

\*\*\*\*\*  
USACE / NAVFAC / AFCEA / NASA                      UFGS-03 15 00.00 10 (August 2010)  
-----  
Preparing Activity:    USACE                      Superseding  
   UFGS-03 15 13.00 10 (November 2009)  
   UFGS-03 15 14.00 10 (November 2009)

## UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated July 2011

\*\*\*\*\*

### SECTION TABLE OF CONTENTS

#### DIVISION 03 - CONCRETE

#### SECTION 03 15 00.00 10

#### CONCRETE ACCESSORIES

08/10

#### PART 1    GENERAL

- 1.1    UNIT PRICES
  - 1.1.1    Waterstops
    - 1.1.1.1    Payment
    - 1.1.1.2    Measurement
    - 1.1.1.3    Unit of Measure
- 1.2    REFERENCES
- 1.3    SUBMITTALS
- 1.4    DELIVERY, STORAGE, AND HANDLING

#### PART 2    PRODUCTS

- 2.1    CONTRACTION JOINT STRIPS
- 2.2    PREFORMED EXPANSION JOINT FILLER
- 2.3    SEALANT
  - 2.3.1    Preformed Polychloroprene Elastomeric Type
  - 2.3.2    Lubricant for Preformed Compression Seals
  - 2.3.3    Field-Molded Type
  - 2.3.4    Hot-Applied Jet-Fuel Resistant Type
- 2.4    WATERSTOPS
  - 2.4.1    Flexible Metal
  - 2.4.2    Rigid Metal
  - 2.4.3    Non-Metallic Materials
  - 2.4.4    Non-Metallic Hydrophilic
  - 2.4.5    Preformed Elastic Adhesive
    - 2.4.5.1    Chemical Composition
    - 2.4.5.2    Adhesion Under Hydrostatic Pressure
    - 2.4.5.3    Sag of Flow Resistance
    - 2.4.5.4    Chemical Resistance
- 2.5    TESTS, INSPECTIONS, AND VERIFICATIONS
  - 2.5.1    Materials Tests
    - 2.5.1.1    Field-Molded Sealants
    - 2.5.1.2    Non-Metallic Waterstops
  - 2.5.2    Splicing Waterstops

- 2.5.2.1 Procedure and Performance Qualifications
- 2.5.2.2 Non-Metallic Waterstops
- 2.5.2.3 Metal Waterstops

## PART 3 EXECUTION

### 3.1 INSTALLATION

#### 3.1.1 Contraction Joints

- 3.1.1.1 Joint Strips
- 3.1.1.2 Sawed Joints
- 3.1.1.3 Bond Breaker

#### 3.1.2 Expansion Joints

#### 3.1.3 Joint Sealant

- 3.1.3.1 Joints With Preformed Compression Seals
- 3.1.3.2 Joints With Field-Molded Sealant

### 3.2 WATERSTOPS, INSTALLATION AND SPLICES

#### 3.2.1 Copper And Stainless Steel

#### 3.2.2 Flat Steel

#### 3.2.3 Non-Metallic

- 3.2.3.1 Rubber Waterstop
- 3.2.3.2 Polyvinyl Chloride Waterstop
- 3.2.3.3 Quality Assurance

#### 3.2.4 Non-Metallic Hydrophilic Waterstop Installation

#### 3.2.5 Preformed Plastic Adhesive Installation

### 3.3 CONSTRUCTION JOINTS

-- End of Section Table of Contents --

\*\*\*\*\*  
USACE / NAVFAC / AFCEA / NASA                      UFGS-03 15 00.00 10 (August 2010)  
-----  
Preparing Activity:    USACE                      Superseding  
   UFGS-03 15 13.00 10 (November 2009)  
   UFGS-03 15 14.00 10 (November 2009)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated July 2011

\*\*\*\*\*

SECTION 03 15 00.00 10

CONCRETE ACCESSORIES  
08/10

\*\*\*\*\*

NOTE: This guide specification covers the requirements for expansion joints, contraction joints and waterstops used in concrete construction. This guide will be used in conjunction with Section 03 30 00.00 10 CAST-IN-PLACE CONCRETE..

Adhere to UFC 1-300-02 Unified Facilities Guide Specifications (UFGS) Format Standard when editing this guide specification or preparing new project specification sections. Edit this guide specification for project specific requirements by adding, deleting, or revising text. For bracketed items, choose applicable items(s) or insert appropriate information.

Remove information and requirements not required in respective project, whether or not brackets are present.

Comments, suggestions and recommended changes for this guide specification are welcome and should be submitted as a Criteria Change Request (CCR). cations where text must be supplied by the designer.

\*\*\*\*\*

PART 1    GENERAL

1.1    UNIT PRICES

\*\*\*\*\*

NOTE: If Section 01 22 00.00 10 MEASUREMENT AND PAYMENT is included in the project specifications, this paragraph title (UNIT PRICES) should be deleted from this section and the remaining appropriately edited subparagraphs below should be inserted into Section 01 22 00.00 10.

\*\*\*\*\*

### 1.1.1.1 Waterstops

#### 1.1.1.1.1 Payment

Payment will be made for costs associated with waterstops, including labor, materials and use of all equipments and tools required to complete the waterstop work. No separate payment will be made for expansion and contraction joints which are included in the costs for the items to which work for expansion and contraction joints are incidental.

#### 1.1.1.1.2 Measurement

Waterstops will be measured for payment by the linear meter foot in place. In computing the quantity of the waterstops, no allowance will be made for laps. No separate measurement will be made for expansion and contraction joints which are included in the costs for the items to which work for expansion and contraction joints are incidental.

#### 1.1.1.1.3 Unit of Measure

Unit of measure: linear meter foot.

## 1.2 REFERENCES

\*\*\*\*\*

NOTE: This paragraph is used to list the publications cited in the text of the guide specification. The publications are referred to in the text by basic designation only and listed in this paragraph by organization, designation, date, and title.

Use the Reference Wizard's Check Reference feature when you add a RID outside of the Section's Reference Article to automatically place the reference in the Reference Article. Also use the Reference Wizard's Check Reference feature to update the issue dates.

References not used in the text will automatically be deleted from this section of the project specification when you choose to reconcile references in the publish print process.

\*\*\*\*\*

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS  
(AASHTO)

AASHTO T 111 (2010) Standard Method of Test for Mineral Matter or Ash in Asphalt Materials

AMERICAN HARDBOARD ASSOCIATION (AHA)

AHA A135.4 (1995; R 2004) Basic Hardboard

ASME INTERNATIONAL (ASME)

ASME BPVC SEC IX (2010) BPVC Section IX-Welding and Brazing Qualifications

ASTM INTERNATIONAL (ASTM)

ASTM A1011/A1011M (2010) Standard Specification for Steel, Sheet, and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability and Ultra-High Strength

ASTM A109/A109M (2008) Standard Specification for Steel, Strip, Carbon (0.25 Maximum Percent), Cold-Rolled

ASTM A167 (1999; R 2009) Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip

ASTM A480/A480M (2011a) Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip

ASTM B152/B152M (2009) Standard Specification for Copper Sheet, Strip, Plate, and Rolled Bar

ASTM B370 (2009) Standard Specification for Copper Sheet and Strip for Building Construction

ASTM C 919 (2008) Use of Sealants in Acoustical Applications

ASTM D 1751 (2004; R 2008) Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)

ASTM D 1752 (2004a; R 2008) Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion

ASTM D 2628 (1991; R 2005) Standard Specification for Preformed Polychloroprene Elastomeric Joint Seals for Concrete Pavements

ASTM D 2835 (1989; R 2007) Lubricant for Installation of Preformed Compression Seals in Concrete Pavements

ASTM D 4 (1986; R 2010) Bitumen Content

ASTM D 412 (2006ae2) Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers - Tension

ASTM D 471	(2010) Standard Test Method for Rubber Property - Effect of Liquids
ASTM D 5249	(2010) Backer Material for Use with Cold-and Hot-Applied Joint Sealants in Portland-Cement Concrete and Asphalt Joints
ASTM D 7116	(2005) Standard Specification for Joint Sealants, Hot Applied, Jet Fuel Resistant Types, for Portland Cement Concrete Pavement
ASTM D6/D6M	(1995e1; R 2011) Loss on Heating of Oil and Asphaltic Compounds

U.S. ARMY CORPS OF ENGINEERS (USACE)

COE CRD-C 513	(1974) Corps of Engineers Specifications for Rubber Waterstops
COE CRD-C 572	(1974) Corps of Engineers Specifications for Polyvinylchloride Waterstops

1.3 SUBMITTALS

\*\*\*\*\*

NOTE: Review submittal description (SD) definitions in Section 01 33 00 SUBMITTAL PROCEDURES and edit the following list to reflect only the submittals required for the project. Submittals should be kept to the minimum required for adequate quality control.

A "G" following a submittal item indicates that the submittal requires Government approval. Some submittals are already marked with a "G". Only delete an existing "G" if the submittal item is not complex and can be reviewed through the Contractor's Quality Control system. Only add a "G" if the submittal is sufficiently important or complex in context of the project.

For submittals requiring Government approval on Army projects, a code of up to three characters within the submittal tags may be used following the "G" designation to indicate the approving authority. Codes for Army projects using the Resident Management System (RMS) are: "AE" for Architect-Engineer; "DO" for District Office (Engineering Division or other organization in the District Office); "AO" for Area Office; "RO" for Resident Office; and "PO" for Project Office. Codes following the "G" typically are not used for Navy, Air Force, and NASA projects.

Choose the first bracketed item for Navy, Air Force and NASA projects, or choose the second bracketed item for Army projects.

\*\*\*\*\*

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for [Contractor Quality Control approval.] [information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

#### SD-02 Shop Drawings

Waterstops[; G][; G, [\_\_\_\_\_]]

#### SD-03 Product Data

Preformed Expansion Joint Filler  
Sealant  
Waterstops

#### SD-04 Samples

Lubricant for Preformed Compression Seals  
Field-Molded Type  
Non-metallic Materials  
Waterstops  
Splicing Waterstops[; G][; G, [\_\_\_\_\_]]

#### SD-07 Certificates

Preformed Expansion Joint Filler  
Sealant  
Waterstops

### 1.4 DELIVERY, STORAGE, AND HANDLING

Protect material delivered and placed in storage off the ground from moisture, dirt, and other contaminants. Deliver sealants in the manufacturer's original unopened containers. Remove sealants from the site whose shelf life has expired.

## PART 2 PRODUCTS

### 2.1 CONTRACTION JOINT STRIPS

Contraction joint strips shall be 3 mm 1/8 inch thick tempered hardboard conforming to AHA A135.4, Class 1. In lieu of hardboard strips, rigid polyvinylchloride (PVC) or high impact polystyrene (HIPS) insert strips specifically designed to induce controlled cracking in slabs on grade may be used. Such insert strips shall have removable top section.

### 2.2 PREFORMED EXPANSION JOINT FILLER

Expansion joint filler shall be preformed material conforming to ASTM D 1751 or ASTM D 1752, Type I, or resin impregnated fiberboard conforming to the physical requirements of ASTM D 1752. Submit certified manufacturer's test reports for premolded expansion joint filler strips, compression seals and lubricant, and metallic waterstops to verify compliance with applicable specification. Unless otherwise indicated, filler material shall be 10 mm 3/8 inch thick and of a width applicable for the joint formed. Backer material, when required, shall conform to ASTM D 5249.

## 2.3 SEALANT

\*\*\*\*\*  
NOTE: Types of joint material should be shown.  
Elastomeric joint seals (ASTM D 2628) will be used  
in compression type joints. For slabs receiving  
considerable fuel spillage, the hot-applied jet-fuel  
resistant type should be used when a thermoplastic  
elastomeric rubber (TPE-R) waterstop is not  
specified.  
\*\*\*\*\*

Joint sealant shall conform to the following:

### 2.3.1 Preformed Polychloroprene Elastomeric Type

ASTM D 2628.

### 2.3.2 Lubricant for Preformed Compression Seals

ASTM D 2835. Submit a piece not less than 3 m 9 ft of 25 mm 1 inch nominal width or wider seal or a piece not less than 4 m 12 ft of compression seal less than 25 mm 1 inch nominal width. Provide one L quart of lubricant.

### 2.3.3 Field-Molded Type

ASTM D 7116. Sealant shall be Type M, Grade P or NS, Class 25, Use [T] [NT] for horizontal joints. Type M, Grade NS, Class 25, Use NT for vertical joints.[ Except, the joint sealant that will be submerged underwater for part or all of its service life shall meet the requirements of USE I.] Bond breaker material shall be polyethylene tape, coated paper, metal foil or similar type materials. The back-up material shall be compressible, non-shrink, nonreactive with sealant, and non-absorptive material type such as extruded butyl or polychloroprene rubber. Submit Four liters One gallon of field-molded sealant and one L quart of primer (when primer is recommended by the sealant manufacturer) identified to indicate manufacturer, type of material, quantity, and shipment or lot represented.

### 2.3.4 Hot-Applied Jet-Fuel Resistant Type

ASTM D 7116, Type [I] [II] [III]

## 2.4 WATERSTOPS

Shop fabricate intersection and change of direction waterstops. Submit a sample of each material consisting of a piece not less than 300 mm 12 inches long cut from each 60 m 200 feet of finished waterstop furnished, but not less than a total of 1.2 linear meters 4 linear feet of each type and size furnished. For spliced segments of waterstops to be installed in the work, furnish one spliced sample of each size and type for every 50 splices made in the factory and every 10 splices made at the job site for inspection and testing. Make the spliced samples using straight run pieces with the splice located at the mid-length of the sample and finished as required for the installed waterstop. The total length of each spliced sample shall be not less than 300 mm 12 inches long. Submit waterstop materials and splice samples for inspection and testing identified to indicate manufacturer, type of material, size and quantity of material and shipment represented.



#### 2.4.1 Flexible Metal

Copper waterstops shall conform to ASTM B152/B152M and ASTM B370, O60 soft anneal temper and 0.686 mm 20 oz mass per sq ft sheet thickness. Stainless steel waterstops shall conform to ASTM A167 and ASTM A480/A480M, UNS S30453 (Type 304L), and 0.9525 mm 0.0375 inch (20 gauge) thick strip.

#### 2.4.2 Rigid Metal

Flat steel waterstops shall conform to ASTM A109/A109M, No. 2 (half hard) temper, No. 2 edge, No. 1 (matte or dull) finish or ASTM A1011/A1011M, Grade 40.

#### 2.4.3 Non-Metallic Materials`

Non-metallic waterstops shall be manufactured from a prime virgin resin; reclaimed material is not acceptable. The compound shall contain plasticizers, stabilizers, and other additives to meet specified requirements. Rubber waterstops shall conform to COE CRD-C 513. Polyvinylchloride waterstops shall conform to COE CRD-C 572. Thermoplastic elastomeric rubber waterstops shall conform to ASTM D 471. Submit a piece not less than 300 mm 12 inch long cut from each 61 m 200 ft of finished waterstop furnished, but not less than a total of 1 m 4 ft of each type, size, and lot furnished. One splice sample of each size and type for every 50 splices made in the factory and every 10 splices made at the job site. Make the splice samples using straight run pieces with the splice located at the mid-length of the sample and finished as required for the installed waterstop. The total length of each splice shall be not less than 300 mm 12 inches long.

#### [2.4.4 Non-Metallic Hydrophilic

\*\*\*\*\*  
NOTE: Do not use these bracketed subparts for Civil  
Works projects.  
\*\*\*\*\*

Swellable strip type compound of polymer modified chloroprene rubber that swells upon contact with water shall conform to ASTM D 412 as follows: Tensile strength 2.9 MPa 420 psi minimum; ultimate elongation 600 percent minimum. Hardness shall be 50 minimum on the type A durometer and the volumetric expansion ratio in distilled water at 20 degrees C 70 degrees F shall be 3 to 1 minimum.

#### 2.4.5 Preformed Elastic Adhesive

Produce preformed plastic adhesive waterstops from blends of refined hydrocarbon resins and plasticizing compounds reinforced with inert mineral filler, containing no solvents, asbestos, irritating fumes or obnoxious odors. The compound shall not depend on oxidizing, evaporating, or chemical action for its adhesive or cohesive strength.

##### 2.4.5.1 Chemical Composition

Meet the chemical composition of the sealing compound requirements shown below:

PERCENT BY WEIGHT			
COMPONENT	MINIMUM	MAXIMUM	TEST
Bitumen (Hydrocarbon plastic)	50	70	ASTM D 4
Inert Mineral Filler	30	50	AASHTO T 111
Volatile Matter		2	ASTM D6/D6M

#### 2.4.5.2 Adhesion Under Hydrostatic Pressure

The sealing compound shall not leak at the joints for a period of 24 hours under a vertical 2 m 6 foot head pressure. In a separate test, the sealing compound shall not leak under a horizontal pressure of 65 kPa 10 psi which is reached by slowly applying increments of 13 kPa 2 psi every minute.

#### 2.4.5.3 Sag of Flow Resistance

Sagging shall not be detected when tested as follows: Fill a wooden form 25 mm 1 inch wide and 150 mm 6 inches long flush with sealing compound and place in an oven at 58 degrees C 135 degrees F in a vertical position for 5 days.

#### 2.4.5.4 Chemical Resistance

The sealing compound when immersed separately in a 5% solution of caustic potash, a 5% solution of hydrochloric acid, 5% solution of sulfuric acid and a saturated hydrogen sulfide solution for 30 days at ambient room temperature shall show no visible deterioration.

### ]2.5 TESTS, INSPECTIONS, AND VERIFICATIONS

#### 2.5.1 Materials Tests

##### 2.5.1.1 Field-Molded Sealants

Samples of sealant and primer, when use of primer is recommended by the manufacturer, as required in paragraph FIELD MOLDED TYPE, shall be tested by and at the expense of the Government for compliance with paragraph FIELD MOLDED TYPE. If the sample fails to meet specification requirements, provide new samples and the cost of retesting will be deducted from payments due the Contractor at a rate of \$[\_\_\_\_\_] per sample.

##### 2.5.1.2 Non-Metallic Waterstops

\*\*\*\*\*  
**NOTE: Testing of Non-Metallic Waterstops will be performed by the Corps of Engineers Waterways Experiment Station.**  
 \*\*\*\*\*

Samples of materials and splices will be visually inspected and tested by and at the expense of the Government for compliance with COE CRD-C 513 or COE CRD-C 572 as applicable. If a sample fails to meet the specification requirements, provide new samples and the cost of retesting will be deducted from payments due the Contractor at the rate of \$[\_\_\_\_\_] per

material sample retested and \$[\_\_\_\_\_] per spliced sample retested.

## 2.5.2 Splicing Waterstops

### 2.5.2.1 Procedure and Performance Qualifications

Demonstrate procedure and performance qualifications for splicing waterstops in the presence of the Contracting Officer. Submit procedures for splicing waterstops for approval.

### 2.5.2.2 Non-Metallic Waterstops

Demonstrate procedure and performance qualifications for splicing non-metallic waterstops by the manufacturer at the factory and the Contractor at the job site by each making three spliced samples of each size and type of finished waterstop.

### 2.5.2.3 Metal Waterstops

Demonstrate procedure and performance qualifications for splicing metal waterstops at the job site by the Contractor. The brazing procedure, brazers and brazing operators for splicing copper waterstops shall be qualified in accordance with Part QB (Brazing), Article XI (Brazing, General Requirements), paragraph QB-170 (Peel Tests) and other applicable requirements of Articles XI, XII, and XIII of ASME BPVC SEC IX. The welding procedure and welders for splicing stainless steel waterstops shall be qualified in accordance with the manufacturer's recommendations.

## PART 3 EXECUTION

### 3.1 INSTALLATION

Joint locations and details, including materials and methods of installation of joint fillers and waterstops, shall be as specified and indicated. In no case shall any fixed metal be continuous through an expansion or contraction joint.

#### 3.1.1 Contraction Joints

\*\*\*\*\*  
NOTE: Since contraction joint strips are difficult to align and maintain in alignment, the option for use of joint strips should be deleted where appearance is important or where concrete slabs will not be covered with subsequent toppings that will hide the joint.  
\*\*\*\*\*

Contraction joints may be constructed by inserting tempered hardboard strips or rigid PVC or HIPS insert strips into the plastic concrete using a steel parting bar, when necessary, or by cutting the concrete with a saw after concrete has set. Make joints 3 mm to 5 mm 1/8 inch to 3/16 inch wide and extend into the slab one-fourth the slab thickness, minimum, but not less than 25 mm 1 inch.

##### 3.1.1.1 Joint Strips

Provide strips of the required dimensions and as long as practicable. After the first floating, groove the concrete with a tool at the joint

locations. Insert the strips in the groove and depress them until the top edge of the vertical surface is flush with the surface of the slab. Float and finish the slab as specified. Working of the concrete adjacent to the joint shall be the minimum necessary to fill voids and consolidate the concrete. Where indicated, saw out the top portion of the strip after the curing period to form a recess for sealer. Discard the removable section of PVC or HIPS strips and leave the insert in place. Maintain true alignment of the strips during insertion.

#### 3.1.1.2 Sawed Joints

Saw joints early enough to prevent uncontrolled cracking in the slab, but late enough that this can be accomplished without appreciable spalling. Cutting shall be started as soon as the concrete has hardened sufficiently to prevent raveling of the edges of the saw cut. Cutting shall be completed before shrinkage stresses become sufficient to produce cracking. Use concrete sawing machines that are adequate in number and power, and with sufficient replacement blades to complete the sawing at the required rate. Cut joints to true alignment and in sequence of concrete placement. Remove sludge and cutting debris. Form reservoir for joint sealant.

#### 3.1.1.3 Bond Breaker

Coat joints requiring a bond breaker with curing compound or with bituminous paint. Protect waterstops during application of bond breaking material to prevent them from being coated.

#### 3.1.2 Expansion Joints

Use preformed expansion joint filler in expansion and isolation joints in slabs around columns and between slabs on grade and vertical surfaces where indicated. Extend the filler to the full slab depth, unless otherwise indicated. Neatly finish the edges of the joint with an edging tool of 3 mm 1/8 inch radius, except where a resilient floor surface will be applied. Where the joint is to receive a sealant, the filler strips shall be installed at the proper level below the finished floor with a slightly tapered, dressed and oiled wood strip temporarily secured to the top to form a recess to the size shown on the drawings. Remove the wood strip after the concrete has set. Contractor may opt to use a removable expansion filler cap designed and fabricated for this purpose in lieu of the wood strip. Thoroughly clean the groove of laitance, curing compound, foreign materials, protrusions of hardened concrete, and any dust. If blowing out the groove use oil-free compressed air.

#### 3.1.3 Joint Sealant

Fill sawed contraction joints and expansion joints in slabs with joint sealant, unless otherwise shown. Joint surfaces shall be clean, dry, and free of oil or other foreign material which would adversely affect the bond between sealant and concrete. Apply joint sealant as recommended by the manufacturer of the sealant.

##### 3.1.3.1 Joints With Preformed Compression Seals

Install compression seals with equipment capable of installing joint seals to the prescribed depth without cutting, nicking, twisting, or otherwise distorting or damaging the seal or concrete and with no more than 5 percent stretching of the seal. Cover the sides of the joint and, if necessary, the sides of the compression seal with a coating of lubricant. Coat butt

joints with liberal applications of lubricant.

#### 3.1.3.2 Joints With Field-Molded Sealant

Do not seal joints when the sealant material, ambient air, or concrete temperature is less than 4 degrees C 40 degrees F. When the sealants are meant to reduce the sound transmission characteristics of interior walls, ceilings, and floors the guidance provided in ASTM C 919 shall be followed. Coat joints requiring a bond breaker with curing compound or with bituminous paint. Install bond breaker and back-up material where required. Joints shall be primed and filled flush with joint sealant in accordance with the manufacturer's recommendations.

### 3.2 WATERSTOPS, INSTALLATION AND SPLICES

Install waterstops at the locations shown to form a continuous water-tight diaphragm. Embed the bottom of each waterstop a minimum of 150 mm 6 inches in firm rock or sealed to other cut-off systems. Make adequate provision to support and completely protect the waterstops during the progress of the work. Repair or replace any waterstop punctured or damaged. Protect exposed waterstops during application of form release agents to avoid being coated. Provide suitable guards to protect exposed projecting edges and ends of partially embedded waterstops from damage when concrete placement has been discontinued. Accomplish splices with certified trained personnel using approved equipment and procedures.

#### 3.2.1 Copper And Stainless Steel

Splices in copper waterstops shall be lap joints made by brazing. Splices in stainless steel waterstops shall be welded using a TIG or MIG process utilizing a weld rod to match the stainless. All welds shall not be annealed to maintain physical properties. Do not use carbon flame in the annealing process. Damaged waterstops shall be repaired by removing damaged portions and patching. Patches shall overlap a minimum of 25 mm 1 inch onto undamaged portion of the waterstop.

#### 3.2.2 Flat Steel

Splices in flat steel waterstops shall be properly aligned, butt welded, and cleaned of excessive material.

#### 3.2.3 Non-Metallic

Fittings shall be shop made using a machine specifically designed to mechanically weld the waterstop. A miter guide, proper fixturing (profile dependant), and portable power saw shall be used to miter cut the ends to be joined to ensure good alignment and contact between joined surfaces. The splicing of straight lengths shall be done by squaring the ends to be joined. Maintain continuity of the characteristic features of the cross section of the waterstop (ribs, tabular center axis, protrusions, etc.) across the splice.

##### 3.2.3.1 Rubber Waterstop

Splices shall be vulcanized or shall be made using cold bond adhesive as recommended by the manufacturer. Splices for TPE-R shall be as specified for PVC.

### 3.2.3.2 Polyvinyl Chloride Waterstop

Make splices by heat sealing the adjacent waterstop edges together using a thermoplastic splicing iron utilizing a non-stick surface specifically designed for waterstop welding. Use the correct temperature to sufficiently melt without charring the plastic. Reform waterstops at splices with a remolding iron with ribs or corrugations to match the pattern of the waterstop. The spliced area, when cooled, shall show no signs of separation, holes, or other imperfections when bent by hand in as sharp an angle as possible.

### 3.2.3.3 Quality Assurance

Edge welding will not be permitted. Compress or close centerbulbs when welding to non-centerbulb type. Waterstop splicing defects which are unacceptable include, but are not limited to the following: 1) Tensile strength less than 80 percent of parent section. 2) Free lap joints. 3) Misalignment of centerbulb, ribs, and end bulbs greater than 2 mm 1/16 inch. 4) Misalignment which reduces waterstop cross section more than 15 percent. 5) Bond failure at joint deeper than 2 mm 1/16 inch or 15 percent of material thickness. 6) Misalignment of waterstop splice resulting in misalignment of waterstop in excess of 13 mm in 3 m 1/2 inch in 10 feet. 7) Visible porosity in the weld area, including pin holes. 8) Charred or burnt material. 9) Bubbles or inadequate bonding. 10) Visible signs of splice separation when cooled splice is bent by hand at a sharp angle.

### 3.2.4 Non-Metallic Hydrophilic Waterstop Installation

Miter cut ends to be joined with sharp knife or shears. The ends shall be adhered with cyanacrylate (super glue) adhesive. When joining hydrophilic type waterstop to PVC waterstop, the hydrophilic waterstop shall be positioned as shown on the drawings. Apply a liberal amount of a single component hydrophilic sealant to the junction to complete the transition.

### 3.2.5 Preformed Plastic Adhesive Installation

The installation of preformed plastic adhesive waterstops shall be a prime, peel, place and pour procedure. Joint surfaces shall be clean and dry before priming and just prior to placing the sealing strips. The end of each strip shall be spliced to the next strip with a 25 mm 1 inch overlap; the overlap shall be pressed firmly to release trapped air. During damp or cold conditions the joint surface shall be flashed with a safe, direct flame to warm and dry the surface adequately; the sealing strips shall be dipped in warm water to soften the material to achieve maximum bond to the concrete surface.

## 3.3 CONSTRUCTION JOINTS

Treat construction joints coinciding with expansion and contraction joints as expansion or contraction joints as applicable.

-- End of Section --