

PART 1 - GENERAL

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| <u>1.1 Related Work</u> | .1 | Section 03 20 00 - Concrete Reinforcing |
| | .2 | Section 03 30 00 - Cast-in-Place Concrete |
| <u>1.2 Reference Standards</u> | .1 | Do concrete formwork and falsework in accordance with CSA A23.1-14/A23.2-14 (or latest edition), Concrete Materials and Methods of Concrete Construction, except where stricter standards specify otherwise. |
| | .2 | CSA S269.1-16 (or latest edition), Falsework for Construction Purposes |
| <u>1.3 Submissions</u> | .1 | Shop Drawings: |
| | .1 | Upon request, submit to the Departmental Representative for review four (4) sets of formwork and falsework shop drawings, in accordance with Section 01 00 00, at least four (4) weeks prior to erection. All such drawings to be stamped and signed by a Professional Engineer registered in the Province of Nova Scotia. |
| | .2 | Clearly indicate method and schedule of construction, materials, arrangement of joints, ties, shores, liners, and locations of temporary embedded parts. Comply with CSA S269.1 for falsework drawings. |

PART 2 - PRODUCTS

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| <u>2.1 Materials</u> | .1 | Formwork lumber: plywood and wood formwork materials to CSA A23.1 |
| | .2 | Falsework materials: to CSA S269.1 |
| | .3 | Form stripping agent: colourless mineral oil, free of kerosene, with viscosity between 70 and 110 s Saybolt Universal, 15 to 14 mm ² /s at 40DC, flash-point minimum 150DC, open cup. |

- .4 Form ties: removable or snap-off metal ties, fixed or adjustable length, free of devices leaving holes larger than 1 in. (25 mm) diameter in concrete surface. When forms are removed, no metal shall be less than 2 in. (50 mm) from the surface of the concrete.

PART 3 - Execution

3.1 Erection

- .1 Verify lines and levels before proceeding with formwork and ensure dimensions agree with drawings.
- .2 Construct forms to produce finished concrete conforming to shape, dimensions, locations and levels indicated within tolerances required by CSA A23.1
- .3 Forms shall be near new with intact and well defined corners, edges and smooth faces.
- .4 Line forms with material only as approved by the Departmental Representative.
- .5 Construct falsework in accordance with CSA S269.1
- .6 Align form joints and make watertight. Keep form joints to minimum.
- .7 Use 1 in. (25 mm) chamfer strips on external corners.
- .8 Clean formwork in accordance with CSA A23.1, before placing concrete.
- .9 Leave formwork in place for at least three days, except seven days when temperature falls below 5 degrees Celsius, unless otherwise directed by the Departmental Representative.
- .10 Re-use of formwork and falsework subject to requirements of CSA A23.1

- .11 All holes from form ties and rods to be plugged with mortar to requirements of CSA A23.1. When forms are removed, no metal shall be less than 2 in. (50 mm) from the surface of the concrete.

END OF SECTION

PART 1 - GENERAL

<u>1.1 Related Requirements</u>	.1	Section 03 10 00 - Concrete Forming and Accessories
	.2	Section 03 30 00 - Cast-in-Place Concrete
<u>1.2 Reference Standards</u>	.1	Do concrete reinforcement work in accordance with CSA standard A23.1-14/A23.2-14, Concrete Materials and Methods of Concrete Construction, except where stricter standards specify otherwise.
	.2	Reinforcing Steel Manual of Standard Practice (Fourth Edition - 2004) by Reinforcing Steel Institute of Canada.
	.3	CSA G30.18-09 (R2014), Billet Steel Bars for Concrete Reinforcement.
	.4	CSA G30.3-M1983 (R1998) (or latest edition), Cold-Drawn Steel Wire for Concrete Reinforcement.
<u>1.3 Source Sampling</u>	.1	Upon request, provide the Departmental Representative with certified copy of mill test of steel supplied showing physical and chemical analysis not less than 2 weeks prior to commencement of work.
<u>1.4 Submissions</u>	.1	Shop Drawings:
	.1	Clearly indicate bar sizes, spacing, location and quantities of reinforcement, reinforcement support bars, mesh, chairs, spacers and hangers with identifying code marks to permit correct placement without reference to structural drawings; to Reinforcing Steel Manual of Standard Practice.
	.2	Detail placement of reinforcing where special conditions occur.
	.3	Design and detail lap lengths and bar development lengths to CSA standard A23.1, unless otherwise specified on drawings.

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- .2 Product Data/Samples:
 - .1 Provide product data for supports and spacers.
 - .3 Test Results:
 - .1 Provide Mill Test Certificates cross referenced to the product supplied to the site.
 - .4 Provide submissions in accordance with Section 01 33 00 - Submittal Procedures.
- 1.5 Storage
- .1 Store reinforcing steel on racks or sills that will permit easy access for identification and handling and prevent it from becoming coated with material which would adversely affect bond.
 - .2 Do not store reinforcing steel in direct contact with the ground.
- PART 2 - PRODUCTS
- 2.1 Materials
- .1 Reinforcing steel: to CSA G30.18; billet steel grade 400 deformed bars.
 - .2 Wire ties: to CSA G30.3 plain, cold drawn annealed steel wire.
 - .3 Spacers: PVC, Fabricated to suit site dimensions.
- 2.2 Reinforcing Steel Fabrication
- .1 Fabricate reinforcing to CSA standard A23.1
 - .2 Fabrication tolerances for reinforcing steel to Reinforcing Steel Manual of Standard Practice.
 - .3 Obtain the Departmental Representative's acceptance for locations of reinforcement splices other than shown on steel placing drawings.
 - .4 Ship bundles of bar reinforcement, clearly identified in accordance with bar list.
 - .5 Do not weld reinforcing steel.

PART 3 - EXECUTION

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| <u>3.1 Placing</u> | <ul style="list-style-type: none">.1 Accurately place reinforcing in positions indicated and hold firmly during placing, compacting and setting of concrete..2 Tie reinforcement where spacing in each direction is:<ul style="list-style-type: none">.1 Less than 300 mm: - tie at alternate intersections..2 300 mm or more: - tie at each intersection..3 All concrete elements shall be reinforced with 15M at 12 in. (300 mm) centres each way each face unless noted otherwise. |
| <u>3.2 Field Bending</u> | <ul style="list-style-type: none">.1 Do not field bend reinforcement except where indicated or authorized by the Departmental Representative..2 When authorized, bend reinforcement without heat, by applying slow and steady pressure..3 Replace bars which develop cracks or splits. |
| <u>3.3 Cleaning</u> | <ul style="list-style-type: none">.1 Clean reinforcing before placing concrete. |
| <u>3.4 Inspection</u> | <ul style="list-style-type: none">.1 Do not place concrete until the Departmental Representative has reviewed and accepted reinforcement work. |
| <u>3.5 Surface Conditions</u> | <ul style="list-style-type: none">.1 Reinforcement, at time concrete is placed, to be free from mud, oil or other non-metallic coatings that adversely affect bonding capacity..2 Reinforcement, with rust, mill scale, or combination of both to be considered as satisfactory, provided minimum dimensions, including height of deformations, and mass of hand wire brushed test specimen are not less than specified requirements in applicable CSA Standards. |

END OF SECTION

PART 1 - GENERAL1.1 REFERENCES

- .1 Abbreviations and Acronyms:
 - .1 Portland Cement: hydraulic cement, blended hydraulic cement (XXb - b denotes blended) and Portland-limestone cement.
 - .1 Type GU, GUb and GUL - General use cement.
 - .2 Type MS and MSb - Moderate sulphate-resistant cement.
 - .3 Type MH, MHb and MHL - Moderate heat of hydration cement.
 - .4 Type HE, HEb and HEL - High early-strength cement.
 - .5 Type LH, LHb and LHL - Low heat of hydration cement.
 - .6 Type HS and HSb - High sulphate-resistant cement.
 - .2 Fly ash:
 - .1 Type F - with CaO content less than 15%.
 - .2 Type CI - with CaO content ranging from 15 to 20%.
 - .3 Type CH - with CaO greater than 20%.
 - .3 GGBFS - Ground, granulated blast-furnace slag.
- .2 Reference Standards:
 - .1 ASTM International
 - .1 ASTM C260/C260M-10a(2016), Standard Specification for Air-Entraining Admixtures for Concrete.
 - .2 ASTM C309-11, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
 - .3 ASTM C494/C494M-17, Standard Specification for Chemical Admixtures for Concrete.

- .4 ASTM C1017/C1017M-13e1, Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.
- .5 ASTM D412-16, Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension.
- .6 ASTM D624-00(2012), Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomer.
- .7 ASTM D1751-04(2013)e1, Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
- .8 ASTM D1752-04a(2013), Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-37.2-M88, Emulsified Asphalt, Mineral Colloid-Type, Unfilled, for Dampproofing and Waterproofing and for Roof Coatings.
 - .2 CAN/CGSB-51.34-M86, Vapour Barrier, Polyethylene Sheet for Use in Building Construction.
- .3 CSA International
 - .1 CSA-A23.1-14/A23.2-14, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
 - .2 CSA-A283-06 (R2016), Qualification Code for Concrete Testing Laboratories.

- .3 CSA-A3000-13, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).

1.2 SUBMITTALS

- .1 Submit samples, certificates and mix designs in accordance with Section 01 33 00 - Submittal Procedure.
- .2 All items are to be submitted to the Departmental Representative at least three (3) weeks prior to start of concrete construction. Submit the following:
 - .1 Proposed source of aggregates, and provide samples if requested.
 - .2 Manufacturer's test data, catalogue data sheet and/or certification by qualified independent inspection and testing laboratory the following materials will meet specified requirements:
 - .1 Portland cement.
 - .2 Supplementary cementing materials.
 - .3 Admixtures.
 - .4 Aggregates.
 - .5 Water.
 - .3 Provide historical data verifying concrete mix proportions selected will produce concrete of quality, yield and strength as specified in concrete mixes, and will comply with CAN/CSA A23.1.
 - .4 Valid certification indicating the concrete supplier is certified in accordance with the Atlantic Provinces Ready Mix Concrete Association Program or equivalent. Only concrete supplied from such certified plants shall be acceptable to the Departmental Representative. Plant certification shall be maintained for the duration of the fabrication and erection until the warranty period expires.
 - .5 Self-consolidating concrete (SCC):
 - .1 Submit evidence that plastic concrete meets workability requirements outlined in Table 23 of CSA A23.1.

- .2 Mix design must include air content and slump flow requirements.
- .6 Certification report, for fine and coarse aggregate, for alkali-aggregate reactivity tests carried out in accordance with CSA A23.2-14a except:
 - .1 Testing period shall be two (2) years.
 - .2 Minimum cement content shall be 430 kg/m³.
 - .3 Specimen expansion shall not exceed 0.035% during test period.
- .3 Submit schedule of proposed construction joints to Departmental Representative for review.

PART 2 - MATERIALS

2.1 STANDARDS

- .1 Concrete materials and methods of concrete construction: to CSA A23.1 unless otherwise specified.
- .2 Contractor shall have a copy of CSA A23.1 at the site office, and make available to the Departmental Representative for reference.

2.2 CONCRETE MATERIALS

- .1 Portland cement: to CAN/CSA A3000.
- .2 Supplementary cementing materials: to CAN/CSA A3000. Use maximum 25% total substitution for Type GU Portland Cement.
 - .1 Fly ash - use maximum 25% substitution.
 - .2 Silica fume - use maximum 10% substitution.
- .3 Water: to CSA A23.1.
- .4 Aggregates: to CSA A23.1. Coarse aggregates to be normal density.

2.3 ADMIXTURES

- .1 Air entraining admixture: to ASTM C260.
- .2 Chemical admixtures: to ASTM C494.

2.4 ACCESSORIES

- .1 Bonding agent:
 - .1 Acceptable products:
 - .1 CPD Concentrated Latex Adhesive.
 - .2 Intralok by W. R. Meadows.
 - .3 Emaco P24 by BASF.
 - .2 Curing compound: to CAN/CSA A23.1 and to ASTM C309, water-based, and compatible with floor finishes.
 - .3 Shrinkage Compensating Grout (baseplates): non-shrink grout, premixed compound consisting of non-metallic aggregate, Portland cement, water reducing and plasticizing agents. Minimum 50 MPa compressive strength at 28 days. Utilize 'Winter Grade' version of the grout during winter conditions.
 - .1 Acceptable products:
 - .1 Sikagrout 212 HP by Sika.
 - .2 Construction Grout by BASF Construction Chemicals.
 - .3 Planigrout 750 by Mapei.
 - .4 Adhesive grout and anchors:
 - .1 Acceptable products:
 - .1 HIT HY 200 by Hilti,
 - .2 Epcon S7 by Red Head,
 - .3 SET-XP by Simpson Strong-Tie.
 - .5 Perimeter insulation: HIGHLOAD Extruded polystyrene (XPS): to ASTM C578.
 - .1 Type: 4.
 - .2 Compressive strength: 415 KPa.
 - .3 Thickness: as indicated.
 - .4 Edges: square.
 - .6 Slab-on-grade vapour barrier/retarder: To ASTM E1745, Class B, complete with all tape and accessories for a complete installation.
 - .1 Acceptable products:
 - .1 Vapor Block 10 by Raven Industries.
 - .2 Perminator by W. R. Meadows.
 - .3 Moistop Ultra 10 by Fortifiber.
 - .7 Floor hardener:
 - .1 Medium duty: dry shake, mineral aggregate hardener.

2.5 JOINT DEVICES
AND FILLER MATERIAL

- .2 Acceptable products:
 - .1 MasterTop 110 ABR by MasterBuilders Solutions.
- .3 Heavy duty: dry shake, mineral aggregate harder, designed for specific flatness designation.
- .4 Acceptable products:
 - .1 Mastercron F_f by BASF.
- .1 Wall Control Joint Sealant: To CAN/CGSB 19.13-M87, Classification C-1-25-B-N. One-part polyurethane, suitable for vertical surfaces.
 - .1 Acceptable products:
 - .1 SIKA/Sternson,
 - .2 Sonneborn/BASF,
 - .3 Tremco.
 - .2 Slab Control Joint Sealant (per Division 7) or if no floor coverings:
 - .1 Loadflex by Sika.
 - .2 Masterseal CR 190 by BASF.
 - .3 Resi-Weld Flex by W.R. Meadows.
 - .3 Slab Isolation Joint Sealant:
 - .1 Self-leveling, one part polyurethane.
 - .2 Acceptable products:
 - .1 Sika Self-Leveling Sealant.
 - .2 Sonolastic SL 1 by BASF.
 - .3 Vulkem 45 by Tremco.
 - .4 Hydrophillic Waterstop:
 - .1 Acceptable products:
 - .1 Swellseal 2010 by DeNeef Construction Chemicals,
 - .2 Hydroflex HF302 by Henry Co.,
 - .3 Akwastop by Volclay.
 - .5 PVC Waterstop:
 - .1 Ribbed type with centre bulb, minimum 229 mm width and 9.5 mm thickness.
 - .2 Acceptable products:
 - .1 Sika Greenstreak.
 - .2 W.R. Meadows.
 - .6 Pre-moulded Isolation Joint Filler:
 - .1 To ASTM D1751.
 - .7 Backer Rod: closed-cell, polyethylene foam joint-filler.

2.6 CONCRETE MIXES

- .1 Proportion normal density concrete in accordance with CAN/CSA A23.1, Table 5, Alternative 1 for the following elements and applications.
- .2 Have mix designs prepared by concrete supplier and tested by a CSA Certified Materials Testing Laboratory.
- .3 Use of calcium chloride or admixture containing calcium chloride not permitted.

Location/ Exposure	Classes	Cement Type	Max. Course Aggregate (mm)	Slump (mm) ^{1,2}	28 Day Strength MPa	Air Content %	Curing Type ⁵
Exterior	C-2	GU	20	80 ± 20	35	5 - 8	1
Curbs	C-2	GU	20	40 ± 15	35	5 - 8	1
Mud Slab, Fill Concrete	N	GU	20	80 ± 20	15	< 3	1
Tilt-up Walls	F-2	GU	20	80 ± 20	35	5 - 8	1
Light Pole Base	N	GU	14	80 ± 20	35	5 - 8	1
Interior Slab-On- Grade	N	GU	25	80 ± 20	25	< 3	
Foundation Walls, Footings	F-2	GU	20	80 ± 20	25	5 - 8	1
Walls Above Grade	F-2	GU	20	80 ± 2 0	25	7 ⁴ -	1

- 1. 150 mm maximum with chemical admixture.
- 2. At point of discharge into work.
- 3. Mechanical consolidation is not permitted for SCC concrete.
- 4. Slump flow of plastic concrete shall be tested per CSA A23.2-19c.
- 5. Curing type per CSA A23.1.

PART 3 - EXECUTION3.1 PREPARATION

- .1 Provide Departmental Representative with 24 hours' notice prior to placing of concrete.

- .2 Place concrete reinforcing in accordance with Section 03 20 00 - Concrete Reinforcement.
- .3 Pumping of concrete is permitted only after Departmental Representative's acceptance of equipment and mix.
- .4 Water is not permitted to be added to concrete after it has left the batch plant.
- .5 Ensure reinforcement and inserts are not disturbed during concrete placement.
- .6 Prior to placing of concrete obtain Departmental Representative's acceptance of proposed method for protection of concrete during placing and curing in adverse weather.
- .7 Protect previous work from staining.

3.2 WORKMANSHIP

- .1 Do cast-in-place concrete work in accordance with CSA A23.1/A23.2.
- .2 Concrete shall be deposited in the forms in a manner that prevents segregation and in accordance with CSA A23.1.
- .3 Prior to concrete placement, anchor rod placement shall be verified by a surveyor to confirm anchor rod positions. Adjust or repair misaligned anchor rods. Resurvey to confirm positions conform to contract documents. Submit copy of survey to Departmental Representative.
- .4 Maintain accurate records of placed concrete items to indicate date, location of placement, quality, air temperature and test samples taken.
- .5 Prior to placement of concrete, ensure:
 - .1 All formwork complete.
 - .2 Excess water, debris and ice removed.
 - .3 All reinforcement, embedded reinforcing dowels, inserts, anchor rods and other embedments installed in proper position and secured.

3.3 COLD WEATHER
REQUIREMENTS

- .1 The requirements of CSA A23.1 shall be followed for cold weather concreting except where amended herein.
- .2 When there is a probability of the air temperature falling below 5° C within 24 hours of placing concrete (as forecast by the nearest meteorological office), all materials and equipment needed for the protection and curing of the concrete in cold weather shall be on site before the concrete placement begins.
- .3 If the temperature of concrete is expected to drop below 5°C, then protection is required.
- .4 Design protection system to retain the initial heat of the placed concrete and to produce the specified curing condition by retention of the heat of hydration plus the supply of additional heat where necessary.
- .5 The use of salamanders, coke stoves, oil or gas burners and similar spot heaters which have an open flame shall not be permitted.
- .6 Fresh concrete shall be protected from heater exhaust. Vent heater equipment to the exterior. Have available on site adequate fire protection during heating.
- .7 All snow, ice and frost shall be removed from the area of work prior to concrete placement.
- .8 Calcium chloride or other de-icing salts shall not be used as a de-icing agent
- .9 Concrete shall not be placed on frozen subgrade.
- .10 Concrete shall not be placed on or against any surface that will lower the temperature of concrete in place below the minimum value shown in CSA A23.1 Table 14 or below 10°C for slabs.

- .11 Protection must be provided immediately after concrete placement.
- .12 Cold weather protection shall be applied in order to maintain the concrete temperature at or above 10°C for the time of the curing periods specified. Protection shall be provided by heated enclosures, coverings, insulation or a suitable combination of these methods.
- .13 Measures shall be taken to prevent subsequent frost penetration to the footing level.
- .14 Loose or absorbent insulation material shall be contained in waterproof liners. Straw is not an acceptable insulation material.
- .15 When placing suspended slabs when the air temperature is at or below 4°C, enclose working area and supply moist heat under the slabs. Supply moist heat over the slabs as required to ensure all surfaces are above 5°C prior to placing and as required for finishing the concrete. Maintain and reduce temperatures as per code requirements.
- .16 To avoid cracking of the concrete due to a sudden temperature change near the end of the curing period, the protection shall not be removed until the concrete has cooled to the temperature differential given in Table 20 of CSA A23.1.

3.4 HOT WEATHER REQUIREMENTS

- .1 Hot weather curing and protection shall conform to the requirements of CSA A23.1.

3.5 CONCRETE MUD SLAB

- .1 Place slab on clean, undisturbed soil or rock.
- .2 Completely expose and clean all rock prior to placing mud slab.
- .3 Remove all loose rock prior to placing slab mud.

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| | .4 | After trowelling and curing, apply waterproofing membrane as specified and as per manufacturer's written instructions. |
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| 3.6 SLEEVES AND
INSERTS | .1 | No sleeves, ducts, pipes or other openings shall pass through walls or slabs, except where indicated or approved by Departmental Representative. |
| | .2 | Sleeves and openings greater than 100 x 100 mm not indicated on drawings must be accepted by Departmental Representative. |
| | .3 | Do not eliminate or displace reinforcement to accommodate hardware. If inserts cannot be located as specified, obtain acceptance of modifications from Departmental Representative before placing of concrete. |
| | .4 | Confirm 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. |
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| 3.7 SLAB VAPOUR
RETARDER/BARRIER | .1 | Install in accordance with manufacturer's written instructions. |
| | .2 | Lap all joints a minimum of 150 mm and seal with manufacturer's recommended tape. |
| | .3 | Seal at all penetrations using manufacturer's recommended accessories and details. |
| | .4 | Seal all punctures, tears and damaged areas. |
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| 3.8 PERIMETER
FOUNDATION INSULATION | .1 | Interior application: extend boards as indicated vertically below bottom of finish floor slab, installed on inside face of perimeter foundation walls. |
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- .2 Under slab application: extend boards as indicated in from perimeter foundation wall. Lay boards on level compacted fill.
- 3.9 ANCHOR RODS
- .1 Place anchor rods using templates under supervision of trade supplying anchors prior to placing concrete.
- .2 Place rods plumb and protect alignment.
- .3 Tie top and base of anchor rods to prevent movement or rotation.
- .4 Prior to concrete placement, survey foundation to determine anchor rod positions. Adjust or repair misaligned anchor rods. Resurvey to confirm positions conform to contract documents. Submit copy of survey to Departmental Representative if requested.
- .5 Protect anchor rods from damage after placement of concrete by means acceptable to Departmental Representative.
- .6 Misplaced and damaged anchor rods shall be repaired at no additional cost to the Departmental Representative, and to the satisfaction of the Departmental Representative.
- 3.10 WATERSTOPS
- .1 Install waterstops to provide continuous water seal per manufacturer's written instructions and as specified within.
- .2 Install waterstops to provide continuous water seal.
- .3 Do not distort or pierce waterstop in way as to hamper performance.
- .4 Do not displace reinforcement when installing waterstops.
- .5 Use equipment to manufacturer's requirements to field splice waterstops.
- .6 Tie waterstops rigidly in place.

- .7 Straight butt joints of PVC waterstops shall be fused in accordance with manufacturer's written instructions, and all other joints including corners and intersections shall be factory prefabricated.
- .8 Waterstops shall be clean and free of any foreign material prior to concrete placement.
- .9 Adequately secure waterstops against displacement during concrete placing using manufacturer's recommended methods.
- .10 Do not distort or pierce waterstop in such a way as to hamper performance.
- .11 Do not displace reinforcement when installing waterstops.
- .12 Use equipment to manufacturer's requirements to field splice waterstops.
- .13 Protect hydrophilic waterstops from moisture prior to concrete placement.

3.11 CONCRETE CONSOLIDATION

- .1 Consolidated concrete shall be dense, homogenous and free of cold joints, voids and honeycombing. Concrete shall be bonded to all reinforcing steel, anchors, and embedded parts.
- .2 Concrete, except SCC concrete, shall be consolidated by means of mechanical internal vibrators in accordance with CSA A23.1.
- .3 Concrete shall be placed in approximately 300 mm to 600 mm horizontal lifts. Lifts shall be consolidated before the next lift is deposited.
- .4 The rate of placement shall be such that each successive lift can be vibrated into the previous lift for proper bonding. The rate of concrete placement shall not exceed form designer's recommendations.

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| | .5 | Do not use vibrator as a means to move concrete from one location to another. |
| | .6 | Allow vibrator to go into and out of concrete at approximately 90 degree angle. Do not insert or remove at an angle. |
| 3.12 DEFECTIVE
CONCRETE | .1 | All defective concrete less than 30 mm deep including, but not limited to, honeycombing, embedded debris, voids and stone pockets shall be patched within 24 hours of form removal. |
| | .2 | Defects shall be removed to sound concrete and to a minimum depth of 25 mm, leaving edges perpendicular. |
| | .3 | Thoroughly wet surface of area to be patched and the surrounding area. |
| | .4 | Brush surface of defective area with a 1:1 cement-sand grout mixture. |
| | .5 | Patch with 1:2 cement-sand mortar with 10% hydrated lime. |
| | .6 | Repair areas deeper than 30 mm with structural repair grout in strict accordance with Manufacturer's written instructions. Submit proposed grout and repair method to Departmental Representative for review prior to undertaking repair. |
| | .7 | Surface irregularities due to movement of forms shall be corrected by grinding or by repair with concrete repair mortar. |
| 3.13 FORM TIE HOLES | .1 | Fill form tie holes immediately after formwork removal in a manner similar to defective concrete except that grout shall match adjacent concrete in texture and colour for concrete exposed to view. |
| 3.14 DAMPPROOFING | .1 | Apply two coats of dampproofing to exterior face of foundation walls, where detailed on drawings, in strict accordance with manufacturer's recommendations and as specified. |

- .2 Do not apply to frozen or frosted surfaces or during snow or rain. Do not permit smoking, fires or open flame near containers or freshly applied coating.
- .3 Protect adjacent work areas and finish surfaces from damage during damproofing application.
- .4 Surface to be free of oil, grease, dirt, laitance, and loose material. Dry surfaces shall be dampened with water and kept damp until application.
- .5 Apply short fiber fibrated material in 2 brush or spray coats. Allow material to set before backfilling.
- .6 Fill in crevices and grooves, providing continuous coating free from breaks and pinholes. Carry coating over exposed top and outside edge of footing. Spread around joints, grooves, and slots, and into chases, corners, reveals, and soffits. Bring coating to finished grade.
- .7 Place backfill at least 24 to 48 hours after application, but within 7 days. Do not rupture or damage film or displace coating or membranes.
- .8 Mask wall control joint sealant during application of damproofing.

3.15 FINISHING

- .1 Rough form finish not exposed to view: as specified in Clause 7.9.2.5 of CSA A23.1-14.
- .2 Formed surfaces exposed to view: smooth form finish as specified in Clause 7.9.2.5 of CSA A23.1-14.

- .3 Interior floor slabs to be left exposed or to receive epoxy, carpet, resilient flooring or other covering requiring a smooth surface:
 - .1 Initial finishing operations - screeding followed immediately by bull floating or darbying, followed by final finishing comprising mechanical floating and steel trowelling as specified in Section 7.5.4 of CSA A23.1 to produce hard, smooth, dense trowelled surface free from blemishes; finishing tolerance classification: Class A.
- .4 Equipment pads and bases:
 - .1 Finish surface to match surrounding concrete unless directed otherwise by Departmental Representative.
- .5 Rub exposed sharp edges of concrete with carborundum to produce 3 mm radius edges unless otherwise indicated.

3.16 BONDING NEW CONCRETE

- .1 Prior to placement of new concrete that has set, the forms shall be retightened.
- .2 The set concrete surface shall be roughened and cleaned of all laitance and foreign matter.
- .3 The prepared surface of the set concrete shall be thoroughly saturated with water in advance of new concrete placement. Remove any excess, free-standing water. Where a bonding agent is used, prepare surface in accordance with manufacturer's written instructions.

3.17 CONSTRUCTION JOINTS

- .1 Construct all construction joints as detailed on drawings. Construction joint locations not shown on drawings shall be approved prior to construction by the Departmental Representative.
- .2 Preparation of construction joints before placement of fresh concrete against set concrete shall conform to CSA A23.1. Reinforcing bars and waterstops extending through joints shall be cleaned of concrete and foreign matter prior to placing fresh concrete.

<u>3.18 CONTROL JOINTS</u>	.1	Provide saw-cut or formed control joints in slabs as detailed on drawings. Clean by compressed air and fill per Division 7.
	.2	Provide control joints in foundation walls at maximum 10 m spacing. Construct and fill joint as detailed.
<u>3.19 EQUIPMENT BASES AND pads</u>	.1	Construct concrete bases, pads and coordinate sizes and locations with appropriate trades.
	.2	Coordinate all embedments, including but not limited to, sleeves, conduits, frames, and anchor rods.
	.3	Finish concrete surface to match surrounding concrete unless directed otherwise by the Departmental Representative.
<u>3.20 BASEPLATE GROUTING</u>	.1	Grout under baseplates in strict accordance with manufacturer's written instructions and with 100% contact with baseplate and concrete.
	.2	Grout to be placed into forms constructed of plywood. Joints shall be sealed to prevent leakage.
	.3	Grout shall be placed in a flowable state using forms. Dry pack is not acceptable.
	.4	Ensure air is properly vented out during grout placement to ensure no air voids are formed.
	.5	All surfaces which will be in contact with grout to be clean of debris and foreign matter. All standing water to be removed.
	.6	Grout shall be cured in accordance with manufacturer's written instructions and these specifications, whichever is most stringent.
<u>3.21 CURING AND PROTECTION</u>	.1	Cure and protect concrete in accordance with CSA A23.1, as specified herein.

- .2 Contractor is responsible for verifying that curing has been done in accordance with specifications.
- .3 Curing types (per CSA A23.1):
 - .1 Type 1 - Basic, for all concrete except as specified otherwise. Basic curing is defined as curing at a minimum temperature of 10° C for a minimum of 3 days or the time necessary to attain 40% of the specified strength.
 - .2 Type 2 - Additional. Additional curing is defined as curing at a minimum temperature of 10° C for a minimum of 7 days and the time necessary to attain 70% of the specified strength.
 - .3 Type 3 - Extended. Extended curing is defined as wet curing at a minimum temperature of 10° C for a minimum of 7 days.
- .4 Curing compounds shall not be used on surfaces where bond is required by subsequent topping or coating.
- .5 Footings shall be fully cured prior to placement of wall reinforcing and formwork.
- .6 If curing compound is utilized for Type 1 or Type 2 curing, apply curing compound to concrete surfaces immediately after form removal.

3.22 FIELD QUALITY
ASSURANCE

- .1 Inspection and testing of concrete and concrete materials:
 - .1 Inspection and testing by independent testing agency is undertaken to inform the Departmental Representative of the Contractor's performance and shall in no way augment the Contractor's quality control or relieve the Contractor of contractual responsibility.

- .2 Inspection and testing of concrete and concrete materials will be carried out by a testing laboratory designated by the Departmental Representative in accordance with CAN/CSA A23.1 and Section 01 45 00 - Quality Control.
- .3 Testing lab shall be certified in accordance with CSA A283.
- .4 Departmental Representative will pay for costs of inspection and testing except where specified otherwise.
- .5 Provide access to the work for selection of samples, and provide materials required for test specimens.
- .6 Cast a minimum of one set of three standard cylinders for each day concrete is placed or for each 50 m³ of concrete, and as required below.
- .7 One additional cylinder shall be taken during cold weather concreting and be cured on site under same conditions as concrete it represents.
- .8 Additional test cylinders required for confirmation of curing or cold weather concreting requirements:
 - .1 Cure cylinders on job site under same conditions as concrete which they represent.
 - .2 Contractor is responsible for field cure cylinders and any additional testing, including field storage and all associated costs.
- .9 Take slump and air tests as required to ensure concrete meets specifications.
- .10 Non-destructive Methods for Testing Concrete shall be in accordance with CAN/CSA A23.2.
- .11 One cylinder shall be tested at 7 days, remaining two at 28 days. When additional cylinders are taken during cold weather concrete conditions, minimum one cylinder shall be tested at 3 days.

- .12 When defects or non-conforming work is revealed, the Departmental Representative may request, at the Contractor's expense, additional review or testing to ascertain the full extent of the defect or non-conforming work.

END OF SECTION
