

WORK SEQUENCES AND TIE-INS

1 GENERAL

1.1 Continuity of Watermain Operations

- .1 The existing Sans Souci Road Watermain continuously distributes potable water. Do not interrupt functions except as specified herein. Coordinate the Work to avoid any interference with normal operation of operations staff, equipment and processes.
- .2 Shutdowns of the watermain across the bridge will be required. Contractor to include bypass pumping as incidental to the contract. For the purposes of bypass pumping, the peak flow rate to be allowed for is 60 L/s.
- .3 In the event of accidental bypassing of potable water to surface waters or drainage courses without dechlorination and District approval is caused by the Contractor's operations, the Owner may employ others or use its own forces to stop the bypassing and recover the costs from the Contractor.
- .4 Pay all penalties and costs including legal fees and other expenses imposed on the Owner as a result of any bypass caused by or resulting from the actions of the Contractor, its employees, or subcontractors.
- .5 The work sequences and tie-in procedures specified in this Section enable the Contractor to perform construction activities concurrently with Owner activities required to maintain watermain operations. The Contractor may propose alternative work sequences or procedures that maintain watermain operations for review by the Engineer.
- .6 Housekeeping is maintained at the highest possible level to minimize interference, security requirements are fulfilled, and the existing facilities are maintained in weather-tight conditions.
- .7 Complete all tie-ins to existing watermains in the shortest practical time frame and within the time limits specified in this Section to minimize interferences and prevent effluent bypassing. Scheduling must reflect that priority.
- .8 Plan, schedule and coordinate all work in operating plant areas to minimize interferences. Conduct work by area while maintaining access for Owner operations.

1.2 Shutdown and Tie-In Plan

- .1 Prepare a detailed plan for any shutdown, tie-in, or construction activity which will potentially affect existing watermain operations, describing temporary provisions, the length of time required to complete, and the necessary personnel and equipment which the Contractor will provide. The Contractor is required to pay for all bypassing required during shutdowns.

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- .2 Prepare and submit the shutdown or tie-in plan to the Engineer a minimum of two weeks prior to conducting a scheduled shutdown or tie-in. Allow for review by the Engineer, followed by a meeting to be held between the Engineer, Owner operations personnel, and the Contractor to discuss activities and responsibilities relating to the shutdown or tie-in and potential limitations and requirements not addressed in the plan.
- .3 Provide backup to critical pumping and electrical operations in case of failure. Indicate backup to be provided including alternate power supplies and controls in shutdown plan.

1.3 General Requirements

- .1 Hours of work are restricted to 7:00am to 5:00pm Monday to Friday. Saturday work to be on a case by case basis requiring written approval from the District. Sunday & Holidays emergency work only.
- .2 Existing systems or individual equipment items will be isolated, de-commissioned, de-energized and de-pressurized by the Owner where such isolation, de-commissioning, de-energizing and de-pressurizing can be done with existing valves and circuit breakers. Where such isolation, de-commissioning, de-energizing and de-pressurizing requires disassembly, such work to be done by the Contractor including any associated clean-up. Perform all such work in accordance with the shutdown plan submitted by the Contractor and reviewed by the Engineer.
- .3 The bridge has a weight limit of 25T G.V.W., the Contractor is not to exceed this weight restriction. No parking of vehicles on the bridge. Bridge access to be maintained at all times.
- .4 Provide all necessary temporary pumps, blinds, piping, electrical wiring, controls, and labour during and subsequent to all activities as required. Pumps and upstream water levels to be continuously monitored by the Contractor to make all provisions necessary to prevent process upsets, flooding, and bypassing during all diversion pumping operations.
- .5 Some shutdowns may have to take place during other than normal working hours (i.e., night-time and/or weekends) in order to comply with watermain shutdown limitations as described in this Section.

1.4 Work Plans and Schedule

- .1 Provide detailed plans and schedules for all work activities which will create a disruption to or require the participation of Owner Operations. Such activities will include shutdowns, tie-ins, or any work disrupting existing access, services, utilities or normal

WORK SEQUENCES AND TIE-INS

operations procedures. Submit two copies of detailed plans and schedules, no later than two weeks prior to the scheduled activity. No shutdown, tie-ins, outages or disruptive work activities will be allowed without approval by the Engineer of the appropriate plan and schedule. Coordinate the shutdown, tie-in or disruptive work with the construction schedule as provided by the Contractor. Identify each shutdown, tie-in, or disruptive work activity in the construction schedule.

1.5 Work Sequence and Tie-In – General

- .1 Written request to the Engineer is required for any equipment shutdown under any circumstances, including but not limited to the interruption of power supplies, control systems, or water, air, or lubricant supply. Approved shutdowns may be limited in duration so as to not impact the water supply.
- .2 Watermain Shutdown Limitations: All shutdowns (including partial shutdowns) of the watermain will require approval and coordination by the Owner and Engineer.
- .3 The Owner's ability to accommodate shutdowns as described above is dependent upon several factors, including but not limited to watermain operating status, equipment availability, influent flow rates and loading manpower availability, timing (i.e. weekdays versus weekends and holidays, and day versus night), and other circumstances beyond the direct control of the Owner. While the Owner will make every effort to cooperate and accommodate shutdowns within the limitations expressed herein, the Contractor shall not rely on watermain shutdowns being immediately available or occurring precisely as planned in every instance.
- .4 Allow a maximum of 4 hours for piping tie-ins unless specifically noted otherwise. Coordinate all work with the Engineer and Owner. Minimize the duration that any equipment is out of service by pre-installation of as much piping as possible.
- .5 Construction Work Areas as identified on the Plans define the general area of the Work only and are not to be interpreted as limits of the Contract. Work outside the Construction Zones is subject to interference from and Owner Operations.

1.6 Work Sequence and Tie-Ins

- .1 The following presents information to be used in a proposed tie-in plan to be provided by the Contractor. The Contractor is responsible for the work sequence and tie-ins and all costs associated with undertaking the Work.
- .2 In general, the work sequence is to be such that at least one pump remains operational at all times, except for the time during pump installation when it will be necessary to have workers within the wet well.

WORK SEQUENCES AND TIE-INS

- .3 Any work that requires a complete shut down of the watermain at the bridge will require the section of watermain to be bypassed.

2 PRODUCTS

Not Applicable.

3 EXECUTION

Not Applicable.

END OF SECTION

CONCRETE FORMING AND ACCESSORIES

1 GENERAL

1.1 Reference Standards

1.1.1 CSA Group (CSA)

- .1 CSA-A23.1 /A23.2, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
- .2 CAN/CSA-O86, Engineering Design in Wood.
- .3 CSA O121, Douglas Fir Plywood.
- .4 CSA O151, Canadian Softwood Plywood.
- .5 CSA O153, Poplar Plywood.
- .6 CAN/CSA-O325.0, Construction Sheathing.
- .7 CSA O437 Series, Standards for OSB and Waferboard.
- .8 CSA S269.1, Falsework and Formwork.
- .9 CAN/CSA-S269.3, Concrete Formwork.

1.1.2 Underwriters' Laboratories of Canada (ULC)

- .1 CAN/ULC-S701, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.

1.2 Action and Informational Submittals

1.2.1 Product Data:

- .1 Submit manufacturer's instructions, printed product literature and data sheets for proprietary materials used in formwork liners and coatings and include product characteristics, performance criteria, physical size, finish, and limitations.

1.2.2 Submit shop drawings for formwork and falsework.

- .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of British Columbia. Erection drawing to be prepared in accordance with WorkSafe BC Occupational Health and Safety Regulation and signed and sealed by a professional engineer registered in the Province of British Columbia.
- .2 Prepare Shop Drawings in accordance with CSA S269.1 for formwork and falsework.

CONCRETE FORMING AND ACCESSORIES

- .3 Formwork and falsework to be inspected in accordance with WorkSafe BC Occupational Health and Safety Regulations.
- .4 The design and inspection of the formwork and falsework is the responsibility of the Contractor.
- .5 Indicate formwork design data: permissible rate of concrete placement, and temperature of concrete, in forms.
- .6 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.
- .7 Indicate sequence of erection and removal of formwork and falsework.
- .8 Include the following information on falsework Shop Drawings:
 - 1. Longitudinal, lateral, vertical, dead, live and impact loads used in design.
 - 2. Safe bearing capacity of soil underneath mud sills.
 - 3. Maximum column, post and support loads.
 - 4. Deflection diagrams for beams with deflection of 10 mm or more.
 - 5. Deflection diagrams indicating initial and final elevation of deck surfaces, roofs and soffits.
 - 6. Grade of structural steel.
 - 7. Indicate steel posts, girders, beams, connections, bracing and welding, providing sufficient detail for safe performance of falsework.
 - 8. Fully detailed steel frame shoring.
 - 9. Species, grades and sizes of wood.
 - 10. Type and weight of equipment (moving or stationary) supported by falsework.
 - 11. Sequence, methods and rate of concrete placement.
 - 12. Proprietary equipment, adequately identified for checking purposes.
 - 13. Full details and locations of splices.

1.3 QUALITY ASSURANCE

- .1 Retain a professional engineer registered or licensed in Province of British Columbia with experience in formwork and falsework design of comparable complexity and scope, to perform following services as part of Work of this Section:

CONCRETE FORMING AND ACCESSORIES

- .1 Design of formwork and falsework:
 - 1. Review, stamp, and sign fabrication and erection Shop Drawings, design calculations and amendments.
 - 2. Conduct on-site field review and prepare and submit field review reports verifying this part of Work is in accordance with Contract Documents and reviewed Shop Drawings. Field reviews to be performed at the discretion of the professional engineer.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .2 Storage and Handling Requirements:
 - 1. Store materials off ground and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - 2. Store and protect formwork from damages.
 - 3. Replace defective or damaged materials with new.

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.
 - 2. For concrete with special architectural features, use formwork materials to CSA-A23.1/A23.2.
- .2 Form ties:
 - 1. Removable or snap-off metal ties, fixed or adjustable length, of a type that no metal will be within 40 mm of the concrete surface when forms have been removed. Use tapered plastic cones at faces of concrete to allow for grouting or filling with precast concrete plugs. Use waterstop flange at mid-length of single wire tie for watertight structures. Multiple strand ties are not permitted.
 - 2. For concrete not designated 'Architectural': removable or snap-off metal ties, fixed or adjustable length, free of devices leaving holes minimum 25 mm diameter in concrete surface.
 - 3. For Architectural concrete; snap ties complete with plastic cones and light grey concrete plugs.

CONCRETE FORMING AND ACCESSORIES

- .3 Form liner:
 - 1. Plywood: Douglas Fir to CSA O121
- .4 Form release agent:
 - 1. Proprietary, non volatile material not to stain concrete or impair subsequent application of finishes or coatings to surface of concrete.
 - 2. Apply form release agent in accordance with manufacturer's recommendations, prior to placing reinforcing steel, anchoring devices and embedded parts.
- .5 Falsework materials: to CSA-S269.1.

3 EXECUTION

3.1 Fabrication and Erection

- .1 Verify lines, levels, and centres before proceeding with formwork/falsework and ensure dimensions agree with drawings. Report discrepancies to the Engineer.
- .2 Hand trim sides and bottoms and remove loose earth from earth forms before placing concrete.
- .3 Fabricate and erect falsework in accordance with CSA S269.1.
- .4 Refer to architectural drawings for concrete members requiring architectural exposed finishes.
- .5 Do not place shores and mud sills on frozen ground.
- .6 Provide site drainage to prevent washout of soil supporting mud sills and shores.
- .7 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 CSA-A23.1/A23.2.
- .8 Align form joints and make watertight.
- .9 Keep form joints to minimum. Do not stagger joints of form lining materials. Align joints to obtain uniform pattern.
- .10 Use 20 mm chamfer strips on external corners and 20 mm fillets at interior corners, joints, unless specified otherwise.
- .11 Form chases, slots, openings, drips, recesses, expansion and control joints as indicated.
- .12 Construct forms for architectural concrete, and place ties as directed.

CONCRETE FORMING AND ACCESSORIES

- .13 Joint pattern not necessarily based on using standard size panels or maximum permissible spacing of ties.
- .14 Build in anchors, sleeves, and other inserts required to accommodate Work specified in other sections. Obtain Engineer's permission before framing openings in concrete slabs, walls or columns not indicated on the drawings.
- .15 Ensure that anchors and inserts will not protrude beyond surfaces designated to receive applied finishes, including painting.
- .16 Form joint at base of wall forms to be sealed tight to the base slab to prevent leakage of cement paste.
- .17 Line forms for following surfaces:
 - 1. Outer face of foundation walls and retaining walls.
 - 2. Soffit of girders and underside of bridge decks if exposed.
 - 3. Exposed faces of abutments, wingwalls, piers and pylons: do not stagger joints of form lining material and align joints to obtain uniform pattern.
 - 4. Secure lining taut to formwork to prevent folds.
 - 5. Pull down lining over edges of formwork panels.
 - 6. Ensure lining is new and not reused material.
 - 7. Ensure lining is dry and free of oil when concrete is poured.
 - 8. Application of form release agents on formwork surface is prohibited where drainage lining is used.
 - 9. If concrete surfaces require cleaning after form removal, use only pressurized water stream so as not to alter concrete's smooth finish.
 - 10. Cost of textile lining is included in price of concrete for corresponding portion of Work.
- .18 Clean formwork in accordance with CSA-A23.1/A23.2, before placing concrete.

3.2 REMOVAL AND RESHORING

- .1 Leave formwork in place for following minimum periods of time after placing concrete.
 - 1. 7 days for walls and sides of beams.
 - 2. 7 days for columns.
 - 3. 7 days for beam soffits, slabs, decks and other structural members.
 - 4. 3 days for footings and abutments.

CONCRETE FORMING AND ACCESSORIES

5. 7 days for forms under structural slabs
- .2 Time intervals given to be the cumulative number of days or fractions thereof, not necessarily consecutive, during which the temperature of the air in contact with concrete is above 10°C and concrete has been damp or thoroughly sealed from evaporation and loss of moisture.
- .1 Do not remove forms and falsework until concrete has gained sufficient strength to carry its own weight, plus construction loads and other design loads that are liable to be imposed.
- .2 No slab forms shall be removed before concrete has reached 75% of the 28 day strength before stripping.
- .3 Strength of concrete to be determined by field-cured cylinders. Alternate methods, if acceptable to the contract administrator, may be used.
- .4 Remove falsework progressively and ensure that no shock loads or unbalanced loads are imposed on the structure.
- .5 Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.
- .6 Provide necessary reshoring of members where early removal of forms may be required or where members may be subjected to additional loads during construction as required.
- .7 Space reshoring in each principal direction at not more than 3000 mm apart.
- .8 Re-use formwork and falsework subject to requirements of CSA-A23.1/A23.2.

END OF SECTION

CONCRETE REINFORCING

1 GENERAL

1.1 Related Documents

- .1 Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 Summary

- .1 This Section includes the performance criteria, materials, design, production, and installation of the structural precast concrete wet well lid. The work performed under this Section includes all labor, material, equipment, related services, and supervision required for the manufacture and erection of the structural precast concrete work shown on the Contract Drawings.
- .2 This Section includes the following:
 1. Electrical Kiosk and Generator Foundations
 2. Wet Well base
 3. Wet Well lid
- .3 Related Sections include the following:
 1. Section 03 10 00 "Concrete Forming and Accessories" for formwork.
 2. Section 03 20 00 "Concrete Reinforcing" for material and installation of reinforcement.
 3. Section 03 30 00 "Cast-in-Place Concrete" for cast in place concrete structures.
 4. Section 03 30 41 "Precast Concrete" for precast concrete structures
 5. Section 06 08 99 "Rough Carpentry for Minor Works" for formwork

1.3 Reference Standards

1.3.1 CSA Group (CSA)

- .4 CSA-A23.1 /A23.2, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.
- .5 CAN/CSA-A23.3, Design of Concrete Structures.
- .6 CSA-G30.18, Carbon Steel Bars for Concrete Reinforcement.

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- .7 CSA-G40.20/G40.21, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
- .8 CAN/CSA-G164, Hot Dip Galvanizing of Irregularly Shaped Articles.
- .9 CSA W186, Welding of Reinforcing Bars in Reinforced Concrete Construction.

1.3.2 Reinforcing Steel Institute of Canada (RSIC)

- .1 RSIC-, Reinforcing Steel Manual of Standard Practice.

1.4 Action and Informational Submittals

1.4.1 Product Data

- .1 Submit manufacturer's instructions, printed product literature and data sheets for proprietary materials used in Cast-In-Place Concrete and additives and include product characteristics, performance criteria, physical size, finish, and limitations.

1.4.2 Shop Drawings

- .1 Submit drawings stamped and signed by professional engineer registered or licensed in British Columbia.
 - 1. Prepare reinforcement drawings in accordance with RSIC Manual of Standard Practice.
 - 2. Indicate placing of reinforcement and:
 - 1.Bar bending details.
 - 2.Lists.
 - 3.Quantities of reinforcement.
 - 4.Sizes, spacings, locations of reinforcement and mechanical splices with identifying code marks to permit correct placement without reference to structural drawings.
 - 5.Mechanical splices if approved by Engineer.
 - 6.Indicate sizes, spacings and locations of chairs, spacers and hangers.
 - 7.Detail rebar splice away from high stress regions and away from rebar congested areas.
 - 3. Detail lap lengths and bar development lengths to CAN/CSA-A23.3, unless otherwise indicated.

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1. Provide type B unless otherwise indicated.

4. Indicate position and size of openings in slabs and walls. Coordinate with trades requiring openings.
5. The number of rebar splices should be kept as a minimum and the splices should stagger and alternate.

1.4.3 Source Quality Control

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

1.5 Delivery, Storage and Handling

- .1 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .2 Storage and Handling Requirements:
 1. Store materials off ground on platforms, skids or racks and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 2. Replace defective or damaged materials with new.
 3. Protect reinforcing steel from prolonged exposure to weather.
- .3 Handle, transport, store and install epoxy coated reinforcing steel bars to prevent damage to coating. Prevent bar-to-bar abrasion and excessive sagging. Do not drop or drag bars. Store on suitable non-metallic supports. For lifting use nylon lifting slings, padded slings, separators or other means recommended by epoxy coated reinforcing steel supplier.
- .4 Deliver, store and handle reinforcing steel, welded wire fabric and accessories in a manner that prevents contamination which reduces bond, and damage to fabricated forms.
- .5 Protect reinforcement from rust, dirt, grease, form oil, deleterious matter and other bond-breaking substances.

2 PRODUCTS

2.1 Materials

CONCRETE REINFORCING

- .1 Substitute different size bars only if permitted in writing by Engineer.
- .2 Reinforcing shall conform to CSA G30.18-09 (R2014)
- .3 Reinforcing bars shall be 400 MPa (58 Ksi) grade new deformed bars, free of dirt, oil, or loose scale.
- .4 Reinforcing steel: weldable low alloy steel deformed bars to CSA-G30.18.
- .5 Cold-drawn annealed steel wire ties: to CSA G30.3 and ASTM 1064/A 1064M.
- .6 Deformed steel wire for concrete reinforcement: to ASTM 1064/A 1064M.
- .7 Epoxy Coating of non-prestressed reinforcement: to ASTM A 775/A 775M.
- .8 Chairs, bolsters, bar supports, spacers: to CSA-A23.1/A23.2. Chairs to be plastic or plastic coated steel. Precast concrete blocks may be used for the base slab if approved by the Engineer. If precast concrete blocks are approved by Engineer, precast concrete blocks cannot be stacked.
- .9 Do not use materials with loose, scaly rust, dirt, oil, paint, deleterious matter or other bond-breaking coatings.
- .10 Tie wire: 1.5 mm diameter annealed wire.
- .11 Mechanical splices: subject to approval of Engineer.
- .12 Plain round bars: to CSA-G40.20/G40.21.

2.2 Fabrication

- .1 Fabricate reinforcing steel in accordance with Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Canada and CSA-A23.1/A23.2.
- .2 Obtain Engineer's written approval for locations of reinforcement splices other than those shown on placing drawings.
- .3 Ship bundles of bar reinforcement, clearly identified in accordance with bar bending details and lists.

3 EXECUTION

3.1 Field Bending

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

CONCRETE REINFORCING

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

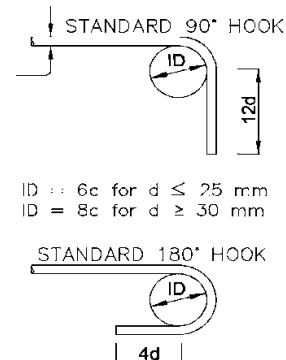
3.2 Placing Reinforcement

- .1 Prior to placing concrete, obtain Engineer's approval of reinforcing material and placement.
- .2 Reinforcement spacing shown is Center to Center of bar, place reinforcing bars symmetrically in spans U.N.O.
- .3 Do not displace or damage vapour barrier. Cutting or puncturing vapour retarder is not permitted; repair damage and reseal vapour retarder before placing concrete. All penetrations through the vapour barrier should be taped and sealed with tuck tape or equivalent as approved by Engineer.
- .4 Place reinforcing steel in accordance as indicated on reviewed placing drawings and in accordance with CSA-A23.1. Conform to CSA A23.1 and CSA A23.3 for hooks, bends, laps, and similar details not specifically shown.
- .5 Unless otherwise noted, use class 'B' tension splice for all reinforcing bars and 90° standard hook at the end of longitudinal bars:

Normal Deformed Bars, $f'_c = 35 \text{ MPa}$ & $f_y = 400 \text{ MPa}$;

BAR SIZE	MINIMUM STRAIGHT EMBEDMENT DEVELOPMENT LENGTH (mm)		MINIMUM TENSION EMBEDMENT WITH STANDARD END HOOKS (mm)
	COMPRESSION	TENSION	
10M	300	350	200
15M	400	500	300
20M	470	700	350
25M	600	1200	450
30M	700	1600	500
35M	900	2200	600

BAR SIZE	LAP SPLICE LENGTHS (mm)	
	COMPRESSION	TENSION
10M	350	400
15M	500	600
20M	600	900
25M	750	1500
30M	900	2000
35M	1100	2800



CONCRETE REINFORCING

- .6 Do not use bury bars unless authorized in writing by Engineer.
- .7 Provide sufficient chairs and support bars to maintain concrete cover as specified
- .8 Concrete cover to reinforcing shall be as follows U.N.O.:

Condition	Specified Cover (mm)
Concrete cast against ground	75
Concrete exposed to earth, liquids, or weather: <ul style="list-style-type: none">• 20M Bars or larger• 10M and 15M Bars	50 40

- .9 Place, support and secure reinforcement against displacement. Do not deviate from required position.
- .10 Provide horizontal "L" shaped corner bars of same cross section and spacing as horizontal bars around wall and grade beam corners.
- .11 Protect coated portions of bars with covering during transportation and handling.
- .12 Reinforce slab and wall openings, unless otherwise shown, as follows:
 - 1. Openings with greatest dimension of 600 mm or less: four 15M diagonal bars, 900 mm longer than greatest opening dimension.
 - 2. Openings with greatest dimension larger than 600 mm: two 15M bars on each side, top and bottom, 1500 mm longer than greatest opening dimension.
 - 3. Reinforce circular openings as square.
- .13 Reinforcing shall be tied securely prior to placing concrete.

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.

3.4 Field Quality Control

- .1 Inspection and testing of reinforcing and reinforcing materials carried out by testing laboratory designated by Engineer for review to CSA A23.1/A23.2.
 - 1. Ensure testing laboratory certified to CSA A283.

Inspection or testing by Engineer not to augment or replace Contractor quality control nor relieve Contractor of contractual responsibility.

END OF SECTION

CAST-IN-PLACE CONCRETE

1 GENERAL

1.1 Related Documents

- .1 Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 Summary

- .1 This Section includes the performance criteria, materials, design, production, and installation of the structural precast concrete wet well lid. The work performed under this Section includes all labor, material, equipment, related services, and supervision required for the manufacture and erection of the structural precast concrete work shown on the Contract Drawings.
- .2 This Section includes the following:
 - 1. Electrical Kiosk and Generator Foundations
 - 2. Wet Well base
- .3 Related Sections include the following:
 - 1. Section 03 10 00 "Concrete Forming and Accessories" for formwork.
 - 2. Section 03 20 00 "Concrete Reinforcing" for material and installation of reinforcement.
 - 3. Section 06 08 99 "Rough Carpentry for Minor Works" for formwork

1.3 Measurement and Payment

- .1 Payment will be made as a lump sum per foundation and shall include all costs for site preparation, materials, formwork and associated labour including all testing, submittals and documentation.

1.4 Reference Standards

- .4 CSA-A23.1, Concrete Materials and Methods of Concrete Construction.
- .5 CSA-A23.2, Methods of Test for Concrete.
- .6 CSA-A23.3, Design of Concrete Structures.

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- .7 CAN/CSA A3000 Cementing Materials Compendium.
- .8 ASTM SP-173 Superplasticizers and Other Chemical Admixtures in Concrete.
- .9 ASTM C309, Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
- .10 CAN/CSA A3000-A5, Portland Cement.
- .11 CAN/CSA G30.5, Welded Steel Wire Fabric for Concrete Reinforcement.
- .12 CAN/CSA G30.18, Billet Steel Bars for Concrete Reinforcement.
- .13 Canadian Standards Association (CSA)
- .14 Canadian General Standards Board (CGSB)
- .15 CAN/CGSB-19.24, Multicomponent, Chemical Curing Sealing Compound.

1.5 Aggregate Testing

- .1 Contractor to retain an approved independent testing agency to conduct the aggregate tests. Test results to be sealed by a Professional Engineer or Geoscientist registered in the Province of British Columbia.
- .2 Contractor to conform to latest CSA Standard A23.2-14, Methods of test for concrete.
- .3 The following tests will be conducted on each aggregate source:
 - 1. Aggregate-alkali reactivity potential will be tested in accordance with CSA A23.1, Appendix B.

1.6 Submittals

- .1 Provide certification that plant, equipment, and materials to be used in concrete comply with requirements of CSA A23.1.
- .2 Provide certification that mix properties selected will produce concrete of quality, yield and strength as specified in concrete mixes, and will comply with CSA A23.1.
- .3 Submit proposed mix design for each concrete type to Engineer for review 2 weeks prior to commencement of work.
- .4 Mix design to be signed and sealed by a qualified professional engineer registered in the Province of British Columbia.
- .5 Submit proposed method of curing for watertight concrete to Engineer for review.
- .6 Submit details of cold weather and hot weather protection, if requested by Engineer.
- .7 Submit quality control procedures to Engineer for review.

CAST-IN-PLACE CONCRETE

1.7 Waste Management and Disposal

- .1 Separate and recycle waste materials.
- .2 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan.
- .3 Place materials defined as hazardous or toxic in designated containers.
- .4 Ensure emptied containers are sealed and stored safely.
- .5 Use excess concrete for: additional paving, post footing anchorage, swale rip rap reinforcing, footing bottom, storm structure covers, underground utility pipe kickers, storm pipe flared end section, toe wash protection.
- .6 Use trigger operated spray nozzles for water hoses.
- .7 Designate cleaning area for tools to limit water use and runoff.

2 PRODUCTS

2.1 Materials

- .1 Portland cement: to CSA A3001, Type GU.
- .2 Water: to CSA-A23.1.
- .3 Aggregates: to CSA-A23.1. Coarse aggregates to be normal density.
- .4 Air entraining admixture: to ASTM C260.
- .5 Chemical admixtures: to ASTM C494 or ASTM C1017. Engineer to approve accelerating or set retarding admixtures during cold and hot weather placing. Do not use admixtures containing calcium chloride.
- .6 Supplementary Cementing Materials: to CSA A3001 Type CI or F.
- .7 Superplasticizing Admixtures: to CSA A3001. Superplasticizer to be added on site, not at batch plant.
- .8 Calcium chloride shall not be added to concrete.
- .9 Reinforcing bars: to CAN/CSA G30.18, Grade 400W.
- .10 Welded steel wire fabric: to CAN/CSA 30.5.
- .11 Joint sealer/filler: grey to CAN/CGSB 19.24, Type 1, Class B.

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2.2 Concrete Mixes

- .1 Conform to latest CSA Standard A23.1-19, concrete materials and methods of concrete construction
- .2 Concrete shall have a maximum aggregate size of 20mm (3/4") diameter.
- .3 Slump shall be limited to 65 mm (2 1/2") for slabs and footings
- .4 All cement shall be Type 10 (Portland cement) and shall meet ASTM C150
- .5 High early strength cement to be used for wet well base
- .6 Compressive strength of concrete at 28 days U.N.O., (minimum cement content is 335 kg./m3)

Location	Strength	Max Agg Size (mm)	Exposure Cl	Fly Ash Content %
Wet well Lid	35 MPa	20	C-1	30-35
Foundation	35 MPa	20	C-1	30-35
Lean Concrete	15 Mpa	20	C-1	30-35

2.3 Joint Sealant

- .1 Type 1 Joint Sealant: Sikaflex 2C NS Polyurethane Sealant primed with Sikaflex Primer 202, or Krystol T1 and T2 by Kryton International, or Xypex Patch and Plug and Xypex Concentrate by Xypex Chemical Corporation unless noted otherwise on the drawing or approved equal.

2.4 Concrete Accessories

- .1 Internal Waterstop: Adeka KBA – 1015 FP or MC-2010MN, or as approved.
- .2 Adeka Ultraseal: P-201.

2.5 SEALING COMPOUNDS

- .1 Surface sealer: to CAN/CGSB 25.20. Intraguard Concrete Penetrating Sealer (WR Meadows).
Apply penetrating sealant in above ground application.

2.6 Curing Compounds

- .2 No curing compounds allow unless approved by Engineer with written notice.
- .3 Select low VOC curing compounds, approved by Engineer.

3 EXCUTION

3.1 General

- .4 Cast-in-place concrete work to be in accordance with CSA-A23.1.

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3.2 Workmanship

- .1 Obtain Engineer's approval before placing concrete. Provide 48 hr 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 Engineer's approval of proposed method for protection of concrete during placing and curing in adverse weather.
- .5 All concrete shall be consolidated with the use of internal mechanical vibrators.
- .6 Chamfer all exposed edges 19mm (3/4") U.N.O.
- .7 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, air temperature, and test samples taken.
- .8 Do not place load upon new concrete until authorized by Engineer.
- .9 Minimum of 7 days to elapse between adjacent wall or slab pours, unless otherwise approved.
- .10 Roughen all construction joints to minimum 6 mm amplitude with exposed aggregate finish by sandblasting or water blasting (minimum 35 MPa (5000 psi)) green concrete or other technique approved by Engineer.

3.3 Finishing of Formed Surfaces

- .1 General: Repair and finish formed surfaces to CSA A23.1 except as noted.
- .2 Patching:
 1. Cutback all tie embedded in concrete to a minimum depth of 40 mm.
 2. Fill tie holes in watertight concrete with crystalline waterproofing materials applied in accordance with manufacturer's instructions.
- .3 Repair honeycombed and defective concrete with method approved by Engineer.
- .4 Repair of honeycombed and defective concrete to be at the expense of the Contractor.
- .5 Finish Types
 1. Class 1 - Rubbed Finish. Finish all formed concrete exposed to view with a sack rubbed finish to CSA A23.1 (unless noted otherwise).
 2. Class 2 - Common Finish. Finish all formed concrete exposed to water with a smooth form finish to CSA A23.1. Fill all bugholes and defects in concrete greater than 6 mm.

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3. Class 3 - Rough Form Finish. Finish all formed concrete in contact with backfill with a rough form finish to CSA A23.1.
4. Class 4 - Broom finish. Finish exterior concrete for vehicle or pedestrian traffic with broom, non-slip, finish to CSA A23.1

3.4 Waterstops

- .1 Waterstop shall be installed where shown on the drawings.
- .2 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.
- .3 Consult with water-stop manufacturer to verify installation and provide letter of acceptance to confirm installation is per manufacture's recommendations.

3.5 Inserts

- .1 No sleeves, ducts, pipes or other openings shall pass through joists, seams, column capitals or columns, except where indicated or approved by Engineer.
- .2 Set sleeves, ties, pipe hangers and other inserts and openings as indicated or specified elsewhere. Sleeves and openings greater than 100 mm square not indicated on drawings must be approved by Engineer.
- .3 Do not cut, bend, eliminate or displace reinforcement to accommodate hardware. If inserts cannot be located as specified, obtain approval of modifications from Engineer before placing of concrete.
- .4 Check locations and sizes of sleeves and openings shown on structural drawings with architectural, civil, process mechanical, building mechanical, electrical or landscaping drawings.

3.6 Embed Anchorage

- .1 Concrete anchors shall be galvanized HILTI HIT-Z-R-316-55 adhesive anchors and shall be installed into sound concrete in accordance with manufacturer's instructions.
- .2 Set anchors rods or other embeds to templates under supervision of appropriate trade prior to placing concrete. Templates shall be rigidly tied in place to avoid being displaced during concrete placement.
- .3 Grout under structural base plates and equipment base plates using procedures in accordance with manufacturer's recommendations which result in 100% contact over grouted area.

CAST-IN-PLACE CONCRETE

3.7 Joint Fillers

- .1 Furnish filler for each joint in single piece for depth and width required for joint, unless otherwise authorized by Engineer. When more than one piece is required for a joint, fasten abutting ends and hold securely to shape by stapling or other positive fastening.

3.8 Construction and Control Joints

- .1 To CSA A23.1, or as approved by the Engineer.
- .2 If additional joints are required to suit construction, locate and design the joints to ensure that the strength, water tightness, and appearance of the structure are not impaired. Submit details to the Engineer for review and approval.
- .3 Sawcut control joints between 8 to 24 hours after concrete placement. Cut in pattern shown on drawings. Control joints for each pour shall be formed by sawing a continuous 1/4 slab depth slot at 6 m centres each way unless otherwise indicated on drawings.

3.9 Curing

- .1 Cure concrete to CSA-A23.1 except where otherwise specified. Curing compounds shall not be used without the written authorization of the Engineer.
- .2 Cure watertight concrete roof and floor slabs by ponding, or absorptive fabric covered with polyethylene and kept continuously moist.
- .3 Cure structural concrete:
 1. For a minimum of 7 days at a minimum temperature of 10°C by maintaining concrete surfaces continuously moist.
- .4 Until concrete reaches 75% of specified 28-day strength as determined by field cured cylinders.

3.10 Hot Weather Concreting

- .1 Hot weather curing procedures are required when forecasts predict that the ambient air temperature will exceed 27°C during the placing and curing period.
- .2 Keep concrete temperature at the time of placing within the limits specified in CSA A23.1 Table 14.
- .3 If the concrete temperature is above the stated limits, concrete shall be cooled by addition of ice to the mixing water.
- .4 Follow recommendations from ACI 305R and the hot weather curing procedures listed below when the ambient air temperature exceeds 27°C during the curing period:
- .5 Provide additional initial curing for concrete slab in accordance with recommendation by ACI 305R.

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- .6 Keep the slab, footing and mat foundation surface moist by fogging until bleeding has stopped.
- .7 Apply evaporate retardant if the rate of evaporation exceeds the rate of bleeding.
- .8 Use Extended Wet Cure methods if the ambient air temperature exceeds 20°C during the initial three days.
- .9 Temperature of concrete placed during hot weather not to exceed the following limits:
 - 1. Watertight concrete = 20°C.
 - 2. All other concrete = 30°C.

3.11 Cold Weather Concreting

- .1 Cold weather curing procedures are required when forecasts predict the ambient air temperature will fall below 5°C during the placing and curing period.
- .2 Keep the concrete temperature at the time of placing within the limits specified in CSA A23.1 Table 14.
- .3 Cold weather curing procedures in accordance with CSA A23.1 and ACI 306R.
- .4 Keep the maximum difference between placing temperature and mean ambient temperature during curing period to 5°C.
- .5 Minimize the use of hot water in the wall concrete during the winter, in order to reduce the risk of early-age thermal cracking. Concrete placing temperature to be as close as possible to the minimum permitted by CSA A23.3.

3.12 Joint Sealant Installation

- .1 Install Joint Sealant after the concrete has aged at least 28 days and the ambient temperature is above 5°C.
 - 1. Remove forms, wood splinters, nails and other foreign matter from all joint grooves. During and after removal of forms care shall be taken to avoid damage to the edges of the joint grooves. Correct any defects, such as honeycombs, as instructed by the Engineer.
 - 2. Prepare joints by dual pass of sand blasting, unless otherwise specified.
 - 3. The joints shall be absolutely dry and free from oil and grease before the primer is applied. An air jet shall then be used immediately prior to the application of the primer to remove all loose particles from the joint grooves.
 - 4. Engineer to inspect and approve joint preparation prior to priming joint.

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5. Prime the joint surfaces with Sikaflex Primer 202, allow to dry (typically 45-60 min.), and then install the sealant within 8 hours of the application of primer. Apply the Sikaflex 2C sealant with approved tools, finished and cured in accordance with manufacturer's recommendations.

3.13 Sealant Application

- .1 Verify that slab surfaces are ready to receive work and elevations are as indicated on drawings and as instructed by manufacturer.
- .2 After floor treatment is dry, seal control joints and joints at junction with vertical surfaces with sealant.
- .3 Apply floor treatment in accordance with Sealer manufacturer's written instructions.
- .4 Clean sealant from adjacent surfaces.

3.14 Leak Repair

- .1 Visible leaks in the structural water tight concrete be repaired by Contractor.
- .2 Visible leaks in the walls within the zone of permanent backfill to be repaired by routing out cracks and installing Crystol T1 by Kryton or Xypex Concentrate by Xypex in accordance with manufacturer's instructions. Submit proposed method of repair to Engineer for approval prior to proceeding with repairs.
- .3 Visible leaks in the roof slab shall be repaired by epoxy injection. Contractor to submit procedure to Engineer for review two weeks prior to commencing with repair.
- .4 All concrete leak and repair to be at the Contractor's expense.

3.15 Field Quality Control

- .1 Assume responsibility for all cast-in-place concrete materials and construction. Sampling and testing will be at the expense of the Contractor.
- .2 Inspection and testing of concrete and concrete materials to be carried out by a CSA certified Testing Laboratory Testing to be in accordance with CSA-A23.1. Take concrete samples and conduct testing in accordance with CSA-A23.2. Field testing technicians to be certified under an industry-recognized program.
- .3 A strength test will consist of 4 standard cylinders, one tested at 7 days, 2 at 28 days, and 1 spare to be tested if required at 56 days.
- .4 Frequency of testing to CSA-A23.1 except minimum one strength test for each 25 m³ of concrete.

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- .5 Take additional test cylinders during cold weather concreting. Cure cylinders on job site under same conditions as concrete which they represent.
- .6 Take additional air content tests for concrete exposed to freezing and thawing in accordance with CSA A23.1.
- .7 All concrete testing costs will be paid for by the Contractor.
- .8 Results of the concrete tests will be forwarded to the Engineer. Included with the results will be the following information: Name of Project, Date of Sampling, Name of Supplier, Delivery Truck Number, Identification of Sampling and Testing Technician and exact location in the structure of the concrete sampled.
- .9 Concrete failing to meet the requirements to be retested, strengthened or rejected in accordance with CSA A23.2. All additional testing, strengthening, and/or replacement to be at the Contractor's expense.
- .10 The Engineer may monitor the mixing and handling of concrete, take additional strength and slump tests, and check all matters affecting quality control of the concrete. Extend full cooperation and assistance to the Engineer, including provision of access and samples for testing. Such additional sampling and testing will be at the expense of the Owner.
- .11 The Engineer will witness the repair of any concrete leak until no visible leak is observed. Extend full cooperation and assistance to the Engineer, including provision of access and all documents supporting the repair methods.

END OF SECTION

PRECAST CONCRETE

1 GENERAL

1.1 Related Documents

- .1 Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 Summary

- .1 This Section includes the performance criteria, materials, design, production, and installation of the structural precast concrete wet well lid. The work performed under this Section includes all labor, material, equipment, related services, and supervision required for the manufacture and erection of the structural precast concrete work shown on the Contract Drawings.
- .2 This Section includes the following:
 - a. Precast concrete lid
- .3 Related Sections include the following:
 - a. Section 03 10 00 "Concrete Forming and Accessories" for formwork.
 - b. Section 03 20 00 "Concrete Reinforcing" for material and installation of reinforcement.
 - c. Section 03 30 00 "Cast-in-Place Concrete" for installing reinforcing steel in concrete.
 - d. Section 06 08 99 "Rough Carpentry for Minor Works" for formwork

1.3 Performance Requirements

- .1 Structural Performances: Provide structural precast concrete members and connections capable of withstanding the following design loads within limits and under conditions indicated:

Dead Load (such as weight of the slab and topping), live load as specified in IFC drawings (such as snow load, occupancy load or H-20 truck load), Soil lateral load under static and seismic load, Wind load, etc.

Design structural precast concrete framing system and connections to maintain clearances at openings, to allow for fabrication and construction tolerances, to accommodate live-load deflection, shrinkage and creep of primary structure and other movements. Maintain structural precast concrete deflections within limits of ACI318 (ACI 318M).

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1.4 Action Submittals

- .1 Product Data: For each type of product indicated. Retain quality control records and certificates of compliance for 5 years after completion of structure.
- .2 Design Mixture: Include compressive strength.
- .3 Shop Drawings:
 - a. Detail fabrication and installation of structural precast concrete unit including connections at member ends and to each adjoining member.
 - b. Indicate locations, plan views, elevations, dimensions, shapes, and cross sections of each unit, openings, support conditions and types of reinforcements, including special reinforcement.
 - c. Indicate aesthetic intent including joints, rustications or reveals, and extent and location of each surface finish.
- .4 Provide handling procedures, erection sequences, and for special conditions provides temporary bracing and shoring plan.

1.5 Informational Submittals

- .1 Qualification Data: For Installer, Fabricator, Testing agency and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include list of completed projects with project names and addresses, names and addresses of Engineers and owners, and other information specified.
- .2 Material Test Reports for aggregates: From an accredited testing agency, indicated and interpreting test results for compliance with requirements indicated.
- .3 Material Certificates: Signed by manufacturers certifying that each of the following items complies with requirements.
 - a. Cementitious materials.
 - b. Reinforcing materials and prestressing tendons.
 - c. Admixtures.
 - d. Structural-steel shapes and hollow structural sections.
 - e. Insulation

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- f. Other components specified in Contract Documents with applicable standards.
- .4 Field quality-control test and special inspections reports.

1.6 Quality Assurance

- .1 Fabricator Qualifications: A firm that complies with the following requirements and is experienced in producing structural precast concrete units similar to those indicated for this Project and with a record of successful in-service performance.
 - a. Participates in PCI's Plant Certification program [at the time of bidding] and is designated a PCI-certified plant for Group C, Category C1 – Precast Concrete Products (no prestressed reinforcement).
 - b. Has sufficient production capacity to produce required members without delaying the Work.
 - c. Certification shall be maintained throughout the production of the precast concrete units. Production shall immediately stop if at any time the fabricator's certification is revoked, regardless of the status of completion of contracted work. Production will not be allowed to re-start until the necessary corrections are made and certification has been re-established. In the event certification(s) can not be re-established in a timely manner, causing project delays, the fabricator, at no additional cost, will contract out the remainder of the units to be manufactured at a PCI certified plant.

1.7 Delivery, Storage and Handling

- .1 Deliver structural precast concrete member in such quantities and at such times to assure compliance with the agreed upon project schedule and setting sequence to ensure continuity of installation.
- .2 Handle and transport member in a manner to avoid excessive stresses that could cause cracking or other damage.
- .3 Store units with adequate dunnage and bracing, and protect units to prevent contact with soil, staining, and to control cracking, distortion, warping or other physical damage.
- .4 Lift and support members only at designated points indicated on the Shop Drawings.

1.8 Sequencing

- .1 Furnish loose connection hardware and anchorage items to be embedded in or attached to other construction without delaying the Work. Provide locations, setting diagrams, templates, instructions, and directions, as required, for installation.

PRECAST CONCRETE

2 PRODUCTS

2.1 Form Material

- .1 Forms: Rigid, dimensionally stable, nonabsorptive material, warp and buckle free, that will provide precast concrete surfaces within fabrication tolerances indicated; nonreactive with concrete and suitable for producing required surface finishes.
 - a. Form-Release Agent: Commercially produced form-release agent that will not bond with, stain or affect hardening of precast concrete surfaces and will not impair subsequent surface or joint treatments of precast concrete.

2.2 Reinforcing Materials

- .1 Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.

2.3 Concrete Materials

- .1 Portland Cement: Type 10
- .2 Supplementary Cementitious Materials
 - a. Fly Ash: ASTM C 618, Class C or F with maximum loss on ignition of 3%.
 - b. Metakolin: ASTM C 618, Class N.
 - c. Silica Fume: ASTM C 1240 with optional chemical and physical requirements.
 - d. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.
- .3 Normalweight Aggregates: Except as modified by PCI MNL 116, ASTM C 33, with coarse, non-reactive aggregates complying with Class [4S] [4M].
- .4 Air Entraining Admixture: ASTM C 260, certified by manufacturer to be compatible with other required admixtures.
- .5 Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and to not contain calcium chloride, or more than 0.15 percent chloride ions or other salts by weight of admixture.
 - a. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
 - b. Retarding Admixture: ASTM C 494/C 494M, Type B.
 - c. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
 - d. Water-Reducing and Accelerating Admixture ASTM C 494/C 494M, Type E.
 - e. High Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
 - f. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
 - g. Plasticizing Admixture for Flowable Concrete: ASTM C 1017/C 1017M.

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- h. Corrosion Inhibiting Admixture: ASTM C 1582/C 1582M

2.4 Concrete Mixtures

- .1 Prepare design mixtures for precast concrete
 - a. Limit use of fly ash to 35 percent replacement of Portland cement by weight; granulated blast-furnace slag to 50 percent of Portland cement by weight; and metakaolin and silica fume to 10 percent of Portland cement by weight.
- .2 Design mixtures may be prepared by a qualified independent testing agency or by qualified precast plant personnel at structural precast concrete fabricator's option.
- .3 Limit water-soluble chloride ions to maximum percentage by weight of cement permitted by ACI 318 (ACI 318M) or PCI MNL 116 when tested in accordance with ASTM C 1218/C 1218M.
- .4 Normal weight Concrete Mixtures: Proportion mixtures by either laboratory trial batch or field test data methods according to ACI 211.1, with materials to be used on Project, to provide normal weight concrete with the following properties:
 - a. Compressive Strength (28 Days): 5000 psi (34.5 Mpa) minimum
 - b. Release Strength: as required by design
 - c. Maximum Water-Cementitious Materials Ratio: 0.45
- .5 Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content complying with PCI MNL 116.
- .6 When included in design mixtures, add other admixtures to concrete mixtures according to manufacturer's written instructions.
- .7 Concrete Mixture Adjustments: Concrete mixture design adjustments may be proposed if characteristics of materials, Project conditions, weather, test results, or other circumstances warrant.

2.5 Fabrication

- .1 Cast-in Anchors, Inserts, Plates, Angles, and Other Anchorage Hardware: Fabricate anchorage hardware with sufficient anchorage and embedment to comply with design requirements. Accurately position for attachment of loose hardware and secure in place during precasting operations. Locate anchorage hardware where it does not affect position of main reinforcement or concrete placement.

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- a. Weld headed studs and deformed bar anchors used for anchorage according to AWS D1.1/D1.1M and AWS C5.4, "Recommended Practices for Stud Welding."
- .2 Cast-in openings larger than 10 inches (250 mm) in any dimension. Do not drill or cut openings or prestressing strand without Engineer's approval.
- .3 Reinforcement. Comply with recommendations in PCI MNL 116 for fabricating, placing, and supporting reinforcement.
 - a. Clean reinforcement of loose rust and mill scale, earth, and other materials that reduce or destroy the bond with concrete. When damage to epoxy coated reinforcing exceeds limits specified in ASTM A 775/A 775M, repair with patching material compatible with coating material and epoxy coat bar ends after cutting.
 - b. Accurately position, support and secure reinforcement against displacement during concrete-placement and consolidation operations. Locate and support reinforcement by plastic tipped or corrosion resistant metal or plastic chairs, runners, bolsters, spacers, hangers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place according to PCI MNL 116.
 - c. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position while placing concrete. Direct wire tie ends away from finished, exposed concrete surfaces.
- .4 Reinforce structural precast concrete members to resist handling, transportation, and erection stresses, and specified in-place loads, whichever governs.

2.6 Fabrication Tolerances

- .1 Fabricate structural precast concrete members of shapes, lines, and dimensions indicated, so each finished member complies with PCI MNL 135 product tolerances as well as position tolerances for cast-in items.

3 Execution

3.1 Preparation

- .1 Furnish loose connection hardware and anchorage devices for precast concrete members to be embedded in or attached to the structural frame or foundation before starting the Work.
- .2 Provide locations, setting diagrams, templates and instructions for the proper installation.

3.2 Examination

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- .1 Examine supporting structural frame or foundation and conditions for compliance with requirements for bearing surface tolerances, and other conditions affecting precast concrete performance.
- .2 Proceed with precast concrete installation only after unsatisfactory conditions have been corrected.

3.3 Installation

- .1 Precast lid to be installed on minimum 300 mm – 20 mm minus well-graded aggregates compacted to 95% of ASTM D 1996 modified proctor density, unless specified otherwise by the design engineer.
- .2 A qualified geotechnical engineer shall inspect and approve the prepared area prior to placement of the precast structure.
- .3 Drainage from the cast in access hatch to be connected to nearby drainage infrastructure.

3.4 Measurement and Payment

- .1 Payment will be made as a lump sum and shall include all costs for fabrication, transport and installation including all testing, submittals and documentation.

END OF SECTION

STEEL PIPE WELDING

1 **General**

1.1 **Description**

1. This section specifies in this Section covers field and related shop welding requirements for manual, semi-automatic and automatic metal arc-welding process specific to the welding of carbon steel pipe and appurtenances for water or sewerage facilities and pipelines.

1.2 **Reference Standards**

1. Welding shall comply with the referenced requirements of the following standards, where applicable:
 - a) ASME B31.3 Process Piping
 - b) AWS A5.20 Specifications for Carbon Steel Electrodes for Flux Core Arc Welding
 - c) AWWA C206 Standard for Field Welding of Steel Water Pipe
 - d) CSA W48 Filler Metals and Allied Materials for Metal Arc Welding
 - e) CSA W59 Welded Steel Construction (Metal Arc Welding)
 - f) CSA W117.2 Safety in Welding, Cutting and Allied Processes
 - g) CSA W178.2 Certification of Welding Inspectors
 - h) CSA Z662 Oil and Gas Pipeline Systems
 - i) Occupational Health and Safety Regulation WorkSafeBC

1.3 **Submittals**

1. The contractor shall submit its proposed welding procedures for review not later than ten (10) working days prior to commencing any welding work.
2. The welding procedures should outline manufacturing, installation, inspection and testing procedures for the welding. This should include weld mapping and non-destructive inspection criteria.
3. Welding documentation for procedures, production and repair welding shall include:
 - a) Welding procedure specifications (WPS)
 - b) Procedure qualification records (PQR), including Charpy V-notch testing
 - c) Welder performance qualifications (WPQ)
 - d) Welding operator certificates (WOC)
 - e) Weld Repair Procedure
 - f) Charpy V-notch reports
4. The Engineer will review and comment on the Contractor's submittal within five (5) working days of receipt thereof.
5. The contractor shall submit all as-built documentation in hard copy or pdf file before substantial completion is granted. All inspection, testing or other documents shall reference a traceable weld and pipe identification system. The binder shall include the following information:
 - a) All welding documentation specified in 1.3.3.
 - b) Shop and fabrication drawings, fully dimensioned and identified, showing the welder and welding procedures actually used.
 - c) Final corrective action / inspection reports.

STEEL PIPE WELDING

1.4 Definition and Symbols

1. The welding terms and symbols employed in these Contract Documents, shall be interpreted according to the definitions given in CSA Standard W59.

2 Products

2.1 Filler Metal

1. Welding electrodes shall conform to the classifications of the AWS A5.20 and CSA W48. The weld steel shall be classed to have the following mechanical properties:
 - a) minimum tensile strength: 480 MPa (70,000 psi);
 - b) minimum yield point: 410 MPa (60,000 psi).
 - c) Filler metal shall have a minimum Charpy toughness of 34 joules (25 ft-lb) at -10C (300F).

2.2 Templates

1. The Contractor shall provide all the necessary pipe mitre templates, jigs, temporary pipe supports, alignment dogs, clamps and consumables required to complete the work.

3 Execution

3.1 General

1. The quality standard shall be CSA Z662 for all pipe greater than 600 mm and ASME B31.3, Category M for all piping less than or equal to 600 mm.
2. All welding shall be done in accordance with the WorkSafe BC's, Occupational Health and Safety Regulation and in accordance with CSA X117.2 Safety in Welding, Cutting and Allied Processes.

3.2 Welder Qualification

1. All welders shall be qualified for the particular welding procedures they will perform in accordance with the requirements of Section 7 of CSA Z662. All welders shall be tested and must pass tests for each welding procedure submitted by the Contractor and reviewed by the Engineer.
2. All welders shall possess a valid Welder's Performance Qualification Record (WPQR) book issued under the authority of the provincial Boiler and Pressure Vessel Safety Program.
3. All welders who have performed welding for the District during the past six (6) months, will be required to prepare weld test specimens as detailed below.

3.3 Welder Testing

1. All welder testing will be witnessed by an independent certified welding inspector at the Contractor's cost.
2. All costs associated with the Welder Performance Qualification test shall be paid by the Contractor including preparation of the welded test coupons (time and consumables), and mechanical and Charpy testing of the coupons by an independent certified weld inspection company.
3. The Welder Performance Qualification test will be performed on 600 mm diameter pipe, of a material equivalent to the production and fabrication piping. Test specimens will be visually inspected by the Engineer and will be bend tested and witnessed by the Engineer. Welder tests are to take place at facilities that are certified to CSA 178.2 and by inspectors that are certified to level 2 or 3.

STEEL PIPE WELDING

4. All butt and fillet welding procedures for pipe to be qualified in accordance with the requirements of Section 7 of CSA Z662. In addition, Charpy V-notch tests are required from all butt weld qualification joints, of the weld metal and heat affected zone samples. Minimum average values of 34 joules (25 ft-lbs) at -10 C (300 F) are required, with a minimum single value of 23 joules (16 ft-lbs).

3.4 Preparation of Surfaces Before Welding

1. Prior to welding, or flame cutting, on lined or coated pipes, the Contractor will carefully remove the lining or coating from the interior and exterior of the pipe over a distance of not less than 150 mm (6 inches) on either side of the position of the proposed weld or flame cut.
2. Surfaces to be welded shall be free from dirt, loose scale, slag, heavy rust, grease, paint, oil, cement and any other foreign material. Joint surfaces shall be smooth, uniform and free from tears, fins and other defects which could adversely affect proper welding.
3. Some pipes may arrive on the Work Site in an out-of-round state. The Contractor shall use blocking, as necessary, to bring the pipes back to true roundness to allow for a proper welding joint.
4. The Contractor shall shim the joints prior to welding, so that the annular gap or high-low is equal all around the circumference of the pipe and within the weld procedure tolerance.

3.5 Welding Environment

1. Welding shall not be performed on wet surfaces, nor when it is raining, snowing or during periods of high wind, unless the operator and the work are properly protected from the elements. Under such conditions it is the Contractor's responsibility to provide suitable hoarding to protect the operator and the work.

3.6 Preheating Temperatures

1. The base metal material at the weld position shall be preheated before welding to a temperature of 650 C (1500 F) and be maintained at this level until welding is complete.

3.7 Tack Welds and Defects

1. Nicks, gouges, notches and depressions in the base metal in the area of the joint shall be repaired before the weld is made. Erection tack welds, used in the assembly of joints, need not be removed, provided that they are sound, and the cover beads are thoroughly fused into the tack welds
2. Written approval of weld procedures are required where weld repairs result in removal of the base material to more than 10% of the wall thickness.

3.8 Polarity of Welding Current

1. The polarity of the welding current shall be in compliance with the reviewed welding procedure.

3.9 Quality of Welds

1. All welds shall produce complete fusion of the parent metal and shall be free from unsound metal containing porosity, cracks and slag inclusion. The surface of each bead and finished weld shall be free from unusual grooves, valleys, depressions, burrs, overlapping, undercutting and other irregularities.
2. The finished weld surface shall be smooth with gradual changes in profile to accept the specified coating or lining. If, in the Engineer's opinion, the welds will not readily accept the lining or coating, the Contractor shall repair the welds at its own cost.
3. All weld spatter shall be removed from the internal weld surfaces by the Contractor prior to inspection or costing preparations.

STEEL PIPE WELDING

3.10 Application

1. The welds shall be applied by means of continuous stringer beads. Each bead shall be completed for the full circumference of the seam before successive beads are started. Each pass shall be thoroughly cleaned, especially at the edges of the bead where it connects to the base metal, to remove dirt, slag, and flux before the succeeding bead is applied.
2. The thickness of the metal build-up behind the advancing arc for each weld pass shall not exceed 5 mm (3/16 inch), and the width shall not exceed three times the SMAW electrode diameter or five times the FCAW wire diameter used to make the weld. Where, in the Engineer's opinion, field connections dictate, the Engineer may revise the application procedure.
3. Fillet welds shall be made with a minimum cutting back of the joint ring or pipe. The throat of a full-fillet weld shall be not less than 0.707 times the thickness of the pipe wall as shown on the drawings. Excess cutting back of 1.6 mm (1/16") or greater is a defect and shall be repaired.
4. The fillet weld bead profile shall be 45 degrees unless specified otherwise.
5. All pipe welds shall have a minimum of a root pass, a hot pass and one fill pass around the entire circumference before the pipe can be left overnight.

3.11 Weld Reinforcement

1. On butt joints, no part of the finished surface in the area of fusions shall lie below the surface of the adjoining pipe. The weld reinforcement shall not be more than 1.6 mm (1/16 inch) above the surface of the pipe.

3.12 Joint Alignment

1. Butt joints shall be accurately aligned and retained in position during the welding operation so that at the finished joint position, the one pipe surface shall not project beyond the other adjoining pipe surface by more than 20 percent of the plate thickness, with a maximum of 1.6 mm (1/16 inch).
2. Where two abutting pipes have different thickness, the difference shall be evenly distributed around the pipe and a 4:1 taper shall be employed by grinding of the thicker pipe to allow a smooth transition between the two thicknesses.

3.13 Workmanship

1. All workmen shall wear rubber soled, or other suitable soft soled shoes, which will not damage the pipe coating or lining.
2. Each welder, working inside a pipe, shall use a container to receive the rod ends, and shall take care not to drop these ends on the pipe coating or lining.
3. Flame-resistant blankets or other suitable coverings shall be provided by the Contractor and be placed over the pipe coating and lining to prevent damage from hot metal and sparks. The lining and the exterior coating are highly susceptible to damage from sparks and spatter.
4. If the Contractor damages the lining or coating during the course of the Work, the Contractor shall repair the damage to the satisfaction of the Engineer.

3.14 Contractor's Quality Control

1. The Contractor's quality control plan for welding shall include:
 - a) Welder qualification;
 - b) Welding procedures;
 - c) And all other things necessary to ensure the specifications are met.
2. Welder and welding operators shall clearly mark each weld they make with their unique, traceable ID using a weather resistant paint marker.

STEEL PIPE WELDING

3.15 Quality Assurance

1. The Engineer will check the Contractor's work to audit the quality of the final weld product, that may include the following tasks:
 - a) Visual inspection on 100% of the welds.
 - b) Magnetic particle examination will be conducted on 10% of all fillet welds, bell & spigot welds, butt strap welds, and 100% of all fillet welds on pipe hatches, passholes and man ways.
 - c) Magnetic particle examination will be conducted on all branch connection joints, on 100% of the welds prior to the installation of the crotch plate assembly and 100% of the welds on the crotch plate assembly.
 - d) Air pressure testing will be done on all bell and spigot and butt strap welds and all reinforcing plates (repads). These will be tested to a maximum of 275 kPa (40 psi) in conjunction with the application of soapy water solution on the entire welded area.
 - e) Radiographic inspection will be conducted on 100% of length of each weld, of a minimum of 10%, of all groove and miter joints. A minimum of 5% of each welder or welding operator shall be represented. The Engineer will select the welds for radiographic examination.
 - f) If welding defects are found through radiographic inspection, then an additional 10% of welds based on the number of welds performed by that welder will be radiographed. If no additional defects are found as a result of this additional 10% inspection criteria, the minimum extent of radiographic inspection may be reduced back to 10% as outlined.
2. The Contractor shall give the Engineer reasonable notice (48 hours minimum) of the production schedule in order to arrange its' quality assurance program. The Engineer shall have unrestricted, safe, access to where the work is being performed.

3.16 Defects and Repairs

1. The Contractor shall make good and/or repair as directed, at its own expense, all welds which are found to be defective.
2. All porosity, cracks, trapped welding flux, welds deficient in quality, or made contrary to any provisions of these specifications, shall be removed and repaired by the reviewed repair procedure. The air-carbon-arc method will not be permitted.
3. All arc strikes, nicks, notches, grooves or depressions in the adjacent base metal during welding, removal of welds and repairs shall be repaired by the Contractor in accordance with the reviewed weld procedure.
4. Mechanical caulking or peening of welds to correct defects will not be permitted. Leaks traced to faulty welded pipe joints shall be repaired by removing the defective material which caused the leak and re-welding.
5. Repairs shall be made by grinding smooth to base metal and building up with weld metal to produce a surface free of defects. All repairs will be subject to re-inspection by the Engineer.

End of Section

METAL FABRICATIONS

1 General

1.1 Work Included

1. This section specifies the requirements for supply, fabrication, coating and installation of all non-structural metal work shown on the drawings and described herein.
2. Includes but not necessarily limited to, miscellaneous embedded and non embedded metal work, anchor bolt assemblies, lifting eyes, ship ladders, grating, railings, and all other metal items required for completion of the works.
3. All anchors, plates, bolts, nuts and screws etc. as may be required to complete all work and to join the work of others.
4. All bracing, cutting, drilling, etc. as required to complete work and to join the work of others.

1.2 Related Work

Cast in Place Concrete (for installation of embedded metalwork)

Section 03 30 00

1.3 Reference Standards

1. Conform to the following reference standards in accordance with Section 01 42 00, Reference Specifications:
 - a) CAN/CSA G40.21, Structural Quality Steels
 - b) CSA G164, Hot-Dip Galvanizing of Irregularly Shaped Articles
 - c) CAN/CSA S16.1, Steel Structures for Buildings
 - d) ASTM A325, Specifications for High Strength Steel Bolts Classes 10.9 and 10.9.3 for Structural Steel Joints
 - e) CSA W47.1, Certification of Companies for Fusion Welding of Steel Structures
 - f) CSA W47.2, Certification of Companies for Fusion Welding of Aluminum.
 - g) CSA W48, Welding Electrodes
 - h) CSA W59, Welded Steel Construction
 - i) CSA W59.2, Welded Aluminum Construction
 - j) CSA HA Series M, Standards for Aluminum and Aluminum Alloys
 - k) CSA S157, Aluminum Fabrication and Assembly.
 - l) ASTM A167, Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheets, and Strip.
 - m) ASTM A511, Specification for Seamless Stainless Steel Mechanical Tubing.
 - n) ASTM A570M, Specification for Hot-Rolled Carbon Steel Sheet and Strip, Structural Quality.
 - o) ASTM A611, Specification for Steel, Cold Rolled Sheet, Carbon, Structural
 - p) ASTM A666, Specification for Austenitic Stainless Steel, Sheet, Strip, Plate and Flat Bar for Structural Applications
 - q) ASTM A780, Practice for Repair of Hot-Dip Galvanized Coatings.
 - r) ASTM B209M, Specification for Aluminum and Aluminum Alloy Sheet and Plate.
 - s) ASTM B221M, Specification for Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes and Tubes.
 - t) ASTM B241, Specification for Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube.
 - u) ASTM B632M, Specification for Aluminum-Alloy Rolled Tread Plate.
 - v) ASTM F738-M, Specification for Stainless Steel Metric bolts, Screws and Studs.
 - w) ASTM F1136, Specification for Chromium/Zinc Corrosion Protective coating for Fasteners.
 - x) ANSI B36.10, Pipe, Steel.
 - y) CSA S136, Design of Light Gauge Steel Structural Members.

METAL FABRICATIONS

z) ANSI/NAAMM MBG 531-88/NAAMM, Metal Bar Grating Manual

1.4 Submittals For Review

1. Submit shop drawings in accordance with Section 01 33 01.
2. Indicate materials, core thicknesses, finishes, connections, joints, method of anchorage, number of anchors, supports, reinforcement, details, and accessories.
3. Drawings to bear the seal of a professional Engineer registered in the Province of British Columbia for all fabricator designed assemblies, components, connections and supports.

2 Products

2.1 Materials

1. Steel sections: to CAN3-G40.21, Grade 350W.
2. Stainless steel plate: to AISI Type 304, 316, or 316L as shown.
3. Hollow Structural Sections: to CAN3-G40.21, Grade 350W.
4. Welding materials: to CSA W59, or CSA W59.2.
5. Bolts, nuts and washers: steel to CSA Standard CAN3-S-16.1, ASTM A325 or stainless steel to ANSI Type 304, or 316, as shown.
6. Aluminum sections and plate: to CSA HA.5 Type 6061 T6 unless otherwise shown.
7. Aluminum sheets and plates: to CSA HA.5 Type 5086-H32 unless otherwise shown.
8. Welding Materials to CSA W48.1.
9. Rubber for fastening to metal pipe support clamps and other uses to be hard neoprene (40-50 Durometer).
10. Bond rubber to various items, as required, with Acro Bond adhesive.
11. Replace steel which is rust pitted, deformed, bent or otherwise defective without extra cost.
12. All steel to be cleaned prior to galvanizing in accordance with CSA S16 and Steel Structures Painting Council Manual.

METAL FABRICATIONS

2.2 Protective Coatings

1. Apply one shop coat of primer compatible with paint system as approved by the Engineer, to metal items, with exception of galvanized, stainless steel, aluminium or concrete encased items.
2. Use primer unadulterated, as prepared by manufacturer. Paint on dry surfaces, free from rust, scale, grease. Do not paint when temperature is lower than 7°C.
3. Galvanize items as required after fabrication.
4. Isolate all aluminium surfaces in contact with concrete with two coats of bituminous paint.

2.3 Fence Collar Access Barrier

1. Not Used.
2. Not Used.
3. Not Used.
4. Fence Collar Access Barrier
 - a) As shown on drawings
5. Galvanized Steel
 - a) To ASTM A-525.

2.4 Railings

1. Not Used.
2. Not Used.
3. Not Used.

2.5 Air Release Valve Box

1. Air Release Valve Box
 - a) As shown on drawings
2. Galvanized Steel
 - b) GALVANIZED 14 GAUGE MILD STEEL SHEET ARV BOX
 - c) INSULATE ALL WALLS MIN 75mm
 - d) To ASTM A-525.

3 Execution

3.1 Fabrication

3.1.1 General

1. Fabricate work square, true, straight and accurate to required size, with joints closely fitted and properly secured.
2. Where possible, fit and shop assemble work, ready for erection.
3. Ensure exposed welds are continuous for length of each joint. File or grind exposed welds smooth and flush.
4. Verify all dimensions on site prior to shop fabrication.
5. Fit and shop assemble in largest practical section for delivery to site.
6. Supply all components required for proper anchorage of all metal fabrications.
7. Grind smooth sharp edges, angles and corners.

METAL FABRICATIONS

8. Fix to concrete or masonry using embedded anchor bolts, expansion shield or self-drilling anchors, or epoxy embedded anchors (type and size of most fasteners noted on drawings, where sizes not shown, size to suit loads being supported).
9. Galvanize all embedded and non embedded metal work including pipe supports and hangers.
10. Aluminium welding shall be of the MIG and TIG process and shall conform to CSA Specification W47.2 using filler rod that is compatible with the specified alloys.
11. Band all holes for piping, valve access, etc.
12. File or grind exposed welds smooth and flush.

3.1.2 Galvanizing

1. Clean all surfaces from rust, scale grease and foreign matter prior to galvanizing.
2. Galvanize to CSA G164 to 380 g/m² minimum coating.
3. Touch up damaged areas with Zinga.

3.1.3 Coating

1. Non-galvanized metalwork shall be coated. Steel work shall be painted with one shop coat of primer compatible with the paint finish.

3.2 Erection

3.2.1 General

1. Erect metalwork square, plumb, straight, and true, accurately fitted, with tight joints and intersections, and free from distortion or defects detrimental to appearance and performance.
2. Provide suitable means of anchorage acceptable to Engineer such as dowels, anchor clips, bar anchors, expansion and adhesive, bolts and shields, and toggles.
3. Make field connections with high tensile bolts to CAN/CSA-S16.1, or stainless steel bolts type 304 or 316 as applicable. Do not field weld.
4. Hand items over for casting into concrete or building into masonry to appropriate trades together with setting templates.
5. Touch-up bolts and burnt or scratched surfaces after completion of erection with primer.
6. Touch-up galvanized surfaces with zinc rich primer where damaged.

3.2.2 Field Painting

1. After erection has been completed, clean steelwork of all dirt, grease and other foreign matter.
2. Touch up all field bolts, field welds and any abrasions to the shop coat with a suitable zinc oxide primer.
3. Touch up all galvanizing with Zinga primer.
4. Provide top coating in accordance with Division 9.
5. Anchor Bolts
6. Install as per manufacturer's instructions.
7. Seal hole around bolts with silicon sealant prior to making bolted connection.

End of Section

ROUGH CARPENTRY FOR MINOR WORKS

1 GENERAL

1.1 References

- .1 Canadian Standards Association (CSA International)
 - 1. CSA B111, Wire Nails, Spikes and Staples.
 - 2. ASTM A123, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - 3. CSA O121, Douglas Fir Plywood.
 - 4. CAN/CSA O141, Softwood Lumber.
 - 5. CSA O151, Canadian Softwood Plywood.
 - 6. CAN/CSA O325.0, Construction Sheathing.
- .2 National Lumber Grades Authority (NLGA)
- .3 Standard Grading Rules for Canadian Lumber.

1.2 Quality Assurance

- .1 Lumber identification: Graded and stamped to NLGA requirements and the Canadian Lumber Standards Accreditation Board. All marked at mill and end -marked; delivered to site with certificates as to species, grades and stress grades, seasoning, moisture content, and other evidence as required by the Engineer to show compliance with the specifications.
- .2 Plywood identification: by grade mark in accordance with applicable CSA standards and CANPLY or APA requirements whichever is most stringent.
- .3 Plywood, OSB and wood based composite panel construction sheathing identification: by grademark in accordance with applicable CSA standards.
- .4 Use moisture meter as required to confirm moisture content.
- .5 Use preservative treated wood products at all locations where wood is in contact with concrete, roofing support construction (parapets, curbs, fascias, cants etc.), openings through air/vapour barriers, and at window support.
- .6 Apply preservative treatment in accordance with manufacturer's written instructions.
- .7 Use fire retardant treated plywood back boards for electrical equipment mounting. Boards shall be 19 mm thick square edged plywood extending from 100 mm above finish floor. Review installation with Engineer prior to installation.

ROUGH CARPENTRY FOR MINOR WORKS

1.3 Product Delivery Storage and Handling

- .1 Protect materials from weather during transit to job site.
- .2 Store materials in the original unopened containers.
- .3 Store materials on site in such a way as to prevent damage, or impairment of their structural or other essential properties. When necessary, store on raised supports. Cover stored materials in such a way as to maintain good air flow and prevent moisture entrapment.

1.4 Waste Management and Disposal

- .1 Separate and recycle waste materials.
- .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .3 Collect and separate for disposal paper, plastic, polystyrene, and corrugated cardboard packaging material for recycling in accordance with Waste Management Plan.
- .4 Divert unused wood materials from landfill to recycling, reuse, composting facility approved by Engineer or Owner.
- .5 Do not dispose of preservative treated wood through incineration.
- .6 Do not dispose of preservative treated wood with materials destined for recycling or reuse.
- .7 Dispose of treated wood, end pieces, wood scraps and sawdust at sanitary landfill approved by Engineer.
- .8 Dispose of unused wood preservative material at official hazardous material collections site approved by Engineer.
- .9 Do not dispose of unused preservative material into sewer system, into streams, lakes, onto ground or in other locations where they will pose health or environmental hazard.

2 PRODUCTS

2.1 Lumber Material

- .1 Lumber: unless specified otherwise, softwood, S4S, moisture content 19% or less in accordance with following standards:
 - 1. CAN/CSA O141.
 - 2. NLGA Standard Grading Rules for Canadian Lumber.
 - 3. Grade: SPF No. 2 or better for framing purpose.
- .2 Furring, blocking, nailing strips, grounds, rough bucks, cants, curbs, fascia backing and sleepers:

ROUGH CARPENTRY FOR MINOR WORKS

1. S2S is acceptable for concealed framing only.
2. Board sizes: "Standard" or better grade.
3. Dimension sizes: "Standard" light framing or better grade.
4. Post and timbers sizes: "Standard" or better grade.

2.2 Panel Materials

- .1 Douglas fir plywood (DFP): to CSA O121, standard construction.
- .2 Canadian softwood plywood (CSP): to CSA O151, standard construction.
- .3 Plywood, OSB and wood based composite panels: to CAN/CSA O325.

2.3 Accessories

- .1 Nails, spikes and staples: to CSA B111.
- .2 Bolts: 12.5 mm diameter unless indicated otherwise, complete with nuts and washers.
- .3 Proprietary fasteners: toggle bolts, expansion shields and lag bolts, screws and lead or inorganic fibre plugs, explosive actuated fastening devices, recommended for purpose by manufacturer.

2.4 Finishes

- .1 Galvanizing: to CAN/CSA G164, use galvanized fasteners for exterior work, pressure preservative treated lumber.
- .2 Where fasteners or accessories listed above are in contact with pressure treated lumber, separate wood from hardware with a foam cell gasket or use stainless steel finish.

2.5 Wood Preservative

- .1 Surface applied wood preservative: clear or copper naphthenate or 5% pentachlorophenol solution, water repellent preservative.
- .2 Pentachlorophenol use is restricted to building components that are in ground contact and subject to decay or insect attack only. Where used, pentachlorophenol treated wood must be covered with two coats of an appropriate sealer.
- .3 Structures built with wood treated with pentachlorophenol and inorganic arsenicals must not be used for storing food nor should the wood come in contact with drinking water.

2.6 Fire Retardant Treatment

- .4 Required at backing boards in electrical and telephone rooms and closets only. To comply with ULC S102. Flame spread rating 25 or less.

3 EXECUTION

ROUGH CARPENTRY FOR MINOR WORKS

3.1 Preparation

- .1 Treat surfaces of material with wood preservative, before installation.
- .2 Apply preservative by dipping, or by brush to completely saturate and maintain wet film on surface for minimum 3 minute soak on lumber and one minute soak on plywood.
- .3 Re treat surfaces exposed by cutting, trimming or boring with liberal brush application of preservative before installation.
- .4 Treat material as follows:
 1. Wood cants, fascia backing, curbs, nailers, sleepers on roof deck.
 2. Wood furring on outside surface of exterior masonry and concrete walls.
 3. Wood sleepers supporting wood subflooring over concrete slabs in contact with ground or fill.

3.2 Installation

- .1 Comply with requirements of the building code, supplemented by the following paragraphs.
- .2 Install furring and blocking as required to space out and support casework, cabinets, wall and ceiling finishes, facings, fascia, soffit, siding and other work as required.
- .3 Align and plumb faces of furring and blocking to tolerance of 1:600. D
- .4 Install rough bucks, nailers and linings to rough openings as required to provide backing for frames and other work.
- .5 Install wood cants, fascia backing, nailers, curbs and other wood supports as required and secure using steel fasteners.
- .6 Install wood backing, dressed, tapered and recessed slightly below top surface of roof insulation for roof hopper.
- .7 Install sleepers as indicated.
- .8 Use caution when working with particle board. Use dust collectors and high quality respirator masks.

3.3 Erection

- .1 Frame, anchor, fasten, tie and brace members to provide necessary strength and rigidity.
- .2 Countersink bolts where necessary to provide clearance for other work.

3.4 Back Board Installation

- .3 Provide electrical equipment backboards for mounting electrical equipment as indicated. Use 16 mm thick plywood on 19 x 38 mm furring around spacing, perimeter and at maximum 300 mm intermediate.

ROUGH CARPENTRY FOR MINOR WORKS

END OF SECTION