Rijkswaterstaat
Ministerie van Infrastructuur en Waterstaat

English version for informal use. Dutch version is leading.

Tender Specification Requirements

Description of products and services to be supplied

Supply of CT sensors for the National Water Monitoring Network

Case number: 31155805

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1 Introduction

These Tender Specification Requirements (VSE), in the form of a collection of sequenced requirements, contain a description of the project in its immediate surroundings and the quality of the systems and services to be supplied. The Tender Specification Requirements are part of the Tender Documents of the European public tendering procedure for the Supply of CT sensors for the National Water Monitoring Network. The full set of Tender Documents that form part of this European public tendering procedure is set out in the Descriptive Document.

1.1 Objective

This document contains a description of all applicable requirements in the supply of products and services during implementation of the Agreement. The purpose of the requirements is to describe the minimum quality of the product and service.

The result of this call for tenders is of adequate quality when:

- The data collected with the supplied CT sensors (Conductivity and Temperature) meets the information requirements;
- The measuring procedure is carried out effectively with the CT sensors and services, by carrying out the procedure in any case with an equal amount of or with less effort;
- The CT sensors can be used in the existing environment without any major adaptations. Any major adaptations would have to lead to a more efficient measuring process;
- The CT sensors are of sufficient quality to endure no interference in normal maintenance and to be used sustainably;
- The maintenance and support services used enable Rijkswaterstaat to use the CT sensors in a sustainable and efficient manner for the intended duration;
- The reports enable Rijkswaterstaat to effectively control the technical and administrative quality and contract execution.

2 Technical project definition

2.1 General description of sensor application within the Dutch National Water Monitoring Network (LMW)

For implementation of its tasks, Rijkswaterstaat (RWS) requires information about the condition of the remit that it manages. This includes information on water quality and water quantity, such as water level data, wave data, data about water temperature and salinity. RWS uses this information for implementation of the primary processes water management and maritime traffic management. The Rijkswaterstaat Centrale Informatievoorziening [Central Information Services] (RWS - CIV) provides this information. Part of this information is obtained by RWS itself at 350 measuring stations at fixed measuring sites in the Dutch National Water Measuring Network (LMW). The measuring data is sent to a central data collection system where it is subsequently processed and distributed.

Figure 1 - Map with CT measuring points

This call for tenders relates to the collection of data on the salinity of water. RWS uses salinity measurements for operational water management, water reporting, modelling, salinity as a basis for water quality and, in the context of information exchange on aspects in common with Water Boards.

Salinity measurements are obtained by RWS itself at measuring stations at fixed measuring sites in the National Water Monitoring Network (LMW). The salt content or salinity of water is derived from the conductivity and temperature of the water.

Due to the fact that salt water is heavier than fresh water and thus tends to sink to the bottom, it is necessary to measure at different depths at many sites. At those sites, a number of sensors are mounted at different depths in the set-up.

2.1.1 Features of the measuring sites

The measuring sites are situated along the coastal zone, the IJsselmeer as well as along rivers and canals. There are several models of the measurement set-ups. Some distinctive features are listed below.

Accessibility

Most of the sites can only be reached across the water. Examples of these are measurement posts and research pontoons. The others can be reached over land. These are structures along a canal or a jetty, for example.

Power supply

Most of the set-ups are powered by solar panels. These are particularly the set-ups that can only be reached across the water. The other set-ups are connected to the electricity grid.



Figures 2 to 4 - Impressions of set-ups, from left to right, research pontoon, quay set-up and measurement post

Mounting onto a structure

There are several ways in which the sensor is fastened onto the structure. Most of the sensors are wedged into what is known as a block and then submerged on a carriage construction or on cables.

Sensors at other sites are clamped into an immersion tool and, attached to a cable, submerged in a tube to the desired depth.


Figures 5 to 7 - Impression of fastening methods, from left to right, a block, immersion tool and tube for submerging

2.1.2 Indicative quantities

There are 56 sites where measuring is currently undertaken. Measurements are usually taken at several depths, making a total of 108 sensors currently being in operation. This does not include future expansion and stocks of spares. The tables below show a few indicative quantities broken down by distinguishing feature of a site.

Accessibility

By ship	34
Over land	22

Power supply

Mains voltage	34
Solar panels	22

Set-up type

Measuring post	23
Buoy/research pontoon	8
Quay set-up/construction	25

Number of depths where measured

1 depth	16
2 depths	31
3 depths	10

Mounting method of sensor

Mounted in block	76
Mounted in immersion tool	32

Tables with indicative numbers per distinguishing feature of a site

2.1.3 Maintenance procedure

The management and maintenance of measurement set-ups and sensors is done by contractors. These contractors carry out both civil engineering maintenance as well as primary maintenance on sensors. Primary maintenance is understood to include activities carried out at measuring sites, such as regular cleaning of sensors, inspection measurements and repairing defects. For other maintenance and for the calibration of sensors, these are replaced and sent to the sensor supplier for secondary level maintenance.

More information on maintenance is available in section 4.1.1.

The time spans for primary and secondary level maintenance thus largely determine the costs.

2.1.4 Challenges when maintaining sensors

Maintenance at the measuring sites involves relatively high costs. This is due to aspects like accessibility of measuring sites: of the 56 measuring sites, 34 can only be reached by ship. Maintenance at measuring sites is carried out by maintenance personnel, who also maintain various other installations. To reduce the costs of maintenance, we foresee a number of challenges when selecting suitable sensors.

Fouling

Fouling is common in summer. This depends on various conditions such as sunlight, water temperature, salinity, nutrients and the depth of the sensor. This plays a role at many of our measuring sites. Depending on the site, these are barnacles, algae or seaweed. Non-organic materials such as sludge could also be deposited on sensors.

If this causes the sensor's measurements to deviate, maintenance is required. The required term of primary maintenance at sites that contain intensive fouling could reach once every two weeks with the current sensor.

Figure 8 – Indication of intensive fouling within two weeks (for sensor cleaning)

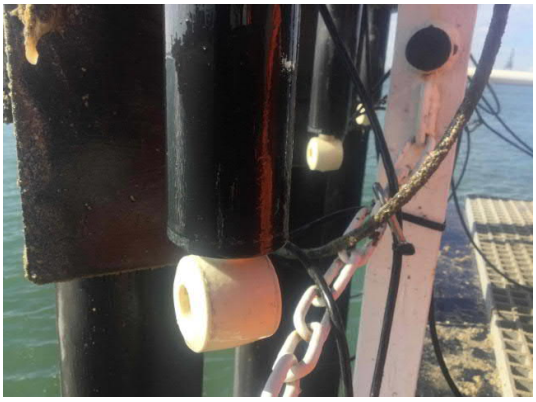


Figure 9 – Sensor after cleaning

Sensor drift

The required measurement uncertainty is minor at some of the measuring sites. This means that these sites must be visited to be able to monitor the drift with inspection measurements and to switch sensors, if necessary. The combination of specifications for measurement uncertainty and sensor drift therefore have an influence on the maintenance period.

Power capacity

At many sites, the energy supply is generated with solar panels. This means that there is a limited amount of power available for the sensors. Greater power consumption by the sensors could mean that the energy supply must be expanded. This will bring about costs.

Constructive adaptation

On implementation of the sensors, the measurement set-ups must be adapted. Particularly where sensors are placed in tubes, the aim is to prevent the replacement of these tubes as much as possible. The requirements set for dimensions and mounting are based on the costs involved for this.

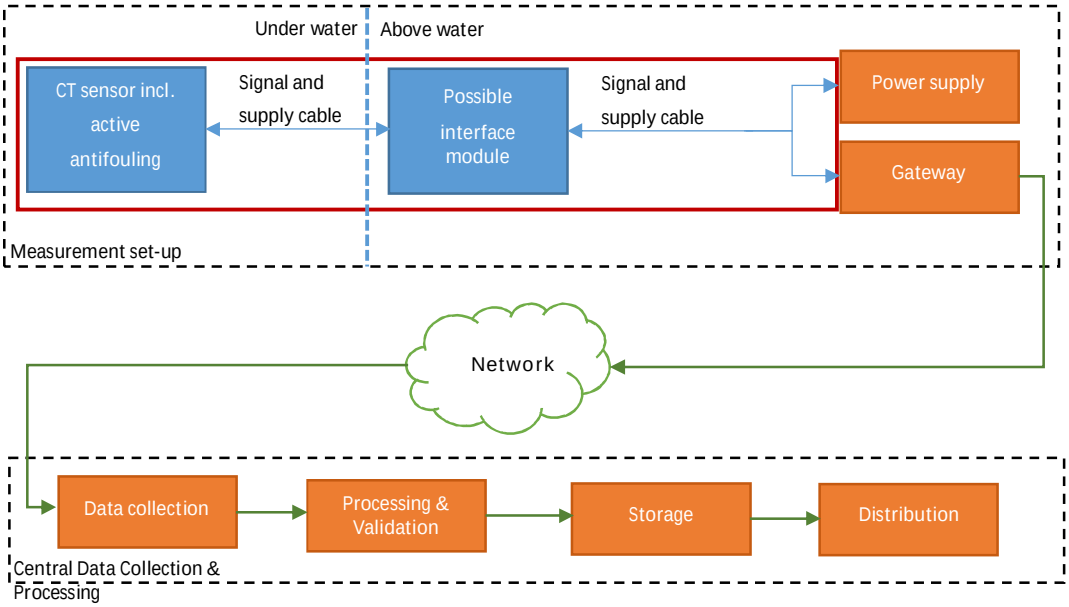
Maintainability and robustness

Implementation of the sensor must be able to withstand environmental conditions and regular cleaning on site. The staff is a generic maintenance crew and works under a variety of weather conditions, which means that no delicate treatment can be expected. This determines the life span of the sensor.

2.2 System boundaries

The requested CT sensors will be used at measurement set-ups and at measuring sites of the National Water Monitoring Network (LMW). These set-ups are located in the canals, rivers, lakes and seas of the Netherlands.

The sensor is part of the chain to eventually be able to make measurements available to the user. The measuring network is built up as much as possible in a modular way, so also for other sensors (e.g. for water levels) arranged with the same generic building blocks (such as a gateway). The illustration below schematically shows both the measurement set-up and the Central Data Collection. The sections outlined in red fall within the scope of this Tender.



Within scope of this call for tenders:

- Sensor for measuring conductivity and temperature. This sensor is equipped with the active antifouling system.
- An interface module between the sensor and the Gateway, if required.
- All the cables needed to transmit signals to the Gateway and taking care of the power supply to the sensor and peripherals.

This scope and any interfaces with the system's common boundaries, have been further elaborated in the technical requirements in the following chapters.

Beyond the scope of this call for tenders:

- Power supply for the sensor and any peripherals.
- Gateway for accessing the measurement data from one or more sensors at the measuring site, to the Central Data Collection.

2.3 Functional description of the system

The requested CT sensors must be suitable for use at measurement set-ups and at measuring sites of the Dutch National Water Monitoring Network, as stated in section 2.1.1. These set-ups are located in the canals, rivers, lakes and seas of the Netherlands. The sensors are located and operate continuously under water at a depth of up to 50 metres.

The measured conductivity and temperature are communicated online to the Gateway. From there, it is transmitted via a fixed or radio link to the Central Data Collection system.

Fouling is common in summer. This may cause the sensor reading to vary, which will require the sensor to be cleaned. To cut back on the frequency of primary maintenance, the sensor must be equipped with an active antifouling system. By opting for active antifouling, we are seeking to create maintenance-free periods of a couple of months (depending on conditions and sites). Within this period, the sensor must continue to operate within specifications.

This functional description has been further elaborated in the technical requirements in the following chapters.

2.4 Requested system size and scope of supply of tendered contract

The Tenderer is requested to offer up to two (2) types of CT sensors. Offering 2 types is only permitted to comply with the uncertainty requirement in combination with the measuring range. The other requirements must be fulfilled in the same way by both types.

The CT sensor - as offered - consists of everything necessary for an operational and manageable operation as described in the requirements. In addition, the system includes at least the following items:

- A sensor for measuring the conductivity and temperature and including an active antifouling solution that works directly on the sensor;
- An interface module, if necessary;

The cables are excluded from the system price (these must be listed separately on the Price List).

The contract for the systems to be delivered, consists of:

- An initial supply of about 200 systems in the first three (3) years. In addition to the 108 sensors in operation, there must be an initial quantity of about 50 sensors in the spares pool, in stock at the management & maintenance contractor and in transit in the maintenance process. Account is also kept of a possible additional need relating to future growth in the measurement programme by about 50 additional sensors. The initial supply will be called in partial deliveries.
- During the term of the Agreement, supplies will be called for replacement of defective devices.

3 Explanatory note to the technical requirements

3.1 Technical requirements

The technical requirements in Chapter 5 are structured according to their functions, aspects and where they commonly interface. In the enumeration of requirements an 'F' denotes 'Functional Requirement'; an 'A' the 'Aspect Requirement' and 'R' for Interfaces. This also distinguishes from the service requirements that follow in the next chapter (these have a 'D' prefix which denotes Service).

Functions
These requirements describe the functions that the system provides. Requirements arising from the functions are functional requirements.

Aspects
Aspect requirements relate to matters which do not in themselves fulfil a function, but which are a condition of functioning. The table below summarizes the aspects applicable to this Agreement.

Interfaces
By placing the project in its environment and describing the interfaces with its environment, deployability is guaranteed. These include interface requirements for the constructive and electrical engineering interfaces and data exchange.

functions	F1	Determine conductivity and temperature	Enables the measuring of conductivity and temperature of surface water.
functions	F1.1	Determine conductivity	Enables the measuring of conductivity of surface water.
functions	F1.2	Determine temperature	Enables the measuring of temperature of surface water.
functions	F2	Measurement data output	Enables output of the measurements to a connected system.
functions	F2.1	Conductivity data output	Enables output of conductivity measurements to a connected system.
functions	F2.2	Temperature data output	Enables output of temperature measurements to a connected system.
functions	F3	Facilitate use	Enables the user to perform actions with the system in a secure and optimum way.
functions	F3.1	Facilitate operating and status	Enables the user to effectively operate the sensor and enables read-out of data.
functions	F3.2	Configure settings	Enables the user to effectively configure the sensor settings.
aspects	A1	Safety	Safety requirements for both the user and the environment, in the operational phase of supplied components.
aspects	A2	Reliability	Requirements with regard to the reliability of components. Reliability relates to the probability that the required function will be performed under given circumstances during a given time interval.
aspects	A3	Availability	Requirements regarding the availability and useful service life of a component. Availability relates to the probability that the required function can be performed at any given point in time under given circumstances.
aspects	A4	Usability	Requirements relating to usability of components for the user during the operational phase.

aspects	A5	Maintainability	Requirements relating to necessary conservation facilities and the relationship with maintenance. It relates to both on-site user maintenance as well as the service.
aspects	A6	Functioning conditions	Requirements relating to the functioning of components under specific circumstances during the operational phase.
interfaces	R1	Interfaces with adjacent objects	Interfaces are integration links with adjacent systems or objects. The system must comply with the set requirements of these interfaces to perform the functions effectively.
interfaces	R1.1	Fouling in environment	Fouling is common in summer. This depends on various conditions such as sunlight, water temperature, salinity, nutrients and the depth of the sensor. This fouling can affect the sensor's operation
interfaces	R1.2	External power supply	The measurement set-ups of the LMW are equipped with solar panels or mains voltage. The sensors and peripherals are connected to this energy supply.
interfaces	R1.3	Measurement set-up	The LMW measurement set-ups contain various sensors to provide information relating to water quantity and water quality. The sensors are mounted on or to the set-ups. The data transmission equipment is also fixed onto these set-ups.
interfaces	R1.4	Gateway	The Gateway is the interface between the sensors at the measuring site and the Central Data Collection. The sensors are connected to the Gateway. From the Gateway, the output signals from the sensors go through a network connection to the Central Data Collection system.

3.2 Applicability of the set requirements

The requirements specify the minimum quality that the systems must meet. The most important aspect in compliance with the Tender is that each individual requirement must be met. The layout in functions, aspects and interfaces is a supporting structure for readability.

All requirements must be met at the same time, unless the requirement is otherwise specified. For example: the measurement uncertainty in one requirement applies to the entire measuring range in the other requirement, at the requested data collection frequency, etc.

3.3 Conductivity definition

Where the text refers to conductivity, the following definition is used: conductivity is an attribute of a substance to conduct electrical current at the prevailing temperature. The value of electrical conductivity of a substance is expressed in siemens per metre (S/m). This conductivity value is not related to a specific temperature.

4 Explanatory note to service requirements

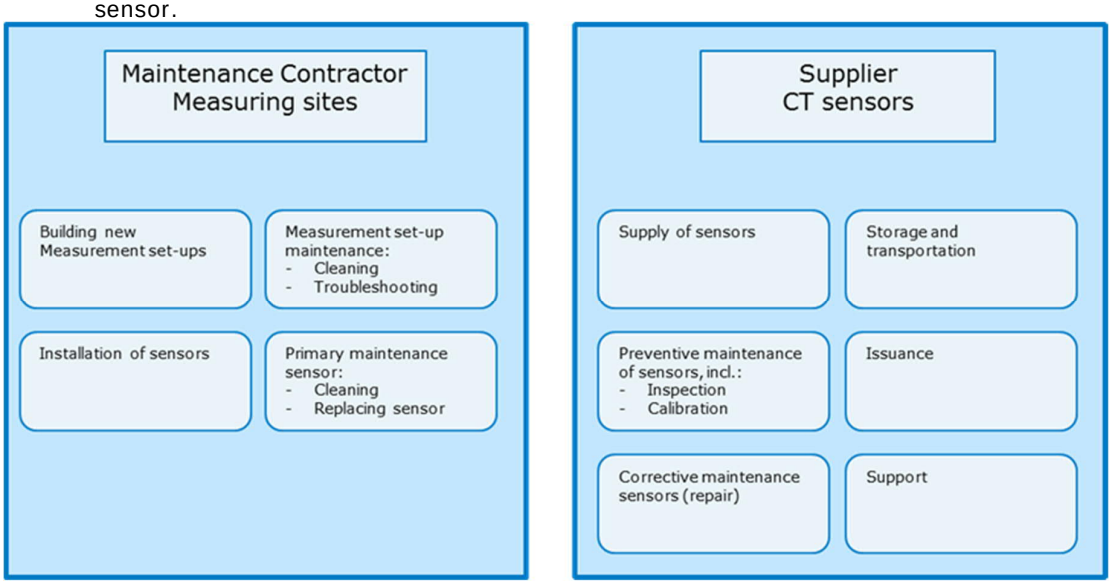
4.1 Description of the services requested

4.1.1 Division of roles for maintenance

To understand the context of the service, firstly maintenance is explained. When operating the measurement set-ups, a distinction is made in two types of maintenance. Not all maintenance forms part of the scope of the envisaged contract.

- Management and maintenance Contractor of measuring sites:
  The management and maintenance of all the measurement set-ups on site is vested in the maintenance contractors already contracted; this includes civil engineering maintenance and the 'primary level sensor maintenance'. This primary sensor maintenance consists of all actions required at the measuring site: installation, regular cleaning, inspection measurements and troubleshooting. For other maintenance of the sensors, the sensors will be taken to shore. For this purpose, a replacement is first installed (the Contractor uses its own small floor stock for this). Maintenance crews at the measuring sites always have sensors at hand which are ready for use.

- Supplier of CT sensors:
  Secondary level maintenance is part of the envisaged contract. This includes preventive maintenance: the thorough regular maintenance 'in the workshop', inspection and calibration. If necessary, corrective maintenance also occurs: this concerns repair of the sensor.



4.1.2 Division of roles in sensor inventory management

The measuring sites are permanently equipped with sensors. For preventive maintenance or defects, these are readily exchanged with another device that works, so that measuring always continues at the measuring site. After the maintenance, the sensors are returned to the spares stock (and are therefore not bound to specific measuring sites). A spares stock is used for this purpose, whereas a small supply is held in stock with the management and maintenance contractor (to achieve quick recovery time) and the remaining bulk is kept in storage by the Contractor subject to this intended contract.

The administrative management of ownership of sensors is called 'sensor management' and is done by RWS. Sensor management keeps track of every sensor, where it is located (measuring site, in maintenance or in stock) and here the technical history is retained. Sensor management also maintains contact with the management and maintenance Contractors of measuring sites regarding requests for intakes and issuances. Requests for physical intakes and issuances to the Contractor of the intended contract will therefore be batched and taken care of by the same contacts. For the actual transportation, the Contractor has direct contact with the senders/recipients. In brief, this means that the Contractor stays in touch with the following parties:

Contract Supervisor at RWS	Called for supplies, called for maintenance, receipt of documents
Sensor Administrator at RWS	Requests for issuances and intakes
Management and maintenance Contractor staff	Senders/recipients for transportations

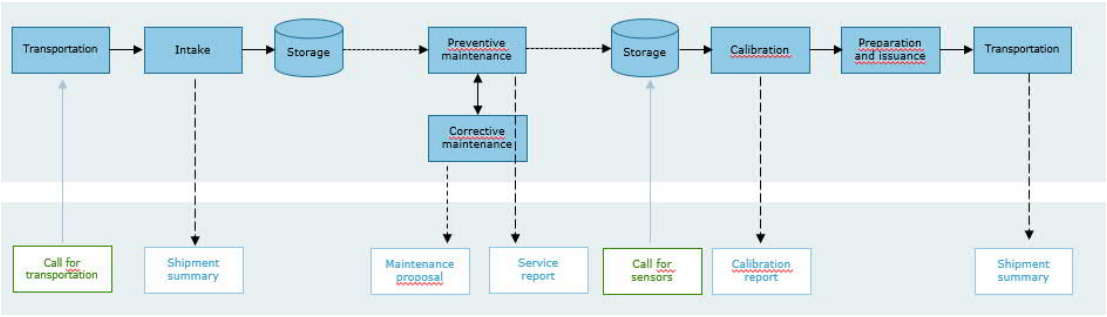
4.1.3 Scope of the services

Services relate to the systems delivered. All services must be able to be provided for the duration of the Agreement. The following service chart summarizes the coherence of services. Chapter 5 describes the services themselves in the relevant requirements, these requirements follow the order in the service chart.

Service group	Description	Service
Supply	This service group consists of: initial supply, additional supplies (increase in number of stations), replacements (defects), components, technical continuity.	Supply of systems
		Supply of components
		Technical continuity
Maintenance	This relates to services intended to restore the used devices to a good condition for a new period of use. For this purpose, the sensors are returned. These are not services at the measuring site.	Calibration
		Preventive maintenance
		Corrective maintenance
Support during use	The user can get immediate support during usage. The support relates to queries when using the sensors or when troubleshooting.	Remote support
		Giving advice and training
Logistics	Logistics services are intended to manage the RWS sensors and make them available to users.	Intake
		Preparation and issuance
		Storage
		Transportation
		Due care

4.1.4 General services process

Coherence between the services is shown in the chart below. A larger version is shown in Annex 1. The chart below shows an overview of moments of sensor exchange and of general communication. These are reflected in the set requirements.



Generally, this amounts to two 'sensor streams': the intake and the issuance. These two streams start up with an initiative by Rijkswaterstaat (in green), to which the Contractor responds within an agreed period. The response consists of an actual activity (transportation, handling of the sensor) and a document transfer (in blue). The Contractor is free to optimize setting up the internal processes and the moments of service (such as preventive maintenance and calibration), albeit within the set requirements.

4.1.5 Indicators for the service

In support of perceiving the scope of the requested service, a number of indicators are provided below. The indicators can be used when estimating the volumes of transportations, storage space and requests for support.

No rights may be derived from these indicators. These serve to give an impression of the magnitude of the various services. The actual scope of the service depends on the distinct features of the solution offered in practice, developments in the number of measuring sites, and organisation of the Contractor's processes.

Description	Number	Comment
Number of sensors owned by RWS	180-220	This relates to the actual operational systems. In other words, the number of systems procured minus the number of systems discarded. This number will accumulate in the initial years of the contract.
Number of sensors in use at measuring sites	120-150	This is the number of sensors that are operationally deployed for measurements.
Average number of sensors not issued (in stock and in the maintenance process)	average of 35 with temporary peaks	This relates to owned systems minus the loaned-out systems. The systems not loaned out are either in the maintenance process or are in the Contractor's stock.
RWS floor stock at management and maintenance Contractors	20	This relates to the combined number of sensors that the two Contractors themselves have in stock to keep recovery times short at measuring sites.
Batch size of transportations	≥5	This relates to the batched transportations of sensors (both intake and issuance).
Number of delivery locations	≤5	This relates to RWS sites or locations of the management and maintenance contractor for transportation on intake or issuance.
Number of senders/recipients for transportations	≤5	This is the contact at RWS or management & maintenance Contractors at the locations for transportation. Intake and issuance notifications/requests are batched by an RWS contact.
Number of remote support requests per year	≤5	This relates to the number of telephone/email support requests after the implementation phase.

5 Requirements tables

5.1 Technical requirements

No.	Type	F A R	Function	Requirement title	Requirement
F01	Function	F1	Determine conductivity and temperature	Purpose of sensor	The CT sensor enables the user to efficiently collect information on the conductivity and temperature of surface water that meets the user's needs. The offered CT sensor is used for continuous online measuring on all current measuring systems of the National Water Monitoring Network of Rijkswaterstaat. These set-ups are situated along the coastal zone, the IJsselmeer as well as along rivers and canals.
F02	Function	F1	Determine conductivity and temperature	Scope of system	The CT sensor - as offered - consists of everything necessary for an operational and manageable operation as described in the requirements. In addition, the system includes at least the following items: - Sensor for measuring the conductivity and temperature and including an active antifouling solution that works directly on the sensor; - An interface module, if necessary to meet all requirements. The cables are excluded from the system price (these must be listed separately on the Price List).
F03	Function	F1	Determine conductivity and temperature	Up to 2 types of sensors	To comply with the requirement uncertainty on the required range, it is permitted to offer up to 2 types. The ranges stated in requirement F07 must be taken into consideration. The 2 types must have the same price and scope of supply. The other requirements, with the exception of requirement F07, must be fulfilled in the same way for the 2 types, so that both types are interchangeable.
F04	Function	F1	Determine conductivity and temperature	Distinguish various types	If 2 types are offered, both types must be distinguished by a unique attribute.
F05	Function	F1	Determine conductivity and temperature	Data Collection Frequency	Continuous sampling frequency is at least 1 Hz.
F06	Function	F1.1	Determine conductivity	Uncertainty	For conductivity measurement, there is an uncertainty of ± 0.03 mS/cm or ±2% of the measured value (whichever is greater). The uncertainty is based on once the standard deviation.
F07	Function	F1.1	Determine conductivity	Range	The measuring range is 0.2 to 50 mS/cm. In order to meet the required uncertainty, it is permitted to offer two types of sensors, each of which has a range of 0.2-28 mS/cm or a range of 2-50 mS/cm.
F08	Function	F1.1	Determine conductivity	Drift	The maximum sensor drift is 0.005 mS/cm per month.

F09	Function	F1.2	Determine temperature	Uncertainty	For temperature measurement, an uncertainty of ± 0.1 °C over the whole measuring range applies. The uncertainty is based on once the standard deviation.
F10	Function	F1.2	Determine temperature	Range	The measuring range is -2 to +35 °C.
F11	Function	F2	Measurement data output	Output message available real time	It must be possible to make output messages available for the Gateway in real time and online.
F12	Function	F2	Measurement data output	One message	Both the measured conductivity value and the measured temperature value must be outputted simultaneously in a single message.
F13	Function	F2	Measurement data output	Output frequency	The output frequency of the output message is equal to the data collection frequency.
F14	Function	F2	Measurement data output	Requesting the output message	If the sensor does not generate an output message automatically at start-up, it should be possible to: - at least call for this output message via a command so often that the output frequency in requirement F13 is met. - the sensor can be configured once to meet the output frequency in requirement F13.
F15	Function	F2.1	Conductivity data output	Conductivity resolution	Resolution of the output message is ≤ 0.001 mS/cm.
F16	Function	F2.2	Temperature data output	Temperature resolution	Resolution of the output message is ≤ 0.01 °C.
F17	Function	F3	Facilitate use	Lockable connectors	All connectors must be lockable.
F18	Function	F3	Facilitate use	Connect connectors	All connectors must be installed as such that they can be connected or disconnected without any tools.
F19	Function	F3.2	Configure settings	Configure sensor	There is a single connection to the sensor for collecting data and for configuring the sensor and active antifouling. It must be possible to configure the sensor by means of a terminal program or web browser on a PC or laptop.
F20	Function	F3.2	Configure settings	Setting active antifouling	It must be possible to configure the active antifouling by means of a terminal program or web browser on a PC or laptop. In any case, configuring refers to setting a time interval and switching the active antifouling on and off.
A01	Aspect	A1	Safety	Sharp edges, electricity, liquids	The assembly must be safe to use, minimising the risk of injury.
A02	Aspect	A2	Reliability	Proven system	The measurement technique, i.e. the method for measuring conductivity and temperature, is a technique that is commonly used.
A03	Aspect	A3	Availability	COTS components	The sensor and the cables and peripherals used must be based on products or components that are or will be commercial off-the-shelf (COTS).
A04	Aspect	A3	Availability	Technical service life	The sensor and accessories have an average technical service life of five (5) years (excluding wear and tear and consumable parts).

A05	Aspect	A4	Usability	Minimum term of use	Under normal operating conditions, the sensor must function within the specifications for a minimum of six (6) months on the LMW's measurement set-ups. Within this term of use, components may need to be replaced on site, but not more often than every two (2) months. The terms of use are calculated from time of issuance for use (and assuming immediate deployment in the water). The term applies until the sensor needs to be dismantled and is returned for preventive maintenance. Normal circumstances are understood to mean for permanent use under water, at a depth of up to 50 metres, in the canals, rivers, lakes and seas in the Netherlands. This is subject to the condition that regular maintenance and use is carried out in accordance with instructions from the Contractor.
A06	Aspect	A4	Usability	Cables and connectors	Cables and connectors must be installed as such that they can function under water for a long time under normal operational conditions at the measuring sites of the LMW.
A07	Aspect	A4	Usability	Cables in just one piece	The individual cables must be supplied in just one piece.
A08	Aspect	A4	Usability	Sensor weight	The sensor, as used, has a maximum weight of 5 kg above the water.
A09	Aspect	A5	Maintainability	Replace components	Components to be replaced within the minimum term of use, as stated in requirement A05, must be able to be replaced by one person within 15 minutes at the measuring site.
A10	Aspect	A5	Maintainability	Sensor cleaning	The sensor must be suitable for being cleaned regularly at the measuring site within a maximum time span of fifteen (15) minutes and using only hand tools. The sensor must be a sufficiently robust model to withstand this. This is subject to the condition that regular maintenance and use is carried out in accordance with instructions from the Contractor.
A11	Aspect	A5	Maintainability	Replace sensor	The sensor must be suitable for replacement, carried out by one person within fifteen (15) minutes, without the use of tools.
A12	Aspect	A6	Functioning conditions	Robust design	The sensor, cables and connectors must be sufficiently robust to be able to function long-term and trouble-free on measurement set-ups and at measuring sites of the LMW, under normal operational conditions. Normal circumstances are understood to mean for permanent use under water, at a depth of up to 50 metres, in the canals, rivers, lakes and seas in the Netherlands. This is subject to the condition that regular maintenance and use is carried out in accordance with instructions from the Contractor.
A13	Aspect	A6	Functioning conditions	Operating temperature	In the water, the sensor must function at an ambient temperature of -2 to +35 degrees Celsius.
A14	Aspect	A6	Functioning conditions	Temperature for transportation and storage	For storage and transportation, the sensor as well as the peripherals and accessories, must withstand ambient temperatures of -20 to +50 degrees Celsius

R01	Interface	R1	Interfaces with adjacent objects	Cable length of sensor to interface module	Interconnecting cables between the sensor and interface module must be suitable for transmitting voltage and data according to the communications protocol offered, over a distance of up to 60 metres. The attributes of the system itself must also be suitable to allow this distance and to enable the required rate for the required output frequency (such as baud rates and transfer protocols). The cable lengths must be available in customized lengths or in options of four (4) fixed lengths.
R02	Interface	R1	Interfaces with adjacent objects	Cable length from sensor or interface module to gateway	Interconnecting cables between the sensor or interface module and the gateway must be suitable for transmitting voltage and data according to the communications protocol offered, over a distance of up to 60 metres. The attributes of the system itself must also be suitable to allow this distance and to enable the required rate for the required output frequency (such as baud rates and transfer protocols). The cable lengths must be available in customized lengths or in options of four (4) fixed lengths.
R03	Interface	R1.1	Fouling in environment	Active antifouling	The sensor must be equipped with active antifouling. Active antifouling is understood to mean antifouling by means of a UV lamp or a wiper/scraper. The antifouling works directly on the sensor. This antifouling is aimed to achieve a maintenance-free period of more than six (6) weeks at sites with intensive fouling conditions. Within this period, the sensor must continue to operate within specifications. Intensive fouling conditions is understood to mean the conditions that can occur at, for example, the LMW site Hoek van Holland. These are described in section 2.1.4 of the Tender Specification Requirements.
R04	Interface	R1.1	Fouling in environment	Effect of antifouling on measurement	If antifouling interferes with the measurement, this measurement must not be used in the output message. Over a period of 10 minutes, up to 10% of the measurements may fail as a result of the antifouling method.
R05	Interface	R1.2	External power supply	Supply voltage	The supply voltage with which the sensor and active antifouling function, is between 9 and 24 volts.
R06	Interface	R1.2	External power supply	Power capacity	The average power consumption of the sensor is up to 2.0 Watt. This power includes the active antifouling as described in requirement R03 and includes any peripherals and the data collection frequency as stated in requirement F05. The setting of the antifouling method in this requirement is the setting recommended by the supplier for compliance with requirement R03 under the stated intensive fouling conditions.
R07	Interface	R1.2	External power supply	Restart sensor	In the event of a power supply disruption, after voltage recovery, the sensor must automatically start up with the correct settings.
R08	Interface	R1.3	Measurement set-up	Sensor diameter	The sensor with a connected cable is able to pass through a circle with a diameter of 97 mm.
R09	Interface	R1.3	Measurement set-up	Sensor length	The sensor can be up to 750 mm in length.

R10	Interface	R1.3	Measurement set-up	Model of interface module	When using a two-part solution (sensors and separate interface module), the second part is suitable for placement in a climate-proof cabinet that provides a protection level with an IP43 rating. The following conditions apply: - mounting on DIN rail - maximum width of 200 mm - maximum height of 200 mm - maximum depth of 150 mm
R11	Interface	R1.4	Gateway	Physical datacom layer	The sensor must have a digital serial output according to at least one of the following standards: RS232, RS422, RS485 or SDI-12.
R12	Interface	R1.4	Gateway	Syntax message	The output message format follows at least one common protocol (such as ASCII, EBCDIC, MODBUS).

[end of technical requirements, requirements for services follow on next page]

5.2 Requirements for Services

No.	Type	D	Function	Requirement title	Requirement
D01	Service	D0	Services in general	Cost-effective services	The Contractor must plan and implement the individual services effectively so that the costs and the period of non-availability of the sensors are minimised for the Client.
D02	Service	D0	Services in general	Reports	All reports are delivered digitally to the Client, and are drawn up in Dutch. Attachments may be in English.
D03	Service	D1	Supply	Service in supplying systems and components	The supply of systems is a service in which, aside from delivering the product, includes a number of agreed services. Supplies are called over the entire duration: they include an initial supply of a number of systems, additional supplies for an increased number of sites and replacement of defective systems, sensors and components.
D04	Service	D1.1	Supply of systems	Supply includes the complete solution	The supply of a system must include the complete solution offered to meet the requirements and added value of best quality-cost ratio offered. The system can therefore include a sensor type, any additional interface modules and additional materials. The cables are excluded from this, but they must be stated on the Price List. Where a type or system type is stated in these requirements, the same applies to sensor type.
D05	Service	D1.1	Supply of systems	Delivery time	The Contractor delivers the ordered systems within a maximum delivery time of three (3) months after being called. This applies when ordering up to thirty (30) systems simultaneously over a period of three (3) months. If more than thirty (30) systems are called, an additional delivery time of three (3) months applies for every thirty (30) devices. As an exception to this, no deliveries are required for the first six (6) months after signing the Agreement.
D06	Service	D1.3	Technical continuity	Technical continuity of service	During the term of the Agreement, the Contractor is responsible for the continuity of the offered system. This relates to ensuring deliverability and supportability of the sensors, modules and components offered by Contractor. When a structural shortcoming in the technical performance or a deviation from the specifications has been identified, it is the responsibility of the Contractor to resolve this for his own account.
D07	Service	D1.3	Technical continuity	Deliverability	The type of system offered must be deliverable for at least five (5) years after Tender application. In the event that the offered type is no longer deliverable or supported within this requirement, to secure continuity, it is permitted to offer a readily exchangeable type: a type with equal specifications, of an equal or up to an equal price and which can be exchanged at the measurement sites without any adaptations by RWS. During the term of the Agreement, the Contractor must always be able to deliver the same or an equivalent type. If the type offered initially is no longer deliverable or supported, an equivalent type may be offered after the initial term of five (5) years. An equivalent type does not need to be readily exchangeable. An equivalent type must meet the set requirements and initially offered specifications. Subsequent types must be deliverable at least five (5) years after the first time offering.
D08	Service	D1.3	Technical continuity	Compatibility of equivalent part of sensor type	If the Contractor offers an equivalent alternative to an individual component of the system's sensor type (such as a detachable sensor, interface module or antifouling facility), this should be as such that it can be readily connected and functional on the existing sensors and interfaces of Rijkswaterstaat.

D09	Service	D1.3	Technical continuity	Supportability after phased out deliverability	After phase-out of the sensor type, this must still be supported by the manufacturer for at least five (5) years. Spare parts must be deliverable in that period and repairs must be able to be carried out.
D10	Service	D1.3	Technical continuity	Quotation for derivative types	When called for by the Client, the Contractor will provide a quotation for follow-up or derivative system types, insofar as these are deliverable in the set of required products. For example, a different model of the sensor offered for deviating applications.
D11	Service	D1.3	Technical continuity	Long-term technical continuity	During the stated deliverability term, the Contractor guarantees the technical continuity of the offered system for its own account. If problems should arise in continuity during usage (e.g. teething trouble and bugs) or if continuity of the supply creates difficulties (e.g. components are no longer available, necessary updates), the Contractor must provide a solution independently and in good time. This means that the Contractor provides bug fixes, keeps the systems current with updates, and provides replacement solutions for End-of-Life parts. If, at any time, the systems supplied by the Contractor do not comply with the specifications as initially offered by the Contractor due to recurrent structural problems, without there being an individual defect and, insofar as the cause is not due to improper use by users, then the Contractor must resolve this for its own account.
D12	Service	D1.3	Technical continuity	Active attitude and action	The Contractor must be vigilant in noticing recurrent complaints and deviations to his own specifications, identifying recurrent issues, analysing the causes and making proposals for solutions and improvements. This includes making improvements or giving advice on use by Rijkswaterstaat on grounds of recurrent complaints or issues.
D13	Service	D1.3	Technical continuity	Firmware/software updates	When installing firmware or software updates, the Contractor must ask the Client for one-off permission for each version. Updates will only be implemented on approval by the Client. Changes in the product could have consequences for the data collection process. Rijkswaterstaat therefore wants to be able to implement them in a controlled manner.
D14	Service	D1.3	Technical continuity	User documentation	During the term of the Agreement, the Contractor must make current documentation of the delivered items available. In any event, this documentation covers instructions for installation, operation, maintenance and treatment. This documentation must be available digitally and must be provided by email upon request. Such documentation must be written in Dutch or English.
D15	Service	D1	Supply	Aspects of Supply	Every supply must: - be delivered within the stated delivery time - be tested/checked and provided with proof of proper functioning - be complete including all components for proper application and to comply with the set technical requirements (excluding cables) - be fitted with a robust sticker stating the text 'Owned by Rijkswaterstaat' and the unique CIB number (to be provided by RWS) - have a Delivery document
D16	Service	D1	Supply	Delivery document	For every delivery, the Contractor must provide the Client a digital Delivery document containing at least the following: - Date of delivery - Serial number(s) with corresponding CIB number(s) - Scope of delivery (all parts delivered) - Description of condition (such as firmware versions, models, etc.) - Proof of proper functioning

D17	Service	D1	Supply	Issuance location supply	The Contractor must physically deliver every supply to its own storage facility and include the items in the stock. The Client reserves the right to physically inspect the supply.
D18	Service	D2.1	Calibration	Calibration service	Calibration is a service to ensure that the instruments produce measured values according to specifications (sometimes referred to as validation). Part of this is to make adjustments (sometimes referred to as recalibration). These are not activities at the measuring site. The systems are returned for maintenance.
D19	Service	D2.1	Calibration	Calibration quality	A calibration involves all the necessary activities to determine that the measurements meet the set specifications. A calibration involves at least determining the technical measuring performance in relation to an identifiable reference and ascertaining an assessment of this performance (whether it is sufficient or not). It also includes, if necessary, adjusting the sensor to ensure it complies with the specification. When a sensor is adjusted, the calibration data is determined and documented both before and after the calibration. Transportation to and from Rijkswaterstaat sites and, if necessary, to a sub-supplier must be included in the price. Registration of all results is documented in a Calibration report. This Dutch or English report must contain at least: - CIB numbers and serial numbers - the calibration data and reference data - a clearly identifiable assessment on functioning in relation to specifications
D20	Service	D2.1	Calibration	Calibration timeliness	The Contractor himself ensures that calibrations of the system and its individual components are performed in a timely manner so that the Issuance time (see the Preparation and issuance service of systems) is achieved and availability of the systems is guaranteed for the user. In doing so, the moment and lead time of calibrations must be consistent with effectively managing and achieving the Issuance time. If the moment of calibration does not coincide with the issuance (but is carried out earlier), then the Contractor must, in any case, ensure that the sensor can be used during the term of use.
D21	Service	D2.2	Preventive maintenance	Preventive maintenance services	Preventive maintenance consists of recurrent and predictable activities to restore or maintain the instrument in a good condition for user issuance, so that it complies with the required accuracy, availability and reliability during the term of use. These activities are basically the same every time and include all the predictable matters in normal use (such as ordinary wear and tear or consumption). These are not activities at the measuring site. The systems are returned for maintenance. Transportation to and from Rijkswaterstaat sites and, if necessary, to a sub-supplier must be included in the price. If a fault is detected during preventive maintenance, a corrective maintenance procedure is followed.
D22	Service	D2.2	Preventive maintenance	Quality of preventive maintenance	Preventive maintenance includes at least: - Checks (e.g. physical condition of components) - Cleaning and repairing marks and stickers - Replacement or replenishment of wearing components and consumables (e.g. batteries, washers, membranes) - Final check - Documenting in a Service report

D23	Service	D2.2	Preventive maintenance	Timeliness of preventive maintenance	The Contractor ensures that preventive maintenance of the system and its individual components is performed in a timely manner so that the Issuance time (see the Preparation and issuance service) is achieved and availability of the systems is guaranteed for the user. In doing so, the moment and lead time of preventive maintenance must be consistent with effectively managing and achieving the Issuance time.
D24	Service	D2.3	Corrective maintenance	Corrective maintenance services	Corrective maintenance consists of activities to correct any deviations and defects identified. These are activities of variable sizes that are determined on a case-by-case basis.
D25	Service	D2.3	Corrective maintenance	Quality of corrective maintenance	Corrective maintenance includes all necessary activities to repair reduced functionality as a result of deviating use (e.g. excessive wear and tear, damage, pollution) or defects (e.g. corrosion, leakage, electronic failure). The activities are determined on a case-by-case basis and include: - Repair or replacement of defective parts - Firmware updates - Final check - Documenting in a Service report. The lead time is determined, depending on the extent of the activities, on a case-by-case basis in conjunction with the Client.
D26	Service	D2.3	Corrective maintenance	Threshold amount of scope	The Contractor must determine the scope of the corrective maintenance before maintenance is carried out. If the costs exceed the threshold amount of €1,500 excluding VAT, approval must first be requested from the Client. This coordination is done with a Maintenance proposal, in which at least the estimated components and activities can be identified in the Price List. If an estimated scope is lower than the threshold amount, the maintenance can be carried out immediately (without coordination with the Client).
D27	Service	D2.3	Corrective maintenance	Proper disposal	The Contractor must ensure correct disposal of sensors and components at the end of their service life. In doing so, the Contractor aims for reuse as much as possible, and if reuse is not possible, the Contractor must ensure an environmentally-friendly and responsible disposal. The Contractor must also take into account any prevailing regulations of the manufacturer/supplier that apply in the country of manufacture (dual use goods). Disposal of items with a CIB number must be confirmed with a proof of proper disposal.
D28	Service	D2	Maintenance	Service report	The Contractor must document every preventive and corrective maintenance carried out and their associated activities in a Service report. The Service report contains at least: - CIB numbers and serial numbers - the cause and an analysis of the problem - activities and checks carried out - the calibration data (if this coincides with maintenance) - final condition (e.g. version, settings) - term of use for proper operation until the next maintenance and/or calibration - proof of proper functioning (e.g. final inspection) - if a registered item is disposed of: proof of proper disposal
D29	Service	D3.1	Remote support	Scope of support	The Contractor supports the users by telephone and email during the term of the Agreement. This includes remote technical support in Dutch in respect of operation, installation, settings and troubleshooting. The subject matter in this respect is limited to the scope of the delivered systems. Any queries will initially be harmonised within the maintenance organisation and will only be presented to the Contractor in the second instance (and thus in incidental cases).

D30	Service	D3.1	Remote support	Telephonic accessibility	For telephonic support, users can contact the Contractor directly. Accessibility applies on working days during office hours. The response time to speak to the user on substantive issues is up to four (4) hours from the first telephone call.
D31	Service	D3.1	Remote support	Email accessibility	For support by email, users can contact the Contractor directly. The response time to reply to users on substantive issues is within two (2) working days from the time the request is made by email.
D32	Service	D3.1	Remote support	Last resort for support	For any queries that cannot be answered directly within his own organisation, the Contractor will forward same to the manufacturer or supplier. If the situation so requires, it must be possible to enable direct contact between the Client's specialist and the Contractor's specialists (this may also be in English). Aside from user queries, the Client can also turn to the Contractor with system-specific queries on measuring technology or data processing.
D33	Service	D3.2	Giving advice and training	Giving advice and training services	The Contractor occasionally provides advice to users in Dutch on usage of the delivered systems. This advice may consist of application recommendations, training, or troubleshooting assistance. This could, for example, include situations that are above and beyond the scope of the operator's manual, for incidents and for solving complicated issues. This support may be required at various RWS sites.
D34	Service	D3.2	Giving advice and training	Training	The Contractor must provide user training on demand, which aims to familiarise users on a senior secondary vocational education level (Dutch MBO) with installation, maintenance, operational control and primary troubleshooting. The group size per training is up to 10 people. The Contractor will provide all the necessary materials. In consultation with the Contractor, the Client will make a suitable training room available.
D35	Service	D3	Operating support	Quality of support	All the support mentioned is done in Dutch by the Contractor's employee, who has sufficient knowledge of the functioning and application of the sensor within Rijkswaterstaat, to effectively resolve queries. For specific knowledge and subjects, support in English is permitted.
D36	Service	D4.1	Intake of sensors	Intake services	Intake relates to the return and inspection of sensors after use. The purpose of the intake is to complete the term of use in a controlled manner for the user.
D37	Service	D4.1	Intake of sensors	Scope of intake	The intake process starts with the notification of a shipment by Rijkswaterstaat. The Contractor coordinates the shipment with the user and takes care of transportation. On arrival, the Contractor at least carries out a visual inspection. A shipment summary is drawn up and sent to Rijkswaterstaat.
D38	Service	D4.1	Intake of sensors	Inspection	On intake, the Contractor must carry out a visual inspection. The most important purpose is to identify damages, incomplete returns and incorrect usage or method of handling. Hence, the Contractor must be vigilant for recurrent defects or complaints or incorrect usage and actively report this back to Rijkswaterstaat.
D39	Service	D4.1	Intake of sensors	Timeliness of intake feedback	The shipment summary must be sent to Rijkswaterstaat within five (5) working days after transportation.
D40	Service	D4.1	Intake of sensors	Shipment summary of intake	On intake, the shipment summary includes at least the following items: - CIB numbers and associated serial numbers - sender (person and transportation location) - findings of visual inspection - any user-provided comments on the sensor
D41	Service	D4.2	Preparation and issuance of sensors	Preparation and issuance services	Preparation and issuance means the sensor is taken from the stock and is suitably prepared and completed for delivery and use. This includes assembly, configuration and final inspection and taking care of documenting and delivery.

D42	Service	D4.2	Preparation and issuance of sensors	Scope of preparation and issuance	The preparation and issuance process starts with the notification of a request by Rijkswaterstaat. The Contractor takes care of the preparation and issuance, and coordinates shipment with the user and takes care of transportation. A shipment summary is drawn up and sent to Rijkswaterstaat.
D43	Service	D4.2	Preparation and issuance of sensors	Quality of preparation and issuance	The Contractor must ensure that every issuance is complete, consists of properly operating components, is ready for use and has been provided with a document which proves its proper functioning and which states the term for use until the next maintenance or calibration. This can be combined with a service report or calibration report. On issuance, the spare stock is used on a first-in-first-out basis as much as possible, except for newly supplied systems that are always issued first.
D44	Service	D4.2	Preparation and issuance of sensors	Time of issuance	The Contractor must have delivered a sensor or parts thereof to the designated site within five (5) working days of the request. This applies for up to ten (10) systems that are requested within a period of five (5) working days. If more systems are requested, then an additional five (5) working days will apply for every additional ten (10) systems. Calibration must be carried out at a time which is just before the time of issuance, to allow the sensor to be usable for the entire term of use after issuance.
D45	Service	D4.2	Preparation and issuance of sensors	Shipment summary on issuance	On issuance, the shipment summary includes at least the following items: - CIB numbers and associated serial numbers - recipient (person and transportation location) - proof of proper functioning (e.g. final checks, service reports or calibration reports)
D46	Service	D4.3	Storage of sensors	Storage services	Storage relates to holding the physical stock of Rijkswaterstaat sensors and components when they are not in use (the spare stock). This service is included so that the Contractor himself can fulfil the process effectively.
D47	Service	D4.3	Storage of sensors	Storage quality	The Contractor manifests due care for the property of Rijkswaterstaat, which the Contractor holds on behalf of the Client and ensures that the systems remain available to the Client. This means, among other things, that the items are kept under proper conditions and that the Contractor has at least taken measures to prevent damages (as a result of temperature, moisture, fire), theft, issuance for purposes other than for the Client and loss.
D48	Service	D4.3	Storage of sensors	List of stock	The Contractor must supply a list of stock on demand within ten (10) working days. This list provides an insight into the stock supplies of systems that the Contractor is holding at that time. This relates to stock at own sites and stock that is held temporarily by subcontractors or suppliers or is in transit. The list of stock itemizes the systems with serial numbers and CIB numbers and only the quantities of accessories such as cables, etc.
D49	Service	D4.3	Storage of sensors	Stocktake	On demand, the Contractor carries out a stocktake of the sensors and components in stock. This means checking for presence of the physical stock (list-to-floor and floor-to-list). This also relates to stock that is held temporarily by subcontractors or suppliers or is in transit. This stocktake is carried out annually and occasionally an additional time.
D50	Service	D4.4	Transportation of sensors	Transportation services to Rijkswaterstaat sites	The Contractor takes care of proper transportation of sensors and components to and from the users. This service is included so that the Contractor can fulfil the maintenance procedure effectively. This relates to transportations by the Contractor to and from Rijkswaterstaat sites.
D51	Service	D4.4	Transportation of sensors	Transportation coordination	The Contractor coordinates with the sender or recipient stated in the request on the pick-up or delivery address and time.

D52	Service	D4.4	Transportation of sensors	Quality of transportation	The Contractor manifests due care for the items to be shipped. This means, among other things, that the items must be shipped properly. The items are shipped under proper conditions, appropriate means of transportation are used and measures are taken to prevent loss, theft and damage.
D53	Service	D4.5	Due care	Risk of possession	The moment that he is in possession of a system and/or components owned by Rijkswaterstaat, the Contractor is liable for damages, theft or loss of such property and is responsible for taking appropriate measures. If this occurs, the Contractor will, in any case, indemnify the Client. This applies both during storage, transportation and maintenance activities. This also applies for transportation and handling to and from suppliers.
D54	Service	D4.5	Due care	Supervision of careful handling	The Contractor must take due care of the systems by handling, shipping and storing the systems carefully and under controlled conditions. Moreover, the Contractor must also ensure that adequate measures have been taken in the work processes against damages, theft and loss and when being handled by manufacturers, third parties or shippers.

[end of service requirements]

Annex 1 – General services process