

1 GENERAL**1.01 REFERENCE STANDARDS**

- .1 American Concrete Institute (ACI)
 - .1 SP-66, ACI Detailing Manual 2004.
- .2 ASTM International (ASTM)
 - .1 ASTM A 143/A 143M, Standard Practice for Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedure for Detecting Embrittlement.
 - .2 ASTM A 641/A 641M, Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.
 - .3 ASTM A 1064/A 1064M, Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
- .3 CSA Group (CSA)
 - .1 CSA-A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.
 - .2 CAN/CSA-A23.3, Design of Concrete Structures.
 - .3 CSA-G30.18, Carbon Steel Bars for Concrete Reinforcement.
 - .4 CSA-G40.20/G40.21, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
 - .5 CAN/CSA-G164, Hot Dip Galvanizing of Irregularly Shaped Articles.
- .4 Reinforcing Steel Institute of Canada (RSIC)
 - .1 RSIC, Reinforcing Steel Manual of Standard Practice.

1.02 ADMINISTRATIVE REQUIREMENTS

- .1 Pre-installation Meetings: in accordance with Section 01 31 19 - Project Meetings, convene pre-installation meeting one week prior to beginning concrete works.
 - .1 Ensure key personnel attend.
 - .1 Verify project requirements.

1.03 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for proprietary materials used in Cast-In-Place Concrete and additives and include product characteristics, performance criteria, physical size, finish, and limitations.
 - .2 When Chromate solution used as replacement for galvanizing non-prestressed reinforcement, provide product description for review by Consultant prior to its use.
 - .3 Submit 2 copies of WHMIS MSDS in accordance with Section 01 35 29.06 - Health and Safety Requirements.

- .3 Shop Drawings:
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Saskatchewan, Canada.
 - .1 Prepare reinforcement drawings in accordance with RSIC Manual of Standard Practice.
 - .2 Indicate placing of reinforcement and:
 - .1 Bar bending details.
 - .2 Lists.
 - .3 Quantities of reinforcement.
 - .4 Sizes, spacings, locations of reinforcement and mechanical splices if approved by Consultant, with identifying code marks to permit correct placement without reference to structural drawings.
 - .3 Detail lap lengths and bar development lengths to CAN/CSA-A23.3, unless otherwise indicated.
 - .1 Provide type A tension lap splices unless otherwise indicated.
 - .4 Indicate position and size of openings in slabs and walls. Coordinate with trades requiring openings.
- .4 Quality Assurance Submittals:
 - .1 Submit in accordance with Section 01 45 00 - Quality Control and as described in PART 2 - SOURCE QUALITY CONTROL.
 - .2 Mill Test Report: submit to Departmental Representative certified copy of mill test report of reinforcing steel, minimum 4 weeks prior to beginning reinforcing work.

1.04 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Replace defective or damaged materials with new.

- .4 Handle, transport, store and install epoxy coated reinforcing steel bars to prevent damage to coating. Prevent bar-to-bar abrasion and excessive sagging. Do not drop or drag bars. Store on suitable non-metallic supports. For lifting use nylon lifting slings, padded slings, separators or other means recommended by epoxy coated reinforcing steel supplier.
- .5 Develop Construction Waste Management Plan related to Work of this Section and in accordance with Section 01 35 21 - LEED Requirements.

2 PRODUCTS

2.01 MATERIALS

- .1 Substitute different size bars only if permitted in writing by Consultant.
- .2 Reinforcing steel: billet steel, grade 400, deformed bars to CSA-G30.18, unless indicated otherwise.
- .3 Reinforcing steel: weldable low alloy steel deformed bars to CSA-G30.18.
- .4 Cold-drawn annealed steel wire ties: to ASTM 1064/A 1064M.
- .5 Deformed steel wire for concrete reinforcement: to ASTM 1064/A 1064M.
- .6 Welded steel wire fabric:
 - .1 Plain in accordance ASTM A 1064/A 1064M, fabricated from as drawn steel wire into flat sheets; sizes as indicated on Drawings.
 - .2 Finish:
 - .1 Galvanized: Fabricated from galvanized wire having Class A coating in accordance with ASTM A 641.
 - .2 Epoxy Coated: Epoxy coated after welding in accordance with ASTM A 884/A 884M, Class A coated <175 µm, Type 1 intended for use in concrete or masonry, colour contrasting with rust.
- .7 Epoxy Coating of non-prestressed reinforcement: to ASTM A 775/A 775M.
- .8 Galvanizing of non-prestressed reinforcement: to CAN/CSA-G164, minimum zinc coating 610 g/m².
 - .1 Protect galvanized reinforcing steel with chromate treatment to prevent reaction with Portland cement paste.
 - .2 If chromate treatment carried out immediately after galvanizing, soak steel in aqueous solution containing minimum 0.2% by weight sodium dichromate or 0.2% chromic acid.
 - .1 Temperature of solution minimum 32 degrees and galvanized steels immersed for minimum 20 seconds.
 - .3 If galvanized steels at ambient temperature, add sulphuric acid as bonding agent at concentration of 0.5% to 1%.
 - .1 No restriction applies to temperature of solution.
 - .4 Chromate solution sold for this purpose may replace solution described above, provided if of equivalent effectiveness.

- .1 Provide product description as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.
- .9 Chairs, bolsters, bar supports, spacers: to CSA-A23.1/A23.2.
- .10 Tie wire: 1.5 mm diameter annealed wire.
- .11 Mechanical splices: subject to approval of Consultant.
- .12 Plain round bars: to CSA-G40.20/G40.21.

2.02 FABRICATION

- .1 Fabricate reinforcing steel in accordance with CSA-A23.1/A23.2 and Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Canada.
- .2 Obtain Consultant's written approval for locations of reinforcement splices other than those shown on placing drawings.
- .3 Upon approval of Consultant, weld reinforcement in accordance with CSA W186.
- .4 Ship bundles of bar reinforcement, clearly identified in accordance with bar bending details and lists.
 - .1 Ship epoxy coated bars in accordance with ASTM A 775A/A 775M.

2.03 SOURCE QUALITY CONTROL

- .1 Provide Consultant with certified copy of mill test report of reinforcing steel, showing physical and chemical analysis, minimum 4 weeks prior to beginning reinforcing work.
- .2 Upon request inform Departmental Representative of proposed source of supplied material.

3 EXECUTION

3.01 PREPARATION

- .1 Galvanizing to include chromate treatment.
 - .1 Duration of treatment 1 hour per 25 mm of bar diameter.
- .2 Conduct bending tests to verify galvanized bar fragility in accordance with ASTM A 143/A 143M.

3.02 FIELD BENDING

- .1 Do not field bend or field weld reinforcement except where indicated or authorized by Consultant.
- .2 When field bending authorized, bend without heat, applying slow and steady pressure.

- .3 Replace bars, which develop cracks or splits.

3.03 PLACING REINFORCEMENT

- .1 Cutting or puncturing vapour retarder is not permitted; repair damage and reseal vapour retarder before placing concrete.
- .2 Place reinforcing steel as indicated on placing drawings and in accordance with CSA-A23.1/A23.2.
- .3 Use plain round bars as slip dowels in concrete.
 - .1 Paint portion of dowel intended to move within hardened concrete with one coat of asphalt paint.
 - .2 Apply thick even film of mineral lubricating grease when paint is dry.
- .4 Prior to placing concrete, obtain Consultant's approval of reinforcing material and placement.
- .5 Maintain cover to reinforcement during concrete pour.
- .6 Protect epoxy coated portions of bars with covering during transportation and handling.

3.04 FIELD TOUCH-UP

- .1 Touch up damaged and cut ends of epoxy coated or galvanized reinforcing steel with compatible finish to provide continuous coating.

3.05 FIELD QUALITY CONTROL

- .1 Site tests: conduct tests as follows in accordance with Section 01 45 00 - Quality Control and submit report as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.
 - .1 Epoxy coating.
 - .2 Reinforcing steel and welded wire fabric.
- .2 Inspection and testing of reinforcing and reinforcing materials carried out by testing laboratory designated by Departmental Representative for review to CSA A23.1/A23.2.
 - .1 Ensure testing laboratory certified to CSA A283.
- .3 Departmental Representative will pay for costs of tests as specified in Section 01 29 83 - Payment Procedures for Testing Laboratory Services.
- .4 Inspection or testing by Consultant not to augment or replace Contractor quality control nor relieve Contractor of contractual responsibility.

3.06 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.

- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

1 GENERAL**1.01 REFERENCES**

- .1 Concrete work shall conform to the requirements of the following Standards unless otherwise required by this specification:
 - .2 American Society for Testing and Materials (ASTM)
 - .1 ASTM C260, Specification for Air-Entraining Admixtures for Concrete.
 - .2 ASTM C309, Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
 - .3 ASTM C494, Specification for Chemical Admixtures for Concrete.
 - .3 Canadian Standards Association (CSA)
 - .1 CAN/CSA-A5, Portland Cement.
 - .2 CSA-A23.1, Concrete Materials and Methods of Concrete Construction.
 - .3 CSA-A23.2, Methods of Test for Concrete.
 - .4 CSA-A23.3, Code for the Design of Concrete Structures for Buildings.
 - .4 A copy of A23.1 and A23.2 shall be kept by the Contractor on site for the duration of the work and be made available for reference.

1.02 SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures
- .2 Keep a record at the job site showing time and place of each pour of concrete, together with a transit-mix delivery slip certifying contents of pour. Make the record available for inspection upon request. Upon completion of this portion of work, submit placing records and delivery slips.
- .3 Submit details of proposed methods of concrete curing and provisions for weather protection for review
- .4 Submit plan locations and details of construction joints for review

1.03 CERTIFICATES

- .1 Minimum 2 weeks prior to starting concrete work submit manufacturer's test data and certification by qualified independent inspection and testing laboratory that following materials will meet specified requirements:
 - .1 Portland cement.
 - .2 Blended hydraulic cement.
 - .3 Supplementary cementing materials.
 - .4 Grout.
 - .5 Admixtures.
 - .6 Aggregates.
 - .7 Water.

- .8 Waterstops.
- .9 Waterstop joints.
- .10 Joint filler.
- .2 Provide certification that mix proportions selected will produce concrete of quality, yield and strength as specified in concrete mixes, and will comply with CAN/CSA-A23.1.
- .3 Provide certification that plant, equipment, and materials to be used in concrete comply with requirements of CAN/CSA-A23.1.

1.04 QUALITY ASSURANCE

- .1 Minimum 2 weeks prior to starting concrete work, submit proposed quality control procedures for approval for following items:
 - .1 Falsework erection.
 - .2 Hot weather concrete.
 - .3 Cold weather concrete.
 - .4 Curing.
 - .5 Finishes.
 - .6 Formwork removal.
 - .7 Joints.

2 PRODUCTS

2.01 MATERIALS

- .1 Portland cement: to CAN/CSA-A5.
- .2 Supplementary cementing materials: to CAN/CSA-A23.5.
- .3 Cementitious hydraulic slag: to CAN/CSA-A363.
- .4 Mixing water shall conform to CAN/CSA-A23.1.
- .5 Aggregates: to CAN/CSA-A23.1. Coarse aggregates to be normal density.
- .6 Air entraining admixture: to ASTM C260.
- .7 Chemical admixtures: to ASTM C494. Accelerating or set retarding admixtures during cold and hot weather placing must be approved.
- .8 Concrete retarders: to ASTM C494 water based. Do not allow moisture of any kind to come in contact with the retarder film.
- .9 Calcium chloride, either as a raw material or as a constituent in other admixtures, shall not be used.
- .10 Curing compounds shall conform to CAN/CSA-A23.1 and shall also be compatible with specified floor hardeners, covering adhesives and waterproofing compounds.

- .11 Grout shall be preapproved, premixed, non-shrink conforming to the Standard. Exposed grout shall be non-staining cement grey in colour.
- .12 Ribbed waterstops: extruded PVC Arctic Grade of sizes indicated with shop welded corner and intersecting pieces with legs:
 - .1 Tensile strength: to ASTM D412, method A, Die "C".
 - .2 Elongation: to ASTM D412, method A, Die "C".
 - .3 Tear resistance: to ASTM D624, method A, Die "B".

2.02 MIXES

- .1 Concrete mixes shall be proportioned by the supplier to meet the compressive strength, exposure class, and other performance specifications noted in the contract documents. In addition, concrete mix design shall satisfy the transport, placing, and finishing requirements of the Contractor. All concrete shall be normal weight unless noted otherwise. Concrete types are specified in accordance with CSA-A23.1 Table 5, Alternate
- .2 Concrete mix design is the responsibility of the supplier, including the use of admixtures, alone or in combination. The supplier is also responsible for ensuring the plastic and hardened properties of the concrete meet the construction and specified requirements. This includes the long term performance of the hardened mix.
- .3 Pump mix slumps shall also conform to the above.
- .4 Water/Cement ratios and air contents for exposure class shall be as per the Standard.
- .5 The proposed mixes shall be submitted for review.
- .6 The mix designs shall note the constituents by weight, the properties required by the structural drawings, and the structural elements for which the mix is to be used.

3 EXECUTION

3.01 PLACING OF CONCRETE

- .1 Conveying and placing of concrete is to conform to the Standard.
- .2 All concrete shall be consolidated by means of vibrators of appropriate size operated by experienced workers.
- .3 The use of vibrators to transport concrete shall not be permitted.
- .4 Cement slurry used to prime concrete pumps shall be discarded and not placed in the project.

3.02 OPENINGS AND INSERTS

- .1 The Contractor shall notify all trades sufficiently in advance to ensure that provision is made for openings, inserts and fasteners. The Contractor shall cooperate with all trades in the forming and setting of all slots, sleeves, bolts, dowels, hangers, inserts, conduits, clips, etc.
- .2 Openings and sleeves shown on the structural drawings must be confirmed with mechanical, electrical and architectural drawings.
- .3 Openings and sleeves not shown on the structural drawings must be approved.

3.03 CONSTRUCTION AND CONTROL JOINTS

- .1 Construction joints shall conform to the Standard except that for horizontal joints in walls it will be sufficient to place fresh concrete on a clean rough surface unless directed otherwise by the Departmental Representative or otherwise noted on the structural drawings.
- .2 Joints in slabs on grade shall be located as indicated on the structural and/or architectural drawings. Unless noted otherwise on the drawings a joint in the slab on grade may be a pour joint, trowelled joint, saw cut, or other pre-approved method. The depth of joints shall be a minimum of $\frac{1}{4}$ of the thickness of the slab. Saw cut joints are to be completed within 24 hr. of placing. Alternative joint details are to be submitted in writing.
- .3 For vertical joints in walls below grade, see standard detail on structural drawings. For locations, see architectural and structural drawings.
- .4 Construction joints in walls and columns shall occur at the top of slab and at the underside of slab/beam systems unless noted otherwise on the structural drawings.
- .5 Construction joints not shown in the drawings or specifications shall be subject to the approval. Note that keys or extra reinforcing may be required to facilitate additional construction joints not shown on the drawings with associated costs borne by the Contractor.
- .6 The existing concrete surface at construction joints shall be wetted thoroughly immediately prior to placement of concrete.
- .7 Construction joints exposed to view may be subject to non-structural review.
- .8 Unless noted otherwise on the drawings, control joints in walls are to be located at a maximum spacing of 9m (30') on centre and detailed as indicated on the structural drawings.
- .9 Supply and install pre-molded water-stops in construction joints where indicated on the drawings. Weld joints to make watertight. Install waterstops in accordance with manufacturer's specifications and recommendations.

3.04 CURING AND PROTECTION

- .1 Curing procedures shall be in accordance with the Standard.
- .2 Cold and hot weather protection shall comply with the Standard or the requirements on the structural drawings, whichever are more rigorous.
- .3 Concrete placement during extreme drying conditions shall satisfy clause 7.4.2.2 of A23.1.

3.05 CURING AND PROTECTION

- .1 Honeycomb, exposed reinforcement and other defects shall be repaired and patched by the Contractor at the Contractor's cost using a preapproved procedure. Exposed patching must also be approved.
- .2 Immediately after the removal of forms, all bolts, ties, nails or other metal not specifically required for construction purposes shall be removed or cut back to a depth of 25 mm (1") from the surface of the concrete.

3.06 TOLERANCES

- .1 Tolerances shall conform to the Standard or the requirements on the structural or architectural contract documents, whichever are more rigorous.

3.07 FINISHING – FLOORS

- .1 Finishing shall conform to CSA-A23.1 - Section 7.5 as a minimum. Care shall be taken during finishing to maintain the cambers specified on the structural drawings. See also the architectural drawings and specifications for additional finish requirements.
- .2 Unless noted otherwise, floor finishes shall be Class A "institutional and commercial floors" and have gaps less than or equal to 8.0 mm (5/16") under a 3000 mm (10'-0") straight edge. Only a single curvature within this distance is allowed.

3.08 FINISHES – FORMED SURFACES

- .1 All formed surfaces shall be treated in accordance with CSA A23.1, Section 7.7 as a minimum. See also architectural drawings and specifications for additional finish requirements.

3.09 ARCHITECTURAL CONCRETE

- .1 See architectural drawings and specifications for any requirements. Conform to CSA-A23.1 - Section 8.3 as a minimum.

3.10 OPENINGS THROUGH STRUCTURAL WORK

- .1 If, after any part of the structural work has been completed, it is required that additional openings be made through the structure, the openings must be approved. No opening, including cored sleeves, shall be made through completed work without authorization in writing. Openings indicated on the drawings that have not been provided for prior to completing the structural work will have the associated costs borne by the Contractor.

3.11 REJECTION OF DEFECTIVE WORK

- .1 In the event that concrete tests do not conform to the requirements of this specification, or when conditions are such to cause doubt about the safety of the structure, testing of the structure will be undertaken. This may entail further concrete tests, coring or load testing as per the Standard, or any other test that deems suitable. Such test shall be made at the expense of the Contractor.
- .2 Where material or workmanship fails to meet the requirements of the specification, such work may be rejected. Work rejected shall be replaced or repaired at no additional cost.
- .3 Provide 48 hours notice prior to placing of concrete.
- .4 Pumping of concrete is permitted only after approval of equipment and mix.
- .5 Ensure reinforcement and inserts are not disturbed during concrete placement.
- .6 Prior to placing of concrete obtain approval of proposed method for protection of concrete during placing and curing in adverse weather.
- .7 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, air temperature and test samples taken.
- .8 In locations where new concrete is dowelled to existing work, drill holes in existing concrete. Place steel dowels of deformed steel reinforcing bars and pack solidly with epoxy grout to anchor and hold dowels in positions as indicated.
- .9 Do not place load upon new concrete until authorized.

3.12 FIELD QUALITY CONTROL

- .1 Inspection and testing of concrete and concrete materials will be carried out by a Testing Laboratory in accordance with CAN/CSA-A23.1.
- .2 The Departmental Representative will pay for costs of tests.
- .3 Non-destructive Methods for Testing Concrete shall be in accordance with CAN/CSA-A23.2.
- .4 Inspection or testing will not augment or replace Contractor quality control nor relieve him of his contractual responsibility.

3.13 APPOINTMENT OF TESTING AGENCY

- .1 The Contractor shall hire a CSA-approved Testing Agency who shall test concrete, reinforcement and grout as per this specification.
- .2 Following testing is the responsibility of the Contractor:
 - .1 Review of initial mix designs.
 - .2 Testing as outlined except for testing required by the Contractor for stripping of formwork.
 - .3 Review of Contractor-requested mix design changes.
 - .4 Any waiting time incurred by the Testing Agency in excess of 1/2 an hour.
 - .5 Any additional costs due to overtime, shift work, holiday or weekend work, except that the Owner's representative will pay for holiday or weekend pickup when the concrete was placed on a regular workday.
 - .6 Costs for testing required by the Contractor for stripping of formwork, such as field cure cylinders etc.
 - .7 Cost for retesting or additional testing of concrete or reinforcement where tests have failed to meet the specified requirements.

3.14 DUTIES

- .1 RESPONSIBILITY OF THE CONTRACTOR
 - .1 The Contractor shall cooperate fully with the Testing Agency.
 - .2 The Contractor shall give the Testing Agency at least four (48) hours prior notice of concrete placement.
 - .3 It is the Contractor's responsibility to provide a finished product that meets the specification. If initial tests indicate that the concrete failed to meet the specification, the Owner's representative shall decide if any additional testing is necessary. This testing shall be done by a CSA-approved Testing Agency, The proposed additional testing shall have prior approval of the Owner's representative.
 - .4 Strengths of cored samples must equal the specified strength if tested dry or 85% of specified if tested wet, with wet or dry tests as per the Standard.

3.15 RESPONSIBILITY AND DUTIES OF THE TESTING AGENCY

- .1 The Testing Agency has the authority to, and is expected to reject any concrete not meeting the specifications.
- .2 If the Testing Agency becomes aware that concrete is being placed without their notification, or if insufficient notice is received, then the Testing Agency shall notify the Departmental Representative immediately.
- .3 Low 7-day, 28-day, and 56-day strength tests shall be brought immediately to the attention of the Departmental Representative and the Contractor.

3.16 TESTING - CONCRETE**.1 GENERAL**

- .1 All strength tests shall be numbered consecutively and the cylinders marked as follows:
 - .1 7-Day Test: Marked "A".
 - .2 28-Day Test: Two (2) cylinders marked "B" and "C".
 - .3 56-Day Test: Where these are required by the drawings and specifications, two (2) cylinders marked "D" and "E".
- .2 All tests reports shall record:
 - .1 Name of Project
 - .2 Date and time of sampling
 - .3 Name of supplier
 - .4 Delivery truck number
 - .5 Batch time and discharge time
 - .6 Identification of sampling and testing technicians
 - .7 Exact location in the structure of the concrete sampled
 - .8 Design strength of concrete sampled
 - .9 Admixtures, cement type, maximum aggregate size
 - .10 Air and concrete temperature
 - .11 Slump, and air content
- .3 All field cured cylinders shall be marked "F".
- .4 Slump tests shall be performed prior to the addition of superplasticizers.
- .5 Tests for slump and air content shall be taken with each strength test and as required by the specifications and drawings.

.2 REGULAR TESTING – CONCRETE

- .1 To conform to the Standard, except each test shall consist of three (3) cylinders - one (1) for 7-day strength and two (2) for 28-day strength. Provide two (2) extra cylinders for 56 day strength requirements on S-2 exposure class concrete elements.
- .2 Regular testing applied to all concrete elements.

3.17 FIELD CURED CYLINDERS

- .1 Field cure cylinders shall be protected against wind and be stored on the floor immediately below the slab they represent unless the floor below is heated. In that case they shall be stored on top of the slab but covered with a plywood box. The cylinders are to be undisturbed at this location until picked up by the Testing Agency. Field core cylinders are not to be stored in temperature controlled containers.

END OF SECTION