

Question	Page	Chapter/paragraph	Question	Answer
1	page 4	2. Assess the current state of technology readiness (TRL)	API RP 17Q is API standard for RECOMMENDED PRACTICE ON SUBSEA EQUIPMENT QUALIFICATION. For TRL-4 Product Validation (Product validated and tested) is requested "d) product testing in a simulated or actual subsea environment". Requested pumps are not for subsea application. Please clarify applicability of API RP 17Q for not subsea pump as for present Project.	For this market consultation, *API RP 17Q* is used solely as a reference framework for Technology Readiness Levels (TRL), independent of the subsea application context. Its purpose is to provide a clear and verifiable scale. If you use a different TRL system, you can explain this in your response on this market consultation question. Also see the general remark below this table.
2	page 6	2.4 Indicative Technical Specifications - Pumped liquid: CO2 >= 95 mol%	Which are other components of process fluid? Water? H2S? Chloride? This is important to understand correct material to be used as for above sentence.	At this stage, the composition is only defined indicatively as **CO₂ ≥ 95 mol%** . During the R&D phase of the innovation partnership it has to be determined which other components of process fluids are present and how this affects the development and requirements of the CO2 pumps and materials. Also see the general remark below this table.
3	page 7	OPERATING CONDITIONS (6.1.2) Rated point to be specified by Supplier. 3: Minimum allowable suction pressure to be determined in conjunction with Supplier to avoid cavitation area.	We will consider most impacting operating conditions or envelope of the same. Minimum allowable suction pressure will be better defined when Process Fluid compositions will be clarified. Please confirm our understanding.	Your understanding is correct. Also see the answer to question 2.
4	page 7	Operating requirements (Pumped medium shall not be contaminated with external fluids (oil or flush water).)	In point 2.4 Technical specification Mechanical Seals are indicated. As for this operating requirements, it seems that Customer prefer using of Dry Gas Seals even if Wet Mechanical Seals with plan 53B or 54 could be used. Please clarify.	At this stage, various specifications are indicative and serve as initial guidance. The operating requirement "pumped medium shall not be contaminated with external fluids (oil or flush water)" is not applicable. During the R&D phase of the innovation partnership it has to be determined which seals are best suited. Also see the general remark below this table.
5	Annex B - Response form – market consultation innovation partnership CO2 pumps (pt 4.1)	4.1 Which internal processes and standards are applied by the supplier in an innovation or R&D project? How is proper documentation of design choices, changes, and design iterations ensured by the supplier?	The product we will offer for this project is not and innovative product and not subject to R&D, it is a proven and referenced product. Do we need to reply to this query in general for any R&D project?	Yes. With your answers to the questions in the market consultation Gasunie can gather further insight, also regarding your approach for R&D projects. Also question 1.3 of the market consultation offers the opportunity to provide input on actual experience, in the form of a reference list.

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6	6	Chpt 2.4	Mechanical seals to the guidelines and intentions of ISO 21049 / API 682 4th Edition have been specified. Can API 692 dry gas seals be considered?	See the answer to question 4.
7	6	Chpt 2.4	Fluid composition is not provided but summarised as ≥ 95 mol% CO ₂ . Are there known limits for corrosive contaminants in the process fluid that would allow material selection? i.e. H ₂ O, H ₂ S etc.	See the answer to question 2.
8	6	Chpt 2.4	Design temperature has been listed as -20°C/+50°C. Has a blowdown assessment been performed to validate the MDMT? We would expect a min design metal temperature requirement closer to the -46°C.	The design temperature is indicatively set at ** -20°C to +50°C ** . During the R&D phase of the innovation partnership, this range may be refined if substantiated (e.g., by blow-down or thermal transient assessments). Also see the general remark below this table.
9	7	Table 6.1.2.	Max start-up' condition is mentioned as a worst-case transient condition based on maximum suction temperature. For clarity does this condition relate to a simulated settle-out condition or process trip?	This indicative condition refers to a process trip or power failure within the station. When CO ₂ supply to the station continues and accumulates in the suction line. Also see the general remark below this table.
10	7		Starting up against closed valve without recycling is preferred' has been stated. Based on defined range of suction pressure and temperature, and approx. proximity of critical point of fluid it is advised that start-up of the units must be performed using a recycle valve.	This operating requirement is not applicable. During the R&D phase of the innovation partnership the exact operation procedures for start-up, normal operations and stops have to be determined. This is also to understand balance of plant requirements. Also see the general remark below this table.
11			Has there been any process modelling performed to ascertain pressure fluctuations in suction and discharge piping, and the requirement for fast acting min flow or pressure relieve valves?	Process modelling of suction and discharge lines (including transients) will be developed within the integrated design in cooperation with the system integrator. During the innovation partnership the minimum-flow requirements, surge behaviour, required recycle/by-pass strategies, and protection philosophies will have to be determined, enabling a robust definition of the control concept and balance of plant.
12	6	2,4	Pumped liquid: CO ₂ ≥ 95 mol%. Question: Which are the remaining trace components to be expected? Should we presence of water vapor be expected?	See the answer to question 2.
13	7		Pumped medium shall not be contaminated with external fluids (oil or flush water). Question: Is there any value defined with regards to allowable emission to atmosphere?	No, not yet. This depends on the choices that will be made in the R&D phase of the innovation partnership. Also see the answer to question 4. Also see the general remark below this table.

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14	6	2,4	Considering the pump operation with a VFD, the maximum operating frequency for improved pump selection is above 50 Hz (56-63 Hz). Please confirm acceptance.	At this stage, there is no acceptance or rejection of proposals regarding the indicative specifications and/or the solution. Also see the general remark below this table.
15	6	2,4	Please define the composition of the fluid, CO2 + other impurities.	See the answer to question 2.
16	6	2,4	Thermofluid properties required for hydraulic selection will be calculated based on the defined fluid composition using REFPROP, alternatively if you are using a different fluid model we can perform the hydraulic calculations interpolating tabulated thermofluid property tables if these are provided.	Noted.
17	6	2,4	Mechanical seal selection requires special attention, dry gas seals are typical, however if wet seals are required some contamination of the process fluid with the seal barrier fluid needs to be acceptable. Please confirm if dry or wet seals are required.	See the answer to question 4.

General remark from Gasunie:

We would like to emphasize that this market consultation is intended as preparation for a European tender procedure for an innovation partnership. To gather insights into the market and relevant technical aspects, several specifications have been included in the market consultation document solely to illustrate our current thinking. Tendering an innovation partnership is fundamentally different from a regular procurement procedure. (See also the explanation in paragraph 2.5 of the market consultation document.)

The purpose of an innovation partnership tender is primarily to identify the right partner who, together with Sweco and Gasunie, will develop and ultimately validate scalable pumps that meet the required specifications for dense-phase CO₂ applications within the DRC project.

This means that the focus during the tender phase will be on selecting the right partner and approach to developing engineering solutions, rather than on finalizing the technical solution. It is therefore not necessary at this stage to make definitive statements regarding technical requirements. These will be addressed during the development process carried out together with the selected innovation partner. However, as indicated in the market consultation questions, we would like to understand to what extent our current assumptions are clear and whether they may require adjustment for the tender process.