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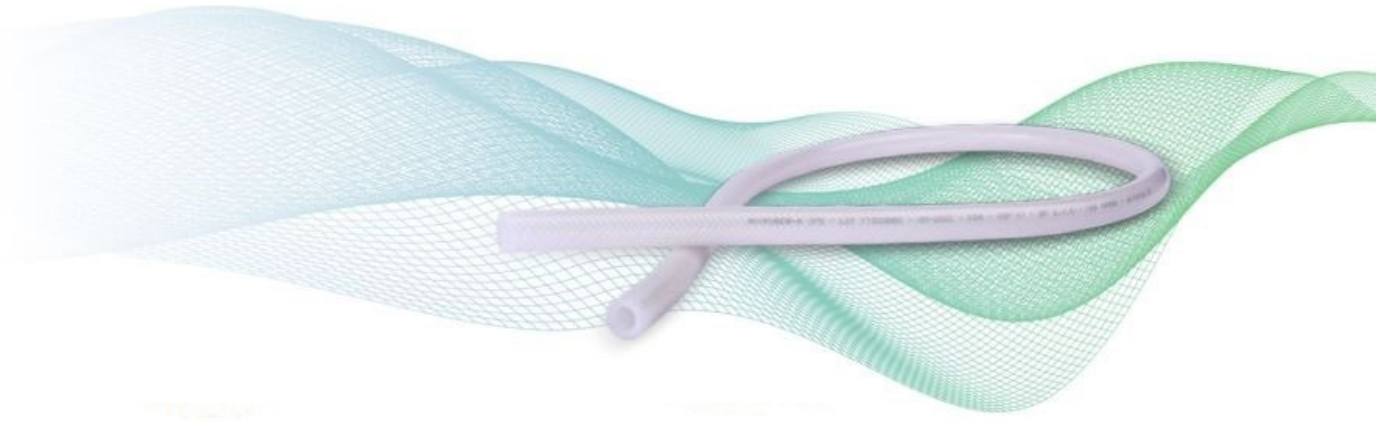
LÖSUNGEN FÜR DIE PROZESS-
UND LIFE SCIENCE INDUSTRIE

AVIPURE® – R Certification Package



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Content

1 Introduction

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1.1 Development and Production of AVIPURE®-R

avintos AG specified the technical requirements for their AVIPURE®-R highly resistant platinum cured silicone hoses with braid reinforcement and has them manufactured through their partner Raumedic AG, Helmbrecht, Germany.
AVIPURE® is a registered Trademark of avintos AG.

1.2 About Raumedic

As a partner of the international medical technology and pharmaceutical industry, Raumedic develops and produces components for customers, including hoses, catheters, and molded parts as well as complex groups of components and systems for a wide range of diagnostic and therapeutic uses.
The company is 100 percent family owned.

1.3 Security of Supply

The Raumedic manufacturing plants operate under ISO 7 clean room conditions. Consistent process performance is ensured by the ongoing qualification of all manufacturing processes and personnel.
Raumedic pursues a multiple sourcing strategy for the Silicone Pharma Grade Silicone SIK8649. Different suppliers are used for this grade to ensure the security of supply. Raumedic has validated the mechanical, physical, and chemical equivalence and will use the sources in parallel according to the market situation.
The used sources can be traced back via batch traceability at any time and fulfill the agreed specification.

1.4 cGMP Conformity

Consistent high quality of silicone hoses is assured by careful selection of the raw material, well planned and validated production technologies, and an efficient Quality Assurance Department, all of which result in high batch-to-batch reproducibility.

1.5 Quality Management System

Raumedic is certified according to ISO 13485. avintos is certified according to ISO 9001:2015.
You may download the certificates from the respective websites.

2 Technical Specifications

2.1 Hose Dimensions, Type and Part Numbers Overview

Hose coils made of Silicone SIK8649 are manufactured in several dimensions.
The color of the hoses is natural without addition of color pigments (Raumedic color no. 20900).
All hose coils are provided in double PE bags packaged in a cardboard box.

Further dimensions upon request.

TYPE	ID x OD DIMENSIONS	WALL THICKNESS	HOSE COIL LENGTH	ARTICLE-NUMBER
	MM	MM	M	
AVIPURE® - R 125	3.2 × 9.0	2.95	15	407HSR0125-15
AVIPURE® - R 250	6.4 × 12.7	3.2	15	407HSR0250-15
AVIPURE® - R 375	9.6 × 15.9	3.2	15	407HSR0375-15
AVIPURE® - R 500	12.7 × 22.2	4.7	15	407HSR0500-15
AVIPURE® - R 750	19.1 × 28.6	4.7	15	407HSR0750-15
AVIPURE® - R 1000	25.4 × 34.9	4.7	15	407HSR1000-15

TYPE	ID x OD DIMENSIONS	WALL THICKNESS	HOSE COIL LENGTH	ARTICLE-NUMBER
	INCH	INCH	FT	
AVIPURE® - R 125	0.125 × 0.355	0.116	49	407HSR0125-15
AVIPURE® - R 250	0.25 × 0.50	0.125	49	407HSR0250-15
AVIPURE® - R 375	0.375 × 0.625	0.125	49	407HSR0375-15
AVIPURE® - R 500	0.50 × 0.875	0.190	49	407HSR0500-15
AVIPURE® - R 750	0.75 × 1.125	0.190	49	407HSR0750-15
AVIPURE® - R 1000	1.0 × 1.38	0.190	49	407HSR1000-15

2.2 Material Information

AVIPURE®-R silicone pharma hoses are made of the material grade Silicone SIK8649, a high purity silicone rubber suitable for pharma applications. Chemically Silicone SIK8649 is an addition cross-linked hot vulcanisate based on vinyl methyl dimethyl polysiloxane using silicic acid fillers and a platinum catalyst.

The material can be used continuously in a temperature range from -60 °C (-76 °F) to +200 °C (+392 °F) without losing its integrity or deterioration of its chemical | physiological properties.

The material Silicone SIK8649 shows good resistance to water up to 100 °C and to low-pressure steam up to 135 °C. Steam from higher temperatures leads to degradation, especially after prolonged exposure.

Silicone SIK8649 has good resistance to weak acids and alkalis. However, the material will degrade by strong acids and alkalis, which will be promoted at higher temperatures. The resistance is strongly dependent on the polar or non-polar character of the contact medium. While there is almost no swelling in polar contact media (e.g., water/alcohol), non-polar contact media (e.g., petrol/oil) cause medium to strong but reversible swelling.

The surface is coated in a plasma process. This coating provides a less sticky surface of these silicone hoses (Low Tack - see also 2.7) in comparison with common non-coated silicone products. Silicone hoses are colourless transparent or translucent.

The reinforcement of the AVIPURE®-R silicone pharma hoses is a filament yarn which is made of Polyester. This reinforcement is required to comply with pressure applications.

2.3 Material Compliance

Based on experience and knowledge of the manufacturer about the materials and production processes the material formulation complies with / does not contain:

- Bisphenol A (BPA)
- Latex
- Phthalates
- Endocrine disruptors
- Ozone depleting substances (Regulation (EC) No 1005/2009)
- Perfluorinated chemicals (PFOA, PFOS)
- Persistent Bioaccumulative Toxins (PBTs)
- Persistent Organic Pollutants (POPs) (Regulation (EU) 2019/1021)
- Genetically Modified Organisms (GMO)
- Animal derived materials (Materials which present BSE/TSE risks)
- Conflict minerals (Dodd-Frank Act, Section 1502)
- RoHS (Directive 2011/65/EU, Directive (EU) 2015/863)
- Heavy Metals (CONEG, Directive 94/62/EC)
- CMR substances (Regulation (EC) No 1272/2008)
- Substances of Very High Concern (SVHC) as identified under article 33 of Regulation (EC) No 1907/2006 (REACH or substances listed in Annex XIV and Annex XVII
- Nanomaterials (acc. to the definition Medical Device Regulation (EU) 2017/745)

as intentionally added components above threshold limits stated in aforementioned Regulations, Directives or Laws.
However, the raw materials used, and our final product(s) are not analyzed for the presence of traces of the above-mentioned substances.

This statement is valid until revoked or until new information is provided.
If you require further information, please contact your responsible sales contact.

The reinforcement filament yarn is not in contact with the fluid.

2.4 Physical Properties

PROPERTY	NORM	SILICONE SIK8649
Shore hardness A	ISO 48-4	60 ± 5
Density (g/cm³)	ISO 1183	1.15
Tear strength (MPa)	ISO 527	≥ 8.0
Elongation at break (%)	ISO 527	≥ 500
Compression Set (%, 22h / 175 °C)	ISO 815-1 type B	≤ 15 %

The physical properties of the raw material were determined on standard test specimen. The specified values represent guide values.

2.5 Physico-Chemical Properties

2.5.1 European Pharmacopoeia: 3.1.9 & FDA regulation 21CFR, § 177.2600.

Test results
Silicone hoses in silicone rubber meets the requirements of the European Pharmacopoeia 3.1.9. and regulation 21 CFR, § 177.2600. The test methods, limits and results are those described by the E.P. monograph and listed in the table below.

TEST DESCRIPTION	E.P. 3.1.9 LIMITS	RESULTS ON SILICONE HOSES: PASS OR FAIL
Appearance of Solution	Colourless	Pass
Acidity	≤ 2.5 mL NaOH 0.01M	Pass
Alkalinity	≤ 1.0 mL HCl 0.01M	Pass
Reducing Substances	≤ 1 mL	Pass
Substances Soluble in Hexane	≤ 15 mg	Pass
Volatile Matter	< 2 %	Pass
Mineral Oils	< 1 ppm	Pass
Platinum	< 30 ppm	Pass

2.5.2 USP <661> - Containers, Physico-chemical Tests – Plastic

Test results
The silicone hoses meet the USP <661> requirements when sterilized at 50 kGy with and without aging conditions corresponding to a shelf life of 5 years.

TEST DESCRIPTION	USP <661> LIMITS	RESULTS ON SILICONE HOSES: PASS OR FAIL
Non Volatile Residue	< 15 mg	Pass
Residue on Ignition	< 5 mg	Pass
Heavy Metals	< 1 ppm	Pass
Buffering Capacity	< 10 mL	Pass

2.6 Biocompatibility

Samples of silicone pharma tubing with compound SIK8649 were tested in accordance with the below mentioned standards to assess state-of-the- art biocompatibility requirements. This includes ISO 10993 testing as well as USP class VI tests to evaluate toxicity systemically, intracutanously, and through implantation. Results according EXB_003813 Material Information Package_SIK8649-1.0, dated January 18th, 2022.

TESTING	STANDARD	RESULT
Hemolysis	ISO 10993-4	Pass
In-vitro Cytotoxicity	ISO 10993-5	Pass
Implantation	ISO 10993-6	Pass
Sensitization	ISO 10993-10	Pass
Pyrogenicity	Eur. Ph.	Pass
USP Class VI Intracutaneous Reactivity in the rabbit 1)	USP <88>	Pass
USP Class VI – Systemic Toxicity in the mouse 1)	USP <88>	Pass
USP Class VI – Implantation muscle in the rabbit 1)	USP <88>	Pass

1)Tests were performed on gamma irradiated samples (50 kGy)

Note:
AVIPURE®-R hoses are not intended for use as an implant material. Not suitable for blood or human fluids.

2.7 Hose Printing

The hoses are printed with the AVIPURE®-logo, type, size, lot number and manufacture date, but is also available unprinted.
Silicone pharma hoses with compound SIK8649 features the patented Low-Tack surface treatment providing enhanced technical and handling properties.
The biocompatibility of the ink was proven by successfully performed ISO 10993-5 and USP <88> testing.

2.8 Extractable Profile

The study on the extractables profile for silicone pharma tubing with compound SIK8649 was performed according to BPOG “BioPhorum Best Practices Guide for Extractables Testing of Polymeric Single-Use Components Used in bio- pharmaceutical Manufacturing” released in April 2020.
The assessment on gamma-irradiated and autoclaved tubing will be provided upon request.

2.9 Sterilization Compatibility

It is the responsibility of the user to validate a sterilization process with autoclave for silicone hoses.
Silicone pharma hoses with compound SIK8649 are produced for multiple use. The products will be delivered non-sterile.

Sterilization with gas (ethylene oxide, ETO), steam (up to 135 °C), gamma or X-rays (Dose: max. 50 kGy) is generally recommended. The suitability of the material must be evaluated by the user. Possible material damage depends on the sterilization conditions (temperature, pressure, energy, time, packa- ging unit and distance to the radiation source).
Multiple sterilization is not recommended, neither with different nor the same sterilization method.
However, sterilization of silicone hoses with multiple CIP/SIP-cycles at 135 °C does not impair fit, form or function of the products. The amount of the repetitions and the process conditions used are within the validation responsibility of the user. The user is obliged to examine the re-sterilizability under application-related conditions, since the number of resterilization cycles may be influenced by the flow medium/ cleaning agent and/ or mechanical stress applied throughout application lifetime.

2.10 General Properties, Shelf Life and Storage

According to the current state of-the-art individual fisheyes due to raw material and processing, foreign material, dirt inclusions and air bubbles as well as contamination on the hose surface, like intrinsic particles and fluff, cannot be completely excluded.
The following shelf life is valid for the non-sterile, originally packed products.
A slight discoloration of the material might appear over storage time which may vary from batch to batch in intensity. This material related aging effect is common and does neither affect functionality nor material properties of silicone pharma hoses with compound SIK8649 in the scope of specified physical properties as well as shelf-life.
The shelf life of the silicone pharma hoses with compound SIK8649 in non-sterile condition and originally packed is 5 years. There is no substantial change of the specified physical, chemical and physiological parameters of the hose material after that period of time.
The following storage conditions shall apply:

- Storage in original packaging
- Dry (Standard conditions 10 – 75% relative humidity)
- Temperature 15 - 25°C with short-term deviations 5 – 35°C
- Goods protected from moisture
- Goods protected from directly exposure to UV-light
- Not in the environment and in presence of chemicals, e.g. solvent and disinfectant

3 Functional Tests

3.1 Pressure Testing

The pressure ratings represent typical reference values for selected dimensions. The tests were conducted on a test bench in accordance with ISO 1402 at ambient conditions. The values are applicable for non-sterile as well as sterilized hoses.

TYPE	ID x OD DIMENSIONS	RECOMMENDED WORKING PRESSURE AT 20°C	MINIMUM BURST PRESSURE AT 20°C	MINIMUM BEND RADIUS	ARTICLE-NUMBER
AVIPURE®	**MM**	**BAR**	**BAR**	**MM**	
R 125	3.2 × 9.0	17.0	40.0	28	407HSR0125-15
R 250	6.4 × 12.7	12.0	35.0	33	407HSR0250-15
R 375	9.6 × 15.9	12.0	30.0	51	407HSR0375-15
R 500	12.7 × 22.2	9.0	25.0	76	407HSR0500-15
R 750	19.1 × 28.6	6.0	15.0	102	407HSR0750-15
R 1000	25.4 × 34.9	4.0	11.0	150	407HSR1000-15

TYPE	ID x OD DIMENSIONS	RECOMMENDED WORKING PRESSURE AT 68°F	MINIMUM BURST PRESSURE AT 68°F	MINIMUM BEND RADIUS	ARTICLE-NUMBER
AVIPURE®	**INCH**	**PSI**	**PSI**	**INCH**	
R 125	0.125 × 0.355	250	580	1.1	407HSR0125-15
R 250	0.25 × 0.50	175	510	1.3	407HSR0250-15
R 375	0.375 × 0.625	170	440	2.0	407HSR0375-15
R 500	0.50 × 0.875	130	360	3.0	407HSR0500-15
R 750	0.75 × 1.125	90	220	4.0	407HSR0750-15
R 1000	1.0 × 1.38	60	160	6.0	407HSR1000-15

Remarks:

- The bursting pressure of the AVIPURE® - R hose is reduced by around 20% per temperature increase of 93°C until the maximum hose temperature is reached. The reduction is linear
- Pressure limit rates can be limited by used end connections
- Norm: ISO 1307 for dimensional tolerances
- Technical contents are subject to change with revision but without prior notice

4 BPOG studies on SIK8649

The studies were designed to provide extractables profiles for SIK8649 biopharmaceutical tubing (autoclaved and gamma irradiated) using 6 different test solutions according BPOG protocol in the version from 2014. They include:

1. pure water
2. 50 % ethanol (v/v)
3. 5 M NaCl
4. 1 % Polysorbate 80
5. 0.1 M H3PO4
6. 0.5 M NaOH.

If you require further information, please contact your responsible sales contact.