

CONCRETE FORMING AND ACCESSORIES

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 03 20 00 – Concrete reinforcement.
- .2 Section 03 30 00 – Cast-in-place concrete.

1.2 MEASUREMENT PROCEDURES

- .1 No measurement will be made under this Section. Include costs in items of work for which concrete formwork and falsework is required.

1.3 REFERENCES

- .1 Canadian Standards Association (CSA)
 - .1 CAN/CSA-A23.1, Concrete Materials and Methods of Concrete Construction.
 - .2 CAN/CSA-O86.1, Engineering Design in Wood (Limit States Design).
 - .3 CSA O121, Douglas Fir Plywood.
 - .4 CSA O151, Canadian Softwood Plywood.
 - .5 CSA O153, Poplar Plywood.
 - .6 CAN3-O188.0, Standard Test Methods for Mat-Formed Wood Particleboards and Waferboard.
 - .7 CSA O437 Series, Standards for OSB and Waferboard.
 - .8 CSA S269.1, Falsework for Construction Purposes.
 - .9 CAN/CSA-S269.3, Concrete Formwork.
- .2 Council of Forest Industries of British Columbia (COFI)
 - .1 COFI Exterior Plywood for Concrete Formwork.
- .3 Underwriters Laboratory Canada (ULC)
 - .1 CAN/ULS – S701 – Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.

1.4 SHOP DRAWINGS

- .1 Submit shop drawings for formwork and falsework in accordance with Section [01 33 00 - Submittal Procedures].
- .2 Indicate method and schedule of construction, shoring, stripping and re-shoring procedures, materials, arrangement of joints, special architectural exposed finishes, ties, liners, and locations of temporary embedded parts.
- .3 Comply with CSA S269.1, for falsework drawings. Comply with CAN/CSA-S269.3 for formwork drawings.

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- .4 Indicate formwork design data, such as permissible rate of concrete placement, and temperature of concrete, in forms.
- .5 Indicate sequence of erection and removal of formwork/falsework to Contract Administrator.
- .6 Each shop drawing submission shall bear stamp and signature of qualified professional engineer registered or licensed in the Province of Manitoba.

Part 2 Products

2.1 MATERIALS

- .1 Formwork materials:
 - .1 For concrete without special architectural features: plywood and wood formwork materials to CSA-O121, CAN/CSA-O86.1, CSA O437 Series and CSA-O153.
 - .2 For concrete with special architectural features: formwork materials to CAN/CSA-A23.1.
- .2 Form liner:
 - .1 Plywood: high density overlay, Douglas Fir to CSA O121, T & G edge, 16 mm thick. Sound, undamaged sheets with clean, smooth, true edges.
- .3 Steel forms: tight fitting and adequately stiffened to support weight of concrete without deflection detrimental to structural tolerances and appearance of finished concrete surfaces.
- .4 Form ties:
 - .1 For concrete not designated 'Architectural', use removable or snap-off metal ties, fixed or adjustable length, free of devices leaving holes larger than 25 mm diameter in concrete surface. Depth of snap-off 38 mm.
 - .2 For Architectural concrete, use snap ties complete with plastic cones and light grey concrete plugs.
- .5 Nails, spikes, lag bolts, anchorages: size as required, of sufficient strength and character to maintain formwork in place while pouring concrete.
- .6 Falsework materials: to CSA-S269.1.

2.2 ACCESSORIES

- .1 Fillets for chamfered corners: unless otherwise indicated 20 x 20 mm. Special sizes, shapes and profiles as indicated on drawings. Styrofoam should not be used.
- .2 Void forms:
 - .1 Paper forms: corrugated paper forms with cellular core, 200 mm thickness, minimum compressive strength to resist wet weight of concrete and construction load. Protected all four sides by wax coated moisture protection. Shearmat or VF

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VoidForm or equal.

Location: As indicated on the drawings.

Part 3 Execution

3.1 FABRICATION AND ERECTION

- .1 Verify lines, levels and centres before proceeding with formwork/falsework and ensure dimensions agree with drawings.
- .2 Obtain Contract Administrator's approval for use of earth forms framing openings not indicated on drawings.
- .3 Hand trim sides and bottoms and remove loose earth from earth forms before placing concrete.
- .4 Fabricate and erect falsework in accordance with CAN/CSA-S269.1 to produce finished concrete conforming to shape, dimensions, locations and levels indicated within tolerances required by CAN/CSA-A23.1.
- .5 Refer to architectural drawings for concrete members requiring architectural exposed finishes.
- .6 Do not place shores and mud sills on frozen ground.
- .7 Provide site drainage to prevent washout of soil supporting mud sills and shores.
- .8 Fabricate and erect formwork in accordance with CAN/CSA-S269.3 to produce finished concrete conforming to shape, dimensions, locations and levels indicated within tolerances required by CAN/CSA-A23.1.
- .9 Arrange and assemble formwork to permit easy dismantling and stripping, so that concrete is not damaged during its removal.
- .10 Arrange forms to allow stripping without removal of principle shores, where these are required to remain in place.
- .11 Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection. Locate openings at bottom of forms to allow flushing water to drain. Close temporary ports or openings with tight-fitting panels, flush with inside face to forms, neatly fitted so those joints will not be apparent in exposed concrete surfaces.
- .12 Form weep holes and drainage holes in formwork as indicated. If wood forms are used, remove after concrete has set.
- .13 Camber slabs and beams 6 mm in 3000 mm of span unless noted otherwise. Maintain beam depth and slab thickness from cambered surface.
- .14 Align form joints and make watertight. Keep form joints to minimum.

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- .15 Locate horizontal form joints for exposed columns 2400 mm above finished floor elevation.
- .16 Use 20 mm chamfer strips on external corners and/or 20 mm fillets at interior corners , joints, unless specified otherwise.
- .17 Form chases, slots, openings, drips, recesses, expansion and control joints as indicated. Obtain Contract Administrator's permission before framing opening not indicated on the Drawings.
- .18 Construct forms for architectural concrete, and place ties as indicated and/or as directed. Joint pattern not necessarily based on using standard size panels or maximum permissible spacing of ties.
- .19 Build in anchors, sleeves, and other inserts required to accommodate Work specified in other sections. Assure that all anchors and inserts will not protrude beyond surfaces designated to receive applied finishes, including painting.
- .20 Inspect completed formwork, falsework, shoring and bracing to ensure that work is in accordance with formwork and falsework design and that supports, wedges, fasteners, ties and embedded parts are secure.
- .21 Inform Contract Administrator when formwork is complete and has been cleaned to allow for inspection. Obtain approval prior to placing concrete.
- .22 Clean formwork in accordance with CAN/CSA-A23.1, before placing concrete.

3.2 VOID FORM INSTALLATION

- .1 Install void form where indicated, level, and to proper elevation.
- .2 Use paper type void form in the locations shown on the Drawings.
- .3 Where void form is to be placed that will be above existing grade elevations the placement, leveling and compaction of backfill materials to be completed before void form is placed.
- .4 Wrap paper type void form with polyethylene film to protect from moisture. Cover paper type void form with 6 mm thick hardboard.
- .5 Provide minimum 300 x 300 mm sections of hardboard at bolster and chair locations.
- .6 Protect from damage until concrete placement. Replace crushed, damaged, or wet void form before placing concrete.

3.3 REMOVAL AND RESHORING

- .1 Do not remove forms and bracing until concrete has gained sufficient strength to carry its own weight, construction loads, design loads that are liable to be imposed upon it. Verify strength of concrete by compressive test results.

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- .2 Notify Contract Administrator 48 hours in advance prior to removing formwork.

Leave formwork in place for following minimum periods of time after placing concrete. LOCATION	TEMPERATURE IN °C		
	21-35	15-21	10-15
Walls	2 days	3 days	4 days
Grade Beams	2 days	3 days	4 days
Side Forms	2 days	3 days	4 days
Slabs	14 days	17 days	21 days
Beams	14 days	17 days	21 days
Structural Shoring	14 days	17 days	21 days

- .3 Loosen forms carefully. Do not wedge pry bars, hammers, or tools against concrete surfaces.
- .4 Re-shore structural members where required due to design requirements or construction conditions and as required to permit progressive construction. Remove forms supporting loads only when concrete has attained 75% of required 28-day compressive strength, provided construction is re-shored.
- .5 Remove formwork progressively and in accordance with Building and Safety Code requirements and so that no shock loads or unbalanced loads are imposed on structure.
- .6 Store removed forms, for exposed concrete, so surfaces in contact with fresh concrete will not be damaged. Marked or scored forms will be rejected.
- .7 Re-use formwork and falsework subject to requirements of CAN/CSA-A23.1.

END OF SECTION

CONCRETE REINFORCING

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 03 10 00 – Concrete formwork.
- .2 Section 03 30 00 - Cast-in-Place Concrete.

1.2 MEASUREMENT PROCEDURES

- .1 Reinforcing steel will be measured in kilograms of steel incorporated into work, computed from theoretical unit mass specified in CAN/CSA-G30.18 for lengths and sizes of bars as indicated or authorized in writing by Contract Administrator.

1.3 REFERENCES

- .1 American Concrete Institute (ACI)
 - .1 ACI 315R, Manual of Engineering and Placing Drawings for Reinforced Concrete Structure.
- .2 American National Standards Institute/American Concrete Institute (ANSI/ACI)
 - .1 ANSI/ACI 315, Details and Detailing of Concrete Reinforcement.
- .3 American Society for Testing and Materials (ASTM)
 - .1 ASTM A 775/A 775M, Specification for Epoxy-Coated Reinforcing Steel Bars.
- .4 Canadian Standards Association (CSA)
 - .1 CAN/CSA-A23.1, Concrete Materials and Methods of Concrete Construction.
 - .2 CAN3-A23.3, Design of Concrete Structures for Buildings.
 - .3 CSA G30.3, Cold Drawn Steel Wire for Concrete Reinforcement.
 - .4 CSA G30.5, Welded Steel Wire Fabric for Concrete Reinforcement.
 - .5 CSA G30.14, Deformed Steel Wire for Concrete Reinforcement.
 - .6 CSA G30.15, Welded Deformed Steel Wire Fabric for Concrete Reinforcement.
 - .7 CAN/CSA-G30.18, Billet-Steel Bars for Concrete Reinforcement.
 - .8 CAN/CSA-G40.21, Structural Quality Steels.
 - .9 CAN/CSA-G164, Hot Dip Galvanizing of Irregularly Shaped Articles.
 - .10 CSA W186, Welding of Reinforcing Bars in Reinforced Concrete Construction.

1.4 SHOP DRAWINGS

- .1 Submit shop drawings including placing of reinforcement in accordance with Section 01 33 00- Submittal Procedures.
- .2 Indicate on shop drawings, bar bending details, lists, quantities of reinforcement, sizes, spacing, locations of reinforcement and mechanical splices if approved by Contract

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Administrator, with identifying code marks to permit correct placement without reference to structural drawings. Indicate sizes, spacing and location of chairs, spacers and hangers.

- .3 Prepare reinforcement drawings in accordance with Reinforcing Steel Manual of Standard Practice - by Reinforcing Steel Institute of Canada, ANSI/ACI 315 and ACI 315R, Manual of Engineering and Placing Drawings for Reinforced Concrete Structure.
- .4 Detail lap lengths and bar development lengths to CAN/CSA-A23.3, unless otherwise indicated. Provide type B tension lap splices unless otherwise indicated.

1.5 SUBSTITUTES

- .1 Substitute different size bars only if approved by the Contract Administrator in writing.

1.6 DELIVERY, STORAGE, HANDLING

- .1 Store materials carefully, clear from ground and protect from rust, soiling, distortion and other damage.

Part 2 Products

2.1 MATERIALS

- .1 Reinforcing steel: billet steel, grade 400, deformed bars to CAN/CSA-G30.18, unless indicated otherwise.
- .2 Reinforcing steel: weldable low alloy steel deformed bars to CAN/CSA-30.18.
- .3 Cold-drawn annealed steel wire ties: to CSA G30.3.
- .4 Deformed steel wire for concrete reinforcement: to CSA G30.14.
- .5 Welded deformed steel wire fabric: to CSA G30.15. Provide in flat sheets only.
- .6 Epoxy coating of non-prestressed reinforcement: to ASTM A 775/A 775M.
- .7 Galvanizing of non-prestressed reinforcement: to CSA G164, minimum zinc coating 600 g/m².
- .8 Corrosion resistant chairs, bolsters, bar supports, spacers: to CAN/CSA-A23.1.
- .9 Mechanical splices: subject to approval of Contract Administrator.
- .10 Plain round bars: to CAN/CSA-G40.21.

2.2 FABRICATION

- .1 Fabricate reinforcing steel in accordance with CAN/CSA-A23.1, ANSI/ACI 315, and Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of

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Canada, ACI 315R, Manual of Engineering and Placing Drawings for Reinforced Concrete Structures unless indicated otherwise.

- .2 Obtain Contract Administrator approval for locations of reinforcement splices other than those shown on placing drawings.
- .3 Upon approval of Contract Administrator, weld reinforcement in accordance with CSA W186.
- .4 Ship bundles of bar reinforcement, clearly identified in accordance with bar bending details and lists.

2.3 SOURCE QUALITY CONTROL

- .1 Upon request, provide Contract Administrator with certified copy of mill test report of reinforcing steel, showing physical and chemical analysis, minimum 4 weeks prior to commencing reinforcing work.
- .2 Upon request inform Contract Administrator of proposed source of material to be supplied.

Part 3 Execution

3.1 FIELD BENDING

- .1 Do not field bend or field weld reinforcement except where indicated or authorized by Contract Administrator.
- .2 When field bending is authorized, bend without heat, applying a slow and steady pressure.
- .3 Replace bars which develop cracks or splits.

3.2 PLACING REINFORCEMENT

- .1 Place reinforcing steel as indicated on reviewed placing drawings and in accordance with CAN/CSA-A23.1.
- .2 Use plain round bars as slip dowels in concrete. Paint portion of dowel intended to move within hardened concrete with one coat of lead or asphalt paint. When paint is dry, apply a thick even film of mineral lubricating grease.
- .3 Keep reinforcing steel 65 mm back from construction joints and non-doweled joints.
- .4 Use chairs, bolsters, bar supports, spacers acceptable to Contract Administrator.
- .5 Use continuous 3 legged high chairs to support top bars in slabs.
- .6 Use corrosion resistant chairs, bolsters, bar support, spacers in areas where concrete is to be left exposed and where directed by Contract Administrator.

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- .7 Securely tie reinforcing in place with No.16 gauge wire.
- .8 Do not use reinforcing having kinks or bends not indicated or detailed on drawings.
- .9 Obtain Contract Administrator's approval before welding or cutting reinforcing bars.
- .10 Splice reinforcing where indicated on the Drawings.
- .11 Prior to placing concrete, obtain Contract Administrator's acceptance of reinforcing material and placement.
- .12 Ensure cover to reinforcement is maintained during concrete pour as per structural drawings.
- .13 Protect epoxy and paint coated portions of bars with covering during transportation and handling.

3.3 FIELD TOUCH-UP

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

END OF SECTION

CAST-IN-PLACE CONCRETE

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 03 10 00 - Concrete Forming and Accessories.
- .2 Section 03 20 00 - Concrete Reinforcing.
- .3 Section 03 35 05 - Concrete Floor Sealing.
- .4 Section 04 05 10 - Common Work Results for Masonry.
- .5 Section 31 63 23 – Bored Concrete Piles
- .6 Work specified in respective trade sections requiring inserts and openings in concrete.

1.2 MEASUREMENT PROCEDURES

- .1 Cast-in-place concrete will be measured in cubic metres calculated from neat dimensions indicated or authorized in writing by Contract Administrator. Concrete placed beyond dimensions indicated will not be measured.
- .2 No deductions will be made for volume of concrete displaced by reinforcing steel, structural steel, or piles.
- .3 No deductions will be made for volume of concrete less than 0.2 m² in cross sectional area displaced by individual drainage openings.
- .4 Heating of water and aggregates and providing cold weather protection will not be measured but considered incidental to work.
- .5 Cooling of concrete and providing hot weather protection will not be measured but considered incidental to work.
- .6 Supply and installation of anchor bolts, nuts and washers and bolt grouting will not be measured but considered incidental to work.
- .7 Supply and installation of waterstops will be measured in lineal metres installed.

1.3 REFERENCES

- .1 American Society for Testing and Materials (ASTM)
 - .1 ASTM C109/C109M, Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2 in. or 50-mm Cube Specimens).
 - .2 ASTM C260, Specification for Air-Entraining Admixtures for Concrete.
 - .3 ASTM C309, Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
 - .4 ASTM C494, Specification for Chemical Admixtures for Concrete.

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- .5 ASTM C939, Test Method for Flow of Grout for Preplaced-Aggregate Concrete.
- .6 ASTM C1017, Specification for Chemical Admixtures for use in producing flowing concrete.
- .7 ASTM D412, Test Methods for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers-Tension.
- .8 ASTM D624, Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomer.
- .9 ASTM D1751, Specification for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
- .10 ASTM D1752, Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.
- .11 ASTM E1155, Test Method for Determining Floor Flatness and Levelness Using the F-Number System.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-37.2, Emulsified Asphalt, Mineral Colloid-Type, Unfilled, for Dampproofing and Waterproofing and for Roof Coatings.
 - .2 CAN/CGSB-51.34, Vapour Barrier, Polyethylene Sheet for Use in Building Construction.
 - .3 CGSB 81-GP-1M, Flooring, Conductive and Spark Resistant.
- .3 Canadian Standards Association (CSA)
 - .1 CAN/CSA-A5, Portland Cement.
 - .2 CAN/CSA-A23.1, Concrete Materials and Methods of Concrete Construction.
 - .3 CAN/CSA-A23.2, Methods of Test for Concrete.
 - .4 CAN/CSA-A23.5, Supplementary Cementing Materials.
 - .5 CAN/CSA A362, Blendid Hydraulic Cement.
 - .6 CAN/CSA A363, Cementitious Hydraulic Slag.
 - .7 CAN/CSA-A3000, Cementitious Material Compendium.

1.4 SAMPLES

- .1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
- .2 At least 4 weeks prior to commencing work, inform Contract Administrator of proposed source of aggregates and provide access for sampling.

1.5 CERTIFICATES

- .1 Provide certification that mix proportions selected will produce concrete of specified quality, yield and that strength will comply with CAN/CSA-A23.1, and that mix design is adjusted to prevent alkali aggregate reactivity problems.
- .2 Provide certification that plant, equipment, and materials to be used in concrete comply with requirements of CAN/CSA-A23.1.

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1.6 QUALITY ASSURANCE

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

Part 2 Products

2.1 MATERIALS

- .1 Portland cement: to CAN/CSA-A5, normal Type GU or sulfate resistant Type HS where indicated on drawings or in mix design.
- .2 Blended hydraulic cement: to CAN/CSA-A362.
- .3 Supplementary cementing materials: to CAN/CSA-A3000.
- .4 Water: 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. Contract Administrator to approve accelerating or set retarding admixtures during cold and hot weather placing.
- .8 Shrinkage compensating grout: premixed compound consisting of non-metallic aggregate, Portland cement, water reducing and plasticizing agents of pouring consistency, capable of developing compressive strength of 50 MPa at 28 days.
- .9 Non-premixed dry pack grout: composition of non-metallic aggregate Portland cement with sufficient water for the mixture to retain its shape when made into a ball by hand and capable of developing compressive strength of 50 MPa at 28 days.
- .10 Curing compound: to CAN/CSA-A23.1 white and to ASTM C309.
- .11 Cushion pads: tough, resilient, weather, moisture, and oil resistant material that will not corrode or cause corrosion, consisting of either layers of approved cotton duck saturated and bound together by approved rubber or synthetic compounds, or made from specially compounded synthetic materials.

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- .12 Ribbed waterstops: extruded PVC of sizes indicated with shop welded corner and intersecting pieces with legs not less than 600 mm long :
 - .1 Tensile strength: to ASTM D412, method A, Die "C".
 - .2 Elongation: to ASTM D412, method A, Die "C", minimum 275%.
 - .3 Tear resistance: to ASTM D624, method A, Die "B".
- .13 Premoulded joint fillers:
 - .1 Bituminous impregnated fiber board: to ASTM D1751, thickness indicated.
- .14 Weep hole tubes: plastic.
- .15 Dovetail anchor slots: minimum 0.6 mm thick galvanized steel with insulation filled slots.
- .16 Dampproof membrane:
 - .1 Polyethylene film: minimum 0.15 mm (6 mil) thickness to CAN/CGSB-51.34:

2.2 CONCRETE MIXES

- .1 All concrete work shall be in accordance with CAN/CSA-A23.1, Alternative 1, Performance Specifications.
- .2 General Contractor to provide proprietary mix design performance record as required by the Manitoba Redi-Mix Association.
- .3 Provide concrete mix-design as per the structural general notes drawing, Table 1.

Part 3 Execution

3.1 PREPARATION

- .1 Obtain Contract Administrator's approval before placing concrete. Provide Contract Administrator with 24 hour notice prior to placing of concrete.
- .2 Pumping of concrete is permitted only after approval of equipment and mix by Contract Administrator.
- .3 Ensure reinforcement and inserts are not disturbed during concrete placement.
- .4 Prior to placing of concrete obtain Contract Administrator's approval of proposed method for protection of concrete during placing and curing in adverse weather.
- .5 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, air temperature and test samples taken.
- .6 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.
- .7 Do not place load upon new concrete until authorized by Contract Administrator.

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3.2 CONSTRUCTION

- .1 Perform cast-in-place concrete work in accordance with CAN/CSA-A23.1.
- .2 Maintain concrete cover around reinforcing as indicated.
- .3 Place concrete in its final position as soon as possible after mixing and within 1.5 hours after the water has been added to the dry materials. Do not use any concrete more than 1.5 hours old.
- .4 Pour concrete continuously between predetermined construction and control joints. Do not “break” or interrupt successive pours such that “cold” joints occur.
- .5 Sleeves and inserts.
 - .1 No sleeves, ducts, pipes or other openings shall pass through joists, beams, column capitals or columns, except where indicated on structural drawings or approved by Contract Administrator.
 - .2 Where approved by Contract Administrator, set sleeves, ties, pipe hangers and other inserts and openings as indicated or specified elsewhere. Sleeves and openings greater than 100 x 100 mm not indicated on drawings must be approved by Contract Administrator.
 - .3 Do not eliminate or displace reinforcement to accommodate hardware. If inserts cannot be located as specified, obtain approval of modifications from Contract Administrator before placing of concrete.
 - .4 Check locations and sizes of sleeves and openings indicated on structural drawings with architectural, mechanical, electrical and other drawings. Report any discrepancies to the Contract Administrator and await remedial measures.
 - .5 Set special inserts for strength testing as indicated and as required by non-destructive method of testing concrete. CSA or ASTM.
- .6 Anchor bolts.
 - .1 Set anchor bolts to templates under supervision of appropriate trade prior to placing concrete.
 - .2 With approval of Contract Administrator, grout anchor bolts in preformed holes or holes drilled after concrete has set. Formed holes to be minimum 100 mm diameter. Drilled holes to be larger in diameter than bolts used to manufacturers’ recommendations.
 - .3 Protect anchor bolt holes from water accumulations, snow and ice build-ups.
 - .4 Set bolts and fill holes with shrinkage compensating grout.
- .7 Drainage holes and weep holes:
 - .1 Form weep holes and drainage holes in accordance with Section 03 10 00 - Concrete Forming and Accessories. If wood forms are used, remove them after concrete has set.
 - .2 Install weep hole tubes and drains as indicated.
- .8 Dovetail anchor slots:

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- .1 Install continuous vertical anchor slot to forms where masonry abuts concrete wall or columns.
- .2 Install continuous vertical anchor slots at 6800 mm on centre where concrete walls are masonry faced.
- .9 Grout under base plates and machinery using procedures in accordance with manufacturer's recommendations which result in 100 % contact over grouted area.
- .10 Waterstops.
 - .1 Install waterstops to provide continuous water seal. Do not distort or pierce waterstop in such a way as to hamper performance. Do not displace reinforcement when installing waterstops. Use equipment to manufacturer's requirements to field splice waterstops. Tie waterstops rigidly in place.
- .11 Joint fillers.
 - .1 Furnish filler for each joint in single piece for depth and width required for joint, unless otherwise authorized by Contract Administrator. When more than one piece is required for a joint, fasten abutting ends and hold securely to shape by stapling or other positive fastening.
 - .2 Locate and form isolation and expansion joints as indicated. Install joint filler.
 - .3 Use 12 mm thick joint filler to separate slabs-on-grade from vertical surfaces and extend joint filler from bottom of slab to within 12 mm of finished slab surface unless indicated otherwise.
- .12 Dampproof membrane.
 - .1 Install dampproof membrane as per Section 07 13 00 – Sheet Waterproofing.

3.3 FINISHING

- .1 Finish concrete in accordance with CAN/CSA-A23.1.
- .2 Use procedures acceptable to Contract Administrator and as noted in CAN/CSA-A23.1 to remove excess bleed water. Ensure surface is not damaged.
- .3 Do not sprinkle dry cement or dry cement and sand mixture over concrete surfaces.
- .4 Saw cut crack-control joints to CAN/CSA – A23.1.
- .5 Fill and patch honeycomb areas, rub form joint lines from all exposed concrete.
- .6 Fill and patch form tie holes on exposed concrete.
- .7 Where floor drains occur, finish floor slabs level around walls and pitched to drains minimum 6 mm in 3 m.
- .8 Provide screed, swirl-trowelled or scratch finish where bonded topping, terrazzo, floor tile or other hard surface or bonded topping is to be applied. Provide depression to accommodate bonded topping, terrazzo, etc.
- .9 Provide steel trowelled, smooth, burnished finish where slabs to be left exposed or to receive carpeting, resilient flooring, floor paint or other applied floor finishes.

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Burnish to smooth, even finish without ridges, trowel marks, voids, or other imperfections that may transmit through flooring material.

- .10 Rub exposed sharp edges of concrete with carborundum to produce 3 mm radius edges unless otherwise indicated.

3.4 COLD WEATHER CONCRETE PLACING

- .1 Maintain the following minimum requirements for protection concrete during and after placement in freezing weather. Except as noted below, concrete curing and protection to be in accordance with CAN/CSA-A23.1.
- .2 Before any concrete is placed, remove ice, snow, and frost completely from all formwork, reinforcing and other surfaces. Raise temperature of formwork, reinforcing and other surfaces above 10 °C for 24 hours minimum prior to concrete placing. Where concrete work is to come in contact with earth, the surface of the earth shall be completely free of frost when concrete is placed thereon.
- .3 Heat concrete aggregate and water to a temperature not over 80 °C. Concrete shall not be less than 10°C nor more than 30°C in temperature when deposited. Concrete when placed during freezing weather (or if freezing is anticipated during curing period) shall be fully enclosed and the temperature of the concrete maintained at not less than 20 °C for 5 days and not less than 5 °C for an additional 5 days. Provide adequate heating to attain the specified concrete strength required prior to stripping or provide a concrete mix that will meet the specified stripping strength under reduced curing temperatures.
- .4 Keep protective covering clear of concrete and form surfaces to permit full circulation of air. Maintain intact for at least 24 hours after the artificial heat is discontinued.
- .5 Construct heating enclosures/hoarding to be strong and windproof, as well ventilated. Locate heating units to prevent local damage to concrete due to local overheating, over drying or combustion gases.
- .6 Use only Herman Nelson heat exchange fuel oil type heaters for slabs and flat areas. Vent units to outside the building/hoarding. Direct-fired units are not acceptable.

3.5 SURFACE TOLERANCE FOR HORIZONTAL SURFACES

- .1 Concrete tolerance in accordance with CAN/CSA-A23.1 straight edge method. Measured within 72 hours of concrete placement, the gap at any point between a 3 metre long straight edge and the concrete surface shall not exceed requirements of the following classifications for areas specified:
 - .1 Conventional 12 mm: exterior slabs, sidewalks, and concrete paving;
 - .2 Moderately flat 8 mm : interior slabs and toppings.

3.6 CURING AND SEALING

- .1 Cure concrete in accordance with CAN/CSA-A23.1.
- .2 Use curing compounds with applied finish on concrete surfaces. Provide written declaration that compounds used are compatible.

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- .3 Do not use curing and sealing compounds on surfaces where bond is required for additional concrete, floor finishes or other surface coatings.

3.7 HOUKEEPING PADS

- .1 Supply and install housekeeping pads for mechanical/electrical and other equipment as indicated in Drawings.
- .2 Refer to mechanical and electrical drawings and specifications and coordinate with respective trades for housekeeping pad sizes and locations.
- .3 Refer to structural drawings for reinforcing for large pads.
- .4 Provide tooled, slightly rounded edges around perimeter of all housekeeping pads.

3.8 DEFECTIVE CONCRETE

- .1 Modify or replace concrete not conforming to lines, detail and elevation indicated on drawings.
- .2 Repair or replace concrete not properly placed, resulting in excessive honeycombing and other defects in critical areas of stress.
- .3 Do not patch, fill, touch-up, repair or replace exposed architectural concrete except upon expressed direction of the Contract Administrator for each individual area.
- .4 Notify Contract Administrator of proposed methods of repairing or shall be acceptable defective concrete. Methods of repairing or replacing defective concrete shall be acceptable to Contract Administrator.

3.9 FIELD QUALITY CONTROL

- .1 Inspection and testing of concrete and concrete materials will be carried out by an Independent Testing Laboratory appointed by the Contract Administrator in accordance with CAN/CSA-A23.1 and as specify below.
- .2 Take three test cylinders from each 50 cubic meters of each class of concrete placed or for each day of concrete placement if the latter is less than 50 cubic meters. Testing shall be as follows:
 - .1 One (1) 7-day laboratory cured test,
 - .2 Two (2) 28-day laboratory cured tests.
- .3 Take one additional test cylinder during cold weather concreting if sulphate resistance cement has been used. Cure cylinder on job site under same conditions as concrete that it represents.
- .4 Make at least one slump test for each set of test cylinders taken.
- .5 Cure concrete test cylinders in location designated by testing agency for a minimum of 48 hours prior to transporting to laboratory.

CAST-IN-PLACE CONCRETE

- .6 Additional testing required due to low, inaccurate or otherwise questionable results shall be paid by the Contractor.
- .7 Non-destructive methods for testing concrete shall be in accordance with CAN.CSA-A23.2
- .8 Inspection or testing by Contract Administrator will not augment or replace Contractor quality control nor relieve him of his contractual responsibility.

END OF SECTION

CONCRETE FLOOR SEALING

Part 1 General

1.1 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit submittals in accordance with Section 01 33 00
- .2 Submit product data sheets and application instructions for concrete sealer and primers.
- .3 Submit WHMIS MSDS - Material Safety Data Sheets.

1.2 ENVIRONMENTAL REQUIREMENTS

- .1 Temperature
 - .1 Maintain ambient temperature of not less than 10 degrees C from 3 days before installation to at least 48 hours after completion of Work and maintain relative humidity not higher than 40% during same period.
 - .2 Maintain substrate temperature at 10 degrees C minimum.
- .2 Moisture: Ensure concrete substrate is within moisture limits prescribed by concrete sealer manufacturer.

Part 2 Products

2.1 FLOOR SEALER

- .1 Water based acrylic curing, sealing, and dustproofing compound.
- .2 Acceptable material:
 - .1 CPD Acylic Cure and seal.
 - .2 W.R. Meadows Sealtight Vocomp-20
 - .3 Sonneborne Kure-N-Seal WB
 - .4 Sika Florseal WB

Part 3 Execution

3.1 EXAMINATION

- .1 Verify that slab surfaces are ready to receive Work.

3.2 SEALING

- .1 Apply floor sealer aggregate at rate in accordance with manufacturer's written instructions for each coat.
- .2 Apply two coats.
- .3 Apply second coat at right angles to first coat.

CONCRETE FLOOR SEALING

3.3 PROTECTION

- .1 Protect finished installation until floor sealer has completely cured.

END OF SECTION