

Part 1 General

1.1 REFERENCES

- .1 Canadian Standards Association (CSA)
 - .1 CAN/CSA-A23.1-04 Concrete Materials and Methods of Concrete Construction.
 - .2 CAN/CSA-O86.1-94, Engineering Design in Wood (Limit State Design).
 - .3 CSA O121M1978, Douglas Fir Plywood.
 - .4 CSA O151-M1978, Canadian Softwood Plywood.
 - .5 CSA O153-M1980, Poplar Plywood.
 - .6 CSA S269.11975, Falsework for Construction Purposes.
 - .7 CAN/CSA-S269.3-M92, Concrete Formwork.

Part 2 Products

2.1 MATERIALS

- .1 Formwork materials:
 - .1 For concrete without special architectural features, use wood and wood product formwork materials to CSA-O121, CAN/CSA-O86.1, CSA-O153.
- .2 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 dia. in concrete surface.
- .3 Form liner:
 - .1 Plywood: Douglas Fir to CSA O121, Canadian Softwood Plywood to CSA O151., square edge, 19mm thick.
- .4 Form release agent: chemically active, non-toxic release agents containing compounds that react with free lime present in concrete to provide water insoluble soaps, preventing concrete from sticking to forms.
- .5 Form stripping agent: colourless mineral oil, non-toxic free of kerosene, with viscosity 15 to 24 mm²/s at 40°C, flashpoint minimum 150°C, open cup.
- .6 Falsework materials: to CSA-S269.1.
- .7 Sealant: to Section 07 92 00 - Joint Sealers.

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 Hand trim sides and bottoms and remove loose earth from earth forms before placing concrete.
- .3 Do not place shores and mud sills on frozen ground.
- .4 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.
- .5 Align form joints and make watertight. Keep form joints to minimum.
- .6 Use 25 mm chamfer strips on external corners and/or 25 mm fillets at interior corners , joints, unless specified otherwise.
- .7 Form chases, slots, openings, drips, recesses, expansion and control joints as indicated.
- .8 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.
- .9 Clean formwork in accordance with CAN/CSA-A23.1, before placing concrete.
- .10 All form lumber, studding, etc. becomes the property of the Contractor when the work is finished, and it shall be removed from the concrete and the site by the Contractor after the concrete is set, free of extra charge, and the entire site left in a neat and clean condition.
- .11 It shall be permissible to use the forms over again where possible, provided they are thoroughly cleaned and in good condition after being removed from the former portions of the Work. The Contract Administrator shall be the sole judge of their condition and his decision shall be final regarding the use of them again.

3.2 REMOVAL AND RESHORING

- .1.1 The Contract Administrator must be notified at least 24 hours prior to form removal and give approval prior to beginning work.

3.3 PATCHING OF FORMED SURFACES

- .1.1 Immediately after forms have been removed, but before any repairing or surface finish is started, the concrete surface shall be inspected by the Contract Administrator. Any repair or surface finishing started before this inspection may be rejected and required to be removed.
- .1.2 All formed concrete surfaces shall have bolts, ties, struts and all other timber or metal parts not specifically required for construction purposes cut back twentyfive (25) mm from the surface before patching.

- .1.3 Minor surface defects caused by honeycomb, air pockets greater than 5 mm in diameter and voids left by strutting and tie holes shall be repaired by removing the defective concrete to sound concrete, dampening the area to be patched and then applying patching mortar. A slurry grout consisting of water and cement, shall be well brushed onto the area to be patched. When the slurry grout begins to lose the water sheen, the patching mortar shall be applied. It shall be struck off slightly higher than the surface and left for one hour before final finishing to permit initial shrinkage of the patching mortar, it shall be touched up until it is satisfactory to the Contract Administrator.
- .1.4 All objectionable fins, projections, offsets, streaks or other surface imperfections shall be removed by approved means to the Contract Administrator's satisfaction. Cement washes of any kind shall not be used.
- .1.5 Wherever "Concrete Surface Coating" is to be applied, patching of minor surface defects shall be done by the Thoroseal applicator using Thorite. Payment for same is considered incidental to the works of this Specification. Patching of snap tie holes to defects larger than 15 mm in diameter shall be done under this Specification.

3.4 FINISHING OF FORMED SURFACES

- .1.1 Concrete shall be cast against forms which will produce plane surfaces with no bulges, indentation or swelling other than those shown on the Drawing. The arrangement of panel joints shall be kept to a minimum. Panels containing worn edges, patches or other defects which will impair the texture of concrete surfaces shall not be used. All fins on the concrete surfaces shall be removed.

Part 4 Quality Control

4.1 INSPECTION

- .1.1 All workmanship and all materials furnished and supplied under this Specification are subject to close and systematic inspection and testing by the Contract Administrator including all operations from the selection and production of materials through to final acceptance of the specified work. The Contractor shall be wholly responsible for the control of all operations incidental thereto notwithstanding any inspection or approval that may have been previously given. The Contract Administrator reserves the right to reject any materials or works which are not in accordance with the requirements of this Special Provision.

4.2 ACCESS

- .1.1 The Contract Administrator shall be afforded full access for the inspection of form work and constituent materials.

END OF SECTION

Part 1 General

1.1 RELATED SECTION

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

1.2 REFERENCES

- .1 American Concrete Institute (ACI)
 - .1 ACI 315R-80, Manual of Engineering and Placing Drawings for Reinforced Concrete Structure.
- .2 American National Standards Institute/American Concrete Institute (ANSI/ACI)
 - .1 ANSI/ACI 315-80, Details and Detailing of Concrete Reinforcement.
- .3 Canadian Standards Association (CSA)
 - .1 CAN/CSA-A23.1-04, Concrete Materials and Methods of Concrete Construction.
 - .2 CAN3-A23.3-00, Design of Concrete Structures for Buildings.
 - .3 CSA G30.12

1.3 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, spacings, locations of reinforcement and mechanical splices if approved by Contract Administrator, with identifying code marks to permit correct placement without reference to structural drawings. Indicate sizes, spacings and locations of chairs, spacers and hangers. 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.
- .3 Detail lap lengths and bar development lengths to CAN3-A23.3, unless otherwise indicated.

Part 2 Products

2.1 MATERIALS

- .1 Substitute different size bars only if permitted in writing by Contract Administrator.
- .2 Reinforcing steel: billet steel, grade 400, deformed bars to CAN/CSA-G30.18, unless indicated otherwise.

- .3 Chairs, bolsters, bar supports, spacers: to CAN/CSA-A23.1.
- .4 Mechanical splices: subject to approval of Contract Administrator.
- .1.5 Colddrawn annealed steel wire ties: to ASTM A82/A82M.
- .1.6 Deformed steel wire for concrete reinforcement: to ASTM A82/A82M.
- .1.7 Welded steel wire fabric: to ASTM A185/A185M.
 - .1.7.1 Provide in flat sheets only.
- .1.8 Welded deformed steel wire fabric: to [ASTM A82/A82M].
 - .1.8.1 Provide in flat sheets only.
- .1.9 Galvanizing of non-prestressed reinforcement: to CAN/CSA-G164, minimum zinc coating 610 g/m².
 - .1.9.1 Protect galvanized reinforcing steel with chromate treatment to prevent reaction with Portland cement paste.
 - .1.9.2 If chromate treatment is carried out immediately after galvanizing, soak steel in aqueous solution containing minimum 0.2% by weight sodium dichromate or 0.2% chromic acid.
 - .1.9.2.1 Temperature of solution equal to or greater than 32 degrees and galvanized steels immersed for minimum 20 seconds.
 - .1.9.3 If galvanized steels are at ambient temperature, add sulphuric acid as bonding agent at concentration of 0.5% to 1%.
 - .1.9.3.1 In this case, no restriction applies to temperature of solution.
 - .1.9.4 Chromate solution sold for this purpose may replace solution described above, provided it is of equivalent effectiveness.
- .1.10 Plain round bars: to CSAG40.20/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 Canada. ACI 315R, Manual of Engineering and Placing Drawings for Reinforced Concrete Structures unless indicated otherwise.
- .2 Obtain Contract Administrator's 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.
- .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 approved 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 asphalt paint. When paint is dry, apply a thick even film of mineral lubricating grease.
- .3 Prior to placing concrete, obtain Contract Administrator's approval of reinforcing materials and placement.
- .4 Ensure cover to reinforcement is maintained during concrete pour.

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

Part 1 General

1.1 RELATED SECTION

- .1 Section 03 10 00 – Concrete Forming and Accessories.
- .2 Section 03 20 00– Concrete Reinforcing.

1.2 REFERENCES

- .1 American Society for Testing and Materials (ASTM)
 - .1 ASTM C260-94, Specification for Air-Entraining Admixtures for Concrete.
 - .2 ASTM C309-94, Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
 - .3 ASTM C494-92, Specification for Chemical Admixtures for Concrete.
 - .4 ASTM D1751-83(1991), Specification for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
- .2 Canadian Standards Association (CSA)
 - .1 CAN/CSA-A5-93, Portland Cement.
 - .2 CAN/CSA-A23.1-04, Concrete Materials and Methods of Concrete Construction.
 - .3 CAN/CSA-A23.2-04, Methods of Test for Concrete.

1.3 STANDARD

- .1 Concrete materials and methods of construction to CAN/CSA-A23.1 unless otherwise specified.

1.4 TESTING AND INSPECTION

- .1 Concrete testing to CAN/CSA-A23.1 by testing laboratory designated by Contract Administrator.
- .2 Give Contract Administrator minimum of seven days notice prior to each concrete pour.

1.5 SAMPLES

- .1 Concrete testing to CAN/CSA-A23.1 by testing laboratory designated by 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.

1.6 CERTIFICATES

- .1 Submit certificates in accordance with Section 01 33 00 - Submittal Procedures.
- .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.

Part 2 Products

2.1 MATERIALS

- .1 Portland cement: to CAN/CSA-A5.
- .2 Supplementary cementing materials: to CAN/CSA-A23.5.
- .3 Water: to CAN/CSA-A23.1.
- .4 Aggregates: to CAN/CSA-A23.1.
- .5 Air entraining admixture: to ASTM C260.
- .6 Chemical admixtures: to ASTM C494. Contract Administrator to approve accelerating or set retarding admixtures during cold and hot weather placing.
- .7 Concrete retarders: to ASTM C494. Do not allow moisture of any kind to come in contact with the retarder film.
- .8 Non-shrink grout: premixed compound consisting of non-metallic aggregate, Portland cement, water reducing and plasticizing agents.
 - .1 Compressive strength: 50 MPa at 28 days
- .9 Polyethylene film: 6 mil thickness to CAN/CGSB-51.34.
- .10 Curing compound: to CAN/CSA-A23.1 and to ASTM C309.
- .11 Premoulded joint fillers:
 - .1 Bituminous impregnated fiber board: to ASTM D1751.

2.2 MIXES

- .1 Proportion concrete in accordance with CAN/CSA-A23.1, to give quality and yield for concrete as indicated. Refer to Drawings, General Notes for mix proportions and strengths.

2.3 DELIVERY AND STORAGE

- .1 Concrete hauling time: deliver to site of Work and discharge within 120 minutes maximum after batching.

Part 3 Execution

3.1 PREPARATION

- .1 Obtain Contract Administrator's approval before placing concrete. Provide seven days notice prior to placing of concrete.
- .2 Pumping of concrete is permitted only after approval of equipment and mix.
- .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 Do not place load upon new concrete until authorized by Contract Administrator.

3.2 COLD WEATHER REQUIREMENTS

- .1 In the event "Possutec 20" as manufactured by Master Builders is used, relaxation of the following bill be considered.
- .2 When the air temperature is at or below 5°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.
- .3 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 acceptable to the Contract Administrator. Equipment inducing carbon monoxide gas free to come into contact with concrete work shall not be acceptable.
- .4 Concrete shall not be placed on or against reinforcing, formwork, ground or any surface that is at a temperature less than 5°C.
- .5 When being placed the concrete shall have a temperature of not less than 10°C nor more than 30°C.
- .6 The temperature of the concrete at all surfaces shall be maintained at not less than 20°C for three days, or at not less than 10°C for five days after placing.
- .7 Means shall be provided to humidify the air within enclosures and to keep the concrete and formwork continuously moist if dry heat is used.
- .8 The concrete shall be kept above freezing temperature for a period of seven days and shall be kept from alternate freezing and thawing for at least fourteen days after placement.
- .9 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 Table 17 of CSA CAN3-A23.1-M77.
- .10 Accelerator or so-called antifreeze compounds shall not be permitted unless otherwise approved by Contract Administrator.

- .11 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 twenty-four hours after the artificial heat is disconnected.
- .12 On slip formed work, newly poured surfaces exposed to exterior weather conditions shall be protected to avoid exposure to adverse effects of wind, rain and low temperatures.

3.3 CONSTRUCTION

- .1 Do cast-in-place concrete work in accordance with CAN/CSA-A23.1.
- .2 Sleeves and inserts.
 - .1 No sleeves, ducts, pipes or other openings shall pass through joists, beams, column capitals or columns, except where indicated 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 (4" x 4") not indicated 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 shown on drawings.
 - .5 Set special inserts for strength testing as indicated and as required by non-destructive method of testing concrete.
- .3 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 (4") diameter. Drilled holes to be [minimum 25 mm (1") larger in diameter than bolts used to manufacturer's recommendations.
 - .3 Protect anchor bolt holes from water accumulations, snow and ice buildups.
 - .4 Set bolts and fill holes with grout.
 - .5 Locate anchor bolts used in connection with expansion shoes, rollers and rockers with due regard to ambient temperature at time of erection.
- .4 Grout under base plates and machinery using procedures in accordance with manufacturer's recommendations which result in 100% contact over grouted area.
- .5 Finishing.
 - .1 Finish concrete to CSA A23.1/A23.2. Refer to Drawings for finishes.

- .2 Use procedures acceptable to Contract Administrator or those noted in CAN/CSA-A23.1 to remove excess bleed water. Ensure surface is not damaged.
- .3 Use curing compounds compatible with applied finish on concrete surfaces. Provide written declaration that compounds used are compatible.
- .4 Rub exposed sharp edges of concrete with carborundum to produce 3 mm (1/8") radius edges unless otherwise indicated.
- .5 Provide light broom finish with no frames for exterior slabs unless noted otherwise.
- .6 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 construction, expansion joints as indicated. Install joint filler.

3.4 CURING

- .1 Cure and protect concrete in accordance with CAN/CSA A23.1.

3.5 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.
- .2 Use only straight heat sealed butt joints in field. Use factory welded corners and intersections unless otherwise approved by Contract Administrator.

3.6 SITE TOLERANCE

- .1 Concrete tolerance in accordance with CAN/CSA-A23.1 and to tolerance schedule as indicated.

3.7 FIELD QUALITY CONTROL

- .1 Inspection and testing of concrete and concrete materials will be carried out by a Testing Laboratory designated by Contract Administrator in accordance with CAN/CSA-A23.1 and Section 01 45 00 - Quality Control.
- .2 Contract Administrator will take additional test cylinders during cold weather concreting. Cure cylinders on job site under same conditions as concrete which they represent.

- .3 Non-destructive Methods for Testing Concrete shall be in accordance with CAN/CSA-A23.2.
- .4 Inspection or testing by Contract Administrator will not augment or replace Contractor quality control nor relieve him/her of his/her contractual responsibility.

END OF SECTION