



INSTRUMENT VERIFICATION: METHOD AND PROCEDURE

Availability/Compatibility of f	eatures:			
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:

PRIFICATION INSTRUCTIONS	×
The instrument verification can be carried out by using standard refractive index liquids (available f consists of measuring a number of these liquids one-by-one and verifying the reading of the instru	from K-Patents). The procedure ment.
Before starting the verification, please read through the following checklist:	
 The verification requires the instrument to be removed from the process and placed onto a tage. Depending on the instrument model, a sample holder may be needed. 	able prism pointing up.
 To carry out an acceptable verification, at least five R.I. standard liquids have to be measure valid only within the range of these liquids. 	ed successfully. The verification is
 The instrument must reach a stable temperature before verification. This temperature must b nominal temperature for the liquids is 25 °C, but there is an automatic temperature compens- temperature range. 	e between 20 °C and 30 °C. The ation which enables a wider
To carry out the verification, do the following for each standard R.I. liquid:	
 Make sure the prism (and sample holder) is clean and dry before placing the liquid on the pris Keep an eye on the optical image; it will help in determining the sufficient amount of liquid or 	m. h the prism; if there is too little liquid
the shape of the optical image will change. 3. Once the liquid is on the prism, click the "New verification point" button. A progress indicator point is measured, the measured values are reported.	will show the progress. Once the
4. Clean the prism and repeat the procedure for each standard liquid.	
You may remove a failed point by clicking the "Remove" button on the line. If you use the sam neverst result will be recorded	ne liquid several times, only the

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). 1.00.08

PROCESS REFRACTOMETER PR-43

INSTRUMENT VERIFICATION

TECHNICAL NOTE



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 \pm 0.0004 of the nominal values, Figure 4.

ERIFICATION (?	\mathbf{O}						
ERIFICATION R	ESULT: P/	ASS 21/12	/2015 15:22:26	5	-		
START	NEW VERIF	ICATION		nD 1.329:	27		Ņ
DEMOVE ALL	STANDAR	D LIQUID:	MEASURE	MENT:		VERIFICATIO	DN
REMOVE ALL	@ 25 °C	@ T	т	nD	CCD	nD ERROR	STATUS
× REMOVE	1.33	1.32958	26.261	1.3293	84.415	0.000279	PASS
× REMOVE	1.37	1.36962	26.105	1.36961	72.321	0.000012	PASS
× REMOVE	1.42	1.41961	25.976	1.41965	56.6003	0.000045	PASS
× REMOVE	1.47	1.46967	25.84	1.46976	39.8128	0.000086	PASS
	1.63	1 51969	25 773	1 5195	21 7132	0.000187	PASS

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 \pm 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).

PR-43 VERIFICATION

The latest saved verification is shown in this report. The verification is valid within the range of standard refractive index liquids used in the verification process. If traceable index of refraction liquids are used in the process, a successful verification proves the standard traceability of the instrument.

Instrument S/N: R99920 Verified at: 14-Jan-2016 11:13:10

STANDAR	RD LIQUID	1	MEASUREMEN	т	VERIFIC	ATION RESULT
@ 25°C	@ T	Т	nD	CCD	nD error	Status
4 2200	4 220405	24.42	4 222425	02.00	0.000000	DAGG
1.3300	1.330195	24.42	1.330135	82.98	0.000060	PASS
1.3700	1.370191	24.44	1.370250	70.91	0.000059	PASS
1.4200	1.420255	24.37	1.419999	55.27	0.000256	PASS
1.4700	1.470211	24.46	1.470281	38.43	0.000070	PASS
1.5200	1.520168	24.59	1.520233	20.29	0.000065	PASS

Verification result: Verification successful (1.3300 .. 1.5200)

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



#1 25*C	and and and a					t	
	at actual	Measured nD	Accuracy	Result	Head temp	* Head hum	N Supply
4 4 8888	temp.			-	¢	-	Current
2 1.3300	1.3692	1.3779	0.0087	fail	26	16	37
3 1.4200							
4 1.4700							
5 1.5200						1.00	
s verified by in angle me	rdaly compar asurements u	ison with N.I.8 Ising a Wild div	8.T. (N.B.8.) /ded-d/de) traceable s spectromet	andards. The er.	N.LO.T.Stan	dards an
Authorize	ed signatı	ires:					
Verification	place:						
Verification	carried out t	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 <u>info@kpatents.com</u> and wait for further instructions.