

## **PART 1 GENERAL**

### **1.1 Section Includes**

- .1 Form work system and supports for cast-in-place concrete, including pile caps, except as specified in Section 321313.
- .2 Place dowels, anchor bolts/plates, embedded plates and assemblies supplied by others.
- .3 Form work for isolation concrete slab.

### **1.2 Related Sections**

- .1 Drilled Cast-in-Place Augured Piles - Section 316323.
- .2 Concrete Reinforcement Section 032000.
- .3 Cast-in-Place Concrete Section 033000.
- .4 Pre-Engineered Light Gauge Metal building System Section 051220
- .4 Mechanical Division 22 AND 23, and Electrical Division 26.

### **1.3 Work Installed Only; Supplied by Others**

- .1 Anchor Bolts/Plates; Embedded Plates and Assemblies, Shelf Angle Anchor Bolts, Conduit and Conduit Sleeves.

### **1.4 Design and Code Requirements**

- .1 Form work and supporting false work shall be designed and constructed in accordance with the requirements of CSA S269.1-1975 and CAN3-A23.1-94 (Latest Edition) and S269.3-M92, as applicable to the work.
- .2 Assume full responsibility for the design and for the adequacy and safety of all form work and false work.
- .3 Retain a Professional Consultant to design false work which consists of shoring more than one tier in height or which is a framed structure.
- .4 The design and erection of form work and related supporting works shall comply with construction safety legislation and regulations.
- .5 Design and construct form work for structural members over voids to ensure positive void. Materials used to form the void shall not produce toxic, odorous or other detrimental bi-products. The use of rigid boards of compressed straw, such as stramit, will not be permitted.

### **1.5 Submittals**

- .1 Prior to commencement of work, submit drawings for the Departmental Representative's file showing form work details and their supports, including re-shoring system for the slabs. These drawings may be required to be signed and sealed by a Consultant registered with the Association of Professional Consultants of the Province of governing jurisdiction.

### **1.6 Handling and Storage**

- .1 Deliver, handle and store form work materials to prevent weathering, warping or damage detrimental to the strength of the materials or to the surface to be formed.
- .2 Ensure that form work surfaces, which will be in contact with concrete are not contaminated by foreign matter. Handle and erect the fabricated form work so as to prevent damage.

## **PART 2 PRODUCTS**

### **2.1 Quality and Strength**

- .1 The quality and strength of form work materials shall comply with the requirements set forth in this Specification and CAN3-A23.1-94 (Latest Edition).

### **2.2 Finishes**

- .1 Form materials for concrete surfaces which will be exposed to view, or which require smooth and uniform surfaces for applied finishes or other purposes shall consist of square edges, smooth

- panels of plywood, metal or plastic to approval of the Departmental Representative. The panels shall be square and made in a true plane, clean, free of holes, surface markings and defects.
- .2 Square edged, tongue and groove or shiplap lumber may be used to form concrete which will not be exposed to view or which does not require smooth uniform surface for other purposes.

### **2.3 Materials**

- .1 Form Plywood: Exterior grade, Douglas Fir conforming to CSA Standard 0121-M1978 (Latest Edition). Plywood shall be resin coated one side (in contact with concrete). Use sound undamaged plywood with clean true edges. Make up or patching strips between panels shall be kept to a minimum.
- .2 Lumber for forms, false work, shoring and bracing: Conform to CSA Standard 0141-91 (Latest Edition) for Softwood Lumber, and the applicable authorized grading authority. All lumber shall be a grade to which allowable unit stresses may be assigned in accordance with the National Building Code. All lumber shall be grade marked by the authorized grading authority.
- .3 Form Ties: Fabricated units having a minimum working strength when assembled of 21 MPa and shall be adjustable in lengths to permit tightening and alignment of forms. Ties shall be made with breakback ends or other means of removing the tie and to a depth of at least 25mm from the concrete surface after the forms are removed. Flat tie for architectural exposed concrete to include plastic cones leaving no metal within 20mm of surface.
- .4 Form Release Agent: Proprietary material which will not stain the concrete or impair the natural bonding or colour characteristics of coating intended for use on the concrete.
- .5 Waterstops: Purpose made polyvinyl chloride: 12 MPa minimum tensile strength, minus 46° Celsius working temperature range, conforming to CGSB 41 GP 35M, Type 2. "DURAJOINT" 150 by Sternson; Waterstop 76 by Greenstreak; Canadian Water Stop SS-11.
- .6 Tubular Column Forms: Round spirally wound laminated fibre forms, internally treated with release material. CSA 0141(Latest Edition).
- .7 Dovetail Anchor Slots: Minimum 0.6mm galvanized steel with insulation filled slots.
- .8 Pre-Molded Joint Fillers:  
.1 Bituminous impregnated fibreboard: ASTM D1751-73. 13mm thick asphalt impregnated fibreboard.  
.2 Vinyl Foam: To ASTM D1752-67 1973 (Latest Edition) Type I, flexible grade.  
.3 Standard Cork: ASTM D1752-67 1973 (Latest Edition) Type II.
- .9 Polyethylene film.
- .10 Reglets: As detailed on drawings.
- .11 Grounds and Nailing Strips: Pressure treated Hemlock-fir, utility grade.
- .12 Steel Forms: Proprietary System to achieve intended result.

## **PART 3 EXECUTION**

### **3.1 Condition of Surfaces**

- .1 Examine the excavations and foundations for adequate working room and support for the work of this section.
- .2 Verify lines, levels and centre lines before proceeding with the work and ensure that dimensions agree with drawings.
- .3 Report to the Consultant, discrepancies in other work which affects the work of this section.

### **3.2 Preparation**

- .1 Make form work with reference to building lines and levels.
- .2 Protect survey reference points during construction

### **3.3 Assembly and Erection**

- .1 Construct the form work and shoring and bracing to meet the design and Code requirements accurately so that the resultant finished concrete shall conform to the shapes, lines and dimensions shown on the drawings, within the specified tolerances.

- .2 Form work shall be so arranged and assembled as to permit easy dismantling and stripping so that the concrete will not be damaged during its removal. Fabricate forms for exposed concrete work using smooth, square edged material, free from surface defects. Chamfer exposed edges of columns, walls, beams and girders, 25mm, unless noted.
- .3 Review locations of ties and form panels for exposed concrete work with the Departmental Representative.
- .4 Check and correct form work as required both horizontally and vertically, during the placing of the concrete.
- .5 Construction form work to maintain the following maximum tolerances:
  - .1 Deviations from horizontal and vertical lines: 6mm in 3000 mm; 20mm in 1200mm
  - .2 Deviation of building dimensions indicated on drawings and position of columns, walls and partitions: 6mm.
  - .3 Deviation in cross sectional dimensions of columns or beams or in thickness of slabs and walls: plus or minus 6mm.
  - .4 Camber slabs and beams: 10mm per 3000mm of span unless indicated on drawings.
- .6 Obtain Departmental Representative's approval for use of earth forms.

### **3.4 Joints in Forms**

- .1 Make form joints tight in order to prevent leakage of mortar.
- .2 Clean all edges and contact surfaces before erection.
- .3 Where required, install PVC waterstop to manufacturer's instructions and without displacing reinforcement. Do not distort or pierce waterstop.
- .4 Make form joints tight. Use minimum number of joints.

### **3.5 Shoring and Bracing**

- .1 Provide bracing to ensure the stability of the form work as a whole.
- .2 Prop or strengthen all previously constructed parts liable to be overstressed by construction loads.
- .3 Arrange forms to allow stripping without removal of the principal shores, where these are required to remain in place.

### **3.6 Embedded Parts and Openings**

- .1 Provide formed openings where required for pipes, conduit, sleeves and other work to be embedded in and passing through concrete members. Accurately locate and set in place items, which are to be cast directly into the concrete. Coordinate the work of other sections and cooperate with the trade involved in the forming and setting of openings, slots, recesses, chases, sleeves, bolts, anchors and other inserts. No such forming or setting of openings, slots, recesses, chases, sleeves or parts shall be done unless specifically shown on the drawings or approved prior to installation.
- .2 Obtain Departmental Representative's approval before framing openings in concrete beams or columns specifically detailed on structural drawings.
- .3 Provide temporary ports or openings where required to facilitate cleaning and inspection. Openings at the bottom of forms shall be located so that flushing water will drain from the forms.
- .4 Close the temporary ports or openings with tight fitting panels, flush with the inside face of the forms, neatly fitted so that the joints will not be apparent in exposed concrete surfaces.
- .5 Do not eliminate or displace reinforcement to accommodate hardware. If inserts cannot be located as specified, obtain approval in writing of all modifications from the Departmental Representative before placing concrete.
- .6 Coordinate work with pre-engineered metal building supplier / erector.
- .7 Accurately locate and set in place items which are to be cast directly into concrete.

### **3.7 Field Quality Control**

- .1 Inspect and check the completed form work, shoring and bracing to ensure that the work is in accordance with the form work design, and that the supports, fastenings, wedges, ties and parts are secure. The Departmental Representative responsible for the design of the form work shall assist in this inspection.
- .2 Inform the Departmental Representative when the form work is complete and has been cleaned. Obtain the approval of the Departmental Representative responsible for the design of the form work and the general approval of the Departmental Representative before placing concrete.

### **3.8 Cleaning**

- .1 Clean the forms as erection proceeds to remove foreign matter.
- .2 Remove cuttings, shavings and debris from within the forms.
- .3 Flush the completed forms with water or air jet to remove remaining foreign matter. Ensure that water and debris drain to the exterior through the clean-out ports.

### **3.9 Winter Construction (not-applicable)**

- .1 Remove ice and snow from within the forms.
- .2 The use of de-icing salts is not permitted.
- .3 Unless form work and concrete construction proceed within a heated enclosure, do not use water to clean out completed forms. Use compressed air or other means to remove foreign matter.

### **3.10 Removal of Form Work**

- .1 Notify the Departmental Representative before removing form work.
- .2 Remove form work progressively and in accordance with the reference Code requirements, and so, that no shock loads or imbalanced loads are imposed on the structure.
- .3 Do not remove forms and shoring before concrete has attained sufficient strength to ensure safety of structure. If evidence to verify concrete strength is not available, the forms and shores shall not be removed before the following minimum intervals after concrete is placed.
  - .1 Footings, walls and grade beams: 4 days
  - .2 Columns: 7 days
  - .3 Beams, soffits and slabs 21 days
- .4 Loosen forms carefully. Do not wedge pry bars, hammers or tools against concrete surfaces.
- .5 Leave forms loosely in place, against vertical surfaces, for protection, until, complete removal is approved by Departmental Representative.
- .6 Store removed forms, for exposed architectural concrete, in a manner that surfaces to be in contact with fresh concrete will not be damaged. Marked or scored forms will be rejected.
- .7 Re-shore structural members where required due to design requirements or construction conditions and as required to permit progressive construction.
- .8 Remove forms so directly supporting weight of concrete as soon as stripping operations will not damage concrete.
- .9 Reuse of form work and false work is subject to the requirements of CAN3-A23.1-94 (Latest Edition).
- .10 Where curing conditions are such as to retard curing of concrete, or where earlier form removal is desired, obtain additional sets of stripping cylinders, cured adjacent to and under same conditions as work in question. Use test results of these cylinders as a guide in determining the time for removal of form work.
- .11 Remove load supporting forms only when the concrete has attained 75 percent of the required 28 day compressive strength and re-shore. Verify strength of concrete by compression tests, prior to removing form work.

### **3.11 Special Form Work**

- .1 Construct void forms on a sand bed over graded earth to levels shown on drawings. Cover void forms with 0.15mm thick polyethylene film and seal joints. The intent is that the special form

work shall provide a positive void, minimum 150mm high, under slab and 100mm under walls and grade beams, after curing of concrete.

- .2 Provide special form work for exposed aggregate finishes where shown on drawings. Where flat surfaces are to be exposed, fabricate form work using new, square-edged plywood (Sonotube where circular) free from surface defects. Tape joints. Locate form ties to a regular pattern as recommended by the Departmental Representative. To form work used for exposed surfaces, apply retarding agent in strict accordance with manufacturer's instructions.

**END OF SECTION**

## **PART 1 GENERAL**

### **1.1 Section Includes**

- .1 Furnish and install all bonded reinforcement and associated.
- .2 Do reinforcing work in accordance with CSA A23.1-94.

### **1.2 Related Work**

- .1 Drilled Cast-in-Place Augured Pile Section 316323.
- .2 Concrete Form Work Section 031000.
- .3 Cast-in-Place Concrete Section 033000.

### **1.3 References**

- .1 Canadian Standards Association:
  - .1 G30.5 (Latest Edition): Welded Steel Wire Fabric for Concrete
  - .2 G30.12 (Latest Edition): Billet Steel Bars for Concrete Reinforcement.
  - .3 W186 (Latest Edition): Welding of Reinforcing Bars in Reinforced Concrete onstruction.
- .2 American Concrete Institute:
  - .1 315 (Latest Edition): ACI Detailing Manual.

### **1.4 Submittals**

- .1 Prior to commencement of work, submit shop drawings in accordance with Section 01300, Submittals. Include placing drawings and cutting sheets. Indicate welding and identify by C.W.B. symbols. Show clearances and special finishes.
- .2 Upon request by the Departmental Representative, submit mill test reports on materials supplied under this Section, indicating physical and chemical properties.
- .3 All drawings and schedules shall be prepared and checked upon the direct supervision of a qualified professional Departmental Representative who is experienced in this work.
- .4 Clearly indicate bar sizes, spacing, location and quantities of reinforcement, mesh, chairs, spacers and hangers with identifying code marks to permit correct placement without reference to structural drawings; to ACI - 315 Manual of Standard Practice and Metric Supplement (Latest Edition) by Reinforcing Steel Institute of Ontario.
- .5 Design and detail lap lengths and bar development lengths to CSA A23.3 (Latest Edition), unless specified on drawings.
- .6 Review of shop drawings for size and arrangement of principal and auxiliary members only. Such review will not relieve the Contractor of responsibility for general and detail dimension and fit, or any errors or omissions.

### **1.5 Substitutes**

- .1 Substitution of different size bars permitted only upon written approval of the Departmental Representative.

### **1.6 Delivery and Storage**

- .1 Reinforcing steel, welded wire fabric and accessories shall be delivered, handled and stored in a manner which prevents contamination from bond reducing or foreign matter and damage to its fabricated form.

## **PART 2 PRODUCTS**

### **2.1 Materials**

- .1 All reinforcing steel, unless noted otherwise on the drawings or herein shall be deformed bars of new billet steel conforming to the current CSA Standard G30.18-M92 (Latest Edition), Grade

- 400, plain finish for all bars. Minimum splice for 10M bars to be 450mm. Minimum lap splice for all other bars to be 36 bar diameter or 675mm, whichever is greater.
- .2 Weldable reinforcing bars: High strength ductile, deformed bars to CSA G30.16M, (Latest Edition), Grade 400.
  - .3 Column ties and beam stirrups shall conform to the current CSA G30.12 (Latest Edition), Grade 300.
  - .4 Welded wire fabric: To CSA G30.5-M1983 (Latest Edition). Provide in flat sheets only.
  - .5 Tie wires shall be 1.29mm or heavier annealed wire or a patented system approved by the Departmental Representative.
  - .6 Reinforcing steel supports shall conform to ACI Standard 315 (Latest Edition), unless otherwise approved by the Departmental Representative.
  - .7 Mechanical splices subject to the approval of the Departmental Representative.

## **2.2 Fabrication**

- .1 Fabricated bends, splices and ties and supply bar supports and accessories in accordance with the arrangements of supports in accordance with CSA A23.3-94 (Latest Edition), unless noted otherwise.
- .2 All intermediate and high strength steel grade reinforcing bars shall be bent cold without hickeying.
- .3 Reinforcing bars shall not be straightened or re-bent.
- .4 Location of reinforcement splices not shown on the drawings subject to approval by the Consultant and shall, for beams and slabs, be away from points of maximum stress in the steel.
- .5 Welding of reinforcing bars: Use only weldable bars; preheat and weld to CSA W186 (Latest Edition).

## **PART 3 EXECUTION**

### **3.1 Examination**

- .1 Examine the work upon which this section depends and report any discrepancies to the Consultant.
- .2 Commencement of the work shall imply acceptance of conditions. Promptly report conditions which may, adversely affect work under this Section.

### **3.2 Installation**

- .1 Reinforcement of the size and shapes shown on the drawings, shall be accurately placed in accordance with the approved shop drawings, the structural drawings and the requirements of the current National Building Code.
- .2 Clear distances between bars, except for columns, shall not be less than the nominal diameter of the bar, or 25mm or one and one-third the maximum size of the coarse aggregate. Bars placed in two or more layers shall have a minimum clear distance between the layers of not less than 25mm and shall be placed directly above and below each other.
- .3 Clear distance between bars in columns shall be not less than one and one-half the nominal diameter of the bar or 40mm or one and one-half times the maximum size of the coarse aggregate.
- .4 Reinforcing steel shall, where not otherwise shown on the structural drawings, be protected by the clear cover of concrete over the reinforcement, in accordance with CSA Standard A23.1-94, as follows:
  - .1 Where concrete is formed against earth, not less than 75mm.
  - .2 Where concrete placed against forms, is to be exposed to the weather or be in contact with the ground, not less than 50mm for bars larger than 15M, and not less than 40mm for bars 15M and smaller.
  - .3 In slabs and walls not exposed to the ground or weather, not less than 20mm.

- .4 In beams, girders and columns not exposed to the ground or weather, not less than 40mm to principal reinforcement, ties and stirrups.
- The foregoing clear covers shall be maintained with 5m.
- .5 Reinforcement shall be adequately supported by metal chairs, spacers or hangers and secured against displacement within the tolerance permitted and in accordance with the latest ACI Standard 315 (Latest Edition).
- .6 For slabs on grade, footings or similar construction, concrete blocks may be used in place of metal chairs.
- .7 Review with the Departmental Representative t, placement of reinforcement prior to concreting.
- .8 Notify the Departmental Representative 24 hours prior to placing concrete.
- .9 Place reinforcing steel to ACI 315 (Latest Edition) and in such a manner that steel will not be visible on exposed aggregate surfaces.
- .10 Secure reinforcing steel to prevent displacement during concrete placement.
- .11 Lap and splice bars as shown and scheduled on drawings. Minimum lap in accordance with current NBC, 500mm minimum.
- 3.3 Cleaning**
- .1 All materials shall be clean and free of all form oil or deleterious materials.
- .2 All deleterious material shall be removed from the surface of the reinforcing steel in a manner acceptable to the Departmental Representative.
- 3.4 Welding**
- .1 Do welding to meet requirements of CSA W186 (Latest Edition). Have welding performed by workmen qualified under CSA W47.1 (Latest Edition). Welding only by written authority of the Departmental Representative

**END OF SECTION**



## **PART 1        GENERAL**

### **1.1        Section Includes**

- .1 Cast-in-Place concrete, with the exception of that specified.
- .2 Cast-in-Place concrete required for this work is indicated on drawings and includes, but is not necessarily limited to:
  - .1 Concrete slabs
  - .2 Miscellaneous concrete (sidewalks, parking lot islands and curbs)
  - .3 Finishing of all formed concrete surfaces
  - .4 Concrete foundations

### **1.2        Related Sections**

- .1 Concrete Form Work Section 031000.
- .2 Concrete Reinforcement Section 032000.
- .3 Drilled Cast-in-Place Augured Piles - Section 326323.

### **1.3        References**

- .1 Canadian Standards Association, Latest Edition:
  - .1 CAN/CSA-A5-M88: Portland Cements
  - .2 CAN/CSA-A23.1-04: Concrete Materials and Methods of Concrete Construction
  - .3 CAN/CSA-A23.2-94: Methods of Test for Concrete.
  - .4 CAN3-A23.3-94: Design of Concrete Structures for Buildings.
- .2 American Concrete Institute, Latest Update:
  - .1 214: Evaluation of Compression Test Results of Field Concrete.
- .3 American Society for Testing and Materials, Latest Update.
  - .1 C260: Air-Entraining Admixtures for Concrete.

### **1.4        Submittals**

- .1 When requested by the Consultant, submit:
  - .1 Concrete mix designs in accordance with CAN/CSA 23.1-04 for separate mixes required for the Work, accounting for concrete supplier's standard deviation, which is part of the new submittals of all performance concrete.
  - .2 Evidence of the concrete supplier's standard deviation, or assume that standard deviation exceeds 4 MPa.
  - .3 Grain size analysis of aggregates proposed for the Work.
- .2 Before beginning work, submit a list of admixtures intended to be used.
- .3 Submit layout drawings, one sepia and one print, showing sequence of pours and construction joint locations.
- .4 Before beginning work, submit a 600mm x 600mm sample of exposed aggregate finish and sandblasted finish. Approved samples will be standard for the work.
- .5 Submit statistical valid evidence of past performance of the mix design for each class of concrete to Consultant for approval 2 weeks prior to commencement of work. The testing authority engaged by the Contractor is to review and approve all evidence after consultation with Consultant and Owner.
- .6 Tests of cement and aggregates may be performed to ensure conformance with requirements stated herein.

### **1.5        Quality Assurance**

- .1 Provide at least one person who shall be present at all times during execution of this portion of the Work and who shall be thoroughly trained and experienced in placing the types of concrete specified and who shall direct all work performed under this Section.
- .2 For finishing of exposed surfaces of the concrete, use only thoroughly trained and experienced journeyman concrete finishers.

**1.6 Product Handling**

- .1 Use all means necessary to protect cast-in-place concrete materials before, during and after installation and to protect the installed work and materials of all other trades.
- .2 In the event of damage, immediately make all repairs and replacements necessary to approval of the Consultant, at no additional cost to the Owner.

**1.7 Inspection and Testing**

- .1 Inspection and testing will be performed by a firm approved by the Consultant and paid for by the Contractor.
- .2 Provide free access to all portions of work and cooperate with appointed firm.
- .3 The testing agency will:
  - .1 Take 3 cylinders in accordance with CAN/CSA-A23.2-94 3C for each 50m<sup>3</sup> or less of concrete placed, a minimum of 1 test for each day's work, or as directed by the Consultant.
  - .2 Take at least 1 slump test in accordance with CAN/CSA-A23.2-94-5C for each set of test cylinders taken.
  - .3 Take at least 1 air test in accordance with CAN/CSA-A23.2-94 4C for each set of test cylinders taken.
- .4 Copies of test results may be provided upon request.
- .5 Concrete materials will be evaluated in accordance with CAN/CSA-A23.2-94.
- .6 Strength tests will be evaluated in accordance with ACI 214 (Latest Edition).
- .7 Six (6) additional test cylinders will be taken during cold weather concreting, and be cured on job site under same conditions of concrete it represents.
- .8 One slump test and one air content test will be taken for each set of test cylinders taken.
- .9 Testing of concrete will be performed in accordance with CSA-A23.2-94 (Latest Edition) "Method of Test for Concrete".
- .10 Test results will be issued to the Contractor, Consultant and Owner. Test reports are to be numbered consecutively beginning with No. 1.
- .11 The Consultant may order additional testing any time even though the required tests indicate the strength requirements have been met. In this instance, the Owner will pay for those tests that meet the specified requirements and the Contractor will pay for those that do not.
- .12 Non-destructive methods for testing concrete shall be according to CSA A23.2-94 (Latest Edition) where noted on drawings or in Soils Report.

**PART 2 PRODUCTS**

**2.1 Concrete Materials**

- .1 Cement: Sulfate Resistant Type 50 Portland Type to CSA-A5-93 (Latest Edition) Portland Cements" and CAN/CSA-A5-93 for all concrete in touch with soil and Type 10 for all other concrete, see Section 2.4.
- .2 Fine and coarse aggregates, conforming to CSA-A23.1-94 "Concrete Materials and Methods of Concrete Construction". The fine and coarse aggregate for concrete slabs that are to be finished with dry shake hardener shall contain a maximum of 0.4% low density particles as determined by CSA A23.2-4A "Low Density Granular Material in Aggregate". Test results shall be submitted to the Consultant for review.
- .3 Water: Clean and free from injurious amounts of oil, alkali, organic matter, or other deleterious material, conforming to CA/CSA-A23.1.

**2.2 Admixtures**

- .1 Air Entrainment: To CAN/CSA A23.5 (Latest Edition) Air-Entraining Admixtures for Concrete", and ASTM C260-1974.
- .2 Chemical: To CAN/CSA A23.5-M86 (Latest Edition) "Chemical Admixtures for Concrete"; water-reducing, strength increasing Type WN - normal setting.

- .3 Pozzolanitic Mineral: To CAN/CSA A23.5-M86 (Latest Edition) "Pozzolanitic Mineral Admixtures for use in Portland Cement Concrete". Typcor Type F fly ash is permitted to a maximum of 15% by weight of total cementitious materials.

### **2.3 Accessories**

- .1 Vapour Barrier: 6 mil polyethylene film, to CGSB 70-GP-A1, Type 1 - low permeance heavy duty/Permalon X-150 crawlspace.
- .2 Curing Compounds: Shall conform to the requirements of the latest issue of ASTM Standard C309.
- .3 Non-Shrink Grout: Premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents; capable of developing minimum compressive strength of 20 MPa at 3 days and 50 MPa at 28 days; typical column bases. For equipment bases, Master Builders 885 metallic aggregate grout, CPD non-shrink grout (premixed) or approved equal or as per item (l).
- .4 Void Form (if indicated in the Drawings):
  - .1 System made decomposable slab and beam forms as manufactured by Shearmat, Allied or approved equal. Top sheet to be 5mm thick hardboard. Cover and wrap edges with 6 mil poly-vapour barrier.
  - .2 Approved Equal:
    - .1 Frost Cushion Commercial Use void form system by AMC Foam Technologists Inc., Winnipeg, Mb.
    - .2 GeoSpan Compressible Fill by Plastifab; supplied by Brock White.
- .5 Joint Filler: Premoulded bituminous impregnated can fibreboard flexcell, as manufactured by Sternson, or approved equal.
- .6 Vertical Joint Sealant: Non-sag polyurethane sealant designed for use on vertical surfaces. Vulkem 116 as manufactured by Mameco Ltd. or approved equal as per item (l). Install strictly in accordance with manufacturers recommendations.
- .7 Horizontal Joint Sealant: Three compound chemically curing, self-leveling, polyurethane joint sealant, THC-900, as manufactured by Tremco, or Vulkem 45 by Mameco. Color selection by Consultant. Install strictly in accordance with manufacturer's recommendations or approved equal as per item (l).
- .8 Concrete Expansion Anchors: To be Hilti Kwik-Bolt, Redhead or approved equal. Sized as per drawings. Minimum embedment length of all Hilti Kwik-Bolt to be 150mm unless otherwise noted.
- .9 Concrete Inserts and Bolt Extension: Concrete inserts to be Hilti HKD anchors or approved equal, sized as detailed on drawings. Bolt extensions to be mild steel threaded extensions sized as detailed on drawings.
- .10 Concrete Patching Material: Pre-packaged, air-entrained, cementitious product containing graded natural aggregate allied floor patch with integral bonding agent.
- .11 Bonding Agent: Approved high polymer polyvinyl acetate emulsion applied in strict accordance with manufacturer's recommendations for proposed application. Duraweld-C or Acrylbond or approved equal.
- .12 Water Stop: PVC water stop by CPD, supplied by Wallace Construction Specialties or approved equal. Stop to be CPD Type 4, elastomeric plastic compound.
- .13 Approved Equals:
  - .1 RC-1 Vertical Joint Sealant by Sternson Construction Products.
  - .2 RC-2S1 Horizontal Joint Sealant by Sternson Construction Products.
  - .3 Ferrogout 939 Non-Shrink Grout by Sternson Construction Products.

### **2.4 Concrete Mixes**

- .1 Mechanical mix concrete in accordance with requirements of CSA A23.1 (Latest Edition).
- .2 All concrete shall have the following minimum properties:
- .2 All concrete shall have the following minimum properties:

	<b>NOMINAL STRENGTH (MPa)</b>	<b>CEMENT SYMBOL</b>	<b>AGGREG MAX 9mm</b>	<b>SLUMP mm</b>	<b>TOTAL AIR %</b>
<b>TYPE/LOCATION</b>					
Piling	32	50	20	75+25	4-7
Grade Beams, and Pile Caps	32	50	20	75+25	4-7
Columns	32	10	20	75+25	5+1
Topping	32	10	10	50-75	5+1
Grade Supported Slab	32	50	20	50-75	4-7
Minimum cement content to be 280 kg m <sup>3</sup> .					
Maximum water cementing ratio 0.45.					
Maximum free water/cement ratio for type 50 cement to be 0.4.					
Cement to be exposed Class 5-2, HS or HS3 cement type.					
All slabs finished with dry shake hardener to contain no artificially entrained air.					
Maximum compressive strength 32 mpa @ 56 days (grade beams).					
.3	Submit proposed statistical evidence on past performance of mix design to inspection and testing firm and to Consultant 2 weeks prior to commencement of work. Provide certification that mix proportions selected will produce concrete of specified quality and that strength will comply with CSA A23.1-04 (Latest Edition).				
.4	Each load of ready-mixed or transit-mixed concrete delivered to the project site shall be accompanied by duplicate delivery slips providing the following information:				
	.1 Name of ready-mix batch plant.				
	.2 Serial number of ticket.				
	.3 Date and truck number.				
	.4 Name of Contractor.				
	.5 Specific designation of project.				
	.6 Specific class of concrete.				
	.7 Amount of concrete in cubic metres.				
	.8 Time of loading or first mixing of aggregate cement and water.				
.5	Use accelerating admixtures in cold weather only when approved by Consultant. If approved, the use of admixture will not relax cold weather placement requirements. Use of calcium chloride strictly prohibited.				
.6	Use set-retarding admixtures during hot weather only when approved by the Consultant.				
.7	Use plasticizers only when approved by the Consultant.				
.8	Product and deliver concrete in accordance with CAN/CSA-A23.1-94 (Latest Edition).				
.9	Design and control mixes so that no more than one test in ten falls below specified strengths, and that average of any three consecutive tests equals or exceeds specified strength. If strength requirements are not met, the Consultant may require, at no cost to the Owner, one or more of the following:				
	.1 Changes in mix proportion for balance of work.				
	.2 Obtain and test core samples in accordance with CAN/CSA-A23.2-94 (Latest Edition).				
	.3 Load testing.				
	.4 Removal of non-conforming material.				
	.5 Additional or revised structural members.				
.10	Fly ash may be incorporated into mix design as a partial replacement for cement. If used, substitute at rate of twice cement content replaced, by weight, to maximum of 15% of cement content required without use of fly ash.				
.11	Patch and repair "pop-outs".				
.12	No materials other than those specified may be incorporated into the mix without the Consultant's written approval.				
<b>2.5</b>	<b>Joint Sealer</b>				
.1	Catalyst cured epoxy rubber:				

- .1 Loadflex by Sternson.
  - .2 AC1210 by Allied Coatings.
  - .3 Cural 337.
  - .4 PR5480 by PRC Canada.
- Refer to Section 03345, Clause 3.1.4. for other product specifications.

## **2.6 Surface Hardener**

- .1 Non-metallic, shake-applied hardener at 3 kg/m<sup>2</sup>. Approved products:
  - .1 Diamag 7 by Sternson.
  - .2 Non-metallic floor hardener by Target Products Ltd.
  - .3 Elsro GenFloor Plane Hardener, distributed by Wallace Construction Specialties
- .2 Refer to Section 03345, Clause 2.1.3. for other product specifications.
- .3 Impact loading metallic hardener recommended for the following areas: Masterplate 200 by Master Builders, 14kg/m<sup>2</sup> natural concrete colour or approved equal.  
Armoured joint system for construction joints by Master Builders.

## **2.7 Liquid Sealer**

- .1 One component silicone penetrant for preventing intrusion of water and water borne salts into concrete topping. Approved products:
  - .1 Masterseal SL 40 by Master Builders Technologies Ltd (broom faced, Concrete o/s).
  - .2 Allied AL309A (clear sealer) distributed by Wallace Construction Specialties. Concrete surfacing with VCT porcelain tile, sheet vinyl floor.
  - .3 Masterkure N-seal HS on slabs where hardeners specified interior and exterior application.
- .2 Refer to Section 03345, Clause 2.1.2 for other product specifications.
- .3 Truck/Concrete Pads (Unless Otherwise Noted on Drawings)
  - .1 All concrete pads to be minimum 8" thick reinforced with 2 rows of 10M bars @ 12" o.c. each way, cast over 6 mil polyethylene and minimum 12' compacted granular fill. Slope 1% minimum away from building lines.

# **PART 3 EXECUTION**

## **3.1 Inspection**

- .1 Prior to all work of this Section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.
- .2 Verify that all items to be embedded in concrete are in place.
- .3 Verify that concrete may be placed to the lines and elevations indicated on the drawings, with all required clearance from reinforcement.

## **3.2 Discrepancies**

- .1 In the event of a discrepancy, immediately notify the Consultant.
- .2 Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

## **3.3 Preparation**

- .1 Remove all wood scraps and debris from the formed areas in which concrete will be placed.
- .2 Thoroughly clean the forms to ensure proper placement and bonding of concrete.
- .3 Thoroughly wet the forms, except in freezing weather, or oil them; remove all standing water.
- .4 Thoroughly clean all transporting and handling equipment.
- .5 Ensure that reinforcing steel and form work are complete and ready for concrete.
- .6 Ensure that anchor bolts, embedded plates and assemblies, inserts and other embedded items are complete, properly located and secured.

- .7 Provide construction joints where shown on submitted layout drawings or as approved by the Consultant. Key and dowel construction joints, or conform to special detail, as required.
- .8 Form construction joints in walls and columns at underside of supported members. Allow two hours (minimum) to elapse before placing concrete in supported member. Place beams, caps, haunches, corbels and brackets monolithically with supported system. Form construction joints in beams, girders and slabs as per Clause 3.3.7. Submit layout drawings prior to construction.
- .9 Where placing concrete against existing concrete, clean concrete face, remove laitance and loose material and wet down contact surfaces prior to placing concrete.

### **3.4 Tolerances**

- .1 Maintain the following tolerances for finished concrete:
  - .1 Concrete Form Work: See Section 03100.
  - .2 Anchor Bolts/Embedded Assemblies: + 3mm.

### **3.5 Installation**

- .1 Place concrete in accordance with requirements of CSA A23.1-04 (Latest Edition) and as indicated on drawings.
- .2 Notify Consultant and Inspection and Testing Firm a minimum of 24 hours prior to commencement of concrete operations.
- .3 Maintain accurate records of poured concrete items. Record date, location of pour, quantity, air temperature and test samples taken.
- .4 Ensure reinforcement, inserts, embedded parts, formed joints and fitments are not disturbed during concrete placement.
- .5 Prepare previously placed concrete by cleaning with steel brush.
- .6 Pour concrete continuously between predetermined construction and control joints. All construction joints subject to approval by Consultant.
- .7 Approval to place concrete shall be contingent on the form work and reinforcing steel placement and evidence that the Contractor can place the planned casting without stopping.
- .8 Convey concrete to the place of final deposit by methods which will prevent the segregation or loss of material.
- .9 Equipment to be such that when concrete work has once started, the depositing of concrete is to proceed at a rate and sequence such that concrete is at all times, sufficiently plastic to ensure proper bonding of successive layers or panels.
- .10 Conveying and placing equipment to be free of hardened concrete and foreign material. Clean at frequent intervals.
- .11 Concrete to be deposited as close as practicable to final position. Avoid segregation due to re-handling or flowing. Place in horizontal lifts to maintain a level surface.
- .12 Vertical height of free fall of concrete not to exceed maximum required for good practice. If segregation occurs, chutes and spouts to be used.
- .13 Consolidate thoroughly and uniformly by tamping with hand tools, vibrators and finishing machines. Ensure dense, homogeneous structure, close bond with reinforcement and smooth formed surfaces. Use internal vibrators wherever practical. External type vibrators only where satisfactory surfaces cannot be obtained with internal type.
- .14 Internal vibrators applied at the point of deposit in the areas of freshly placed concrete. Allow to sink in the concrete until penetrated into the previous layer of concrete. Withdraw immediately at the same speed at which they sank. Move about 300mm to a new location and then repeat process. Extreme care to be taken not to disturb the reinforcing steel of the forms.
- .15 Excessive honeycomb or embedded debris in concrete is not acceptable. Remove and replace defective concrete. Excessive honeycomb is when eraser end of a pencil fits into cavity.
- .16 Convey and place concrete in such a manner as to prevent segregation of concrete or displacement of reinforcing steel, forms or inserts.
- .17 Finish integral concrete floors with steel trowel to produce smooth dense surface.

- .18 After removal of form work, clean concrete surfaces to remove fins and laitance. Fill honeycombed areas after inspection and approvals by the Consultant. Fill break backs and conical holes below grade with plugs.
- .19 Upon completion of erection of structural steel, grout bearing plates and other specified units in accordance with manufacturer's directions.
- .20 Retarder for concrete with exposed aggregate surfaces, where such finish is required on drawings.
  - .1 Treat forms with retardant where exposed aggregate is indicated so that after stripping forms, surface matrix can be removed to expose aggregate.
  - .2 Mix concrete using gap graded concrete mix containing 65% to 75% by volume of coarse aggregate. Coarse aggregate: Size 15mm to 20mm. Once exposed aggregate design has been approved, mix materials to ensure consistent colour and texture for entire exposed aggregate areas.
  - .3 After removal of forms, clean exposed aggregate surfaces as follows:
    - .1 Thoroughly clean surfaces with stiff brush and water.
    - .2 Wash surfaces with 10% solution of muriatic acid.
    - .3 Thoroughly wash surfaces with clean water completely removing all traces of acid.
- .21 Sandblasting (for finishes as required on drawings):
  - .1 After concrete has achieved 7-day strength and before achieving 28-day strength, expose aggregate to a medium exposure where shown on drawings. Achieve exposure by dry sandblasting to degree as per approved sample.
- .22 Saw cut control joints in straight lines, within 24 hours after finishing. Cut in pattern shown on drawings. Use 3mm thick blade, cut 1/4 through full depth of slab.

### **3.6 Cold Weather Requirements**

- .1 When the air temperature is at or below 5 degrees C, or when there is a probability of it falling to that limit during the placing or curing period, cold weather requirements shall be applicable.
- .2 Provide heating equipment or heating plant on the job ready for use when concrete is being placed during cold weather. Such equipment shall be adequate for the purpose of maintaining the required temperature during the placing and curing of the concrete. The methods used for heating shall be approved by the Consultant. Equipment inducing carbon monoxide gas in the building shall not be accepted. Heating equipment is to be vented through heat exchange designed heaters.
- .3 Concrete shall not be placed on or against reinforcement, form work, ground or any surface that is at a temperature less than 5° C.
- .4 The temperature of the concrete at all surfaces shall be maintained at not less than 25° C for 3 days, or at not less than 10° C for 5 days after placing. Means shall be provided to humidify the air within enclosures and to keep the concrete and form work continuously moist if dry heat is used. The concrete shall be kept above freezing temperatures for a period of 7 days, and shall be kept from alternate freezing and thawing for at least 14 days after placement.
- .5 At the end of the specified protection period the temperature of the concrete shall be reduced gradually at a rate not exceeding that shown in CSA A23.1 (Latest Edition).
- .6 Accelerator or so-called antifreeze compounds shall not be permitted unless otherwise approved in writing by the Consultant.
- .7 All protective coverings shall be kept clear of the concrete and form surfaces to permit free circulation of air and shall be maintained intact for at least 24 hours after artificial heat is discontinued.

### **3.7 Hot Weather Requirements**

- .1 When the air temperature exceeds 27° C, hot weather requirements shall be applicable.

- .2 Time of initial mixing to complete discharge shall not exceed one hour and fifteen minutes and concrete placed shall not exceed 30° C.
- .3 Concrete forming surfaces and reinforcing steel shall be sprinkled with cold water just prior to placing concrete. Standing water or puddles shall be removed prior to concrete placement.
- .4 Special wind protection will be required as directed by the Consultant.
- .5 Columns, walls, beams and slabs shall be kept continuously damp for 24 hours by normal curing procedures as outlined by this specification. Slabs cured by the applications of sealing shall have curing compound applied immediately after finishing of the slab but before evaporation of surface moisture.
- .6 The use of water reducing agents shall be subject to the approval of the Consultant when hot weather conditions prevail.

### **3.8 Construction Joints**

- .1 The location and detail of all construction joints not detailed on the structural drawings shall be approved by the Consultant.
- .2 When fresh concrete is to be placed against concrete which has set or has partially set, the surface of the set or partially set concrete shall be roughened, cleaned of all laitance and thoroughly soaked with water prior to the placement of fresh concrete.
- .3 In general, the construction joints in floor and roof systems shall be located at the one-third span of slabs, beams and girders. Proper key and dowels or extensions of reinforcing shall be provided at all construction joints.
- .4 Concrete placed in wall and column forms shall be struck off flush with the underside of the floor.
- .5 Vertical construction joints in foundation walls shall be properly keyed and doweled and constructed with an approved waterstop, properly anchored against displacement during the placement of the concrete and properly sealed at all of the intersections. Splices and intersections of waterstop shall be joined by heat fusion in accordance with approved manufacturer's instructions.

### **3.9 Defective Concrete**

- .1 Concrete not meeting the requirements of the specifications and/or the drawings shall be considered defective concrete.
- .2 Concrete not conforming to the lines, details and grade specified herein or as shown on the drawings shall be modified or replaced at the Contractor's expense and to the satisfaction of the Consultant. Finished lines, dimensions and surfaces shall be correct and true within tolerances specified in the Form Work Section of these specifications.
- .3 Concrete not properly placed, resulting in excessive honeycombing and all honeycombing and other defects in critical areas of stress shall be repaired or replaced at the Contractor's expense and to the satisfaction of the Consultant.
- .4 Concrete of insufficient strength or improper consistency shall be, as required by the Consultant, subject to one or more of the following:
  - .1 Changes in mix proportions for the remainder of the work.
  - .2 Cores drilled and tested from the areas in question as directed by Consultant and in accordance with CSA A23.2-94 (Latest Edition). The test results shall be indicative of the in-place concrete.
  - .3 Load testing of the structural elements in accordance with CSA A23.3-94 (Latest Edition).
  - .4 The changes in the mix proportions and the testing shall be at the Contractor's expense.
  - .5 Concrete failing to meet the strength requirements of this specification shall be strengthened or replaced at the Contractor's expense and to the satisfaction of the Consultant.



**3.10 Patching and Concrete**

- .1 After the removal of the forms, concrete surfaces may be subject to inspection by the Consultant.
- .2 All exposed metal form ties, nails and wires shall be removed, fins broken off and all loose concrete removed.
- .3 Form tile pockets shall be thoroughly wetted and patched with patching concrete followed by proper curing.
- .4 Honeycombed and other defective surfaces shall be chipped away to a depth of not less than 25mm with the edges perpendicular to the surface, thoroughly wetted and patched with patching concrete, followed by proper curing.
- .5 Patching concrete shall be thoroughly compacted into place and finished in such a manner as to match the adjoining concrete. The design mix of the patching concrete shall be approved by the Consultant.

**3.11 Finishing of Formed Surfaces**

- .1 All formed surfaces shall be final finished to remove all protrusions, ridges and other irregularities. All voids and pinholes are to be filled. "Clean form" finish is acceptable.
- .2 On all other exposed formed concrete surfaces, except at unfinished areas, remove blemishes and form work joint marks by rubbing with carborundum block and water. Leave finished surfaces smooth and unmarred. Complete rubbing within 24 hours of stripping form work.

**3.12 Anchor Bolts and Weldments**

- .1 Set anchor bolts and weldments to the following tolerances:
  - .1 Alignment: + 3mm of location, plumb and true.
  - .2 Projection: + 6mm of elevations called for.

**3.13 Base Plates Grouting**

- .1 Mix and place as per manufacturer's specifications. Pack grout tightly under plates and leave no voids. Neatly finish edges. Use grout as per Clause 3 of Section 03300.

**3.14 Liquid Sealer**

- .1 Apply liquid sealer in strict accordance with the manufacturer's directions.

**3.15 Sealing Saw Cut Control Joints**

- .1 Remove loose particles from joint and install joint sealant in strict accordance with the manufacturer's instructions.

**3.16 Concrete Finishes**

- .1 Provide concrete hardener where required on drawings at the rate of 3.0 kg/m<sup>2</sup>, to unfinished concrete floor areas and where scheduled, in accordance with manufacturer's recommendations.
- .2 Refer to general notes on structural drawings.

**3.17 Protection and Curing**

- .1 Protect concrete and grout in accordance with CAN/CSA-A23.1 (Latest Edition).
- .2 Cure in accordance with CAN/CSA-A23.1 (Latest Edition).
- .3 Provide protection as required for floor slabs to ensure that design compressive strength of concrete is reached in 28 days. Refer to Section 03100 - Concrete Form Work.

**3.18 Concrete Topping**

- .1 Concrete topping is to be bonded by either of the following methods, unless specifically directed:
  - .1 Application of cement/sand grout to prepared base course in accordance with CSA Standard A23.1-94.
  - .2 Application of approved bonding agent to prepared base coarse to be applied immediately before concrete placement.

- .3 There is to be a stringent wet cure for at least 7 days after the pour for bond to develop before drying shrinkage occurs.
- .4 Contractor to propose details as to the preparation of the substrate for Consultant's approval.

**3.19 Equipment Pads**

- .1 Provide concrete pads for equipment where and as indicated on drawings.
- .2 Insert bolts and sleeves and pack solidly with non-shrink grout in accordance with setting details and templates.
- .3 Steel trowel top surfaces smooth. Tool edges.

**3.20 Sidewalks**

- .1 Unless specifically detailed otherwise on drawings or in specifications, sidewalks shall be constructed to the following details.
- .2 Use forms for edges of concrete walls to provide straight lines and smooth curves.
- .3 Locate asphalt impregnated fibreboard joint filler at 4.5 m centres and where walks abut walls and other vertical surfaces. Joint filler to be full area of concrete section.
- .4 Install tooled joints at 1.5 m on centre.
- .5 Round all edges, including edges of control joints and tooled joints with 12mm radius edging tool.
- .6 Provide exposed surfaces of all sidewalks with medium broomed finish.
- .7 Slope walks and slabs as detailed on drawings.
- .8 Unless detailed otherwise, all sidewalks to be 125mm thick reinforced with 10M bars at 300mm centres, each way, at mid-depth. Cast over 6 mil polyethylene and minimum 200mm compacted granular fill.

**END OF SECTION**

## **PART 1 GENERAL**

### **1.1 Related Sections**

- .1 Cast-In-Place Concrete Section 033000.
- .2 Structural Steel Section 051200.
- .3 Metal Fabrications Section 055000.

### **1.2 Job Conditions**

- .1 Maintain surface and ambient air temperature of minimum 10° C for a minimum period of 24 hours prior to, during and 72 hours after application.
- .2 If grouting outside, provide and maintain temporary weatherproof enclosures during inclement weather during preparation, grouting and curing.

## **PART 2 PRODUCTS**

### **2.1 Grout**

- .1 Non-Ferrous Grout, pre-mixed, non-shrink.  
Approved products:
  - .1 M-Bed Standard by Sternson.
  - .2 Sika Grout 212 by Sika.
  - .3 CI Grout by Steel Bros.
  - .4 CPD Non-shrink Grout by Wallace Construction Specialties.
- .2 Epoxy Grout: high strength, self-leveling, 100% epoxy grout.  
Approved products:
  - .1 Brutem MP multi-purpose epoxy grout by Master Builders.

### **2.2 Form Work Materials**

- .1 Plywood: Douglas Fir Plywood, GIS, undamaged sheets with true edge.
- .2 Lumber: Sound; sizes as required.
- .3 Nails, Spikes, Staples: Galvanized steel.

## **PART 3 EXECUTION**

### **3.1 Examination**

- .1 Before starting work, examine work by others which may affect this work.
- .2 Notify the Departmental Representative of any conditions which would prejudice proper completion of this work.
- .3 Commencement of work implies acceptance of existing conditions.

### **3.2 Surface Preparation**

- .1 Remove defective concrete, laitance, dirt, oil, grease and other foreign material from concrete surfaces by bush-hammering, chipping or other similar means until a sound, clean concrete surface is achieved.
- .2 Lightly roughen surface to ensure proper bond with grout.
- .3 Remove paint primers, where possible, from ferrous metal surfaces in contact with grout.
- .4 Follow manufacturer's directions respecting saturation of surfaces with water prior to grouting.

### **3.3 Form Work**

- .1 Construct form work accurately, ensuring ground conforms to lines, levels and dimensions indicated on drawings.
- .2 Arrange and assemble form work to permit easy dismantling and stripping, ensuring grout is not damaged during form work removal.

- .3 Provide sufficient clearance for proper placement between form work and area being grouted.
- .4 Cover form surfaces with an acceptable release coating to prevent bonding with grout.

**3.4 Inspection**

- .1 Notify Departmental Representative prior to placing grout, to permit inspection of form work and placing of grout.

**3.5 Mixing**

- .1 Mix grout materials with clean, potable water in accordance with manufacturer's directions. Use minimum amount required for workable mixture.
- .2 Mix grout as close to work areas as possible. Transport quickly, and in a manner that does not permit segregation of materials.
- .3 Do not permit water to be added after grout has been mixed.

**3.6 Installation**

- .1 If necessary, heat surfaces to minimum temperature recommended by manufacturer.
- .2 Place grout quickly and continuously by most practical means permissible as recommended by manufacturer.
- .3 Thoroughly compact grout and leave free of voids and air pockets.
- .4 Trowel edges of grout to true lines.

**3.7 Curing**

- .1 Cure grout to manufacturer's directions.

**3.8 Form Removal, Repairs**

- .1 Remove forms after curing.
- .2 Repair any visible defects in grouting, patch with matching grout.

**END OF SECTION**