers of this decision. The award shall be specifically subject to:

- the results of the verification of the supporting documents for Grounds for Exclusion and suitability requirements.
- approval by the Executive Board of TNO.

If, for some reason the need arises, TNO reserves the right to decide against awarding the contract (provisionally or otherwise, Paragraph 2.13). The issue of the intention to award notice by the contracting authority shall not constitute the acceptance of the tenderer's bid, as defined in article 6:217, Section 1 of the Netherlands Civil Code.

4 Evaluation of timely submission, form, presentation and completeness

4.1 Timely submission

The Tender must be submitted before final date (and time) for submission of Tenders (paragraph 2.1). Any Tender that is received by TNO after this deadline will be deemed invalid and excluded from further consideration.

4.2 Form, presentation and completeness

Tenders will be assessed in terms of completeness and compliance with the published instructions. The omission of required information will result in disqualification.

Tenders which are incomplete and/or fail to comply with the presentation instructions will be declared invalid and excluded from further consideration.

5 Evaluation against Grounds for Exclusion and Eligibility Requirements

5.1 Grounds for Exclusion

The Tenderer will be evaluated against the Grounds for Exclusion. The Self-Declaration (European Single Procurement Document; Appendix A01, A02 en B01) includes a section which requires the Tenderer to confirm that none of the Grounds for Exclusion applies. If one or more of the Grounds for Exclusion does apply, the Tenderer will be disqualified and excluded from the Tender Procedure. The Tenderer on who one or more of Ground of Exclusion applies, has the right to describe in the Self-Declaration if it has taken any self-cleaning measures which prove the Tenderer's reliability and/ or if exclusion is disproportionate (article 2.87a and 2.88 Dutch Procurement Act).

Where any of the Grounds for Exclusion applies to any one member of a Combination, the entire Combination is excluded from the Tender Procedure. The Combination, or one or more of its members, on who one or more of Ground of Exclusion applies, has the right to describe in the Self-Declaration if it has taken any self-cleaning measures which prove the Combination's reliability and/ or if exclusion is disproportionate (article 2.87a and 2.88 Dutch Procurement Act).

Where the Tenderer calls upon the resources or abilities of one or more Third Parties, as described in Para. 2.2.10, and one or more Grounds for Exclusion applies to any of those Third Parties, TNO will disallow the involvement of that Third Party. The Tenderer will then be given an opportunity to find another Third Party able to provide the necessary resources. The Tenderer must do so within seven (7) calendar days after TNO's message. If the Tenderer is unable to do so within the allotted period, or if the replacement Third Party is also subject to any other Grounds for Exclusion, the Tenderer will be excluded from the remainder of the Tender Procedure. Tenderers must be aware that the replacing Third Party must comply to the same Eligibility Requirements as the original Third Party.

In the first instance, a duly completed and signed Self-declaration form (Appendix **A01**) is enough to establish that none of the Grounds for Exclusion applies to the Tenderer. In the case of a Third Party, the Self-Declaration form in Appendix **A02** is required. If the Tenderer is identified as the Provisional Contractor, it must provide evidence concerning the Self-Declaration. At the request of TNO, that Tenderer must provide the following evidential documents within the period stated Para. 7.1. In the case of a Combination, each individual member of that combination must submit these documents within the period stated Para. 7.1. Where the Tenderer calls upon the resources or abilities of one or more Third Parties, the Tenderer must submit these documents for each Third Party within the period stated Para. 7.1.

The evidential documents in question are:

- A certified extract from the Chamber of Commerce Trade Register pertaining to the Tenderer, or in the case of a Combination, to each member individually. The extract(s) must be dated no more than six months prior to the date of submission.
- A Certificate of Good Conduct (GVA) by the Tenderer or - in the case of a Combination - of any combinant and/or - if the Tenderer appeals to one or more Third Parties - every Third Party to which the Tenderer appeals. The Certificate of Good Conduct (GVA) is dated no more than two years prior to the date of submission of the Tender. To apply for a procurement statement, the Tenderer, combinant and/or Third Party must consult the Justis website (www.justis.nl) and follow the instructions contained therein regarding the application for a Certificate of Conduct;
- A declaration issued by the Tax Administration of the Tenderer or – in the case of a combination – of any combinant and/or – if the Tenderer appeals to one or more Third Parties – every Third Party to which the Tenderer appeals. The declaration must at the time of submission of the Subscription not exceed six months to prove that the Tenderer, combinant and/or Third Party has fulfilled his obligations under applicable legal provisions applicable to him relating to the payment of national insurance premiums or taxes.

Tenderers are reminded that it can take several weeks to obtain some types of evidential document. Especially a Certificate of Conduct (GVA), for which a maximum term of sixteen (16) weeks applies. It is therefore advisable to apply for them at the earliest possible moment. It will then be possible to produce the documents when required. It should also be noted that Tenderers are responsible for the timely submission of evidential documents, including documents pertaining to any Third Parties on whose resources they intend to rely. TNO therefore advises Tenderers to approach those Third Parties as soon as possible to make the necessary arrangements. Third Parties should be made aware of the time needed to obtain some documents.

A Tenderer who fails to submit and/or fails to timely submit and/or fails to fully submit the requested evidential documents (pertaining to himself or to any Third Parties) on time will be excluded from the Tender Procedure. except when exclusion is disproportionate. TNO may then invite the party who came second in the evaluation process to submit evidential documents.

5.2 Evaluation of Eligibility Requirements

A Tenderer must be able to demonstrate the level of expertise and skill required to perform the Contract activities. These are termed the 'Eligibility Requirements'.

The Tenderer is evaluated against the Eligibility Requirements as formulated for the Tender. If the Tenderer intends to call upon the professional expertise of one or more Third Parties, as described in Para. 2.2.10, TNO will assess whether each of those Third Parties fulfils the Eligibility Requirements.

The Eligibility Requirements apply to several aspects: financial and economic capacity, technical and professional ability, and professional qualifications. The Tenderer must meet all Eligibility Requirements in order to be considered for the Contract, either independently or by relying on the capacity of one or more Third Parties.

5.2.1 Financial and economic capacity

5.2.1.1 Insurance

The Tenderer must hold full liability insurance with a cover of at least € 1,250,000 per claim, with a minimum annual payment of 200% of this amount (see Appendix C03, para. 20.1), or must be willing to meet this requirement if identified as the Provisional Contractor. The insurance cover must be in place for the entire term of the Contract.

In the first instance, a duly completed and signed Self-declaration form (Appendix **A01**) is sufficient to establish that this requirement has or will be met. If, for the purposes of the present Eligibility Requirement, the Tenderer intends to rely on the financial and economic capacity of a Third Party, a separate Self-declaration must be submitted using the template provided as Appendix **A02**.

At the request of TNO, the Tenderer identified as the Provisional Contractor must submit evidence, within the period specified, of adequate insurance cover in the form of the policy document or a certificate of insurance issued by a recognized insurance company, showing that the Tenderer is insured as required in the Tender documents. Where the policy document is in the name of a holding company, group or concern, the Tenderer must present a copy together with evidence that cover extends to the Tenderer organization.

Where the Tenderer is not (yet) in the possession of the insurance policy or a certificate of insurance issued by an insurance company, within the period specified, he must complete, sign and return a Declaration of Intent to do so (Appendix **B04**). This is a statement to the effect that the Tenderer will obtain the required insurance cover and present the necessary evidential documents no later than **seven calendar days** before the signing of the Contract. It should be noted that this is a suspensory condition; failure to (timely) provide a copy of the policy or a certificate of insurance issued by the insurance company will result in the Contract offer being withdrawn and the Tender being deemed invalid. TNO will not issue confirmation of the Contract until the deadline for legal objections has passed or, if an objection is indeed lodged, it is overruled by the court. The Contract itself cannot be signed until TNO is in possession of evidence that the Tenderer holds the required insurance cover. In the absence of such evidence, TNO reserves the right to withdraw the Contract offer, whereupon the runner-up in the Tender evaluation process will assume first place and will be identified as the Provisional Contractor.

The prescribed document format for the insurance policy or certificate of insurance is enclosed as Appendix **B04**.

5.2.2 Professional authority

By completing the Self-declaration (Appendix **A01**) the Tenderer declares that he is registered in the relevant professional register or trade register, in compliance with all requirements of the member state in which he is based.

At the request of TNO, the Tenderer must provide the following evidential documents within the period stated in Para. 7.1:

- For companies registered in the Netherlands: an original certified extract from the Chamber of Commerce Trade Register should be submitted. This must be no more than six months old at the time of submission. Companies registered in another country should provide a comparable document in accordance with national legislation and practice.
- If the Tenderer is a legal partnership, extracts should be submitted for all parties who are included on the Trade Register, together with a declaration signed by all partners establishing the right of representation with regard to the Tender.

- If the Tenderer is a Combination, an extract should be submitted for each member.
- If the Tenderer intends to call upon the resources of one or more Third Parties or subcontractors, extracts should be submitted in respect of each Third Party or subcontractor.

5.2.3 Legal fitness to carry out the task

Following Regulation (EU) No. 833/2014 as last amended by EU Council Regulation (EU) 2022/576 of 8 April 2022, extensive sanctions have been imposed against the Russian Federation. These sanctions also include a prohibition, taking effect from 11 October 2022, on the execution of public contracts awarded to contractors to which Article 5k of the Sanctions Regulation applies.

In order to prove that no such prohibition on the execution of a contract is applicable, TNO requires Tenderer to complete and submit the declaration (Appendix **B05**). This statement should be legally signed by a representative of the company/ tenderer.

6 Evaluation against Award Criteria

TNO will evaluate and rank the Tenders based on the Award Criteria. In most cases, the primary consideration will be the Price-Quality Ratio.

6.1 Best Price-Quality Ratio

This criterion is divided into the following sub-award criteria and weighting factors. A numerical score is given in respect of Price (TP) and another for Quality (QU).

Award criteria	Max. points
Price (TP)	4000
Quality (QU)	6000
Total	10000

The Tender with the highest overall score is designated the ‘*Economically Most Advantageous Tender based on the Price-quality Ratio*’ (‘*Best PQR*’). The scores are rounded down to the nearest (1) decimal point. The overall score is the total of all non-rounded scores.

The Call for Tenders will state the maximum scores available for each (sub-) sub-award criterion.

In the event of a ‘tie’ – two Tenders with exactly the same overall score - the choice will fall to the Tender with the highest score for Quality. If the Tenders have equal scores for all sub criteria, a winner will be selected at random by an independent and impartial notary.

6.1.1 Sub-award criterium: Price (TP)

To allow an evaluation of the Tender by total price (the TP sub-award criterium), the Tenderer should complete the schedule of prices and costs in Appendix **A04**. If this schedule is found to include omissions or inaccuracies, the entire Tender will be declared invalid and excluded from further consideration.

The price is assessed according to the following elements.

To allow a fair comparison of total price (TP), Tenderers must use the schedule provided by TNO as an MS Excel worksheet (Appendix **A04**). On completion, the schedule must be printed out, signed by an authorized representative of the Tenderer organization. It should then be added to the Tender. The Tenderer must adhere to the prescribed format. All sections must be completed.

The allocation of points for Price is shown in the table below:

Criterion	Max. score
Price TP 1 – SEM , This includes: <ul style="list-style-type: none"> • Two year warranty; • (Critical) Design review; • Site Acceptance Test (SAT); • Installation on site; • Operator & (basic) maintenance training; • Delivery according Incoterms Delivered Duty Paid (DDP), 2020 (location TNO Delft, the Netherlands) 	3000

Criterion	Max. score
<p>Price TP 2 – Maintenance A one-year basic maintenance contract multiplied by five (5) years. Providing insight into at least the following elements:</p> <ul style="list-style-type: none"> • All activities covered by the contract; • All activities which are not part of the contract; • Giving insight into response times (both inside and outside business hours), where we distinguish the following service levels; <ul style="list-style-type: none"> ○ Service level 1: A complete loss of service in which the single-photon detector is down. A major issue prevent access to the system or the use of significant portions of the system; ○ Service level 2: Users are unable to perform a non-mission critical function, such as change a portion of the system’s configuration; ○ Service level 3: The single-photon detector issue is cosmetic in nature and/or displays minor flaws which are easily circumvented with little or no impact on the customer’s normal business operations. • Service-desk reachability (both inside and outside business hours), either by telephone or via an online portal; • Number of planned maintenance visits; <p>Replacement parts prices or discounted prices on Tenderer enlisted selling price.</p>	1000
Total TP = TP1 + TP2	4000

When evaluating the Tender against the sub-award criterium of price, TNO will check that the schedule of costs and prices (Appendix **A04**) has been completed in full. A price quotation on the basis of the schedule must meet the following minimum requirements:

- 1) Prices and costs must be stated in euros, excluding VAT, and accurate to two decimal places.
- 2) Only the unit prices and rates which appear on the price schedule will be included in the evaluation. They will remain valid throughout the duration of the Contract. Prices which deviate from those stated in the Tender Documents confer no rights or obligations on either party during the actual execution of the definitive Framework Agreement.
- 3) Hourly rates are deemed to be ‘all-in’ amounts which include all costs associated with the service provision, including but not limited to travel and accommodation expenses, office costs and overheads. The Tenderer confirms that there will be no additional costs further to the performance of the Contract. Costs, rates and/ or prices not included in the price sheet (Appendix A04) will not be paid by TNO during the fulfilment of the Contract.
- 4) The schedule of prices must be completed in full. The Tenderer must use the MS Excel spreadsheet provided by TNO without any amendments or alterations.
- 5) The Tenderer is responsible for ensuring the accuracy of all figures and calculations. There will be no negotiations about the price sheet (Appendix A04).
- 6) All prices quoted by the Tenderer must be based on the contents of the Tender Documents and form a binding offer.
- 7) Specific minimum requirements and additional instructions for the completion of the Schedule of Prices can be found under the tab marked ‘Additional Instructions’. Submission of the Tender indicates that the Tenderer accepts these conditions in full.

The lowest Total Price (TP) is assessed using the cumulative costs as defined by TNO and appearing on the schedule.

The Tender which offers the lowest Total Price (TP), corresponding to the lowest amount calculated for the total price, will be awarded the maximum of 4000 points. Other Tenders will be scored *pro rata* in inverse proportion to price.

The calculation of the total number of points for Price is made using the following formula:

$$Points = 4000 - \left\{ \frac{(I - LI)}{LI} \times 4000 \right\}$$

Where:

Points: number of points scored for the criterion Price

I: Tender with "Price-TP"

LI: Tender with lowest "Price-TP"

If $I \geq 2xLI$, zero (0) points are awarded for the criterion Price TP.

6.1.2 Sub-award criterium: Quality (QU)

Chapter 8 of the Tender Instructions, the Programme of Requirements (PoR), sets out the Minimum Requirements which must be met during the performance of the Contract activities. These are hard requirements, as formulated by TNO. If one or more of the hard requirements of the PoR are not met, the Tender is invalid.

In addition, the PoR includes a number of preferences with regard to the quality of the products/services concerned. These preferences have been identified by means of a process of consultation. Tenderers are asked to state whether and how they can meet these soft requirements. The ability to do so is likely to influence the assessment of quality. For each preference, the Tenderer is asked to provide a description which addresses certain specific aspects.

The description should be clear and unambiguous, covering all the relevant points in order. Each submission must be no more than the stated number of A4 pages (printed on one side only, with a line spacing of at least 1, minimum font size of 9 pt and margins of 2.5cm left, right, top and bottom). TNO will base its assessment solely on the answers given, which must remain within the permitted length. If an answer exceeds the permitted length, the pages exceeding the maximum will not be assessed. Tenderers should avoid including cross-references to other documents in an attempt to evade the length restriction. Illustrations, diagrams, tables, organograms and sample reports are permitted. Any appendices do not form part of the answer and will not be included in this part of the evaluation procedure. It is possible that two or more tenderers will achieve the same scores for a particular question.

The answers setting out the manner in which the which the Tenderer proposes to meet the stated requirements must be presented in accordance with the instructions in Chapter 8. The Tenderer must use the template provided in Appendix A05.

The allocation of scores for Quality is shown in the table below.

Chapter 7 Sub-sub-award criteria: Quality	Max points
8.3 QU - Aspect "SEM imaging"	1105
8.4 QU - Aspect "Materials analysis"	800
8.5 QU - Aspect "Sample's and sample measurement area to be measured"	1940
8.6 QU - Aspect "Vacuum system and vacuum quality"	475
8.8 QU - Aspect "Control software"	1680
Total	6000

The evaluation of the answers to questions relating to the preferences listed in the PoR will rely on a system of numerical scores. The scores applied consist of the degree of fulfillment of the relevant preference being either binary or in percentage (table below).

Rating	or	Notes
No/poor answer	0%	Nil score. In the assessment team's opinion, the tenderer does not answer the quality element or has skipped it altogether.
Inadequate answer	35%	In the assessment team's opinion, the tenderer does not sufficiently address the required elements and aspects in terms of content and relevance. The tenderer does not take sufficient account of the principles set out in this invitation to tender. The connection with the quality element of the contracting authority is insufficient.
Adequate answer	60%	In the assessment team's opinion, the tenderer does sufficiently address the required elements and aspects in terms of content and relevance, but his answer is too limited. The tenderer does take sufficient account of the principles set out in this invitation to tender, but his answer is too limited. The alignment with the quality element of the contracting authority is only partially sufficient.
Good answer	80%	In the assessment team's opinion, the tenderer addresses the required elements and aspects well in terms of content and relevance. The tenderer takes good account of the principles set out in this invitation to tender. The alignment with the quality element of the contracting authority is good.
Very good answer	100%	In the assessment team's opinion, the tenderer addresses the required elements and aspects very well in terms of content and relevance. The tenderer takes full account of the principles set out in this invitation to tender. The alignment with the quality element of the contracting authority is very good.

NB These are the only possible scores: there are no intermediate values.

When evaluating the degree to which the Tender addresses TNO's preferences, the assessors will consider:

- the degree to which the proposed solution is specific, realistic, feasible, effective, complete and consistent
- the degree to which the proposed solution is in keeping with the specific situation and circumstances, and the degree to which it address the (hard) requirements and preferences stated in the PoR.

The evaluation is based on the 'total picture' created by each answer.

Tenderers must be aware that the Tender will be a contract document if the Contract is awarded to the Tenderer. Therefore, the Tender must be as specific as necessary. A more specific Tender will score higher than a more general Tender.

6.2 Award of Contract

6.2.1 Announcement of Award Decision

All Tenderers will be notified of the results of the evaluation and the Award Decision. Every effort will be made to ensure that this notification is given on the date stated in the Schedule in Para. 2.1.

The notification of the Award Decision will state which Tenderer has been selected as the Provisional Contractor and will give general reasons for the rejection of other Tenders. In the interests of confidentiality, TNO will not provide any information relating to the Tender price offered by the unsuccessful Tenderers.

6.2.2 Objections

A Tenderer who does not agree with the Award Decision may lodge an objection. He must do so within twenty (20) calendar days of the date of the Award Decision and in the manner described in Para 2.4.

If interlocutory proceedings are filed, the Court's preliminary decision will be the basis for the continuation of the Tender Procedure.

6.2.3 Confirmation of Award

Once the period permitted for objections has elapsed and no interlocutory proceedings are filed, TNO will contact the winning Tenderer, as soon as possible, with a view to signing the Contract *unless* an appeal has been lodged with the judicial authorities. The Award is confirmed and is deemed to be final when TNO and the Tenderer enter into a formal Contract. Until the agreement is signed, TNO has no obligation, legal or otherwise, towards the Tenderer or any other party.

6.2.4 Ways of Working

To ensure a successful implementation of the Contract and improve business cooperation, the Tenderer to whom the contract will be awarded must at least agree to the following working approach. This agreement forms part of the final contract and includes, inter alia, the following:

Project Management

Tenderer initially designates the person(s) ("Project Managers") with respect to this Agreement, which person(s) may be re-designated from time to time by Tenderer by notice to TNO.

Meetings and boards will be held for control and guidance of all project activities performed by the Supplier. Each review shall demonstrate the compatibility of the existing technical status with the applicable requirements, and will also examine plans, specifications and procedures for future work in order to provide confidence that the specified requirements will be met within the defined schedule.

The Purchaser intends to hold at least the following reviews:

A Kick-off Meeting

The Kick-off Meeting objective is to cross-check and clarify (if any need) the Supplier proposed design including the complete set of compliance against customer applicable documentation at the issue that is relevant for the contract/kick off. The declaration of a successful kick-off review will give the go-ahead for all activities defined and agreed during the Kick-off Review.

A (preliminary/critical) Design Review

The (preliminary/critical) Design Review objective is to examine the preliminary design of the equipment and to confirm the performance against the requirements. It establishes the compatibility of external & internal interfaces and the compliance of the design with contractual requirements (predicted and/or measured). The successful completion of the PDR permits the Supplier to start the detailed design and the manufacturing.

A Delivery Review The objective of the Delivery Review is to confirm that the equipment and all deliverables satisfies the agreed contractual baseline; and to verify the hardware status through a visual inspection of the equipment. A successful DRB shall authorise shipment of all deliverables in subject.

7 Evaluation of evidential documents and other documents

7.1 Submission of evidential documents and other documents

The Tenderer identified as the Provisional Contractor must submit all necessary documents and information in support of the statements made in the Self-declaration, as well as any other documents and/or information necessary to determine whether the Tender meets all requirements and can be realised, no later than (7) calendar days of being requested to do so by TNO. (These documents in question are those supporting Appendices **B01** to **B05** and any others stipulated in the Tender Instructions and/or request for information.)

TNO will request the Provisional Contractor to submit the required evidential documents which will then be evaluated against the following criteria:

- Timely submission (within allotted period)
- Whether all requested documents have been provided and are complete. The absence of (part of) any document and/or other information may result in the disqualification of the Tender.
- Whether the documents support the Tenderer's eligibility, as claimed by means of the self-Declaration.

It is stressed that any Tenders which prove to include material errors or make claims which cannot be substantiated will be excluded from the Tender Procedure. Tenderers must therefore compile their Tenders with the utmost care and truthfulness.

TNO can request the Provisional Contractor to provide other documents or evidence concerning the contents of the Tender.

7.2 Suspensory conditions

Where the Tenderer is unable to submit a copy of the required insurance policy or a certificate of insurance issued by a recognized insurance company within the period stated in the foregoing paragraph, but has nevertheless signed the Declaration of Intent in Appendix **B04**, and provided that the period permitted for objections has elapsed without any party notifying the intention to instigate legal action (or such action has been adjudicated in TNO's favour), TNO will notify the Tenderer of its intention to enter in a contract 'under suspensory conditions'. In practice, this means that the Contract may only be deemed final and valid if the Tenderer is able to submit a copy of the required insurance policy or a certificate of insurance issued by a recognized insurance company, showing that the Tenderer is insured as required in the Tender documents, no later than seven (7) calendar days before the signing of the Contract. The Contract will be finalized upon receipt of one or other of these documents.

If the Tenderer fails to submit either a copy of the insurance policy or a certificate of insurance issued by a recognized insurance company, the Contract will be deemed null and void. TNO reserves the right to approach the party whose Tender was ranked second in the Tender Procedure with a view to entering into a Contract.

7.3 Contract signing

If the conditions in paragraph 7.1 and 7.2 are met and no interlocutory proceedings are filed within twenty (20) days after Award decision, or, if proceedings are filed, the claims are denied, TNO and the Provisional Contractor can proceed with the signing of the contract. TNO points out that the Contract has not been definitively awarded until the Contract has been signed by both TNO and the Contractor.

8 Minimum requirements with regard to Contract performance (Programme of Requirements)

TNO will assess all Tenders against the Minimum Requirements which relate to the manner in which the Contract itself is to be performed. The Minimum Requirements imposed by TNO itself are listed in Chapter 8, the **Programme of Requirements (PoR)**.

By submitting a Tender, the Tenderer indicates his unconditional acceptance of all Minimum Requirements, including the terms and conditions stated in the Draft Contract (Appendix **C02**).

Tenders which do not comply unconditionally with all minimum requirements are deemed invalid and will be excluded from further consideration. This applies to the hard requirements. Tenders are requested to file an answer on the preferences/ soft requirement that can be scored by TNO (chapter 6).

As stated in Para. 6.1.2 of these Tender Instructions, this PoR contains, in addition to the minimum requirements, a number of requests, which are asked by question, regarding the quality of the requested service/delivery. The Tenderer demonstrates the ability to meet the requirements and preferences by means of his answers to the various questions, which must be structured in accordance with the instructions given in Chapter 8 and Appendix **D000**, where you will find more detailed information. The Tenderer must use the template provided in Appendix **A05 and A06**.

Activities further to the Contract must be performed in full accordance with the Tender Documents and the Tender submitted by the Tenderer. TNO wishes to stress that the requirements listed in the PoR form binding Contract conditions. Any amendments to the PoR made during the term of the Contract are to be implemented within the framework provided by the Contract. TNO will ensure that there is no material alteration to the Contract or the obligations it imposes on either party.

Chapter 1 of this document includes a description of current situation. It sets out the purpose and scope of the Contract and hence the purpose and scope of the PoR.

The Programme of Requirements is divided into the following sections:

- 8.2 SEM generic requirements
- 8.3 SEM imaging
- 8.4 Material analysis
- 8.5 Sample's and sample measurement area to be measured
- 8.6 Vacuum system and vacuum quality
- 8.7 Facilities
- 8.8 Control software
- 8.9 Generic requirements
- 8.10 Options
- 8.11 Corporate Social Responsibility (CSR) – Questions.

Identification of external interfaces

The SEM could have the following external interfaces. 'TBD' in most cases means that it depends on the design of the SEM, and the final location of the SEM in the VLL. TNO expects that in most cases this can be achieved without any problems. The installation requirement from the supplier will clarify the requirement from the supplier. The final interfaces will be agreed on during the CDR meeting in the ICD.

interface type	identification	location
<i>Mechanical</i>		
SEM to Floor	SEM to Floor	Laboratory or clean room
<i>Supplies</i>		
Power	Power	Laboratory or clean room
Process cooling water	PCW	TBD
Compressed dry air	CDA	Laboratory or clean room

interface type	identification	location
Nitrogen	N ₂	Laboratory or clean room
<i>Signals</i>		
Interlocks	Interlocks	TBD
remote access	remote access	TBD
<i>Environment</i>		
Laboratory or clean room	VLL	-

8.1 Configurations

The SEM might have two configurations, one during testing in the factory, using common ancillary equipment that will not be part of the delivery, and a configuration installed at TNO. The supplier is responsible for both configurations, if applicable.

8.2 Aspect “SEM generic requirements”

Aspect “SEM generic requirements”		Method of validation
Requirement R-0000-005	<p>Meet all requirements The SEM supplier shall deliver a system that is capable of meeting all the stated requirements, and accepted preferences, in this document at the same time, unless indicated otherwise in a specific requirement.</p> <p>Rationale: Required to meet main function of the SEM system.</p>	R
Requirement R-0000-010	<p>Human, machine and sample safety The SEM shall ensure, human, machine and sample safety.</p> <p><u>Remark</u>: close-out of this requirement is done by review of the provided FMEA and demonstration that the implemented mitigation actions function, therefor VM is demonstration.</p> <p>Rationale: TNO requires a safe system</p>	D
Requirement R-0000-015	<p>Operation lifetime The SEM system shall have an operation lifetime of at least 10 years.</p> <p><u>Remark</u>: Close out shall be done through review of design, proof of heritage, used materials and equipment.</p> <p>Rationale: Minimum expected lifetime of such a system.</p>	R

8.3 Aspect “SEM imaging”

TNO considers the imaging part of the SEM the core business of the SEM supplies, also looking at the stated performance of the SEM’s on the imaging part, the differences are very limited. Because of this, TNO will have in this chapter more high level requirements compared to some other chapters of this requirements document.

Aspect “SEM imaging”		Remarks for score (in case of preference)	Max. Score	Method of validation
Requirement R-1000-005	<p>Source for imaging and material analysis The SEM shall have a source that matches best the stated requirements on both imaging (Requirement R-1000-025) and material analysis (Requirement R-2000-005).</p> <p>Rationale: The SEM will be used for both imaging and material analysis. A source that would perform very well on one of those two items, but very poor on the other is not desired with the foreseen use of the SEM.</p>			R
Requirement R-1000-010	<p>Electron optical column The Electron optical column shall enable the SEM to meet the required imaging (Requirement R-1000-025) and material analysis (Requirement R-2000-005) requirement stated in this document.</p> <p>Rationale: TNO seeks a SEM that can be used for both imaging and material analysis using EDX, the SEM Electron optical column shall ensure that both required functions are possible.</p>			R
Requirement R-1000-015	<p>Source lifetime demand The SEM source shall have a minimum lifetime of 2 years when operated 1000 hours per year.</p> <p><u>Remark 1</u>: close out of requirement by proof from similar systems in use, or free repair when the source fails before stated requirement.</p> <p><u>Remark 2</u>: lifetime is stated a time before full replacement of source, not tip maintenance or exchange. The supplier shall state the expected time before tip maintenance or tip exchange is needed.</p> <p>Rationale: The use-case of the SEM is not high volume SEM use, therefore the stated use per year is on the higher side of use. However, TNO desires low maintenance time and cost.</p>			R

Aspect "SEM imaging"		Remarks for score (in case of preference)	Max. Score	Method of validation
Preference R-1000-020	<p>Source lifetime desire The SEM should have a minimum lifetime of 10 years when operated 1000 hours per year.</p> <p><u>Remark 1</u>: close out of requirement by proof from similar systems and use, or free repair when the source fails before stated requirement.</p> <p><u>Remark 2</u>: the supplier shall state in the tender document the promised lifetime.</p> <p><u>Remark 3</u>: lifetime is stated a time before full replacement of source, not tip maintenance or exchange. The supplier shall state the expected time before tip maintenance of tip exchange is needed.</p> <p>Rationale: The use-case of the SEM is not high volume SEM use, therefore the stated use per year is on the higher side of use. However, TNO desires low maintenance time and cost.</p>	<ul style="list-style-type: none"> ▪ 0 points if 24 months (warranty periode); ▪ 50 points if > 2 years; ▪ 100 points if > 3 years; ▪ 150 points if > 4 years; ▪ 200 points if > 5 years; ▪ 250 points if > 6 years; ▪ 300 points if > 7 years; ▪ 350 points if > 8 years ▪ 400 points if > 9 years. 	400	R
Requirement R-1000-025	<p>Imaging quality demand The SEM shall meet the stated requirements on imaging as stated in Appendix D001.</p> <p><u>Remark</u>: this consists for example, but not limited to:</p> <ul style="list-style-type: none"> - resolution, - brightness, - tuneability of parameters like voltage, current. <p>Rationale: TNO seeks a general use SEM, and is of the opinion that the stated values are represented in this requirement.</p>			A
Requirement R-1000-035	<p>Imaging detectors TNO concluded that both, different names and, slightly different implementations are used for similar detectors. To ensure equal opportunities for every supplier, the SEM shall be equipped with the detectors needed to generate the required measurements as stated in Appendix D001, and the minimum required detectors stated in Appendix D002.</p> <p><u>Remark 1</u>: In the tender document the used/ offered detectors shall be stated, and the detectors that are not offered.</p> <p><u>Remark 2</u>: VM is stated as analysis, this because the detectors will be tested, and the results analysed on the stated performance/ function. First check will be review of the offered detectors.</p> <p>Rationale: Imaging is the core requirement of the SEM, the detectors are the needed for this. The presented requirement measurements in Appendix D001, and the support Appendix D002 should ensure that TNO has a SEM that fulfils our use-case.</p>			A

Aspect "SEM imaging"		Remarks for score (in case of preference)	Max. Score	Method of validation
Requirement R-1000-040	<p>Charging samples The SEM shall have one or more mitigations in place to measure a sample as described in Appendix D003.</p> <p><u>Remark 1:</u> Several mitigation options are present in the market, TNO does not have a specific preference for the proposed solution, and several mitigation solutions may be used for the specific best solutions for the sample, or the measurement type.</p> <p><u>Remark 2:</u> close-out of this requirement is verification that stated samples can be measured according to requirement R-1000-025.</p> <p>Rationale: TNO must be able to measure charging samples, therefore mitigation against charging samples are needed.</p>			D
Requirement R-1000-045	<p>Beam acceleration voltage on sample between 0.1 keV and 30 keV The beam energy on the sample shall be able to be controlled between 0.1 keV and 30 keV.</p> <p>Rationale: Lower energy on the sample from the beam will enable the imaging of the top surface of the sample</p>			D
Preference R-1000-050	<p>Beam acceleration voltage on sample between 0.1 keV and 30 keV stepless desire The beam energy on the sample should be able to be controlled stepless, with a resolution of not bigger than 50 V steps, between 0.1 keV and 30 keV.</p> <p><u>Remark:</u> the supplier shall state the minimum step size in the tender document.</p> <p>Rationale: Lower energy on the sample from the beam will enable the imaging of the top surface of the sample.</p>	Binary (yes or no) No is 0 points; Yes is 30 points.	30 points	D
Requirement R-1000-055	<p>Horizontal field width at eucentric height The SEM shall have a maximum horizontal field width (HFW), at eucentric height, of at least 2 mm, both for SE and BSE imaging.</p> <p>Rationale: The stated horizontal field width will provide a nice balance between imaging resolution and ease and speed of finding location of interest.</p>			A
Preference R-1000-056	<p>Horizontal field width at low vacuum, at eucentric height desire The SEM should ideally have a large maximum HFW of 2 mm or more when imaging non-conducting samples, at eucentric height.</p> <p>Rationale: When imaging non-conducting samples, sometimes a detector aperture or cone aperture is used, limiting the maximum HFW. A larger maximum HFW provides more flexibility.</p>	Binary (yes or no) No is 0 points; Yes is 75 points.	75 points	A

Aspect "SEM imaging"		Remarks for score (in case of preference)	Max. Score	Method of validation
Requirement R-1000-057	<p>Beam current setting The SEM shall have the possibility of tuning the beam current stepless.</p> <p>Rationale: The beam current is an essential parameter to tune to obtain the best imaging settings.</p>			R
Requirement R-1000-060	<p>Imaging multiple channels simultaneously demand It is expected that the SEM has several detectors, the SEM shall be able to image at least 2 detectors simultaneously.</p> <p><u>Remark</u>: imaging simultaneously is not equal to showing all the images simultaneously, TNO accepts that not all images will be displayed at the same time.</p> <p>Rationale: Different detectors show different images. It is very useful if images are taken simultaneously. It would be nice if those could be displayed next to each other, but TNO understands that at a certain time the screens are a limiting factor.</p>			D
Preference R-1000-065	<p>Imaging multiple channels simultaneously desire It is expected that the SEM has several detectors, the SEM should be able to image all detectors simultaneously.</p> <p><u>Remark 1</u>: the supplier shall state (if not all detectors can be imaged simultaneously) the detectors that can be imaged simultaneously</p> <p><u>Remark 2</u>: imaging simultaneously is not equal to showing all the images simultaneously, TNO accepts that not all images will be displayed at the same time.</p> <p>Rationale: Different detectors show different images. It is very useful if images are taken simultaneously. It would be nice if those could be displayed next to each other, but TNO understands that at a certain time the screens are a limiting factor.</p>	<ul style="list-style-type: none"> ▪ Able to image > 2 detectors simultaneously = 25 points; ▪ Able to image ≥ 3 detectors simultaneously = 50 points. ▪ Able to image ≥ 4 detectors simultaneously = 100 points; 	100	D
Requirement R-1000-070	<p>Segmented detector The SEM shall be equipped with at least one segmented detector, which can be read out per segment to be able to obtain detailed topographical information.</p> <p><u>Remark</u>: in the tender document the supplier shall state the amount of segments.</p> <p>Rationale: Making images with certain segments can show shadow effects and give information about height/depth.</p>			R

Aspect "SEM imaging"		Remarks for score (in case of preference)	Max. Score	Method of validation
Preference R-1000-075	<p>Use of all detectors without manual hardware changes desire The SEM should be able to use all offered detectors without any manual hardware actions needed.</p> <p><u>Remark:</u> If not possible for all the detectors, the supplier shall state what is possible.</p> <p>Rationale: TNO seeks a complete SEM, manual removing, or installing detectors is not desired, this because it will limit for instance automated measurements with different detectors.</p>	Binary (yes or no) No is 0 points; Yes is 100 points.	100	D
Preference R-1000-080	<p>Electron energy filtering option desire The SEM should be equipped with a BSE detector where the detected electron energy can be filtered.</p> <p>Rationale: Filtering out BSE electrons with certain energy before arriving in a detector can give extra information on material properties.</p>	Binary (yes or no) No is 0 points; Yes is 200 points.	200	R
Preference R-1000-081	<p>Stage bias desire The SEM should be equipped with stage bias with a tuneable range between at least -250 V to +250 V.</p> <p><u>Remark:</u> the performance of the stage bias will be stated in the tender document, if applicable.</p> <p>Rationale: A stage voltage bias can improve imaging resolution and quality in certain demanding situations. Furthermore it could be used for charge filtering.</p>	Binary (yes or no) No is 0 points; Yes is 200 points.	200	D
Requirement R-1000-085	<p>Imaging integration settings In the SEM software it shall be possible to set or tune, at least the following imaging settings:</p> <ul style="list-style-type: none"> • Pixel-, line-, frame-integration options. • Drift correction option. • Dwell time setting. <p><u>Remark:</u> It is expected that this can all be done from within the SEM software GUI.</p> <p>Rationale: These imaging settings are necessary to prevent certain charging effects and obtain the best images. Drift correction is required to be able to image when there is some sample or image drift.</p>			R

8.4 Aspect “Materials analysis”

To TNO’s knowledge all suppliers are able to deliver the SEM with the COTS Energy Dispersive X-rays Spectroscopy EDX, i.e. Bruker or Oxford instruments, or have designed a company EDX. To not limit any suppliers proposal, TNO will not require a specific supplier, but will require the stated performance requirements in this chapter.

Aspect “Materials analysis”		Remarks for score (in case of preference)	Max. Score	Method of validation
Requirement R-2000-005	<p>Material analysis (EDX) The SEM shall be delivered with an integrated, and functional EDX, with the requirements stated within Appendix D005.</p> <p><u>Remark 1:</u> TNO opted to state the requirements in one Appendix document, this because TNO is of the opinion that all suppliers can deliver an EDX to the stated requirement, this by either installing a COTS EDX, or install an in-house developed EDX.</p> <p><u>Remark 2:</u> the supplier shall state in the tender document the selected detector, with all the specifications.</p> <p>Rationale: TNO requires to measure the composition of the sample, this is commonly done with SEM EDX.</p>			D
Requirement R-2000-010	<p>Material analysis samples The EDX of the SEM shall be able to measure the stated samples in Appendix D003</p> <p><u>Remark:</u> including in this sample list, <u>charging samples</u> are present. It is expected that charge mitigation will be required. This may be done by so called low vacuum SEM.</p> <p>Rationale: In Appendix D003 the common used samples are stated, the EDX and SEM must be able to measure these samples.</p>			D
Requirement R-2000-015	<p>Minimum detector surface EDX The minimum detector surface area shall be 60 mm².</p> <p>Rationale: Requirement to ensure similarity in offers, bigger detector surfaces may be offered, or presented as an option.</p>			D
Preference R-2000-020	<p>Level of integration desire The by the supplier selected EDX should have an as high as possible integration of the EDX control into the SEM control system.</p> <p><u>Remark 1:</u> The supplier shall provide documentation (up to 10 slides) how the level of integration of the EDX is achieved in the overall SEM control system.</p> <p><u>Remark 2:</u> the stated level of integration will be validated with demonstration.</p> <p>Rationale: The higher the level of integration, the easier it will become for the operator, increasing the efficiencies of operation of the SEM</p>	Evaluation according to paragraph 6.1.2	800	D

8.5 Aspect “Sample’s and sample measurement area to be measured”

This chapter will host the requirements related to the nominal samples that need to be able to be measured with the SEM. TNO expects that the demands are possible within a COTS SEM, and is hopeful that with smart sample holders, most of the desired samples also can be loaded, and measured.

Aspect “Sample’s and sample measurement area to be measured”		Remarks for score (in case of preference)	Max. Score	Method of validation
Requirement R-3000-005	<p>Sample size loading demand The SEM shall be able to load the samples that are stated in Appendix D003.</p> <p>Rationale: Commonly used samples within the domain that TNO works in, will be used.</p>			D
Preference R-3000-010	<p>Sample size loading desire The SEM should be able to load samples which are larger than stated in D003, which is explained in Appendix D004.</p> <p>Rationale: Being able to load these samples, which are larger than the baseline samples in Appendix D003, will increase the use-case for the SEM.</p>	Evaluation according to Appendix D004	500	D
Requirement R-3000-015	<p>Sample measurement area demand The SEM shall be able to measure the samples in the stated measurement area in Appendix D003 without making use of stage rotations.</p> <p><u>Remark</u>: it is expected that an XYZ translation of the sample stage will be used to position the sample to measure at the required measurement spot</p> <p>Rationale: The SEM will be used to scan across the loaded sample, therefore the SEM must be able to translate the sample to the desired position.</p>			D
Preference R-3000-020	<p>Sample measurement area desire The SEM should be able to measure a surface area which is larger than stated in Appendix D003 baseline. This is explained in Appendix D004.</p> <p><u>Remark 1</u>: it is expected that an XYZ translation of the sample stage will be used to position the sample to measure at the desired measurement spot. It is allowed to also use a rotation to increase the measurement area. If this rotation is used, this shall be fully automated in the software of the SEM.</p> <p><u>Remark 2</u>: if rotation is used, this shall be stated in the tender documentation.</p> <p>Rationale: The SEM will be used to scan across the loaded sample, therefore the SEM must be able to translate the sample to the desired position. An increase in measurable area will increase the use-case of the SEM.</p>	Evaluation according to Appendix D004	400	D

Aspect "Sample's and sample measurement area to be measured"		Remarks for score (in case of preference)	Max. Score	Method of validation
Requirement R-3000-030	<p>Sample measurement at tilt demand The SEM shall be able to tilt, and measure, the specified samples, in the specified measurement area, and to the specified angle as stated in Appendix D003.</p> <p><u>Remark:</u> The supplier shall indicate how the design of the sample stage will prevent the samples from movement during tilting.</p> <p>Rationale: Measuring under a tilt angle will provide additional information from the sample surface.</p>			D
Preference R-3000-035	<p>Sample measurement at tilt desired The SEM should be able to tilt more than 60 degrees, as stated in Appendix D003.</p> <p><u>Remark:</u> The supplier shall indicated how the design of the sample stage will prevent the samples from movement during tilting.</p> <p>Rationale: Measuring under a tilt angle will provide additional information from the sample surface.</p>	Evaluation according to Appendix D004	50	D
Requirement R-3000-045	<p>Sample weight demand The SEM shall be perform all stated SEM requirements with a sample weight up to 0,5 kg, with the exemption of the tilt motion.</p> <p><u>Remark:</u> this stated sample weight is excluding sample holders weight that are required for normal SEM usage, with the stated samples in Appendix D003, and if applicable Appendix D004, and therefor are in the delivery of the SEM.</p> <p>Rationale: Stated sample weight is the maximum sample weight that TNO expects.</p>			T
Preference R-3000-050	<p>Sample weight desired The SEM should be perform all stated SEM requirements with a sample weight up to 2,5 kg, with the exemption of the tilt motion.</p> <p>Remark 1: this stated sample weight is excluding sample holders weight that are required for normal SEM usage, with the stated sample in Appendix D003, and if applicable Appendix D004, and therefor are in the delivery of the SEM.</p> <p>Remark 2: the supplier shall state the maximum sample weight.</p> <p>Rationale: Stated sample weight is the maximum sample weight that TNO expects with some additional margin.</p>	<ul style="list-style-type: none"> • 2kg is 12 points; • 2,5 is 27 points; • >2,5 = 30 points. 	30	T

Aspect "Sample's and sample measurement area to be measured"		Remarks for score (in case of preference)	Max. Score	Method of validation
Requirement R-3000-055	<p>Sample weight including tilt motion demand The SEM shall be perform all stated SEM requirements with a sample weight up to 0,5 kg, including the tilt motion.</p> <p>Remark: this stated sample weight is excluding sample holders weight that are required for normal SEM usage, with the stated sample in Appendix D003, and if applicable Appendix D004, and therefor are in the delivery of the SEM.</p> <p>Rationale: Stated sample weight is the maximum sample weight that TNO expects.</p>			T
Preference R-3000-060	<p>Sample weight including tilt motion desired The SEM should be perform all stated SEM requirements with a sample weight up to 2,5 kg, including the tilt motion.</p> <p>Remark: this stated sample weight is excluding sample holders weight that are required for normal SEM usage, with the stated sample in Appendix D003, and if applicable Appendix D004, and therefor are in the delivery of the SEM.</p> <p>Rationale: Stated sample weight is the maximum sample weight that TNO expects with some additional margin.</p>	<ul style="list-style-type: none"> • 1kg is 6 points; • 1,5kg is 15 points; • 2kg is 24 points; • >= 2,5 = 30 points. 	30	T
Requirement R-3000-065	<p>Mounting of stated samples The SEM shall enable mounting of samples as stated in Appendix D003, and if applicable for the samples stated in Appendix D004.</p> <p>Remark: The supplier shall state in the tender documents how the supplier intends to mount the samples.</p> <p>Rationale: The stated samples are the normally used samples for TNO, an option is to have sample holders that are dedicated for the stated sample holders, see option R-0000-145, another option is that the SEM is equipped with a sample holder that can easily mount all the stated samples.</p>			D
Preference R-3000-066	<p>Limit of use of carbon tape desire The use of carbon tape for mounting the defined standard samples, see Appendix D003 and D004, should be kept as minimal as possible.</p> <p>Rationale: Carbon tape will contaminate samples, sample holders, and the SEM. For the stated normally used samples it is considered beneficial of mounting of those samples can be done in dedicated sample holders that do not require carbon tape, see option R-0000-145.</p>	Evaluation according to paragraph 6.1.2	100	R

Aspect "Sample's and sample measurement area to be measured"		Remarks for score (in case of preference)	Max. Score	Method of validation
Requirement R-3000-070	<p>Mounting of sample time needed demand The SEM shall enable the mounting of the sample on the sample stage within 10 minutes for all the samples indicated in Appendix D003 and if applicable Appendix D004.</p> <p><u>Remark</u>: this is the time without pump down of the system. Sample holders that enable easy mounting of the sample will reduce the time required for mounting the samples, and will reduce the risk of sample damage and will save time during loading.</p> <p>Rationale: Sample holders that enable easy mounting of the sample will reduce the time required for mounting the samples, and will reduce the risk of sample damage and will save time during loading</p>			T
Preference R-3000-075	<p>Mounting of sample time needed desired The SEM should enable the mounting of the sample on the sample stage within 2 minutes for all the samples indicated in Appendix D003 and if applicable Appendix D004.</p> <p><u>Remark</u>: this is the time without pump down of the system.</p> <p>Rationale: Sample holders that enable easy mounting of the sample will reduce the time required for mounting the samples, and will reduce the risk of sample damage and will save time during loading.</p>	<ul style="list-style-type: none"> • Within 8 min. = 3 point; • Within 6 min. = 9 points; • Within 4 min = 15 points; • Within 2 min = 30 points. 	30	T
Requirement R-3000-076	<p>Mounting interface The SEM supplier shall share the interface description to the sample stage in the tender document.</p> <p><u>Remark</u>: detailed 2D and STEP files are expected to be part of this delivery.</p> <p>Rationale: Having the interface description will enable TNO to judge the complexity of the interface and enable TNO to design sample holders that can interface with the sample stage</p>			R
Requirement R-3000-080	<p>Mounting of non-stated samples The SEM shall ensure that non-stated samples can be mounted safely.</p> <p><u>Remark 1</u>: This may be achieved by ensuring a (large) flat surface that enables the sample to be secured with carbon tape.</p> <p><u>Remark 2</u>: The supplier shall state in the tender documents how the supplier intends to mount non-stated samples.</p> <p><u>Remark 3</u>: it is expected that this mounting can be done within 10 minutes, if this is not expected the supplier shall put forward this in the tender document.</p> <p>Rationale: As stated, this is for the nonstandard samples, that are not used that often to grant dedicated sample holders, however TNO still needs to be able to mount these samples safely.</p>			R

Aspect "Sample's and sample measurement area to be measured"		Remarks for score (in case of preference)	Max. Score	Method of validation
Requirement R-3000-085	<p>Sample stage rotation The SEM shall be able to rotate the stated samples in Appendix D003 with a range of +/- 180°.</p> <p>Rationale: Rotation of the samples are required for alignment of samples to, in example detectors.</p>			D
Requirement R-3000-086	<p>Compucentric sample stage rotation The SEM shall be able to perform compucentric rotations of the stage, when requested by the operator.</p> <p>Rationale: A compucentric stage is capable of preserving the region of interest focused and in the field of view after performing a rotation. This feature will be used regularly.</p>			D
Requirement R-3000-090	<p>Sample position repeatability demand With the stated sample motions of requirement R-3000-015, and the stated sample weight in requirement R-3000-045, the repeatability of the sample stage position shall be better than or equal to 3 um.</p> <p><u>Remark 1</u>: this requirement directed to the demanded measurement areas and sample weight. Unless indicated differently TNO expects that when a demanded requirement are upgraded to a desired requirement, the stated value of this requirement still applies. If this is not the case, the supplier shall make this clear in the tender document.</p> <p><u>Remark 2</u>: repeatability is defined as; how well does the sample stage does return back to previous position.</p> <p><u>Remark 3</u>: this requirement is without unloading the sample</p> <p><u>Remark 4</u>: this requirement is without tilt of the sample.</p> <p>Rationale: Good repeatability will decrease the time for the operator to find back a location of interest.</p>			T
Preference R-3000-095	<p>Sample position repeatability desired With the stated sample motions of requirement R-3000-015, and the stated sample weight in requirement R-3000-045, the repeatability of the sample stage position should be better than or equal to 1 um.</p> <p><u>Remark 1</u>: this requirement direct to the demanded measurement areas and sample weight. Unless indicated differently TNO expects that when a demanded requirement is upgraded to a desired requirement, the stated value of this requirement still applies. If this is not the case, the supplier shall make this clear in the tender document.</p> <p><u>Remark 2</u>: repeatability is defined as; how well does the sample stage does return back to previous position.</p> <p><u>Remark 3</u>: this requirement is without unloading the sample</p> <p><u>Remark 4</u>: this requirement is without tilt of the sample.</p> <p>Rationale: Good repeatability will decrease the time for the operator to find back a location of interest.</p>	<p>Better than or equal to:</p> <ul style="list-style-type: none"> • 2,5 um = 40 point; • 2 um = 120 points; • 1,5 um = 200 points; • 1 um = 400 points. 	400	T

Aspect "Sample's and sample measurement area to be measured"		Remarks for score (in case of preference)	Max. Score	Method of validation
Requirement R-3000-100	<p>Stage position accuracy demand With the stated sample motions of requirement R-3000-015, and the stated sample weight in requirement R-3000-045. The accuracy of the sample stage shall be better than or equal to 3 um over a travel range of 100 mm in either X or Y direction.</p> <p><u>Remark 1:</u> this requirement direct to the demanded measurement areas and sample weight. Unless indicated differently TNO expects that when a demanded requirement is upgraded to a desired requirement, the stated value of this requirement still applies. If this is not the case, the supplier shall make this clear in the tender document.</p> <p><u>Remark 2:</u> accuracy is defined as; how well does the sample stage know it absolute position.</p> <p><u>Remark 3:</u> this requirement is without unloading the sample</p> <p><u>Remark 4:</u> this requirement is without tilt of the sample.</p> <p>Rationale: For certain measurements or experiments it is important to know coordinates of certain features or particles, or to measure the dimensions of features with high accuracy.</p>			T
Preference R-3000-105	<p>Stage position accuracy desire With the stated sample motions of requirement R-3000-015, and the stated sample weight in requirement R-3000-045. The accuracy of the sample stage should be better than or equal to 1 um over a travel range of 100 mm in either X or Y direction.</p> <p><u>Remark 1:</u> this requirement direct to the demanded measurement areas and sample weight. Unless indicated differently TNO expects that when a demanded requirement is upgraded to a desired requirement, the stated value of this requirement still applies. If this is not the case, the supplier shall make this clear in the tender document.</p> <p><u>Remark 2:</u> accuracy is defined as; how well does the sample stage know its absolute position.</p> <p><u>Remark 3:</u> this requirement is without unloading the sample</p> <p><u>Remark 4:</u> this requirement is without tilt of the sample.</p> <p>Rationale: For certain measurements or experiments it is important to know coordinates of certain features or particles, or to measure the dimensions of features with high accuracy.</p>	<p>Better than or equal to 1 um over a travel range of 100 mm in either X or Y direction</p> <ul style="list-style-type: none"> • > 2 um = 0 points; • 2 um = 100 points • 1 um or better = 400 points. 	400	T
Requirement R-3000-110	<p>Resolution of stage movements The control of the stage shall have the following resolution:</p> <ul style="list-style-type: none"> - XYZ= 0.0001 mm - R = 0.1° - Tilt =0.5° <p><u>Remark:</u> We expect that both can use absolute coordinates and relative steps can used to move the stage via the GUI.</p> <p>Rationale: Common and fitting resolution for such a sample stage.</p>			

Aspect "Sample's and sample measurement area to be measured"		Remarks for score (in case of preference)	Max. Score	Method of validation
Requirement R-3000-115	<p>Analysis position readout The SEM shall display a readout of all axes of the analysis position (i.e. at least x, y, z, R and θ) in the SEM software.</p> <p>Rationale: The readout of the analysis position is necessary to confirm the position of the analysis position and for reporting the position to customers.</p>			

8.6 Aspect "Vacuum system and vacuum quality"

The vacuum quality of a SEM must be up to the level that it does not disturb the measurement of the SEM. TNO does not expect that during a SEM measurement no carbon growth on the sample will accrue. This growth is also depended on the cleanliness of the sample. The set requirement is to ensure that the SEM is clean enough to be used for TNO's use cases.

Aspect "Vacuum system and vacuum quality"		Remarks for score (in case of preference)	Max. Score	Method of validation
Requirement R-4000-005	<p>Contamination growth demand The SEM shall meet the stated values, with the stated method in appendix D006 with respect to contamination growth.</p> <p><u>Remark:</u> if the stated method is not possible perform, this shall be stated during the question period of the tender phase, with a counter proposal how to obtain the values TNO seeks, TNO will investigate to proposal.</p> <p>Rationale: Contamination growth on samples is a problem, potentially not only for the measurement but also for the follow up experiment.</p>			A
Preference R-4000-010	<p>Contamination growth desired The SEM should meet the stated values, with the stated method in Appendix D006 with respect to contamination growth.</p> <p>Rationale: Contamination growth on samples is a problem, potentially not only for the measurement but also for the follow up experiment.</p>	Binary (yes or no) No is 0 points; Yes is 250 points.	250	A

Aspect "Vacuum system and vacuum quality"		Remarks for score (in case of preference)	Max. Score	Method of validation
Requirement R-4000-015	<p>Cleaning of SEM with plasma cleaner</p> <p><u>Remark 1:</u> Because TNO expects that this a common component on a SEM, TNO expect that either COTS plasma cleaner will be offered, or an "inhouse" developed cleaner.</p> <p><u>Remark 2:</u> Because of the expected common component, no specific performance requirements are set. TNO however expects, in example, an Evactron model 25 or 50, or a plasma cleaner similar performance.</p> <p><u>Remark 3:</u> this plasma cleaner does not necessary be directly connected to the measurement chamber of the SEM</p> <p><u>Remark 4:</u> Ideally the plasma cleaner is permanently installed on the SEM</p> <p><u>Remark 5:</u> the tender document will state the selected plasma cleaner, the location, and used method of plasma cleaning.</p> <p>Rationale: TNO expects that the SEM is clean, and does because of that influences the SEM measurement or sample, see requirement R-4000-005. However it could happen that the SEM is contaminated. Without a plasma cleaner it would be very difficult to clean the chamber. TNO does not expect to use the plasma cleaner on sample.</p>			D
Requirement R-4000-025	<p>Forbidden material list</p> <p>The SEM shall not use the stated materials in appendix D007.</p> <p><u>Remark:</u> if a material is listed in appendix D007 that is needed for functional or performance, this shall be ideally stated in the tender document, but at latest in the CDR documentation. TNO expects that mitigation options are present to resolve the used material conflict.</p> <p>Rationale: The SEM might be used before a sample will be subjected to harsh experimental conditions. In those harsh experimental conditions it vacuum conditions, and the materials present in the SEM could affect the experimental outcome of the experiment.</p>			R
Preference R-4000-030	<p>Materials in contact with sample desire</p> <p>Unless needed for SEM performance the material(s) that are in contact with the sample should be aluminium.</p> <p><u>Remark:</u> If there are items in contact with the sample that are made from a different material, the supplier shall state this in the tender document.</p> <p>Rationale: The samples may be used in setups with very stringent material requirements, cross contamination from the SEM could serious impact these experiments and setups. The mitigation this risk TNO has the string rules to which materials the samples come in contact with.</p>	Binary (yes or no) No is 0 points; Yes is 30 points.	30	R

Aspect "Vacuum system and vacuum quality"		Remarks for score (in case of preference)	Max. Score	Method of validation
Requirement R-4000-035	<p>Pump down time with sample demand</p> <p>The SEM shall reach the required high vacuum level for SEM operation within 10 minutes after loading a sample as stated in Appendix D003 and D004 from atmosphere with a sample that has been exposed to atmospheric conditions for at least 24 hours.</p> <p>Rationale: The use-case of the SEM is not high volume SEM use, therefor reasonable loading time is acceptable for TNO</p>			T
Preference R-4000-040	<p>Pump down time with sample desired</p> <p>The SEM should reach the required high vacuum level for SEM operation within 2 minutes after loading a sample as stated in Appendix D003 from atmosphere with a sample that has been exposed to atmospheric conditions for at least 24 hours.</p> <p>Rationale: The use-case of the SEM is not high volume SEM use, therefor reasonable loading time is acceptable for TNO, however reduced waiting time after loading will increase effective of the operation of the SEM</p>	<p>High vacuum level within:</p> <ul style="list-style-type: none"> • 8 min = 3 points; • 6 min = 9 points; • 4 min = 15 points; • 2 min = 30 points. 	30	T
Requirement R-4000-045	<p>Venting time demand</p> <p>The venting time, including all internal SEM actions that are required, shall be within 10 minutes after giving the venting signal.</p> <p><u>Remark:</u> Internal SEM actions could be stop and cool down of SEM source.</p> <p>Rationale: The use-case of the SEM is not high volume SEM use, therefor reasonable loading time is acceptable for TNO.</p>			T
Preference R-4000-050	<p>Venting time desired</p> <p>The venting time, including all internal SEM actions that are required, should be within 2 minutes after giving the venting signal.</p> <p><u>Remark:</u> Internal SEM actions could be stop and cool down of SEM source.</p> <p>Rationale: The use-case of the SEM is not high volume SEM use, therefor reasonable loading time is acceptable for TNO, however reduced waiting time after loading will increase effective of the operation of the SEM</p>	<p>Venting time within:</p> <ul style="list-style-type: none"> • 8 min = 3 points; • 6 min = 9 points; • 4 min = 15 points; • 2 min = 30 points. 	30	T
Preference R-4000-055	<p>Switching time between vacuum modes desire</p> <p>The switching time between high vacuum operation mode and low vacuum operation mode, and vice versa should be within 5 minutes.</p> <p>Rationale: It is expected that for EDX measurements with charging samples, low vacuum operation mode will be used. If this switching takes longer then the stated time, this will impact the throughput of the SEM</p>	<p>Switching time:</p> <ul style="list-style-type: none"> • 5 min = 3 points; • 3 min = 15 points; • 1 min = 30 points. 	30	D

Aspect "Vacuum system and vacuum quality"		Remarks for score (in case of preference)	Max. Score	Method of validation
Preference R-4000-060	<p>Switching time between vacuum modes manual actions desire The switching time between high vacuum and low vacuum mode, and vice versa should not require manual actions.</p> <p>Rationale: Manual actions will increase the risk of operator errors, and will limit the option of automatization</p>	Binary (yes or no) No is 0 points; Yes is 30 points.	30	D
Requirement R-4000-065	<p>Automated pump down and venting The SEM shall, after receiving the signal to pump-down or vent, execute all steps to needed to for fill this command without further instructions from the operator.</p> <p><u>Remark</u>: it is expected that giving the instruction to pump down or vent can be done with a very simple instruction, like a button pump down or vent in the HMI.</p> <p>Rationale: Automated pump down or venting will increase the safety of the machine because it prevents operator error. It also increases the ease of use of the SEM</p>			D
Requirement R-4000-070	<p>Prevention against damage due to over- pressure The SEM shall prevent the system against damage due to over-pressure. I.e., source on at a too high pressure will impacting lifetime. A second example would be that during venting the entire vacuum vessel is set on an over-pressure resulting in, in example windows will burst</p> <p><u>Remark</u>: as stated previously, TNO expects a COTS SEM, and assumes that the suppliers have adamant experience in manufacturing a save SEM. The proposed mitigations against the risks shall be stated in the tender document.</p> <p>Rationale Damage to the SEM most likely would result in unexpected maintenance required for the SEM, impacting the availability of the SEM. I worse case it could affect human safety, this is unacceptable.</p>			R
Requirement R-4000-075	<p>Dry roughing pump The SEM shall use dry roughing pump(s)</p> <p><u>Remark</u>: Dry rough pumps are considered roughing pumps that prevent oil contamination reaching the SEM, this could be by not having oil in the vacuum part of the roughing pump, or shielding this i.e. with N2 flow from the vacuum side of the pump.</p> <p>Rationale: In the case of a failure with a dry roughing pump no contamination can be introduced into the SEM. The current market of roughing pumps has a wide selection that would fulfill this requirement.</p>			I

Aspect "Vacuum system and vacuum quality"		Remarks for score (in case of preference)	Max. Score	Method of validation
Preference R-4000-080	<p>Turbo Molecular Pump (TMP) without oil, desire The SEM should use a TMP without oil.</p> <p>Remark: this may be achieved by using a magnetically levitated TMP.</p> <p>Rationale: Although TNO would prefer a magnetically levitated TMP with respect to cleanliness in the SEM vacuum, it is for TNO unclear if this would impact the SEM performance, therefor this is stated a desired requirement.</p>	<p>Binary (yes or no) No is 0 points; Yes is 75 points.</p>	75	I

8.7 Aspect "Facilities"

This chapter describes all the requirements that are related to the VLL facility and the SEM. This goes from mechanical and electrical interfaces to the clean room, or laboratory.

Aspect "Facilities"		Method of validation
Requirement R-5000-005	<p>External resources specifications The SEM system shall meet its requirements while complying to the following external resource specifications:</p> <ul style="list-style-type: none"> - GN2 supply pressure = up to 6 bar(a) - CDA supply pressure = up to 7.5 bar(a) - Cooling water supply temperature <18 °C - Maximum cooling water return temperature = 30 °C - Maximum cooling water flow available is 500 l/hour - An electric power supplied of; 240 volt, 50 hrz, and/or 400 volt, 3 phase, 50hrz. <p>Rationale: The SEM will be located in the VLL building and thus should comply with its resource specifications.</p>	R
Requirement R-5000-010	<p>Electric power connection fusing The electric power connections of the SEM system shall have double poled fusing or circuit breakers (fuses placed in both the phase and neutral conductors).</p> <p>Rationale: TNO safety standard.</p>	I
Requirement R-5000-015	<p>Protected earth grounding The SEM system shall be provided with at least one protected earth groundings to enable connection to protected ground connection in the VLL.</p> <p><u>Remark 1:</u> It is expected that each electric cabinet has a protected ground connection. <u>Remark 2:</u> Within the VLL dedicated grounding points are available.</p> <p>Rationale: TNO safety requirement.</p>	I
Requirement R-5000-020	<p>Power consumption during normal operation The power consumption of the SEM during normal operation shall not be more than 5 kW.</p> <p><u>Remark:</u> The power consumption and all electrical requirements shall be listed in the quotation of the supplier.</p> <p>Rationale: Available power in facility for SEM.</p>	R

Aspect "Facilities"		Method of validation
Requirement R-5000-025	<p>Provided gas cleanliness The SEM shall be able to operate, to the stated requirements (for instance cleanliness) with a GN2 and XCDA quality provided by the VLL facility of 99.999% purity.</p> <p><u>Remark:</u> If a higher quality is required this may be solved by using end point filters located on the gas distribution boards. These end point filters are then part of the delivery of the SEM system. The tenderer shall put forward during PDR the expected lifetime of these end point filters.</p> <p>Rationale: 99.999% gas quality is guaranteed by the VLL.</p>	R
Requirement R-5000-030	<p>Location of the roughing pump(s) The roughing pump(s) shall be located in the VLL corridor.</p> <p><u>Remark 1:</u> the supplier shall state the maximum distance that the roughing pump can be away from the SEM in the tender document.</p> <p><u>Remark 2:</u> the lay-out of the SEM in the VLL, will be agreed on in an interface control document during the PDR meeting.</p> <p>Rationale: Reduction of noise and vibration in the clean room, also most likely needed for SEM performance.</p>	R
Requirement R-5000-035	<p>Roughing pumps - connection to exhaust The roughing pumps shall allow for connection to a central exhaust in the VLL building.</p> <p>Remark: The SEM supplier shall state the flange type and dimensions of the pre-pump(s) in the ICD documentation.</p> <p>Rationale: Noise and contamination levels in the machine room and the cleanroom will be negatively affected when the roughing pumps are not connected to an exhaust.</p>	R
Requirement R-5000-040	<p>Maximum weight The floor load per 1 m² of both the SEM and the support equipment shall not exceed 1000 kg.</p> <p>Rationale: The stated value is the maximum value allowed floor load of the VLL building.</p>	R
Requirement R-5000-045	<p>Required volume claim At the PDR, or preferably in the tender document, the supplier shall specify the required volume claim in the cleanroom and in the VLL corridor of the entire SEM system.</p> <p>Rationale: Needed for preparation of the cleanroom and VLL corridor.</p>	R
Requirement R-5000-050	<p>Required volume claim for maintenance At the PDR the supplier shall specify the required volume claim for maintenance.</p> <p>Rationale: Needed to prepare the cleanroom and VLL corridor.</p>	R
Requirement R-5000-055	<p>SEM electronics cabinet All electronics shall be installed in an electronics cabinet.</p> <p>Rationale: All electronics should be grouped together.</p>	R
Requirement R-5000-060	<p>Clean room conditions The SEM system and the support equipment located in the cleanroom shall be compatible with operating under cleanroom conditions (room temperature 21 °C +/- 1 °C, humidity between 30% and 70%).</p> <p>Rationale: SEM will be located in a cleanroom.</p>	R

Aspect "Facilities"		Method of validation
Requirement R-5000-065	<p>VLL corridor conditions The support equipment of the SEM system that is located in the VLL corridor shall be compatible with operating under the VLL corridor conditions (room temperature 15 °C to 30 °C, humidity between 30% and 70%).</p> <p>Rationale: Expected worst case conditions in the VLL corridor. Normal temperature is similar to clean room conditions.</p>	R
Requirement R-5000-070	<p>Cleanroom compatibility All external surfaces of the SEM shall be easily cleanable, i.e. smooth surfaces and no hidden areas.</p> <p>Rationale: Ensure that the clean room is not contaminated by the SEM system.</p>	I
Requirement R-5000-075	<p>External cleanliness The external surface of the SEM and support equipment shall be free of grease, oils, and other manufacturing residues.</p> <p>Rationale: Cross contamination should be prevented.</p>	I
Requirement R-5000-080	<p>Particle contamination on external surfaces The SEM and the support equipment shall be visibly clean, i.e. they shall have a Particle Area Coverage (PAC) of less than 250 ppm.</p> <p><u>Remark 1:</u> The SEM and support equipment may be cleaned by the supplier before entering the clean room.</p> <p><u>Remark 2:</u> TNO believes that this requirement will be met if the supplier takes care to use smooth and easy to clean materials.</p> <p>Rationale: Realistic requirement for particle contamination on the outside of a chamber and support equipment.</p>	I
Requirement R-5000-085	<p>Restrict amount of air-cooled equipment The amount of active/forced air-cooled equipment needed for the SEM that is located inside the ISO 14644 class 6 cleanroom shall be kept to a minimum.</p> <p>Remark: In case active/forced air-cooled equipment inside the cleanroom is needed to operate the system, this shall be listed and put forward by the supplier during PDR.</p> <p>Rationale: The flow of the air-cooled equipment can disturb the cleanroom flow conditions.</p>	I
Requirement R-5000-090	<p>Noise output cleanroom The noise output of the SEM system and support equipment located in the cleanroom shall be less than 75 dB(A) in the cleanroom</p> <p><u>Remark:</u> The preferred solution is to select equipment that produces less than the required 75 dB(A). Isolation or locating equipment in the VLL corridor is allowed.</p> <p>Rationale: It is expected that people are working close to the SEM for many hours. The lower the noise level, the better.</p>	R
Requirement R-5000-095	<p>Grouped cables The cables both in vacuum and outside vacuum shall be grouped together as much as possible.</p> <p>Rationale: Grouped cables decrease the risk of damage to a single cable and make routing easier.</p>	I
Requirement R-5000-100	<p>Labelled cables The cables outside vacuum shall be labelled.</p> <p>Rationale: Labelled cables will increase safety and decrease installation and troubleshooting time.</p>	I

8.8 Aspect “Control software”

TNO expects the SEM to be operated with a Windows 10 or 11 based operating system. TNO desires that the operation of the SEM and EDX can be done remotely, with the exception of loading samples. For this the SEM and EDX computers need to be integrated into the TNO network. The computers are required to have a virus scanner.

In some cases TNO will export the measurement data (raw or processed images, raw or processed EDX data, generated reports) to other network locations. Therefore, the measurement data should be able to be copied or exported to other computers or network locations.

The software should be user friendly, meaning it should not take too long to be able to operate the SEM at a basic level. Under user friendly TNO also considers ease of repeated measurements. Being able to write a basic recipe and repeating it a number of times will save significant amounts of operator time and reduce the chance of human errors.

Aspect “Control software”		Remarks for score (in case of preference)	Max. Score	Method of validation
Requirement R-6000-005	<p>Computer controlled SEM operation All operations of the SEM system shall be computer-controlled.</p> <p><u>Remark:</u> After awarding the tender, TNO and supplier shall agree on the best way to configure and install one or multiple computers for the SEM and EDX software and how it should be integrated into the TNO network. This will be documented in the ICD.</p> <p>Rationale: The SEM contains multiple instruments that need to operate simultaneously.</p>			D
Requirement R-6000-010	<p>Computer username and password The computer used for controlling the SEM shall use username and password to protect the SEM against unauthorized use.</p> <p>Rationale: Untrained personnel must be prevented from operating the SEM.</p>			D
Requirement R-6000-015	<p>Multiple user profiles The control system of the SEM system shall have at least four user profiles.</p> <p><u>Remark:</u> It is expected that each operator shall be able to log in on their own user account, or profile, with their own user preferences in the SEM and EDX software.</p> <p>Rationale: Each user has his/her own preferences, which can be loaded by logging into the system using their own credentials.</p>			D
Preference R-6000-020	<p>Customizable GUI desire The SEM software GUI should be able to be customized and saved per user profile.</p> <p>Rationale: Customizable GUI will improve efficiency of the SEM users</p>	Binary (yes or no) No is 0 points; Yes is 150 points.	150	D

Aspect "Control software"		Remarks for score (in case of preference)	Max. Score	Method of validation
Requirement R-6000-025	<p>Navigation on sample The SEM shall be equipped with a method to navigate across the loaded sample using an image of the loaded sample.</p> <p><u>Remark</u>: it is expected that this at least can be done using a camera, see requirement R-6000-030.</p> <p>Rationale: The SEM user should be able to know where on the sample the electron beam is positioned.</p>			D
Requirement R-6000-030	<p>Camera on SEM The SEM shall be equipped with a permanently installed camera that is able to obtain an image that can be used for navigation across the loaded sample.</p> <p>Rationale: This camera can take the image is used for navigating over the sample, see requirement R-6000-025.</p>			D
Requirement R-6000-035	<p>Navigation camera field of view The camera stated in R-6000-035 shall be able to make an image with field of view dimensions of 10 cm x 10 cm.</p> <p><u>Remark 1</u>: the supplier shall state the field of view in the tender document.</p> <p><u>Remark 2</u>: Ideally imaging all the stated samples in D003 is preferred.</p> <p>Rationale: At least a 4" wafer should be fully imaged by this camera.</p>			D
Requirement R-6000-040	<p>Navigation camera resolution The navigation camera image shall be able to resolve details on a sample of 0.1 mm or smaller for the defined wafer samples as stated in Appendix D003.</p> <p>Rationale: Small features should be visible, to aid the SEM operator navigating over the sample.</p>			R
Preference R-6000-045	<p>Use external images as navigation image desire The SEM software should be able to load an external image, to be used as navigation image (Requirement R-6000-025).</p> <p><u>Remark</u>: expected formats are: .JPG, .PNG, .TIFF</p> <p>Rationale: In case no acceptable image can be made using the navigation image camera.</p>	Binary (yes or no) No is 0 points; Yes is 200 points.	200	D
Requirement R-6000-050	<p>Navigation image alignment The SEM software shall be able to perform an alignment procedure between the navigation image (Requirement R-6000-025) and the SEM position on the sample.</p> <p><u>Remark</u>: This may be achieved by performing a 3 point alignment procedure, linking the images with the navigation image.</p> <p>Rationale: Prevent mismatch between navigation image of sample and SEM position on sample.</p>			D

Aspect "Control software"		Remarks for score (in case of preference)	Max. Score	Method of validation
Requirement R-6000-055	<p>Scan rotation The SEM shall be able to perform scan rotation, to align to features in the obtained image without having to physically rotate the sample stage.</p> <p>Rationale: When the image can be rotated by any arbitrary rotation clockwise and counter clockwise, without the sample being physically rotated. This can be useful, for example to align patterns on a sample with the horizontal alignment of the SEM image.</p>			D
Requirement R-6000-060	<p>Scan rotation range and resolution Scan rotation (Requirement R-6000-055) shall be possible over 360 degrees.</p> <p><u>Remark</u>: It is expected that the scan rotation can be set with an accuracy of 0.1 degrees.</p> <p>Rationale: Accuracy and range of the scan rotation are needed for the type of samples TNO uses.</p>			D
Requirement R-6000-065	<p>Find back previous imaging locations The system shall be able to return to locations of interest, or locations where images were previously made, on a sample.</p> <p><u>Remark</u>: This may be done, for example, by saving a location of interest in a positions list embedded in the GUI.</p> <p>Rationale: After an experiment we need to make images on the same locations where imaged were made during pre-experiment SEM imaging, to be able to compare the pre- and post-experiment images.</p>			D
Preference R-6000-070	<p>Export and import stage coordinate list desire A list of saved coordinates should be able to be exported and imported, for example in a text format file.</p> <p><u>Remark</u>: The coordinate list should at least consist of X, Y, Z coordinates. Preferable also rotation and tilt.</p> <p>Rationale: A position should be able to be found back to inspect on a later moment. Furthermore, for later analysis purposes it can be useful to have a list of coordinates.</p>	Binary (yes or no) No is 0 points; Yes is 200 points.	200	D
Requirement R-6000-075	<p>Find back previous imaging locations on sample accuracy The SEM shall be able to find back image locations made in a previous imaging session, with an accuracy of 10 um or better.</p> <p><u>Remark</u>: This may be solved by for example setting up a custom coordinate system based on three easy to find markers on the sample, after which image locations expressed in this coordinate system can be saved.</p> <p>Rationale: Find back micrograph locations before and after an experiment. The micrograph locations of pre-experiment imaging can then be found back during the post-experiment imaging.</p>			T

Aspect "Control software"		Remarks for score (in case of preference)	Max. Score	Method of validation
Preference R-6000-080	<p>Custom coordinate system desire The SEM system should be able to set-up a custom coordinate system, which can be set-up based on one, two or three positions.</p> <p><u>Remark:</u> see Appendix D008 for the detailed description on the expected implementation.</p> <p>Rationale: In some occasions it is very useful to mimic the coordinate system of another experimental setup or material analysis tool. To the user it can then also be immediately clear at which location expressed in this other tool's coordinate system a certain feature is visible.</p>	<ul style="list-style-type: none"> Based on max 1 position = 50 points; Based on max. 2 positions = 400 points; Based on max. 3 positions = 500 points. 	500	D
Requirement R-6000-085	<p>Perform basic scripting It shall be possible to perform basic scripting, either with a simple scripting language, C++ or Python, or using visual scripting (e.g. using blocks with certain functions and parameters).</p> <p><u>Remark:</u> A script or recipe should be able to be saved and loaded, such that it can be used multiple times.</p> <p>Rationale: Scripting of repetitive tasks will significantly reduce operator time and reduce the chance of making human errors.</p>			D
Preference R-6000-090	<p>External control of SEM desire The SEM should be able to be controlled by an external programming script using a programming language, such as Python or C++.</p> <p>Rationale: Use the SEM as part of a programming script, to use the SEM, obtain data, and process the data further.</p>	Binary (yes or no) No is 0 points; Yes is 30 points.	50	D
Requirement R-6000-095	<p>Stitched imaging The system shall be able to make a large area, high resolution image.</p> <p><u>Remark:</u> This may be achieved by performing stitched imaging, in which an area is defined and a resolution is set, after which the SEM will acquire the necessary micrographs and combine these in one large image.</p> <p>Rationale: Acquire large area high resolution micrographs.</p>			D
Preference R-6000-100	<p>3D image acquisition desire The system should be able to process micrographs made with a segmented detector, to acquire a 3D reconstruction.</p> <p>Remark: This may be done using external software, which will be supplied with the system.</p> <p>Rationale: Obtain depth information of sample features.</p>	Binary (yes or no) No is 0 points; Yes is 200 points.	200	D

Aspect "Control software"		Remarks for score (in case of preference)	Max. Score	Method of validation
Requirement R-6000-105	<p>Simple analysis tools The SEM software shall be able to perform various analyses on the acquired image data, such as:</p> <ul style="list-style-type: none"> • Measuring length of features • Counting the number of particles • Determine size and surface area of particles <p><u>Remark:</u> In the tender document it shall be stated which analysis tools are available.</p> <p>Rationale: Will add value to the obtained SEM data by supplying a complex analysis.</p>			D
Requirement R-6000-110	<p>Save analysis data Analysis data shall be able to be saved in a file format, such as PDF, DOCX, or similar.</p> <p><u>Remark:</u> In the tender document it shall be stated what filetypes are available.</p> <p>Rationale: Saving analysis data in a file makes it possible to distribute results in a reliable way</p>			D
Requirement R-6000-115	<p>Customizable data bar The SEM software shall allow for customization of the micrograph data bar, including the ability to select which parameters are displayed and the order in which they are presented.</p> <p>Rationale: Important parameters should be visible in the image to give context for the viewer.</p>			D
Preference R-6000-120	<p>Save and load data bar settings desire Users should have the ability to save and recall custom data bar configurations for future use.</p> <p>Rationale: Data bar settings may vary per SEM measurement. Loading certain data bar pre-sets will save time and reduce the chance of human errors.</p>	Binary (yes or no) No is 0 points; Yes is 30 points.	30	D
Requirement R-6000-125	<p>SEM remote operation The SEM shall support remote operation.</p> <p><u>Remark:</u> Protocol to be determined after awarding tender. Minimum requirements are Microsoft Windows 10 with up to date anti-malware software and firewall.</p> <p>Rationale: Efficient use of the SEM will be increased if the operator can control the SEM remotely.</p>			D
Requirement R-6000-130	<p>SEM operation single operator The SEM shall be able to be safely operated by a single person.</p> <p>Rationale: Efficiency and cost-effectiveness of SEM will be increased if it can be operated by a single person.</p>			D

Aspect "Control software"		Remarks for score (in case of preference)	Max. Score	Method of validation
Requirement R-6000-135	<p>SEM human machine interface The SEM shall be delivered including a specialised input unit, that will control the most basic parameters of the SEM, such as magnification, zoom, astigmatism controls.</p> <p>Rationale: Efficiency and cost-effectiveness of SEM will be increased if it can be operated with an optimized HMI.</p>			D
Requirement R-6000-140	<p>EDX colour element mapping The SEM EDX system shall be capable of producing element colour maps, which display the distribution of elemental composition within a sample by assigning each element a unique colour.</p> <p><u>Remark</u>: expected is that TNO can assign a colour to an element and can change this freely. If this is not possible, this shall be stated in the Tender document.</p> <p>Rationale: Element colour maps are a very powerful representation of measured data.</p>			D
Requirement R-6000-145	<p>SEM software display operating parameters The SEM software shall display the key operating parameters on a dedicated part of the GUI.</p> <p><u>Remark 1</u>: The SEM supplier shall put forward in the tender the proposed key parameters that are shown and logged.</p> <p><u>Remark 2</u>: Key operating parameters are to be discussed and agreed on after the tender is awarded.</p> <p>Rationale: Necessary for convenience of operation.</p>			D
Preference R-6000-150	<p>SEM software system logging desire The SEM should ideally log all operations in a system logfile.</p> <p>Rationale: To be able to trace back when certain actions were performed, which parameters were used, or check system performance and usage.</p>	Binary (yes or no) No is 0 points; Yes is 30 points.	50	D
Requirement R-6000-155	<p>Measurement data file system information When a micrograph is saved in 16-bit grayscale TIFF format, the file shall contain EXIF metadata, such as date and time created, accelerator voltage, magnification, stage coordinates, etc.</p> <p><u>Remark</u>: It is expected that other file formats, such as 8-bit grayscale TIFF and various JPG formats, will also contain EXIF metadata.</p> <p>Rationale: 16-bit grayscale TIFF will be the preferred image file format. Including this information with this measurement data (16-bit TIFF file) is necessary for verification of the measurement.</p>			D

Aspect "Control software"		Remarks for score (in case of preference)	Max. Score	Method of validation
Requirement R-6000-160	<p>SEM computer data transport The SEM software shall enable transport of the data stored on the SEM computer to other storage locations.</p> <p><u>Remark:</u> Network shares are the expected destination of the data.</p> <p>Rationale: The generated data of the SEM must be able to be backed-up on the TNO network shares</p>			D
Requirement R-6000-165	<p>Abort button The SEM software shall feature an abort button which stops immediately all motion, and will stop immediately the SEM measurement. After the abort button is activated the SEM will await new commands.</p> <p><u>Remark:</u> This button shall not power the SEM down.</p> <p>Rationale: Necessary for remote operation of SEM, convenience of operation and, sample safety.</p>			D
Preference R-6000-170	<p>Imaging file name desire The SEM software should enable an easy to program file name, for saving micrograph images, with options like automatically adding relevant imaging information, e.g.:</p> <ul style="list-style-type: none"> - Magnification - Accelerator voltage - Stage coordinates <p><u>Remark:</u> The Tender document shall provide the level of easy naming of files, including all options to add to the filename.</p> <p>Rationale: Easy naming of imaging names will reduce the risk of naming errors, and will reduce the work load of the operator. Furthermore, image files with information in the names will make searching for scientists much easier.</p>	Binary (yes or no) No is 0 points; Yes is 300 points.	300	D
Requirement R-6000-175	<p>SEM control with gloves The control of the SEM shall function while operating it with non-conductive gloves.</p> <p>Rationale: The SEM could be located in a cleanroom environment, therefore the operators will wear gloves.</p>			D
Requirement R-6000-180	<p>Software to be delivered The SEM shall be delivered with all the installation software required to (re-)install the control system of the SEM.</p> <p><u>Remark 1:</u> This includes all the programs installed in the PC and the PLC (if applicable).</p> <p><u>Remark 2:</u> The installation process shall be documented in a manual that is part of the data pack to be delivered.</p> <p>Rationale: TNO should be able to (re-)install the control software if this is required after losing the control software, e.g. in case of hardware failure.</p>			R

Aspect "Control software"		Remarks for score (in case of preference)	Max. Score	Method of validation
Requirement R-6000-185	<p>Control interface user friendly It shall be possible to perform basic operations with the system after three days of instructions.</p> <p><u>Remark 1:</u> The supplier shall put forward in the tender document the number of days that are needed for initial instruction.</p> <p><u>Remark 2:</u> The supplier shall put forward in the tender document a relevant example of the control interface screen, e.g. by using print-screen(s).</p> <p>Rationale: Operation of the SEM system must be simple and safe. User friendly software will increase safety and efficiency.</p>			D

8.9 Aspect "Generic requirements"

This chapter states the generic requirements for the SEM, from safety to documentation. Each paragraph starts with a small introduction.

The following section describes the requirements on documentation that needs to be provided before, during and after the installation of the SEM.

Aspect "Generic requirements", requirements on documentation that needs to be provided before, during and after the installation of the SEM		Method of validation
Requirement R-0000-020	<p>Installation requirements The PDR documentation shall include all the documentation/information necessary for preparing the installation of the SEM.</p> <p><u>Remark:</u> This includes for instance fitting diameters, electrical connections, floor load, required space for transportation, EMC fields, hoisting points etc.</p> <p>Rationale: Necessary to verify that TNO is able to provide required supplies.</p>	R
Requirement R-0000-025	<p>Specification of external resources At the PDR, or preferably in the tender document, the supplier shall specify the required external resources for the SEM system.</p> <p>Remark 1: TNO expects to be able to provide all required external resources.</p> <p>Remark 2: Information provided in the tender document shall at least include ball-park figures of:</p> <ul style="list-style-type: none"> - electrical power requirements; - power consumption; - cooling requirements; - required mass flow rates of gasses (such as nitrogen and compressed dry air); - liquids. <p>Rationale: Information is needed to facilitate the SEM.</p>	R

Aspect "Generic requirements", requirements on documentation that needs to be provided before, during and after the installation of the SEM		Method of validation
Requirement R-0000-030	<p>Output to VLL At the PDR, or preferably in the tender document, the supplier shall specify the SEM generated output to the cleanroom or lab.</p> <p><u>Remark 1:</u> It is expected that the SEM system will produce heat, magnetic fields, etc., the amount and source of which shall be stated.</p> <p><u>Remark 2:</u> TNO will inspect the supplied information and expects that that none of the output will be unacceptable for the environment. If an output to the environment is unacceptable, a method of mitigation shall be discussed between both parties.</p> <p>Rationale: Information needed to prepare the VLL cleanroom.</p>	R
Requirement R-0000-035	<p>Documentation of third party hardware The supplier shall deliver certificates, CE declarations of conformity, and manuals for all the third party hardware that is part of the SEM system.</p> <p><u>Remark:</u> Delivery of documentation is expected during FAT.</p> <p>Rationale: TNO quality requirement.</p>	I
Requirement R-0000-040	<p>CE certification The SEM shall be CE certified.</p> <p>Rationale: Safety and quality of SEM.</p>	I
Requirement R-0000-045	<p>SEM manual The SEM shall be delivered with a manual. This manual shall include the necessary drawings and electric layouts to perform simple troubleshooting and shall include basic operation instructions.</p> <p>Rationale: Necessary for simple trouble shooting or for operating the SEM.</p>	I
Requirement R-0000-050	<p>Certificates The supplier shall document all the certificates.</p> <p><u>Remark 1:</u> TNO expects certificates on: <ul style="list-style-type: none"> - Calibration certificates (if applicable); - Specifications and manuals of COTS equipment; - Outcome of the review of the used materials against the forbidden material list </p> <p><u>Remark 2:</u> Delivery of documentation is expected during FAT.</p> <p>Rationale: Certification of the used materials and equipment may be required by the customers of TNO.</p>	I
Requirement R-0000-055	<p>Drawings to be delivered The SEM shall be delivered with all relevant STEP files and "as built" drawings.</p> <p><u>Remarks 1:</u> It is expected that it will include, relevant mechanical drawings (interfaces, sample holder), electric, gas, water, etc.</p> <p><u>Remarks 2:</u> Delivery of documentation is expected during FAT.</p> <p>Rationale: These drawings are needed for documentation and trouble shooting.</p>	I

The following section describes the requirements on the SEM safety and used standards.

Aspect "Generic requirements", requirements on the SEM safety and used standards		Method of validation
Requirement R-0000-060	<p>Used standards The SEM system design and implementations shall implement the relevant and applicable legislation and regulations in the following order of preference if not already specified in this requirements document.</p> <ul style="list-style-type: none"> - International standards; - European standards; - Commercial standards; - National standards; - Manufacturing standards, newly developed standards <p>Rationale: TNO safety requirement.</p>	R
Requirement R-0000-065	<p>Radioactivity The SEM system shall comply with all radioactive codes and regulations in order to be allowed to be installed and operated in the Netherlands.</p> <p><u>Remark</u>: If any actions are needed on the facility side, like a permit, the supplier shall inform TNO that this is needed before PDR.</p> <p>Rationale: Safety requirement within TNO</p>	R
Requirement R-0000-070	<p>FMEA The supplier shall perform an FMEA and shall share the outcome with TNO.</p> <p><u>Remark 1</u>: It is expected that TNO is asked for input to the FMEA in an early stage of the process. <u>Remark 2</u>: TNO expects that identified critical failures are safe-guarded with at least two independent mitigation methods.</p> <p>Rationale: An FMEA is required to close out some of the requirements, and is needed to increase the safety of SEM, and or the samples that are loaded into the SEM.</p>	R
Requirement R-0000-075	<p>SEM emergency stop button The SEM shall have at least one physical emergency stop button.</p> <p><u>Remark 1</u>: This emergency stop will initiate the EMO state. <u>Remark 2</u>: The location of the emergency stop button shall be agreed on with TNO.</p> <p>Rationale: Machine and operator safety.</p>	D

The following section describes the requirements during SAT.

Aspect "Generic requirements", requirements during SAT		Method of validation
Requirement R-0000-080	<p>Functionality during SAT The SEM shall be fully functional during SAT.</p> <p><u>Remark 1</u>: The supplier shall provide a validation protocol for SAT at least two months before SAT. <u>Remark 2</u>: The supplier shall put forward what is expected from TNO during SAT at least two months before SAT.</p> <p>Rationale: Needed for successful outcome of SAT test.</p>	D

The following section describes the requirements for the SEM during external and internal transport.

Aspect "Generic requirements"		Method of validation
Requirement R-0000-085	<p>Transport to TNO The SEM supplier shall be responsible for the transport of the entire SEM system from their facility to the VLL building, according Incoterm Delivered Duty Paid (DDP) 2020.</p> <p>Rationale: Part of the delivery.</p>	R
Requirement R-0000-090	<p>Transport inside VLL TNO will arrange and bear the costs of the transport of the SEM system from outside the VLL building to its final location inside the VLL. The supplier shall be present during this transport, and shall act actively, in case the supplier deems this transport to be unsafe for the SEM system.</p> <p><u>Remarks 1:</u> Since at time of transport the SEM is not yet the property of TNO, both the supplier and TNO share the responsibility that this transport will not damage the SEM system. <u>Remarks 2:</u> The installation/assembly of the SEM system remains the responsibility of the supplier. <u>Remarks 3:</u> On request, TNO can supply information about companies that have permission and experience to work in the VLL building concerning installation work and transportation.</p> <p>Rationale: Due to local regulations, TNO deems it not feasible for the supplier to arrange the transport from outside of the VLL building into the VLL building and to the final location. Therefore, TNO decides to take the responsibility of arranging this.</p>	R
Requirement R-0000-095	<p>SEM external volume claim during transport During transport the SEM shall fit in the volume claim of 1.8 by 1.8 by 2.0 meters.</p> <p><u>Remark:</u> During transport the SEM may be delivered in several parts, as long as the available space in the clean room is sufficient for assembly.</p> <p>Rationale: Available transport volume in laboratory.</p>	R

The following section describes the requirements on software updates and licence cost.

Aspect "Generic requirements", requirements on software updates and licence cost		Method of validation
Requirement R-0000-100	<p>Windows update The control software shall support, free of charge, all future versions of windows during the expected lifetime of the SEM.</p> <p><u>Remark:</u> the free of charge is as long as no hardware upgrade is needed.</p> <p>Rationale: With the expected lifetime of the SEM it can be expected that several new windows versions can be released. To ensure safety of the IT infrastructure the SEM control PC might be required to update to the latest version. When this is required it is vital for the IT infrastructure that this upgrade is performed, not doing this will result in the SEM being disconnected from the IT infrastructure hindering operation of the SEM.</p>	R

Aspect "Generic requirements", requirements on software updates and licence cost		Method of validation
Requirement R-0000-105	<p>Control software updates The supplier shall update the software free of charge up to the minimum expected lifetime of the SEM.</p> <p><u>Remark:</u> if a hardware update is needed for the software update, this option will be presented to TNO, and if TNO wishes to perform this hardware update, the no additional license fee remains in place. The hardware cost shall be marked conform prizes.</p> <p>Rationale: TNO expects that the SEM is delivered with a software that in time will be updated with new features or bugfixes. TNO demands to receive these without any charge.</p>	R
Requirement R-0000-110	<p>License costs The offer includes all possible software licence fees, for all required applications, including all options and updates, without any limitation, for the minimum expected lifetime of the SEM.</p> <p>Rationale: TNO is not willing to pay additional fees for applications / options or updates.</p>	R

The following section describes the requirements for training courses.

Aspect "Generic requirements", requirements for training courses		Method of validation
Requirement R-0000-115	<p>Advanced training Advanced application training for the SEM and selected accessories shall be given to TNO personnel on site, within 4 months after successful SAT. This training shall be given by an expert in the field of the supplier.</p> <p><u>Remark:</u> it is expected that this training will be a 2- or 3-days training.</p> <p>Rationale: Increasing the efficient and successful operation of the SEM.</p>	R

The following section describes the requirements for payment conditions.

Aspect "Generic requirements", requirements for payment conditions		Method of validation
Requirement R-0000-118	<p>Terms and conditions of payment</p> <ul style="list-style-type: none"> • 20% at order, after receipt of a bank guarantee covering 80% of the total amount; • 20% after (Preliminary/Critical) Design Review (CDR); • 40% after delivery and visual inspection at location TNO Delft. • 20% after installation and commissioning On-site and Site Acceptance Test (SAT) including test periods, approved by TNO, Management Nano Instrumentation and Procurement. At this moment TNO will return the bank guarantee. <p><u>Remark 1:</u> The Tenderer to whom the Contract will be awarded must provide a bank guarantee to TNO, covering 80% of the total price. The Bank guarantee and the bank who issues the Bank guarantee have to be approved by TNO (minimal A rating). TNO must have the right to draw the bank guarantee in any and all cases where Tenderer falls short in fulfilling its obligations under the Contract. The validity of the bank guarantee may not expire until approval of the SAT by TNO Management and Procurement.</p> <p><u>Remark 2:</u> please note, that approving the CDR this does not mean that TNO will take final responsibility if during SAT it is found that the system does not meet the minimum requirements. TNO will at all times hold Tenderer ultimately responsible for delivering an single-photon detector in accordance with the requirements as stated in this Tender.</p> <p>Rationale: Clear understanding of when TNO will proceed with payment.</p>	R

8.10 Aspect "Options"

TNO expects that several options can be offered with the SEM, the following requirements are applicable for the options that can be offered with the SEM. As stated in European public tender of the SEM, the proposed options will not influence the outcome of the awarding, but after awarding could be added to the quotation of the winning tender.

Proposed options are in example:

- Load lock
- Sample holders for stated samples in Appendix D003
- Cold trap
- STEM

Aspect "Options"		Method of validation
Option R-0000-120	<p>List available options</p> <p>The supplier shall list the available options including the cost of each item individually.</p> <p>Rationale: For fair comparison, an option may not affect (the awarding of) the tender.</p>	R
Options R-0000-125	<p>Not affecting the performance of any other requirement</p> <p>The stated option(s) shall not affect the required performance / the compliance, with any other requirement stated in this document.</p> <p>Rationale Proposed options shall not affect the stated requirements or preferences.</p>	D
Options R-0000-130	<p>Clear description of performance of the options</p> <p>The supplier shall put forward the relevant performance parameters of each option. If the option is selected, this stated performance will become a requirement that shall be met.</p> <p>Rationale: To not limit the number of options that can be offered, TNO does not write down the performance requirements for the options. Some foreseen options are presented in the product tree.</p>	R

Aspect "Options"		Method of validation
Option R-0000-135	<p>Option for load lock The SEM supplier shall state if the SEM can be equipped with a load lock, and if so, which of the samples can be loaded from Appendix D003 and D004.</p> <p>Rationale: A load lock can decrease the time to load a sample, and increase the vacuum quality of the SEM.</p>	R
Option R-0000-140	<p>Option dedicated sample holders Appendix D003 samples Requirements R-3000-065, R-3000-070 and Preference R-3000-075 aim for easy, and speedy loading of the standard samples, stated in Appendix D003.</p> <p>The supplier shall state all standard sample holder available and mark the sample holders that can be used to load the samples stated in Appendix D003, including prizes. Next to standard sample holders, and if needed, the supplier shall state the cost for dedicated sample holders to load the stated samples, stated in Appendix D003</p> <p>Remark: TNO expect that wafer, reticle and a multipurpose sample holder is in the default sample holder catalogue are available.</p> <p>Rationale: Efficiency and sample safety increases when sample holders are present that enables simple loading of standard samples.</p>	R
Option R-0000-145	<p>Option cold trap The SEM supplier shall state if a cold trap is of benefit for TNO's anticipated usage of the SEM.</p> <p>Rationale: A cold trap could catch contaminants in the SEM vacuum chamber and reduce carbon formation on analysed surfaces.</p>	R

8.11 Aspect "corporate Social Responsibility (CSR) - Questions"

As mentioned (see para. 1.4), sustainability is an important aspect of DEEPL's core business and where relevant and possible, sustainability aspects have been translated into sustainability requirements and/or preferences.

For now, TNO has included a few concrete requirements or preferences for this, but in the near future these aspects will play a larger, and perhaps decisive role in awarding a contract. To find out where you currently stand in this development, we would like to ask you to answer some questions. To be clear, there is no right or wrong answer.

Aspect "corporate Social Responsibility (CSR) - Questions"	
Question 8.10.1	<p>Corporate Social Responsibility is becoming increasingly important in our own organization and in the future TNO will also ask more from our suppliers to play a part in this.</p> <p>What possibilities have you already initiated and where do you see opportunities for yourself and for TNO?</p>
Question 8.10.2	<p>As you're aware, ISO 20400 is an international standard that provides guidelines on sustainable procurement. The standard can be used by any organization that intends to improve their social, economic, and environmental sustainability. Considering the growing awareness with regard to sustainable business practices, nationally and internationally, whether required by laws and regulations, promoted by the UN Sustainable Development Goals, or even by the changing societal expectations – there are a myriad of reasons in today's world that drive organizations to be more sustainable, including TNO.</p> <p>Do you embrace the ISO 20400 guideline? - if so, how do you implement it in your own organisation? - If not, are you still planning to so, or are there specific reasons why your organisation is not embracing it?</p>

Aspect “corporate Social Responsibility (CSR) - Questions”	
Question 8.10.3	<p>Laboratory instruments, like the single-photon detector, that TNO uses for its scientific research often consume a lot of energy and also often consist of very high-quality raw materials.</p> <p>For the purpose of corporate social responsibility (CSR), do you, or will you in the future, make technological investments to reduce power consumption during instrument use, without negatively affecting the technical application of the instrument?</p>
Question 8.10.4	<p>The design of products with recycling in mind should be an important place to start for all of us. The inclusion of recycled or reused materials is a good way to increase demand for recycled and reused materials as it can significantly reduce the greenhouse gas emissions impact of the materials used in such laboratory instruments.</p> <p>Can you give TNO some insight on how and in which way you are using recycled or reuse materials now, or are working on solutions to use more recycled or reuse materials in the future, but still safeguard the basic use of such laboratory instruments?</p>
Question 8.10.5	<p>TNO focuses within its organization on reducing energy, water use and emissions.</p> <p>What greening initiatives have you taken or can you take in your product portfolio to reduce energy and water consumption and emissions?</p>
Question 8.10.6	<p>In the case of transport packaging, one important opportunity is that of substituting reusable packaging for single trip packaging.</p> <p>Can you give TNO some insight on how and in which way you are using recycled or reuse materials now, or are working on solutions to use more recycled or reuse materials in the future?</p>
Question 8.10.7	<p>In the case of shipping, from the sold products to the customer, we all have an important possibility to reduce emissions.</p> <p>Can you give TNO some insight into how you are trying to reduce the greenhouse gas impact in this perspective?</p>
Request 8.10.8	<p>TNO expects suppliers to take responsibility in sustainable product development and product use. Therefore we expect suppliers to offer a service for buying back equipment at the end of lifetime or at the end of service at TNO. Please elaborate on the service you will offer to TNO and make your offer explicit in terms of actions and impact.</p>

9 Appendices

All Appendices to the Tender Documents are published to accompany the Tender Instructions on www.tenderned.nl.

The Appendices fall into three categories:

A) To be submitted with Tender

- Appendix A01** Self-declaration by the Tenderer: European Single Tender Document (ESTD)
- *If the Tender is to be submitted by a Combination, a copy of Appendix A01 must be submitted by each member of the Combination.*
- Appendix A02** Self-declaration by all Third Parties on whose resources the Tenderer intends to rely: European Single Tender Document (ESTD)
- *Where necessary, a copy of this form should be provided for each Third Party on whose resources the Tenderer intends to rely.*
- Appendix A03** Reference projects
- Appendix A04** Schedule of Prices and Costs
- Appendix A05** Conformity list Programme of Requirements
- Appendix A06** Notification of preferences/answers to questions
- Appendix A07** Maintenance/services proposal

B) To be submitted on request (evidential documents)

- Appendix B01** Self-declaration with regard to subcontractor(s) to be deployed during performance of Contract
- *Where necessary, a copy of this form should be provided for each subcontractor*
- Appendix B02** Declaration re. use of Third Party financial and economic capacity
- Appendix B03** Declaration re. use of Third Party technical and professional competence
- Appendix B04** Declaration re. insurance policy/certificate of insurance
- Appendix B05** Declaration European Sanctions

C) Additional information:

- Appendix C01** Standard template for questions submitted by Tenderer
- Appendix C02** Draft Contract
- Appendix C03** Purchasing Conditions for Goods TNO – February 2022

D) Additional technical information:

- Appendix D000** SEM-TNO-RS-001_SEM_Requirements_final_v0.1.0.0
- Appendix D001** Imaging quality of SEM
- Appendix D002** Minimum requirements detectors
- Appendix D003** Used samples and analysis area
- Appendix D004** Used samples and analysis area desire

- Appendix D005** EDX performance
- Appendix D006** Contamination experiment
- Appendix D007** Forbidden material list
- Appendix D008** Custom coordination method desire

Remarks

Some of the forms and templates listed above are made available as 'editable' MS Excel or MS Word files. This is to facilitate both their completion by the Tenderer and the subsequent evaluation by TNO, in accordance with Chapter 5. Some (sections of the) documents are secured in order to prevent unintentional or undesirable changes.

It is not permitted to make any alteration to the format or pre-completed content of any document. The format and text of all documents as included in the Tender Instructions and published on www.tenderned.nl will take precedence at all times.