TABLE OF CONTENTS

END OF SECTION

SECTION 01 11 00

SUMMARY OF WORK

PART 1 GENERAL

1.1 SUMMARY

A. This section outlines in general the Work to be done under the Contract at the Water Treatment Research and Process Optimization Facility at the Winnipeg Water Treatment Plant.

B. Construct and test structures shown on the Contract Drawings and specified herein.

C. Supervise, organize, coordinate and direct construction operations of Sub-trades and Suppliers.

D. In addition to constructing the Works shown on the Drawings, design, construct, and maintain, unless otherwise specified or shown on the Contract drawings, temporary works and facilities required for the construction of the Works. Remove temporary works and facilities when construction is completed. Temporary works and facilities include, but are not limited to the following:
1. Formwork for concrete.
2. Falsework and bracing for formwork or for other parts of the Works while under construction.
3. Bracing and shoring for partially completed masonry, steelwork, precast concrete, or other assembly.
4. Scaffolding.
5. Temporary vehicular access and parking development, maintenance, and restoration.

1.2 WORK COVERED BY CONTRACT DOCUMENTS

A. The completed Work will provide the City with access to the equipment to be installed (by others) in the Water Treatment Research and Process Optimization Facility and provide a foundation for the equipment to be installed upon and includes a mezzanine, a walkway, and concrete pads.

B. The Contract includes but is not limited to the following Work:
1. Specifically the Work includes supplying and installing:
   a. Concrete equipment pads.
   b. Galvanized structural steel and aluminum grating and handrailing:
      1) Elevated mezzanine.
      2) Walkway.
      3) DAF tank support.
      4)
2. Cleaning up on completion.
3. Furnishing of materials, equipment, tools, implements, and labour.

4. Warranty period.

C. As an alternative to galvanized structural steel, the Bidder may supply & install aluminum structural members. If the Bidder chooses to provide a Bid for this option, the Bidder shall be required to engage a registered professional engineer licensed to practice in Manitoba to design the system with aluminum structural members. The design and drawings shall be sealed by a registered professional engineer licensed in Manitoba.

1.3 EQUIPMENT, MATERIAL, AND SERVICES PROVIDED BY THE CITY

A. The Contract Documents allow for an area on-site for the Contractor's use. The boundary limits must be strictly adhered to in order to minimize the impact to the natural conditions. If additional space is required, obtain agreement in writing from the City.

1.4 CONTRACT DRAWINGS

A. The Drawings are prepared in SI metric units.
Additional drawings showing details in accordance with which the Work is to be constructed may be supplied from time to time by the City or the Contract Administrator. Such drawings are for the information of and assistance to the Contractor and will not become a basis for extra payment. The City or the Contract Administrator may supply drawings covering additional work. These will be identified as additional work.

1.5 CONTRACT SPECIFICATIONS

A. For easy reference, the Contract Specifications are divided into divisions. Read the Specifications as a whole as details applicable to one division may appear in another division or divisions.

B. Coordinate and be responsible for the work done by Subcontractors.

1.6 WORK COMPLIANCE

A. Provide Work conforming to the lines, levels and grades specified or shown on the Contract Drawings.

B. Build Work in a thoroughly substantial and workmanlike manner, in accordance with the Contract Drawings and Specifications, subject to such modifications and additions as may be deemed necessary during its execution. In no case will payment be made for Work in excess of the requirements of the Drawings and Specifications, unless approved in writing by the Contract Administrator and the City.

1.7 ENGINEER DESIGN

A. Where specifications require work to be designed by an Engineer, engage an Engineer licensed in the Province of Manitoba to design such work.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION (Not Used)

END OF SECTION

SECTION 01 31 13

PROJECT COORDINATION

PART 1 GENERAL

1.1 RELATED WORK AT SITE

A. General:
1. Other work that is either directly or indirectly related to scheduled performance of the Work under these Contract Documents, listed henceforth, is anticipated to be performed at site by others.
2. Coordinate the Work of these Contract Documents with work of others as specified in General Conditions.
3. Include sequencing constraints specified herein as a part of progress schedule.

B. Other Installations:
1. Agency and Contact Person: City of Winnipeg.
2. Work to be performed by: City of Winnipeg and other Contractors.
a. Supply and installation of equipment, piping, electrical, and instrumentation and controls.

1.2 FACILITY OPERATIONS

A. Continuous operation of the City's facilities is of critical importance. Schedule and conduct activities to enable existing facilities to operate continuously, unless otherwise specified. In the event of conflict between construction activities and facility operations, facility operations have priority unless otherwise specified.

B. Do not close lines, open or close valves, or take other action which would affect the operation of existing systems, except as specifically required by the Contract Documents and after authorization by the City and the Contract Administrator. Such authorization will be considered within 48 hours after receipt of Contractor's written request.

1.3 ADJACENT FACILITIES AND PROPERTIES

A. Examination:
1. After Effective Date of the Agreement and before Work at site is started, Contractor, the Contract Administrator, and affected property owners shall make a thorough examination of pre-existing conditions including existing buildings, structures, and other improvements in vicinity of Work, as applicable, which could be damaged by construction operations.
2. Periodic reexamination shall be jointly performed to include, but not limited to, cracks in structures, settlement, leakage, and similar conditions.

B. Documentation:

1. Record and submit documentation of observations made on examination inspections in accordance with paragraph CONSTRUCTION PHOTOGRAPHS.
2. Upon receipt, the Contract Administrator will review, sign, and return one record copy of documentation to Contractor to be kept on file in field office.
3. Such documentation shall be used as indisputable evidence in ascertaining whether and to what extent damage occurred as a result of Contractor's operations, and is for the protection of adjacent property owners, Contractor, and the City.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION

3.1 CUTTING, FITTING, AND PATCHING

A. Cut, fit, adjust, or patch Work, to make Work complete.

B. Obtain prior written authorization of the Contract Administrator and the City before commencing Work to cut or otherwise alter:
   1. Structural or reinforcing steel, structural column or beam, elevated slab, trusses, or other structural member.
   2. Weather- or moisture-resistant elements.

C. Refinish surfaces to provide an even finish.
   1. Refinish continuous surfaces to nearest intersection.
   2. Refinish entire assemblies.
   3. Finish restored surfaces to such planes, shapes, and textures that no transition between existing work and Work is evident in finished surfaces.

D. Restore existing work and surfaces that are to remain in completed Work including concrete-embedded piping, conduit, and other utilities as specified and as shown.

E. Make restorations with new materials and appropriate methods as specified for new Work of similar nature; if not specified, use recommended practice of manufacturer or appropriate trade association.

F. Remove specimens of installed Work for testing when requested by the Contract Administrator.

END OF SECTION

SECTION 01 31 19

PROJECT MEETINGS

PART 1 GENERAL

1.1 GENERAL

A. The Contract Administrator will schedule physical arrangements for meetings throughout progress of the Work, prepare meeting agenda with regular participant input and distribute with written notice of each meeting, preside at meetings, record minutes to include significant proceedings and decisions, and reproduce and distribute copies of minutes within (7) seven calendar days after each meeting to participants and parties affected by meeting decisions.

B. The location of the meeting shall be the Winnipeg WTP.

1.2 PRECONSTRUCTION CONFERENCE

A. Contractor shall be prepared to discuss the following subjects, as a minimum:
1. Required schedules.
2. Status of Bonds and insurance.
3. Sequencing of critical path work items.
4. Progress payment procedures.
5. Project changes and clarification procedures.
6. Requirements for use of site, access, site signs, office and storage areas, security, utilities, hoarding and temporary facilities.
7. Major product delivery and priorities.
8. Contractor’s safety plan and representative.
9. Contractor’s environmental management plan.
10. Required Submittals.
11. Quality Control Plan.

B. The Preconstruction Meeting shall take place no later than ten (10) Working Days after the issuance of the Notice to Commence and shall be held at the Winnipeg WTP.

C. Attendees will include:
1. City’s representatives.
2. Subcontractors’ representatives whom Contractor may desire or the Contract Administrator may request to attend.
3. Contract Administrator’s representatives.
4. Others as appropriate.

1.3 PRELIMINARY SCHEDULES REVIEW MEETING

A. As set forth in Section 01 32 00, Construction Progress Documentation.

1.4 PROGRESS MEETINGS

A. The Contract Administrator will schedule two (2) progress meetings at site, to review the following:
   1. Health and safety issues.
   2. Review of any comments on the previous meeting summaries.
   3. Review of the progress of the Work including comments regarding the progress schedule.
   4. Schedule and status of Shop Drawing and Sample submittals.
   5. Status of Contractor-issued requests for information.
   6. Status of City-issued requests for quotation.
   7. Status of change orders.
   8. Status of Contractor claims.
   9. Status of Payment Certificates.
   10. Other matters needing discussion and resolution.

B. Attendees will include:
   1. City's representative(s), as appropriate.
   2. Contractor, Subcontractors, and Suppliers, as appropriate.
   3. Contract Administrator's representative(s).
   4. Others as appropriate.

1.5 QUALITY CONTROL AND COORDINATION MEETINGS

A. Scheduled by the Contract Administrator in conjuction with the progress meetings to review test and inspection reports, and other matters relating to quality control of the Work and work of other contractors.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION (Not Used)

END OF SECTION

SECTION 01 32 00

CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 GENERAL

1.1 SUBMITTALS

A. Informational Submittals:
   1. Detailed Progress Schedule:
      a. Submit initial detailed progress schedule within ten calendar (10) days after Effective Date of the Agreement.
      b. Submit an updated progress schedule at each update, in accordance with Article DETAILED PROGRESS SCHEDULE.
   2. Submit with each progress schedule submission:
      a. Contractor's certification that progress schedule submission is actual schedule being utilized for execution of the Work.
      b. Progress Schedule: Six legible copies.
      c. One electronic copy in Microsoft Project and PDF
      d. Narrative Progress Report: Same number of copies as specified for progress schedule.
   3. Prior to final payment, submit a final updated progress schedule.

1.2 DETAILED PROGRESS SCHEDULE

A. In addition to requirements of General Conditions, submit detailed progress schedule beginning with Notice to Proceed and continuing through Completion.

B. Show the duration and sequences of activities required for complete performance of the Work reflecting means and methods chosen by Contractor.

C. When accepted by the Contract Administrator, detailed progress schedule will become baseline schedule. Subsequent revisions will be considered as updated progress schedules.

D. Format: In accordance with Article PROGRESS SCHEDULE - BAR CHART.

E. Update bi-weekly to reflect actual progress and occurrences to date, including weather delays.

1.3 PROGRESS SCHEDULE – BAR CHART

A. Format:
   1. Unless otherwise approved, white paper, 11-inch by 17-inch sheet size.
   2. Title Block: Show name of project and the City, date submitted, revision or update number, and name of scheduler.
   3. Identify horizontally, across the top of the schedule, the time frame by year, month, and day.

4. Identify each activity with a unique number and a brief description of the Work associated with that activity.
5. Legend: Describe standard and special symbols used.

B. Contents: Identify, in chronological order, those activities reasonably required to complete the Work, including as applicable, but not limited to:
1. Obtaining permits, submittals for early product procurement, and long lead time items.
2. Mobilization and other preliminary activities.
3. Specified work sequences, constraints, and Milestones, including Substantial Performance date(s).
4. Subcontract work.
5. Concrete work.
6. Structural steel work.
7. Project closeout and cleanup.
8. Demobilization.

1.4 PROGRESS OF THE WORK

A. Updated progress schedule shall reflect:
1. Progress of Work to within five (5) working days prior to submission.
2. Approved changes in Work scope and activities modified since submission.
3. Delays in submittals or resubmittals, deliveries, or Work.
4. Adjusted or modified sequences of Work.
5. Other identifiable changes.
6. Revised projections of progress and completion.
7. Report of changed logic.

B. If Contractor fails to complete activity by its latest scheduled completion date and this failure is anticipated to extend Contract Times (or Milestones), Contractor shall, within seven (7) calendar days of such failure, submit a written statement as to how Contractor intends to correct nonperformance and return to acceptable current progress schedule. Actions by Contractor to complete the Work within Contract Times (or Milestones) will not be justification for adjustment to Contract Price or Contract Times.

C. The City may order Contractor to increase plant, equipment, labour force, or working hours if Contractor fails to:
1. Complete a Milestone activity by its completion date.
2. Satisfactorily execute Work as necessary to prevent delay to overall completion of Project, at no additional cost to the City.

1.5 SCHEDULE ACCEPTANCE

A. The Contract Administrator’s acceptance will demonstrate agreement that:
1. Proposed schedule is accepted with respect to:
a. Contract Times, including Completion and all intermediate Milestones are within the specified times.
b. Specified Work sequences and constraints are shown as specified.
c. Access restrictions are accurately reflected**.**

d. Submittal review times are as specified.

2. In all other respects, the Contract Administrator's acceptance of Contractor's schedule indicates that, in the Contract Administrator's judgment, schedule represents reasonable plan for constructing Work in accordance with the Contract Documents. The Contract Administrator's review will not make any change in Contract requirements. Lack of comment on any aspect of schedule that is not in accordance with the Contract Documents will not thereby indicate acceptance of that change, unless Contractor has explicitly called the nonconformance to the Contract Administrator's attention in submittal. Schedule remains Contractor's responsibility and Contractor retains responsibility for performing all activities, for activity durations, and for activity sequences required to construct Work in accordance with the Contract Documents.

B. Unacceptable Detailed Progress Schedule:

1. Make requested corrections; resubmit within ten (10) days.
2. Until acceptable to the Contract Administrator as baseline progress schedule, continue review and revision process.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION (Not Used)

END OF SECTION

SECTION 01 33 00

SUBMITTAL PROCEDURES

PART 1 GENERAL

1.1 DEFINITIONS

A. Action Submittal: Written and graphic information submitted by Contractor, that requires the Contract Administrator's review.

B. Informational Submittal: Information submitted by Contractor, that does not require the Contract Administrator's review. Submittals not meeting conditions of the Contract will be returned.

1.2 PROCEDURES

A. Direct submittals to the Contract Administrator at the following address, unless specified otherwise.
   1. CH2M HILL Canada Limited
      1301 Kenaston Boulevard
      Winnipeg, MB R3P2P2
      Canada
      Attn: Kelly Griffiths, M.A.Sc.
      Email: Kelly.Griffiths@ch2m.com

B. Electronic Submittals: Submittals shall be made in electronic format.
   1. Each submittal shall be electronic file in Adobe Acrobat Portable Document Format (PDF). Use latest version available at time of execution of Agreement.
   2. Electronic files that contain more than 10 pages in PDF format shall contain internal book marking from index page to major sections of document.
   3. PDF files shall be set to open "Bookmarks and Page" view.
   4. Add general information to each PDF file, including title, subject, author, and keywords.
   5. PDF files shall be set up to print legibly at 8.5 inches by 11 inches, or 11 inches by 17 inches. No other paper sizes will be accepted.
   6. Submit new electronic files for each resubmittal.
   7. Include copy of Transmittal of Contractor's Submittal form, located at end of section, with each electronic file.
   8. Detailed procedures for handling electronic submittals will be discussed at Preconstruction Conference.
   9. Limit size of each electronic transmission to 8 MB.

C. List of Submittals
   1. For each specification section submittal, Contractor shall provide a table listing all the submittals anticipated for that specification section. The table shall include the following information:

a. Specification Section.
b. Total Number of Submittals for this section.
c. Shop drawings associated with each submittal.
d. Revision and status for each submittal.

D. Transmittal of Submittal:
1. Contractor shall:
a. Review each submittal and check for compliance with Contract Documents.
b. Stamp each submittal with uniform approval stamp before submitting to the Contract Administrator.
1) Stamp to include Project name, submittal number, Specification number, Contractor's reviewer name, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with Contract Documents.
2) The Contract Administrator will not review submittals that do not bear Contractor's approval stamp and will return them without action.
3) The Contract Administrator will not review submittals received directly from a Subcontractor or Supplier and will return them without action.
2. Complete, sign, and transmit with each submittal package, one Transmittal of Contractor's Submittal form. Format to be as per Supplement-1 attached at end of this section or in alternate format approved by the Contract Administrator.
3. Identify each submittal with the following:
a. Numbering and Tracking System:
1) Sequentially number each submittal.
2) Resubmission of submittal shall have original number with sequential alphabetic suffix.
b. Specification section and paragraph to which submittal applies.
c. Project title.
d. Date of transmittal.
e. Names of Contractor, Subcontractor or Supplier, and manufacturer as appropriate.
4. Identify and describe each deviation or variation from Contract Documents.
5. Include Contractor's written response to each of the Contract Administrator's review comments with resubmission of submittals stamped "Exceptions Noted, Resubmit".
6. Submit Contractor's written acknowledgement and acceptance of each of the Contract Administrator's review comments on submittals stamped "Exceptions Noted".

E. Format:
1. Do not base Shop Drawings on reproductions of Contract Documents.

2. Package submittal information by individual Specification section. Do not combine different Specification sections together in submittal package, unless otherwise directed in Specification.
3. Present in a clear and thorough manner and in sufficient detail to show kind, size, arrangement, and function of components, materials, and devices, and compliance with Contract Documents.

F. Timeliness:
1. Schedule and submit in accordance with schedule of Shop Drawing and Sample submittals, and requirements of individual Specification sections.
2. Submit Shop Drawings and Samples well in advance of scheduled delivery date for associated equipment or material.
3. Coordinate submittals prepared by multiple trades such that information is available to allow prior review and sufficient review time where work of one trade interfaces with or affects work of another.

G. Processing Time:
1. Time for review shall commence on the Contract Administrator's receipt of submittal.
2. The Contract Administrator will act upon Contractor's submittal and transmit response to Contractor not later than eight (8) calendar days after receipt, unless otherwise specified.
3. Resubmittals will be subject to same review time.
4. Allow additional review time for complex equipment and systems.

H. Resubmittals:
1. Clearly identify each correction or change made and include revision date.
2. Provide clear response to each itemized comment by the Contract Administrator on the submittal, whether or not action has been taken, and description of action.
3. No adjustment of Contract Times or Price will be allowed due to delays in progress of Work caused by rejection and subsequent resubmittals.

I. Incomplete Submittals:
1. The Contract Administrator will return entire submittal for Contractor's revision if preliminary review deems it incomplete.
2. When any of the following are missing, submittal will be deemed incomplete:
    a. Contractor's review stamp, completed and signed.
    b. Transmittal of Contractor's Submittal, completed and signed.
    c. All requested information is not provided.
    d. Submittals missing Professional Engineer's seal and signature, where it is required.

J. Submittals not required by Contract Documents:
1. Will not be reviewed and will be returned stamped "Not Subject to Review."
2. The Contract Administrator will keep one copy and return all remaining copies to Contractor.

K. Do not revise submittals after they have been reviewed and stamped "No Exceptions Taken" or "Exceptions Noted".

L. The Contract Administrator will complete up to two reviews of each submittal at no cost to Contractor. The City will deduct cost of additional reviews from Contract Price.

1.3 ACTION SUBMITTALS

A. General:
1. Prepare and submit Action Submittals required by individual Specification sections.
2. The Contract Administrator will review Action Submittals only for general conformance with design concept and general compliance with Contract Documents. The Contract Administrator's review does not relieve Contractor from compliance with requirements of Contract Documents nor from errors in submittals or Contractor's design.
3. Contractor is responsible for confirmation of dimensions at jobsite; fabrication processes; means, methods techniques, sequences and procedures of construction; coordination of Work of all trades; and performance of Work in safe and satisfactory manner.
4. At the Contract Administrator's option, the Contract Administrator's review comments and review stamp will be placed either directly on submitted copies of Shop Drawings or on separate submittal review comment form.

B. Shop Drawings:
1. Copies: Six, and one reproducible electronic copy via email, except copyrighted documents. Six copies of copyrighted materials and one electronic copy.
2. Identify and Indicate:
   a. Applicable Contract Drawing and Detail number, products, units and assemblies, and system or equipment identification or tag numbers.
   b. Equipment and Component Title: Identical to title shown on Drawings.
   c. Critical field dimensions and relationships to other critical features of Work. Note dimensions established by field measurement.
   d. Project-specific information drawn accurately to scale.
3. Manufacturer's standard schematic drawings and diagrams as follows:
   a. Modify to delete information that is not applicable to the Work.
   b. Supplement standard information to provide information specifically applicable to the Work.
4. Product Data: Provide as specified in individual Specifications.
5. Foreign Manufacturers: When proposed, include following additional information:
   a. Names and addresses of at least two companies that maintain technical service representatives close to Project.
   b. Complete list of spare parts and accessories for each piece of equipment.
6. Units: Submit all Shop Drawings in SI metric units.
7. Required submittals include but are not limited to:

a. Catalogue Drawings: Include reprints of catalogue drawings of proprietary articles of standard fabrication and manufacture for the work.
b. Shop Drawings: Include dimensioned line drawings and related specifications, information and literature for custom fabricated articles and equipment.
c. ISA data sheets for all instruments.

C. Samples:
1. Copies: Two, unless otherwise specified in individual Specifications.
2. Preparation: Mount, display, or package Samples in manner specified to facilitate review of quality. Attach label on unexposed side that includes the following:
   a. Manufacturer name.
   b. Model number.
   c. Material.
   d. Sample source.
3. Manufacturer's Color Chart: Units or sections of units showing full range of colors, textures, and patterns available.
4. Full-size Samples:
   a. Size as indicated in individual Specification section.
   b. Prepared from same materials to be used for the Work.
   c. Cured and finished in manner specified.
   d. Physically identical with product proposed for use.
5. Do not use materials in Work which are in any way inferior to Samples submitted and reviewed. Match accepted samples.
6. Review of samples notwithstanding, materials that are unsound or imperfect when delivered to site will be rejected.
7. Retain reviewed samples on site readily available to the Contract Administrator.

D. Action Submittal Dispositions: the Contract Administrator will review, mark, and stamp as appropriate, and distribute marked-up copies or submittal review comment forms as noted:
1. No Exceptions Taken (NET):
   a. Contractor may incorporate product(s) or implement Work covered by submittal.
   b. Distribution:
      1) One copy furnished the City via email
      2) One copy furnished Resident Project Representative.
      3) One copy retained in the Contract Administrator's file.
      4) Remaining copies returned to Contractor appropriately annotated via email.
2. Exceptions Noted (EN):
   a. Contractor may incorporate product(s) or implement Work covered by submittal, in accordance with the Contract Administrator's notations.
   b. Distribution:
      1) One copy furnished the City via email

2) One copy furnished Resident Project Representative.
3) One copy retained in the Contract Administrator's file.
4) Remaining copies returned to Contractor appropriately annotated via email.

3. Exceptions Noted, Resubmit (ENR):
   a. Make corrections or obtain missing portions, and resubmit.
   b. Contractor may not incorporate product(s) or implement Work covered by submittal, except portions where indicated Contractor may begin to incorporate product(s) or implement Work covered by the submittal in accordance with the Contract Administrator's notations.
   c. Distribution:
      1) One copy retained in the Contract Administrator's file.
      2) Remaining copies returned to Contractor appropriately annotated via email.

1.4 INFORMATIONAL SUBMITTALS

A. General:
1. Copies: Submit one reproducible electronic copy via email unless otherwise indicated in individual Specification section.
2. Refer to individual Specification sections for specific submittal requirements.
3. Where work is to be designed by Contractor, comply with applicable codes and submit Shop Drawings signed and sealed by professional engineer licensed in province of Work.
4. The Contract Administrator will review each submittal for general conformance with design intent and general compliance with Contract Documents. The Contract Administrator's review does not relieve the Contractor from compliance with requirements of Contract documents nor from errors in the submittal or Contractor's design.

B. Certificates:
1. General:
   a. Provide notarized statement that includes signature of entity responsible for preparing certification.
   b. Signed by officer or other individual authorized to sign documents on behalf of that entity.
2. Welding: In accordance with individual Specification sections.
3. Material Test: Prepared by qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements.
4. Certificates of Successful Testing or Inspection: Submit when testing or inspection is required by Laws and Regulations or governing agency or specified in individual Specification sections.

C. Photographs: In accordance with Section 01 31 13, Project Coordination, and as may otherwise be required in Contract Documents.

D. Contract Closeout Submittals: In accordance with Section 01 77 00, Closeout Procedures

E. Contractor-Design Data:
1. Written and graphic information.
2. List of assumptions.
3. List of performance and design criteria.
4. Summary of loads or load diagram, if applicable.
5. Calculations.
6. List of applicable codes and regulations.
7. Name and version of software.
8. Information requested in individual Specification section.
9. Seal and signature of professional engineer licensed in the province of Manitoba.

F. Schedules:
1. Schedule of Shop Drawing and Sample Submittals: Prepare separately or in combination with Progress Schedule as specified in Section 01 32 00, Construction Progress Documentation.
    a. Show for each, at a minimum, the following:
        1) Specification section number.
        2) Identification by numbering and tracking system as specified under Paragraph Transmittal of Submittal.
        3) Estimated date of submission to the Contract Administrator, including reviewing and processing time.
    b. On a monthly basis, submit updated schedule to the Contract Administrator if changes have occurred or resubmittals are required.
2. Progress Schedules: In accordance with Section 01 32 00, Construction Progress Documentation.

G. Special Guarantee: Supplier's written guarantee as required in individual Specification sections.

H. Statement of Qualification: Evidence of qualification, certification, or registration as required in Contract Documents to verify qualifications of professional land surveyor, engineer, materials testing laboratory, specialty Subcontractor, trade, Specialist, consultant, installer, and other professionals.

I. Submittals Required by Laws, Regulations, and Governing Agencies:
1. Submit promptly notifications, reports, certifications, payrolls, and otherwise as may be required, directly to the applicable federal, provincial, or local governing agency or their representative.
2. Transmit to the Contract Administrator for the City's records one copy of correspondence and transmittals (to include enclosures and attachments) between Contractor and governing agency.

J. Test and Inspection Reports:
1. General:
    a. Shall contain signature of person responsible for test or report.
2. Factory:

a. Identification of product and Specification section, type of inspection or test with referenced standard or code.
b. Date of test, Project title and number, and name and signature of authorized person.
c. Description of inspection, test results, adjustments made, quantitative results, and suggestions for precautions to be taken for correct maintenance.
d. If test or inspection deems material or equipment not in compliance with Contract Documents, identify corrective action necessary to bring into compliance.
e. Provide interpretation of test results, when requested by the Contract Administrator.
f. Other items and requirements as identified in individual Specification sections.

3. Field: As a minimum, include the following:
   a. Project title and number.
   b. Date and time.
   c. Record of temperature and weather conditions.
   d. Identification of product and Specification section.
   e. Type and location of test, Sample, or inspection, including referenced standard or code.
   f. Date issued, testing laboratory name, address, and telephone number, and name and signature of laboratory inspector.
   g. If test or inspection deems material or equipment not in compliance with Contract Documents, identify corrective action necessary to bring into compliance.
   h. Provide interpretation of test results, when requested by the Contract Administrator.
   i. Other items as identified in individual Specification sections.
   j. Inspection Includes:
      1) Soundness (without cracked or otherwise damaged parts).
      2) Completeness of installation as specified and as recommended by manufacturer.
      3) Correctness of setting, alignment, and relative arrangement of various parts of system.
   k. Submit notice in writing at least 48 hours before manufacturer's representative is scheduled to perform these services.
   l. Modify or replace equipment or materials failing required tests.
   m. Perform additional testing required due to changes of materials requested by Contractor or due to failure of materials or construction to meet specifications.
   n. Mandatory forms follow this section include: Concrete Pour Release Form, Contractor Submittal Transmittal, Extra Work Report, and Pressure Testing Report.

K. As-Built Documents: In accordance with Section 01 77 00, Closeout Procedures.

1.5 SUPPLEMENTS

A. The supplements listed below, following "End of Section", are part of this Specification.
1. Forms: Transmittal of Contractor's Submittal

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION (Not Used)

END OF SECTION

CH2MHILL

TRANSMITTAL OF CONTRACTOR'S SUBMITTAL
(ATTACH TO EACH SUBMITTAL)

DATE: _____

TO: _____

_____

_____

_____

_____

FROM: _____
Contractor

_____

_____

_____

Submittal No.: _____

☐ New Submittal ☐ Resubmittal

Project: _____

Project No.: _____

Specification Section No.: _____
(Cover only one section with each transmittal)

Schedule Date of Submittal:

_____

SUBMITTAL TYPE:	☐ Shop Drawing	☐ Sample	☐ Informational

The following items are hereby submitted:

Number of Copies	Description of Item Submitted (Type, Size, Model Number, Etc.)	Spec. and Para. No.	Drawing or Brochure Number	Contains Variation to Contract	
				No	Yes

Contractor hereby certifies that (i) Contractor has complied with the requirements of Contract Documents in preparation, review, and submission of designated Submittal and (ii) the Submittal is complete and in accordance with the Contract Documents and requirements of laws and regulations and governing agencies.

By: _____
Contractor (Authorized Signature)

SECTION 01 35 29.01

HEALTH AND SAFETY

PART 1 GENERAL

1.1 REFERENCES

A. Canadian Standards Association (CSA):
1. Z797, Code of Practice for Access Scaffold – First Edition.

B. Workplace Safety and Health Act of Manitoba .

C. Canada Labour Code, Part 1, Canada Occupational Safety and Health Regulations

D. The Workers Compensation Act RSM 1987 – Updated 2006.

1.2 CONSTRUCTION – SAFETY MEASURES

A. The Contractor shall meet or exceed the latest revision of all local, federal, provincial laws, regulations, standards, and industry best practices relating to health and safety. Be solely responsible for safety of the Work under this Contract and for complying with and ensuring that every person on the Site complies with the requirements contained within the Contract documents and regulatory requirements.

B. Perform the Work, or ensure that it is performed, in a manner to avoid risk of injury, security or damage to persons or property, adjacent property, or environment.

C. Perform a health and safety pre-qualification of all lower-tiered subcontractors prior to contract award and only accept lower-tiered subcontractors that have demonstrated an ability to comply with health and safety requirements and are below industry average for incidents.

D. Provide safe access, egress, and equipment in accordance with the Workplace Safety & Health Regulation and Occupational Safety and Health Regulations for entry into all areas by employees, subcontractors, the City, and the Contract Administrator. Where hazardous areas or confined space entry exists, implement procedures defined by the latest revision of the applicable Occupational Health and Safety Regulations or the Electrical Code.

E. Designate a qualified safety representative at the Project site with responsibility for preventing accidents and implementing and supervising the Health and Safety Plan and other safety programs. The safety representative shall attend all project safety meetings, participate fully in all activities outlined in the Health and Safety Plan and shall devote whatever time is necessary to perform such duties properly. Contractor’s safety representative shall provide the City and the Contract Administrator with requested information and shall have the authority to immediately correct safety deficiencies.

F. Prior to the commencement of the Work, review and become fully familiarized with all local, provincial, and federal regulatory requirements and the following documentation:
   1. **Winnipeg WTP** site safety rules, emergency evacuation, spill response procedures, permits, and other applicable procedures.
   2. Contract Documents.

G. In event of a conflict between any provisions of the various regulatory requirements, the most stringent provision shall govern.

H. Ensure that all employees and subcontractors are competent, as prescribed by the applicable legislation, in performing the Work and have been trained accordingly.

I. At least five (5) business days prior to commencement of any Work, throughout the Work as required, and at the City's request, make the following documentation available:
   1. A copy of the Contractor's project specific Health and Safety Plan.
   2. Emergency response and evacuation procedures, including local contact names and numbers.
   3. Procedures in the event of a spill including local contact names and numbers.
   4. Training and orientation training records of employees or subcontractors.
   5. Applicable Material Safety Data Sheets.

J. Provide and maintain first aid, hygiene, washrooms, potable water, and fire prevention equipment, at the Site in accordance with the applicable regulatory requirements.

K. Establish, maintain, and mark clear paths of access and egress for routine and emergency personnel and vehicles.

L. Erect signage acceptable to the City at all entry points to the Site identifying the name, address, and telephone number of the Contractor and to advise personnel and visitors entering the Site of the requirements respecting entry.

M. Ensure adequate coordination and communication between all parties on site in regards to safety.

N. In addition to Workplace Safety and Health Act and applicable Regulations reporting requirements, report all incidents, near misses, spills, environmental damage, and property damage to the City and the Contract Administrator immediately. An incident investigation must be conducted and a copy of the complete report provided to the City and the Contract Administrator within 24 hours.

O. Provide a copy of all Ministry of Labour inspection reports, orders, and charges to the City and the Contract Administrator immediately.

1.3 SPECIAL PROTECTION AND PRECAUTIONS

A. Comply with the Winnipeg WTP Health and Safety Procedures where necessary. The City will provide orientation to a specified representative of the Constructor. Provide orientation training to all Contractor's staff, subcontractors, the Contract Administrator, and visitors on Site and maintain a record of this training.

1.4 WORKPLACE HAZARDOUS MATERIALS INFORMATION SYSTEM

A. Comply with applicable health and safety regulatory requirements, including but not limited to Workplace Hazardous Materials Information System (WHMIS) regulations.

B. Maintain a copy of the current Material Safety Data Sheets (MSDSs) for all hazardous chemicals or substances brought onsite by Contractor or any lower-tiered subcontractors.

C. If such materials or substances are part of any item requiring a shop drawing or other submittal, provide the MSDS with the submittal.

D. Provide and maintain a copy of MSDSs to the City and Contract Administrator.

1.5 MATERIAL HANDLING

A. Store, stack, place, remove, and handle materials on Site in a stable and secure manner so as not to endanger the safety of personnel or cause damage to property.

B. Secure materials which, by virtue of their configuration or weight, cannot be stored or stacked in a secure and stable manner, against tipping, collapse, or falling by use of appropriate bracing systems, structures, or equipment.

C. Ensure that vehicles, construction machinery, and materials handling equipment are only operated on the Project by persons suitably qualified to do so.

1.6 CITY'S HEALTH AND SAFETY AUDITOR

A. The Contractor acknowledges that the City may employ the services of an Occupational Health and Safety Auditor, an Environmental Inspector, or other authorized inspector knowledgeable in the local statutes, laws, or by laws for the purpose of conducting inspections of the Site.

B. Grant the Auditor, Inspector, or any other inspector full and unimpeded access to the Site, at all times, and immediately comply with any direction issued by the Auditor, Inspector, the City, or any other inspector.

C. This provision does not impact the Constructor status or negate regulatory responsibilities of the Contractor. The intent is to exercise due diligence as the City.

D. The Contractor's Health and Safety representative shall accompany the Safety Auditor on Site visits where requested.

E. The Safety Auditor will report any observations made during inspections and audits and assign these to the Contractor. The Contractor will be granted access to these documents. It will be the responsibility of the Contractor to review these documents and take whatever action is necessary to fulfill its responsibility as the Constructor.

1.7 PERMITS

A. Observe rules of the Facility and the City.

B. Prior to starting work which requires welding, cutting, open flame, or heat, complete and obtain approval on a Welding and Cutting Permit or Hot Work Permit from the City or the Contract Administrator.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION (Not Used)

END OF SECTION

SECTION 01 41 00

REGULATORY REQUIREMENTS

PART 1 GENERAL

1.1 APPLICABLE CODES

A. Comply with the latest edition of the codes and standards referenced in Contract Documents and following statutes and codes and all amendments thereto:
   1. Manitoba Workplace Health and Safety Act.
   2. National Building Code of Canada, with Manitoba Amendments.
   3. Occupational Health and Safety Act and Regulations for Construction Projects, covering safety, hazardous materials, and Workplace Hazardous Material Information.
   4. Manitoba Building Code.
   5. Canadian Environmental Protection Act.
   6. Environment Act, Manitoba.
   7. Workers Compensation Board.
   8. Codes and Standards of the National Fire Protection Association (NFPA).
   9. Manitoba Fire Code Regulation 216/2006

1.2 PERMITS, APPROVALS, AND LICENCES

A. The Contractor will obtain and pay only for the building permit, if required.

B. The City will provide Contractor with a clean set of Drawings and Specifications, as necessary, for each application.

C. Arrange for regular inspections and a final inspection with:
   1. Building Inspector.

D. Arrange for all other regular inspections and final inspections required.

E. The Contractor shall be solely responsible, without limitations, for any delays arising from the Contractor's failure to plan for the required inspections and to ascertain the availability of the Permit/Approval/Licensing Inspectors to complete the required inspections for the Works under this Contract. The related costs and expenses incurred by the Contractor shall be borne by the Contractor, with no change in the Contract Price and/or Contract Time.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION (Not Used)

END OF SECTION

SECTION 01 45 16.13

CONTRACTOR QUALITY CONTROL

PART 1 GENERAL

1.1 QUALITY CONTROL

A. The City may provide services of independent inspection company to perform the following routine quality control services, at no cost to the Contractor:
   1. Concrete cylinder testing, aggregate testing and cement testing for both cast-in-place concrete and precast concrete items.
   2. Welding of structural steel.
   3. Load tests of structural items.

B. The City's tests do not relieve Contractor of his own quality control.

C. The City may request samples at any reasonable time. Provide concrete and other materials for tests as may be required.

D. Additional testing required to prove the adequacy of construction shall be at Contractor's expense, where the routine test shows the construction to be inadequate or where Contractor's materials and procedures have not been as specified or when work has proceeded without observation.

E. Such additional testing or retesting will be performed by a testing agency approved by the City.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION (Not Used)

END OF SECTION

SECTION 01 61 00

COMMON PRODUCT REQUIREMENTS

PART 1 GENERAL

1.1 REFERENCES

A. National Building Code of Canada, with Manitoba Amendments.

1.2 DEFINITIONS

A. Products:
   1. New items for incorporation in the Work, whether purchased by Contractor or the City for the Project.

1.3 DESIGN REQUIREMENTS

A. Provide systems, equipment, and components, including supports and anchorages, in accordance with provisions of latest edition of the National Building Code of Canada, with Manitoba Amendments.

1.4 PREPARATION FOR SHIPMENT

A. When practical, factory assemble products. Mark or tag separate parts and assemblies to facilitate field assembly. Cover machined and unpainted parts that may be damaged by the elements with strippable protective coating.

B. Package products to facilitate handling and protect from damage during shipping, handling, and storage. Mark or tag outside of each package or crate to indicate its purchase order number, bill of lading number, contents by name, name of Project and Contractor, equipment number, and approximate weight. Include complete packing list and bill of materials with each shipment.

C. Extra Materials, Special Tools, Test Equipment, and Expendables:
   1. Furnish as required by individual Specifications.
   2. Deliver materials to site.
   3. Notify the City upon arrival for transfer of materials.
   4. Replace extra materials and special tools found to be damaged or otherwise inoperable at time of transfer to the City.

1.5 DELIVERY AND INSPECTION

A. Deliver products in accordance with accepted current progress schedule and coordinate to avoid conflict with the Work and conditions at site. Deliver anchor bolts and templates sufficiently early to permit setting prior to placement of structural concrete.

B. Deliver products in undamaged condition, in manufacturer's original container or packaging, with identifying labels intact and legible. Include on label, date of manufacture and shelf life, where applicable. Include ULC labels on products so specified.

C. Unload products in accordance with manufacturer's instructions for unloading or as specified. Record receipt of products at site. Inspect for completeness and evidence of damage during shipment.

D. Remove damaged products from site and expedite delivery of identical new undamaged products, and remedy incomplete or lost products to provide that specified, so as not to delay progress of the Work.

PART 2 PRODUCTS

2.1 GENERAL

A. Regulatory Requirement: Coating materials shall meet federal, provincial, and local requirements limiting the emission of volatile organic compounds and for worker exposure.

B. Bolted Connections: Project bolt ends minimum 3 mm but not more than one bolt diameter beyond nut faces.

2.2 FABRICATION AND MANUFACTURE

A. General:
1. Manufacture parts to North American standard sizes and gauges.
2. Two or more items of the same type shall be identical, by the same manufacturer, and interchangeable.
3. Design structural members for anticipated shock and vibratory loads.
4. Modify standard products as necessary to meet performance Specifications.

PART 3 EXECUTION

3.1 INSPECTION

A. Inspect materials and equipment for signs of pitting, rust decay, or other deleterious effects of storage. Do not install material or equipment showing such effects. Remove damaged material or equipment from the site and expedite delivery of identical new material or equipment. Delays to the Work resulting from material or equipment damage that necessitates procurement of new products will be considered delays within Contractor's control.

3.2 FIELD FINISHING

A. In accordance with Section 09 90 00, Painting and Coating and individual Specification sections.

END OF SECTION

SECTION 01 77 00

CLOSEOUT PROCEDURES

PART 1 GENERAL

1.1 SUBMITTALS

A. Informational Submittals:
   1. Submit prior to application for final payment:
      a. Record Documents.
      b. Approved Shop Drawings and Samples.
      c. Special Bonds, Special Guarantees, and Service Agreements.
      d. Releases or Waivers of Liens and Claims: As required in General Conditions.
      e. Releases from Agreements.
      f. Extra Materials: As required by individual Specification sections.

1.2 RECORD DOCUMENTS

A. Quality Assurance:
   1. Furnish qualified and experienced person, whose duty and responsibility shall be to maintain record documents.
   2. Accuracy of Records:
      a. Coordinate changes within record documents, making legible and accurate entries on each sheet of Drawings and other documents where such entry is required to show change.
      b. Purpose of Project record documents is to document factual information regarding aspects of the Work, both concealed and visible, to enable future modification of the Work to proceed without lengthy and expensive site measurement, investigation, and examination.
   3. Make entries within 24 hours after receipt of information that a change in the Work has occurred.
   4. Prior to submitting each request for progress payment, request the Contract Administrator's review and approval of current status of record documents. Failure to properly maintain, update, and submit record documents may result in a deferral by the Contract Administrator to recommend whole or any part of Contractor's Application for Payment, either partial or final.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION

3.1 MAINTENANCE OF RECORD DOCUMENTS

A. General:
1. Promptly following commencement of Contract Times, secure from the Contract Administrator at no cost to Contractor, one complete set of Contract Documents.
2. Delete Engineer title block and seal from all documents.
3. Label or stamp each record document with title, "RECORD DOCUMENTS," in neat large printed letters.
4. Record information concurrently with construction progress and within 24 hours after receipt of information that change has occurred. Do not cover or conceal Work until required information is recorded.

B. Preservation:
1. Maintain documents in a clean, dry, legible condition and in good order. Do not use record documents for construction purposes.
2. Make documents and Samples available at all times for observation by the Contract Administrator.

C. Making Entries on Drawings:
1. Using an erasable colored pencil (not ink or indelible pencil), clearly describe change by graphic line and note as required.
   a. Color Coding:
      1) Green when showing information deleted from Drawings.
      2) Red when showing information added to Drawings.
      3) Blue and circled in blue to show notes.
2. Date entries.
3. Call attention to entry by "cloud" drawn around area or areas affected.
4. Legibly mark to record actual changes made during construction, including, but not limited to:
   a. Depths of various elements of foundation in relation to finished first floor data if not shown or where depth differs from that shown.
   b. Horizontal and vertical locations of existing and new Underground Facilities and appurtenances, and other underground structures, equipment, or Work. Reference to at least two measurements to permanent surface improvements.
   c. Location of internal utilities and appurtenances concealed in the construction referenced to visible and accessible features of the structure.
   d. Locate existing facilities, piping, equipment, and items critical to the interface between existing physical conditions or construction and new construction.
   e. Changes made by Addenda and Field Orders, Work Change Directive, Change Order, Written Amendment, and the Contract Administrator's

written interpretation and clarification using consistent symbols for each and showing appropriate document tracking number.

5. Dimensions on Schematic Layouts: Show on record drawings, by dimension, the centerline of each run of items such as are described in previous subparagraph above.
   a. Clearly identify the item by accurate note such as “cast iron drain,” “galv. water,” and the like.
   b. Show, by symbol or note, vertical location of item (“under slab,” “in ceiling plenum,” “exposed,” and the like).
   c. Make identification so descriptive that it may be related reliably to Specifications.

3.2 FINAL CLEANING

A. At completion of the Work or of a part thereof and immediately prior to Contractor’s request for Certificate of Substantial Performance; or if no certificate is issued, immediately prior to Contractor’s notice of completion, clean entire site or parts thereof, as applicable.
   1. Leave the Work and adjacent areas affected in a cleaned condition
   2. Remove grease, dirt, dust, paint or plaster splatter, stains, labels, fingerprints, and other foreign materials from exposed surfaces.
   3. Repair, patch, and touch up marred surfaces to specified finish and match adjacent surfaces.
   4. Clean floors.
   5. Hose clean loading areas.

B. Use only cleaning materials recommended by manufacturer of surfaces to be cleaned.

END OF SECTION

SECTION 03 30 00

CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.1 SUMMARY

A. Comply with Division 1, General Requirements.

B. Comply with requirements of CSA A23.1 and A23.2, except where noted otherwise in this Specification.

C. The following sections form part of this Section:
1. Section 03 60 00, Grouting.

D. Do not use materials that are toxic in installed condition. Do not use volatile organic compounds where not permitted by law. Where use of volatile organic compounds is permitted, provide adequate ventilation and take necessary safety precautions.

E. Section Includes:
1. Normal-density concrete.

1.2 DEFINITIONS

A. Exposed Concrete: Visible concrete surfaces inside or outside of structures, including surfaces above liquid level.

B. Defective Areas: Surface defects that include honeycomb, rock pockets, indentations greater than 5 mm, cracks 0.1 mm or wider as well as any crack that leaks in hydraulic structures and below grade habitable spaces; cracks 0.25 mm and wider in non hydraulic structures, spalls, chips, air bubbles greater than10 mm in diameter, pinholes, bug holes greater than 4mm in diameter, embedded debris, lift lines, sand lines, bleed lines, leakage from form joints or penetrations or openings, fins and other projections, form pop outs, texture irregularities, and stains and other color variations that cannot be removed by cleaning.

C. New Concrete: Less than 60 days old.

D. Type of concrete: Project specific concrete type and shall not be confused with type of cements or finishes.

E. Exposure classes of concrete: As defined in Table 1 CSA A23.1.

F. Water/Cementing Material Ratio (W/C): A weight ratio of total water content including admixtures over the weight of all cementing materials.

1.3 REFERENCES

A. Comply with the latest edition of the following statutes codes and standards and all amendments thereto.
   1. Canadian Standards Association (CSA):
      a. A23.1, Concrete Materials and Methods of Concrete Construction.
      b. A23.2, Methods of Test and Standard Practices for Concrete.
      c. A23.3, Design of Concrete Structures for Buildings.
      d. G30.18-M, Billet-Steel Bars for Concrete Reinforcement.
      e. A3001, Cementitious Materials for Use in Concrete.
      f. A3002, Masonry and Mortar Cement.
      g. A3003, Chemical Test Methods for Cementitious Materials for Use in Concrete and Masonry.
      h. A3004, Physical Test Methods for Cementitious Materials for Use in Concrete and Masonry.
      i. A3005, Test Equipment and Materials for Cementitious Materials for Use in Concrete and Masonry.
      j. S269.1, Falsework for Construction Purposes.
      k. S269.3-M, Concrete Formwork.
   2. American Concrete Institute (ACI):
      a. 304.2R, Placing Concrete by Pumping Methods.
      b. 347, Guide to Formwork for Concrete.
   3. American Society for Testing and Materials International (ASTM):
      a. C260, Specifications for Air-Entraining Admixtures for Concrete.
      b. A82/A82M, Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
      c. A185/A185M, Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.
      d. A497/A497M, Standard Specification for Steel Welded Wire Reinforcement, Deformed, for Concrete.
   4. AASHTO T 318-02 Water Content of Freshly Mixed Concrete Using Microwave Oven Drying.
   5. Reinforcing Steel Institute of Canada (RSIC):
      a. Reinforcement Steel Manual of Standard Practice.
   6. International Conference of Building Officials (ICBO):
      a. ICBO Research Report.
   7. National Lumber Grades Authority (NLGA):
      a. Standard Grading Rules for Canadian Lumber.

1.4 PERFORMANCE REQUIREMENTS

A. Concrete for the project is used in water and waste water facilities. Ph for the liquids is normally neutral at about 7. Various chemicals are added to help the process. Degradation of organic material emits gases like hydrogen sulphide which when combined with moisture forms mild sulphuric acid. Life expectancy of water and waste water plant is 60 to 80 years.

B. This project structures are used for potable water. Potable water requirements are in force.

C. Type of Concrete Class of Exposure and Compressive Strengths.
1. Normal-density concrete:
a. Class of Exposure: C-2 -32 MPa at 28 days w/c 0.45.

D. Performance requirement for temperatures during curing.
1. Design concrete mix taking in the account the expected ambient temperature during the curing. Peak curing temperature of concrete shall not exceed 40 degree C and shall not be less then 10 degrees C.

E. Density.
1. Air entrained normal density concrete: As defined in CSA 23.1-09 Clause 3 except the density shall be not less than 2250 kg/m^3.

F. Construction Tolerances:
1. Comply with CSA A23.1-09 Clause 6.4 unless noted otherwise.

G. Concrete Finishes:
1. As specified in Clause 3.3.

1.5 SUBMITTALS

A. Concrete Mix Design:
1. Design in accordance with CSA 23.1 Table 5 based on performance requirements.
2. Submit proposed mix, and supplier's applicable standard deviations.
3. Tabulate concrete mixes. Indicate type of cements, size of coarse aggregate; water/cementing material ratio, admixtures used, air content, slump, and locations of use for each mix. Identify mix with pump or bucket type of discharge.
4. Concrete mix designs will be reviewed for conformance with requirements of the Specifications and will be returned with the Contract Administrator’s comments.

B. Source Quality Control Submittals:
1. Provide certification that source for fine and coarse aggregates are not subject to deleterious expansion.
2. Chemical admixtures, used in the production of concrete for potable water structures, shall be certified as safe product from recognized approving authorities such as NSF 61.

C. Quality Control Submittals:
1. Submit Concrete quality control plan for the project. Include the following:
a. Certification from a professional engineer who has designed the mix based on the requirements of the Contract Documents and that concrete mix will meet the performance requirements. Where the mix designer is

not a professional engineer, then the signing officer of the ready mix plant shall sign the certification.

b. Identify the Company and contact names of subcontractors, material suppliers, and testing companies involved with concrete manufacture and placement.
c. Identify concrete requirements for each element of the project.
d. Identify all tests that will be used for material acceptance and indicate minimum specification requirements for each test.
e. Identify the frequency of testing for each test.
f. Identify the course of action to be taken if the testing program indicates that specification requirements have not been met.
g. Concrete quality control plan shall not take precedence over any other Contract documents.

2. Submit concrete delivery records.
3. Submit certified mill test reports of steel reinforcing bars: Determine physical and chemical properties of steel reinforcing in accordance with requirements of CAN/CSA-G30.18-M.

D. Concrete Placing Schedule:
1. Submit concrete placing schedule.

E. Certificates:
1. Submit certificate of Ready Mixed Concrete Production Facilities.
2. Submit certification that aggregates will not, nor have the potential to, react with cement to result in deleterious expansion in the concrete.
3. Submit certification that deleterious substances in aggregate are within limits specified in CSA A23.1-09**,** Table 12 - Limits for Deleterious Substances and Physical Properties of Aggregates.
4. Submit certification that proposed performance mix will produce concrete meeting the requirements of Specifications.
5. Submit certification that proposed mix design strengths have been selected allowing for the supplier's standard deviations as indicated in CSA A23.1-09,Clause 4.4.6.6- Compressive Strength Requirements.
6. Submit certification that proportion of supplementary cementing material in combination of General Use (GU) hydraulic cement will provide the performance of the specified cement type.
Submit certification that bonding agent, if used, will meet the requirements of Specifications.

F. Reinforcing Bars:
1. Submit reinforcing bar placement drawings prepared in accordance with Reinforcement Steel Manual of Standard Practice by the Reinforcing Steel Institute of Canada and as specified below.
2. Indicate reinforcing bars that form part of an individual concrete placement and reinforcing bars that extends into adjacent placements.

3. For each reinforcing bar placement shop drawing, submit a separate bar list and bending schedule showing size, shape, dimensions, and numbers of bars required for each bar type.
4. Identify reinforcing bars in the bar list and bending schedule with a separate bar mark that corresponds to bar marks shown on reinforcing bar placement drawings.
5. If bar list and bending schedule contain details of bars of more than one reinforcing bar placement drawing, then arrange bar marks in separate groups for each placement drawing. Clearly indicate for each bar mark the corresponding reinforcing bar placement drawing number.
6. Do not add new information on previously reviewed shop drawings.
7. Reinforcing bar placement shop drawings will be reviewed for bar sizes, locations, and spacing, and will receive submittal stamp and signed. Reviewed bar list and bending schedule will be dated only.

1.6 QUALITY ASSURANCE

A. Ready Mixed Concrete Producer: Certified member in good standing of the local Ready Mixed Concrete Association.

B. Concrete Testing:
1. Testing of concrete for materials, compression and water content of freshly mixed concrete will be done by agencies paid for by the City.
2. Pay for additional testing required because of changes in material or the mix proportions, as well as any extra testing of concrete or materials occasioned by their failure to meet the specification requirements.
3. The use of testing services does not relieve the Contractor of his responsibility to provide materials and construction in compliance with the Drawings and Specifications.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Comply with manufacturers' recommendations for delivery, storage, and handling.

B. Store materials in a manner that will prevent deterioration or contamination. Deteriorated or contaminated materials will be rejected and must be removed from site.

C. Ship bundles of reinforcing bars identified by tags containing bar marks along with bar list.

D. Store materials to prevent deterioration or contamination. Deteriorated or contaminated materials will be rejected and must be removed from site.

1.8 SITE CONDITIONS

A. Influence of Ambient Concrete Temperature on Concrete Crack Control:

1. To minimize the formation of thermal cracks during placement and curing, maintain previously cured concrete and concrete that will be placed against it at the same temperature.
2. Failure to minimize temperature differential between adjacent pours will result in temperature induced cracking. Repair such cracks as specified in this Section.

PART 2 PRODUCTS

2.1 MATERIALS

A. Portland Cements/ Blended Hydraulic Cements:
   1. CSA A23.1 Table 7 Types of blended hydraulic cement:
      Type: GU as appropriate.
   2. Supplementary Cementing materials shall be limited to ground granulated blast-furnace slag (S), fly ash (F) and silica fume (SF).

B. Aggregates:
   1. Normal-density Concrete:
      a. Coarse aggregate: CSA A23.1; rough and angular gravel or crushed stone.
      b. Fine aggregate: CSA A23.1; natural sand.

C. Admixtures:
   1. Admixtures used for potable water hydraulic structures shall be NSF 61 certified. Import where admixtures are not locally produced.
   2. Compatible with each other and with other concrete materials.
   3. Calcium chloride, thio-cyanates, or admixtures containing more than 0.05% chloride ions are not permitted.
   4. Air-entraining admixture: ASTM C260; non-detergent type.
   5. Water-reducing admixtures: ASTM C494; Type A.
   6. Set-retarding admixture: ASTM C494; Type B.

D. Water: CSA A23.1; clear and free from oil, acid, alkali, organic matter, or other deleterious substances with a maximum soluble chloride ion content of 0.10 percent by weight.

E. Bonding Agent: Suitable for conditions of service and performance requirements of this Section.

F. Polyurethane injection resin for sealing cracks, single-component Diphenylmethane Diisocyanate (MDI) based, water-activated, hydrophobic type resin:
   1. Flexible Resin by Multiurethanes Limited.
   2. Hydro Active Flex LV by DeNeef Construction Chemicals (U.S.) Inc.

G. Reinforcing Bars:

1. Deformed steel bars: CAN/CSA-G30.18-M; Grade 400R except Grade 400 W where welding is indicated or specified. Do not substitute with epoxy-coated bars.
2. Comply with CSA A23.1 and CSA A23.3.
3. Tolerances:
    a. Length: Plus or minus 25 mm.
    b. Height of truss bar: Plus 0 to minus 10 mm.
    c. Outside dimensions of stirrups, ties, and spirals: Plus or minus 10 mm.
    d. Other bends: Plus or minus 25 mm.
4. Use longest bar possible.
5. Keep number of splices to a minimum.
6. Do not weld chairs, bolsters, bar supports, or spacers to reinforcing bars.

2.2 ACCESSORIES

A. Tie Wire:
1. Black, soft-annealed 1.6 mm diameter wire.
2. Nylon-, epoxy-, or plastic-coated wire.

B. Bar Supports and Spacers:
1. Adequate for accurate placing and as required for construction loads.
2. Provide non-conductive bar supports in contact with exposed surfaces that has geometry and bond characteristics that prevents moisture movement from the surface to the reinforcement.

2.3 CONCRETE MIXES

A. General:
1. Establish proportions of cementing materials, aggregates, water, and admixtures required to produce consistent workable concrete that when placed properly is watertight and durable with strength and other properties specified. Comply with -CSA A23.1-09 Clause 4.3.6 Volume Stability Considerations.
2. Use same type and brand of cement/cementing material throughout.
3. Comply with and allow for the supplier's Standard Deviation as specified in CSA A23.1-09 Clause 4.4.6.6- Compressive Strength Requirements. If the concrete supplier has no established Standard Deviations for concrete of the specified strengths, use a value of 4 MPa minimum.

B. Types of Normal-density Concrete:
1. Exposure Class C-2: Concrete for equipment bases.

C. Mixes for Normal-density Concrete:
1. Cementing Materials Content:
    a. Provide cementing materials contents as required to meet performance.
2. Coarse Aggregates:
    a. Nominal size 40 mm to 5 mm, unless noted otherwise.
3. Air Content:

a. Comply with CSA A23.1-09, Table 4 - Requirements for the Air Content Categories.
b. Provide air content category 2, unless noted otherwise.

4. Admixtures:
a. Use water-reducing admixture as necessary.

2.4 SOURCE QUALITY CONTROL

A. Testing by an independent laboratory in accordance with CSA A23.1 and A23.2, where test results less than one year are not available, to determine:
1. Chemical composition and physical properties of aggregates.
2. Presence and quantity of deleterious substances in aggregates.

2.5 FORM MATERIALS

A. General:
1. Materials:
a. Lumber for Formwork and Falsework: Grade-marked sawn lumber graded in accordance with NLGA.
b. Plywood for Formwork: CSA A23.1; high density overlay (plastic overlay) grade plywood. Plywood may be of lower finish grade when use in conjunction with form liner.
c. Fibreglass or steel forms in undamaged condition, of sufficient strength and surface smoothness to produce specified finish.

B. Form Release Agent:
1. Use form release agent on all cast in place concrete.
2. Material: Release agent that does not bond with, leave residue on, stain, or adversely affect concrete surfaces, and does not impair subsequent treatments of concrete surfaces when applied to forms
3. Freezing point: Minus 15 degrees C or lower.
4. Manufacturers and Products:
a. Master Builders, Inc.; Rheofinish.
b. Cresset Chemical Company; Crete-Lease 20-VOC.
c. NCA/Acrow-Richmond Ltd.; RICH-COTE.
d. W.R. Meadows of Canada Ltd.; Sealtight Duogard.
e. Euclid Admixture Canada, Inc.; Eucoslip VOX.

C. Rustication Grooves and Beveled Edge Corner Strips: Nonabsorbent material, compatible with form surface, fully sealed on all sides preventing loss of paste or water between the two surfaces.

PART 3 EXECUTION

3.1 PREPARATION

A. General:

1. Determine requirements of other trades, inform concerned trades, and assume responsibility for location, installation, and quality of items which affect the Work of this Section.

B. Preparation of Surfaces:
1. Remove water and debris from surfaces on or against which new concrete will be placed.
2. Roughen and clean surfaces of previously placed concrete against which subsequent concrete will be placed.
3. Clean reinforcing bars of loose rust, mill scale, dried cement paste, mud, oil, or other coatings that will affect adhesion in accordance with CSA A23.1-04, Clause 6.1.5 Surface Conditions of Reinforcement, prior to placing concrete

3.2 PLACING CONCRETE

A. General:
1. Do not commence concrete placing until sufficient manpower and equipment is available to complete the placement expeditiously preventing the formation of cold joints, and to produce specified surface finish.
2. Provide standby equipment for critical items in case of equipment failure.
3. Verify that cast-in-place accessories, inserts, and reinforcement are set correctly and are not disturbed during concrete placement.
4. Place concrete on dry and clean substrate.

B. Depositing:
1. Deposit concrete in a manner that prevents segregation in accordance with CSA A23.1-09 Clause 7.2.4 - Depositing.

C. Time Limitations on Concrete Placement:
1. Do not use concrete after a period of two hours has passed since first mixing of ingredients.

D. Adverse Weather Conditions:
1. Make suitable arrangements to prevent damage to fresh concrete, under adverse weather conditions.
2. Do not place concrete when ambient temperature is below 5 degrees C or approaching 5 degrees C and falling, without special protection.
3. Provide heated enclosures when air temperatures are below 5 degrees C.
4. Maintain surface temperature of concrete above 5 degrees C.

E. Consolidation:
1. Consolidate the concrete during and immediately after depositing, thoroughly and uniformly by means of tamping, hand tools, finishing machines, and vibrators in order to obtain dense, watertight, homogeneous concrete well bonded to reinforcing bars.
2. Do not allow concrete to form cold joints.

3.3 CURING & FINISHING

A. Wet Cure for 7 days.

B. During curing, ensure the temperature is kept uniform over the whole surface and across the cross section of the concrete. A temperature gradient across the member may cause cracking.

C. Provide Steel Trowel Finish (Type S-1):
1. Trowel surface with steel hand or power trowel in accordance with CSA A23.1-09, Clause 7.5.4.3. Trowelling, keeping blade flat at first and raising blade angle a little more on subsequent passes. Leave surface smooth, dense, of fine uniform texture without a swirl and free of blemishes.
2. Do not use dry cement or additional water during trowelling. Do not over finish.
3. Do not use power machine when concrete has not attained necessary set to allow finishing. Do not introduce high and low spots in slab during trowelling.

3.4 REPAIR OF TEMPERATURE AND SHRINKAGE INDUCED CRACKS

A. Repair cracks in the completed structures employing a suitable polyurethane injection technique to make such cracks completely watertight after repair.

B. Remove surface injection materials following completion of work and finish affected areas to match surrounding concrete.

C. For dry areas, propose repairs to meet the specifications.

3.5 CONCRETE BONDING

A. To Existing Concrete:
1. Thoroughly clean and mechanically roughen existing concrete surfaces to roughness profile of 6 mm.
2. Saturate surface with water for 24 hours prior to placing new concrete.

3.6 FIELD QUALITY CONTROL

A. General:
1. Tests will be made throughout progress of the Work and will be paid for by the the City to determine concrete quality. Tests will be in accordance with CSA A23.1 and A23.2. Provide labour, concrete, and other facilities for making the test specimens.
2. Provide and maintain facilities for storing and initial curing of test cylinders, and provide suitable crates for shipping test cylinders in accordance with CSA A23.2-09 Test Method A23.2-3C - Making and Curing Concrete Compression and Flexural Test Specimens. Provide microwave oven and facility of carrying out test in field.
3. The testing laboratory shall provide the test results to the the City, Contract Administrator, Contractor and material supplier within 5 days of availability. For

a test that fails to meet the Specification inform the Contract Administrator, Contractor and material supplier within 48 hours of the test.

4. Testing company in coordination with the Contractor shall consider using on line secured website such as CMATS to record, view and distribute concrete test data. Data shall be entered in standard format as designed by the software. Protocol for distribution and filing of test results shall be agreed upon at the pre placement meeting.

B. Standard Strength Tests:

1. Provide concrete for one standard strength test consisting of 3 cylinders for each 40 m^3 of concrete of each type placed in any day. If the amount placed, for each type of concrete is less than 40 m^3 in a day, provide concrete for one standard strength test of 3 cylinders. One cylinder will be tested at 7 days and one at 28 days and one cylinder at 56 days.

C. Air Content Tests:

1. Testing agency will carry out air content tests in accordance with CSA A23.1 and A23.2.

D. Slump Tests:

1. Testing agency will carry out slump tests in accordance with CSA A23.1 and A23.2.

E. Failure to Meet Strength, Air Content, or Slump Requirements:

1. When measured slump or air content falls outside of required limits, carry out a check test immediately on another portion of the same sample. In the event of a second failure, the concrete will be considered to have failed to meet the requirements. Remove the whole batch, from which the samples were taken, off the site.
2. When the strength requirement provisions are not met, carry out one or more of the alternatives:
    a. Change the mix proportions.
    b. Carry out nondestructive testing.
    c. Provide additional curing on portions of the structure represented by the test specimen.
    d. Core drill portion of the structure in question and test cored cylinder in accordance with CSA 23.2-09 Test method A23.3-14C Obtaining and testing drilled cores for compressive strength.
    e. Load test structure to design loading.
    f. Other test the City may require for acceptance.
3. When, after carrying out these requirements, there is still doubt about of the adequacy of the concrete, strengthen or replace, as directed, portions of the Work which failed to develop the required strength.

F. Uniformity of Mixed Concrete

1. If the results of slump, slump flow, air content or density for any mix design do not comply with CSA A23.1-09, Table 13 - Determination of Within-Batch Uniformity, alter mixing operations and equipment until tests indicate that the requirements are satisfied.

G. Concrete Delivery Records:
   1. Submit with each batch of concrete before unloading, a typed delivery ticket prepared at the ready mix plant containing following information:
      a. Name of ready-mix batch plant.
      b. Date and serial number of ticket, truck plate number.
      c. Name of Contractor.
      d. Project Name.
      e. Specific class of concrete with identifying mix number.
      f. Amount of concrete in cubic metres.
      g. Time loaded or of first mixing of cement and aggregates.
      h. Amount of admixtures, or water added on site.
   2. Keep records of the time when each load arrives at the site and when discharge is completed. Record the temperature of fresh concrete.

3.7 FORM SURFACE PREPARATION

A. Remove water, laitance, curing compound, and other debris and thoroughly clean form surfaces that will be in contact with concrete or that have been in contact with previously cast concrete, dirt, and other surface contaminants prior to coating surface.

B. Exposed Wood Forms in Contact with Concrete: Apply form release agent as recommended by the manufacturer.

C. Steel Forms: Apply form release agent to steel forms as soon as they are cleaned to prevent discoloration of concrete from rust.

3.8 ERECTION

A. General:
   1. Unless specified otherwise, follow applicable recommendations of CSA S269.1, and S269.3-M.
   2. Align form joints and make watertight. Keep number of joints to a minimum.
   3. Laterally brace formwork and falsework and prevent displacement during concrete placement.
   4. Form chases, openings, projections, recesses.
   5. Form around pipes, mechanical, and electrical equipment which penetrate the concrete structure.
   6. Incorporate frames, castings, pipes, sleeves, and similar items into formwork if required.
   7. Do not re-use damaged formwork which may not provide a uniform consistent finish.

B. Beveled Edges (Chamfer):

1. Form 20 mm bevels at concrete edges, unless otherwise shown.
2. Where beveled edges on existing adjacent structures are other than 20 mm, obtain the Contract Administrator's approval of size prior to placement of beveled edge.

C. Form Tolerances: Comply to tolerances of CSA A23.1.

D. Fasteners: Use only galvanized nails and fasteners when such fasteners will be left in place in the permanent structure.

3.9 FORM REMOVAL

A. Remove nails, fasteners, tie wire and similar items at the surface.

3.10 REINFORCING BAR INSTALLATION

A. Notify the Contract Administrator when reinforcing is ready for inspection and allow sufficient time for inspection prior to placing concrete.

B. Place reinforcement within tolerances specified in CSA A23.1 Clause 6.6.8 Tolerances for location of reinforcement.

C. Tying Reinforcing Bars:
1. Bend tie wire away from concrete surface. Ensure a cover for tie wires, form tie bolts etc are same as the reinforcing bars. Do not let reinforcing tie wire touch formwork or be exposed in the finished concrete structure.

D. Straightening and Rebending: Field bending of reinforcing steel bars is not permitted.

E. Unless permitted by the Contract Administrator, do not cut reinforcing bars in field.

END OF SECTION

SECTION 03 60 00

GROUTING

PART 1 GENERAL

1.1 SUMMARY

A. This Section forms part of Section 03 30 00, Cast-in-Place Concrete.

B. Section Includes
   1. Grouting including:
      a. Filling tie holes.
      b. Filling openings and blockouts.
      c. Grouting under base plates for equipment and fittings, and structural steel.
      d. Through bolt openings.
      e. Machine bases 26 hp and up.
      f. Grouted-in dowels for connecting to existing concrete.
   2. Alterations and modifications to existing structures, including:
      a. Removing existing concrete.
      b. Cutting construction joint keys in existing structures.
      c. Finishing of existing concrete.
      d. Refinishing.
   3. Product Installed But Not Supplied Under the Work of This Section
      a. Reinforcing bar for grouted - in bar.

1.2 REFERENCES

A. Comply with the latest edition of the following statutes codes and standards and all amendments thereto.
   1. American Concrete Institute (ACI):
      a. 351.1R, Grouting between Foundations and Bases for Support of Equipment and Machinery.
   2. American Society for Testing and Materials International (ASTM):
      a. C230/C230M, Standard Specification for Flow Table for Use in Tests of Hydraulic Cement.
      b. C939, Standard Test Method for Flow of Grout for Preplaced-Aggregate Concrete (Flow Cone Method).
      c. C1107, Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).

1.3 SUBMITTALS

A. Shop Drawings:
   1. Product data of grouts including installation, application, and maintenance instructions.

2. Proposed method for keeping existing concrete surfaces wet prior to placing hydraulic cement grout.
3. Forming method for fluid grout placements.
4. Curing method for grout.

B. Quality Control Submittals:
1. Manufacturer's printed Instructions:
   a. Adding fiber reinforcing to batching.
   b. Water/Cementing material ratio of grout.
   c. Mixing of grout.
2. Manufacturer's proposed training schedule for grout work.
3. Manufacturer's Certificate of Compliance:
   a. Grout free from chlorides and other corrosion-causing chemicals.
   b. Nonshrink hydraulic cement grout properties of Types II and III, verifying expansion at 3 or 14 days will not exceed the 28-day expansion and nonshrink properties are not based on gas or gypsum expansion.
4. Manufacturer's Certificate of Proper Installation.
5. Statements of Qualification: Nonshrink grout manufacturer's representative.
6. Test Reports for Nonshrink Hydraulic Cement Grout:
   a. Field test reports and laboratory test results for field-drawn samples.
7. Load Test Results for Grouted in Dowels:
   a. Submit load test results of grouted - in dowels.

1.4 QUALIFICATIONS

A. Nonshrink Grout Manufacturer's Representative: Authorized and trained representative of grout manufacturer. Minimum of 1 year experience that has resulted in successful installation of grouts similar to those for this Project.

1.5 GUARANTEE

A. Manufacturer's guarantee containing disclaimer on the product data sheet, grout bag, or container limiting responsibility to only the purchase price of products and materials furnished will not be accepted.

B. Manufacturer guarantees participation with Contractor in replacing or repairing grout found defective due to faulty materials, as determined by industry standard test methods.

PART 2 PRODUCTS

2.1 NONSHRINK HYDRAULIC CEMENT GROUT SCHEDULE

A. Furnish nonshrink hydraulic cement grout of type specified for applications in the following schedule:

	Temperature Range	Maximum Placing Time	
Application	4 to 38 C	20 minutes	Greater than 20 minutes
Filling tie holes	I	I	I
Column base plates single-storey	I or II		II
Machine bases 25 hp or less	II	II	II
Through-bolt openings	II	II	II

2.2 NONSHRINK HYDRAULIC CEMENT GROUT

A. Type I:
1. Nonmetallic and nongas-liberating.
2. Prepackaged natural aggregate grout requiring only the addition of water.
3. Test in accordance with ASTM C1107:
   a. Flowable consistency 140 percent, five drops in 30 seconds, in accordance with ASTM C230.
   b. Flowable for 15 minutes.
4. No bleeding of grout at maximum allowed water.
5. Minimum strength of flowable grout,
   a. 20 MPa at 3 days.
   b. 35 MPa at 7 days.
   c. 48 MPa at 28 days.
6. Manufacturers and Products:
   a. Chemrex, Inc.; Set Grout.
   b. Euclid Chemical Co.; NS Grout.
   c. Dayton Superior Corp.; 1107 Advantage Grout.

B. Type II:
1. Nonmetallic, nongas-liberating.
2. Prepackaged natural aggregate grout requiring only the addition of water.
3. No segregation or settlement of aggregate at fluid consistency at specified times or temperatures.
4. Test in accordance with ASTM C939 and ASTM C1107, Grade B:
   a. Fluid consistency 20 to 30 seconds using flow cone method.
   b. Temperatures of 5, 27, and 38 degrees C.
5. 1 hour after mixing, pass fluid grout through flow cone with continuous flow.
6. Minimum strength of fluid grout,
   a. 25 MPa at 1 day.
   b. 30 MPa at 3 days.
   c. 52 MPa at 28 days.
7. Maintain fluid consistency when mixed in 1 to 7 m^3 loads in ready-mix truck.
8. Manufacturers and Products:
   a. Chemrex, Inc.; Master Flow 928.
   b. Euclid Chemical Co.; Hi Flow Grout.

c. Dayton Superior Corp.; Sure Grip High Performance Grout.

C. Nonshrink Epoxy Grout:
1. Minimum strength of grout: 62 MPa at 1 day.
2. Manufacturers and Products:
a. Euclid Chemical Co.; E3-HP.
b. Dayton Superior Corp.; Sure-Grip Epoxy Grout (J-54).
c. Chemrex, Inc.; Masterflow 648 CP.

2.3 DOWELLING GROUT

A. Hydraulic Cement Grout:
1. Set 45 by Master Builders Inc.
2. Anchorite II by C C Chemicals Limited.
3. Epoxy grout:
a. Poly-All Epoxy Anchoring System by Ucan Fastening Products.
b. Sikadur Injection Gel by Sika Canada Inc.
c. Liquid Roc 500 supplied by Concrete Chemicals.

PART 3 EXECUTION

3.1 NONSHRINK GROUT

A. General: Mix, place, and cure nonshrink grout in accordance with grout manufacturer's representative’s printed training instructions.

B. Form Tie or Through-Bolt Holes: Provide nonshrink hydraulic cement grout, Type I and II, fill space with dry pack dense grout hammered in with steel tool and hammer. Through-bolt holes coordinate dry pack dense grout application with vinyl plug.

C. Grouting Machinery Foundations:
1. Use nonshrink hydraulic cement grout except where equipment supplier specifically recommends nonshrink epoxy grout.
2. Block out original concrete or finish off at distance shown below bottom of machinery base with grout. Prepare concrete surface by abrasive blasting, chipping, or by mechanical means to remove any soft deleterious material.
3. For nonshrink hydraulic cement grout, thoroughly clean concrete surface and metal surfaces to be in contact with grout to remove all paint, oil, grease, loose rust, and all other foreign matter.
4. For nonshrink epoxy grout, thoroughly clean concrete surface and abrasive blast metal surfaces to be in contact with grout unless grout manufacturer states in writing that abrasive blasting is not necessary.
5. Set machinery in position and wedge to elevation with steel wedges or use cast-in leveling bolts.
6. Form with watertight forms at least 50 mm higher than bottom of plate.
7. Fill space between bottom of machinery base and original concrete in accordance with manufacturer's representative’s training instructions.

3.2 GROUTED-IN DOWEL FOR CONNECTING TO EXISTING CONCRETE

A. Using a Hydraulic Cement Based Dowelling Grout:
1. Drill hole in existing concrete of diameter equal to diameter of dowel bar plus **20** mm.
2. Clean hole of dust and debris.
3. Fill hole to surface with dowelling grout.
4. Install dowel bar and wipe away overflow.
5. Secure dowel bar firmly in position and do not disturb bar for minimum of 24 hours after installation.

B. Using an Epoxy Type Dowelling Grout:
1. Drill hole and install dowel in accordance with manufacturer's printed instructions.

3.3 ALTERATIONS TO EXISTING CONCRETE

A. General:
1. Cut out, remove, or modify parts of existing concrete structures, roughen surfaces, cut keys, weld bars, and carry out other items of work as required.
2. Use satisfactory methods which will not result in damage to equipment or other parts of the structures by vibration, dust, water, or other contaminants.
3. Verify actual conditions before beginning alterations.
4. After alterations are done, repair surface defects and damaged areas and finish surface to match adjacent areas.

B. Finishing of Existing Concrete Surfaces:
1. As a result of alterations where previously exterior faces become interior, abrasive blast and clean entire surface.
2. Patch surface depressions with sand-cement mortar.
3. Grind smooth fins and protrusions.
4. Apply sack-rubbed finish to entire exposed surface to match adjacent interior surfaces.

C. Refinishing:
1. Refinish cut edges of openings flush and smooth, with a bonding agent and concrete or with a non-shrink non-ferrous pre-blended hydraulic cement grout of same colour as adjacent concrete.
2. Cut back exposed reinforcing bars 25 mm from the finished surface level. Fill voids at each bar with grout. Grind edges smooth after repairs and modifications have been completed.

3.4 FIELD QUALITY CONTROL

A. Evaluation and Acceptance of Nonshrink Hydraulic Cement Grout:
1. Provide a flow cone and cube molds with restraining plates onsite. Continue tests during Project as demonstrated by grout manufacturer's representative.

2. Perform flow cone and bleed tests, and make three 50 mm by 50 mm cubes for each cubic metre of each type of nonshrink grout used. Use restraining caps for cube.
3. Consistency: Grout with consistencies outside range requirements will be rejected.
4. Segregation: Grout when aggregate separates will be rejected.
5. Tests must show that strength attained by non shrink grout cubes is equal to or greater than minimum strength specified.
6. Strength Test Failures: Remove and replace non shrink grout work failing strength tests.
7. Perform bleeding test to demonstrate grout will not bleed.
8. Store cubes at 21 degrees C.

B. Load Testing of Grouted-in Dowels for Connecting to Existing Concrete:
1. To demonstrate proper installation of grouted-in dowels carry out tension tests on two vertical and two horizontal installations for each size of dowel bar before proceeding further installation.
2. Apply an axial test load of 75 percent of the yield strength of the dowel bar. Prevent possible failure of the concrete in the vicinity of the dowels tested.
3. Dowel bar will be considered acceptable if there is no slippage of the dowel bar.
4. If improper installation procedures are suspected additional load tests may be ordered.

END OF SECTION

SECTION 05 05 23

WELDING-QUALITY ASSURANCE

PART 1 GENERAL

1.1 REFERENCES

A. Comply with the latest edition of the following statutes codes and standards and all amendments thereto.
   1. Canadian Standard Association CSA:
      a. G30.18, Carbon Steel Bars for Concrete Reinforcement.
      b. W59, Welded Steel Construction (Metal Arc Welding).
      c. W59.2, Welded Aluminum Construction.
      d. W186, Welding of Reinforcing Bar in Reinforced Concrete Construction.
      e. W47.1, Certification of Companies for Fusion Welding of Steel.
      f. W47.2, Certification of Companies for Fusion Welding of Aluminum.
      g. W117.2, Safety in Welding, Cutting and Allied Processes.
      h. W178.1 Certification of Welding Inspection Organisations.
      i. W178.2, Certification of Welding Inspector.
      j. W55.3, Certification of Companies for Resistance Welding of Steel and Aluminum
   2. ASTM International (ASTM):
      a. A370, Standard Test Methods and Definitions for Mechanical Testing of Steel Products.
      b. E10-01, Standard Test Method for Brinell Hardness of Metallic Materials.
      c. E23-02, Standard Test Methods for Notched Bar Impact Testing of Metallic Materials.
   3. American Welding Society (AWS):
      a. A2.4, Standard Symbols for Welding, Brazing, and Nondestructive Examination.
      b. A3.0, Standard Welding Terms and Definitions; Including Terms for Adhesive Bonding, Brazing, Soldering, Thermal Cutting and Thermalspraying.
      c. D1.1, Structural Welding Code – Steel.
      d. D1.3, Structural Welding Code - Sheet Steel.
      e. D1.6, Structural Welding Code – Stainless Steel.
      f. QC1-96, Specification for AWS Certification of Inspection Personnel.
   4. Canadian General Standards Board (CGSB):
      a. 48.9712 Non-Destructive Testing – Qualification and Certification of Personnel.
   5. American Society of Mechanical Engineers (ASME):
      a. BPVC SEC V, Nondestructive Examination.

b. BPVC SEC IX, Qualification Standard for Welding and Brazing Procedures, Welders, Brazers, and Welding and Brazing Operators.

1.2 DEFINITIONS

A. Class W47.1 welding positions flat (F) horizontal (H); vertical (V) overhead (O).

B. CJP: Complete Joint Penetration.

C. CWB: Canadian Welding Bureau.

D. CWI: Certified Welding Inspector.

E. GTSM: Gauge to Sound Metal.

F. MT: Magnetic Particle Testing.

G. NDE: Nondestructive Examination.

H. NDT: Nondestructive Testing.

I. PJP: Partial Joint Penetration.

J. PQR: Procedure Qualification Record.

K. PT: Liquid Penetrant Testing.

L. RT: Radiographic Testing.

M. UT: Ultrasonic Testing.

N. VT: Visual Testing.

O. WPQ: Welding Personnel Performance Qualification.

P. WPS: Welding Procedure Specification.

Q. WPDS: Welding Procedure Data Sheets.

R. WQR: Welder Qualification Record.

1.3 SUBMITTALS

A. Shop and Field Drawings:
1. Welding Data (Shop and Field):
a. Show on a weld map complete information regarding base metal specification designation, location, type, size, and extent of welds with reference called out for WPS and NDE numbers in tail of welding symbol.

b. Distinguish between shop and field welds.
c. Indicate, by welding symbols or sketches, details of welded joints and preparation of base metal. Provide complete joint welding details showing bevels, groove angles, and root openings for welds.
d. Fillet weld symbols shall show fillet size and length.
e. Groove weld symbols shall indicate CJP or PJP or GTSM in the tail of the symbol, as applicable.
f. For pipe fittings, provide a joint weld beveling diagram.
g. Welding and NDE symbols shall be in accordance with AWS A2.4.
h. Welding terms and definitions shall be in accordance with AWS A3.0.
i. Submit welding data together with shop drawings as a complete package.

B. Informational Submittals:
1. When CAN/CSA applies, WPS's and related WPDS's shall be submitted for all joints prequalified in accordance with W59. Similar documentation is required for non prequalified joints accompanied by PQR's for the non-prequalified joints. All such documentation shall be affixed with the CWB acceptance stamp.
2. When AWS applies, WPS's standard formats shall be submitted for all prequalified and non prequalified joints. In addition, PQR's shall be submitted for non-prequalified joints.
3. When the BPVC applies, WPS's and PQR's shall be submitted in accordance with ASME SECT. IX approved by the authority having jurisdiction.
4. When CAN/CSA W55.3 applies, documentation of resistance welded joint qualification accepted by the CWB shall be submitted.

1.4 QUALIFICATIONS

A. Structural fabricators and erectors shall be certified in accordance with CAN/CSA W47.1-03 and/or W47.2.

B. BPVC fabricators shall be qualified in accordance with ASME Section IX.

C. Welding personnel shall be qualified in accordance with the appropriate codes – CAN/CSA W47.1 or W47.2; AWS D1.1; D1.2; D1.6; ASME Section IX.

D. CWI shall be qualified in accordance with CAN/CSA W178.2 or AWS QC1 and shall have prior experience with the welding codes specified.

E. Non-destructive inspection personnel shall be qualified in accordance with the appropriate CAN/CGSB requirements or NDT Level II certified in accordance with ASNT SNT-TC-1A.

1.5 SEQUENCING AND SCHEDULING

A. Unless otherwise specified, all Submittals required in this Section shall be submitted and approved prior to commencement of welding operations.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION

3.1 GENERAL

A. Welding and Fabrication by Welding: Conform to governing welding codes referenced in attached Welding and Nondestructive Testing Table.

3.2 NONDESTRUCTIVE WELD TESTING REQUIREMENTS

A. Contractor's Inspection Criteria:
   1. Selection of Welds to be Tested: Unless 100 percent NDT is specified herein, as agreed upon between the Contract Administrator and Contractor.
   2. Unless otherwise specified, perform NDT of welds at a frequency as shown in the attached NDT table in accordance with the referenced welding codes. Perform UT on CJP groove welds that cannot be readily radiographed. In case there is a conflict the higher frequency level of NDT shall apply.

B. Weld Acceptance criteria for Contractor's inspection shall be based on the acceptance criteria as per the governing welding codes listed in the NDT table.

3.3 SOURCE AND FIELD QUALITY CONTROL

A. Contractor Inspection:
   1. The W178.2 (or QC1-96) CWI, employed by the Contractor, shall be present whenever shop or field welding is to be performed. The CWI shall perform inspection prior to assembly, during assembly, during welding, and after welding. CWI shall perform inspections as required in referenced welding codes and as follows:
      a. Verifying conformance of specified job material and proper storage.
      b. Monitoring conformance with approved WPS.
      c. Monitoring conformance of WPQ.
      d. Inspecting weld joint fit-up and in-process inspection.
      e. Providing 100 percent visual inspection of all welds.
      f. Supervising nondestructive testing personnel and evaluating test results.
      g. Maintaining records and preparing report confirming results of inspection and testing comply with the Work.

B. Verification Inspection:
   1. An independent testing agency may be retained by the City to perform verification inspection and testing of welds.

3.4 WELD DEFECT REPAIR

A. Repair and retest rejectable weld defects until sound weld metal has been deposited in accordance with appropriate welding codes.

B. Repair and retest rejected weld defects to meet the design, plans and specifications.

C. Retesting shall be performed with the same NDT method used for initial tests and to the same frequency of testing.

3.5 SUPPLEMENTS

A. The supplements listed below, following "End of Section," are a part of this Specification.
   1. Welding and Nondestructive Testing table.

END OF SECTION

WELDING AND NONDESTRUCTIVE TESTING						
Specification Section	Governing Welding Codes or Standards	Submit WPS	Submit WPQ	Onsite CWI Req'd	Submit Written NDT Procedure Specifications	NDT Requirements
05 50 00 Metal Fabrications (Basic)	CAN/CSA W59, Welded Steel Construction (Metal Arc Welding)or CAN/CSA W59.2, Welded Aluminum Construction	Yes	Yes	Yes	Yes	100% VT; see Section
05 52 00 Aluminum Guards and Handrails	CAN/CSA W59, Welded Steel Construction (Metal Arc Welding) or CAN/CSA W59.2, Welded Aluminum Construction	No	No	No	No	100% VT; see Section
05 53 00 Metal Gratings	CAN/CSA W59, Welded Steel Construction (Metal Arc Welding)or CAN/CSA W59.2, Welded Aluminum Construction	No	No	No	No	100% VT; see Section

SECTION 05 50 00

METAL FABRICATIONS (BASIC)

PART 1 GENERAL

1.1 SUMMARY

A. Comply with Division 1, General Requirements.

B. Welding (Quality Assurance) Refer to Section 05 05 23, Welding-Quality Assurance.

1.2 REFERENCES

A. Comply with the latest edition of the following statutes codes and standards and all amendments thereto.
1. CAN/CGSB-1.105 Quick-Drying Primer.
2. CGSB 1-GP-181 Ready-Mixed Organic Zinc-Rich Coating.
3. CAN/CGSB-1.184 Coal Tar-Epoxy Coating.
4. CAN/CSA-S16 Limit States Design of Steel Structures.
5. CAN/CSA G40.20/G40.21 General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
6. CSA S157/S157.1 Strength Design in Aluminum/Commentary on CSA S157-05, Strength Design in Aluminum.
7. CSA W47.1 Certification of Companies for Fusion Welding of Steel.
8. CSA W47.2-M Certification of Companies for Fusion Welding of Aluminum.
9. CSA W55.3 Resistance Welding Qualification Code for Fabricators of Structural Members used in Buildings.
10. CSA W59 Welded Steel Construction (Metal Arc Welding).
11. CSA W59.2-M Welded Aluminum Construction.
12. ASTM A36 Standard Specification for Carbon Structural Steel.
13. ASTM A48 Standard Specification for Gray Iron Castings.
14. ASTM A53 Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated, Welded and Seamless.
15. A108 Standard Specification for Steel Bars, Carbon and Alloy, Cold-Finished.
16. ASTM A123/A, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
17. ASTM A153 Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
18. ASTM A167 Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
19. ASTM A193 Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature or High Pressure Service and other Special Purpose Applications.
20. ASTM A194 Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High-Pressure or High-Temperature Service, or Both.
21. ASTM A307 Standard Specification for Carbon Steel Bolts and Studs, 60000 psi Tensile Strength.

22. ASTM A312 Standard Specification for Seamless, Welded and Heavily Cold Worked Austenitic Stainless Steel Pipe.
23. ASTM A325 Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
24. A429 Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube.
25. ASTM A511 Standard Specification for Seamless Stainless Steel Mechanical Tubing.
26. ASTM A525 Standard Specification for General Requirements for Steel Sheet, Zinc Coated (Galvanized) by the Hot-Dip Process.
27. ASTM A563 Standard Specification for Carbon and Alloy Steel Nuts.
28. ASTM A666 Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
29. ASTM A743 Standard Specification for Castings, Iron-Chromium, Iron-Chromium - Nickel, Crossion-Resistant, for General Application.
30. ASTM A780 Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
31. A786 Standard Specification for Hot-Rolled Carbon, Low-Alloy, High-Strength Low-Alloy, and Alloy Steel Floor Plates.
32. A793 Standard Specification for Rolled Floor Plate, Stainless Steel.
33. A1008 Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low Alloy, High-Strength low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable.
34. A1011 Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength.
35. ASTM B26 Standard Specification for Aluminum-Alloy Sand Castings.
36. ASTM B209 Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
37. ASTM B221 Standard Specification for Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
38. ASTM B241 Standard Specification for Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube.
39. B308 Standard Specification for Aluminum-Alloy 6061-T6 Standard Structural Profiles.
40. ASTM B316 Standard Specification for Aluminum and Aluminum-Alloy Rivet and Cold-Heading Wire and Rods.
41. ASTM A429 Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube.
42. ASTM B468 Standard Specification for Welded UNS N08020, N08024 and N08026 Alloy Tubes.
43. ASTM B632 Standard Specification for Aluminum-Alloy Rolled Tread Plate.
44. ASTM B766 Standard Specification for Electrodeposited Coatings of Cadmium.
45. ASTM F436 Standard Specification for Hardened Steel Washers.
46. ASTM F467 Standard Specification for Nonferrous Nuts for General Use.
47. ASTM F468 Standard Specification for Nonferrous Bolts, Hex Cap Screws, and Studs for General Use.

48. ASTM F738 Standard Specification for Stainless Steel Metric Bolts, Screws, and Studs.
49. ASTM F1136 Standard Specification for Zinc/Aluminum Corrosion Protective Coatings for Fasteners.
50. ANSI B36.10 Pipe, Steel.
51. ANSI/NAAMM MBG 531-88/NAAMM Metal Bar Grating Material.
52. CISC/CPMA 2-75a A Quick-Drying Primer for use on Structural Steel.
53. National Building Code of Canada 2010 (NBCC).

1.3 SUBMITTALS

A. Shop Drawings: Submit shop drawings before fabrication commences of each metal fabrication item, showing in large scale fabrication details, thickness, anchors, location, dimensions, erection details, connections and jointing details, and finishes.

B. Submit welding procedure specification for each type of material.

C. Submit sample of aluminum railing including a welded joint to the City for acceptance. Commence fabrication only after acceptance has been obtained.

D. Submit written certification from professional engineer licensed in the Province of Manitoba stating that support systems, anchorage, and equipment have been designed according to requirements of the NBCC Division B, part 4, Article 4.1.8.17 for post-disaster structures at time of shop drawing submittals**.**

1.4 QUALITY ASSURANCE

A. Ensure workmanship of the highest quality throughout by employing only metal workers that have demonstrated the highest skills in this type of work and qualified welders certified to weld the materials used in fabrication of the miscellaneous metals. Comply with Section 05 05 23, Welding-Quality Assurance.

B. Welding Procedure for Steel, aluminum and Stainless Steel:
1. Comply with Section 05 05 23, Welding-Quality Assurance.

1.5 DELIVERY, STORAGE AND HANDLING

A. Provide protective coating on stainless steel and aluminum items.

B. Coordinate deliveries with construction schedule and arrange ahead for off-the-ground, covered storage locations.

C. Handle and store metal materials at job site to prevent damage to other materials, existing buildings, structure, finishes or property.

D. Handle components with care, and provide protection for surfaces against marring or other damage. Ship and store members with cardboard or other resilient spacers between surfaces.

E. Use removable coatings or wrappings to protect exposed surfaces of prefinished metal work which does not receive site finishing. Use materials recommended by finishers or manufacturers to ensure that method is sufficiently protective, easily removed, and harmless to the finish.

F. Prevent the formation of wet storage stain on galvanized members with the following measures:
   1. Stack members or bundle to allow air between the galvanized surfaces during transport from supplier. Load materials in position that continuous drainage could occur.
   2. Raise members from the ground and separate with strip spacers to provide free access of air to most parts of the surface. Incline in a manner which will allow continuous drainage. Do not lay galvanized steel on cinders, clinkers, wet soil or decaying vegetation.
   3. Handle galvanized members in such a manner as to avoid any mechanical damage and to prevent distortion.

1.6 COORDINATION

A. Supply to concrete, masonry and/or other Sections, materials requiring setting and/or building-in in concrete, masonry or other trades. This includes inserts, anchors, frames, sleeves, etc. Verify locations of these materials on site before fabrication and erection.

1.7 WARRANTY

A. Submit a 5-year warranty for prefinished aluminum work against defects in materials and workmanship including but not limited to fading or non-uniformity of color, cracking, peeling or other corrosion.

PART 2 PRODUCTS

2.1 MATERIALS

A. Where anchors, lifting hooks, screws, bolts, nuts, washers, hangers and other fasteners are not specifically shown or specified, provide such items with at least the strength and corrosion resistance properties of the metal fabrication for which they are required.

B. Structural Steel:
   1. W and H-Shapes:
      a. CAN/CSA-G40.20/G40.21 Grade 350W.
      b. ASTM A992, Grade 50 ksi.
   2. Shapes Except W and H-Shapes, Rolled plates and Bars:
      a. CAN/CSA-G40.20/G40.21 Grade 300W.
   3. Steel Pipe: ASTM A53, Type E or S, Grade B.
   4. Hollow Structural Sections (HSS): CAN/CSA-G40.20/G40.21 Grade 350W Class C.
   5. Cold Formed Sections:
      a. ASTM A653 Grade 340 (Grade 50), Fy = 345 MPa for coated sections.

b. ASTM A1011 Grade 340 (Grade 50), Fy=345 MPa for uncoated sections.

C. Welding Electrode: Comply with requirements of applicable welding codes. Refer to Section 05 05 23, Welding-Quality Assurance for applicable codes.

D. Structural Steel Connections:
1. High strength Bolts:
   a. For structural connections at platforms, support frames and similar items; use ASTM A325 carbon steel high strength bolts with nuts and washers.
   b. Where such structural connections will be normally exposed to atmospheric conditions use ASTM A325 carbon steel bolts hot-dip galvanized to ASTM A153.
2. Nuts: ASTM A563 and the recommended nut grade and style listed in Appendix X1, Table X1 thereof. Where connections will be normally exposed to atmospheric conditions use Grade C3 or DH3.
3. Washers: Bolted connections - hardened steel washers conforming to ASTM F436. Hot-dip galvanized washers with galvanized bolts.

E. Welded Anchor Studs:
1. Headed anchor studs (HAS) or threaded anchor studs (TAS), as indicated on Drawings.
   a. Carbon Steel: ASTM A108, Standard Quality Grades 1010 through 1020, inclusive either semi-killed or killed aluminum or silicon dioxidation, unless indicated otherwise.
   b. Stainless Steel: ASTM F593, AISI Type 316, Condition CW, where indicated.
2. Manufacturers:
   a. Nelson Stud Welding.
   b. Stud Welding Associates, Inc.

F. Cast In Place Anchor Bolts and Anchor Bolt Sleeves:
1. Cast-In-Place Anchor Bolts:
   a. Headed type, unless otherwise shown on Drawings.
   b. Material type and protective coating as shown in Fastener Schedule at end of this Section.
2. Anchor Bolt Sleeves:
   a. Plastic:
      1) Single unit construction with corrugated sleeve.
      2) Top of sleeve shall be self-threading to provide adjustment of threaded anchor bolt projection.
      3) Material: High density polyethylene.
   b. Fabricated Steel: ASTM A36/A36M.

G. Concrete and Masonry Drilled Anchors:
1. General:
   a. Material and Protective coating as shown in Fastener Schedule at end of this section.

b. Acceptable for use in potable water structures by local health agencies or NSF.

2. Wedge Anchors:
   a. Hilti Kwik-Bolt-3 (KB-3) Anchor.
   b. ITW Construction Products; Ramset/Red Head; Trubolt Wedge Anchor.
3. Drop in Expansion Anchors:
   a. Hilti HDI Drop-In Anchor.
   b. ITW Construction Products; Ramset/Red Head; Multi-Set II Drop-In and Self Drill Anchor.
4. Undercut Anchors:
   a. Hilti HDA Undercut Anchor.
   b. USP Structural Connectors; DUC Undercut Anchor.
5. Heavy Duty Sleeve Anchors:
   a. Hilti HSL-3 Heavy Duty Sleeve Anchor.
   b. ITW Construction Products; Ramset/Red Head; Dynabolt Hex Nut Sleeve Anchor.
6. Adhesive Anchors:
   a. Threaded Rod:
      1) ASTM F593 stainless steel threaded rod, diameter as shown on Drawings.
      2) Length as required, to provide minimum depth of embedment.
      3) Clean and free of grease, oil, or other deleterious material.
      4) For hollow-unit masonry, provide galvanized or stainless steel wire cloth screen tube to fit threaded rod.
   b. Adhesive:
      1) Two-component, designed to be used in adverse freeze/thaw environments, with gray color after mixing.
      2) Cure Temperature, Pot Life, and Workability: Compatible for intended use and environmental conditions.
      3) Non sag, with selected viscosity base on installation temperature and overhead application where applicable.
      4) Manufacturers and Products:
         a) Hilti HIT HY 150 Adhesive Anchor System.
         b) ITW Construction Products; Ramset/Red Head; C6 Adhesive Anchor System or A7 Adhesive Anchor System. (Use A7 Adhesive Anchor System for hollow masonry.)
7. Adhesive Threaded Inserts:
   a. Stainless steel, internally threaded insert.
   b. Manufacturer and Product: Hilti HIS-R Insert with HIT HY 150 adhesive.

H. Galvanized steel sheet: ASTM A525- Class Z275 zinc coating.

I. Hot rolled steel sheet: ASTM A1011.

J. Cold rolled steel sheet: ASTM A1008.

K. Steel Pipe: ASTM A53 - Type S Grade A or ANSI B36.10.

L. Neoprene: Premium grade Durometer A 40.

M. Fasteners: ASTM F1136, galvanized, 19 mm diameter minimum.

N. Stainless Steel: Alloy 316**.**

Item	ASTM	UNA Designations
Structural	A666	S30400
Architectural	A666	S30400 or S31600
Plates, Sheets and Strips	A167	S30400 or S30403
		Grade
Fasteners	F738, F1136,	B8A
	A193, A194	
Castings	A743	CF-8M
Tubing	A511	MT-304 or
	A511	MT304L

O. Aluminum:

Item	ASTM	UNA Designations
Extruded Shapes - Structural	B211	A96351-T6
Extruded Shapes - Architectural	B221	A96063-T6
Smooth Plates and Sheets	B209	A93003-H16
Checkered or Tread Plates	B632	A96061-T6
Gratings	B221	A96061-T6
Rivets	B316	A96061-T6
Castings	B26	A03560-T6 or A05350-F
Tubing & Pipe	B241	A96061-T6
Fasteners - Bolts	F468	A96061-T6
- Nuts	F467	A96061-T6

P. Primer: CISC/CPMA 2-75a.

Q. Isolation coating: CAN/CGSB-1.184, Coal Tar-Epoxy Coating.

R. Zinc-rich primer: CGSB 1-GP-181M, Sealtight Galvafroid Zinc-Rich Coating by W.R. Meadows Ltd.

S. Grouting: Set 45 by Master Builders Technologies Ltd. M-Bed Standard by Sternson Ltd., Sika Grout 212 by Sika Canada Inc.

2.2 FINISHES

A. Rough Edges and Mill Scale:
1. Following completion of fabrication of any item, grind rough edges straight and finish smooth. Remove mill scale and rust.

B. Electrolytic Corrosion:
1. Back paint metal surfaces in contact with dissimilar metal or concrete or masonry, with coal tar-epoxy coating, 1.0 mm (40 mils) DFT minimum.
2. Paint galvanized metal surfaces to be in contact with or encased in concrete with rust inhibitive epoxy coating ICI Devoe Coating: Devran 201. Prepare surfaces to SSPC SP1, apply coating to 125 microns DFT.

C. Aluminum:
1. Restore aluminum to original mill finish after fabrication. Buff and brighten exposed aluminum surfaces, which have been damaged during construction.
2. Paint the surfaces to be in contact with aluminum with coloured coal tar-epoxy coating where aluminum is intended to be in contact with dissimilar metals, concrete, or masonry.
3. Use anodizing quality aluminum where anodizing is required.

D. Carbon Steel:
1. Hot dip galvanize metal fabrications where carbon steel is intended to be exposed to atmospheric conditions or sewage.
2. Hot dip galvanize the surfaces to be in such contact Where carbon steel is intended to be in contact with either concrete, brick or mortar.

E. Galvanizing:
1. Hot-dip galvanized items after fabrication. Galvanize steel scheduled for exposure to exterior conditions or corrosive materials.
2. Clean surfaces to be galvanized of slag and impurities immediately before being galvanized or cadmium plated.
3. Where specified or detailed, galvanize plates and other structural shapes in accordance with CSA G164M. Where fabrications are too large to be hot-dipped, employ zinc metallizing.
4. Repair of Damaged Galvanized Surfaces:
   a. Repair hot-dip galvanized coatings damaged by welding, cutting, rough handling during shipping or erection or otherwise, in accordance with ASTM A780 using organic zinc-rich primer. Dry film thickness on repairs to exceed original coating thickness by 25 percent.

F. Shop Finishes:
1. Aluminum finish:
   a. Where shop finishing is specified or indicated, after fabrication or forming, prepare surfaces, shop prime, and factory finish in accordance with PPG specifications for the manufacturer's Duranar two-coat

fluoropolymer enamel system for aluminum. Shop finishing: Performed by an accepted applicator. Minimum dry film thickness – 30 microns (1.2 mil).

b. Color : To later selection.

c. After installation, touch-up shop finished surfaces damaged during construction.

d. Anodized finish: Anodizing Architectural Class I Anodic Coating 0.018 mm (0.7 mil) thickness, one-hour coating 215 RI (AA-C22A41 clear) preceded by a caustic etch.

G. Stainless Steel:

1. Remove rust and postweld discoloration from stainless steel by grinding, using only stainless steel tools.
2. Passivate stainless steel, which was cleaned by grinding, with a solution of 12-15 percent nitric acid and 3 percent hydroflouric acid.
3. During finishing ensure no carbon steel gets into contact with the stainless steel surfaces.
4. Finishes: No. 4 finish XL Blend S

H. Steel Finish:

1. Where shop finishing is specified or indicated, after fabrication or forming, prepare surfaces, shop prime, and factory finish in Stelcolor 8,000 Series**.**
2. Shop finishing: Performed by an accepted applicator. Minimum dry film thickness – 30 microns (1.2 mil).
3. Color: To later selection.
4. After installation, touch-up shop finished surfaces damaged during construction

2.3 FABRICATION - GENERAL

A. Where possible, verify dimensions on site before preparing shop drawings or proceeding with shop work. Fit and shop assemble insofar as possible various sections of the work and deliver to the project site in the largest practical sections.

B. The general dimensions and details of the metal fabrications are shown on the Drawings where practical. Such details and dimensions are suggested concepts for design.

C. Assume responsibility for the correctness of the actual detailed dimensions used in fabrication and carefully check the same, by field measurement.

D. Variations from suggested details are subject to acceptance in writing by the Contract Administrator. Such acceptance does not in any way waive the above mentioned responsibility.

E. Wherever overlapping or contacting surfaces cannot be avoided, completely seal weld these surfaces. Rusting or deterioration of finish in such areas will require remedial seal welding and refinishing.

F. Fabricate the work true to dimensions and square. Accurately fit members with hairline joints, and join using adequate fastening. Assemble members without twists or open joints.

G. Construct finished work free from distortion and defects detrimental to appearance and performance.

H. File or grind exposed welds smooth and flush. Do not leave grinding marks. Construct internal and external corners with sharp lines. Provide continuous welds unless otherwise accepted by the Contract Administrator in writing. Brighten and buff aluminum and stainless steel welds to match appearance of adjacent surface.
1. Remove weld spatter and slag. After finish grinding and smoothening welds, passivate welds with pickling paste.

I. Fabricate metal work complete with components required for anchoring to concrete; bolting or welding to structural steel frames; standing free; or resting in frames or sockets, in a safe and secure manner.

J. Countersink exposed fastenings, where such are accepted in writing, and make as inconspicuous as possible with bolts cut off flush with nuts. Construct fastenings of the same material and finish as the base material on which they occur.

2.4 STAIRS

A. Design stairs in accordance with National Building Code and for additional requirements specified.

B. Shop drawings for stairs and support members shall bear the seal and signature with BCIN number of a Professional Structural Engineer responsible for their design.

C. Material:
1. Stainless Steel: ASTM A793, AISI Type 316.
2. Aluminum: ASTM B632, Alloy 6060-T6.

D. Minimum Thickness:
1. Aluminum: 10 mm, unless shown otherwise on Drawings.

E. Fabricate stairs as detailed on drawings and install using stainless steel anchor bolts.

F. Design the tread sections to limit deflection to 1/180th of the span under a concentrated load of 1.0 kN at the centre.

G. For handrail requirements, refer to Section 05 52 00, Aluminum Guards and Handrails.

H. Fabricate stairs with open grating treads of welded grating with slip-resistant, 32 mm cross hatch solid nosing.
1. Manufacturers:
a. Borden Metal Products Ltd.
b. Fisher & Ludlow Ltd.

PART 3 EXECUTION

3.1 INSTALLATION - GENERAL

A. Install work of this Section using skilled craftsmen and in accordance with manufacturer's recommendations where applicable.

B. Install metal fabrications in the correct locations and positions, plumb, level, structurally sound, securely fastened, free from defects detrimental to finished appearance and to acceptance of the Contract Administrator.

C. Perform drilling of steel, concrete or masonry to fasten the work of this Section.

D. For aluminum and stainless steel items, and exterior locations, use stainless steel anchors.

E. After installation, spot prime bolt heads and nuts, field rivets, field welds and any abrasions or damage to the shop coat of primer.

F. Touch-up galvanized steel where galvanizing is damaged during installation with zinc rich primer.

G. Apply isolation coating to surfaces between dissimilar metals, and between metal and concrete, mortar, grout or masonry.

H. Where items are specified to be installed by other Sections, fabricate items to the appropriate trade with necessary instructions and templates required for proper installation. Include required fastenings, such as screws, bolts, expansion shields and similar items.

I. Tolerances: CAN/CSA S16.

J. Deliver items to be cast into concrete with instructions for setting.

3.2 INSTALLATION - ANCHORS AND FASTENERS

A. Use anchor bolts of sufficient length to embed into concrete to develop full strength of the anchor or 200 mm minimum, the maximum governs, and project the threaded portion a minimum of 50 mm for the installation of the nuts.

B. Set anchor bolts accurately in holes in concrete using plywood templates prepared from manufacturer's shop drawings. Set items in grout. Use anchor grout for submerged and exterior conditions.

C. Do not offset bolts by deformation.

D. For submerged conditions where bolts are used, use lock nuts or nuts with lock washer.

3.3 FASTENER SCHEDULE

A. Unless indicated otherwise on the Drawings, provide fasteners as follows:

Service Use and Location	Product	Remarks
1. Anchor Bolts Cast Into Concrete for Structural Steel, Metal Fabrications and Castings		
Interior Dry Areas	**Hot-dip galvanized** steel headed anchor bolts, unless indicated otherwise.	
2. Anchor Bolts Cast Into Concrete for Equipment Bases		
Interior Dry Areas	Hot dip galvanized carbon steel headed anchor bolts, unless otherwise specified with equipment	
3. Drilled Anchors for Metal Components to Cast-in-Place Concrete (e.g., Ladders, Handrail Posts, Electrical Panels, and Equipment)		
Interior Dry Areas	Stainless steel wedge or drop in expansion anchors	**Use undercut anchors for overhead and ceiling installations.**
4. Anchors in Grout-Filled Concrete Masonry Units		
Exterior and Interior Wet and Dry Areas	Hot-dip galvanized steel headed anchor bolts, or stainless steel heavy duty sleeve anchors, or stainless steel adhesive anchors	
5. Anchors in Hollow Concrete Masonry Units		
Exterior and Interior Wet and Dry Areas	Stainless steel adhesive anchors with screen tube	
6. Connections for Structural Steel Framing		
Exterior and Interior Wet and Dry Areas	High-strength steel bolted connections	Use hot-dipped galvanized high-strength bolted connections for galvanized steel framing members and for Exterior areas
7. Connections for Steel Fabrications and Wood Components		
Exterior and Interior Wet and Dry Areas	**Hot-dip galvanized carbon or Stainless** steel bolted connections	
8. Connections of Aluminum Components		

Service Use and Location	Product	Remarks
Submerged, Exterior and Interior Wet and Dry Areas	Stainless steel bolted connections, unless otherwise specified with equipment	
9. All Others		
Exterior and Interior Wet and Dry Areas	Stainless steel fasteners	

B. Anti-seizing Lubricant: Use on all stainless steel threads.

C. Do not use adhesive anchors to support fire-resistive construction or where ambient temperature will exceed 120 degrees F.

END OF SECTION

SECTION 05 52 00

ALUMINUM GUARDS AND HANDRAILS

PART 1 GENERAL

1.1 REFERENCES

A. Comply with Section 05 50 00, Metal Fabrications (Basic).

1.2 DEFINITIONS

A. Guard: A protective barrier around openings in floors or at the sides of stairs, landings, balconies, mezzanines, galleries, raised walkways or other locations, capable of withstanding the loadings prescribed by codes.

B. Handrail: A horizontal or inclined rail at one or both sides of a stair or ramp, continuous and without interruptions, intended to be grasped by hand when ascending or descending and capable of withstanding the loadings prescribed by codes. A handrail may function as a guard on the open side of a stair.

C. Post: Supporting member for a guard or handrail, capable of transmitting the guard or handrail loadings prescribed by code to the supporting structure.

D. Railing: A horizontal or inclined rail supported by posts, acting as a guard at or below the minimum prescribed guard height.

E. Toeboard: Vertical barrier along exposed edges of platforms, ramps, landings or other floor openings preventing miscellaneous items from falling over the exposed edge.

1.3 SYSTEM DESCRIPTION

A. Fabrication Requirements
   1. Comply with Section 05 50 00, Metal Fabrications (Basic).
   2. Fabricate guard and handrail components in accordance with applicable Codes.

1.4 SUBMITTALS

A. Metal fabrication details for all guard and handrail assemblies.

B. Shop Drawings:
   1. Indicate guard and handrail profiles, connections, terminations, and accessories.
   2. Project specific plans, elevations, and details of guards and handrails.

C. Information Submittals:
   1. Manufacturer’s assembly and installation instructions.

2. Manufacturer's written recommendation describing procedures for maintaining guards and handrails including cleaning materials, application methods, and precautions to be taken in the use of cleaning materials.

1.5 QUALITY ASSURANCE

A. Comply with Section 05 50 00, Metal Fabrications (Basic).

1.6 DELIVERY, STORAGE AND HANDLING

A. Comply with Section 05 50 00, Metal Fabrications (Basic).

1.7 WARRANTY

A. Comply with Section 05 50 00, Metal Fabrications (Basic).

PART 2 PRODUCTS

2.1 MATERIALS

A. Aluminum: ASTM B241, A96061-T6.

B. Stainless Steel: Type 316 with minimum yield strength of 350 MPa.

C. Stainless Steel Rods and Plates: Type 2205 with minimum yield strength of 450 MPa.

D. Stainless Steel Self Drilling Fasteners: Type 302 PFHUC, S-WD 12-14x25mm #3 bimetal flex by HILTI, or Type 302 EHE352, 14x25mm type AB self tapping, flat undercut head, ALLFLEX by ELCO.

2.2 FINISHES

A. Grind all welds and terminations smooth.

B. Restore aluminum to original mill finish after fabrication. Buff and brighten all aluminum surfaces.

C. Where aluminum is in contact with dissimilar metals, concrete, or masonry, paint contact surfaces with aluminum coloured bituminous paint.

2.3 ANCHORS AND FASTENERS

A. Comply with Section 05 50 00, Metal Fabrications (Basic).

2.4 FABRICATION – WELDED ALUMINUM GUARDS AND HANDRAILS

A. Comply with Section 05 05 23, Welding-Quality Assurance.

B. Provide guard and handrail systems in accordance with the National Building Code, and for additional requirements specified.

C. Fabricate posts of 40 mm nominal size 6061-T6 Schedule 80 aluminum pipe, 42.16 mm o.d., 4.83 mm wall thickness with shop welded connections.

D. Fabricate railings of 40 mm nominal size 6061-T6 Schedule 40 aluminum pipe, 42.16 mm o.d., 3.56 mm wall thickness with shop welded connections.

E. Fabricate guards, posts and railings with the following characteristics:
1. Vertical posts and horizontal or inclined railings of identical outside diameter.
2. Vertical posts spaced at maximum 1200 mm o.c.
3. Handrail and guard not less than 1070 mm above the floor, landing or platform on which it is installed.
4. Handrail and guard at stair flight not less than 920 mm above line drawn through the front of nosing of stair.
5. Guard and handrail assembly design configuration:
   a. Two rails as indicated.
   b. Pickets and infill grillage as indicated.
6. All railings aluminum construction.
7. All connections, except expansion connections, continuously welded using welding rod to achieve welds identical in appearance to railings.
8. Fabricate Type 2205 stainless steel base plate assemblies with Type 2205 vertical stainless steel rod sized for friction fit within aluminum posts.
9. Anchor Handrail System with:
   a. Side mounted post bracket anchored to supporting structure as indicated. Anchor posts to rod with stainless steel self drilling fasteners in predrilled pilot holes.
   b. Connection as indicated.
10. Formed elbows at changes of direction of rails and handrail.
11. Expansion sleeves at location of building expansion joints and at 8000 mm o.c. maximum spacing. Locate expansion sleeves within 300 mm of post.
12. Handrail turned back to wall, floor or post at end of run.
13. Posts located maximum 300 mm each way from corner or point of change of direction. Space both posts equal distance from corner.
14. Welded aluminum end caps at railing terminations.
15. Aluminum toe-board 125 mm high, 6.0 mm thick aluminum plate.
16. Hairline joints at butt connections.
   a. Interior welds: concave profile.
   b. Exterior or butt welds: smooth profile.
   c. End caps, closure plates, exposed edges: pencil round.
17. Wall Brackets: Extruded aluminum Julius Blum Model 498. Grind exposed edges pencil round.
18. Hardware: Stainless steel.
19. Finish assembly after fabrication.
20. Do not field weld.

F. Finish: Architectural Class I Anodic Coating, AA-C22A41 clear.

PART 3 EXECUTION

3.1 INSTALLATION - GENERAL

A. Comply with Section 05 50 00, Metal Fabrications (Basic).

3.2 INSTALLATION - ANCHORS AND FASTENERS

A. Comply with Section 05 50 00, Metal Fabrications (Basic).

3.3 INSTALLATION – GUARDS AND RAILINGS

A. Install guards and handrails to meet design requirements.

B. Fasten posts to SST rod in predrilled pilot holes, sized as recommended by fastener manufacturer.

C. Set posts into holes of post diameter plus 20 mm maximum, 100 mm deep. Side mount railing with brackets and anchors as shown.

3.4 INSTALLATION – WALL MOUNTED HANDRAILS

A. Install handrails to meet design requirements.

B. Anchor handrails to walls with wall brackets.

C. Anchor wall brackets with bolts. Exposed threads and nuts are not acceptable.

3.5 INSTALLATION – TOEBOARD

A. Provide continuous toeboard at all platforms, ramps, landings or other floor openings, except at gates or where 125 mm or higher curbs are installed.

B. Accurately measure in field for correct length, after handrail post installation, cut and secure to posts with stainless steel fasteners.

C. Dimension between bottom of toeboard and walking surface not to exceed 3.0 mm. Cope toeboard at baseplates.

D. Provide expansion and contraction connections at each post. Provide expansion sleeves at location of railing expansion sleeves.

END OF SECTION

SECTION 05 53 00

METAL GRATINGS

PART 1 GENERAL

1.1 REFERENCES

A. Comply with the latest edition of the following statutes codes and standards and all amendments thereto.
   1. American Society for Testing and Materials (ASTM):
      a. A36, Standard Specification for Structural Steel.
      b. A123/A, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
      c. A153, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
      d. A167, Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
      e. A193, Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service.
      f. A194, Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High-Pressure and High-Temperature Service.
      g. A307, Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.
      h. A525, Standard Specification for General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.
      i. A569/A569M, Standard Specification for Steel, Carbon (0.15 Maximum Percent), Hot-Rolled Sheet and Strip Commercial Quality.
      j. B221, Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes.
      k. F844, Standard Specification for Washers, Steel, Plain (Flat), Unhardened for General Use.
   2. Canadian Standards Association (CSA):
      a. S16.1-M Limit States Design of Steel Structures.
      b. S157-M Strength Design in Aluminum.
   3. National Association of Architectural Metal Manufacturers (NAAMM):
      a. ANSI MBG 531, Metal Bar Grating Manual.
      b. ANSI MBG 532, Heavy-Duty Metal Bar Grating Manual.

1.2 SUBMITTALS

A. Shop Drawings:
   1. Grating: Show dimensions, weight, and size, and location of connections to adjacent grating, supports, and other Work.
   2. Grating Anchorage: Show structural calculations and details of anchorage to supports to prevent displacement from traffic impact.

3. Grating Supports: Show dimensions, weight, size, location, and anchorage to supporting structure.
4. Catalog information and catalog cuts.

B. Information Submittals:
1. Special handling and storage requirements.
2. Installation instructions.
3. Factory test reports.
4. Manufacturer's Certification of Compliance for specified products.
5. Written Test Report that swaged crossbars, if used on grating, meet the requirements of the specified test and additional requirements of these Specifications.

1.3 PREPARATION FOR SHIPMENT

A. Insofar as is practical, factory assemble items provided.

B. Package and clearly tag parts and assemblies that are of necessity shipped unassembled and protect the materials from damage, and facilitate identification and final assembly in the field.

PART 2 PRODUCTS

2.1 FOOT TRAFFIC GRATING

A. Design:
1. Uniform Service Load: 4.8 kN/m^2 minimum, unless otherwise shown.
2. Maximum Deflection: 6 mm, unless otherwise shown.
3. Space bearing bars at 30 mm center-to-center.
4. Banding: 5 mm minimum.

B. Material:
1. Aluminum Bar Type Grating:
a. Non-slip surface with serrated edge.
b. Press-locked rectangular design, as manufactured by IKG/Borden, IKG/Borden Type B or Type F.
c. Swage locked aluminum grating, rectangular bar type, as manufactured by:
1) IKG Industries, Ltd.; Type BS or Type FS.
2) Borden Metal Products (Canada) Limited; Type S/B.
3) Fisher & Ludlow; Type 30-102.
d. Swage locked aluminum I-bar grating, as manufactured by:
1) IKG Industries, Ld.; Type IF.
2) Borden Metal Products (Canada) Limited; Type SBX.

2. Stair Treads:
   a. Material and Type: Same as grating material and grating type as furnished for connecting walkway or work surface.
   b. Nosings: Integral ribbing and serrated edge on one long axis of tread or non-slip, abrasive on each tread along one long edge.
   c. Carrier Plate or Angle: Furnish at each end for connection to stair stringers.

2.2 ACCESSORIES

A. Anchor Bolts and Nuts:
   1. Carbon Steel: ASTM A307 or A36.
   2. Stainless Steel: ASTM A193 and ASTM A194, Type 316.
   3. Galvanized Steel Bolts and Nuts: ASTM A153, zinc coating for ASTM A307 or A36.

B. Flat Washers (Unhardened): ASTM F844; use ASTM A153 for zinc coating.

C. Removable Fastener Clips and Bolts:
   1. Removable from above grating walkway surface.
   2. Hat Bracket: Type 304 stainless steel.
   3. Bolt: Type 316 stainless steel.
   4. Cast iron, galvanized body.

D. Partially Removable Anchor:
   1. Bolt: Threaded stud, Type 316 stainless steel.
   2. Hat Bracket: Type 304 stainless steel.

2.3 FABRICATION

A. General:
   1. Exposed Surfaces: Smooth finish and sharp, well-defined lines.
   2. Furnish necessary rabbets, lugs, and brackets so work can be assembled in a neat, substantial manner.
   3. Conceal fastenings where practical.
   4. Drill metalwork and countersink holes as required for attaching hardware or other materials.
   5. Weld Connections: Not permitted on grating except at banding bars.

B. Design:
   1. Field measure areas to receive grating, verify dimensions of new fabricated supports, and fabricate to dimension required for specified clearances.
   2. Section Length: Sufficient to prevent its falling down through clear opening when oriented in the span direction when one end is touching either the concrete or the vertical leg of grating support.
   3. Minimum Bearing: ANSI/NAAMM MBG 531.
   4. Metal Crossbar Spacing:100 mm maximum, unless otherwise shown or specified.

5. Crossbars: Flush with top of main bar and extend downward a minimum of 50 percent of the main bar depth.
    a. Swaged Crossbars:
        1) Within 6 mm of top of grating with 12 mm minimum vertical dimension after swaging, and minimum before swaging dimension of 8 mm square.
        2) Crossbar Dimension After Swaging: Minimum 3 mm wider than the opening at minimum of two corners at each side of each square opening in main bar.
        3) Crossbars may be a special extruded shape so that after swaging the top will be flat, 5 mm wide and will be flush with the top surface of the bearing bars for a minimum of 16 mm at center between bearing bars.
        4) Flush crossbar meeting all of the above except that after swaging, overlaps one corner by a minimum of 3 mm. Test sample of one bearing bar and one crossbar shall be tested by holding the bearing bar and pulling on the crossbar. The crossbar to bearing bar must sustain a minimum of 1.3 kN without pullout of the bearing bar.
        5) Tightly fit main bars and crossbars allowing no differential movement.
6. Do not use weld type crossbars.
7. Banding: Same material as grating; ANSI/NAAMM MBG 531 and ANSI/NAAMM MBG 532.
8. Furnish stainless steel Type 316 threaded anchor studs, as fasteners for grating attachment to metal supports either not embedded or partially embedded in concrete.

C. Supports:
1. Seat angles and beams where shown:
    a. Same material as rectangular bar grating.
    b. Extruded aluminum frame with slot for recessed grating clips, for aluminum I-Bar type grating.
2. Coordinate dimensions and fabrication with grating to be supported.
3. Coordinate dimensions with increased depth due to serrations.
4. Welded Frames with anchors: Continuously welded.
5. Fabricate frames with neatly fitted, welded, mitered corners. For aluminum frames in contact with concrete, apply isolation coating.

D. Slip-Resistant Surface:
1. Rectangular Aluminum Bar Grating: As manufactured by:
    a. IKG Industries Ltd.; EZ Weldslip-Resistant Coating.
2. I-Bar grating: aluminum with a striated antiskid walking surface produced during the extrusion process, as manufactured by:
    a. IKG Industries Ltd.
3. Extruded Plank Grating incorporating a rib pattern as part of the extrusion process and a crosswise serration to provide uni-directional slip resistance.

E. Aluminum:
1. ASTM B221 extruded shapes.
2. Fabricate as shown and in accordance with manufacturer's recommendations.
3. Grind smooth sheared edges exposed in the finished work.
4. Swage crossbars, if used, with equipment strong enough to deform crossbars.
5. Eliminate any loose crossbar intersections on swaged grating.

F. Foot Traffic Grating: Provide any single grating section, individual plank, or plank assembly in sizes not less than 450 mm or greater than 900 mm in width or weighing more than 68 kg.

PART 3 EXECUTION

3.1 PREPARATION

A. Electrolytic Protection:
1. Aluminum in contact with dissimilar metals, other than stainless steel, and embedded or in contact with masonry, grout, and concrete, protect surfaces as specified in [Section 09 90 00, Painting and Coating].
2. Allow paint to dry before installation of the material.

3.2 INSTALLATION

A. Install supports such that grating sections have a solid bearing on both ends, and that rock and wobble grating movement does not occur under designed traffic loading.

B. Install plumb or level as applicable.

C. Install welded frames with anchors to straight plane without offsets.

D. Anchor grating securely to supports using minimum of four fastener clips and bolts per grating section.

E. Use stainless steel anchors and accessories with aluminum gratings.

F. Ensure completed installation is rigid and neat in appearance.

G. Commercially Manufactured Products:
1. Install in accordance with manufacturer's recommendations.
2. Secure grating to support members with fasteners.
3. Welding is not permitted.
4. Fasteners: Field locate and install.
5. Permit each grating section or plank style grating assembly to be easily removed and replaced.

H. Protect painted surfaces during installation.

I. Should coating become marred, prepare and touch up surface in accordance with paint manufacturer's instructions.

END OF SECTION

SECTION 09 90 00

PAINTING AND COATING

PART 1 GENERAL

1.1 SUMMARY

A. Comply with Division 1, General Requirements.

B. Refer to Colour Schedule in this Section for items to be painted.

1.2 REFERENCES

A. Comply with the latest edition of the following statutes codes and standards and all amendments thereto.
   1. ASTM D523 Standard Test Method for Specular Gloss.
   2. Steel Structures Painting Manual Vol. 2 - Systems and Specifications.
   3. Manitoba Workplace Health and Safety Act National Fire Code of Canada.

1.3 SUBMITTALS

A. List of materials: Prior to commencement of work, submit three copies of list with name of manufacturer, number, grade and quality of materials proposed for use on this project.

B. Product and safety data sheets: Submit WHMIS MSDS – Material Safety Data Sheets for each paint system. Submit three (3) copies of paint system data sheet and three (3) copies of each data sheets.

C. Samples:
   1. Before painting work is started, prepare minimum 200 by 300 mm sample with type of paint and application specified on similar substrate to which paint is to be applied.
   2. Furnish additional samples as required until colours, finishes, and textures are approved.
   3. Approved samples to be the quality standard for final finishes.

1.4 QUALITY ASSURANCE

A. Prior to commencement of painting operations meet at site with material supplier's representative and with the Contract Administrator to review these Specifications, painting Work to be done and following related items:
   1. Equipment use and servicing.
   2. Material storage and application techniques.
   3. Surface preparation and ambient temperature.
   4. Inspection requirements.
   5. Inspection reports.
   6. Hold points or check points.
   7. Safety requirements during application.

8. Mock ups or samples of coatings in highly corrosive environment.

B. Field Sample:
1. A sample area located in the building will be designated by the Contract Administrator.
2. Apply samples of finishes in the sample area in the presence of the Contract Administrator, Contractor and paint manufacturer. Apply the samples with the correct material, number of coats, colour, texture and degree of gloss required. Refinish if required, until acceptance is obtained.
3. Leave test areas undisturbed until completion of the Work. Accepted work in the test area will serve as a standard for similar work throughout the Project.

C. Regulatory Requirements:
1. Meet regulatory requirements limiting the emission of volatile organic compounds.
2. Perform surface preparation and painting in accordance with recommendations of the following:
   a. Paint manufacturer's instructions.
   b. SSPC PA 3, Guide to Safety in Paint Applications.
   c. Federal, provincial, and local agencies having jurisdiction.

1.5 SITE CONDITIONS

A. Do not paint interior surfaces at temperatures below 3 degrees C above dewpoint or on surfaces where condensation has or will form due to presence of high humidity and lack of proper ventilation.

B. Follow manufacturer's product data for application conditions.

PART 2 PRODUCTS

2.1 MATERIALS

A. Paint and related materials: Akzo Nobel Coatings Ltd. (Canada) (Glidden Devoe Brands).

B. Protective coating system is based on materials manufactured by Akzo Nobel Coatings Ltd. (Canada) and represents standard of quality. Comparable systems by PPG Canada Inc., Sherwin-Williams Company are acceptable.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine surfaces which are to be finished including existing surfaces that require refinishing.

B. Report surfaces which are defective, or which cannot be prepared by usual sanding and cleaning. Report unsatisfactory site and environmental conditions.

C. Commence work after corrective work has been completed.

3.2 PREPARATION

A. Commencement of work means acceptance of job site and substrate conditions.

B. Protect work performed under separate Sections from paint splatter, overspray and accidental spill.

C. Remove soiled and used rags, waste and empty containers from the building daily.

D. Take precautions to prevent fire.

E. Comply with instructions on paint manufacturer's Safety Data Sheets.

F. Related Work: Surface preparation and prime coat of metal surfaces are specified to form part of the permanent protective coating in Division 5 - Metals, including responsibility for surface preparation, shop painting, and field touch-ups after erection. Be responsible for field painting of steel items which will remain exposed, after completion of erection and touch-up of shop primer, including items shop finished with a protective coating, unless specified otherwise.

G. Provide surface preparation in accordance with SSPC Manual Volume 2 "Systems and Specifications", Chapter 2.

H. Apply primer within time recommended after surface preparation. Comply with SSPC-PA-1 for application techniques, requirements and precautions.

I. Remove cover plates of service devices, surface hardware, frames of lighting fixtures and other obstructions and reinstall them after painting work is completed. Replace units damaged while performing work under this contract.

J. Clean surfaces to be finished from machine, tool or sanding marks, dust, grease, soiling, or any extraneous matter.

K. Test surfaces for moisture content. Do not apply materials to substrate when moisture content exceeds 12 percent as determined by accepted moisture testing device.

L. Shop welds: Grind smooth and rounded and abrasive blast in accordance with SSPC commercial type blasting SP 6. Remove weld flux and other surface contaminants.

M. Field welds: Use hand wire brush followed by cleaning with solvent swab in accordance with SSPC SP 1.

N. Unpassivated galvanized metal and plain aluminum surfaces: Wash thoroughly with Trisodium Phosphate solution mixed in accordance with manufacturers printed instructions. Rinse thoroughly. Follow instructions on Product Data sheets.

O. Galvanized surfaces that have been passivated: On small areas use abrasive buffing with bronze wool pad SP 2 or power wire brush SP 3 and clean with solvent. On large areas use brush off blast SP 7 and clean with solvent.

P. Concrete surfaces: Remove mold release oil with Xylol. If smooth etch for better adhesion. Follow instructions on manufacturer's Product Data sheets.

Q. Concrete surfaces treated with capillary waterproofing: Do not commence application until capillary waterproofing is minimum two weeks old. Rinse thoroughly with water and spray with solution one part muriatic acid to eight parts of potable water. Allow ten minutes of contact and rinse thoroughly with water.

R. Concrete block surfaces: Remove dirt, grease, dust and other contaminants. Fill holes and cracks with patching plaster.

3.3 APPLICATION

A. Apply paint materials free from defects.

B. Mask surfaces where necessary, to prevent contamination or marring of adjacent material, or different protective coating system.

C. Prevent overspray onto adjacent surfaces or properties.

D. Do not apply paint over sealant.

3.4 APPLICATION - MISCELLANEOUS EXISTING SURFACES

A. Paint or repaint existing surfaces of rooms where noted on the Room Finish Schedule including new work which has been incorporated into the existing work and existing work which has been damaged, altered or otherwise disturbed during renovation operations.

B. Repaint surfaces or rooms adjacent to rooms where alterations or renovations have been carried out and which have been damaged or otherwise disturbed by the alterations or renovations. Where such damage occurs, repaint completely.

C. Remove oil, grease, mildew, chemicals and other foreign matter from existing surfaces to be coated.

D. If coatings on existing surfaces have failed so as to affect the performance or appearance of coatings to be applied, or if such coatings can be scraped off, remove them and prepare their substrates correctly. Dull hard or glossy surfaces by sanding, or other abrasive methods prior to painting.

3.5 ITEMS TO BE PAINTED

A. Building Items:
   1. Paint items not prefinished with complete protective coating system.
   2. Paint shop-primed items.

3. Do not paint stainless steel and aluminum surfaces unless called for in Colour Schedule.

B. Touch up field-painted building items, equipment, piping and ducting damaged during construction.

3.6 APPLICATION – GENERAL

A. Apply finish coats of paint in thickness per coat specified.

B. If minimum dry film thickness (DFT) in micrometres (microns) is not achieved, apply additional coat(s) until required thickness is obtained.

C. Apply paint in accordance with SSPC Manual Volume 2 – "Systems and Specifications", Chapter 5.1.

D. Sand semi gloss, medium and high gloss finishes lightly between coats, unless otherwise approved by the coating manufacturer.

E. Gloss terms of following values when tested in accordance with ASTM D523 Test for Specular Gloss:

Gloss Term	Gloss Value
Flat	5 to 20
Eggshell	20 to 40
Semi-gloss	40 to 60
Gloss, medium	60 to 80
Gloss, high	80 to 90

F. Finish work uniformly as to sheen, gloss, colour and texture free from sags, runs and other defects and under adequate illumination.

G. Apply materials in accordance with directions and instructions of manufacturers of materials. Do not use adulterants.

H. Do not paint sprinkler heads, over ULC or other fire rating labels on doors and frames, nor over identification labels on mechanical and electrical equipment.

SERVICE USE	PROTECTIVE COATING SYSTEM	SURFACE PREPA—RATION	NO. OF COATS	MIN. D.F.T. PER COAT IN MICRONS

3.7 SCHEDULE - PROTECTIVE COATING SYSTEMS
By Akzo Nobel Coatings Ltd. (Canada) (Glidden and Devoe Brands)

A. CONCRETE BLOCK & CONCRETE: INTERIOR

	1.	Low chemical, moisture and sulfide fume exposure	PRIME: (Concrete Block) U-36250 Block Filler Primer	See Art. 3.2	1 150 min.
			PRIME: (Concrete) U-36600 Latex Sealer Primer FINISH: Devflex 4216L Waterborne Acrylic Semi-Gloss Enamel	See Art. 3.2	1 38 2 38-50

B. GALVANIZED STEEL - INTERIOR

	1.	Low chemical, moisture and sulfide fume exposure	PRIME: Devran 203 Waterborne Epoxy Primer FINISH: Devthane 379 H Aliphatic Urethane Gloss-Enamel	SP-7	1 75-100 2 50-75
			or Devthane 349 QC Aliphatic urethane Gloss		2 50-75

3.8 COLOUR SCHEDULE - GENERAL

A. Colour numbers shown are from current brochures of manufacturers of materials.

3.9 COLOUR SCHEDULE - BUILDING ITEMS

A. Exposed Structural Steel: To later selection.

B. Steel Stair Stringer, Riser, Underside: To later selection.

END OF SECTION