Thermometer Probe Selection Guide

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PRTs

Model	Range	Size	Calibration Uncertainty†	Page
Secondary Standards PRTs				
5626	–200 °C to 661 °C	305 or 381 x 6.35 mm (12 or 15 x 0.25 in)	±0.004 °C at 0 °C	62
5628	–200 °C to 661 °C	305 or 381 x 6.35 mm (12 or 15 x 0.25 in)	±0.004 °C at 0 °C	
5624 High Temperature PRT	0 °C to 1000 °C	508 x 6.35 mm (20 x 0.25 in)	±0.004 °C at 0 °C	63
Secondary Reference PRTs				
5615-6	–200 °C to 300 °C	152 x 4.76 mm (6 x 0.188 in)	±0.010 °C at 0 °C	64
5615-9	–200 °C to 300 °C	229 x 4.7 mm (9 x 0.188 in)	±0.010 °C at 0 °C	
5615-12	–200 °C to 420 °C	305 x 6.35 mm (12 x 0.25 in)	±0.010 °C at 0 °C	
Small Diameter Industrial PRTs				
5618B-6	–200 °C to 300 °C	152 x 3.2 mm (6 x 0.125 in)	±0.010 °C at 0 °C	67
5618B-9	–200 °C to 500 °C	229 x 3.2 mm (9 x 0.125 in)	±0.010 °C at 0 °C	
5618B-12	–200 °C to 500 °C	305 x 3.2 mm (12 x 0.125 in)	±0.010 °C at 0 °C	
Precision Freezer PRT				
5623B	–200 °C to 156 °C	152 x 6.35 mm (6 x 0.25 in)	±0.010 °C at 0 °C	68
Precision Industrial PRTs				
5627A-6	–200 °C to 300 °C	152 x 4.7 mm (6 x 0.187 in)	±0.025 °C at 0 °C	69
5627A-9	–200 °C to 300 °C	229 x 4.7 mm (9 x 0.187 in)	±0.025 °C at 0 °C	
5627A-12	–200 °C to 420 °C	305 x 6.35 mm (12 x 0.25 in)	±0.025 °C at 0 °C	
Fast Response PRTs				
5622-05	–200 °C to 350 °C	100 x 0.5 mm	±0.040 °C at 0 °C	70
5622-10	–200 °C to 350 °C	100 x 1.0 mm	±0.040 °C at 0 °C	
5622-16	–200 °C to 350 °C	200 x 1.6 mm	±0.040 °C at 0 °C	
5622-32	–200 °C to 350 °C	200 x 3.2 mm	±0.040 °C at 0 °C	

Thermistors

Thermistor Standards				
5640	0 °C to 60 °C	229 x 6.35 mm (9 x 0.25 in)	±0.0015 °C	72
5641	0 °C to 60 °C	114 x 3.2 mm (4.5 x 0.125 in)	±0.001 °C	
5642	0 °C to 60 °C	229 x 3.2 mm (9 x 0.125 in)	±0.001 °C	
5643	0 °C to 100 °C	114 x 3.2 mm (4.5 x 0.125 in)	±0.0025 °C	
5644	0 °C to 100 °C	229 x 3.2 mm (9 x 0.125 in)	±0.0025 °C	
Secondary Thermistor Probes				
5610	0 °C to 100 °C	152 or 229 x 3.2 mm (6 or 9 x 0.125 in)	±0.01 °C	74
5611A	0 °C to 100 °C	1.5 mm (0.06 in) tip dia.	±0.01 °C	
5611T	0 °C to 100 °C	28 x 3 mm (1.1 x 0.12 in)	±0.01 °C	
5665	0 °C to 100 °C	76 x 3.2 mm (3 x 0.125 in)	±0.01 °C	

Thermocouples

Type R and S Thermocouple Standards				
5649/5650-20	0 °C to 1450 °C	508 x 6.35 mm (20 x 0.25 in)	±0.7 °C at 1100 °C	80
5649/5650-20C	0 °C to 1450 °C	508 x 6.35 mm (20 x 0.25 in)	±0.7 °C at 1100 °C	
5649/5650-25	0 °C to 1450 °C	635 x 6.35 mm (20 x 0.25 in)	±0.7 °C at 1100 °C	
5649/5650-25C	0 °C to 1450 °C	635 x 6.35 mm (20 x 0.25 in)	±0.7 °C at 1100 °C	

Other

Glass Thermometers	–38 °C to 405 °C –36 °F to 761 °F	381 mm (15 in) length	0.1 °C Divisions 0.2 °F Divisions	81

†Calibration uncertainty includes short-term repeatability. It does not include long-term drift.

How accurate is that probe?

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At Hart, we field inquiries every day about reference thermometers. Inevitably, as a particular thermometer is discussed, the same bottom-line question is asked: "How accurate is it?"

The purest metrology answer to this question is, at best, disconcerting: "Nobody knows until you re-calibrate it—*after* you've used it."

While this is probably the best answer that can be given, it's not very helpful when you're trying to select the right thermometer. So if you'd like an idea of accuracy *before* you buy a thermometer, here are five things to consider.

Calibration

One of the most important contributors to the accuracy of your reference thermometer is the way it was calibrated. Not all calibrations are equal.

Calibrations by fixed points are generally better than calibrations by comparison. Calibrations limited to a narrow temperature range are better than calibrations done over a needlessly wide range. Calibrations by people who know what they're doing are better than calibrations by people who don't.

Your calibration should describe the method used, state the uncertainty or test-uncertainty-ratio of the calibration, include a calibration report that meets your quality standards and demonstrates traceability to a national laboratory, and be done by an accredited lab or company you trust. The uncertainty of your probe's own calibration is the first element of accuracy to consider.

Short-term stability (repeatability)

Just because your thermometer has been well calibrated doesn't mean it repeats each identical measurement perfectly. Limitations on the abilities and physical purity of the sensing element and other materials used in the construction of the thermometer prohibit perfect repeatability.

Different types of thermometers made by different manufacturers have varying susceptibilities to errors from hysteresis, oxidation, and other sources of instability. Thermocouples, for example, are inherently less repeatable than reference-grade thermistors. Strain-free SPRTs are more repeatable than industrial RTDs. The point is that short-term instabilities cannot be "calibrated out" and must be considered as an additional source of uncertainty.

Long-term stability (drift)

Long-term stability, or "drift," is a critical specification for any reference thermometer. Many causes of short-term instability grow worse as a thermometer's thermal history increases. Normal wear and tear takes its toll on even the best sensing elements and affects their output. It's important to note that "normal wear and tear," in this case, should be defined in the specification.

For example, a drift specification may be stated as "less than 2 mK after 100 hours at 661 °C" (such as on page 9) or as "±0.025 °C at 0 °C per year maximum, when used periodically to 400 °C" (such as on page 64). If your intended use of the thermometer is more or less strenuous than what the manufacturer states, you may anticipate correspondingly more or less drift.

Many causes of long-term drift can be periodically addressed and, to some extent, removed. The effects of oxidation, for example, can be largely removed by occasional annealing at high temperatures. Annealing, itself, however, adds more high-temperature history to the sensor and should not be done needlessly. One of the reasons the drift specification is so important is that it helps identify how long you can use your thermometer between recalibrations. Be wary of suppliers who don't provide a drift specification.

Usage

You won't find a specification to account for all the ways a reference thermometer can be misused (or even abused), but in evaluating specifications it must be understood that the manufacturer has made assumptions regarding how its instrument will be used. At Hart, we tend to write "looser" specifications to allow for instruments being used in less ideal conditions than those under which we use them. Not every manufacturer does so.

Typical examples of misuse include inadequate immersion depth, subjection to mechanical or thermal shock, inadequate thermal contact against the subject being measured, use outside the specified temperature range, and extended use at extreme ends of the temperature range. Before assuming your thermometer will perform the way the manufacturer says it will, satisfy yourself that it will be used within the manufacturer's intended parameters.

Display accuracy

The uncertainty of the thermometer's readout device (bridge, DMM, *Black Stack,* etc.) must be added to the uncertainty of the actual thermometer when considering total accuracy. No electrical thermometer (PRT, thermistor, thermocouple, etc.) generates a direct temperature reading. The resistance or voltage must always be interpreted (and usually fitted to an equation), and there are always errors inherent in this process.

In the final analysis...

In the end, the fact remains that the metrologist is right. You won't know how accurately your thermometer has performed until you recalibrate it. The moral is simple: consider all the appropriate performance specifications, use the thermometer correctly and carefully, and recalibrate it soon to verify its performance. As recalibrations yield positive results and confidence in an instrument grows, calibration intervals can be extended and maintenance costs decreased. If you're buying from the right manufacturer and handling your thermometer correctly, you'll find it not uncommon to experience much better results than what the manufacturer has specified.

Secondary Standard PRTs

- Range to 661 °C
- Meets all ITS-90 requirements for resistance ratios
- R_{TPW} drift < 20mK after 500 hours at 661 °C

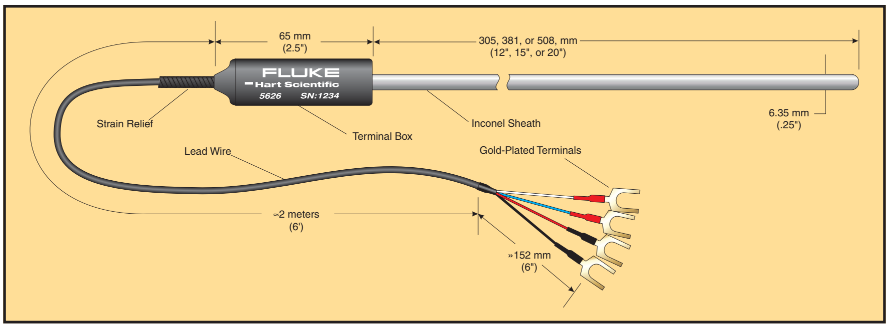
Hart's high-temp secondary standards fill the gap between affordable, but temperature-limited secondary PRTs and more expensive, highly accurate SPRTs.

If you're using block calibrators, furnaces, or temperature points above normal PRT temperatures (420 °C), then these two PRTs are for you. The 5626 is nominally 100Ω and the 5628 is nominally 25.5Ω. Both instruments have a temperature range of –200 °C to 661 °C. They make great working or check standards for calibration work up to the aluminum point.

Using a regular PRT at temperatures above 500 °C exposes the platinum to contamination. If the PRT is used as a reference or calibration standard, contamination is a major problem. SPRTs, which are more expensive and delicate, can handle the higher temperatures, but with greater risk to the instrument due to shock, contamination, or mishandling. The 5626 and 5628 are designed to reduce the contamination risk through the use of internal protection while not impairing performance.

In addition to the right measurement performance and durability, a PRT for secondary applications should be priced affordably. Hart's new PRTs are inexpensive and come with an accredited calibration. The calibration comes complete with ITS-90 constants and a resistance-versus-temperature table.

Check the temperature range, check the stability, check the price! Who else gives you this much quality, performance, and value for your money? No one!



Specifications

Temperature Range	–200 °C to 661 °C
Handle Temp.	0 °C to 80 °C
R_{TPW}	**5626:** 100Ω (±1Ω) **5628:** 25.5Ω (±0.5Ω)
W(Ga)	≥ 1.11807
Calibration Uncertainty (k=2)	±0.006 °C at –200 °C ±0.004 °C at 0 °C ±0.009 °C at 420 °C ±0.014 °C at 661 °C
Stability	**5626:** ±0.003 °C **5628:** ±0.002 °C
Long-Term Drift	**5626:** < 0.03 °C/500 hours at 661 °C **5628:** < 0.02 °C/500 hours at 661 °C
Immersion	At least 12.7 cm (5 in) recommended
Sheath	Inconel™ 600
Lead Wires	4-wire Super-Flex PVC, 22 AGW
Termination	Gold-plated spade lugs, or specify
Size	6.35 mm dia. x 305 mm, 381 mm, or 508 mm (0.25 x 12, 15, or 20 in) standard, custom lengths available
Calibration	Accreditated calibration from Fluke Hart Scientific

Ordering Information

5626-12-X	High-temp PRT, 100Ω, 305 mm (12 in)
5626-15-X	High-temp PRT, 100Ω, 381 mm (15 in)
5626-20-X	High-temp PRT, 100Ω, 508 mm (20 in)
5628-12-X	High-temp PRT, 25.5Ω, 305 mm (12 in)
5628-15-X	High-temp PRT, 25.5Ω, 381 mm (15 in)
5628-20-X	High-temp PRT, 25.5Ω, 508 mm (20 in)
2609	Spare Case

Appropriate case included with purchase of 5626 or 5628 PRT.

X = termination. Specify "B" (bare wire), "D" (5-pin DIN for Tweener Thermometers), "G" (gold pins), "I" (INFO-CON for 1521 or 1522 Handheld Thermometers), "J" (banana plugs), "L" (mini spade lugs), "M" (mini banana plugs), or "S" (spade lugs).

FLUKE ®
Hart Scientific ®

Ultra High-Temp PRT

- Temperature range of 0 °C to 1000 °C
- Calibration uncertainty of ±0.004 °C at 0 °C
- Long-term drift of 0.01 °C at 0 °C after 100 hours at 1000 °C
- Designed by Hart's primary standards design team

At Hart, we receive many requests for precision PRT accuracy at thermocouple temperatures. Until now metrologist have settled for expensive, high-temperature SPRTs or inaccurate thermocouples for high-temperature measurement.

We're pleased to introduce the world's finest high-temperature secondary PRT, our Model 5624.

Ideal for use as a reference thermometer in high-temperature furnaces, the 5624 can reach a temperature of 1000 °C with long-term drift at 0 °C of only 10 mK! Due to Hart Scientific's proprietary sensor design, this PRT has short-term stability of 5 mK, and an immersion requirement of less than 153 mm (6 in) at 700 °C.

The 5624 is assembled in an alumina sheath that is 508 mm (20 in) long and 6.35 mm (0.25 in) in diameter. Several termination configurations can be selected to match different thermometer readouts. Each 5624 comes with a NIST-traceable, NVLAP-accredited (lab code 200348-0) fixed-point calibration from 0 °C to 962 °C. That's a *fixed-point* calibration! The 5624 also comes in a protective carrying case.

Specifications

Range	0 °C to 1000 °C
Calibration Uncertainty	±0.004 °C at 0 °C ±0.020 °C at 962 °C
Long-term Drift (R_{tpw})	<0.01 °C at 0 °C/100 hours at 1000 °C <0.06 °C at 0 °C/1000 hours at 1000 °C
Short-term Stability	±0.005 °C
Immersion	<153 mm (6 in) at 700 °C
R_{tpw}	10 ohm (±1 ohm)
Hysteresis	<0.005 °C from 0 °C to 1000 °C
Thermocycling	<0.01 °C, 10 cycles from 0 to 1000 °C
Current	1 mA
Size	6.35 mm (0.25 in) O.D.
Length	508 mm (20 in)
Sheath Material	Alumina
Weight	1 kg (2 lb.)
Calibration	Included 1913-6 fixed-point calibration

Ordering Information

5624-20-X	Probe, 1000 °C, 10 ohm PRT, 6.35 mm x 508 mm (0.25 in x 20 in), (includes 2609 case)

X = termination. Specify "B" (bare wire), "D" (5-pin DIN for 1502A), "G" (gold pins), "I" (infocon for 1521/1522), "J" (banana plugs), "L" (mini spade lugs), "M" (mini banana plugs, or "S" (spade lugs).

1913-6	Cal, SPRT by Fixed Point, 0 °C to 962 °C
2609	Case, PRT, Plastic

Secondary Reference Temperature Standards

- Affordable wide-range accuracy
- Excellent stability
- Reference-grade platinum sensing element
- NVLAP-accredited calibration included, lab code 200706-0

For years, you've relied on our 5612, 5613, and 5614 Secondary Reference Probes. These field-durable, lab-accurate PRTs have been replaced by the 5615, which comes with a NVLAP accredited calibration.

The 5615-12 is a Platinum Resistance Thermometer (PRT) with an Inconel™ 600 sheath that's 305 mm (12 in) long and 6.35 mm (0.250 in) in diameter. It is a secondary reference temperature standard designed to bridge the gap between the highest laboratory standards and industrial or second-tier lab locations. It has short-term accuracy of ±0.013 °C at 0.01 °C.

The element is constructed of reference-grade platinum wire (99.999 % pure) for excellent stability. The wire is wound in a coil and placed in a mandrel where it's uniformly supported in a manner that virtually eliminates hysteresis. The electrical configuration is a four-wire current-potential hookup that eliminate the effects of lead-wire resistance.

These Inconel™-sheathed probes have a fully supported sensing element, making them more durable than SPRTs. The element is protected in an ultrahigh-purity ceramic case with a hermetic glass seal to improve output stability by locking out moisture and contaminants.

This probe comes calibrated with ITS-90 coefficients, making it compatible with many excellent readout devices, including Hart's 1529 Chub-E4, 1560 *Black Stack,* and 1502A Tweener. It bridges the gap between a 100-ohm industrial RTD and an SPRT.

For those needing faster thermal response, or where diameter and immersion depth are problems, order the 5615-9 or 5615-6. These probes are excellent reference probes for comparison calibrations in a Hart dry-well. The sheaths of the 5615-6 and 5615-9 are 4.76 mm (0.188 in) in diameter.

A printout of sensor resistance is provided in 1 °C increments for each probe. The 5615-9 and 5615-12 are calibrated from −196 °C to 420 °C. The 5615-6 is calibrated to 300 °C.

We've tested many of the probes on the market. We've used them in our manufacturing facility and tested them in the lab, and this is an excellent secondary standards PRT. Other instruments on the market are priced much higher, have lower stability, or are of lower quality. Remember, these are reliable instruments and each probe comes with its own individual NVLAP-accredited calibration, lab code 200706-0.

Ordering Information

5615-6-X	Secondary Standard PRT, 4.76 mm x 152 mm (0.188 x 6.0 in), −200 °C to 300 °C
5615-9-X	Secondary Standard PRT, 4.76 mm x 229 mm (0.188 x 9.0 in), −200 °C to 420 °C
5615-12-X	Secondary Standard PRT, 6.35 mm x 305 mm (0.250 x 12.0 in), −200 °C to 420 °C
2601	Probe Carrying Case

X = termination. Specify "B" (bare wire), "D" (5-pin DIN for Tweener Thermometers), "G" (gold pins), "I" (INFO-CON for 1521 or 1522 Handheld Thermometers), "J" (banana plugs), "L" (mini spade lugs), "M" (mini banana plugs), or "S" (spade lugs).

Secondary Reference Temperature Standards

Specifications

Temperature range	5615-12 and 5615-9: –200 °C to 420 °C 5615-6: –200 °C to 300 °C
Nominal resistance at 0 °C	100 Ω ± 0.10 Ω
Temperature coefficient	0.0039250 Ω/Ω/°C
Accuracy[1]	See footnote
Short-term repeatability[2]	±0.013 °C at 0.010 °C
Drift[3]	±0.01 °C at 0.010 °C
Sensor length	28 mm (1.1 in)
Sensor location	6.9 mm ± 3.3 mm from tip (0.27 in ± 0.13 in)
Sheath diameter tolerance	±0.127 mm (±0.005 in)
Sheath material	Inconel™ 600
Minimum insulation resistance	1000 MΩ at 23 °C
Transition junction temperature range[4]	–50 °C to 200 °C
Transition junction dimensions	71 mm x 13 mm dia (2.8 in x 0.5 in)
Maximum immersion length	5615-6: 102 mm (4 in) 5615-9: 178 mm (7 in) 5615-12: 254 mm (10 in)
Response time[5]	9 seconds typical
Self heating (in 0 °C bath)	50 mW/°C
Lead-wire cable type	Teflon™ insulated with Teflon™ jacket, 22 AWG
Lead-wire length	183 cm (72 in)
Lead-wire temperature range	–50 °C to 200 °C
Calibration	NVLAP-accredited calibration included, lab code 200706-0. Please see calibration uncertainty table and its explanation of changeable uncertainties.

[1]"Accuracy" is a difficult term when used to describe a resistance thermometer. The simplest way to derive "accuracy" is to combine the probe drift specification and calibration uncertainty with readout accuracy at a given temperature.
[2]Three thermal cycles from min to max temp, includes hysteresis, 99.9 % confidence
[3]After 100 hrs at max temp, 99.9 % confidence
[4]Temperatures outside this range will cause irreparable damage. For best performance, transition junction should not be too hot to touch.
[5]Per ASTM E 644

NVLAP† Calibration Uncertainty

Temperature	Expanded Uncertainty (k=2)
–196 °C	0.024 °C
–38 °C	0.011 °C
0 °C	0.010 °C
200 °C	0.018 °C
420 °C‡	0.029 °C

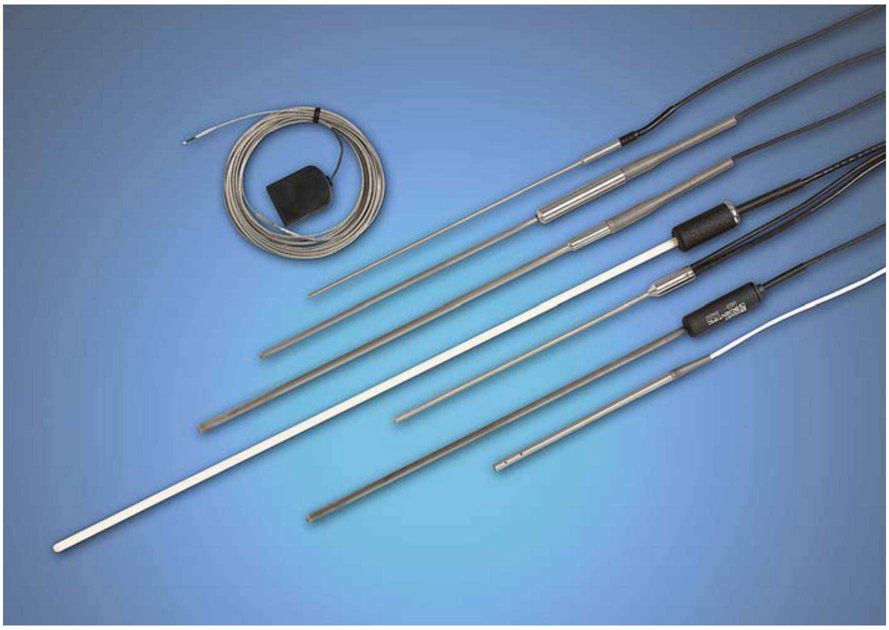
Note: Calibration uncertainties depend on the uncertainties of the lab performing the calibration. Subsequent calibrations of this probe performed with different processes, at different facilities, or with changed uncertainty statements may state different uncertainties.
†Lab code 200706-0
‡5615-6 excluded

Interim checks save trouble later

You spend good money getting your reference standards calibrated. How can you be sure that they continue to measure accurately prior to their next calibration? One way is to periodically compare them to other reference standards with higher accuracy. Such a test is called an interim check.

An interim check that most of us are familiar with is the use of a water triple point cell to check the stability of a PRT. The ISO 17025 suggests the use of interim checks as a quality safeguard. Do this regularly, keep good records, and you may improve your accuracy by more than a factor of 10. And if you find a problem, you'll be glad you found it sooner rather than later!

Sensible temperature specifications



Based on an article from *Random News*

Specifications are used to quantify the performance of platinum resistance thermometers (PRTs) and are often the main determinant in the customer's probe choice. Therefore marketers sometimes use a tactic called "specmanship" to artificially enhance their PRT's performance. "Specmanship" is defined as presenting instrument specifications in a misleading fashion. PRT specmanship can come in many forms. Here are some of the most common we see in the temperature world:

Incomplete specifications

Completeness means providing all the information necessary for a user to form proper expectations of PRTs performance over its intended range and for its intended purpose. A specification only given at one temperature point gives little indication of the PRT's performance over its full range.

It is usually not practical to define specifications in every detail at every increment over its range (or for every imaginable application). However, this is no excuse for intentionally omitting or relocating critical specifications in an effort to give a false impression of performance. Make sure specifications provide all the information needed to adequately predict performance over your intended range of use.

Drift is more important than many people realize, and they often fail to give it the consideration it deserves. The amount your probe drifts affects how often it must be recalibrated. Drift can be monitored by periodically measuring the probe's resistance shift at the triple point of water (TPW), or 0.01 °C.

Misuse of "typical" and "best performance"

Unfortunately, manufacturers are not bound by a common standard defining how to derive or present specifications. Ideally, manufacturers are adequately conservative when publishing specifications so that actual performance is better than the stated specifications. This should be done not only to provide a high level of confidence to the user when they validate the PRT's performance, but also to account for applications that may not be "typical" or that don't fit the "best performance" criteria.

It is important to realize that when a manufacturer qualifies a specification with the words like "typical", "as good as" or "depends on actual use" that they are not guaranteeing the specification. This is not to say that such terms may never be used. The term "typical" may be used in literature to give users a general indication of performance on non-critical specifications that have several variables. For example, the term "typical" can provide the user with an indication of performance when that performance is more within the user's control than the manufacturer's.

However use of such terms may be an indication that inadequate testing has been performed, or that an attempt is being made to exaggerate the actual performance of the majority of instruments being produced. These terms and others like them may be stated so the manufacturer may publish the most attractive specification possible while trying to build a defensible position for when the probe does not perform to the stated specification. Don't be fooled by exaggerated performance specifications. Ask for a guarantee.

Declaring specifications that are difficult to interpret or apply

Not enough can be said for clearly stated specifications that are easy to interpret and apply. Some specmanship artisans ambiguously represent specifications so customers are left to their own interpretation of the specification and how to apply it. Once a customer has clarified the "true" meaning, he or she often finds the specification is not based on the general application-thus, rendering it useless. Properly written specifications should therefore apply to the anticipated application.

If you ever see a specification that you do not understand, please ask. Otherwise, you may be misunderstanding a critical part of your probe's performance.

Conclusion

Specmanship exists in the temperature calibration market today. We suggest a thorough examination of PRT specifications on completeness and application use. We understand that thorough specifications can be challenging to develop, but we excuse no one, including ourselves. If you see a chance for us to improve the presentation of our specifications, please let us know!

Small Diameter Industrial PRT

FLUKE®

Hart Scientific®

- Small diameter sheath, 3.2mm (0.125 in)
- Excellent stability
- Includes ITS-90 coefficients
- NVLAP-accredited calibration from –200 °C to 500 °C, lab code 200706-0

For secondary level performance with full ITS-90 calibration, Hart's 5618B series PRTs are an excellent choice for critical temperature measurements. Featuring a 3.2 mm diameter (1/8 in) sheath, these industrial standards probes have reduced response time without compromising precision. This small diameter 5618B probe works well in many applications where immersion depth is limited. Larger diameter probes give more measurement error in short immersion depth applications because they conduct more heat between ambient and the sensor.

With each probe you will receive a full NVLAP-accredited calibration report, lab code 200706-0. On the report you'll get the test data and the ITS-90 calibration coefficients that you can easily input into your Hart thermometer. If you are using a 1521 Handheld Thermometer readout, we'll program the coefficients directly into your INFO-CON connector.

The 5618B is also a great probe to use for calibrating your Hart 9132 or 9133 infrared calibrators. In fact, these IR black body heat sources were designed to be calibrated with this type of probe. Now you can calibrate these targets in your own lab!

For use from –200 °C to 500 °C (the six-inch model goes to 300 °C), you won't find a better industrial standard in this configuration than our 5618B. We recommend using the 5618B PRTs with the 1521, 1522, 1502A, 1529, or 1560 thermometer readouts.

Ordering Information

5618B-12-X	305 mm (12 in) Small Diameter Probe
5618B-9-X	229 mm (9 in) Small Diameter Probe
5618B-6-X	152 mm (6 in) Small Diameter Probe
2601	Probe Carrying Case

X = termination. Specify "B" (bare wire), "D" (5-pin DIN for Tweener Thermometers), "G" (gold pins), "I" (INFO-CON for 1521 or 1522 Handheld Thermometers), "J" (banana plugs), "L" (mini spade lugs), "M" (mini banana plugs), or "S" (spade lugs).

Specifications

Resistance	Nominal 100Ω at 0 °C
Temperature Coefficient	0.003923Ω/Ω/ °C nominal
Temperature Range	–200 °C to 500 °C (–200 °C to 300 °C for 5618B-6-X)
Drift Rate	±0.1 °C when used periodically to 500 °C
Sheath Material	316 SST
Leads	22 AWG Teflon, 6'
Termination	Specify
Hysteresis	Less than 0.01 °C at 0 °C when using –196 °C and 420 °C as the end points.
Time Constant	9 seconds max for 63.2 %
Thermal EMF	Less than 25 mV at 420 °C
Calibration	Includes manufacturer's NVLAP-accredited calibration w/ITS-90 coefficients, R vs. T values in 1 °C increments, lab code 200706-0
Size	**5618B-12:** 305 mm L x 3.2 mm dia. (12 x 1/8 in) **5618B-9:** 229 mm L x 3.2 mm dia. (9 x 1/8 in) **5618B-6:** 152 mm L x 3.2 mm dia. (6 x 1/8 in)
Probe Accuracy† (includes calibration uncertainty and short-term stability)	±0.05 °C over entire range

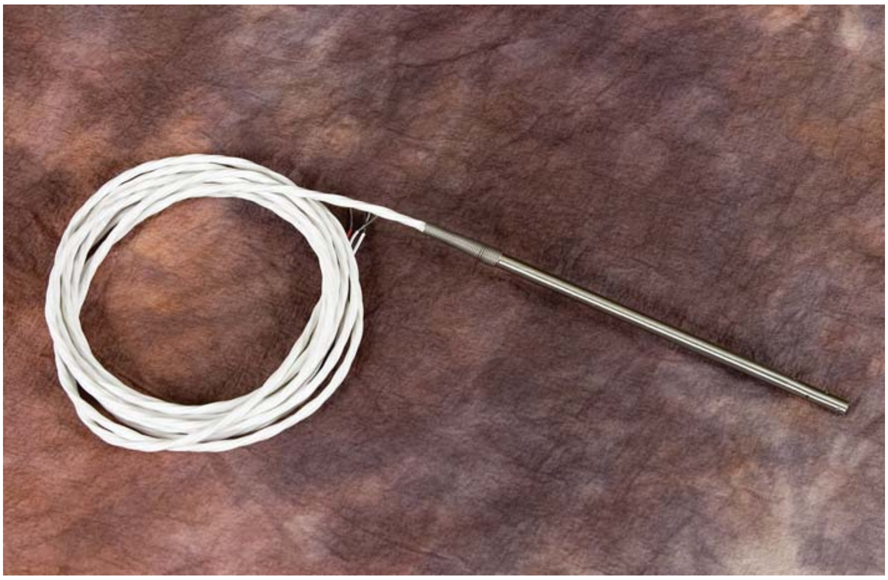
†"Accuracy" is a difficult term when used to describe a resistance thermometer. The simplest way to derive "accuracy" is to combine the probe drift specification and calibration uncertainty with readout accuracy at a given temperature.

NVLAP† Calibration Uncertainty

Temperature	Expanded Uncertainty (k=2)
–196 °C	0.024 °C
–38 °C	0.011 °C
0 °C	0.010 °C
200 °C	0.018 °C
420 °C‡	0.029 °C

Note: Calibration uncertainties depend on the uncertainties of the lab performing the calibration. Subsequent calibrations of this probe performed with different processes, at different facilities, or with changed uncertainty statements may state different uncertainties.
†Lab code 200706-0
‡300 °C for 5618B-6

Precision Freezer PRT



- Fully immersible probe assembly to –200 °C
- NVLAP-accredited calibration, lab code 200706-0
- Accuracy to ±0.05 °C over the full range

If you need a precision measurement at low temperatures, do not look any further than Hart Scientific.

The 5623B, precision "freezer probe," is specially sealed from the sensing element to the end of the probe cable, preventing ingress of moisture when exposed to temperatures as low as –200 °C. The entire assembly withstands temperatures over its full range (–200 °C to 156 °C), which is ideal for verification of freezers or autoclaves where a thermowell isn't available. The 5623B assembly can be fully immersed in fluids when the application may require use in a liquid bath. The 5623B is available in a 6.35 mm (0.25 in) dia. × 125 mm (6 in) long Inconel™ sheath. With calibration uncertainty of only ± 0.010 °C at 0 °C, the 5623B is just right as a secondary standard for calibration of other process sensors.

Most Hart Scientific readouts make an excellent companion for the 5623B. We recommend the use of the 1521, 1522, 1502A, 1529, or 1560 thermometer readouts.

With each 5623B, you receive a full NVLAP-accredited calibration report, lab code 200706-0. This report includes test data and ITS-90 calibration coefficients to enter into your Hart Scientific thermometer readout.

Ordering Information

5623B-6-X	Freezer Probe, RTD 6.35 mm dia. x 152 mm (1/4 in x 6 in), –200 °C to 156 °C
2601	Probe Carrying Case

X = termination. Specify "B" (bare wire), "D" (5-pin DIN for Tweener Thermometers),"G" (gold pins), "I" (INFO-CON for 1521 or 1522 Handheld Thermometers), "J" (banana plugs), "L" (mini spade lugs), "M" (mini banana plugs), or "S" (spade lugs).

Specifications

Resistance	Nominal 100Ω (±0.1Ω)
Temperature Coefficient	0.003925 Ω/Ω/°C nominal
Temperature Range	–200 °C to 156 °C
Transition Temperature	–200 °C to 156 °C
Drift Rate	±0.01 °C per year maximum at 0 °C, when used periodically at max temperature
Sheath Material	Inconel™ 600
Leads	Teflon™-insulated, silver-plated stranded copper, 22 AWG.
Termination	Specify. See ordering information.
Calibration	Includes manufacturer's NVLAP-accredited, lab code 200706-0, calibration and table with R vs. T values in 1 °C increments from –200 °C to 156 °C. ITS-90 coefficients included.
Probe Accuracy† (includes calibration uncertainty and short-term stability)	±0.05 °C over the full range
Cable Length	6.7 meters (20 ft)
Size	6.35 mm (0.25 in) dia. x 152 mm (6 in)

†"Accuracy" is a difficult term when used to describe a resistance thermometer. The simplest way to derive "accuracy" is to combine the probe drift specification and calibration uncertainty with readout accuracy at a given temperature.

NVLAP† Calibration Uncertainty

Temperature	Expanded Uncertainty (k=2)
–196 °C	0.024 °C
–38 °C	0.011 °C
0 °C	0.010 °C
100 °C	0.018 °C
200 °C	0.018 °C

Note: Calibration uncertainties depend on the uncertainties of the lab performing the calibration. Subsequent calibrations of this probe performed with different processes, at different facilities, or with changed uncertainty statements may state different uncertainties.
†Lab code 200706-0

Precision Industrial PRTs

FLUKE®
Hart Scientific®

- Vibration and shock resistant
- 19 mm (3/4-inch) bend radius for increased durability
- NVLAP-accredited calibration included, lab code 200706-0

When buying a PRT, performance isn't the only criterion you need to look at. The real issues are price-to-accuracy and price-to-durability ratios.

5627A probes have a temperature range up to 420 °C and an accuracy as good as ±0.025 °C. They come in three different lengths. (Both six- and nine-inch models cover –200 °C to 300 °C.) Each instrument is shipped with its ITS-90 coefficients and a calibration table in 1 °C increments.

One of the best features of this sensor is that it conforms to the standard 385 curve, letting you use your DIN/IEC RTD meters fully. Why use a probe that's less accurate than your meter?

The 5627A is manufactured using a coil suspension element design for increased shock and vibration resistance. It has a mineral-insulated sheath with a minimum bend radius of 19 mm (3/4-inch) for flexibility and durability. (Bend, if any, should be specified at time of order.)

Six- and nine-inch 5627As are calibrated at –196 °C, –38 °C, 0 °C, 200 °C, and 300 °C. For 12-inch versions the point at 300 °C is replaced by a calibration point at 420 °C.

Each probe is individually calibrated and includes a NVLAP-accredited report of calibration from the manufacturer, lab code 200706-0.

This probe is an excellent value. It has the price-to-accuracy and price-to-durability ratios you should demand in every PRT you buy!

Ordering Information

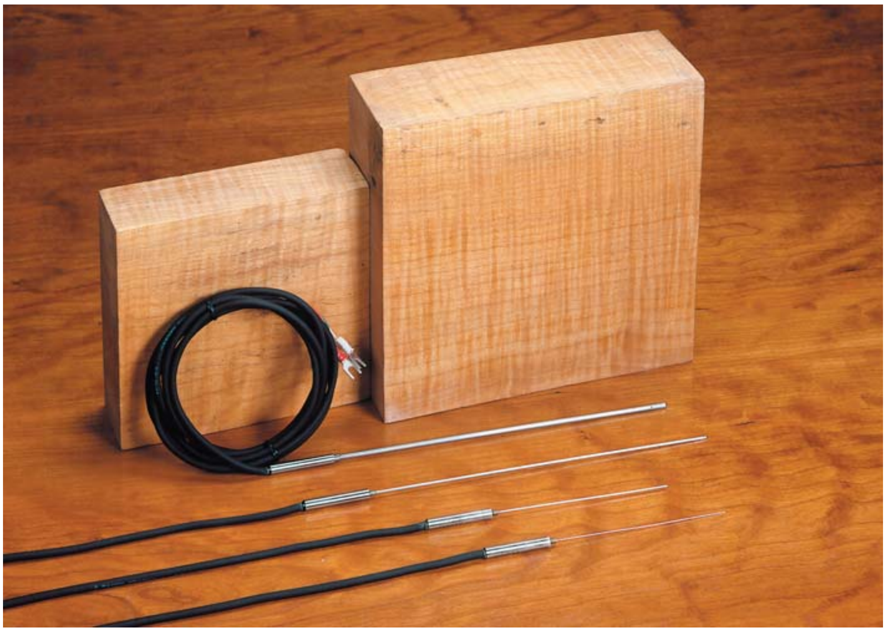
5627A-6-X	Secondary PRT, 152 mm x 4.7 mm (6 x 3/16 in), –200 °C to 300 °C
5627A-9-X	Secondary PRT, 229 mm x 4.7 mm (9 x 3/16 in), –200 °C to 300 °C
5627A-12-X	Secondary PRT, 305 mm x 6.35 mm (12 x 1/4 in), –200 °C to 420 °C
2601	Probe Carrying Case

X = termination. Specify "B" (bare wire), "D" (5-pin DIN for Tweener Thermometers), "G" (gold pins), "I" (INFO-CON for 1521 or 1522 Handheld Thermometers), "J" (banana plugs), "L" (mini spade lugs), "M" (mini banana plugs), or "S" (spade lugs).

Specifications

Resistance	Nominal 100Ω
Temperature Coefficient	0.00385 Ω/Ω/ °C nominal
Temperature Range	–200 °C to 420 °C (5627A-6 and 5627A-9 to 300 °C; transition and cable temperature: 0 °C to 150 °C)
Drift Rate	±0.13 °C at 0 °C after 1000 hours at 400 °C
Sheath Material	316 Stainless Steel
Leads	Teflon™-insulated, nickel-plated stranded copper, 22 AWG
Termination	Specify. See Ordering Information.
Time Constant	Four seconds maximum for 63.2 % response to step change in water moving at 3 fps.
Bending Radius	Sheath may be ordered with a bend on a minimum radius of 19 mm (3/4 in) except for 50 mm (2 in) area of sheath near tip. (Hart lab requires 20 cm [8 in] of unbent sheath to re-calibrate.)
Calibration	Includes manufacturer's NVLAP-accredited (lab code 200706-0) calibration and table with R vs. T values in 1 °C increments from –196 °C to 500 °C (to 300 °C for 5627A-6 and 5627A-9). ITS-90 coefficients included.
Immersion	At least 100 mm (4 in) recommended
Accuracy (includes calibration uncertainty and short-term stability)	±0.050 °C at –196 °C ±0.050 °C at 0 °C ±0.051 °C at 200 °C ±0.055 °C at 420 °C
Size	**5627A-12:**12 in L x 1/4 in Dia. **5627A-9:** 9 in L x 3/16 in Dia. **5627A-6:** 6 in L x 3/16 in Dia.

Fast Response PRTs



- Time constants as fast as 0.4 seconds
- Available as DIN/IEC Class A PRTs or with NVLAP-accredited calibration, lab code 200348-0
- Small probe diameters ranging from 0.5 mm to 3.2 mm

For special temperature measurement applications requiring fast response or short immersion over a wide temperature range, Hart's new 5622 series PRTs are the perfect solution.

Made by Netsushin, one of the world's leading PRT manufacturers, this series includes four models with stainless steel sheaths ranging from 0.5 to 3.2 mm (0.02 to 0.125 in) in diameter. Because these high-quality wire-wound sensors come in small packages, heat transfer to the sensors occurs quickly. Time constants from 0 °C to 100 °C are as fast as 0.4 seconds.

Immersion requirements for these probes is also a plus, ranging from just 10 mm to 64 mm (0.4 to 2.5 inch), depending on the model. Getting into shallow or tight places is not a problem. And because these probes can handle temperatures from –200 °C to 350 °C, they're more versatile than most thermistors.

5622 PRTs come with two calibration options. Uncalibrated, each of these probes conforms to DIN/IEC Class A requirements with accuracy of ±0.15 °C at 0 °C and ±0.55 °C at 200 °C and –200 °C. Alternatively, any 5622 PRT may be purchased with a 1923-4-N ITS-90 NVLAP-accredited comparison calibration (lab code 200348-0) that includes seven points from –197 °C to 300 °C. With calibration, short-term accuracies are achieved as good as ±0.04 °C at 0 °C.

Readout options for the Model 5622 PRTs include Hart's Little Lord Kelvin and Little Lord Logger Handheld Thermometers (page 54) as well as the 1502A Tweener Thermometer (page 52). Each of these readouts will read your PRT as a standard DIN/IEC probe or as an individually calibrated PRT.

Whatever your thermometry requirements are, come to Hart. No one else offers a wider range of standards-quality reference thermometers than Hart.

Specifications

Temperature Range	–200 °C to 350 °C
Nominal R_{TPW}	100Ω
Sensor	Four "385" platinum wires
Calibrated Probe Accuracy (includes calibration uncertainty and short-term stability)	**5622-05 and 5622-10:** ±0.04 °C at –200 °C ±0.04 °C at 0 °C ±0.09 °C at 200 °C ±0.09 °C at 300 °C **5622-16 and 5622-32:** ±0.04 °C at –200 °C ±0.04 °C at 0 °C ±0.045 °C at 200 °C ±0.055 °C at 300 °C
Uncalibrated DIN/IEC Conformity	DIN/IEC Class A; ±0.15 °C at 0 °C
Time Constant (63.2 %)	From 0 °C to 100 °C: **5622-05:** 0.4 seconds **5622-10:** 1.5 seconds **5622-16:** 3.0 seconds **5622-32:** 10 seconds (90 %)
Immersion Depth	**5622-05:** 10 mm (0.4 in) **5622-10:** 20 mm (0.8 in) **5622-16:** 32 mm (1.25 in) **5622-32:** 64 mm (2.5 in)
Thermal EMF	20 mV at 350 °C
Sheath	316 SST **5622-05:** 100 x 0.5 mm (4 x 0.02 in) **5622-10:** 100 x 1.0 mm (4 x 0.04 in) **5622-16:** 200 x 1.6 mm (8 x 0.06 in) **5622-32:** 200 x 3.2 mm (8 x 0.13 in)
Cable	PVC, 4-wire cable, 2 meters long, 90 °C max temp

Ordering Information

5622-05-X	Fast Response PRT, 0.5 mm (0.02 in)
5622-10-X	Fast Response PRT, 1.0 mm (0.04 in)
5622-16-X	Fast Response PRT, 1.6 mm (0.06 in)
5622-32-X	Fast Response PRT, 3.2 mm (0.13 in)

(All models come without calibration unless calibration purchased separately.)

1923-4-N	NVLAP-accredited Calibration, PRT Comparison, –196 °C to 300 °C, lab code 200348-0
2601	Probe Carrying Case

X = termination. Specify "B" (bare wire), "D" (5-pin DIN for Tweener Thermometers), "G" (gold pins), "I" (INFO-CON for 1521 or 1522 Handheld Thermometers), "J" (banana plugs), "L" (mini spade lugs), "M" (mini banana plugs), or "S" (spade lugs).