# SPECIFICATION AP-S2920

# SILOXANE AND POLYSILOXANE COATINGS FOR THE LONG-TERM PROTECTION OF STEEL AND MASONRY

## 1 SCOPE

This specification applies to siloxane coatings for application to masonry surfaces and steel on which optimum surface preparation can be achieved.

## 2 BACKGROUND

a) To obtain a broad overview of the Australian Paint Approval Scheme (APAS), refer to APAS document AP-D001.
b) To obtain an overview of restricted ingredients in APAS certified products, refer to APAS document AP-D123.
c) To obtain the current list of APAS participating manufacturers (and suppliers) and resellers, refer to APAS document AP-D152.
d) To obtain an overview of how to participate in the APAS, refer to APAS document AP-D177.
e) APAS approval to this specification may be gained by compliance with the requirements detailed in this specification and those in APAS document AP-D192.

## 3 DESCRIPTION AND GUIDE FOR USERS

### 3.1 General Requirements

a) This specification applies to siloxane coatings for application to masonry surfaces and steel on which optimum surface preparation can be achieved.
b) Products can be either one or two-pack, pure siloxane or organic modified (polysiloxane). They are principally used where high corrosion resistance and a high level of durability – resistance to weather – is required.
c) A key benefit of these coatings is that they give the high durability of polyurethanes without any of the health concerns associated with isocyanate-cured products.
d) Where steel surface preparation is likely to be marginal and surface tolerant coatings are required, reference should be made to APAS specification AP-S0156.
e) These systems are intended to provide a service life in excess of 10 years under Category C3 Medium environmental conditions (AS 2312.1) or in situations where frequent maintenance is impractical.
f) Table 6.3 of AS 2312.1 should be consulted for likely times to first maintenance in more or less aggressive environments and for different coating systems.
g) The manufacturer's technical/product data sheet should confirm that the exposure conditions to which the coating system is to be exposed is within the capabilities of that system.
h) Approvals under this specification will usually be Systems approvals for atmospheric exposure. However, other classes of exposure may also be relevant, refer to clause 3.2 below.

### 3.2 Sub-Classes

a) This specification incorporates the following sub-class:
   i. **2920/1:** Topcoats primarily for corrosion resistance
   ii. **2920/2:** Topcoats primarily for atmospheric durability
   iii. **2920/3:** Other specialised application topcoats e.g. high temperature resistance

### 3.3 Basis of this Specification

a) This specification is not based on any know standard or specification.
b) Paints approved under this specification are described under Paint Reference Number (PRN) C37 of AS 2312.1.

## 4 REFERENCED DOCUMENTS

a) The following standards are referenced in this document:

   i. **AS/NZS 1580** – Paints and related materials: Methods of test
   ii. **AS 2312.1** – Guide to the protection of structural steel against atmospheric corrosion by the use of protective coatings – Part 1: Paint Coatings
   iii. **ASTM G85-19** – Standard Practice for Modified Salt Spray (Fog) Testing
   iv. **ASTM G154-16** – Standard Practice for Operating Fluorescent Ultraviolet (UV) Lamp Apparatus for Exposure of Non-metallic Materials
   v. **ISO 20340** – Paints and Varnishes – Performance Requirements for Protective Paint Systems for Offshore and Related Structures
   vi. **MIL-PRF-23236 Revision D** – Coating Systems for Ship Structures – Revision D

These documents may be purchased through the Reference Standards Australia website: https://www.standards.org.au/

   vii. **The Poisons Standard June 2021**: Standard for the Uniform Scheduling of Medicines and Poisons (SUSMP) No. 33, Part 2: Control on Medicines and Poisons, Section Seven / Appendix I Paint or Tinters

This document is available from the Australian Government Federal Register of Legislation website at: https://www.legislation.gov.au/Details/F2021L00650

b) The following APAS documents are referenced in this document:

   i. AP-D001 Rules Governing How APAS® Operates
   ii. AP-D123 Restrictions on Ingredients in Product Formulations
   iii. AP-D152 APAS® Participating Manufacturers and Resellers
   iv. AP-D177 Rules Governing How Product Manufacturers participate in APAS®
   v. AP-D181 Volatile Organic Compounds (VOC) Limits
   vi. AP-D192 Rules Governing APAS® Product Certification Scheme
   vii. AP-S0091 Enamel in Pressure Pack
   viii. AP-S0156 Epoxy Mastic High Build Two-Pack Coating for Rusted Steel

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All APAS documents are available for download from the APAS website: https://vs.csiro.au/apas/documents/

All APAS specifications are available for download from the APAS website: https://vs.csiro.au/apas/specifications/

## 5 COMPOSITIONAL REQUIREMENTS

### 5.1 Binder

a) Although not restricted by this specification, typically the binder shall be either a pure siloxane or an organically modified siloxane, available as either a single or two-pack product.
b) The organic modification shall be typically acrylic, urethane or epoxy (or other) to achieve the desired balance of properties.

### 5.2 Volatiles

a) Although the product is high solids, low VOC, the volatile portion will typically be comprised either of hydrocarbons or oxygenated solvents.
b) For VOC content restrictions, refer to APAS document AP-D181.

### 5.3 Pigmentation

a) The pigmentation shall be chosen to impart the properties detailed in clause 10, Table 1 below.

### 5.4 Colour

a) Products approved under this specification are normally available in a wide range of colours.

## 6 PRODUCT APPROVAL REQUIREMENTS

### 6.1 General Requirements

a) The product and its application for approval shall comply with the relevant requirements of APAS document AP-D192 during the life of the approval.

### 6.2 Technical Requirements

a) The product shall comply with **all** the requirements of clause 10, Table 1 below.

### 6.3 Health and Safety Requirements

a) The manufacturer's Safety Data Sheet (SDS) must be studied closely prior to using the product and complied with during use of the product.
b) As products covered by this specification may contain solvents, the paint is considered flammable and should be stored away from all sources of heat or ignition.
c) Containers should be resealed immediately after use and good ventilation provided during use to minimise the risk of fire or explosion and the long-term toxic effects of absorption of the vapour into the lungs.
d) Care should be taken to avoid contact with the skin using protective clothing and barrier cream. All pumping equipment should be adequately earthed. A full-face air fed respirator should be used when spraying.
e) Products intended for sale in Australia shall comply with all the requirements of the SUSMP. Products intended for sale in other countries shall comply with all local WHS and environmental requirements.
f) The product shall comply with all requirements of clause 6.3 and 6.4 of APAS document AP-D192.

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## 7 APPENDIX A

### Accelerated Durability Tests

**7.1** **General:** CLASS II (Interim) approval [refer to APAS document AP-D192, clause 7.2 b)] may be given on the basis of satisfactory performance of accelerated durability test defined below.

**7.2** This test is based on ISO 20340 Paints and Varnishes – Performance requirements for protective paint systems for offshore and related structures – Annex A.

**7.3** **Apparatus:**

i. Panels: Mild steel of suitable size coated in the applicant full coating system (including primer and/or intermediate coats) according to manufacturer's recommendations and cured for a minimum of 7 days at routine conditions. Triplicate panels are required plus one unexposed control. The exposure panels shall be scored through to base metal with an **X** of minimum dimensions 75 mm
ii. Fluorescent UV-Condensation exposure chamber complying with ASTM G154 e.g. QUV incorporating UVA-340 lamps
iii. Salt fog/dry cabinet complying with ASTM G85 Annex A5 e.g. Q-FOG
iv. Freezer capable of maintaining -20 ± 2 °C
v. Microscope

**7.4** **Exposure Conditions:** The test panels are exposed to alternating cycles of 72 hours in the QUV chamber (Friday AM to Monday AM) followed by 72 hours in the Q-FOG chamber (Monday AM to Thursday AM) followed by 24 hours in a freezer at -20 ± 2 °C.

**7.5** Settings for the QUV shall be:

i. 4 hours UV (using UVA-340 lamps) at 60 ± 3 °C. This shall be followed by
ii. 4 hours condensation at 50 ± 3 °C.

**7.6** Settings for the Q-FOG shall be:

i. 1 hour salt fog at 25 °C. The salt electrolyte shall comprise 0.05% sodium chloride and 0.35% ammonium sulphate. This shall be followed by
ii. 1 hour dry off at 35 ± 2 °C.

**7.7** The cycle shall be repeated until the required number of hours has been achieved.

## 8 APPENDIX B

### Method for Assessing Protection Against Graffiti

**8.1** **General:** All panel conditioning, coating application, curing and graffiti removal shall be carried out under routine drying conditions.

**8.2** **Panel Preparation:**

i. Apply the coating (system) to a mild steel panel 300 x 150 mm, according to the coating manufacturer's instructions and allow to cure for 7 days.
ii. Apply black spray pack enamel (approved to APAS specification AP-S0091) at a nominal dry film thickness of 30µm to approximately 20% of the panel area and allow to dry for 96 hours.
iii. Using a broad tip (approx. 1cm wide) solvent based felt tip marking pen, apply several approx. 1cm wide stipes to a clean section of panel close to the spray paint.

**8.3** **Assessment:**

i. Attempt to remove the markings using the thinning solvent for the product (or a nominated graffiti remover) in accordance with the manufacturer's instructions.
ii. Rinse panel free of remover/graffiti residues with water, wipe dry. The coating shall exhibit complete removal of the markings and no discernible effect on the graffiti barrier.
iii. Condition the test panel examined for a further 2 hours ± 5 minutes and repeat steps 8.2 ii. to 8.3 ii. ensuring the **graffiti** is applied to the same area of the test panel as previously.
iv. Repeat step 8.3 iii. to provide a test sequence comprising 3 complete cycles of graffiti application and removal.

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## 9 APPENDIX C
### Edge Retention Test

**9.1 General:**

Products with high surface tension properties and too much flow, can cause issues with product **running away** from sharp edges. The resulting low film builds at these sharp edges can reduce the protecting properties of the coating, resulting in premature breakdown of the coating. Edge retention becomes critical in two coat systems offering long term service e.g., 15-25 years, compared to typical 3 or 4 coat systems. Consequently, edge retention is a critical parameter in the evaluation of siloxane and polysiloxane coatings.

Evaluation of edge retention must be carried out on the recommended system, not the coating on its own, as the creep from bare metal is not necessarily the same as from a primer/intermediate coat.

**9.2 Apparatus:**

i. Aluminium extrusion 60 mm sides, approx. 180 mm long and approx. 3 mm cross-section. The extrusion angle shall be 90 ± 3 degrees. Radius of curvature at the bend shall not be greater than 1.0 mm. These extrusions are available as **off the shelf** items.
ii. Microscope with attachments capable of measuring dry film builds of less than 20 microns.

**9.3 Procedure:**

**9.3.1 Sample Preparation:**

i. Using a rag wetted with a suitable hydrocarbon solvent, wipe the angle clean of any contaminants.
ii. Using 80 grit emery paper, abrade both flat faces of the angle including the ridge. Clean off any residue using the rag in 9.3.1 i. above.
iii. Prepare the paint sample for spraying according to the manufacturer's directions.

**9.3.2 Paint Application:**

i. Using a conventional spray gun, and with the long side of the angle vertical, within one minute spray square onto each face sufficient paint to achieve the manufacturer's recommended wet film thickness on each flat face. The final pass shall be made to the sharp edge of the extrusion. The aim is to achieve the correct dry film thickness (DFT) on both flat faces and to determine the resulting DFT on the edge.
ii. Immediately after application of the correct amount of paint, transfer the aluminium angle to the drying area and allow curing to take place in a vertical orientation for a period of seven days in routine conditions.

**9.3.3 Dry Film Thickness (DFT) Determination:**

i. Using a band saw or a hacksaw, cut the angle into nine samples approx. 20 mm in length.
ii. Using either polyester or epoxy casting resin, cast groups of 3 angle sections together, resulting in 3 casts with 3 sections in each cast.
iii. Grind the cold mounts using either fine emery paper or a polishing machine to yield a surface from which the film builds can be measured.
iv. Using a microscope with a calibrated graticule, on each section, take two (2) DFT measurements on each flat surface and one reading on the peak. Calculate and record the average $DFT_{flat}$ of each section. Repeat for the other 8 sections.
v. For each section, calculate the ratio:

$$\frac{DFT_{peak}}{DFT_{flat}}$$

Express ratio as a percentage.

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## 10 TABLE 1: PERFORMANCE PROPERTIES

| TEST | AS/NZS 1580 METHOD | REQUIREMENTS |
|---|---|---|
| **For EACH Component** | | |
| Preliminary Examination | 103.1 | To be readily reincorporated. Shall be free of coarse particles, gel and foreign matter. |
| Density | 202.1 or 202.2 | Value to be reported. |
| Non-Volatile Content | 301.1 | Value to be reported. |
| VOC Content | APAS AP-D181 | Refer to APAS document AP-D181 for method and limits.<br>If the APAS specification is not listed on AP-D181, a declaration of VOC content **is still required**. |
| **Wet Mixed Paint Tests** | | |
| Preliminary Examination | 103.1 | The mixed material shall be readily reincorporated. Shall be free of coarse particles, gel and foreign matter. |
| Volume Solids | 301.2 | Value to be reported. |
| Thinning or Mixing Properties | 208.1 | Using 10% of manufacturers recommended thinner, there shall be no signs of incompatibility. |
| Viscosity | 214.x | State method and record results. |
| Application | 205.2 or 205.4 | When sprayed to the specified wet film build, a film free of bits and film defects shall result with no clogging of the spray gun. |
| Storage Properties | 211.1 | When stored at 25°C for 18 months, the material shall not exhibit settling rating less than 6. Any settlement shall be easily reincorporated with manual stirring. |
| Aged Application | 205.2 or 205.4 | When the aged sample (refer to Storage Properties above) is applied by spray application, it shall produce a film equivalent in appearance to the initial application test panel. |
| Pot Life (if applicable) | 214.x | Shall not be less than 2 hours. |
| VOC Content | APAS AP-D181 | Refer to APAS document AP-D181 for method and limits.<br>If the APAS specification is not listed on AP-D181, a declaration of VOC content **is still required**. |

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| TEST | AS/NZS 1580 METHOD | REQUIREMENTS |
|---|---|---|
| **Dry Film Tests – ALL Sub-classes** | | |
| Surface Dry Time | 401.1 | Shall not be greater than 4 hours. |
| Hard Dry Time | 401.6 | Shall not be greater than 12 hours. |
| Curing | 403.1 | After 7 days curing at routine conditions, the film shall withstand a load of 1500gm. |
| Flexibility | 402.1 | When sprayed onto tinplate panels and air dried at routine conditions for 28 days there shall be no cracking, loss of adhesion or separation of the coats when bent around a 12mm mandrel and examined at 10X magnification. |
| Direct Impact Resistance | 406.1 | An impact of 5 Joules shall not produce any cracking, chipping or lifting of the film. |
| Adhesion | 408.5 | Not less than 3 MPa for manufacturer's recommended system over Class 2 ½ blast cleaned mild steel after 7 days curing at routine conditions. |
| Specular Gloss | 602.2 | Not less than 80% on a 60° head when drawn down on glass. |
| Finish | Visual | The sprayed finish shall be smooth and free of defects, uniform in visual colour and gloss and typical of the product. |
| Recoating Properties | 404.1<br><br><br><br>402.1<br><br>403.1<br><br>408.2 | When a film that has been cured for 7 days at routine conditions is resprayed with another coat of the same product at the recommended wet film build, there shall be no wrinkling, lifting or cracking or other defect in the original coat.<br>No cracking, loss of adhesion or separation of the coats when bent around a 6mm mandrel.<br>Shall withstand a 1500gm load.<br>Adhesion rating shall not be greater than 0. |
| Edge Retention | Clause 9, Appendix C | Average ratio shall not be less than 70% with no single reading less than 50%.<br>**NOTE:** Based on US Navy specification MIL-PRF-23236. |
| Accelerated Durability | Clause 7, Appendix A<br>481.1.5<br><br>481.1.7<br>481.1.8<br>481.1.9<br>481.1.11<br>481.1.12<br>481.3<br>408.5 | After 4200 hours (25 cycles) at the specified exposure, ratings shall not be greater than the following:<br>Gloss change — Not less than 75% of original gloss shall be retained.<br>Checking — 0<br>Cracking — 0<br>Blistering — 0<br>Chalking — 0<br>Colour change — 0<br>Corrosion — Visible corrosion rating not greater than 0<br>Adhesion — Not less than 50% of original value |

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| TEST | AS/NZS 1580 METHOD | REQUIREMENTS |
|---|---|---|
| **Dry Film Tests – ALL sub-classes (Cont.,)** | | |
| Resistance to Weathering | 457.1 | After **72 months exposure** at all 3 atmospheric exposure sites (listed in APAS document AP-D192, clause 12), all panels shall exhibit ratings not greater than those nominated in the accelerated weathering test above **except that** gloss retention shall be not less than 75% of original value and colour change shall be not greater than ΔE of 1.5 (white or off-white only).<br>CLASS II (Interim) approval may be granted on the basis of the above results being achieved at 48 months.<br>**All** results shall be reported. |
| Resistance to Graffiti | Clause 8, Appendix B | **AP-S2920/1 & AP-S2920/2 only.**<br>When tested according to clause 8, Appendix B, there shall be no softening, marking or marring of the film after removal is complete. All graffiti shall be easily removed. |
| **Dry Film Tests – Sub-class 2920/1 ONLY** | | |
| Corrosion Resistance | 481.3 | Creep from the scribe shall not be greater than 3 mm. |
| Resistance to Chemicals | | A drop each of 10% nitric acid, 10% sulphuric acid and 10% sodium hydroxide, when left for 2 hours at routine conditions under a watch glass, shall have no effect on the film surface. |
| Resistance to Solvents | | A drop each of solvents methoxy propanol (monopropylene glycol methyl ether), white spirit, xylene and butyl acetate, when left for 2 hours at routine conditions under a watch glass, shall have no effect on the film surface when inspected 60 minutes after removal from exposure. |
| **Dry Film Tests – Sub-class 2920/3 ONLY** | | |
| Heat Resistance (if applicable) | <br><br><br>406.1<br>402.1<br>601.4<br>602.2 | A 250µm DFB film of the paint system (primer(s) and topcoats) shall be heated for 2 hours at 200°C then allowed to come to room temperature for 60 minutes.<br>**Impact Resistance:** Not less than 50% of original figure.<br>**Flexibility:** No cracking around a 12mm mandrel.<br>**Colour Change:** Shall be not greater than ΔE of 1.5.<br>**Gloss Change:** Not less than 75% of original. |

## 11 APPENDIX D

**Document History**

Status: Current
Version: 9
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| Document Version No.: | Date Published: | Summary of Changes: |
|---|---|---|
| 9 | 14-09-2021 | • General format changes<br>• Updated background information in clause 2<br>• Updated SUSMP information<br>• Updated APAS website information |
| 8 | 21-12-2020 | • Addition of Appendix D Document History and removal of the Editorial Note previously used in specification versions<br>• Updated document to the current format<br>• Updated internal and external document references<br>• Inclusion of VOC Content requirement to Table 1 Performance Properties<br>• Addition of “People + Product = Protection” to Footer |
| 7 | 21-12-2005 | • Updated for allowing acrylic, urethane or epoxy modified siloxanes<br>• Tightened up the testing requirements<br>• Removed reference to GPC and incorporated a general format update |
| 6 | 23-05-2001 | • Initiated the second stage of the move to new specification numbering with prominence given to the new number (previously GPC-C-29/20) |