Water Temperature: Hand held temperature validation checks

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Overview:
All measuring equipment used for 'check data' collection for continuous water quality measurement, or equipment used for water quality (SOE and discharge) is required to have a current validation certificate. Horizons send two reference probes away for independent verification prior to validating our other probes in house. All validations must comply with the NEMS water temperature standard.

Primary reference temperature probes:
A record of inspection history should be maintained for each sensor. Horizons shall maintain two independently verified primary reference probes. Probes shall have an accuracy of ± 0.05 degrees or better, with a precision of 0.01 degrees or better.

Accepted models for Horizons Regional Council:

- ebro TFX 430 Precision Thermometer (PT100) [± 0.05º]

Reference temperature probes:
A record of validation history should be maintained for each sensor. Horizons reference probes shall be verified either independently or in house using the following procedure. Reference probes shall have an accuracy of ± 0.3 degrees or better, with a resolution of 0.1 degrees or better.

Accepted models for Horizons Regional Council:

- ebro TFX 410-1 Precision Core Thermometer (PT1000) [± 0.3º]
- YSI Pro [±0.2% FS]
- Center375 ("TPs") (±0.1 degrees)
- Aqua TROLL 400 (±0.1 degrees)

Validation frequency:
All reference probes, including the primary reference probes shall be validated for a period of a year, in line with NEMS guidelines.

Validation points:
All probes shall be validated for the temperature ranges likely to be encountered. (Typically 0 – 50 degrees). The validation steps are shown in the following table (refer NEMS):

Expected temperature range (all in degrees Celsius)	Minimum Horizons requirement
-0.5 – 0.0	
0.0 – 5.0	Require one validation value in this range
5.0 – 10.0	Require one validation value in this range
10.0 – 15.0	Require one validation value in this range
15.0 – 20.0	Require one validation value in this range
20.0 – 25.0	Require one validation value in this range
25.0 – 30.0	Require one validation value in this range
30.0 – 35.0	Require one validation value in this range
35.0 – 40.0	Require one validation value in this range
40.0 – 45.0	Require one validation value in this range

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45.0 – 50.0	Require one validation value in this range
50.0 – 60.0	
60.0 – 70.0	
70.0 – 80.0	
80.0 – 90.0	
90.0 – 100.0	

Validation procedure:
Quantities are a guide only as they will vary with water bath size.

- In a water bath, ¼ fill with Ice, then top up with cold water to approximately ½ full.
- Stir for ten minutes.
- Place two currently certified reference probes at opposite ends of the bath together with all probes being validated (Ensure all probes are fully immersed in the water).
- Allow time for the temperature to stabilise (minimum 5 minutes).
- Record the time and temperatures of the reference probes.
- Record the values of all probes being validated.

Repeat the following steps for each of the required validation points in the table above.

- Allow time for the water to heat slowly. Use a heater, or remove ice/water and top up with warm water to achieve the next validation point.
- Allow time for the temperature to stabilise (minimum 5 minutes).
- Record the time and temperatures of the reference probes.
- Record the values of all probes being validated.

After completing the validation, check the primary reference values and ensure the deviation between the two does not exceed 0.1 degrees at any point. If they do the validation is invalid and cannot be used. Consider rechecking and/or send the primary reference sensors away for revalidation.

Check each validation point against the mean of the two primary reference sensors. If the deviation exceeds 0.3 degrees at any validation point then the sensor fails the validation.

Failed sensors:
A sensor that fails its validation will be discarded, replaced or recalibrated. Check data collected by the sensor will need to be reviewed and assigned a lower quality code (QC200).

After the validation is complete, fill in a new version of the *Temp Validation* spreadsheet found in *ares / Hydrology / Hydrology Calibrations / Temperature*. PDF the results on the *Validation Report* tab for each meter and save into the same folder. Open Assets and click on *ED*, then *Ref Sensors*, then *Water Temperature – Reference*. Right click on the meter validated and hit *Edit*. Add a new calibration and include the corresponding PDF. Save & close. Right click on the meter and select *Asset History.* It should say *"Calibration and Certificate".* Double click to check the PDF. Repeat for each meter validated.