SECTION 07900
JOINT SEALANTS AND EXPANSION JOINT SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:
   1. Surface preparation, installation, and quality control requirements of sealant in control joints, construction joints, and cracks in concrete.
   2. Specification of expansion and control joint systems.

1.2 RELATED SECTIONS

A. The following are related to Work in this Section, but are specified in other Sections:
   1. Section 09900 – Protective Coatings

1.3 DEFINITIONS

A. Adhesion – The bonding of one material to another (sealant to a substrate).

B. Adhesive Failure – Failure that occurs when a sealant pulls away from the surface or substrate to which it was bonded.

C. Bond Breaker – Material such as tape or backer rod designed to prevent three-sided adhesion.

D. Backer Rod – Flexible foam used behind sealant to increase elasticity, control the thickness and configuration of the sealant and provide a bond breaker to prevent three-sided adhesion.

E. Class 12.5 Sealant – A sealant that, when tested for adhesion or cohesion under cyclic movement per ASTM C719 will withstand an increase and decrease of at least 12.5% of the joint width as measured at the time of application.

F. Class 25 Sealant – A sealant that, when tested for adhesion or cohesion under cyclic movement per ASTM C719 will withstand an increase and decrease of at least 25% of the joint width as measured at the time of application.

G. Class 35 Sealant – A sealant that, when tested for adhesion or cohesion under cyclic movement per ASTM C719 will withstand an increase and decrease of at least 35% of the joint width as measured at the time of application.

H. Class 50 Sealant – A sealant that, when tested for adhesion or cohesion under cyclic movement per ASTM C719 will withstand an increase and decrease of at least 50% of the joint width as measured at the time of application.

I. Class 100/50 Sealant – A sealant that, when tested for adhesion or cohesion under cyclic movement per ASTM C719 will withstand an increase of at least 100% of the joint width and decrease of 50% of the joint width as measured at the time of application.

J. Coefficient of Expansion – The amount a material increases and decreases in size with temperature changes.

K. Cohesion – The molecular attraction (internal strength) that holds the body of a sealant or adhesive together.

L. Cohesion Failure – Failure that occurs when the sealant fails to hold together.

M. Elastomeric – A material having the property of returning to its original shape and position.

N. Elongation – The lengthening or stretching ability of a sealant to accommodate movement.

O. Grade NS – A non-sag or gun grade sealant.

P. Grade P – A pourable of self-leveling sealant.

Q. Hardness – The ability of a sealant to resist surface penetration by a blunt probe.

R. Joint – A longitudinal or lateral opening that occurs when any two building surfaces meet. Within concrete, joints (cracks) also propagate at locations where movement and/or internal stresses occur.
   1. Static Joint – Fixed, non-moving, non-working joints not subject to extreme thermal changes.
   2. Dynamic Joint – Moving joints that experience expansion and contraction from thermal changes.

S. Modulus – Ration between stress and strain classified as low, medium and high. Low modulus material stretches more easily.

T. Primer – A material applied to joint faces to improve the adhesion of sealants.

U. Substrate – The surface(s) to which a sealant is applied and bonded to.

V. Three-Sided Adhesion – Adhesion of sealant to a substrate on three sides. In dynamic joints, subsequent movement from three sides often causes adhesive failure, cohesive failure or both.

W. Tooling – Application technique to force a material against a backing and the surfaces of a joint to provide a smooth finished look and provide better adhesion to the substrate.

X. Type M – A multi-component sealant.

Y. Type S – A single component sealant.

Z. Use A – A sealant that meets the bond requirements when tested on aluminum specimens.

AA. Use G – A sealant that meets the bond requirements when tested on glass specimens.

BB. Use I – A sealant that meets the bond requirements when tested in immersion.

CC. Use M – A sealant that meets the bond requirements when tested on mortar specimens.

DD. Use O – A sealant that meets the bond requirements when tested on substrates other than standard substrates (glass, aluminum & mortar).

EE. Use NT – A sealant designed for use in non-traffic areas.

FF. Use T – A sealant designed for use in pedestrian and vehicular traffic areas.

1.4 REFERENCE STANDARDS

A. Reference Standards (Refer to the latest edition):
   1. American Society for Testing and Materials (ASTM):
      a. ASTM C661: Standard Test Method for Indentation Hardness of Elastomeric-Type Sealant by Means of a Durometer
      b. ASTM C679: Standard Test Methods for Tack-Free Time of Elastomeric Sealants
      c. ASTM C711: Standard Test Method for Low-Temperature Flexibility and Tenacity of One-Part, Elastomeric, Solvent-Release Type Sealants
      d. ASTM C717: Standard Terminology of Building Seals and Sealants
      e. ASTM C719: Standard Test Method for Adhesion and Cohesion of Elastomeric Joint Sealants Under Cyclic Movement
      f. ASTM C732: Standard Test Method for Aging Effects of Artificial Weathering on Latex Sealants
      g. ASTM C734: Standard Test Method for Low-Temperature Flexibility of Latex Sealants After Artificial Weathering
      h. ASTM C736: Standard Test Method for Extension-Recovery and Adhesion of Latex Sealants
      i. ASTM C794: Standard Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants

j. ASTM C834: Standard Specification for Latex Sealants
k. ASTM C919: Standard Practice for Use of Sealants in Acoustical Applications
l. ASTM C920: Standard Specification for Elastomeric Sealant
m. ASTM C1183: Standard Test Method for Extrusion Rate of Elastomeric Sealants
n. ASTM C1193: Standard Guide for Use of Joint Sealants
o. ASTM C1241: Standard Test Method for Volume Shrinkage of Latex Sealants During Cure
p. ASTM C1248: Standard Test Method for Staining of Porous Substrate by Joint Sealants
q. ASTM C1299: Standard Guide for Use in Selection of Liquid-Applied Sealants
r. ASTM C1330: Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid-Applied Sealants
s. ASTM C1375: Standard Guide for Substrates Used in Testing Building Seals and Sealants
t. ASTM C1382: Standard Test Method for Determining Tensile Adhesion Properties of Sealants When Used in Exterior Insulation and Finish Systems (EIFS) Joints
u. ASTM C1521: Standard Practice for Evaluating Adhesion of Installed Weatherproofing Sealant Joints
v. ASTM D70: Standard Test Method for Density of Semi-Solid Bituminous Materials (Pycnometer Method)
w. ASTM D412: Standard Test Method for Vulcanized Rubber and Thermoplastic Elastomers - Tension
x. ASTM D624: Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers
y. ASTM D638: Standard Test Method for Tensile Properties of Plastics
z. ASTM D903: Standard Test Method for Peel or Stripping Strength of Adhesive Bonds
aa. ASTM D1004: Standard Test Method for Tear Resistance (Graves Tear) of Plastic Film and Sheeting
bb. ASTM D2202: Standard Test Method for Slump of Sealants
cc. ASTM D2203: Standard Test Method for Staining from Sealants
dd. ASTM D2240: Standard Test Method for Rubber Property-Durometer Hardness
ee. ASTM D3960: Standard Practice for Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings
ff. ASTM E84: Standard Test Method for Surface Burning Characteristics of Building Materials
gg. ASTM G155: Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Non-Metallic Materials

1.5 SUBMITTALS

A. CONTRACTOR shall provide the following submittals, specific to this Section, to OWNER for review and/or approval:
   1. Pre-Award Submittals: Submitted as part of the Bid Process.
      a. CONTRACTOR and Subcontractor qualifications:
         1) Include CONTRACTOR and individual certifications, licenses, work experience and related documentation.
         2) Include evidence that company has a minimum of 5-years continuous experience in application of specified materials. Submit list of at least five completed Projects of similar scope and size, including:
            a) Project Name.
            b) Owner's Name.
            c) Owner's Representative's Name, Address and Contact Information.
            d) Description of Work.
            e) Sealant(s) Used.
            f) Project Manager / Supervisor.
            g) Total cost of Sealant Work.
            h) Start and Completion Date.

b. Intent to Warrant and Sample Warranty.
    1) Copy of warranty, stating obligations, remedies, limitations, and exclusions.
2. Pre-Construction Submittals: Submitted prior to Work.
    a. Product Data / Safety Data: Sealant manufacturer's literature including written instructions for evaluating, preparing and treating substrate, technical data including tested physical and performance properties, installation instructions and safety data. Include:
        1) Temperature ranges for storage and application of materials, and special cold-weather application requirements or limitations.
        2) Manufacturer's recommendations for substrate cleaner and substrate primer for specific substrate surface and conditions.
        3) Manufacturer's color card showing range of colors available for each product exposed to view.
    b. Letter from Manufacturer indicating that specific sealant products and auxiliary products are recommended for control joint and crack types and exposures on Project. Based on mockups, include specific recommendations for surface preparation and primers for Project.
    c. Quality Control Forms.
        1) To be submitted as part of Quality Control System.
    d. Product Samples.
3. During Construction: Submitted at specified intervals during construction.
    a. Quality Control Documentation (weekly or as requested).
    b. Quality Assurance Documentation.
4. Closeout Documents: Submitted upon Project completion and prior to final payment.
    a. Final Warranty.
    b. Submit a letter from the sealant manufacturer indicating that a representative portion of all major steps in the sealant work were inspected by the manufacturer and that all that work was performed in accordance with the manufacturer's recommendations and instructions.
    c. Record Documentation.
        1) Includes as-built documentation and records of work completed such as red-lines drawings, specifications, etc.
    d. Construction Photos.
    e. Quality Control Documentation.

1.6 QUALITY CONTROL AND ASSURANCE REQUIREMENTS

A. Installer Qualifications:
1. Approved, authorized, or licensed by sealant manufacturer to install sealant and eligible to receive sealant manufacturer's warranty.
2. Must have documented installations of specified materials in local area in use for minimum of 5 years.
    a. Employ foreman with minimum 5-years of experience as foremen on similar projects to be on-site at all times.
    b. Employ only personnel who have been trained, or approved, by the Sealant Manufacturer in writing as being qualified to perform the sealant Work covered herein.

B. Quality Control:
1. General:
    a. Verify existing dimensions and details prior to installation of materials. Notify OWNER of conditions found to be different than those indicated in Contract Documents. OWNER will review situation and inform CONTRACTOR and Applicator of changes.
    b. Inspect all materials upon receipt to verify product and condition.
    c. Inspect to verify that specified storage conditions for materials are provided

d. Do not use or retain contaminated, outdated, or improperly stored materials. Do not use materials from previously opened containers.
e. Make available all locations and phases of the work for periodic and/or required observation and/or inspection by OWNER, OWNER's designated representative and/or Quality Assurance Inspector.
    1) The CONTRACTOR shall provide necessary access, support, ventilation, egress, safety and other means required.
f. Provide daily quality control reports to OWNER on a weekly basis, or as requested. Submit reports in a Portable Document Format (PDF). At a minimum, Quality Control Report's shall include:
    1) Project Identification.
    2) Date and Time(s).
    3) Atmospheric and Ambient Conditions.
    4) Inspector and Foreman Identification.
    5) Number of Workers On-Site.
    6) Work Area(s).
    7) Work Scope Performed.
    8) Work Progress.
    9) Product Data (Name, Lot, Exp.).
    10) Substrate Conditions.
    11) Quality Control Inspections.
    12) Quality Assurance Inspections (Internal and By Others).
    13) Other Pertinent Information.
g. The methods of construction shall be in accordance with requirements of the Contract Documents and best trade practices unless otherwise permitted by OWNER.

C. Inspection by OWNER, OWNER's designated representative or Quality Assurance Inspector does not limit the CONTRACTOR's responsibilities for inspection, quality workmanship or quality control as specified herein or as required by the Manufacturer's instructions.

D. Mockups: For each sealant material and/or system to be installed, prepare and install sealant to a representative location designated by OWNER to demonstrate aesthetic affects, quality of materials and execution.
1. Sealant manufacturer's representative and Quality Assurance Inspector shall observe mockup and approve, in writing, preparation and installation.
2. Quality Assurance Inspector may perform adhesion adhesion tests of sealant as part of acceptance.
3. If Quality Assurance Inspector determines mockup does not comply with requirements, modify mockup or construct new mockup until mockup is approved. Do not proceed with Work until mockup is approved.
4. Approved mockup will be acceptance standard for remainder of Work.
5. Approved mockup may become part of completed Work, if appropriate.

E. Quality Assurance Testing and Inspection:
1. Quality assurance testing and inspection will be performed by qualified Quality Assurance Inspector's to be provided by OWNER.
    a. Refer to Contract Documents for general quality assurance and testing reporting requirements.
    b. Testing and/or inspection frequency may be increased or decreased at OWNER's discretion.
2. Field-Adhesion Testing: Quality Assurance Inspector will perform non-destructive and destructive field adhesion tests on sealant in accordance with ASTM C1521; sealant manufacturer's representative shall observe testing as requested by OWNER or CONTRACTOR.
    a. Non-Destructive Testing:
        1) Procedure:

a) Depress center of sealant bead with probing tool to depth of 50 percent of bead width; or
b) Depress sealant bead near substrate bond-line until it appears visually that sealant is about to fail in cohesive; or
c) Apply uniform pressure with roller no more than one-half sealant bead in width, to create depression that represents approximately 50 percent of sealant deflection; advance roller along centerline of sealant bead; and note anomalies in sealant performance.

2) Record anomalies in sealant performance, if failures are adhesive or cohesive, and maximum surface depression as percent of joint or crack width.
3) Perform test every 12 inches for first 10 linear feet of joint or crack; if no test failure is observed, test every 24 inches thereafter.

b. Destructive testing, Method A:
1) Cut 6-inch-long tail of sealant loose from substrate.
2) Mark tail 1 inch from adhesive bond.
3) Grasp tail 1 inch from adhesive bond and pull until tail extends to 2 times the specified movement capability of sealant. If sealant has not failed, continue pulling to failure.
4) Record elongation at failure and if failure was adhesive or cohesive.
5) Observe sealant for complete filling of joint or crack with absence of voids, and for joint or crack configuration in compliance with requirements. Record observations and sealant dimensions.
6) Perform test every 100 feet for first 1,000 linear feet of joints and cracks; if no test failure at 2 times movement capability occurs, test every 1,000 feet thereafter.

c. Test reports shall include date when sealant was installed, name of person who installed sealant, test date, test location, and whether primer was used.
d. Immediately after testing, replace failed sealant in test areas. Neatly cut out and remove failed sealant, prepare and prime surfaces, and install new sealant. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.
e. Sealant not evidencing adhesive failure from testing or noncompliance with requirements will be considered satisfactory.
f. Where Quality Assurance Inspector determines that sealant has failed adhesively from testing or does not comply with requirements, additional testing will be performed to determine extent of non-conforming sealant. Neatly cut out and remove non-conforming sealant, prepare and prime surfaces, and install new sealant. Perform field adhesion tests on new sealant. Additional testing and replacement of non-conforming sealant shall be at CONTRACTOR's expense.

F. Inspection Hold Points:
1. The Quality Assurance Inspector shall conduct hold point inspections during the sealant work. The CONTRACTOR is required to coordinate such hold points in the sealant work with OWNER or its designated representative such that inspections can be performed on a scheduled basis. CONTRACTOR shall provide OWNER a minimum 48-hour advanced notice for required quality assurance hold point inspections.
2. Refer to Checklist 1 herein for a typical sealant Quality Control/Assurance checklist. OWNER and/or their designated representative may modify the contents of Quality Control/Assurance checklists as required based on Project needs, changes, constraints, etc.

G. Identification and Resolution of Conflicts
1. It shall be the responsibility of the CONTRACTOR to notify OWNER of any conflicts, obstructions, discrepancies and similar items related to Contract Document content, specifications, instructions, field conditions, weather, etc. promptly upon discovery by means of a formally submitted Request for Information (RFI).

1.7 WARRANTY

A. CONTRACTOR & Manufacturer Joint Warranty, include:

1. Removal and replacement of sealant that does not comply with requirements; that does not remain watertight; that fails in adhesion, cohesion, or general durability; or that deteriorates in manner not clearly specified by submitted sealant manufacturer's literature as inherent quality of material for application indicated.
2. Removal and replacement of bond breaker materials.
    a. Excessive joint or crack movement caused by structural settlement or errors attributable to design or construction, resulting in stresses in sealant exceeding sealant manufacturer's written data for sealant elongation or compression.
    b. Deterioration or failure of sealant due to failure of substrate prepared according to requirements.
    c. Mechanical damage caused by individuals, tools, or other outside agents.
    d. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.
3. Warranty Period: 3 years (min) from date of Project Completion.

1.8 DELIVERY, STORAGE AND HANDLING

A. Adhere to requirements herein and applicable requirements within the Contract Documents.

B. Deliver, store, and handle materials according to manufacturer's recommendations and in such manner as to prevent damage to materials and structure.

C. Deliver materials to Project site in original containers with seals unbroken, labeled with:
1. Product name or title of material.
2. Manufacturer's stock/batch number
3. Date of manufacture and shelf life, or expiration date.
4. Application and mixing instructions.
5. Handling instructions and precautions.
6. Hazardous material identification label

D. Keep materials dry and do not allow materials to be exposed to moisture during transportation, storage, handling, or installation. Reject and remove from Site new materials which exhibit evidence of moisture during application or which have been exposed to moisture.

E. Store materials in original, undamaged containers in a clean, dry, protected location on raised platforms with weather-protective coverings, within temperature range required by sealant manufacturer. Protect stored materials from direct sunlight. Manufacturer's standard packaging and covering are not considered adequate weather protection.

F. Limit stored materials on structures to safe loading of structure at time materials are stored, and to avoid permanent deck deflection.

G. Handle and store materials to prevent damage.

H. Conspicuously mark damaged or opened containers, expired materials and/or diluted materials and remove from site as soon as possible.

I. Dispose materials in accordance with local, state and federal laws, rules and regulations.

1.9 CLEANING

A. At end of each workday, clean site and work areas and place rubbish, empty tubes and containers, rags, and other discarded materials in appropriate containers.

B. Clean off excess sealant or sealant smears as Work progresses by methods and with cleaning materials approved in writing by sealant manufacturer. Exercise care to avoid scratching or damage to surfaces. Remedy surfaces stained, marred, or otherwise damaged during sealant Work.

C. At conclusion of Work, clean up debris and surplus materials and remove from site.

1.10 SAFETY

A. Adhere to requirements herein and applicable requirements within the Contract Documents.

B. The CONTRACTOR is required to attend a safety briefing with OWNER prior to Work.

C. The CONTRACTOR shall ensure OWNER and CONTRACTOR personnel are aware of any hazards peculiar to the jobsite.
   1. Provide and/or identify location(s) of available first aid stations, eye wash stations and pertinent safety equipment.
   2. Provide contact information of responsible personnel and emergency phone numbers.
   3. Obtain contact information for OWNER stakeholders and pertinent OWNER site personnel.
   4. Determine and communicate evacuation routes.

D. Keep all work areas clean and safe.

E. Obey all plant rules and regulations.

F. The CONTRACTOR shall conduct all work covered by this section in accordance with all pertinent OSHA regulations.

1.11 CHANGES IN WORK

A. During Work, existing conditions may be encountered which are not known or are at variance with the Contract Documents. Such conditions may interfere with sealant Work and may consist of damage or deterioration of substrate or installed materials that could jeopardize integrity or performance of the sealant system.

B. Notify OWNER of conditions that may interfere with proper execution of Work or jeopardize integrity of new sealant prior to proceeding with Work.

PART 2 - PRODUCTS

2.1 PRODUCTS AND MATERIALS

A. General:
   1. Source Limitations: Obtain sealants through one source from single manufacturer, or from sources approved by sealant manufacturer.
   2. Material Compatibility: Provide sealants, backings, and other related materials that are compatible with one another and with concrete substrates under conditions of service and application, as demonstrated by sealant manufacturer based on testing on similar projects, mockups inspection and testing for this project and field experience.
   3. Color of Exposed Sealant: Selected and approved in writing by OWNER, from sealant manufacturer's full range.
   4. Primer: Provide manufacturer's recommended primer for conditions and/or applications requiring primer.

B. Elastomeric Sealants: Comply with ASTM C920
   1. General
      a. Verify sealant compatibility with Coating System Manufacturer for use at areas to be coated.
      b. For joint and/or crack configurations exceeding 1-inch in width or less than 1/4-inch in depth, notify OWNER and/or ENGINEER for further direction.
   2. Polyurethane Sealant:
      a. HRSD System #1: ASTM C920, Type S, Grade NS, Class 35, Use A, G, M, NT, O.
         1) For use as a general purpose sealant in interior, exterior, atmospheric, submerged and/or intermittently submerged environments.
         2) For use with standard construction materials [concrete, metals, fiberglass, wood, masonry, aluminum].
         3) For use in joints and cracks not exceeding 1/2-inch (D).

4) For use in dynamic (movement) joints (Up to 35% expansion/contraction).
5) For use on substrates to be coated.
6) Not for use in chemical containments and/or submerged environments with moderate-to-severe chemical exposure.
a) Products:
(1) Sikaflex-1a; Sika Corporation.
(2) Sikaflex-1c SL; Sika Corporation.
(3) MasterSeal NP 1; BASF Corporation
(4) Eucolastic 1NS; Euclid Chemical Company.
(5) Approved Equal.

b. HRSD System #2: ASTM C920, Type M, Grade NS/P, Class 25 or 50, Use A, G, I, M, NT, O.
1) For use as a general purpose sealant in interior, exterior, atmospheric, submerged and/or intermittently submerged environments.
2) For use with standard construction materials [concrete, metals, fiberglass, wood, masonry, aluminum].
3) For primary use in larger joint configurations and for submerged and intermittently submerged environments.
4) For use in dynamic (movement) joints.
5) For use on substrates to be coated.
6) For use in environments with mild-to-moderate chemical exposure.
a) Products:
(1) DynaTrol II; Pecora Corporation.
(2) Sikaflex-2c NS; Sika Corporation.
(3) MasterSeal NP 2 with MasterSeal P 173; BASF Corporation
(4) Approved Equal.

c. HRSD System #3: ASTM C920, Type M, Grade P, Class 25, Use T.
1) For primary use in horizontal applications with exposure to vehicular and/or pedestrian traffic.
a) Products:
(1) DynaTrol II-SG; Pecora Corporation.
(2) Sikaflex-2c SL; Sika Corporation.
(3) MasterSeal SL 2; BASF Corporation
(4) Approved Equal.

3. Polysulfide Sealant: ASTM C920, Type M, Grade NS or P, Class 25, Use A, G, M, NT.
a. HRSD System #4:
1) For use with standard construction materials [concrete, metals, fiberglass, wood, masonry, aluminum].
2) For primary use in atmospheric, submerged and/or intermittently submerged environments exposed to chemicals, fuels, etc.
3) For use on substrates to be coated.
a) Products:
(1) Synthacalk GC2+ NS; Pecora Corporation.
(2) Tammsflex NS; Euclid Chemical Corporation.
(3) Tammsflex SL; Euclid Chemical Corporation.
(4) Approved Equal.

4. Hybrid Polyurethane Sealant (Silyl-Terminated Polyether): ASTM C920, Type S, Grade NS, Class 100/50, Use A, G, M, NT, O.
a. HRSD System #5:
1) For use with standard construction materials [concrete, metals, fiberglass, wood, masonry, aluminum].
2) For use where high movement (flexibility) is required.
3) For use with vertical applications such as concrete panel and wall systems, window and door frames, reglets, flashing, facades, etc.
4) For use in joints and cracks no greater than 1-inch (W).

5) For use in above-grade atmospheric environments exposed to weathering.
6) For use on substrates to be coated.
7) Not for use in submerged and intermittently submerged environments and/or environments with chemical exposure.
a) Products:
(1) Sikaflex -15 LM; Sika Corporation.
(2) MasterSeal NP 150; BASF Corporation.
(3) Approved Equal.

5. Silicone Sealant: ASTM C920, Type S, Grade NS, Class 100/50, Use A, G, M, NT, O.
a. HRSD System #6:
1) For use with standard construction materials [concrete, metals, fiberglass, wood, masonry, aluminum].
2) For primary use in exterior vertical non-structural glazing applications such as building envelopes, concrete panel and wall systems, window and door frames, reglets, flashing, facades, etc.
3) For use where high movement (flexibility) is required.
4) For use in above-grade atmospheric environments exposed to weathering.
5) Not for use where surfaces will be coated.
6) Not for use in interior, submerged and intermittently submerged environments, environments with chemical exposure, structural glazing applications, below-grade environments, confined spaces, wet- or frost-laden environments and/or with building materials that outgas or bleen oils, plasticizers or solvents.
a) Products:
(1) Sikasil WS-290; Sika Corporation.
(2) Dowsil 790 Silicone Building Sealant; The DOW Chemical Company.
(3) Spectrem 1; Tremco Incorporated.
(4) Approved Equal.

6. Acrylic Latex: Comply with ASTM C834.
a. HRSD System #7:
1) General purpose for use with most substrates found in interior and exterior applications.
2) For primary use over substrates such as vinyl, aluminum, wood, porcelain, etc. in interior and/or controlled environments with minimal movement characteristics.
3) For use on substrates to be coated.
4) Not for use in industrial environments.
a) Products:
(1) DAP Alex Plus; DAP Inc.
(2) Tremflex 834; Tremco Incorporated.
(3) AC-20 +Silicone; Pecora Corporation.
(4) Approved Equal.

7. Auxiliary Materials:
a. General: Sealant-backer materials, primers, surface cleaners, masking tape, and other materials recommended by sealant manufacturer, that are non-staining and compatible with substrate.
b. Backer materials: Polyethylene, closed-cell backer-rod, or as recommended by sealant manufacturer.

C. Expansion and Control Joint Systems
1. General:
a. Verify joint system compatibility with Coating System Manufacturer (CSM) for use at areas to be coated.
2. Flexible Polyolefin Rubber Sealant System:
a. HRSD System #8:
1) For use with standard construction materials [concrete, metals, masonry]
2) For use in crack and joint widths up to 4-inches, unless noted otherwise.

3) For use in static and movement joints.
4) For use in submerged, intermittently submerged and atmospheric environments.
5) May be used in conjunction with elastomeric joint sealant systems.
6) For long-term use with exposure to water, lime, seawater, sewage and bitumen.
7) For short-term use with exposure to light fuel oil, diesel, diluted alkali, diluted mineral acids, ethanol and methanol.
a) Products:
(1) Sikadur Combiflex SG System by Sika Corporation.
(2) Approved Equal.

3. Submersible Joint Systems for Limited Chemical Exposure: Cellular Polyurethane Foam with Impregnated Hydrophobic 100% Acrylic Coated with Chemically Resistant Silicone; ± 25% Movement.
a. HRSD System #9:
1) For use with standard construction materials [concrete, metals, masonry, aluminum]
2) For use in joint widths between 1-inch and 4-inches.
3) For primary use in submerged and intermittently submerged environments.
4) May be used in non-submerged environments as a continuation from the submerged system.
5) For use in submerged environment with chloride levels less than 5 ppm.
6) Not for use in areas subjected to high chemical concentrations and/or potential chemical exposure.
a) Products:
(1) Submerseal by Emseal LLC.
(a) Allowable depth and hydrostatic head pressures:
- 1-inch joint; 2-1/8 inches (D); 30 ft. head
- 2-inch joint; 3-inches (D); 20 ft. head
- 3-inch joint; 3-1/2 inches (D); 15 ft. head
- 4-inch joint; 4-3/4 inches (D); 10 ft. head

(b) Approved Equal.

4. Submersible Joint Systems for Chemical Exposure: Precompressed Silicone, or Polysulfide, and Impregnated Foam Hybrid Installed into Field-Applied Epoxy Adhesive; ± 25% Movement.
a. HRSD System #10:
1) For use with standard construction materials [concrete, metals, masonry, aluminum]
2) For use in joint widths between 1-inch and 4-inches.
3) For use in submerged, intermittently submerged and non-submerged environments.
4) For use in areas subjected to high chemical concentrations and/or potential chemical exposure.
a) Products:
(1) Chemseal by Emseal LLC.
(a) Maximum hydrostatic head pressure = 5 ft.
(b) Joint width (W) to depth (D) ratios:
- 1-inch (W) = 2-inch (D).
- 1-1/2 inch (W) = 2-3/8 (D).
- 2-inch (W) = 2-1/2 inch (D).
- 2-1/2 inch (W) = 2-3/4 inch (D).
- 3-inch (W) = 2-3/4 inch (D).
- 4-inch (W) = 3-1/2 inch (D).
- Refer to manufacturer's current product data sheets for additional sizes and to validate joint sizing requirements.

(2) Approved Equal.

PART 3 - EXECUTION

3.1 GENERAL

A. Coordinate Work with applicable stakeholders to ensure that continuous, watertight, sealant installation is achieved. Coordinate with:
   1. OWNER or OWNER's designated representative.
   2. ENGINEER.
   3. Quality Assurance Inspector.
   4. Other trades to ensure that Work done by other trades is complete and ready to receive sealant.
   5. Other trades to avoid or minimize Work in immediate vicinity of sealant Work in progress or completed Work.

3.2 EXAMINATION

A. CONTRACTOR shall examine and verify existing dimensions, conditions and details prior to installation of materials. CONTRACTOR shall report to OWNER, in writing, any conditions that would adversely affect the appearance or performance of the sealant system to be installed and which cannot be put into an acceptable condition by the preparatory work specified herein.
   1. Verify dimensions of joints at the project site by field measurement so that proper sealant profiles will be accurately maintained.
   2. Verify that areas and conditions under which Work is to be performed permit proper and timely completion of Work.

B. Do not proceed with affected Work until concerns have been dispositioned and clear direction is provided.

C. Installation of sealant system indicates acceptance of surfaces and conditions.

3.3 WORK CONDITIONS

A. Environmental Limitations: Install sealant when existing and forecast weather conditions permit sealant to be installed according to sealant manufacturer's written instructions and warranty requirements.
   1. Do not install sealant when ambient or substrate temperature is below 40 degrees F or is expected to fall below 40 degrees F within 12 hours of installation unless otherwise permitted by manufacturer.
   2. Do not proceed with installation during inclement weather except for temporary work necessary to protect structure and installed materials. Remove temporary work and Work that becomes damaged by moisture.

B. Maintain adequate ventilation during preparation and placement.

C. Newly placed concrete surfaces shall be cured as recommended by sealant manufacturer prior to sealant application, unless otherwise approved by OWNER and/or OWNER's designated representative.

3.4 PROTECTION

A. General:
   1. Protect adjacent surfaces and surrounding site from staining, damage, or debris from sealant Work.
      a. Mask off surfaces (as required).
   2. Protect prepared cracks and joints from windborne and local debris and/or contaminants.
   3. Protect fresh sealants from windborne and local debris, liquids and contaminants.
   4. Protect finished Work from damage.
   5. As necessary, prevent access to Work areas or provide "Wet Sealant" signs to protect newly sealed cracks and joints.
   6. Remove masking and other protective measures upon completion of Work.

7. Restore surfaces and site to condition prior to sealant Work, to satisfaction of OWNER and at no additional cost to OWNER.

3.5 SURFACE PREPARATION

A. General:
   1. For premanufactured sealant joint systems (HRSD System #8, #9 and #10), refer to Manufacturer's written instructions for surface preparation requirements.
   2. For elastomeric sealants, refer to Manufacturer's written requirements and instructions below for surface preparation requirements.

B. Prepare surfaces and install sealant per sealant manufacturer's written recommendations and approved mockup procedures.

C. Notify sealant manufacturer and/or OWNER upon discovery of damaged or deteriorated concrete surfaces that may inhibit proper installation of sealant system for further direction prior to installation.

D. Remove existing sealant, backer rod and other foreign material from joints and cracks.

E. Rout joints and cracks to square or rectangular cross-section satisfying width (W) and depth (D) dimensions shown in Figure 1 *{Engineer to Specify}*.

F. Clean substrate immediately before installing sealant, to comply with sealant manufacturer's written instructions.
   1. Clean by wire brushing, grinding, blast-cleaning, mechanical-abrading, or combination of methods to produce clean, sound substrate capable of developing optimum bond with sealant.
   2. Remove laitance and form-release agents from joint and crack surfaces.
   3. Remove foreign material that could interfere with adhesion of sealant, including dirt, dust, existing sealant, oil, grease, and surface coatings.
   4. Provide dry substrate; prevent wetting of substrate prior to sealant installation.
   5. Remove loose particles remaining after cleaning operations by vacuuming or blowing out joints and cracks with oil-free, compressed air.

G. Install masking tape on adjacent surfaces to prevent permanent staining or damage due to contact with sealant or cleaning methods to remove sealant smears. Install masking tape on sides of joints and cracks where sealant will be recessed. Remove tape immediately after tooling sealant, without disturbing sealant.

3.6 INSTALLATION

A. General:
   1. For premanufactured sealant joint systems (HRSD System #8, #9 and #10), refer to Manufacturer's written instructions for installation requirements.
   2. For elastomeric sealants, refer to Manufacturer's written requirements and instructions below for installation requirements.

B. Prime substrate where recommended by sealant manufacturer.
   1. Apply primer per sealant manufacturer's written instructions.
   2. Confine primer to areas of sealant bond; do not allow spillage or migration onto adjoining surfaces.
   3. Limit priming to areas that will be covered with sealant in same day. Unless recommended otherwise by sealant manufacturer, re-prime areas exposed for more than 24 hours.

C. Install sealant in routed and un-routed cracks to completely fill crack configuration.

D. Install backer rod in conventional joints and routed cracks greater than 1/2-inch (W).
   1. Backer rod shall be sized approximately 25% larger than joint/crack width, but not less than 10% larger than the smallest width along the joint/crack.
   2. As required, utilize various backer rod sizes for joints and cracks with varying widths.

3. The use of multiple backer rods to fill joint/crack widths at any point along the joint/crack is not permitted.

E. Install sealant in conventioned joints and routed cracks greater than 1/2-inch (W) to produce uniform, cross-sectional shape and depth; to directly contact and fully wet joint or crack sides; and to completely fill recesses in joint or crack configuration up to the backer rod.
   1. Mix multi-component sealants per manufacturer's written instructions.
   2. For non-sag sealants:
      a. Install sealant flush with surface.
      b. Immediately after sealant application and before skinning or curing begins, tool joint or crack with slightly concave surface, compressing sealant into joint or crack to form smooth, uniform sealant bead; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint or crack. Do not use tooling agent.
   3. For pourable self-leveling sealants on horizontal surfaces:
      a. Install sealant slightly below the surface.
      b. Immediately after sealant application and before skinning or curing begins, lightly tool joint or crack, compressing sealant into joint or crack to form smooth, uniform sealant bead; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint or crack. Do not use tooling agent.
   4. Remove excess sealant from surfaces adjacent to joints and cracks.

3.7 FINAL INSPECTION

A. CONTRACTOR shall arrange for a final inspection with OWNER to determine whether sealant Work meets the requirements of the Contract Documents.

CHECKLIST 1: SEALANT INSTALLATION

Project
Inspector

Task
Location

Quality Assurance Hold points are indicated in Bold

Date	Initials	Task
_____	_____	**1. Required submittals have been provided to OWNER for review and have been accepted.**
_____	_____	2. Existing conditions, surfaces and related items relevant to work tasks have been examined and accepted. Deficiencies, obstructions, abnormalities and/or constraints have been communicated to OWNER and appropriately resolved.
_____	_____	**3. Cracks and/or joints to be sealed have been marked and reviewed by Quality Assurance Inspector.**
_____	_____	4. Sealant Manufacturer has reviewed substrates, environmental and operating conditions. Manufacturer has verified selected sealant is suitable for application.
_____	_____	5. OWNER property including, but not limited to, equipment, components, structures, etc. have been adequately protected.
_____	_____	**6. Required mockups have been applied, reviewed, and approved.**
_____	_____	7. Cracks and/or joints have been routed, prepared and cleaned with adjacent surfaces masked as specified in the Contract Documents and per Sealant Manufacturer requirements. Verify product to be applied will accommodate any changes to anticipated joint configuration.
_____	_____	**8. Quality Assurance Inspector has verified crack and/or joint preparation and configuration meets requirements as specified in the Contract Documents and per the Sealant Manufacturer.**
_____	_____	9. Install primer as specified in the Contract Documents and per the Sealant Manufacturer's requirements.
_____	_____	10. Install backer rod or bond breakers as specified in the Contract Documents and per the Sealant Manufacturer's requirements.
_____	_____	**11. Quality Assurance Inspector has verified backer rod and primer installation meets requirements as specified in the Contract Documents and per the Sealant Manufacturer.**
_____	_____	**12. Batch information, shelf life, storage conditions and related items for materials to be applied have been reviewed by Quality Assurance Inspector.**
_____	_____	13. Mix sealant material in accordance with the Contract Documents and Manufacturer requirements.
_____	_____	14. Apply sealant material in accordance with the Contract Documents and Manufacturer requirements. Ensure sealant is tooled with appropriate spatula(s) or tools. No hand tooling is permitted.
_____	_____	**15. Quality Assurance Inspector has reviewed application and performed requisite number of adhesion tests (Destructive / Non-Destructive). Sealant has been re-applied at destructive test locations.**

END OF SECTION