

SECTION 076200**FLASHING****PART 1 - GENERAL****1.1 SUMMARY**

- A. Provide flashing in accordance with requirements of the Contract Documents.
- B. This section includes, but is not limited to the following:
 - 1. Manufactured reglets and counterflashing.
 - 2. Formed roof drainage sheet metal fabrications.
 - 3. Formed low-slope roof sheet metal fabrications.
 - 4. Formed wall sheet metal fabrications.
- C. Related Work:
 - 1. Division 04 Section "Unit Masonry" for flashing specified in the work of that section.
 - 2. Division 06 Section "Rough Carpentry" for wood nailers, curbs, and blocking.
 - 3. Division 07 Section "Roof Work" for installing flashing integral with membrane roofing.
 - 4. Division 07 Section "Roof Accessories" for pre-manufactured roof flashing specialties, including but not limited to copings, pre-manufactured flashings, parapet scuppers, and splash pans.

1.2 COORDINATION

- A. Coordinate sheet metal flashing and trim layout and seams with sizes and locations of penetrations to be flashed, and joints and seams in adjacent materials.
- B. Coordinate sheet metal flashing and trim installation with adjoining roofing and wall materials, joints, and seams to provide leakproof, secure, and noncorrosive installation.

1.3 PERFORMANCE REQUIREMENTS

- A. General: Flashing assemblies as indicated shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed flashing shall not rattle, leak, or loosen, and shall remain watertight.
- B. FM Approvals Listing: Manufacture and install copings, roof edge flashings that are listed in FM Approvals' "RoofNav" and approved for windstorm classification, Class 1-60. Identify materials with name of fabricator and design approved by FM Approvals.
- C. Sheet Metal Standard for Flashing and Trim: Comply with NRCA's "The NRCA Roofing Manual" and SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.
- D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

1.4 ACTION SUBMITTALS

- A. **Product Data:** For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each manufactured product and accessory.
- B. **Shop Drawings:** Show installation layouts of flashing. Distinguish between shop- and field-assembled work. Include the following:
 - 1. Include plans, elevations, sections, and attachment details.
 - 2. Identification of material, thickness, weight, and finish for each item and location in Project.
 - 3. Details for joining, supporting, and securing flashing, including layout and spacing of fasteners, cleats, clips, and other attachments. Include pattern of seams.
 - 4. Details of termination points and assemblies, including fixed points.
 - 5. Details of edge conditions, and counterflashings as applicable.
 - 6. Details of connections to adjoining work.
- C. **Samples:** For each exposed product and for each finish specified, prepared on Samples of size indicated below:
 - 1. **Sheet Metal Flashing:** 12 inches long by actual width of unit, including finished seam and in required profile. Include fasteners, cleats, clips, closures, and other attachments.
 - 2. **Trim, Metal Closures, Expansion Joints, Joint Intersections, and Miscellaneous Fabrications:** 12 inches long and in required profile. Include fasteners and other exposed accessories.
 - 3. **Accessories and Miscellaneous Materials:** Full-size Sample.

1.5 INFORMATIONAL SUBMITTALS

- A. **Qualification Data:** For qualified fabricator.
- B. **Product Certificates:** For each type of coping and roof edge flashing that is FM Approvals approved.
- C. **Product Test Reports:** For each product, for tests performed by a qualified testing agency.
- D. **Warranty:** Sample of special warranty.

1.6 CLOSEOUT SUBMITTALS

- A. **Maintenance Data:** For sheet metal flashing, trim, and accessories to include in maintenance manuals.

1.7 QUALITY ASSURANCE

- A. **Fabricator Qualifications:** Shop that employs skilled workers who custom fabricate flashing similar to that required for this Project and whose products have a record of successful in-service performance.
 - 1. For copings and roof edge flashings that are FM Approvals approved, shop shall be listed as able to fabricate required details as tested and approved.
- B. **Preinstallation Conference:** Conduct conference at Project site.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Do not store flashing materials in contact with other materials that might cause staining, denting, or other surface damage. Store flashing materials away from uncured concrete and masonry.
- B. Protect strippable protective covering on flashing from exposure to sunlight and high humidity, except to the extent necessary for the period of flashing installation.

1.9 WARRANTY

- A. Special Warranty on Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace flashing that shows evidence of deterioration of factory-applied finishes within the warranty period.
 - 1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 hunter units when tested according to ASTM D 2244.
 - b. Chalking in excess of a No 8 rating when tested according to ASTM D 4214.
 - c. Cracking, checking, peeling or failure of paint to adhere to bare metal.
 - 2. Finish Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS**2.1 SHEET METALS**

- A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying a strippable, temporary protective film before shipping.
- B. Stainless-Steel Sheet Flashing Type (FL-01): ASTM A 240 or ASTM A 666, Type 304, dead soft, fully annealed; with smooth, flat surface.
 - 1. Finish: 2D (dull, cold rolled).
- C. Aluminum Sheet Counter Flashing Type (FL-02): ASTM B 209, alloy as standard with manufacturer for finish required, with temper as required to suit forming operations and performance required; with smooth, flat surface.
 - 1. Exposed Coil-Coated Finishes:
 - a. Standard 2-coat thermocured system consisting of corrosion inhibitive primer, fluoropolymer color coat and clear fluorocarbon topcoat, complying with AAMA 2605 and AA-C12C42R1x, containing not less than 70 percent PVDF resin by weight in color coat, in not less than 1.2 mils dry film thickness. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - b. Color and Gloss: to match adjacent metal color and finish
 - 2. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with minimum total dry film thickness of 0.5 mil.

2.2 ELASTOMERIC SHEET

- A. Neoprene Elastomeric Flashing Type (FL-03): Uncured black neoprene synthetic rubber, red lead curative, formed into uniform flexible sheets not less than 1/16 in. thick, by required width. Provide one of the following:

1. "Hydrotech Flex-Flash UN" (American Hydrotech, Inc.).
 2. "GacoFlex NF-621" (Gaco Western, Inc.).
 3. "Ram-Flash 327 H.D. (uncured)" (The Barrett Co.).
 4. "Neoflash" (Henry Company).
- B. Adhesives: Type recommended by neoprene elastomeric flashing manufacturer for waterproof/weather-resistant seaming and adhesive application of elastomeric flashing and compatible with materials to which it is bonded to and in contact with. Provide appropriate color of adhesive to prevent staining of substrates.
- C. Elastomeric Flashing Filler: Closed-cell polyethylene or other soft closed-cell material recommended by elastomeric flashing manufacturer as filler under flashing loops to ensure movement with minimum stress on flashing sheet.
- D. Primer, Cleaners and Sealant: As recommended by the elastomeric flashing manufacturer and compatible with the materials to which it is bonded.

2.3 UNDERLAYMENT MATERIALS

- A. Self-Adhering, High-Temperature Sheet: Minimum 30 to 40 mils thick, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.
1. Thermal Stability: ASTM D 1970; stable after testing at 240 deg F.
 2. Low-Temperature Flexibility: ASTM D 1970; passes after testing at minus 20 deg F.
 3. Products: Subject to compliance with requirements, provide one of the following:
 - a. Carlisle Coatings & Waterproofing Inc.; CCW WIP 300HT.
 - b. Grace Construction Products, a unit of W. R. Grace & Co.; Ultra.
 - c. Henry Company; Blueskin PE200 HT.
 - d. Metal-Fab Manufacturing, LLC; MetShield.
 - e. Owens Corning; WeatherLock Metal High Temperature Underlayment.
- B. Slip Sheet: Rosin sized building paper, 3-lb/100 sq. ft. minimum, rosin sized.

2.4 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete flashing installation and recommended by manufacturer of primary sheet metal or manufactured item unless otherwise indicated.
- B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal or manufactured item.
1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.
 - a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating.
 - b. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.
 - c. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.
 2. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.

3. Fasteners for Stainless-Steel Sheet: Series 300 stainless steel.
- C. Solder:
1. For Stainless Steel: ASTM B 32, Grade Sn60, with an acid flux of type recommended by stainless-steel sheet manufacturer.
- D. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.
- E. Elastomeric Sealant: ASTM C 920, elastomeric polymer sealant; low modulus; of type, grade, class, and use classifications required to seal joints in flashing and remain watertight.
- F. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.
- G. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.
- H. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.5 MANUFACTURED SHEET METAL FLASHING AND TRIM

- A. Reglets: Units of type, material, and profile indicated, formed to provide secure interlocking of separate reglet and counterflashing pieces, and compatible with flashing indicated with factory-mitered and -welded corners and junctions, with interlocking counterflashing on exterior face, of same metal as reglet.
1. Material: Stainless steel, 0.050 inch thick
 2. Finish: Mill.

2.6 FABRICATION, GENERAL

- A. General: Custom fabricate sheet metal flashing to comply with recommendations in details shown and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, geometry, metal thickness, and other characteristics of item indicated. Fabricate items at the shop to greatest extent possible.
1. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
 2. Obtain field measurements for accurate fit before shop fabrication.
 3. Form flashing without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.
 4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces exposed to view.
- B. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.
- C. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant.

- D. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.
 - 1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.
 - 2. Use lapped expansion joints only where indicated on Drawings.
- E. Sealant Joints: Where movable, nonexpansion-type joints are required, form metal to provide for proper installation of elastomeric sealant according to cited sheet metal standard.
- F. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.
- G. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints where necessary for strength.
- H. Do not use graphite pencils to mark metal surfaces.

2.7 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

- A. Base Flashing (FL-01): Shop fabricate interior and exterior corners. Fabricate from the following materials:
 - 1. Stainless Steel: 0.025 inch thick.
- B. Counterflashing and Flashing Receivers (CFL): Fabricate from the following materials:
 - 1. Aluminum: 0.032 inch thick.
- C. Roof-Penetration Flashing (FL-01): Fabricate from the following materials:
 - 1. Stainless Steel: 0.025 inch thick.
- D. Roof-Drain Flashing (FL-01): Fabricate from the following materials:
 - 1. Stainless Steel: 0.025 inch thick.

2.8 WALL SHEET METAL FABRICATIONS

- A. Through-Wall Flashing (FL-01): Fabricate continuous flashings in minimum 96-inch- long, but not exceeding 12-foot- long, sections, under copings, at shelf angles, and where indicated. Fabricate discontinuous lintel, sill, and similar flashings to extend 6 inches beyond each side of wall openings. Form with 2-inch-high, end dams where flashing is discontinuous. Fabricate from the following materials:
 - 1. Stainless Steel: 0.025 inch thick.
- B. Opening Flashings in Frame Construction (FL-01): Fabricate head, sill, jamb, and similar flashings to extend 4 inches beyond wall openings. Form head and sill flashing with 2-inch-high, end dams. Fabricate from the following materials:
 - 1. Stainless Steel: 0.025 inch thick.

PART 3 - EXECUTION**3.1 EXAMINATION**

- A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions and other conditions affecting performance of the Work.
 - 1. Verify compliance with requirements for installation tolerances of substrates.
 - 2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
 - 3. Verify that air- or water-resistant barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
- B. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 UNDERLAYMENT INSTALLATION

- A. Self-Adhering Sheet Underlayment: Install self-adhering sheet underlayment, wrinkle free. Apply primer if required by underlayment manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation; use primer rather than nails for installing underlayment at low temperatures. Apply in shingle fashion to shed water, with end laps of not less than 6 inches staggered 24 inches between courses. Overlap side edges not less than 3-1/2 inches. Roll laps with roller. Cover underlayment within 14 days.
- B. Apply slip sheet, wrinkle free, directly on substrate before installing sheet metal flashing and trim.

3.3 INSTALLATION, GENERAL

- A. General: Anchor flashing and other components of the Work securely in place, with provisions for thermal and structural movement so that completed flashing shall not rattle, leak, or loosen, and shall remain watertight. Use fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required to complete flashing system.
 - 1. Install flashing true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
 - 2. Install flashing to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
 - 3. Space cleats not more than 12 inches apart. Anchor each cleat with two fasteners. Bend tabs over fasteners.
 - 4. Install exposed flashing without excessive oil canning, buckling, and tool marks.
 - 5. Install sealant tape where indicated.
 - 6. Torch cutting of flashing is not permitted.
 - 7. Do not use graphite pencils to mark metal surfaces.
- B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by SMACNA.

1. Coat back side of uncoated aluminum and stainless-steel flashing with bituminous coating where flashing and trim will contact wood, ferrous metal, or cementitious construction.
 2. Underlayment: Where installing metal flashing directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet or install a course of polyethylene sheet.
- C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection.
1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.
 2. Use lapped expansion joints only where indicated on Drawings.
- D. Fastener Sizes: Use fasteners of sizes that will penetrate metal decking not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.
- E. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.
- F. Seal joints as shown and as required for watertight construction.
1. Use sealant-filled joints unless otherwise indicated. Embed hooked flanges of joint members not less than 1 inch into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is between 40 and 70 deg F, set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F.
 2. Prepare joints and apply sealants to comply with requirements in Section 079200 "Joint Sealants."
- G. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets to be soldered to a width of 1-1/2 inches, except reduce pre-tinning where pre-tinned surface would show in completed Work.
1. Do not solder aluminum sheet.
 2. Do not use torches for soldering.
 3. Heat surfaces to receive solder and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.
 4. Stainless-Steel Soldering: Tin edges of uncoated sheets using solder recommended for stainless steel and acid flux. Promptly remove acid flux residue from metal after tinning and soldering. Comply with solder manufacturer's recommended methods for cleaning and neutralization.
- H. Rivets: Rivet joints in uncoated aluminum where indicated and where necessary for strength.

3.4 ELASTOMERIC FLASHING

- A. General: Apply using continuous sheets as large as practicable. Apply adhesive to substrate and back of membrane. Avoid wrinkles, buckles and any other imperfections. Complete the work to assure that no water leakage through the flashing occurs.

- B. Masking: Mask off areas or take other precautions to prevent soiling of adjacent areas. Immediately clean areas which are soiled by adhesive or other materials.
- C. Follow the recommended technique for cleaning seam, lap and splice areas, for the method and sequence of forming field joints in the flashing and for the application of adhesive both for seaming and for bonding to substrate. Each flashing sheet shall be carefully positioned in place, trimmed and cut to be installed in a relaxed condition and allowed to adapt to contours without bridging. Keep polyethylene liner in position to facilitate movement and placement of flashing.
- D. Flashing Adhesive: Mix flashing adhesive to a uniform consistency prior to applying to substrates. Prior to mixing adhesive verify that air temperatures, relative humidity and surface temperatures. Apply adhesive to each of the surfaces to be bonded with each surface coated for 100% adhesion. Adhesive shall be allowed to dry free of solvent, before bonding. Coated surfaces shall be bonded together as soon as possible after adhesive application.
- E. Installation of Flashing: Carefully position flashing sheet, pressing the adhesive coated surface of the sheet into place and flattening to prevent air entrapment. Lap seams a minimum of 6 in. in the direction of drainage. Overlap selvage seams and joints. Adhere seams and joints in a full bed of adhesive and anchor edges to provide smooth flat seams, free from bubbles, wrinkles, fish mouths, folds or other surface defects. Fully adhere flashing to relieving angles and other substrates. Where required, provide for movement at joints by forming loops or bellows in width of flashing. Locate cover or filler strips at joints to facilitate complete drainage of water from flashing.
 - 1. As soon as the adhesive is fully set and dry, recheck joints. Where any openings, fish-mouths or other defects occur, reseal and reroll joints. Where flashing terminates on a vertical surface, at edge intersections of laps and at inside and outside corners, provide a continuous fillet bead of sealant to seal edge of flashing sheet.
 - 2. Extend flashing not less than 8 in. up or down on vertical surfaces, unless otherwise indicated.
 - 3. In locations of discontinuous flashing, turn up the ends of the membrane to produce an end dam to retain water. Seal projections passing through elastomeric flashing and provide watertight construction throughout.
 - 4. Provide accessories to make flashing a complete system.
- F. Coordinate installation of elastomeric flashing with installation of stainless steel metal drip trim. Allow flashing to lap and extend beyond intended limit to allow for neat trimming after sealants, mortar and other related work has been completed.

3.5 ROOF DRAINAGE SYSTEM INSTALLATION

- A. General: Install sheet metal roof drainage items to produce complete roof drainage system according to SMACNA recommendations and as indicated. Coordinate installation of roof perimeter flashing with installation of roof drainage system.

3.6 ROOF FLASHING INSTALLATION

- A. General: Install flashing to comply with performance requirements, sheet metal manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, set units true to line, and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.

- B. Roof Edge Flashing: Anchor to resist uplift and outward forces according to recommendations in SMACNA's "Architectural Sheet Metal Manual" and as indicated. Interlock bottom edge of roof edge flashing with continuous cleat anchored to substrate at staggered 3-inch centers.
- C. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending a minimum of 4 inches over base flashing. Install stainless-steel draw band and tighten.
- D. Counterflashing: Coordinate installation of counterflashing with installation of base flashing. Insert counterflashing in reglets or receivers and fit tightly to base flashing. Extend counterflashing 4 inches over base flashing. Lap counterflashing joints a minimum of 4 inches and bed with sealant. Secure in waterproof manner by means of snap-in installation and sealant or lead wedges and sealant.
- E. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Seal with elastomeric sealant and clamp flashing to pipes that penetrate roof.

3.7 WALL FLASHING INSTALLATION

- A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to SMACNA recommendations and as indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.
- B. Through-Wall Flashing: Installation of through-wall flashing is specified in Division 04 Section "Unit Masonry."
- C. Reglets: Installation of reglets is specified in Division 03 Section "Cast-in-Place Concrete."
- D. Opening Flashings in Frame Construction: Install continuous head, sill, jamb, and similar flashings to extend 4 inches beyond wall openings.

3.8 ERECTION TOLERANCES

- A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet on slope and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.9 CLEANING AND PROTECTION

- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
- B. Clean and neutralize flux materials. Clean off excess solder and sealants.
- C. Remove temporary protective coverings and strippable films as flashing are installed unless otherwise indicated in manufacturer's written installation instructions.
- D. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION