

General Information for PAL SPME Arrow

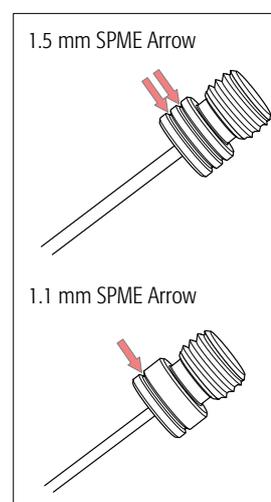
Note:

This data sheet contains important notes for the operator. It is highly recommended for operators to become familiarized with the product prior to use.

- PAL3 Firmware 2.3 is required for the use of SPME Arrows.
- The use of the SPME Arrow Conditioning Module and the Heatex Stirrer together with the SPME Arrows is essential.
- The SPME Fiber Conditioning Module cannot be used with SPME Arrows.
- Depending on the brand of the used Gaschromatograph (GC), it might be mandatory to adapt the inlet of the GC prior to the use of SPME Arrows. Please contact your GC provider for more details. Adaptation kits are available for the following types of GCs: TMO Trace Ultra / 1300 / 1310, Agilent GC 6890 / 7890, and Shimadzu GC 2010.
- To facilitate the differentiation between the two different thicknesses of the SPME Arrows, and to help avoiding any mistake, each SPME Arrow is either marked with one (1.1 mm thickness) or with two notches (1.5 mm thickness) on the threaded joint (see figure below).



PAL SPME Arrow Collection.



Differentiation of the two diameters.

PAL SPME Arrow Order Information

The PAL SPME Arrows are available in order quantities of one, three or five Arrows per box. For method development, a set of each Arrow type (set of five) is available.

| Diameter | Phase Thickness | Color Code | Set of 1 SPME Arrow Description PNo. | Set of 3 SPME Arrow Description PNo. | Set of 5 SPME Arrow Description PNo. |
|---|-----------------|------------|--------------------------------------|--------------------------------------|--------------------------------------|
| PDMS SPME Arrow (Polydimethoxysiloxane) | | | | | |
| 1.1 mm | 100 µm | Red | ARR11-P-100/20-P1 | ARR11-P-100/20-P3 | ARR11-P-100/20-P5 |
| Acrylate SPME Arrow (Polyacrylate) | | | | | |
| 1.1 mm | 100 µm | Grey | ARR11-A-100/20-P1 | ARR11-A-100/20-P3 | ARR11-A-100/20-P5 |
| Carbon WR SPME Arrow / PDMS (Carbon Wide Range / PDMS) | | | | | |
| 1.1 mm | 120 µm | Light Blue | ARR11-C-WR-120/20-P1 | ARR11-C-WR-120/20-P3 | ARR11-C-WR-120/20-P5 |
| DVB SPME Arrow / PDMS (Divinylbenzene / PDMS) | | | | | |
| 1.1 mm | 120 µm | Violett | ARR11-DVB-120/20-P1 | ARR11-DVB-120/20-P3 | ARR11-DVB-120/20-P5 |
| PDMS SPME Arrow (Polydimethylsiloxane) | | | | | |
| 1.5 mm | 250 µm | Black | ARR15-P-250/20-P1 | ARR15-P-250/20-P3 | ARR15-P-250/20-P5 |
| SPME Arrow Collection – Development Kit (1 SPME Arrow of each type Set of 5) | | | | | |
| various | | | | | ARR1115-SEL5-S1 |

Table 1. PAL SPME Arrow Order Information.

All PAL SPME Arrows have a phase length of 20 mm.

The PAL SPME Arrows can be used for a wide range of GC and injector models.

The PAL SPME Arrow assortment and the range of applications will be constantly expanded and developed.

In order to receive first-hand information, register directly under the web page www.palsystem.com.

PAL SPME Arrow Conditioning and Cleaning

Caution:

Without gas protection the SPME Arrow surface will be damaged, if exposed to elevated temperatures.

SPME Arrow Preconditioning

Prior to analytical use, it is mandatory to precondition each SPME Arrow at a specified temperature in an inert gas phase environment. The life span of the SPME Arrow can be extended if it is not unnecessarily preconditioned at maximum temperature.

Generally, it is recommended to precondition the SPME Arrow 20°C above the planned operating temperature, while respecting the maximum temperature threshold. Recommended temperatures and conditioning times are given in Table 2.

SPME Arrow Conditioning

It is part of the analytical process to condition the SPME Arrow after thermal desorption of the analytes has been completed. This conditioning is a preparatory step for the next analytical run. It is necessary to eliminate all possible contaminants from the SPME Arrow which have not been desorbed and transferred to the GC column.

To avoid contamination of the GC inlet system and/or the GC column, it is recommended to remove the SPME Arrow after the thermal desorption step from the GC injector and move the SPME Arrow Tool to the SPME Conditioning Module for the conditioning step.

The large surface of the SPME Arrow can trap impurities from the ambient atmosphere if a SPME Arrow has been left in the open. Considering this, it is good recommended practice to run a blank prior to running a series of analytical samples. Evaluating the baseline level of the GC detector helps to ensure that the entire system, such as the SPME Arrow, the GC inlet, the GC column, and detector, is free from any contaminants.

Rinsing of SPME Arrows

It is possible to clean the SPME Arrow using an organic solvent, should the SPME Arrow be subject to inappropriate storage, e.g. keeping it in the open at ambient environment without protection for a prolonged period, or if obvious dust particles are sticking to the SPME Arrow. The recommended types of solvents are listed in Table 2.

Do not use any other solvents than those mentioned here. Other solvents can cause a swelling of the SPME Arrow which would lead to significant damage. It is important that a SPME Arrow is not cleaned mechanically by any means; do not touch the SPME Arrow with fingers, not even when wearing gloves. The cleaning process can be done manually by dipping the SPME Arrow into a container filled with the appropriate solvent or in an automated manner by defining a vial for cleaning.

To avoid a potential misunderstanding, do not use a wash or waste solvent of the Wash Module from the PAL System. This solvent can be contaminated or the solvent in use may not be suitable for the particular SPME Arrow type.

General Remarks for SPME Arrow Conditioning and Cleaning

Table 2 summarizes the various parameters for conditioning and cleaning. The values provided are empirical values which are suitable for a number of applications and give reliable results. The life span of a SPME Arrow depends to a great degree on the field and type of application. Using the SPME technique, by inserting the SPME Arrow into a liquid with a high degree of matrix, the number of analyses can vary from a few to approximately 100 analyses. If the SPME Arrow is positioned in the headspace of a vial and avoids any contact with liquid and matrix, it is typically possible to run several hundred extractions.

It is not possible to visually judge the SPME Arrow quality if there are no obvious signs of major mechanical damage, such as a fracture.

Any sign of staining, caused by a starting vitrification of the surface in case of a PDMS SPME Arrow, or signs of a yellowish discoloration in the case of a Polyacrylate SPME Arrow, does not give any indication on the remaining life span of the particular SPME Arrow.

As a rule of thumb, the life span of a SPME Arrow can be extended if its exposure to high temperatures is minimized. Do not exceed the maximum temperature for each SPME Arrow type as shown in Table 2.

PAL SPME Arrow Temperature and Conditioning Recommendations

| Stationary Phase Arrow Type | Maximum Temperature (°C) | Recommended Operating Temperature (°C) | Preconditioning Temperature (°C) | | Preconditioning Time (min.) | | Conditioning Temperature (°C) | | Conditioning Time (min.) | | Arrow Rinsing Solvent | Arrow Rinsing Time (min.) | |
|--|--------------------------|--|----------------------------------|-----|-----------------------------|--------------|-------------------------------|-----|--------------------------|--------------|-----------------------------|---------------------------|--------------|
| | | | Min. | Max | Min. | Max Recom. | Min. | Max | Min. | Max Recom. | | Min. | Max Recom. |
| PDMS SPME Arrow (Polydimethylsiloxane) | | | | | | | | | | | | | |
| 100 µm | 300 | 200-300 | 200 300 | | 15 120 30 | | 200 300 | | 1 60 5 | | MeOH EtOH iProp | 0.5 10 2 | |
| Acrylate SPME Arrow (Polyacrylate) | | | | | | | | | | | | | |
| 100µm | 280 | 200-280 | 180 280 | | 15 120 30 | | 180 280 | | 1 60 5 | | MeOH EtOH aliphatic HC | 0.5 10 2 | |
| Carbon WR SPME Arrow / PDMS (Carbon Wide Range / PDMS) | | | | | | | | | | | | | |
| 120 µm | 300 | 200-300 | 180 300 | | 15 120 30 | | 180 300 | | 1 60 5 | | MeOH | 0.5 10 2 | |
| DVB SPME Arrow / PDMS (Divinylbenzene / PDMS) | | | | | | | | | | | | | |
| 120 µm | 300 | 220-300 | 200 300 | | 15 120 60 | | 200 300 | | 1 60 10 | | MeOH EtOH iProp | 0.5 10 2 | |
| PDMS SPME Arrow (Polydimethylsiloxane) | | | | | | | | | | | | | |
| 250 µm | 300 | 220-300 | 200 300 | | 15 120 60 | | 200 300 | | 1 60 10 | | MeOH EtOH iProp | 0.5 10 2 | |

Table 2. Operational Parameters for PAL SPME Arrows.

MeOH = Methanol
iProp = Iso-Propanol (2-Propanol)

EtOH = Ethanol
aliphatic HC = aliphatic hydrocarbons (example n-Hexane)

- Thermal stress shortens the lifetime of the SPME Arrow polymers. Depending on your application, choose the lowest necessary temperature, not the highest possible.
- Prevent permanent storage at conditioning temperatures.
- Injectors often have a temperature gradient whereby the setpoint might differ from the actual temperature.
- Flow of inert gas during conditioning needs to be > 20mL/minute, or PAL inlet gas pressure > 2.0 bar.

Prerequisites Mandatory Tool and Modules for the use of SPME Arrows

The PAL SPME Arrows are compatible with the following Tool and Modules:

PAL SPME Arrow Tool

The SPME Arrow Tool and the SPME Arrow collection are part of the PAL3 SPME Arrow kit.

It can be used with the PAL3 System models PAL RTC and PAL RSI or with the corresponding products and models distributed under different names by OEM partners.

For the PAL3 System, the patented SPME Arrow Holder has been developed with a maximum needle penetration depth of 70 mm.

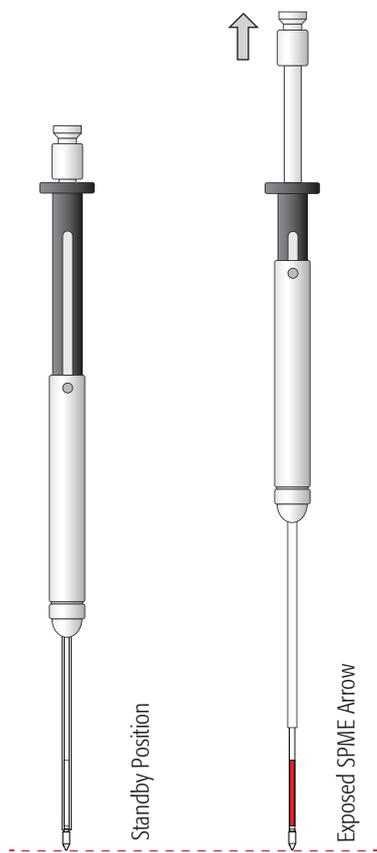
Note:
This holder cannot be used with SPME Fibers and is not compatible with the previous PAL and PAL-xt Systems.



Heatex Stirrer

A **Heatex Stirrer** is mandatory to incubate, equilibrate, and extract samples either from headspace or liquid phase (immersion).





SPME Arrow Conditioning Module

The SPME Arrow Conditioning Module offers two functions. The first function is the cleaning (bake-out) of the inserted SPME Arrow after the analytical process to prepare for the next analysis. The second function is to condition a spare SPME Arrow in an inert gas phase. This module is strongly recommended since it will help to protect the GC injection port from contamination and free up the port after thermal desorption.



SPME Arrow Adaptation Kits for GC

| | |
|------------------------|---|
| ARR-SSL-Inj-TraceUltra | SPME Arrow adaptation kit for split/splitless injector of Thermo GC Trace Ultra |
| ARR-SSL-Inj-Trace1300 | SPME Arrow adaptation kit for split/splitless injector of Thermo GC Trace 1300 / 1310 |
| ARR-SSL-Inj-GC6890 | SPME Arrow adaptation kit for split/splitless injector of Agilent GC 6890 |
| ARR-SSL-Inj-GC7890 | SPME Arrow adaptation kit for split/splitless injector of Agilent GC 7890 |
| ARR-SSL-Inj-GC2010 | SPME Arrow adaptation kit for split/splitless injector of Shimadzu GC 2010 |