

# Tender Instructions

**Applicable to the European Public Tender for: Thalia - Skid  
Integration for capture, conversion and separation**

**Contracting authority:**

The Netherlands Organisation for Applied Scientific Research / TNO

Document ref. : FPL/INK169 Project Thalia  
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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 (Netherlands 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"> <li>• <b>A01</b> to A05 – prescribed templates to be used when preparing and submitting the Tender (bid)</li> <li>• <b>B01</b> to B03 – 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</li> </ul>
Award Criteria (singular: criterion)	: the requirements imposed by TNO with regard to the content of Tenders. Weighted scores are awarded for each requirement in order to select the Tenderer to whom the Contract is to be awarded. Further information 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.
<b>C01</b> to C.[...]	: documents and supplementary information which form part of the Tender Instructions but are not intended for submission to any external party.
Call for Tender	: the announcement of a European (Public) Tender, usually on <a href="http://www.tenderned.nl">www.tenderned.nl</a> .
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.
Combined tender	: a Tender which applies to two or more Lots, submitted on the condition that the Tenderer is to be considered for all such Lots rather than selected Lots.
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 mandatory 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 company, an officer of that company and/or a Third Party with a material involvement in the Tender and the proposed Contract. Mandatory Grounds for Exclusion are restrictions established by European legislation.

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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 <b>A01</b> , <b>A02</b> and <b>B01</b> .
Tender	: the bid/proposal 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 ‘TNO’, is a modern, theme-led Research & Knowledge organization. It was established in 1930 by Act of Parliament with the intention of maximizing the practical relevance of scientific research to the public sector, industry and society at large. The government of the day believed that this would enhance the innovative strength of the Netherlands and contribute to long-term economic growth.

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.

The organization has approximately 3300 staff who work to develop and apply innovative knowledge. 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 ground-breaking 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 2015-2018 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](http://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 unit structure 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.

Staff of the various divisions and expertise areas are based at nine regional offices located throughout the Netherlands. The organization’s head office is in The Hague and it is here that the central support departments (‘Shared Services Organisation’) are based.



### *Procurement*

The Procurement Department oversees all purchasing, procurement and tendering procedures on behalf of TNO, doing so in close cooperation with the department Sustainable Process & Energy Systems which is part of the unit Energy Transition part of TNO.

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.

### **1.3 Contract description**

The purpose of the current Tender Procedure is to select one (1) Contractor to supply/provide the integrated unit consisting of multiple skids. The supplies/services/works 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 and Appendix). There may be a combination of ‘hard’ and ‘soft’ requirements. The former are mandatory and must be met. The latter are in the nature of ‘preferences’ which should be taken into consideration to the greatest extent possible.

#### **1.3.1 Contract duration**

The Contract is entered into for a period of 2 year(s). The proposed date of commencement is January of 2021. The Contract will therefore expire on 31 December 2022. Before this time the project had to be finished. No period of notice is required on either side.

#### *Options*

TNO is entitled – but not obliged – to extend the duration of the Contract under the same terms and conditions by 2 periods of each one years, commencing January 2023 and thereafter January 2024.

TNO is to give notice of its intention to exercise this option no later than three months prior to the due expiry date of the Contract (including any prior extensions).

A Contract can only be extended by mutual agreement of TNO and the Contractor.

TNO will make all reasonable efforts to allow the Contract to come into effect on January 2021.

#### **1.3.2 Current situation and assessment of future requirements**

In the current situation, TNO is buying skids through either direct orders or through public tenders for specific skids.

#### **1.3.3 Scope and content of the Contract**

The Contract for the demonstration unit relates to the provision of supplies, services or works as specified in the Programme of Requirements as applicable.

Further to the current Tender Procedure, TNO also intends to issue a Contract for the basic engineering, detailed design, manufacturing, delivery and support of the skids.

The key points of this Contract are:

- Basic engineering according to conceptual process diagrams
- Detailed design according to engineering requirements
- Construction of the skids
- Delivery, installation and start-up support of the demonstration unit.

#### **Purchase volume**

One integrated unit consisting of two independent skids that is integrated with a third skid supplied by others.

#### **1.3.4 Purpose of the service / supplies**

TNO has formulated the following objectives for service provision subject to this Agreement:

- To form an alliance with a contractor.
- To standardize procurement and working processes, thus achieving cost reductions.
- To monitor and control performance; contract management.

The Tenderer must be able to safeguard the stability and continuity of the requested service provision. TNO requires alert and proactive performance at a level which will guarantee efficiency and effectiveness. It is therefore essential to make allowance for potential developments within TNO and/or the graphic industry which may affect the requirement for the stated services during the lifetime of the Agreement. The ability to respond to demand from the TNO organization in a flexible, adaptive manner is therefore essential.

The proposed Contract covers the supply/provision of the following products/services, as further specified in the Programme of Requirements ( Chapter 8).

#### *'Scope' of the tender procedure.*

The supplies/services will comprise basic engineering, detailed design, manufacture, transportation and installation of an integrated demonstration unit capable of producing at least a 1kg/h 50 w/w% formic acid solution from an inlet gas stream.

This requires:

- 1) Capturing and purifying carbon dioxide from a mixture of inlet gasses;
- 2) Converting the captured carbon dioxide to a formic acid solution using electrolysis and
- 3) Separate the formic acid from the solvent using electro dialysis.

It is furthermore the intention of TNO to place the demonstration unit at a special facility in the Rotterdam area which is not owned by TNO. Most of the utilities and infrastructure will therefore be supplied by the facility owner.

The demonstration unit must consist of interconnected and self-contained skids that can be manufactured, transported to the facility and installed. Each skid will furthermore have separate connections to the site supplied utilities.

The following is excluded from the scope:

- Design and manufacture of the electrolysis reactor which will be supplied by others.
- Provision of common utility supply to the staging area. The connection between the individual skids and supply points are within scope.

TNO has formulated the following objectives with respect to the service provision. They will apply throughout the contract period:

- Continuity
- Customer satisfaction
- Flexibility
- Reduction of TCO
- CSR
- Efficiency
- Innovation

#### **1.4 Socially responsible procurement**

Sustainability is an extremely important aspect of TNO's core business. Much of our research is concerned with managing the economic, environmental and social impact of developments within our adopted themes. We do so using the 'roadmap' approach. In addition, we devote very close attention to the manner in which we can minimize the negative impact – and ideally maximize the positive impact – of our own operations.

We therefore attach great importance to social and environmental responsibility: People and Planet. We acknowledge that our staff are essential to our mission. The core values of TNO – integrity, independence, professionalism and social responsibility – underpin the organization's strategy and all its activities.

In terms of environmental responsibility, our policy centres on the spearheads of energy efficiency, reducing the carbon footprint of business travel, and sustainable procurement practice. Further information can be found in the TNO Sustainability Report which forms part of the TNO Annual Report.

Socially responsible procurement practice is therefore an intrinsic part of the procurement agenda. All procurement decisions are taken in consultation with the TNO budget holders and involve careful consideration of sustainability aspects. 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.

## 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](http://www.tenderned.nl).

TNO has opted to apply the European public procurement procedure. This is because:

- i) 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 <a href="http://www.tenderned.nl">www.tenderned.nl</a> )	30th of October 2020
2.	Final opportunity for interested parties to submit questions for first round of questions	11 <sup>th</sup> of November 2020
3.	Publication of (final) Memorandum of Information	After 11 <sup>th</sup> of November 2020
4.	Final opportunity for interested parties to submit questions for second round of questions	19 <sup>th</sup> of November 2020
5.	Publication of (final) Memorandum of Information	After 19 <sup>th</sup> of November 2020
6.	Final date (and time) for submission of Tenders	10 <sup>th</sup> of December 2020, 12.00 hours
7.	Announcement of Intention to Award	December 2020/ January 2021
8.	Final date for submission of evidential documents by intended Contractor	December 2020/ January 2021
9.	Final date for lodging an objection	January 2021
10.	Confirmation of Contract Award	January 2021

Dates are indicative. TNO reserves the right to amend the schedule but will of course observe all legislative requirements.

### 2.2 Tender conditions

#### 2.2.1 Acceptance

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

#### 2.2.2 Formats

The Tenderer must use the templates and prescribed 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 TenderNed 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 : Paul Springer  
Position : Procurement advisor  
Department : Procurement  
Correspondence : P.O. Box 96800, 2509 JE, The Hague  
Visitors : Anna van Buerenplein 1, 2595 DA, The Hague, The Netherlands  
Email : paul.springer@tno.nl

Tenderers cannot 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, should 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 Procurement Act, 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.

##### 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 for the fulfilment of all obligations and responsibilities further to the Tender Instructions, the Tender Procedure and the Contract itself should this be awarded to the Combination.

#### **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.

- 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 to fulfil any part of the Contract, the following provisions apply during or after the Tender Procedure.
  - Requirements prior to Contract Award (during Tender Procedure)

Information regarding to subcontractors : When using one or more subcontractors, tenderer has to provide information about the use of subcontractors. This information has to be provided in a separate document (free format, maximal 1A4).

The following information have to be provided in this document:

- Main activity which the subcontractor will carry out including an organization chart and responsibilities.
- Communication structure with the subcontractor
- Contractual agreements which are in place
- Provide information how Tenderer maintain consistent quality in the complete process. Provide information why activities are outsourced, the benefit of the approach and how quality (technical solution, scope, schedule, team dynamic) is maintained.
- Provide information about the tools and facilities from the subcontractor that are relevant to engineering and manufacturing during project execution.
- Any past experience in collaboration within reference projects

**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 (only) 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 Provisional 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.

➤ **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. 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 suspend or cancel the entire Tender Procedure. Tenderers are not entitled to compensation for any form of loss or damage directly or indirectly incurred as a result.
3. TNO reserves the right to subject all information provided by Tenderers to further scrutiny for the purposes of verification. Referees may be contacted without further notice.

The Tenderer is aware that the provision of false or incomplete information will result in disqualification 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.

#### **Confidentiality Agreement**

The winner of the tender procedure will sign an NDA.

### **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**

Once a Tender has been submitted it cannot be withdrawn. 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 ninety (90) days from the deadline for the submission of Tenders. This period of validity is automatically extended until the point at which the final Contract is signed with the Tenderer who emerges as the Provisional Contractor.

If an objection to the Award Decision is placed before the judicial authorities, 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 Agreement, the draft version of which is included as Appendix **C02**.
- TNO's General Terms and Conditions of Procurement, version of June 2014, as included as Appendix **C03**, except where the Tender Documents and/or Agreement include alternative provisions, in which case the Tender Documents and/or Agreement 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 General Terms and Conditions of Procurement. The definitive Contract and Terms and Conditions of Procurement will accompany the final Memorandum of Information.

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 Terms and Conditions of Employment is to be regarded as a minimum requirement. Failure to meet this 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 related documents must be duly signed in ink by an authorized representative of the Tenderer organization. The hard copy of each document is then be 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 a 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".

### **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) and 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.

### 2.3 Further information (questions)

The Tender documents, including the Tender Instructions and Appendices, have been compiled with the greatest possible care. Interested parties are able to submit questions 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.

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.

**IMPORTANT: Queries will not be accepted via the TenderNed system (even though it has a module for this purpose). All questions and requests for further information must be submitted directly to the TNO contact person.**

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](http://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.

### 2.4 Disputes and applicable jurisdiction

All aspects of the Tender Procedure are subject to Dutch law. Any dispute 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.

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 served at the

registered business address of TNO within the twenty-day period. Where formal proceedings have not been instigated within the designated period, all rights shall lapse.

Any Tenderer wishing to lodge an objection or appeal is requested to notify TNO prior to commencing proceedings.

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. 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 A05** which must be completed in full and 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 12.00 hours on *11<sup>th</sup> of december 2020*.

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:

**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 A03** Prescribed format for reference projects

**Appendix A04** Schedule of prices / charges

**Appendix A05** Prescribed format for answering questions/notification of preferences

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 **A05**) 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.

### 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 several 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).

The activities involved in the overall evaluation procedure are (in chronological order):

- Confirming timely submission; opening the TenderNed secure document safe; establishing the number of Tenders submitted.
- Evaluation of form, presentation and completeness.
- Evaluation against Grounds for Exclusion and Eligibility Requirements
- Evaluation against Minimum Requirements
- Evaluation of Tenders which have passed the preceding stages, against the Award Criteria.

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.

## **4 Evaluation of timely submission, form, presentation and completeness**

### **4.1 Timely submission**

The Tender must be submitted before the published deadline. Any Tender which fails to meet this requirement 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) 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.

Where any of the Grounds for Exclusion applies to any one member of a Combination, the entire Combination is excluded from the Tender Procedure.

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. 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.

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, further evidence will be required. 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 on behalf of 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 certified extract from the Chamber of Commerce Trade Register pertaining to each Third Party on whose resources the Tenderer intends to rely. 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](http://www.justis.nl)) and follow the instructions contained therein regarding the application for a Certificate of Good 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. 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 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 the requested evidential documents (pertaining to himself or to any Third Parties) on time will be excluded from the Tender Procedure. 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 and/or the Third Parties on whose capacity the Tenderer relies must meet all requirements in order to be considered for the Contract.

## 5.2.1 Financial and economic capacity

### 5.2.1.1 Insurance

The Tenderer must hold full liability insurance with cover of at least € 2.000.000 per event giving rise to damage or series of related events, 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**.

### 5.2.1.2 Reference projects

To support the evaluation of technical and professional competence, the Tenderer is required to submit one or more reference projects using the template provided in Appendix **A03**. These reference projects should demonstrate that the Tenderer has adequate experience and possesses the skills which make up the core competencies listed below. For each core competency, the Tenderer should refer to *one* of the reference projects in **A03**. It is not necessary to list a separate reference project for each core competency; one project may be used to demonstrate several competencies.

To demonstrate adequate experience in the core competencies listed below, the Tenderer should submit details of reference projects as part of the tender. This is accomplished using Appendix **A03**, which must be completed in full and signed in ink by a duly authorized representative of the Tenderer organization. If the Tenderer intends to call on the technical or professional resources of one or more Third Parties, a completed and signed form (Appendix **A03**) should also be submitted in respect of each Third Party, stating the core competency /competencies to which it refers.

If any of the reference projects has yet to be completed, only the results achieved thus far should be cited. A prognosis of results will not be accepted.

Core competence 1	
1.	The Tenderer has experience in the design of a modular, flexible skids for gas treatment, preferably CO2 capture in amine solvent.
2.	<i>Reference project:</i> During the 3/5 years prior to the date of the Call for Tenders, the Tenderer completed a project which demonstrates core competency 1 and which had a contract value of at least € 20.000 ex. VAT. The project must have been completed in accordance with all the contractual conditions agreed at the time, including those relating to lead time and budget.

Core competency 2	
1.	The Tenderer has experience in building and commissioning modular, flexible R&D skids for gas treatment, preferably CO2 capture in amine solvent.
2.	<i>Reference project:</i> During the 3/5 years prior to the date of the Call for Tenders, the Tenderer completed a project which demonstrates core competency 2 and which had a contract value of at least € 150.000 ex. VAT. The project must have been completed in accordance with all the contractual conditions agreed at the time, including those relating to lead time and budget.

Core competency 3	
1.	The Tenderer has experience in integrating several R&D skids at the hardware and software level.

2.	<p><i>Reference project:</i> During the 3/5 years prior to the date of the Call for Tenders, the Tenderer completed a project which demonstrates core competency 3 and which had a contract value of at least € 250.000 ex. VAT. The project must have been completed in accordance with all the contractual conditions agreed at the time, including those relating to lead time and budget.</p>
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TNO reserves the right to verify all references TNO assumes that the Tenderer will have informed its referees accordingly and has obtained their permission. Where the Tenderer has not demonstrated the necessary experience in all competencies, the Tender will be declared invalid and excluded from the remainder of the Tender Procedure.

#### 5.2.1.3 Environmental management measures

TNO has implemented an active Corporate Social Responsibility (CSR) policy and expects all Tenderers to take a similar approach. In terms of their technical/professional competence and quality, environmental management systems are subject to the following requirements:

The Tenderer must implement appropriate environmental management measures to minimize any adverse impact further to the execution of the Contract (as provided by Article 2.93 g of the Procurement Act).

The Tenderer must demonstrate that he/she pursues an active environmental policy, must be in full compliance with all extant environmental legislation, and must be in possession of all permits and licences required for the performance of the Contract activities.

In the first instance, the Tenderer can establish compliance with these requirements by means of the Self-declaration (see Appendix B06). Within five days of being requested to do so by TNO, the Tenderer identified as the Provisional Contractor is required to submit evidence in the form of:

1. An ISO 14001 certificate or EMAS registration.
2. (If not certified): a detailed description of the environmental management activities undertaken by the Tenderer organization. This description should clearly establish that the Tenderer has implemented measures which are at least equivalent to those of the ISO 14001 certificate and/or EMAS registration.

#### 5.2.1.4 Quality standards and certification

TNO attaches importance to the quality of the Tenderer's organization, i.e. the manner in which operational processes are managed and the measures taken to maximize client satisfaction.

The Tenderer should provide a full description of the measures taken to ensure that quality management is fully integrated within the organization. The Tenderer must also state how quality is to be safeguarded during the performance of the Contract.

In terms of technical competence and/or professional competence and quality, the following requirements apply with regard to quality standards and certification (further to the provisions of Art. 2.96 of the Procurement Act):

- The Tenderer should be in possession of a valid ISO 9001:2008 certificate (or equivalent) issued by a recognized audit authority, or a current internal quality handbook which meets or exceeds all requirements of the ISO 9001:2008 standard.
- The Tenderer should be in possession of a valid ISO 27001:2005 certificate (or equivalent) issued by a recognized audit authority, organization, or an information security management system which meets or exceeds all requirements of the ISO 27001:2005 standard.
- In the first instance, compliance with these requirements can be demonstrated by means of the Tenderer's Self-declaration (see Appendix).

Within five working days of being requested to do so by TNO, the Tenderer identified as the Provisional Contractor is required to submit evidence in the form of an ISO 9001:2008 certificate. If the Tenderer wishes to submit an alternative certificate which is claimed to be equivalent, it must be accompanied by:

- a summary of the relevant standard's requirements
- an account and summary of the manner in which compliance with these requirements is safeguarded in practice (no more than one A4 page).

The Tenderer should also provide a Declaration of Intent from the management which establishes:

1. that the organization's management endorses the contents of the internal quality handbook and monitors compliance
  2. that the organization's management endorses the contents of the internal information security handbook and monitors compliance.
- If the Tenderer is in possession of certificates, copies thereof must be submitted on request from TNO within seven (7) calendar days.
  - TNO reserves the right to inspect the original copies of the certificates following the award of contract. The Tenderer is expected to cooperate with TNO on any further assessment of certificates and quality systems that may be required.

### 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.

## 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 (KW).

Award criteria	Max. points
Price (TP)	65
Quality (KW)	150
<b>Total</b>	<b>215</b>

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.

#### 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.

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) Prices are fixed. Changes to the prices can only be made with an official “Notification of Non-Compliance” and has to be approved by TNO. 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.
- 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.
- 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.
- 6) All prices quoted by the Tenderer must be based on the contents of the Tender Documents and form a binding offer.
- 7) If the Award is confirmed, the prices and rates quoted in the Tender will apply at the start of the Agreement and for the first two (2) years of the Contract under that Agreement.

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 65 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:

$$Points = 65 - \left\{ \frac{(I - LI)}{LI} \times 65 \right\}$$

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 (KW)

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.

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. 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 may use their own A4 format for this purpose, or the template provided in Appendix A05.

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

Chapter 6 Sub-sub-award criteria: Quality	Max points
8.6.1 KW 1 Project approach	60
8.6.2 KW 2 Project team experience	60
8.6.3 KW 3 Maintenance and service plan	30
<b>Total</b>	<b>150</b>

The evaluation of the answers to questions relating to the preferences listed in the PoR will also rely on a system of numerical scores. These scores will reflect the degree to which the Tenderer meets each preference. The various sub-sub-criteria will be scored by the individual assessors in accordance with the table below. The overall score (derived from the averages of the individual scores) will then be calculated as described in Para. 3.1.

Rating	Score	Notes
No/poor answer	0%	<i>No answer given/a poor answer which does not address TNO's preferences</i>
Inadequate answer	40%	<i>Answer is not complete, unsatisfactory or otherwise not in keeping with TNO's preferences</i>
Adequate answer	60%	<i>The answer is sufficient, satisfactory, and sufficiently in line with the wishes of TNO;</i>
Good answer	90%	<i>Answer is good, the answer is well in line with TNO's wishes;</i>
Very good answer	100%	<i>The answer is excellent, the answer exceeds the wish (s) of TNO.</i>

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.

## 6.2 Award of Contract

### *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.

### *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.

### *Confirmation of Award*

Once the period permitted for objections has elapsed, 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.

## **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, within seven (7) calendar days of being requested to do so by TNO. (These documents in question are those supporting Appendices B01 to B.[.....] 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.

### **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, within a period of seven (7) calendar days. 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.

## 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**).

Statements using the word “SHALL” must be interpreted as a minimum requirement while statements using the word “will” must be interpreted as a fact or given (i.e. a battery limit interface will be available).

Tenders which do not comply unconditionally with all minimum requirements are deemed invalid and will be excluded from further consideration.

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. The Tenderer may use their own A4 format for this purpose, or the template provided in Appendix **A05**, provided the chosen format meets the requirements stated in Para. 6.1.2.

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 Contract. TNO will ensure that there is no material alteration to the Contract or the obligations it imposes on either party.

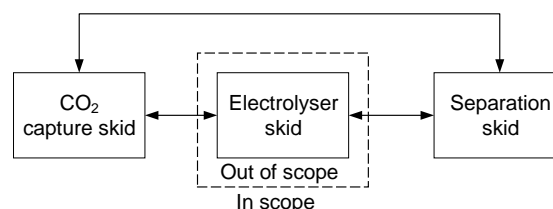
Chapter 1 of this document includes a description of current situation. It sets out the purpose and scope of the Contract and hence the purpose and scope of the PoR.

### **Thalia Project**

The demonstration unit to be constructed and commissioned for the Thalia project will have three separate skids that has the capability to:

- Capture and purify a carbon dioxide rich stream (Carbon dioxide capture skid);
- Convert the carbon dioxide to formic acid using an electrolysis reactor which is supplied by others (electrolysis skid);
- Downstream separation, purification and storage of the formic acid (separation skid).

These interconnected and self-contained skids must be manufactured and transported to the facility and have separate connections to the site supplied utilities. The different skids will therefore operate as a single integrated unit through interfacing with piping/tubing connections and automation (Figure 1). A more detailed functional description for the required interfaces as well as operational requirements are provided below.



**Figure 1:** Thalia project unit integration

## 8.1 Project requirements

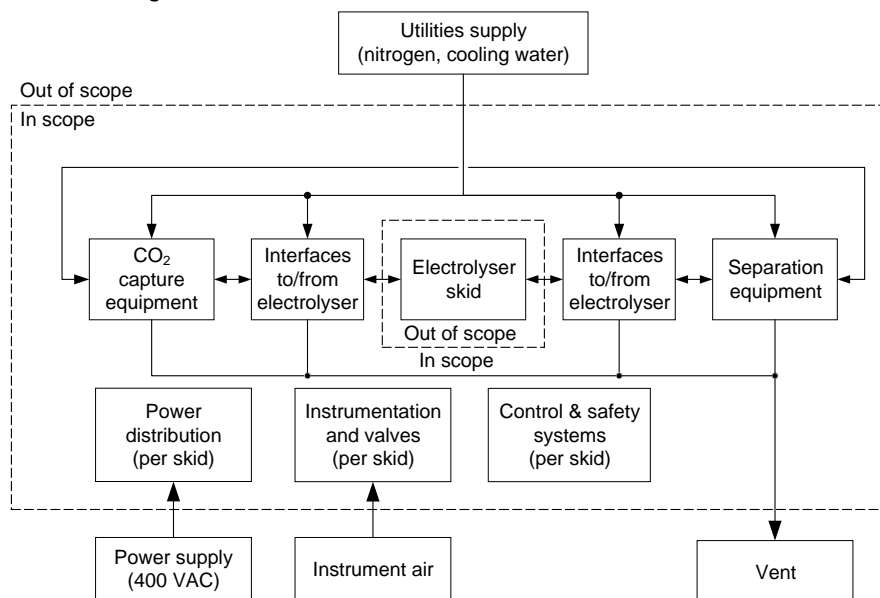
Nr	Requirement
8.1.1	<p>A project plan SHALL be submitted to TNO for approval with activities shown on a monthly basis with the following milestones clearly indicated in the project plan:</p> <ul style="list-style-type: none"> <li>• Basic engineering package completed</li> <li>• HAZOP completed</li> <li>• Detailed design completed</li> <li>• Procurement, manufacturing and building completed – illustrating the long lead items</li> <li>• Factory acceptance test completed</li> <li>• Skid delivery date</li> <li>• Construction phase on site completed</li> <li>• Site acceptance test completed</li> <li>• Commissioning completed</li> </ul> <p>The dependence between the activities SHALL be shown (i.e. start and end dates linked) and the critical path clearly indicated.</p>
8.1.2	<p>The delivery period SHALL be stated in the proposal, mentioning a <b>maximum of 18</b> months from the moment the purchase order is received by the Contractor.</p>
8.1.3	<p>Once the purchase order is placed, the Contractor SHALL schedule bi-weekly progress meetings with TNO in which a summary report on the progress will be shared:</p> <ul style="list-style-type: none"> <li>• Summary of the finished tasks in the last 2 weeks</li> <li>• Planned tasks for the next 2 weeks</li> <li>• Deviations from the plan and actions for recovery</li> </ul>
8.1.4	<p>All documentation and correspondence SHALL be in the English language.</p>
8.1.5	<p>After maximum 2 weeks from the moment the purchase order was placed, the Contractor SHALL arrange a kick-off meeting in which the following agenda will be followed:</p> <ul style="list-style-type: none"> <li>• Project plan, including the main project milestones and the following project related activities, next to the technical milestones:</li> <li>• Risk assessment</li> <li>• Quality management plan</li> <li>• Project execution plan</li> <li>• Scope change management</li> <li>• Project deliverables and their dates</li> <li>• Roles and responsibilities – assigned personnel</li> </ul>
8.1.6	<p>During the project execution, in case a scope change is necessary, the Contractor SHALL send in written the offer which will be further discussed with TNO. In the situation in which the offer is accepted by TNO, an official purchase order will be send to the Contractor by TNO.</p>
8.1.7	<p>The design phase activities SHALL comply of the following phases and their approximate duration:</p> <ul style="list-style-type: none"> <li>• Basic engineering package including HAZOP completed (~4 months)</li> <li>• Detailed design completed (~3 months)</li> </ul>
8.1.8	<p>The Contractor SHALL submit the appropriate documentation for review to TNO at each of the design phases.</p>
8.1.9	<p>The next design phase SHALL start only when TNO has reviewed and approved the design of the previous phase.</p>
8.1.10	<p>The construction phase activities SHALL comply of the following tasks and approximate duration:</p>

Nr	Requirement
	<ul style="list-style-type: none"> <li>• Procurement and manufacture ( 5 months)</li> <li>• Construction and software (4 months)</li> <li>• Inspecting and testing (2 months)</li> <li>• Transportation ( &lt;1 month)</li> <li>• Installation on site (&lt; 2 months)</li> <li>• Commissioning (&lt;1 month)</li> </ul>
8.1.11	The hardware deliverable of the project SHALL consist of a coherent, fluidic and mechanically integrated setup complying to the functional requirements as defined for use cases 1, 2, 3, 4.
8.1.12	The software deliverable of the project SHALL consist of an control and automation software to enable continuous and safe operation of the integrated setup for the use cases 1, 2, 3, 4.
8.1.13	The documentation deliverable of the project SHALL consist of the design documentation, safety documentation and operation manuals listed in the deliverables section.

**8.2 Functional requirements**

**8.2.1 General functional design requirements and interfaces**

The process flow description for each of the three skids are described in more detail in the following sections with the scope description showed below in Figure 2.



**Figure 2:** Scope overview of the demonstration unit and different skids

Figure 2 shows that there will be two main technical interfaces for the integration unit. The first interface will be for the supply of utilities such as:

- cooling water supply and return,
- nitrogen supply,
- instrument air supply,
- a common vent.

A main distribution board with 3-phase power will also be supplied at the battery limit.

The second interface will be to the electrolyser skid which is supplied by others. The physical piping connections, valves and automation must therefore be provided to the feed and receive the product from the electrolysis skid as described in the use cases below. A more detailed description of the interface requirements are stated in section 8.2.3.

The demonstration unit will allow for operation under four different operating modes or “use cases” as described below. Each operating mode will make use of different solvents and produce different products.

The use cases are:

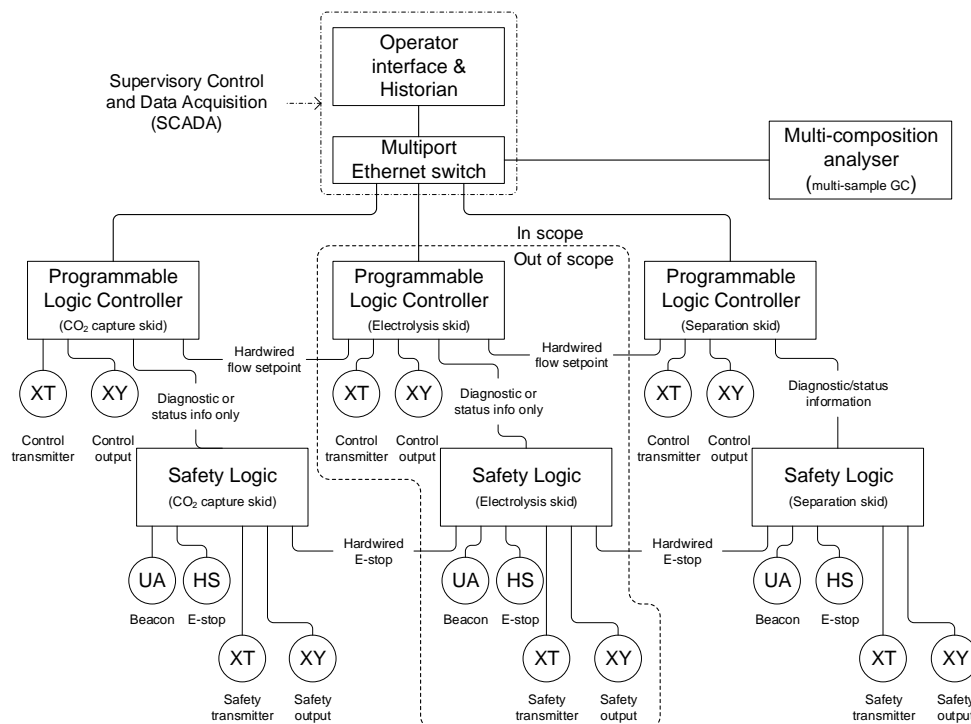
**Use case 1:** Purified carbon dioxide gas will be generated from the incoming gas stream by means of an aqueous amine solvent and sent to the electrolysis skid. The purified carbon dioxide gas will be dissolved in an aqueous potassium carbonate solvent in the electrolysis skid and formate will be produced within the electrolyser. The formate will subsequently be separated by means of electro dialysis in the separation skid.

**Use case 2:** A carbon dioxide rich amine solution will be routed directly from the absorber to the electrolysis skid. The electrolysis skid will convert the carbon dioxide to carbon monoxide and hydrogen which will be separated and vented directly at the electrolyser. The lean amine solution will be returned to the absorber.

**Use case 3:** Similar to use case 1 but with the carbon dioxide feed supplied directly from gas bottles instead of originating from the carbon dioxide capture skid.

**Use case 4:** Carbon dioxide supply from gas bottles is dissolved in an aqueous potassium carbonate solution. The captured carbon dioxide will be converted to carbon monoxide and hydrogen within the electrolyser which will be separated and vented directly at the electrolyser.

A principle drawing showing the process automation and safety system connections and interfaces are indicated in Figure 3 below. An allowance will have to be made for a separate centralised operator interface and historian with integration to the individual skid control systems as well as the multi-sample gas analyser.



**Figure 3:** Demonstration unit control and safety system principle drawing

Two hardwired 24VDC interfaces are foreseen between the skid control and safety systems. The first being the flow set point (4-20mA) originating from the electrolysis skid (which is expected to be the bottleneck) to set the total feed supply of carbon dioxide capture skid and batch sequence “hold” duration of the electro dialysis sequence. The second hardwired interface is

between the safety systems to either indicate or receive (i.e. two hardwired signals) an emergency stop command from the other skids. The emergency stop will originate either from the hand switch or deviation of a critical measurement.

A connection between the programmable logic controller and its safety logic system will be necessary for diagnostic alarming, schematic status indication and historisation. It should be noted though that only non-safety critical connections will be allowed between the individual logic controllers and their associated safety logic systems. The interface which will either be hardwired or a proprietary bus connection depending on the vendor technology supplied by the Contractor.

The individual controllers will interface to the operator interface and historian computer by means of an Ethernet interface (i.e. TCP/IP with RJ-45 connectors) using a standard and recognised Supervisory Control and Data Acquisition (SCADA) protocol and software. An interface to the electrolysis skid will also have to be provided.

Lastly an ethernet based interface to the multi-sample multi-composition analyser will also be provided. The intent will be to incorporate and time stamp the data array originating from the analyser within the historian.

The general functional requirements of the demonstration unit are therefore:

Nr	Requirement
8.2.1.1	The entire demonstration unit SHALL be designed, constructed and installed as a combination of the carbon capture, electrolysis and separation skid units which will be located indoors.
8.2.1.2	The performance of the electrolysis unit will be negatively affected by stray metal ions in the electrolyte solution. All equipment, tubing and/or piping (incl. inter-skid connections) used in the preparation or transport of the electrolyte SHALL therefore be metal-free (i.e. non-metal or lined with a stable non-metal compound).
8.2.1.3	The following utilities will be supplied at the battery limit: <ul style="list-style-type: none"> <li>• Potable water at a pressure of 3 bar gauge.</li> <li>• Cooling water at a pressure of 4 bar gauge and temperature of 25 °C. The cooling water SHALL not be returned with a differential temperature higher than 10 °C.</li> <li>• Nitrogen at a supply pressure of 8 bar gauge.</li> <li>• Instrument air supply at a pressure of 7.5 bar gauge.</li> </ul>
8.2.1.4	The three phase 400 VAC, 50 Hz electrical power supply will be available at the battery limit with a safety ground connection.
8.2.1.5	A vent to a safe location will be made available at the battery limits, if required.
8.2.1.6	The individual skids SHALL be able to function independently from the other skids in terms of utility and vent connections as well as power distribution and process automation systems.
8.2.1.7	The individual skids SHALL be interconnected with flexible hoses and quick release couplings where Dutch regulations allow.
8.2.1.8	The different skids SHALL still be capable to be drained safely after the hoses are removed.
8.2.1.9	The individual skids SHALL be connected to the utilities and vent supplied at the battery limits by means of flexible hoses and quick release couplings where Dutch regulations allow.
8.2.1.10	The number of physical utility and vent connections SHALL be minimised by combining internal sources with internal piping or tubing to provide a common interface for the individual skids to the battery limit interface.
8.2.1.11	The number and type of interface connections for utilities, power and venting SHALL be confirmed with TNO before manufacturing or procurement.

Nr	Requirement																									
8.2.1.12	<p>The individual skids SHALL allow for different use cases which are summarised in the table below.</p> <table border="1" data-bbox="336 311 1383 1025"> <thead> <tr> <th data-bbox="336 311 612 398">Use case</th> <th data-bbox="612 311 823 398">Absorbent solvent</th> <th data-bbox="823 311 1034 398">Electrolyte solvent</th> <th data-bbox="1034 311 1206 398">Product</th> <th data-bbox="1206 311 1383 398">Separation technology</th> </tr> </thead> <tbody> <tr> <td data-bbox="336 398 612 555">1 – Purified carbon dioxide gas from regenerator to electrolysis skid</td> <td data-bbox="612 398 823 555">Aqueous amine solvent.</td> <td data-bbox="823 398 1034 555">Aqueous potassium carbonate solvent</td> <td data-bbox="1034 398 1206 555">Formate</td> <td data-bbox="1206 398 1383 555">Electrodialysis</td> </tr> <tr> <td data-bbox="336 555 612 745">2 – Carbon dioxide rich absorbent to electrolysis skid forming carbon monoxide and hydrogen gas.</td> <td data-bbox="612 555 823 745">Amine + organic solvent.</td> <td data-bbox="823 555 1034 745">N/A</td> <td data-bbox="1034 555 1206 745">Carbon monoxide + hydrogen</td> <td data-bbox="1206 555 1383 745">Physical separation at electrolysis skid.</td> </tr> <tr> <td data-bbox="336 745 612 869">3 – Gas bottles to electrolysis skid forming formic acid or formate</td> <td data-bbox="612 745 823 869">N/A</td> <td data-bbox="823 745 1034 869">Aqueous potassium carbonate solvent</td> <td data-bbox="1034 745 1206 869">Formate</td> <td data-bbox="1206 745 1383 869">Electrodialysis</td> </tr> <tr> <td data-bbox="336 869 612 1025">4 – Gas bottles to electrolysis skid forming carbon monoxide or hydrogen.</td> <td data-bbox="612 869 823 1025">N/A</td> <td data-bbox="823 869 1034 1025">Aqueous potassium carbonate solvent</td> <td data-bbox="1034 869 1206 1025">Carbon monoxide + hydrogen</td> <td data-bbox="1206 869 1383 1025">Physical separation at electrolysis skid.</td> </tr> </tbody> </table>	Use case	Absorbent solvent	Electrolyte solvent	Product	Separation technology	1 – Purified carbon dioxide gas from regenerator to electrolysis skid	Aqueous amine solvent.	Aqueous potassium carbonate solvent	Formate	Electrodialysis	2 – Carbon dioxide rich absorbent to electrolysis skid forming carbon monoxide and hydrogen gas.	Amine + organic solvent.	N/A	Carbon monoxide + hydrogen	Physical separation at electrolysis skid.	3 – Gas bottles to electrolysis skid forming formic acid or formate	N/A	Aqueous potassium carbonate solvent	Formate	Electrodialysis	4 – Gas bottles to electrolysis skid forming carbon monoxide or hydrogen.	N/A	Aqueous potassium carbonate solvent	Carbon monoxide + hydrogen	Physical separation at electrolysis skid.
Use case	Absorbent solvent	Electrolyte solvent	Product	Separation technology																						
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4 – Gas bottles to electrolysis skid forming carbon monoxide or hydrogen.	N/A	Aqueous potassium carbonate solvent	Carbon monoxide + hydrogen	Physical separation at electrolysis skid.																						
8.2.1.13	The demonstration unit will be set-up for a specific use case and operated for a week. The alignment of the different process streams for the different use cases SHALL therefore be done manually by means of block valves.																									
8.2.1.14	The mass and energy balance throughout the different skids SHALL be sufficiently monitored through pressure, level, flow and temperature measurement and automatically controlled by means of variable speed drives or valves.																									
8.2.1.15	A common operator interface and historian (or SCADA system) SHALL be provided that interfaces to the individual logic controllers of the different skids as well as the multi-component analyser. The SCADA connections SHALL be based on an standardised and internationally recognised TCP/IP based protocol with RJ-45 connections.																									
8.2.1.16	The SCADA interface to the multi-component analyser SHALL allow for the integration of the time stamped composition data array and diagnostic information into the historian.																									
8.2.1.17	A loose standing and movable table SHALL be supplied for the operator interface and other SCADA hardware. The hardware SHALL be positioned securely by means of mounting brackets and/or housings, Sufficient cable slack SHALL furthermore be provided such that the table can be located at a safe distance from the demonstration unit.																									
8.2.1.18	The standard operating procedures SHALL be developed subsequent to basic engineering and provided to TNO before the demonstration unit is commissioned.																									

## 8.2.2 Specific functional requirements for the carbon dioxide capture skid

The process overview for the carbon capture skid is shown below in Figure 4. The artificial flue gas supply that originates from pressurised bottles encounters a “lean” amine absorbent within the absorber that operates at near atmospheric pressure. The carbon dioxide will be captured within the absorbent and the rest of the “cleaned” gas supply vented. The rich amine adsorbent will then either be routed to the regenerator (use case 1) or directly to the electrolysis skid (use case 2).

The “rich” amine solution will be regenerated through the addition of an electric heating element in the regenerator, that operates at about 1.9 bar gauge, before being recycled back to the absorber via the lean/rich heat exchanger. The pure carbon dioxide will be routed to the electrolysis skid and the condensed water mixture returned to the mixing vessel for re-use. A pressure override controller will provide an alternative route to the vent if the down-stream skid is not available in case of a process upset.

The mixing vessel will collect the returned condensate (use case 1) or lean amine solution from the separation skid (use case 2). The mixing vessel will also allow for the introduction of additional amine, organic (use case 2) or demineralised water (use case 1) make-up feeds into the system.

The batch sequence controller from the electrolysis skid will provide the setpoint to the feed gas inlet and associated solvent circulation rate. Any oversupply of carbon dioxide to the electrolysis skid will be vented to the atmosphere by means of the pressure controller after the condenser at the re-generator outlet.

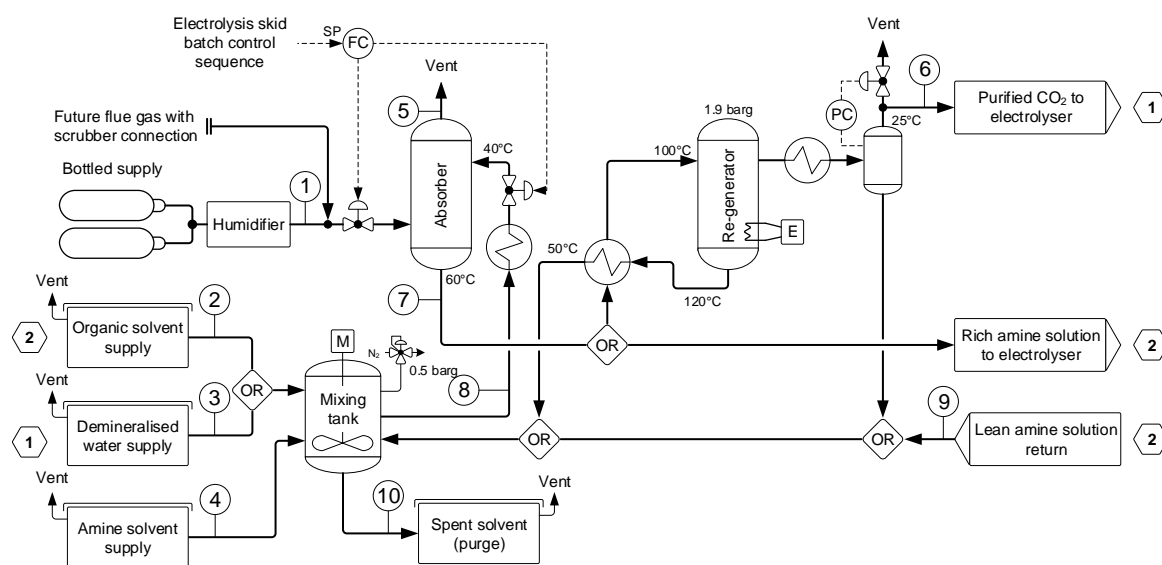


Figure 4: Carbon dioxide capture process flow description (stream numbers in circles and operating mode routing number in hexagon)

The functional requirements of the carbon dioxide capture skid are therefore:

Nr.	Requirement
8.2.2.1	The carbon dioxide capture skid SHALL be capable of producing 500 to 3000 g/h of purified carbon dioxide gas to the electrolysis skid and as described in the use cases.
8.2.2.2	The carbon dioxide capture skid SHALL be capable of capturing and re-generating least 90% of the carbon dioxide that enters from a 10 w/w % gas mixture also containing oxygen, nitrogen and water vapour originating from an evaporator.
8.2.2.3	The inlet gas stream SHALL be obtained from a mixture of carbon dioxide originating from storage bottles as well as air and nitrogen supply originating from a supply header at the battery limit.
8.2.2.4	The carbon dioxide capture skid SHALL use a combination of amine-based capture solvents diluted within a water or organic solvent. As a minimum the following solvents SHALL be used: <ul style="list-style-type: none"> <li>• Aqueous solution of Ethanol Amine (MEA)</li> <li>• Amino Methyl Propanol diluted within Propylene Carbonate (PC)</li> </ul>

Nr.	Requirement
8.2.2.5	The absorber SHALL operate at or near atmospheric pressure and be made-up of removable sections which is stacked one atop of the other. This will allow for re-configuration to achieve different resident times and feed nozzle inlets.
8.2.2.6	The re-generator SHALL operate at 0.5 to 2.5 bar gauge and be made-up of removable sections which is stacked one atop of the other. This will allow for re-configuration to achieve different resident times and feed nozzle inlets. .
8.2.2.7	Both the absorber and re-generator SHALL make either use of packing or trays to facilitate optimal liquid-gas contact and residence times.
8.2.2.8	Use SHALL be made of a rich/lean amine stream heat exchanger as well as an additional trim cooler to allow for effective temperature control of the lean amine stream.
8.2.2.9	The carbon dioxide capture skid SHALL have a 120 L (working volume) intermediary mixing vessel complete with a speed-controlled stirrer and pressure control regulator to act as: <ul style="list-style-type: none"> <li>• A collection of the rich amine stream,</li> <li>• A collection of condensate return,</li> <li>• A collection of the absorbent return from the separation skid,</li> <li>• Additional make-up of solvents, additives or de-mineralised water from storage containers.</li> </ul> A route SHALL also be provided to send spent solvent from the vessel to a separate storage container.
8.2.2.10	The design SHALL allow for the connection of removable intermediate bulk containers by means of flexible hoses for the solvent supplies and spent product that can easily be replaced when empty or full.
8.2.2.11	Apart from the instrumentation and control required to achieve the mass and energy balances of the equipment for the carbon dioxide capture skid additional instrumentation SHALL be provided for: <ul style="list-style-type: none"> <li>• Continuous pH and conductivity measurement inside the intermediate mixing vessel,</li> <li>• Continuous pH and conductivity measurement of the rich amine stream from the absorber.</li> <li>• Continuous carbon dioxide and water vapour measurement of the absorber vent outlet.</li> <li>• Continuous carbon dioxide and water vapour measurement of the re-generator vapour outlet to the down-stream consumers.</li> <li>• Temperature profile measurement of the absorber and re-generator.</li> </ul>
8.2.2.12	A manual emergency stop SHALL be provided in addition to other safeguards identified during the design and risk studies for the carbon dioxide capture skid. The emergency stop SHALL act to: <ul style="list-style-type: none"> <li>• Isolate the feed gas supply.</li> <li>• Remove power from all electrical devices such as pumps, drives, stirrers and heaters.</li> <li>• The flow of cooling water and safe vent locations SHALL NOT be interrupted.</li> </ul>
8.2.2.13	All control and quality related input and output signals for the carbon dioxide capture skid SHALL be taken to a centralised logic controller for regulatory control, operator display, alarming and historization.
8.2.2.14	An allowance SHALL be made for a hardwired 4-20 mA setpoint input from the batch sequence controller of the electrolyser skid to the flow controls of the absorber.
8.2.2.15	All safety related input and output signals for the carbon dioxide capture skid SHALL be taken to a separate safety certified protection system that is independent from the control system.
8.2.2.16	An allowance SHALL be made for four hardwired 24VDC signals within the safety system. Two signals will send/receive an emergency stop command to/from the electrolysis skid and the other two to/from the separation skid.
8.2.2.17	The Supervisory, Control and Data Acquisition (SCADA) system SHALL be capable of interfacing to the carbon dioxide capture control system and be based on an Ethernet TCP/IP protocol with RJ-45 connections.

### 8.2.3 Specific functional requirements for the electrolysis skid

The process overview for the electrolysis unit is shown below in Figure 5. It should be noted that the supply of the electrolysis unit will be by others as is indicated in the figure below. The specific battery limit interfaces with the electrolysis reactor are therefore described in Table 1 below.

Interface	Stream no.	Flows	Pressure	Temperature
Carbon dioxide feed gas supply (use case 1)	6	0.5 – 1.5 kg/h	0 – 0.5 bar g	0 – 30 °C
Rich amine solvent from absorber (use case 2)	7	15 – 45 kg/h	0 – 0.5 bar g	40 °C – 80 °C
Inorganic solvent (make-up) supply (use cases 1, 3 and 4)	11	0 – 12 kg/h	0 – 0.5 bar g	0 – 30 °C
Inorganic solvent return from separation (use cases 1, 3)	12	4 – 16 kg/h	0 – 0.5 bar g	0 – 30 °C
Formate and solvent from electrolysis (all use cases)	14	4 – 45 kg/h	0 – 0.5 bar g	0 – 30 °C
1 M acid anolyte make-up from acid feed preparation (all use cases)	18	0 – 5 kg/h	0 – 0.5 bar g	0 – 30 °C

**Table 1:** Scope interfaces to electrolyser skid

Carbon dioxide gas can either be introduced from the upstream carbon capture unit (use case 1) or supplied from bottles (use cases 3 & 4). The option further exists to route the carbon dioxide to the:

- feed preparation for absorption using an inorganic solvent or,
- humidifier to be directly introduced as a gas product at the cathode.

The carbon dioxide will be absorbed into the electrolyte within the feed preparation vessels. The electrolyte will be an inorganic solvent (use cases 1, 3 & 4). As an alternative the rich amine absorbent will be routed via the feed preparation vessels directly to the analyser (use case 2).

The electrolyser with its recirculation vessels will operate as batch cycle where the formic acid fraction will increase as the catholyte is circulated through the electrolyser. Product from the upstream skid will therefore accumulate within the feed preparation vessels during the batch cycle until completion and the fresh catholyte can be loaded. The feed flow will then be switched to the second preparation vessel already pre-loaded with a fresh solvent mixture.

The electrolysis reaction is mildly exothermic therefore cooling coils connected to the cooling water system will be provided within the recirculation vessels. Automated valves for the loading and unloading of the electrolyte will also be provided. Any undissolved vapour that forms within the cathode cells will be collected and vented to the atmosphere using the pressure controller. Similarly, the acidic/alkaline electrolyte will decompose to form oxygen. The oxygen will be vented to atmosphere by means of the pressure controller.

The formic acid rich electrolyte (as formate) will be sent via the collection vessel to the separation skid once the batch cycle is concluded. Similarly, the spent anolyte will be sent to storage after it is cooled.

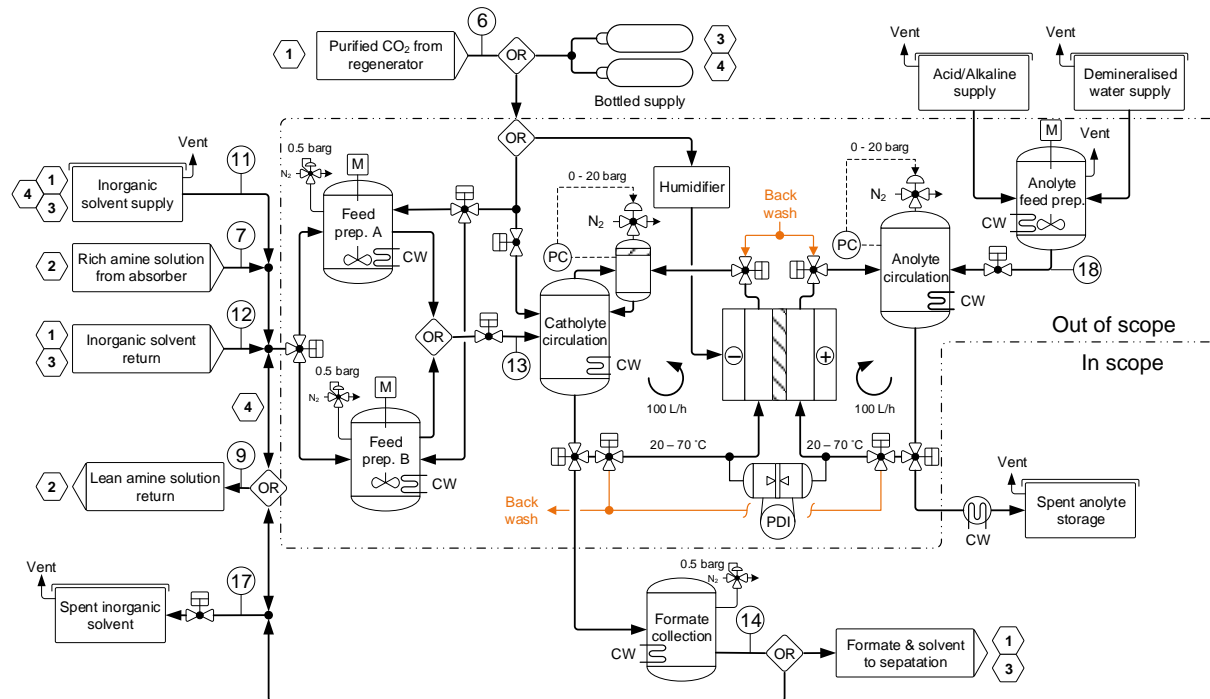


Figure 5: Electrolysis skid process flow description

The functional requirements of the electrolysis skid are therefore:

Nr	Requirement
8.2.3.1	The electrolysis skid will be capable of producing a 4 to 16 kg/h mixture of formate and solvent for use cases 1, 3 and 4. The product will contain 10 w/w% concentration of formate.
8.2.3.2	The electrolysis skid will be able to convert 400 to 1300 g/h of dissolved carbon dioxide to carbon monoxide and hydrogen as per use case 2.
8.2.3.3	The supporting skid infrastructure SHALL be able to support the electrolyser to operate from 0 to 20 bar gauge with an anolyte and catholyte temperature ranging from 20 to 70 °C and a pH range between 1 and 14.
8.2.3.4	The electrolysis interface SHALL have the option to either receive 0.5 – 1.5 kg/h carbon dioxide gas from the up-stream carbon dioxide capture skid or from a local bottled supply.
8.2.3.5	The electrolysis interface SHALL be capable to supply 0 – 12 kg/h from make-up 2 to 3M potassium carbonate/potassium bicarbonate solution as the inorganic solvent supply to the feed preparation vessels for use cases 1, 3, 4.
8.2.3.6	The electrolysis interface SHALL be capable to supply 4 – 16 kg/h from the inorganic solvent return to the feed preparation vessels for use cases 1 and 3.
8.2.3.7	The electrolysis interface SHALL be capable to route 4 – 16 kg/h inorganic solvent from the formate collection vessel directly to the feed preparation vessels for use case 4.
8.2.3.8	The electrolysis interface SHALL be capable to supply 15 – 45 kg/h of rich amine solvent from the absorber for use case 2. The rich amine solvent SHALL contain at least a 6 w/w % concentration of dissolved carbon dioxide.
8.2.3.9	The electrolysis interface SHALL be capable to return 15 – 45 kg/h of lean amine solvent to the absorber for use case 2. The lean amine solvent will contain at least a 3 w/w% concentration of dissolved carbon dioxide.

Nr	Requirement
8.2.3.10	The electrolysis interface SHALL be capable to deliver a 0 – 5 kg/h 1M acid solution to the anolyte feed preparation vessel for all use cases.
8.2.3.11	A 200 L (working volume) collection vessel SHALL be supplied with a pressure control regulator (0 to 0.5 bar gauge) and cooling coil to receive 4 – 45 kg/h product from the re-circulation vessel.
8.2.3.12	The electrolysis interface SHALL have the ability to send 0 – 15 kg/h of spent inorganic solvent to an intermediate bulk container for storage.
8.2.3.13	A heat exchanger for the spent anolyte outlet SHALL be supplied.
8.2.3.14	The design SHALL allow for the connection of removable intermediate bulk containers by means of flexible hoses for the solvent, demineralised water and acid supplies and spent product that can easily be replaced when empty or full.
8.2.3.15	The batch operation of the electrolyser will be done automatically by means of remotely actuated block valves operated by a pre-configured sequence within the programmable logic controller which is supplied by others. The following steps SHALL however as a minimum be supported: <ul style="list-style-type: none"> <li>• Step 1: Load catholyte and anolyte into the re-circulation vessels.</li> <li>• Step 2: Increase pressure and load solvent into empty catholyte and anolyte feed preparation vessels.</li> <li>• Step 3: Circulate the catholyte and anolyte through the electrolyser.</li> <li>• Step 4: Decrease pressure and start with electrolyser back-wash using a mildly acidic solution.</li> <li>• Step 5: Unload reactant into reactant collection vessel and spent anolyte to storage.</li> <li>• Step 6: Change the inlet carbon dioxide feed to the stand-by feed preparation vessel.</li> </ul>
8.2.3.16	A manual emergency stop SHALL be provided in addition to other safeguards identified during the design and risk studies for the electrolysis skid interfaces. The emergency stop SHALL act to: <ul style="list-style-type: none"> <li>• Isolate the feed gas supply.</li> <li>• Remove power from all electrical devices such as pumps, drives, stirrers and heaters.</li> <li>• The flow of cooling water and safe vent locations SHALL NOT be interrupted.</li> </ul>
8.2.3.17	All control and quality related input and output signals for the electrolysis skid will be supplied by others and taken to a centralised logic controller for regulatory control..
8.2.3.18	An allowance SHALL be made for four hardwired 24VDC signals within the safety system. Two signals will send/receive an emergency stop command to/from the carbon dioxide capture skid and the other two to/from the separation skid.
8.2.3.19	All safety related input and output signals for the electrolysis skid will be supplied by others and taken to a separate safety certified protection system that is independent from the control system.
8.2.3.20	The Supervisory, Control and Data Acquisition (SCADA) system SHALL be capable of interfacing to the electrolysis skid control system and be based on an Ethernet TCP/IP protocol with RJ-45 connections.

#### 8.2.4 Specific functional requirements for the separation skid

The process overview for the electrolysis unit is shown below in Figure 6. The reagent solution containing the different solvents, formic acid and unreacted dissolved carbon dioxide will be accumulated within the inlet buffer tank. The electro dialysis unit will operate in a batch fashion similarly to the electrolysis unit where the catholyte, anolyte and formic acid concentrate is recycled through the electrolyser. During this process the formic acid as a formate will transfer out of the solvent or diluent stream through the membrane and accumulate within the formic acid concentrate stream. A more detailed description of the electro dialysis cell is given further below.

Cooling coils within the circulation vessels will control the temperature and the pressure will be controlled by means of the individual pressure regulators. Any gas by-products created at the anode and cathode will be vented to a safe location.

The concentrated formic acid will be sent to storage and the solvent either returned to the absorber skid (use cases 2) or to the electrolysis skid (use cases 1 & 3) for re-use. The spent alkaline solution will be directed to a storage container after being cooled to mitigate the build-up of impurities.

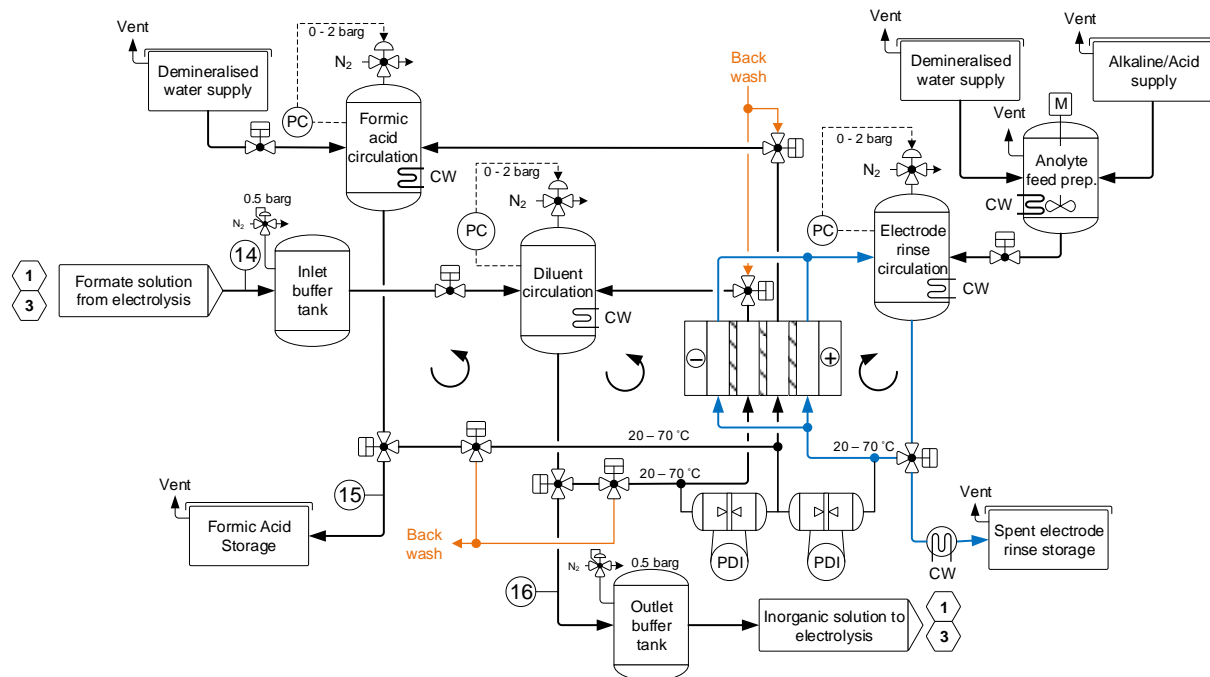


Figure 6: Separation skid process flow description

A more detailed description of the different compartments for a electrodiolysis cell in combination with the electrode compartments is shown in Figure 7 below. Each cell will therefore consist of two compartments. The intent is that multiple cells be placed in parallel to form a stack. The number of cells will depend on the total electrode area needed to transfer the formate from the diluent stream to the concentrate stream.

The two outermost electrode compartments for the stack will be separated from the diluent and concentrate compartments by a Bipolar Membrane (BPM). Each cell will also be separated by a BPM from the other. The BPM allows for the generation of proton and hydroxide ions which in turn will act to protonate the concentrate compartment and alkalis the diluent compartment.

The two innermost compartments, that forms a cell, will be separated by an Anion Exchange Membrane (AEM) which will allow for the transfer of the formate ( $\text{HCOO}^-$ ) and bicarbonate ( $\text{HCO}_3^-$ ) anions into the concentrate stream. The bicarbonate will most likely be protonated to form carbon dioxide gas which will have to be separated and vented to a safe location.

Hydrogen will be formed at the cathode and oxygen at the anode which will also have to be removed from the alkaline streams and vented to a safe location.

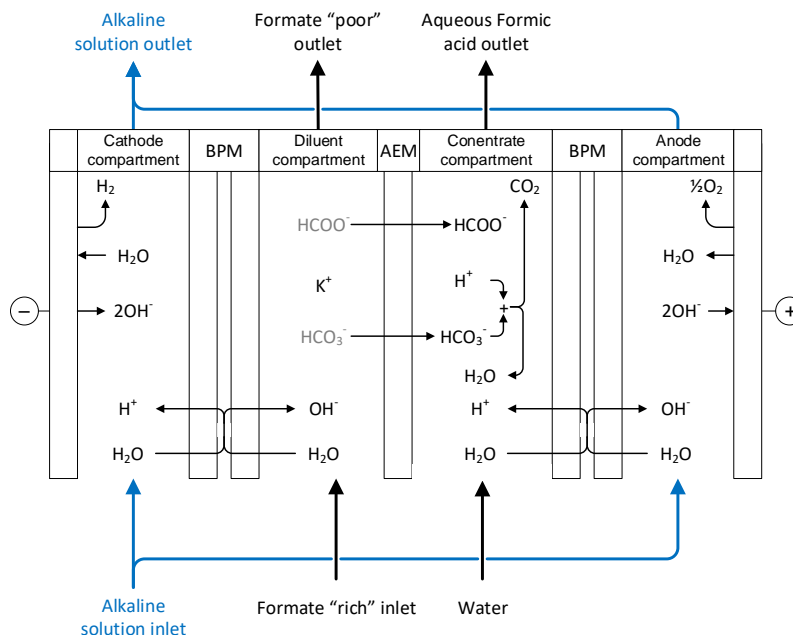


Figure 7: Electrodesalination cell configuration

The functional requirements of the separation skid are therefore:

Nr	Requirement
8.2.4.1	The separation skid SHALL be capable of processing a 4 to 16 kg/h supply with a 10 w/w% formate concentration to produce at least a 50 w/w% pure formic acid solution as described within use case 1 and 3.
8.2.4.2	The supporting skid infrastructure SHALL be able to support the electrodesalination stack to operate from 0 to 2 bar gauge with an anolyte and catholyte temperature ranging from 20 to 70 °C and a pH range between 1 and 14.
8.2.4.3	A, 120 L (working volume), feed collection vessel SHALL be provided complete with a pressure control regulator (0 to 0.5 bar gauge), instrumentation to allow for the discharge of catholyte product to the batch electrodesalination set-up.
8.2.4.4	A, 80 L (working volume), diluent re-circulation vessel SHALL be provided complete with a pressure control regulator (0 to 2 bar gauge), cooling coil and instrumentation to allow for the circulation of diluent through the electrodesalination set-up.
8.2.4.5	A, 80 L (working volume), formic acid re-circulation vessel SHALL be provided complete with a pressure control regulator (0 to 2 bar gauge), cooling coil and instrumentation to allow for the circulation of the formic acid concentrate through the electrodesalination set-up.
8.2.4.6	A, 80 L (working volume), anolyte feed preparation vessel SHALL be provided complete with a speed controlled stirrer, cooling coil and instrumentation to allow for the dilution of the acid with demineralised water as well as the discharge of the prepared anolyte to the electrodesalination set-up.
8.2.4.7	A, 80 L (working volume), electrode rinse re-circulation vessel SHALL be provided complete with a pressure control regulator (0 to 2 bar gauge), cooling coil and instrumentation to allow for the circulation of the anolyte through the electrodesalination set-up.
8.2.4.8	A 120 L (working volume) outlet buffer vessel SHALL be supplied with a pressure control regulator (0 to 0.5 bar gauge) and cooling coil to receive the solvent from the catholyte re-circulation vessel.

Nr	Requirement
8.2.4.9	A stack made up of parallel electrolyser cells SHALL be provided with pressure accumulators between the inlet streams.
8.2.4.10	Each cell SHALL be made up of a diluent and concentrate compartment. The diluent and concentrate compartments SHALL be separated from each other by a Anode Exchange Membrane. The cell (i.e. two compartments) will be separated either from other cells or the electrode compartments by Bipolar Membranes on either side.
8.2.4.11	The electrodes provided SHALL allow for high reactivity in the formation of hydrogen and oxygen from water in alkaline conditions.
8.2.4.12	The anion exchange membrane SHALL have high selectivity for the transfer of formate ( $\text{HCOO}^-$ ) and bicarbonate ( $\text{HCO}_3^-$ ) anions.
8.2.4.13	A heat exchanger for the spent anolyte outlet SHALL be supplied.
8.2.4.14	An option SHALL be provided to re-route the solvent to the absorption skid, the electrolysis skid or the spent solvent to a storage container from the outlet buffer vessel.
8.2.4.15	The design SHALL allow for the connection of removable intermediate bulk containers by means of flexible hoses for the product, demineralised water and acid supplies and spent product that can easily be replaced when empty or full.
8.2.4.16	<p>Apart from the instrumentation and control required to achieve the mass and energy balances of the equipment for the electrolysis skid additional instrumentation SHALL be provided for:</p> <ul style="list-style-type: none"> <li>• pH and conductivity measurement inside the diluent re-circulation vessel,</li> <li>• pH measurements for the formic acid re-circulation and electrode rinse re-circulation and anolyte feed preparation vessels,</li> <li>• Sample take off points of the circulation streams of the diluent and formic acid re-circulation vessels connected to a multi-sample Liquid or Gas Chromatograph for multi-composition analysis.</li> <li>• Hydrogen measurement of the electrode rinse recirculation products sent to vent.</li> </ul>
8.2.4.17	<p>The batch operation of the electrolyser SHALL be done automatically by means of remotely actuated block valves operated by a pre-configured sequence within the programmable logic controller. The following steps SHALL as a minimum be configured:</p> <ul style="list-style-type: none"> <li>• Step 1: Load diluent, anolyte and de-mineralised water into re-circulation vessels</li> <li>• Step 2: Increase pressure and load the anolyte feed preparation vessel</li> <li>• Step 3: Circulate the diluent, anolyte and formic acid concentrate through the electrolyser</li> <li>• Step 4: Decrease pressure.</li> <li>• Step 5: Unload formic acid into the collection vessel and spent anolyte to storage vessel.</li> </ul>
8.2.4.18	<p>A manual emergency stop as well as a high differential pressure trip SHALL be provided in addition to other safeguards identified during the design and risk studies for the separation skid. The emergency stop SHALL act to:</p> <ul style="list-style-type: none"> <li>• Isolate the feed supply and stop the sequence.</li> <li>• Remove power from all electrical devices such as pumps, drives, stirrers and heaters.</li> <li>• The flow of cooling water and safe vent locations SHALL NOT be interrupted.</li> </ul>
8.2.4.19	All control and quality related input and output signals for the separation skid SHALL be taken to a centralised logic controller for regulatory control, operator display, alarming and historization.
8.2.4.20	An allowance SHALL be made for a hardwired 4-20mA setpoint input from the batch sequence controller of the separation skid to the batch control sequence of the electro dialysis skid.

Nr	Requirement
8.2.4.21	All safety related input and output signals for the separation skid SHALL be taken to a separate safety certified protection system that is independent from the control system.
8.2.4.22	An allowance SHALL be made for four hardwired 24VDC signals within the safety system. Two signals will send/receive an emergency stop command to/from the carbon dioxide capture skid and the other two to/from the electro dialysis skid.
8.2.4.23	The Supervisory, Control and Data Acquisition (SCADA) system SHALL be capable of interfacing to the separation skid control system and be based on an Ethernet TCP/IP protocol with RJ-45 connections.

The following feature should be listed as an optional price within the schedule of prices:

Nr	Option
8.2.4.21	It is required to add the price for allowance for an option to back-wash the electrolyser by: 1) reversing the polarity of electrodes while 2) washing the internals with a mildly acidic solution during the batch sequence step 4.

### 8.3 Safety, health and environmental requirements

#### 8.3.1 General design considerations

Nr	Requirement
8.3.1.1	<p>Risks of the personnel should be prevented at the source or should be reduced as much as possible to secure the safety and health of the personnel. In order to meet these requirements, the demonstration unit SHALL incorporate the following design issues such that an optimum operating environment for the personnel is ensured:</p> <ul style="list-style-type: none"> <li>• Adequate provisions against noise at all working places. The noise limit for the facility is 80 dB. Additional noise protection SHALL therefore be required to reduce the level down to an acceptable level.</li> <li>• Additional adequate lighting SHALL be provided. This SHALL be achieved through the installation of dedicated lights within cabinets as well as mounted lights on the skids where specific activities would need it.</li> <li>• Execution and layout of the unit parts inclusive finishing of working places such that easy cleaning is possible;</li> <li>• Adequate provision for escape routes, eyebaths and safety showers where needed.</li> </ul>
8.3.1.2	<p>The preliminary chemical hazardous analysis was conducted and the following minimum requirements that SHALL be adhered to as part of the design are:</p> <ul style="list-style-type: none"> <li>• A risk assessment SHALL be done during detail design once the exact quantities of product is known and better understood and an area classification drawing developed to confirm ATEX requirements.</li> <li>• Carbon dioxide gas detection with alarming SHALL be provided if the gas bottles are stored in doors. The need for automatic isolation of carbon dioxide feed in case of detection at the skid units should furthermore be considered.</li> <li>• Product storage containers, vessels and tanks where explosive mixtures of carbon monoxide, hydrogen or oxygen can form SHALL be purged with nitrogen.</li> <li>• The impact of liquid spills SHALL be contained by means of drip trays installed underneath the skids or where the product storage containers are located.</li> </ul>

Nr	Requirement
8.3.1.3	In the design phase, the tenderer SHALL strive to prevent, or at least to minimize, the necessity of SIL qualification of control loops.
8.3.1.4	Design, construction and operation of the facility SHALL be conducted according to the applicable rules and regulations from Dutch authorities.

### 8.3.2 Plant waste, effluents and emissions

Nr	Requirement
8.3.2.1	The design and operation of the facility will be conducted with minimal environmental impact in focus.

### 8.3.3 Fire protection and fire fighting

Nr	Requirement
8.3.3.1	The manual firefighting procedures of the site owner SHALL be updated to incorporate specific fire-fighting requirements after the hazard and risk reviews.

### 8.3.4 Gas detection and ventilation

Nr	Requirement
8.3.4.1	An early event gas detection system with a suitable visual and acoustic alarming SHALL be installed where toxic or flammable gases are used.

### 8.3.5 Required safety studies and risk assessments

Nr.	Requirement
8.3.5.1	<p>A Hazard and operability study SHALL be conducted at the end of basic engineering with the attendance from TNO and representatives from site. The HAZOP study SHALL confirm that:</p> <ul style="list-style-type: none"> <li>All safety and environmental risks have been considered and suitable safeguards have been incorporated,</li> <li>All issues regarding the maintainability and operation of the unit has been considered and suitably addressed.</li> </ul>
8.3.5.2	A risk study SHALL be conducted to determine the likely sources and size of explosive gas mixtures.
8.3.5.3	An area classification drawing SHALL subsequently be made for the demonstration unit that indicates the zones as well as the gas group types and temperature classifications.
8.3.5.4	<p>A layer of protection analysis (LOPA) SHALL be conducted where automated safety related functions are used to:</p> <ul style="list-style-type: none"> <li>Classify the consequences and likelihoods of the hazards identified during the hazard and operability study and to</li> <li>Determine the SIL requirements for safety related functions.</li> </ul>
8.3.5.5	<p>A constructability review SHALL be arranged with TNO and representatives from site before the skid units are transferred and installed on site to confirm that:</p> <ul style="list-style-type: none"> <li>Engineering design drawings are available and as built,</li> <li>All manufacturing and factory acceptance testing are complete and test certificates signed,</li> </ul>

Nr.	Requirement
	<ul style="list-style-type: none"> <li>• The necessary transport, construction and site inspection plans for onsite work is in place,</li> <li>• The material and suitably qualified resources are available as planned,</li> <li>• All permits for transportation, hoisting and lifting as well as onsite work are in place.</li> </ul>
8.3.5.6	TNO will arrange a pre-start-up safety review with site representatives and representatives from the Contractor before the demonstration unit is finally commissioned to determine whether: <ul style="list-style-type: none"> <li>• The risk assessments are complete, and all safety related documentation is signed and available;</li> <li>• All site acceptance testing activities are complete and check sheets are signed,</li> <li>• All engineering drawings are updated with any construction modifications and as built,</li> <li>• Production and maintenance teams have conducted their pre-start-up activities and their procedures are in place.</li> </ul>

## 8.4 General mechanical, electrical and automation design requirements

### 8.4.1 General Mechanical

Nr	Requirement
8.4.1.1	Piping, flanges and vessels with its accessories with a design pressure higher than 0.5 bar SHALL be designed, fabricated and installed according to the requirements set out in the Dutch pressure vessel regulations for the Pressure Equipment Directive (PED) as well as the Machinery Directive (MD).
8.4.1.2	All vessels, piping and safety accessories SHALL have a CE marking as stated within the regulations. The associated Declaration of Conformance (DoC) together with the technical documentation SHALL subsequently be provided to TNO.
8.4.1.3	Piping, flanges and vessels with its accessories less than or equal to 0.5 bar SHALL conform to the additional requirements as stipulated in the Dutch regulations and SHALL also be CE marked.
8.4.1.4	The layout of piping and piping accessories SHALL be designed free draining towards the respective low point drain. The accessibility for maintenance of equipment, valves and instruments SHALL be considered in the layout design. The layout design SHALL be confirmed with TNO before construction and procurement.
8.4.1.5	The proposed connection points for utilities supply and drains SHALL be confirmed with TNO before construction and procurement.
8.4.1.6	The as-built engineering drawings, manufacturing procedures as well as material and test certificates SHALL be undersigned and furnished to TNO conform to the requirements of the regulations and its associated standards.
8.4.1.7	The mechanical design temperature SHALL be selected to be the highest of: <ul style="list-style-type: none"> <li>• Maximum operating condition plus 30°C (MEOT+30°C)</li> <li>• Maximum calculated temperature during upset condition</li> <li>• Black bulk temperature at 65°C SHALL be considered for facilities exposed to solar radiation.</li> </ul>
8.4.1.8	Unless protected by a pressure safety valve at a lower pressure, the mechanical design pressure SHALL be set at the highest of the following: <ul style="list-style-type: none"> <li>• Addition of 10% to the highest specified operating pressure.</li> <li>• For piping and equipment connected to a pump discharge, the design pressure is the sum of the following, rounded up to the nearest 0.5 bar: Design pressure on the suction side; Static height of the liquid at suction; Pump shut-off head.</li> </ul>

Nr	Requirement
8.4.1.9	The compatibility of all wetted components (i.e. seals or gaskets) and materials SHALL be confirmed for use given the properties of the process fluid. Consideration SHALL also be given regarding the compatibility of dissimilar materials in contact with each other.
8.4.1.10	The bottom of the different skids of the demonstration unit SHALL be provided with a leak tray with a lock closed manual drain valve.

#### 8.4.2 Vessels, pumps and piping

Nr	Requirement
8.4.2.1	The demonstration unit will be subject to frequent loading cycles. The number and size of cycles SHALL therefore be confirmed with TNO and considered within in the design.
8.4.2.2	The performance of the electrolysis unit will be negatively affected by stray metal ions in the electrolyte solution. All equipment, tubing and/or piping used in the preparation or transport of the electrolyte SHALL therefore be metal-free (i.e. non-metal or lined with a stable non-metal compound).
8.4.2.3	Double mechanical seals with barrier fluid SHALL be used for pumps servicing hazardous fluids.
8.4.2.4	Metallic and plastic lined metallic piping SHALL be seamless. All plastic lined metallic piping connections SHALL be flanged and not welded.
8.4.2.5	The use of plastic piping SHALL not be used with steam, flammable or toxic materials..
8.4.2.6	The use of type 316 steel SHALL be used for tubing unless a different material is required because of specific fluid properties. The tubing connections SHALL either be welded or joined by means of compression tube type fittings (i.e. Swagelok or Parker fittings).
8.4.2.7	All loading, unloading and sampling points SHALL be marked with a clear indication of the product within the pipe.
8.4.2.8	Piping and tubing SHALL be suitably grounded against electrostatic build-up due to product flow.

#### 8.4.3 Manual isolating and pressure safety valves

Nr	Requirement
8.4.3.1	Pressure relief valves SHALL be sized, selected and installed according to ISO 4126 for vessels and piping. Pressure relief valves for tanks at atmospheric or low-pressure service SHALL be sized, selected and installed according to API 2000.
8.4.3.2	The relief of hazardous material SHALL be routed by means of a closed system to a flare, scrubber or incinerator. Non-hazardous material SHALL be vented to a safe location. The backpressure requirements for the relief system SHALL be considered during the design and installation of the relief valve and/or rupture plate.
8.4.3.3	Process isolation valves SHALL be specifically designed for tight shut-off and not be automated or combined with remote actuated valves. A means SHALL be provided to lock the valves in a closed position. Process isolation valves with open connections to atmosphere (i.e. used for venting or draining) SHALL furthermore be blind flanged or plugged for hazardous materials. Use of double block valves for sampling SHALL be confirmed with TNO.
8.4.3.4	Valves in hazardous service SHALL make use of bellow seals in addition to the standard packing material.

#### 8.4.4 General electrical

Nr	Requirement
8.4.4.1	Electrical equipment and its accessories SHALL be designed, fabricated and installed according to the requirements set out in the Dutch regulations for the Low Voltage Directive (LVD) as well as the Machinery Directive (MD). The Declaration of Conformance (DoC) together with the technical documentation SHALL subsequently be provided to TNO.
8.4.4.2	All electrical equipment SHALL be assigned a unique tag name. The tag number SHALL be clearly affixed to the housing or nearest structure of the equipment.
8.4.4.3	All electronic housings for electronic components within the skid frame SHALL be minimum IP 55. The electrical components and/or housing SHALL furthermore meet the minimum area classification rating or design as per the Dutch regulations for the ATEX Directive.
8.4.4.4	Electrical plugs SHALL be mounted in a safe location (i.e. not within explosive area and exposed to liquid spray in case of a leak). The plug SHALL have a hinged housing with a rating of minimum IP 54.
8.4.4.5	Cabling within the frame SHALL be neatly routed and strapped on wire mesh cable racks or within open ended conduiting.

#### 8.4.5 Power feeder sizing, routing and distribution

Nr	Requirement
8.4.5.1	A load list SHALL be generated where the power requirements for the different components are listed. The maximum cable voltage drop SHALL not exceed 5%. Cable sizes SHALL furthermore be based on the rated insulation temperature, grouping, current and short circuit rating. All cables SHALL be glanded and terminated on device terminals or terminal blocks using cable lugs.
8.4.5.2	Cabling SHALL not run underground and be securely and neatly affixed with cable ties to a cable tray dedicated for power supply runs. Care should be taken to minimise cable lengths and should preferably not run through areas where the insulation can be susceptible to damage due to external heat or chemical spills.
8.4.5.3	The feeder connection points, and routing SHALL be presented to TNO for approval first before procurement and installation may continue.
8.4.5.4	Protective devices such as fuses and circuit breakers SHALL be sized and designed such as to ensure that the device nearest to the source of the short circuit opens first.
8.4.5.5	A distribution board with a feed originating from a 3 phase supply SHALL be supplied with each of the skids of the demonstration unit. <ul style="list-style-type: none"> <li>• Large power equipment typically greater than 2 kW is wired to the 3-phase supply in the distribution board.</li> <li>• Medium power equipment typically less than 2 kW is powered from the distribution board single phase supply.</li> <li>• Small power equipment typically less than 0.5 kW should be connected to an individually fused multiplug to optimise on space and circuit breakers within the distribution board single phase supply.</li> </ul>

#### 8.4.6 Safety Grounding

Nr	Requirement
8.4.6.1	All equipment frames, junction boxes and distribution panels SHALL be directly bonded to the earthing system as per the regulation.
8.4.6.2	The earthing system of the demonstration unit SHALL be directly bonded to the earthing system of the facility.

#### 8.4.7 General for Instrumentation and remotely actuated valves

Nr	Requirement
8.4.7.1	The wetted parts SHALL be type 316 stainless steel unless a different material is required because of specific fluid properties. All threaded process connections SHALL furthermore be National Pipe Taper (NPT) thread.
8.4.7.2	The piping connections for in-line flow instruments and valves SHALL be according to the pipeline class rating. All pressure containing parts SHALL meet the design, testing and quality assurance requirements as prescribed by the regulations for the Pressure Equipment Directive (PED).
8.4.7.3	The signal output for transmitters SHALL be 4 – 20 mA and 24 VDC for sensors or switches.
8.4.7.4	All electronic housings for electronic components SHALL be minimum IP 65. The electronic components and/or housing SHALL furthermore meet the minimum area classification rating as per the regulations for the Explosive Atmospheres (ATEX) Directive as well as the Electromagnetic Compatibility (EMC) Directive.
8.4.7.5	The instrument and valve SHALL be marked clearly with its unique tag number that is securely fixed to the housing.
8.4.7.6	Each instrument SHALL have its own nozzle and separate instruments SHALL be used for control and safety. Actuated control valves SHALL not be used in a safety function.
8.4.7.7	The positioning of all instruments and actuated valves SHALL allow for easy access for maintenance. Specific allowances for adequate draining and venting SHALL be made to minimise the formation of liquid and/or vapour pockets during removal.
8.4.7.8	The instrument or valve SHALL be calibrated or set as per the datasheet and a calibration certificate SHALL be provided. A copy of the SIL certificate SHALL also be provided in cases where the instrument or valve is used in a SIL rated application.

#### 8.4.8 Pressure measurement

Nr	Requirement
8.4.8.1	All pressure measurements SHALL be absolute with units of bar or millibar if required for accuracy.
8.4.8.2	Differential pressure measurement SHALL be done by a single instrument.
8.4.8.3	Consideration SHALL be given to the risks of fouling and/or corrosive properties of the measured fluid and confirmed to be suitably outengineered. Diaphragm seals or an alternative direct measurement technology should be used in cases where the tubing can be susceptible to corrosion, embrittlement or blockage because of fouling.
8.4.8.4	Instrument tubing SHALL be free draining for gas service and free venting for liquid service. Steam service SHALL have a liquid trap or siphon where liquid can accumulate as a temperature barrier for the instrument.

Nr	Requirement
8.4.8.5	Pressure gauges SHALL be equipped with a solid front and back blow-out in case of an element rupture. An excess flow shut-off valve should furthermore be considered in cases of explosive or toxic fluids.

#### 8.4.9 Level measurement

Nr	Requirement
8.4.9.1	All measurements SHALL be in units of mm.
8.4.9.2	Consideration SHALL be given to the risks of fouling or build-up and corrosive properties of the fluid that is measured in selecting a suitable technology for measurement.
8.4.9.3	The horizontal installation of the wetted parts of the instrument SHALL be free-draining and/or venting such that: <ul style="list-style-type: none"> <li>• A false measurement due to the formation of a vapour or liquid pocket will not occur.</li> <li>• No liquid pockets are formed that can spill when the instrument is removed from its mounting point.</li> </ul>

#### 8.4.10 Temperature measurement

Nr	Requirement
8.4.10.1	All measurements SHALL be in units of °C.
8.4.10.2	A Resistance Temperature Detector (RTD) element SHALL be used where an accuracy better than 1°C is required.
8.4.10.3	The probe elements SHALL be sheathed in a ¼" type 316 stainless steel tube unless a different material is required due to measured fluid properties. The elements SHALL be properly insulated within the sheath. The elements SHALL not be grounded to the sheath.
8.4.10.4	Consideration SHALL be given to the risks of fouling, erosion, corrosion and flow induced vibration in the specification of the probe length and sheath material. A thermowell should be used in cases where the sheath will be susceptible to damage due to flow induced vibration, erosion or corrosion.

#### 8.4.11 Flow measurement

Nr	Requirement
8.4.11.1	Measurements for vapour or gas flow SHALL be in Nm <sup>3</sup> /h and kg/h for liquids.
8.4.11.2	Vortex and Coriolis type installations SHALL not be installed in piping with excessive vibration.
8.4.11.3	Magnetic type flow meters SHALL be properly grounded to the process to ensure measurement accuracy. Grounding rings or electrodes should be used for lined or non-conductive piping.
8.4.11.4	Only variable area flow meters with a metal tube SHALL be used if selected.
8.4.11.5	Sizing for orifice plates or venturis SHALL be according to ISO 5167.
8.4.11.6	The measuring element (e.g. orifice plate) or instrument SHALL be installed with enough straight pipe length to meet the measured accuracy requirements. The measuring element SHALL furthermore be installed in

Nr	Requirement
	the vertical. Alternatively, a means SHALL be provided to sufficiently drain or vent the fluid from the element or instrument before removal.

#### 8.4.12 Inline analytical measurement

Nr	Requirement
8.4.12.1	In-line measurement should be used for the analysis of single component composition or physical properties and the use of extractive sampling should be minimised.
8.4.12.2	The sensing element SHALL be selected and mounted such that a representative sample is taken, and the sensor is free from excessive vibration, exposure to erosion and/or fouling.
8.4.12.3	Special purpose cabling used for signalling between the sensing element and transmitter SHALL be procured to the nearest standard length from the instrument vendor. The excess length SHALL be neatly coiled and properly secured.

#### 8.4.13 Extractive sampling and analytics

Nr	Requirement
8.4.13.1	The sampling systems SHALL ensure that a representative sample is received, with minimal delay and that is suitable for the operation of the analyser with minimal waste.
8.4.13.2	The sampling system SHALL typically comprise of: <ul style="list-style-type: none"> <li>• A probe or take-off point for sampling from the process.</li> <li>• Conditioning sections for pressure reduction, product vaporization or cooling and filtering.</li> <li>• A transportation section.</li> <li>• A fast loop manifold, if necessary, for fast measurement response.</li> <li>• A sample disposal and/or recovery system.</li> <li>• A calibration system.</li> <li>• Test and service gas cylinders.</li> </ul>
8.4.13.3	Local indicators SHALL be installed on the sampling system for: <ul style="list-style-type: none"> <li>• Pressure indication of sample lines and utility supplies;</li> <li>• Flow indication for sampling flow rate, if needed;</li> <li>• Temperature indicators to indicate sample temperature after heating or cooling.</li> </ul>
8.4.13.4	The samples of product SHALL be piped to a non-hazardous remote shelter or location where the analytical instruments are situated. The tubing SHALL be type 316 stainless steel unless a different material is required because of specific fluid properties
8.4.13.5	At the remote location or shelter an allowance SHALL be made for the following utilities and infrastructure: <ul style="list-style-type: none"> <li>• Single phase power for the analytical instruments.</li> <li>• Drain and/or venting facilities.</li> <li>• Secure storage of test and calibration gas cylinders.</li> <li>• Ventilation and gas detection if it are a shelter with an enclosed space.</li> </ul>
8.4.13.6	The different sample lines for multi-sample systems as well as well as utility supply lines, drains and vents SHALL be clearly marked for easy visual interpretation.

Nr	Requirement
8.4.13.7	Hot surfaces SHALL either be insulated or clearly marked with a suitable warning sign. Enclosures housing electrical equipment that can causing injury due to electrification SHALL has a suitable warning sign.

#### 8.4.14 Smoke and gas detectors

Nr	Requirement
8.4.14.1	Gas detection SHALL be provided where hazardous gases are used.
8.4.14.2	The physical properties of the released gas and prevailing direction of air movement SHALL be carefully considered in the determination of the amount and placement of the detectors.

#### 8.4.15 Remotely actuated valves

Nr	Requirement
8.4.15.1	Actuated valves used for control purposes SHALL be sized according to IEC 60534 or ANSI/ISA 75.01.
8.4.15.2	All actuators SHALL use instrument air and be spring return. The fail direction of the valve SHALL be the same in case of instrument air and signal failure and SHALL be confirmed during the safety risk review. The actuator SHALL be able to withstand the 1.5 times the maximum design pressure upstream of the pressure regulator.
8.4.15.3	The air supply to solenoids and valve positioners SHALL be kept dry and free from solid particulates or oil. A regulator with integral filter of at least 3 microns SHALL be used.
8.4.15.4	The leakage rates for actuated control valves SHALL be ANSI class IV. Tight shut off where specified for actuated safety valves SHALL be ANSI class V or better. Specific requirements for tight shut off together with speed of response SHALL be confirmed in the safety risk review.
8.4.15.5	Actuated safety valves SHALL not have a means of manually by-passing the trip function in the field i.e. manual by-pass line for fail closed valves, handwheels or field override switches. The position of all actuated safety valves SHALL furthermore be indicated: <ul style="list-style-type: none"> <li>• visually in the field by means of an indication beacon, and</li> <li>• remotely on the operator display by means of limit switches.</li> </ul>
8.4.15.6	Valves in hazardous service SHALL make use of bellow seals in addition to the standard packing material within the valve bonnet.

#### 8.4.16 General automation system and operator interface

Nr	Requirement
8.4.16.1	Sensors, logic solvers and final elements used for control and safety functions SHALL be physically segregated. Diagnostic information from the safety system to the control system for display and historization purposes SHALL be allowed.
8.4.16.2	The diagnostic information, alarms and data trends SHALL be time stamped and stored within a single data historian.
8.4.16.3	Each skid SHALL be controlled by a separate control and safety system that is individually powered.

Nr	Requirement
8.4.16.4	The individual control systems for the different skids SHALL be connected to a common operator interface by means of an internationally accepted bus communication system such as Ethernet or Modbus.

#### 8.4.17 Cabinet marshalling and wiring

Nr	Requirement
8.4.17.1	Panel wiring within SHALL be routed in plastic trunking that is not more than 80% filled. Multi-stranded connections SHALL be lugged and tagged showing the both the source and destination. Single stranded wiring SHALL not be lugged. Different voltages SHALL be routed separately.
8.4.17.2	Signal cabling from the field SHALL be terminated on an incoming terminal strip within the marshalling panel. The cabling SHALL be properly glanded and grounded with the individual wiring lugged within the terminals. The signalling SHALL then be marshalled to the individual electronic components such as cards or relays by means of individual panel wiring.
8.4.17.3	The use of special terminals with bridging combs SHALL be preferred instead of “daisy chained” wiring (i.e. 24 V supply strips).
8.4.17.4	Different wiring colours SHALL be used logically and consistently with reserved colours (i.e. yellow/green for safety ground) used as per legal requirements.

#### 8.4.18 Operator Interface (schematic)

Nr	Requirement
8.4.18.1	Alarms SHALL be properly described and clearly annunciated both visibly and audibly on the operator display and the operator SHALL have the ability to silence and accept all alarms.
8.4.18.2	Alarms SHALL only be removed from the list and/or display once the alarm condition has cleared and all alarms SHALL be historized.
8.4.18.3	The schematic SHALL be a reasonable representation of the layout and logical ordering of the physical demonstration unit. A general overview schematic SHALL be provided in addition to the more detailed schematics for certain sections of the demonstration unit. The overview schematic SHALL provide shortcuts to the more detailed schematics or equipment “pop-ups” and display the major safety alarms and equipment status.
8.4.18.4	The different status and alarm conditions of equipment SHALL be shown dynamically with suitable colouring that describes the different priority levels in a consistent way.
8.4.18.5	The use of multi-coloured displays SHALL be confirmed with TNO before configuration may commence.
8.4.18.6	Multi-coloured displays SHALL be minimised with the colours yellow and red reserved for the different levels of priority for alarms or indications and the use of the colour green SHALL be minimised.

#### 8.4.19 Safety instrumented systems

Nr	Requirement
8.4.19.1	The system and associated protection functions SHALL be fail safe in case of a utility failure such as power or instrument air. Safety rated functions SHALL be designed according to IEC 61511.

Nr	Requirement
8.4.19.2	Safety alarms SHALL be wired to a visual and acoustic beacon at the demonstration unit location in addition to being shown on the schematic.
8.4.19.3	Automated by-passes and/or safety overrides SHALL NOT be allowed.
8.4.19.4	Emergency isolations valves SHALL be provided with a means to close locally as well as remotely.

#### 8.4.20 Explosive gas protection methods (ATEX)

Nr	Requirement																								
8.4.20.1	<p>The table below lists the different protection options for the equipment that SHALL be used within the different classified areas.</p> <table border="1"> <thead> <tr> <th>Type</th> <th>Zone 0</th> <th>Zone 1</th> <th>Zone 2</th> </tr> </thead> <tbody> <tr> <td>Transmitters, detectors and switches</td> <td>Ex i</td> <td>Ex d</td> <td>Ex d</td> </tr> <tr> <td>Hand switches</td> <td>Not allowed</td> <td>Ex d or Ex e</td> <td>Ex d or Ex e</td> </tr> <tr> <td>Electric motors, heaters or fans</td> <td>Not allowed</td> <td>Ex d or Ex e</td> <td>Ex d or Ex e</td> </tr> <tr> <td>Junction boxes and marshalling cabinets</td> <td>Not allowed</td> <td>Not allowed</td> <td>Ex e</td> </tr> <tr> <td>Equipment cabinets</td> <td>Not allowed</td> <td>Not allowed</td> <td>Not allowed</td> </tr> </tbody> </table>	Type	Zone 0	Zone 1	Zone 2	Transmitters, detectors and switches	Ex i	Ex d	Ex d	Hand switches	Not allowed	Ex d or Ex e	Ex d or Ex e	Electric motors, heaters or fans	Not allowed	Ex d or Ex e	Ex d or Ex e	Junction boxes and marshalling cabinets	Not allowed	Not allowed	Ex e	Equipment cabinets	Not allowed	Not allowed	Not allowed
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Transmitters, detectors and switches	Ex i	Ex d	Ex d																						
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Equipment cabinets	Not allowed	Not allowed	Not allowed																						

#### 8.4.21 Maintenance and support requirements

Nr	Requirement
8.4.21.1	The number of different types and makes from various sub-contractors for pumps, valves, piping specials, instrumentation and electrical equipment SHALL be minimized to limit the number of spare parts and to ease maintenance.
8.4.21.2	Only components from (sub-) contractors that have proven their suitability for equivalent applications and which are related to high reliability, safety, service life and low maintenance SHALL be applied (no prototype) to minimize technical risks and maintenance. In exceptional cases, identified by the tenderer and acknowledged by TNO, the TNO team will be consulted and the components under discussion will be evaluated.
8.4.21.3	Vessels, piping and tubing SHALL be engineered for an operational lifetime of at least 5 years.
8.4.21.4	Commissioning support SHALL be provided during normal working hours for one month to allow for: <ul style="list-style-type: none"> <li>• Software and hardware modifications;</li> <li>• Trouble shooting;</li> <li>• Training</li> </ul>

The following support should be listed as an optional price within the schedule of prices:

Nr	Option
8.4.21.4	Call out assistance during normal working hours for six months to allow for: <ul style="list-style-type: none"> <li>• Software and hardware modifications;</li> <li>• Trouble shooting;</li> </ul>

Nr	Option
	<ul style="list-style-type: none"> <li>• Training It is required to give this price.</li> </ul>

#### 8.4.22 Detailed design reviews

Nr	Requirement
8.4.22.1	The following design review meetings SHALL be arranged with TNO for approval before manufacture and procurement can continue: <ul style="list-style-type: none"> <li>• Piping and instrumentation drawing.</li> <li>• General layout and power distribution drawings for the distribution boards and controller cabinets.</li> <li>• 3D review of the demonstration unit showing the placement of equipment and layout of piping.</li> </ul>

#### 8.4.23 Factory Acceptance Test (FAT)

Nr	Requirement
8.4.23.1	All equipment and manufactured items SHALL be subjected to a joint inspection and functional testing between TNO and the Contractor before release for shipment. The signed Factory Acceptance Test certificates SHALL be submitted to TNO.
8.4.23.2	A quality plan that details the planned FAT dates SHALL be provided to TNO for approval before manufacturing commences. TNO will indicate whether a TNO or site representative is required to be present during the test.
8.4.23.3	During the Factory Acceptance Testing (FAT) the following SHALL be verified: <ul style="list-style-type: none"> <li>• Adherence to the minimum requirements as stated within the Programme of Requirements (PoR);</li> <li>• Confirmation of function and usability of equipment and/or software as per the engineering design documentation and minimum requirements;</li> <li>• Manufacturing completion and check for damages;</li> <li>• Availability and correctness of test certificates and vendor documentation.</li> </ul>
8.4.23.4	Any non-conformance identified during the test or inspection SHALL be jointly confirmed, documented within an official register and corrected within the agreed time-frame at no additional charge.

#### 8.4.24 Site Acceptance Test (SAT)

Nr	Requirement
8.4.24.1	The final site integration and functionally tests of the different systems SHALL be conducted by the Contractor and witnessed by TNO and representatives from site.
8.4.24.2	The Site Acceptance Test SHALL occur in person and subsequent to the delivery and final installation at the site. The signed test certificates SHALL be submitted to TNO.
8.4.24.3	A quality plan that details the planned SAT dates SHALL be provided to TNO for approval before manufacturing commences. TNO will indicate whether a TNO or site representative is required to be present during the test.

8.4.23.4	During the Site Acceptance Testing (SAT) the following SHALL be verified: <ul style="list-style-type: none"> <li>• Integration and final function testing of equipment and/or software as per the engineering design documentation and minimum requirements;</li> <li>• Construction completion and check for damages;</li> <li>• Availability and correctness of test certificates and vendor documentation.</li> </ul>
8.4.23.5	Any non-conformance identified during the test or inspection SHALL be jointly confirmed, documented within an official register and corrected within the agreed time-frame at no additional charge.

## 8.5 Delivery of documents

The result of the project is the commissioned demonstration unit which will be developed in line with the Programme of Requirements. Next to the demonstration unit, the Contractor SHALL deliver the following documentation:

Nr	Requirement
8.5.1	As part of the basic engineering package the following documents SHALL be delivered to TNO as a minimum: <ul style="list-style-type: none"> <li>• Mass &amp; energy balance</li> <li>• Process description</li> <li>• Piping and Instrumentation diagrams</li> <li>• Layout drawings</li> <li>• Equipment specification sheets</li> <li>• Instruments specification sheets</li> <li>• Analysers specification sheets</li> <li>• Process control and safeguarding narratives</li> <li>• Automation systems user requirements specification.</li> </ul>
8.5.2	As part of safety assessments, the following reports SHALL be submitted to TNO as a minimum: <ul style="list-style-type: none"> <li>• HAZOP report (the HAZOP will be organized and facilitated by the chosen supplier and TNO as well as the facility owner will be part of the HAZOP sessions).</li> <li>• Layer of Protection Analysis (LOPA) study report detailing the requirements for the safety instrumented functions, if required.</li> <li>• Area classification drawing to confirm ATEX requirements.</li> </ul>
8.5.3	As part of the detailed design package the following documentation SHALL be submitted as a minimum: <ul style="list-style-type: none"> <li>• Updated piping and instrumentation diagrams (P&amp;ID'S)</li> <li>• Equipment specification sheets</li> <li>• Process control, sequence and safety logic narratives</li> <li>• Electrical single line diagram and load lists</li> <li>• Instrument specification sheets</li> <li>• Valve and safety valve specification sheets</li> <li>• Analysers and sampling system specifications</li> <li>• Mechanical and electrical lay-out drawings with size indications</li> <li>• Process manual</li> <li>• Operating manual</li> <li>• Maintenance instructions</li> <li>• Safety instructions</li> <li>• Civil design if applicable</li> <li>• 3D model description and drawings</li> </ul>
8.5.4	As part of procurement and manufacture the following documentation SHALL be provided to TNO as a minimum:

Nr	Requirement
	<ul style="list-style-type: none"> <li>• Quality plans indicating hold and review points for factory acceptance testing, certification and site acceptance testing.</li> <li>• Signed test certificates</li> <li>• Equipment data books</li> <li>• Recommended spare lists</li> <li>• Declaration of conformance certificates</li> <li>• As-built engineering drawings</li> </ul>

**8.6 Preferences**

Nr	Project approach
8.6.1.	<p>Within the project plan, which is made before the kick off meeting, several chapters are made.</p> <p>TNO is inviting the tenderer to provide (already) in the current tender an outline for the following parts of the project plan. The outline will contain information about how the tenderer will approach the specific parts of production of the unit</p> <p>TNO is asking an outline for the following subjects (specific parts) :</p> <ul style="list-style-type: none"> <li>• SAT</li> <li>• FAT</li> <li>• HAZOP</li> <li>• The scope of the project – meaning a description on how Tenderer understand the unit to function;</li> </ul> <p>Tenderer is kindly asked to support the outline with the use of examples (incl. lessons learned) from previous and/or similar projects and support their explanation on (but not limited to) mentioned topics. Use information from the reference project. With that the tenderer is to illustrate a clear pathway for a successful project execution.</p> <p>The confidentiality limitations in providing the details will be respected.</p>
	<p>The entire answer should be concise, easily readable and not too extensive.</p> <p>The Tenderer is invited to describe in maximum <u>ten pages</u> the answer to the above mentioned preference.</p>

Nr	Project team experience
8.6.2.	<p>TNO would like to see a balanced and focused team, with relevant experience for the project. The tenderer will provide the motivation and relevant information on the key personnel leading and executing the project, including:</p> <ul style="list-style-type: none"> <li>• Organigram of the project with description of the roles and choices that were made % of involvement of each project member in the project and roles and responsibilities of team members;</li> <li>• Functional CV's (Appendix A06) of the key team members envisaged to work on the project. Use the provided template to do so, including a motivation from each team member and relevant working experience on the reference project(s);</li> </ul> <p>Add minimal 2 people with a project role like "Project manager" and "Specialist/Engineer".</p>
	<p>The entire answer should be concise, easily readable and not too extensive.</p> <p>The Tenderer is invited to describe in maximum <u>five pages</u> (excluding the functional CV's) the answer to the above mentioned preference.</p>

Nr	Maintenance and service plan:
8.6.3.	<p>The tenderer will present a plan that specifies maintenance &amp; service activities to be performed by the tenderer during the warranty period. This includes the approach to the maintenance request, i.e. the tenderer shall indicate the procedures (plan, action, solution), the response times and personnel that will be charged with carrying out the activities (including their experience and affiliation).</p> <p>It is also up to the tenderer to provide the information of the after warranty services, including description of the post-warranty support and response times.</p>
	<p>The entire answer should be concise, easily readable and not too extensive.</p> <p>The Tenderer is invited to describe in maximum <u>three pages</u> the answer to the above mentioned preference.</p>

## 9 Appendices

All Appendices to the Tender Documents are published to accompany the Tender Instructions on [www.tenderned.nl](http://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** Answering questions/notification of preferences
- Appendix A06** CV Template
- Appendix A07** Subcontractor information (if applicable)

### 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

### C) Additional information:

- Appendix C01** Standard template for questions submitted by Tenderer
- Appendix C02** Draft Contract
- Appendix C03** TNO General Terms and Conditions of Procurement, June 2014

#### 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](http://www.tenderned.nl) will take precedence at all times.