INSTRUMENT VERIFICATION: METHOD AND PROCEDURE

Availability/Compatibility of features:

Feature:	Availability/compatibility:
Menu guided instrument verification.	PR-43 standalone refractometer or PR-43 refractometer with Compact user interface or PR-43 refractometer with Multichannel user interface

For K-Patents verification you need:

- K-Patents PR-23/43 sample holder (see Figure 1 below). The sample holder PR-1012 keeps the sample on the prism surface and also keeps the ambient light out.
- A set of standard refractive index liquids.
- Cleaning solution (ethanol) to clean the refractometer prism and the sample holder.

Figure 1. The universal sample holder PR-1012.

INTRODUCTION

A company maintaining ISO 9000 or other quality system needs to have defined procedures for controlling and calibrating its measuring equipment.

Such procedures are needed for demonstrating that the end products conform to specifications.

The company should:

- Identify the required accuracy and select appropriate equipment for the measurements.
- Establish calibration procedures including a check method and acceptance criteria.
- Calibrate the equipment at prescribed intervals against certified equipment that has a known valid relationship with national standards. When no such standards exist, the basis for the calibration should be documented.

K-PATENTS VERIFICATION METHOD

K-Patents' quality system is ISO 9001 certified by Det Norske Veritas.

Each K-Patents refractometer is provided with a calibration certificate comparing a set of standard liquids to the actual refractometer output. Therefore, the calibration and accuracy can be easily verified on-site with the certified refractive index liquids and K-Patents documented and menu guided verification procedure.

The verification of the PR-43 refractometer calibration is made using a set of standard refractive index liquids with the nominal values at 25 °C:

- 1.330
- 1.370
- 1.420
- 1.470
- 1.520

The accuracy of the certified standard refractive index liquids is ± 0.0002 and they can be traced back to national standards: NIST Standards # 1823 and # 1823 II. As the specified accuracy of PR-43 is ±0.0002, then the representative level is the sum of the two accuracy specifications, that is, ±0.0004.

K-Patents provides a set of standard R.I. liquids, PR-2300, containing these five liquids. The set can be ordered directly from K-Patents or through your K-Patents representative.

VERIFICATION PROCEDURE WITH MULTICHANNEL USER INTERFACE (MI) OR COMPACT USER INTERFACE (CI)

Select VERIFICATION from the Main menu of Compact user interface or Multichannel user interface. Instructions for the verification steps are given on the display:

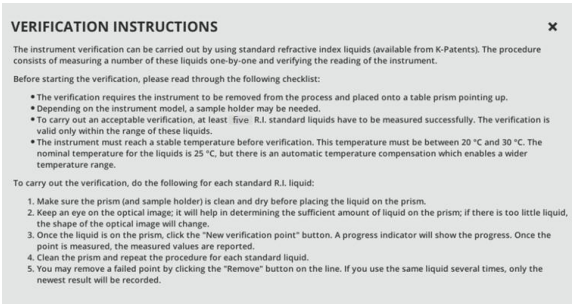


Figure 2. Verification steps.

To check that the standard liquid is properly wetting the prism, the optical image can be monitored during the verification procedure. The optical image should show a sharp shadow edge, as e.g. in Figure 3 (normal conditions).

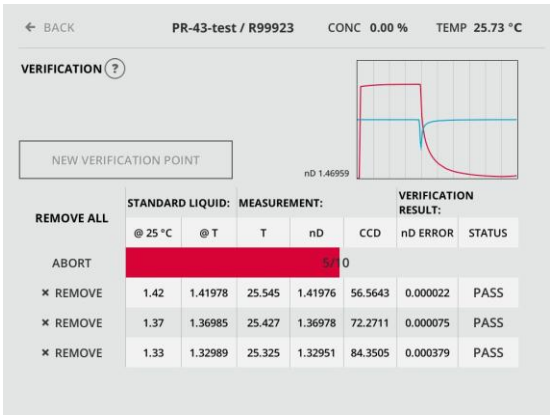


Figure 3. Typical optical image in the right corner.

The instrument measures each verification data point ten times and uses the average of these measurements. Measuring each verification liquid takes a few seconds, during which the measurement progress display is shown.

Please wait until the verification step 2 display reappears before proceeding to next verification liquid. The limit for acceptance is that all measurements must be within ± 0.0004 of the nominal values, Figure 4.

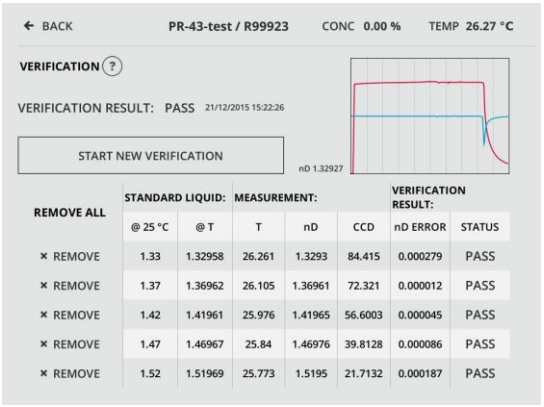


Figure 4. Verification results.

Note: The refractometer verification concerns only the refractive index n_D measurement. The calculation of concentration from n_D and process temperature TEMP is not included.

VERIFICATION PROCEDURE WITH PR-43 REFRACTOMETER WEB INTERFACE

Select VERIFICATION from the Main menu of PR-43 refractometer web interface. Instructions for the verification steps are shown.

To check that the standard liquid is properly wetting the prism, the optical image can be monitored during the verification procedure. The optical image should show a sharp shadow edge, as e.g. in Figure 5 (normal conditions).

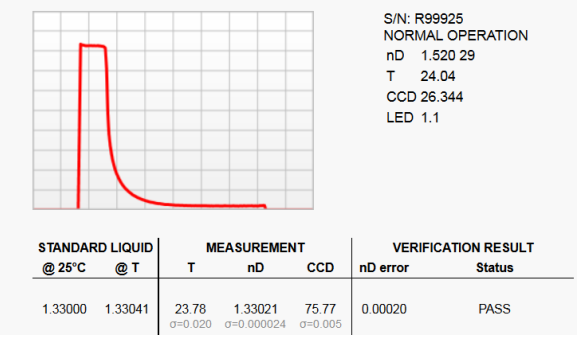


Figure 5. Typical optical image on the left.

The instrument measures each verification data point ten times and uses the average of these measurements. Measuring each verification liquid takes a few seconds, during which the measurement progress display is shown.

Please wait until the verification step 2 display reappears before proceeding to next verification liquid. The limit for acceptance is that all measurements must be within ± 0.0004 of the nominal values, Figure 6.

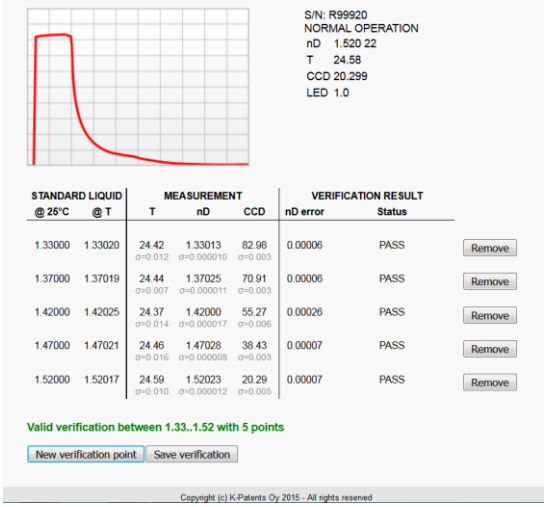


Figure 6. Verification results.

You may remove failed point by clicking “Remove” button on the line. If you use the same liquid several times, only the newest result will be recorded

Once you have carried out the measurement for all five points, click the “Save verification” button. This will save the verification result into the instrument and show the verification report. The latest verification report can always be seen by clicking the “Verification report” link in the menu.

Note: The refractometer verification concerns only the refractive index n_D measurement. The calculation of concentration from n_D and process temperature TEMP is not included.

VERIFICATION CERTIFICATE

You also have access to a *printable verification certificate* over the Ethernet connection (Figure 7). The Multichannel user interface MI, Compact user interface CI and refractometer Web interface WI store the most recent verification. The results of that verification can be viewed on the screen of the instrument or on the refractometer web pages by following the Verification link on the link bar. When you have performed a verification on a refractometer, reload/refresh the verification page to view the newest results. The date given on the verification page is the page load date, not necessarily the verification date.

To print the verification certificate, simply use your browser’s print function. The page is designed so that with browser default settings it normally fits onto a single sheet of A4 or letter sized paper; the navigation bar is omitted for cleaner printout (Figure 8).

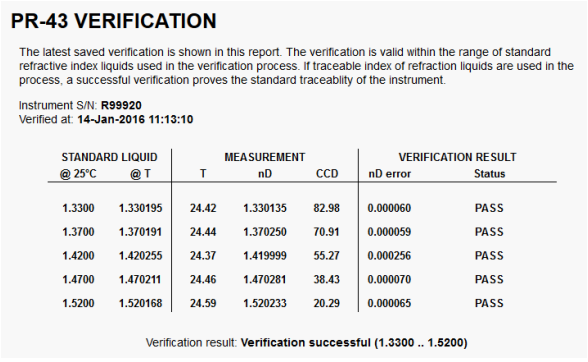
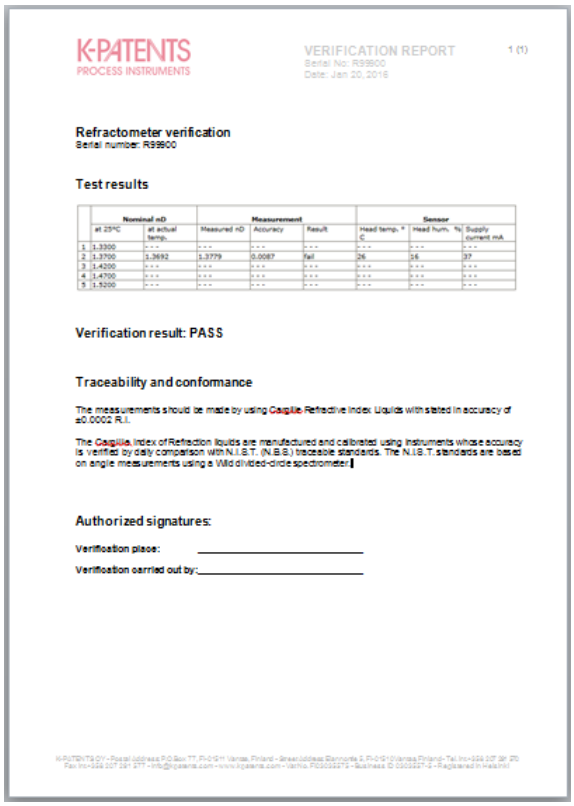


Figure 7. Instrument verification report page of PR-43 refractometer open in a browser.



K-PATENTS
PROCESS INSTRUMENTS

VERIFICATION REPORT 1 (1)
Serial No: RS9900
Date: Jan 20, 2016

Refractometer verification
Serial number: RS9900

Test results

	Nominal nD		Measurement			Sensor		
	at 25°C	at actual temp.	Measured nD	Accuracy	Result	Head temp. °C	Head hum. %	Supply current mA
1	1.3300	---	---	---	---	---	---	---
2	1.3700	1.3692	1.3779	0.0087	Fail	26	16	37
3	1.4200	---	---	---	---	---	---	---
4	1.4700	---	---	---	---	---	---	---
5	1.5200	---	---	---	---	---	---	---

Verification result: PASS

Traceability and conformance

The measurements should be made by using Cargille Refractive Index Liquids with stated in accuracy of ±0.0002 R.I.

The Cargille Index of Refraction liquids are manufactured and calibrated using instruments whose accuracy is verified by daily comparison with N.I.S.T. (N.B.S.) traceable standards. The N.I.S.T. standards are based on angle measurements using a Wild divided-circle spectrometer.

Authorized signatures:

Verification place: _____

Verification carried out by: _____

Figure 8. Instrument verification report downloaded from MI/CI web pages.

CORRECTIVE ACTION

If VERIFICATION FAILED, first check that the prism **and** the sample holder are absolutely clean and the sample holder sits tightly on the refractometer tip before a standard liquid is applied. Make sure the standard liquids are in good condition and not past their expiration date. Also, inspect the prism surface, checking that it is flat and glossy without any scratches.

Repeat the verification procedure. If the verification still fails, fill in the form **PR-43 refractometer verification form**, found in the end of the manual. The refractometer's serial number is shown in the upper right corner of each display. The list of CCD and TEMP values are found on the Verification results display (Figure 4). Send the form to K-Patents or your nearest K-Patents representative or email the collected data to info@kpatents.com and wait for further instructions.