



Royal Netherlands
Meteorological Institute
*Ministry of Infrastructure
and Water Management*

Annex 1B

Verification phase and delivery

Pertaining to : Precipitation gauges and 3rd line maintenance

According to a : Public European Tender Procedure

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Disclaimer

Throughout this document the phrase "Precipitation gauge" is used when describing all the stages involved in the Verification phase. For those Tenderers offering an auxiliary device along with a Precipitation gauge, the phrase "Precipitation gauge" should be understood as "The Solution." In this case, the process outlined below should be applied to "The Solution."

1. Introduction

This document describes the Verification Phase that is part of the Descriptive Document pertaining to 'Precipitation gauges and 3rd line maintenance', reference no. TN 472117 dated 19-06-2024.

As outlined in the Descriptive Document, the Tenderer with the best price/quality ratio while meeting all mandatory requirements will be awarded the Contract (paragraph 3.2 of the Descriptive Document) and enters the Verification Phase. The Verification Phase, as well as the required gauges and maintenance, are detailed in this document. The Verification Phase has a duration of sixty-two (62) weeks, including 52 weeks of parallel testing at selected AWSs (Automatic Weather Stations) so that the Contracting Authority can verify the performance of the Precipitation gauges during all seasons. The acceptance of the offered Precipitation gauges and continuation of the Contract occurs only after a successful completion of the Verification Phase.

Next to the selected Tenderer that will be contracted, a waiting room Agreement with the duration of the Verification phase will be concluded with all other valid Tenderers. The stand-by Tenderer only enters the Verification Phase when the first or earlier winning Tenderer fails the Verification Phase, at any time during the 62 week period.

In addition, this document outlines the delivery details of the gauges and the locations at which the Precipitation gauges will be operated.

By submitting a Tender, the Tenderer fully and unreservedly agrees to the process described in this document.

2. Overview

First ranked party (1st supplier):

The Tenderer of the selected Precipitation gauge shall make nine (9) Precipitation gauges and related products (when applicable: standpoles, mounting tools, calibrators, etc.) available to KNMI. Of the nine (9), three (3) gauges and related parts shall be delivered to KNMI in De Bilt within four (4) weeks after signing the Contract. The other six (6) gauges and related parts shall be delivered to KNMI in De Bilt within nine (9) weeks after signing the Contract. See section 4.6 for further details of the Delivery Schedule.



The FAT and calibration reports shall be provided by the Tenderer together with a full set of documentation at the time of the gauge deliveries.

The Tenderer will provide support, when requested by KNMI, during the entire period of the Verification Phase. Specifically, enquiries shall be answered by the Tenderer within two (2) working days (Monday to Friday from 09:00-17:00).

In the event KNMI has questions about (the performance of) the Precipitation gauge, KNMI will initiate an inquiry. An example of an inquiry can be: clarifying documentation, problem solving, discuss gauge performance, sharing findings to confirm assumptions etc. The contact details of Tenderer's staff required for these inquiries shall be specified beforehand to KNMI by the Tenderer.

KNMI will report any malfunctioning of a selected Precipitation gauge, accompanying part or tool, directly to Tenderer. If the issue cannot be resolved by KNMI with Tenderer's support within one (1) week then a spare or repair shall be provided by Tenderer within two (2) weeks. An analysis detailing the cause of the problem and an incident report shall be provided to KNMI stating the reason for the malfunction and a detailed report on how the malfunction was resolved.

The selected Precipitation gauge will be subjected to laboratory tests before, during and after the parallel test. The parallel test will take place in De Bilt and at five (5) other measurement locations of KNMI throughout the Netherlands and Bonaire (see section 4.6 - Delivery schedule, first and second delivery). However, KNMI reserves the right to perform tests partly or entirely at other locations during the Verification Phase. The performance of the gauge on Bonaire will have no impact on the decision to accept the gauge for the mainland.

The Verification Phase starts four (4) weeks after signing the Contract. The duration of the Verification Phase is sixty-two (62) weeks. All costs of the Verification Phase including the nine (9) precipitation gauges, one set of calibrators and materials and tools for installation and maintenance will be borne by KNMI at the amount quoted in the pricing sheet.

During the Verification Phase information will be shared with the selected Tenderer in order to make sure that the gauges are configured, installed and operating correctly and that the results are interpreted correctly.

The Verification Phase will be used to verify that all mandatory requirements **and offered Desirables** are met and that the offered Precipitation gauge is indeed suitable for the intended use by KNMI. The performance of the Precipitation gauge during the Verification Phase will be analysed and the results will be examined by representatives of several user groups (observers, forecasters, technicians, validation staff, R&D) and stakeholders (weather, climate). The final decision regarding the suitability of the offered Precipitation gauge will be determined by these representatives. Note that when a Precipitation gauge at one (1) or more locations is non-compliant or receives a negative



decision on the suitability, the offered Precipitation gauge is considered non-compliant or unsuitable.

A negative decision on the compliance or suitability of the offered Precipitation gauge can occur at any point during the Verification Phase. If this occurs, the Tenderer is informed immediately. The Tenderer has one (1) week to provide a solution that resolves the problem. Note that only changes to the configuration or installation of the Precipitation gauge are allowed at this stage because we are verifying the offered Solution.

A negative decision on the suitability occurs when, despite the mandatory requirements:

- the availability of measurements from the gauge is substantially less than what is indicated in the requirements: there are 50% or more telegrams missing or are of poor quality (i.e., false positive – precipitation when clear or false negative – no precipitation when raining) compared to what is stated in the requirements (99,98% availability) and/or;
- the offered Precipitation gauge requires substantially more 1st and 2nd line maintenance compared to what the tenderer indicated in the pricing sheet (there are 50% more corrective events compared to what was indicated) and/or;
- the data quality is considered substandard based on, for example:
 1. a panel of sensor experts opinion;
 2. data from the laboratory tests;
 3. data from two collocated offered gauges;
 4. data from other collocated meteorological instruments;
 5. comparison of the daily sums between the offered gauge and the validated climatological data from the collocated AWS precipitation gauge (shall be within -3% and +5%);
- one (1) or more Precipitation gauges fail during the Verification Phase and a solution cannot be provided within one (1) week.

Note: The first bullet is evaluated by comparison to weather conditions reported on the test field in De Bilt since the quality of the measurements depend on the actual conditions occurring during the Verification Phase.

Second or next ranked party (2nd supplier):

The Precipitation gauge of the Tenderer with the second or next highest price/quality ratio will be stand-by during the Verification Phase. Two (2) units of this Precipitation gauge and related products (when applicable: standpoles, mounting tools, calibrators, etc.) shall be made available to KNMI within fourteen (14) weeks after signing the Contract. The costs for the Precipitation gauges and related products will be borne by KNMI at the amount quoted in the pricing sheet. The gauges will be tested in the lab and installed at the test field in De Bilt to facilitate, if needed, an efficient transition to this Precipitation gauge. The precipitation gauge of the second or next ranked Tenderer only enters the Verification Phase when the Precipitation gauge of the first or earlier ranked Tenderer fails the Verification Phase. In that case, the sixty-two (62) weeks Verification Phase with the second or next ranked Tenderer starts anew at week 4 of the schedule



given in section 4.6 to accommodate delivery time for 5 gauges for the parallel test. When the delivery is done the Verification Phase of the second or next ranked Tenderer will resume at week 9 of the schedule given in section 4.6.

3. Verification Phase

The Verification Phase lasts sixty-two (62) weeks and will be executed from approximately week 4 to week 66 after signing the Contract (see section 4.6). The verification will take place at the test field in De Bilt and at five (5) other KNMI locations (see section 4.6 - Delivery Schedule). During the Verification Phase, if the offered Precipitation gauge is demonstrably non-compliant with the Program of Requirements and issues cannot be resolved in time by the Supplier, then KNMI will dissolve the Agreement for this reason and the stand-by Supplier (second or next ranked party) will take the 1st or earlier supplier's place. This process is the same for every subsequent supplier in ranking.

In case of a negative outcome of the Verification Phase, the Agreement is cancelled. The gauges and related materials and tools are returned to the Tenderer and the 50% purchase costs shall be reimbursed (see clause 4.4. - Draft Agreement). Contracting Authority is not obliged to compensate Tenderer in any other way for the consequences (if any) of the termination of the Agreement.

3.1. Stage 1: Laboratory tests and field installation

The selected Precipitation gauge will be inspected upon arrival and specifications will be verified in the laboratory using the calibrators and tools provided by the Tenderer. This process includes phases 1 and 2 of Delivery acceptance (see section 4.2). In the laboratory the gauge will be tested in order to verify that the requirements are met, for example under constant and dynamic flow rates. KNMI will decide whether all or just a subset of the requirements will be verified. All requirements remain obligatory even if not tested directly by KNMI during the Verification Phase. The calibration procedure (provided by Tenderer with the first delivery) must be successfully completed by KNMI before installing the Precipitation gauge at the test field of KNMI in De Bilt. The procedures for 1st and 2nd line maintenance issued by Tenderer that are carried out by KNMI will be evaluated and implemented if necessary

A sensor interface will be developed by KNMI for the selected Precipitation gauge to verify the communication with the gauges and to facilitate implementation of the gauges in the meteorological network of KNMI. The data of the gauge will be polled and archived together with technical status information at a 12 second resolution. Raw data from all gauges will be archived during the verification as well. Next, the selected Precipitation gauge will be installed in a windscreen at the test field of KNMI in De Bilt using the installation materials, mounting tools and documentation provided by the Tenderer and on hand at KNMI. Seven (7) Precipitation gauges will be operated for one week at the test field in De Bilt. If the Precipitation gauge operates correctly for the duration of one



week and has passed all previous tests, the Precipitation gauge has passed the SAT (site acceptance test) and is ready for deployment at other sites. The successful completion of stage 1, during the Verification Phase, leads to acceptance of the gauges and a first instalment 50% of payment of the total purchase price of the nine (9) gauges (the remaining 50% of the total purchase price of the nine (9) gauges will be paid after the Verification Phase if the gauge is accepted).

3.2. Stage 2: parallel test evaluation

During the evaluation the gauges will be inspected and maintained by KNMI on a regular basis. The calibration will also be checked on a regular basis. Two (2) units of the selected Precipitation gauge will be installed at the test field of KNMI in De Bilt. The other five (5) gauges will be installed at other locations, parallel to the currently deployed Precipitation gauge. Note that the two (2) gauges installed at the test field in De Bilt will be used to verify the reproducibility of the Precipitation gauge results. KNMI may also repeat or extend the laboratory tests of stage 1. The remaining two (2) gauges will be used for development and as spare.

The performance, maintainability, and overall quality of the Precipitation gauge will be analysed during the parallel test in accordance with the requirements and Desirables set out in the Program of Requirements (Annex 4). The quality of the Precipitation gauge will be examined statistically for the overall performance and for specific conditions by comparison with data from other appropriate sensors at the location (see page 5 starting at "A negative decision on the suitability"). Also, the Agreement between the results obtained with the two (2) collocated units of the selected Precipitation gauge will be evaluated. The effect of contamination and the suitability of the maintenance interval will also be investigated by maintaining one (1) sensor as good as possible while letting the other deteriorate until the precipitation gauge starts reporting warnings or errors or the results of the Precipitation gauge become obviously affected. Special attention will be given to how the gauge performs when subjected to known environmental errors, such as wind induced undercatch, high intensity precipitation, evaporation and vibrations.

3.3. Stage 3: Evaluation continued and completion

The evaluation of the selected Precipitation gauge of stage 2 is continued.

When certain meteorological conditions have not occurred during the evaluation, KNMI will ask for field test reports that describe the performance of the gauge during these conditions.

At the end of the parallel test, each Precipitation gauge will be inspected and verified in the laboratory using the calibrators and tools provided by the Tenderer.

An overall analysis of the Verification Phase is prepared and examined by KNMI representatives of several user groups (observers, forecasters, technicians, validation staff, R&D) and stakeholders (weather, climate). The result of this examination is the



decision whether the offered precipitation gauge meets all mandatory requirements and offered Desirables and is considered suitable for the intended use by KNMI.

At the end of the Verification Phase and in case of a successful completion of the Verification Phase, all Waiting Room Agreements (Annex 1A) with following Suppliers will officially expire. Upcoming orders will then exclusively be placed with the Winning Tenderer for the duration of the Contract.

4. Delivery of gauges

The offered Precipitation gauge is accepted when the Verification Phase is completed successfully. Thereafter, KNMI/Contracting Authority will order the Precipitation gauge (including manuals) and related products (when applicable: standpoles, mounting tools, calibrators, etc.) in two (2) batches with eight (8) weeks in between, as indicated in section 4.6.

4.1. Delivery location

All the gauges shall be delivered to the KNMI in De Bilt. From there, KNMI will transport and install the gauges at the measurement locations.

Royal Netherlands Meteorological Institute (KNMI)
T.a.v. Kalibratielab (calibration laboratory)
Utrechtseweg 297
3731 GA De Bilt
Netherlands

4.2. Delivery acceptance

Each delivery of gauges will be checked and tested at the calibration laboratory and the test field of KNMI in De Bilt. The acceptance of a delivery is divided into three phases.

Phase 1:

The delivery will be checked at the KNMI for completeness and damage to the gauges, parts or tools.

Each gauge must be delivered with a passed FAT protocol and a calibration certificate.

Phase 2:

The verification and calibration protocols (provided by Supplier with first delivery) will be performed in accordance with the procedures specified by the Supplier.

This process includes checking that the settings and firmware version of the gauges are correct.



Depending on the verification and calibration procedure, the lead time of a gauge in the calibration laboratory will be one (1) day. This procedure involves placing and removing the gauge in the laboratory and performing the verification and calibration protocols.

Once a gauge is approved (considered complete and functioning), a calibration certificate will be created for the gauge, which will be used internally for proof of well-functioning of the gauge.

Phase 3:

With each delivery a selection of the gauges will be placed on the KNMI test field in De Bilt for a short period. For example,

- From the first 2 deliveries consisting of nine gauges, seven will be placed on the testfield;
- From the 3rd & 4th delivery one gauge per delivery will be placed on the testfield.

During this period, the gauge will be checked to ensure they operates correctly. Eventually the gauges will be implemented on the automated weather stations.

In the case of a deviation in any of the above phases mentioned under 4.2, the gauge will be returned with an indication of the corresponding problem. When the delivery has passed all three phases successfully, the gauges are ready for deployment. A certificate of acceptance will be completed and sent to the Tenderer for each shipment. A gauge is accepted with reservations in case of minor defects. These minor defects need to be remedied before a specified date that has been agreed upon.

4.3. Payment

50% of payment of the total purchase price of the first nine (9) gauges (1st & 2nd delivery) will be done after completion of stage 1 (see page 6). The remaining 50% of the total purchase price of the nine (9) gauges will be paid after the Verification Phase if the gauge is accepted.

Payment for the 3rd and 4th delivery will be made when each gauge of the delivery has successfully passed the three phases of acceptance given in section 4.2 - Delivery acceptance.

When one (1) or more gauges in a delivery are returned with a problem, new gauges or a new invoice will be requested for the remaining gauges that have been accepted.

4.4. Delivery on hold

KNMI reserves the right to put the ordering process on hold if there is reasonable justification for doing so. The deliveries will be stopped when problems have been detected during the deployment of the gauges in the field or when more than three (3) gauges are returned after delivery (see section 4.2). Delivery will resume when both the Supplier and the KNMI agree that the underlying problem has been resolved.



4.5. Installation after acceptance

The installation of the gauges at the measurement locations is carried out by KNMI employees. Based on experience, we anticipate that installation at a location should take no more than one day per gauge.

The timeline of one installation is as follows:

- Remove current Precipitation gauge.
- Adapt infrastructure to facilitate new gauge.
- Install the new Precipitation gauge.
- Data communication testing of gauge.
- Gauge is ready.

4.6. Delivery schedule

The delivery schedule below is given in weeks starting after signing the Contract(s) (T=week 0). The number of Precipitation gauges in each delivery is indicated. Note that these numbers are indications and the actual numbers may change after consultation. The gauges shall be delivered with the associated parts. The Contracting Authority expressly reserves the right to adjust the schedule during the course of the Verification Phase.



Date	Delivery details	Number of precipitation gauges	Number of windscreen set-ups	Number of english pit set-ups
T	Contracts signed			
T+4 weeks	1st delivery and start of verification phase 1 st supplier, delivery of one (1) set of calibrators, two (2) gauges for test field De Bilt and one (1) extra gauge. Training for selected KNMI staff shall be provided during this time.	3	2	
T+6 weeks	Feedback on labtest (incl testreport) of gauge of 1 st supplier.			
T+8 weeks	Feedback on preparations on testfield of gauge of 1 st supplier.			
T+9 weeks	2nd delivery 1 st supplier, delivery of gauges for verification locations: - De Bilt 260 (AWS)(Windscreen) - De Kooy (Military Aviation)(Windscreen) - Hupsel (AWS)(Windscreen) - Marknesse (AWS)(Windscreen) - Bonaire (Aviation)(Windscreen) and one (1) extra gauge.	6	5	
T+14 weeks	Start parallel test of gauges of 1st supplier Only delivery and start of stage 1 of verification phase of 2nd supplier 2 nd supplier (2 nd ranked party awarded with waiting room Agreement), delivery of one (1) set of calibrators and two (2) gauges for test field De Bilt. Gauges of 2 nd supplier will only be tested in the laboratory and on the test field in de Bilt.	2	2	
T+16 weeks	Feedback on labtest of gauge of 2 nd supplier (incl testreport).			
T+18 weeks	Feedback on preparations on testfield of gauges of 2 nd supplier.			



Date	Delivery details	Number of precipitation gauges	Number of windscreen set-ups	Number of english pit set-ups
T+66 weeks	End of Verification Phase Conclusion of Verification Phase of gauge of 1 st supplier (incl test report) with acceptance of precipitation gauge. Training for remaining KNMI staff shall be provided during this time. Waiting Room Agreement with 2 nd supplier will officially expire.			
T+68 weeks	3rd delivery 1 st supplier, delivery of gauges for rollout: - Cabauw WIS (Research)(Windscreen) - Cabauw AWS (AWS)(Windscreen) - Zestienhoven (Aviation)(Windscreen) - Hoek van Holland (AWS)(English Pit) - Voorschoten (AWS)(Windscreen) - Schiphol (Aviation)(Windscreen) - Wijk aan Zee (AWS)(Windscreen) - Berkhout (AWS)(English Pit) - Lelystad (Aviation)(Windscreen) - Heino (AWS)(Windscreen) - Stavoren (AWS)(Windscreen) - Terschelling Hoorn (AWS)(English Pit) - Leeuwarden (Military Aviation)(Windscreen) - Lauwersoog (AWS)(English Pit) - Eelde (Aviation)(Windscreen) - Nieuw Beerta (AWS)(English Pit) - spare precipitation gauges	21	11	5
approx. T+76 weeks	4th delivery 1 st supplier, delivery of gauges for rollout: - Hoogeveen (AWS)(English Pit) - Twenthe (AWS)(English Pit) - Deelen (Military Aviation)(English Pit) - Herwijnen (AWS)(Windscreen) - Volkel (Military Aviation)(English Pit) - Arcen (AWS)(English Pit) - Ell (AWS)(English Pit) - Beek (Aviation)(Windscreen) - Gilze Rijen (Military Aviation)(English Pit) - Eindhoven (Military Aviation)(English Pit) - Woensdrecht (Military Aviation)(Windscreen) - Westdorpe (AWS)(Windscreen) - Wilhelminadorp (AWS)(English Pit) - Vlissingen (AWS)(English Pit) - spare precipitation gauges	20	4	10
Total 1 st supplier		50	22	15
Total 2 nd supplier		2	2	



5. References

The following list of references provide both:

- an overview of KNMI's current gauge (its specifications and its performance);
- and recommendations on how to conduct an intercomparison among precipitation gauges.

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