SECTION  – metal stairs and railings

1. GENERAL
   1. SUMMARY
      * + 1. This Section includes requirements for supply, fabrication, and installation of the following:

Structural Steel Stairs: Steel stair stringers will be considered as structural steel components, and shall be coordinated with Section 05 12 00 "Structural Steel"; requirements for certification and record keeping for steel stairs shall be the same as for structural steel framing, and as follows:

Stairs with concrete filled treads.

Industrial stairs with galvanized steel grating treads.

SPEC NOTE: Only use checker plate for areas which require high slip resistance. Use steel plate for interior applications. Use stainless-steel for exterior application and galvanized for interior.

Industrial stairs with [**stainless steel**] [**galvanized steel**] checker plate.

[**Steel**] [**Stainless Steel**] [**Aluminum**] Railings, as follows:

Handrails and railings attached to stairs.

Handrails attached to walls adjacent to stairs.

Steel Ladders [**and Safety Cages**].

Elevator Pit Ladders.

High Parapet Ladders.

* + - * 1. Related Requirements:

Section 03 30 00 "Cast-In-Place Concrete."

Section 05 12 00 "Structural Steel."

Section 05 50 00 "Miscellaneous Metals."

Section 09 90 00 "Painting and Finishing."

* 1. DEFINITIONS
     + - 1. Field Dimensions: Actual dimensions measured on site and used by fabricator to construct required assemblies.
         2. Established Dimensions: Dimensions derived from drawings or that can be reasonably determined from adjacent construction where actual dimensions required by components fabricated in this Section are not available; dimensions shall have suitable tolerances so that assemblies can be adjusted on site to fit actual field dimensions.
  2. REFERENCE STANDARDS
     + - 1. American Society for Testing and Materials (ASTM):

ASTM A53/A53M-12 Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.

ASTM A108‑13, Standard Specification for Steel Bars, Carbon and Alloy, Cold‑Finished.

ASTM A167‑99(2009), Standard Specification for Stainless and Heat‑Resisting Chromium‑Nickel Steel Plate, Sheet, and Strip.

ASTM A276/A276M-15, Standard Specification for Stainless Steel Bars and Shapes.

ASTM A307‑14, Standard Specification for Carbon Steel Bolts, Studs and Threaded Rod 60,000 psi Tensile Strength.

ASTM A325-14 Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.

ASTM A653/A653M‑15, Standard Specification For Steel Sheet, Zinc Coated (Galvanized) Or Zinc‑Iron Alloy Coated (Galvannealed) By The Hot Dip Process.

ASTM A1011/A1011M-14, 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.

ASTM 1064/1064M-15, Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.

ASTM B209‑14, Standard Specification for Aluminum and Aluminum‑Alloy Sheet and Plate.

ASTM B221-14 Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

ASTM B241/B241M‑12e1, Standard Specification for Aluminum and Aluminum‑Alloy Seamless Pipe and Seamless Extruded Tube.

ASTM C939-10, Standard Test Method for Flow of Grout for Preplaced Aggregate Concrete (Flow Cone Method).

ASTM C1107/C1107M-14a, Standard Specification for Packaged Dry, Hydraulic Cement Grout (Nonshrink).

* + - * 1. Canadian Institute of Steel Construction (CISC):

Handbook of Steel Construction, latest edition, and revision.

* + - * 1. Canadian Standards Association (CSA):

CAN/CSA‑G40.20-13/G40.21‑13, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steels.

CSA W47.1‑09(2014), Certification of Companies for Welding of Steel Structures.

CSA W48-14, Filler Metals and Allied Materials for Metal Arc Welding.

CSA W55.3‑08(R2013), Resistance Welding Qualification Code for Fabricators of Structural Members Used in Buildings.

CSA W59-13, Welded Steel Construction (Metal Arc Welding).

* + - * 1. National Association of Architectural Metal Manufacturers (NAAMM):

NAAMM AMP 503‑88, Finishes for Stainless Steel.

NAAMM AMP 510‑92, Metal Stair Manual.

NAAMM AMP 521‑01, Pipe Railing Systems Manual.

ANSI/NAAMM MBG 531‑00, Metal Bar Grating Manual, 5th Edition.

ANSI/NAAMM MBG 533‑89, Welding Specifications for Steel, Aluminum and Stainless-Steel Bar Gratings, 2nd Edition.

* 1. DESIGN REQUIREMENTS
     + - 1. Retain a Professional Engineer, registered in the province of the Work, to design details and connections of steel stairs, and ascertain that the following will comply with the requirements of the Building Code and the Contract Documents:

Selection and design of connections not detailed on the Contract Documents.

Fabrication of components.

Erection of the work of this Section.

* + - * 1. Design details and connections in accordance with requirements of CAN/CSA S16.1, and applicable codes and authorities having jurisdiction.
        2. Design gratings for 4.8 kN/m2 or a concentrated load of 4.8 kN at any point on the standard grating width.
        3. Design stair and landing sections, attachments, and connections, except where members are specifically sized on the drawings, to support a minimum live load of 4.8 kN/m2 or a concentrated load of 2.0 kN at any point on indicated tread widths in accordance with Building Code.
        4. Design railing assemblies to withstand a minimum uniform load of 0.75 kN/m or a concentrated load of 1.0 kN at any point applied horizontally to top rail and a minimum of 1.5 kN/m applied vertically to top rail, with individual elements within the assembly designed for a concentrated load of 0.5 kN at any point in the element in accordance with the Building Code.
  1. SUBMITTALS
     + - 1. Submit submittals in accordance with the requirements of the General Conditions and Section 01 33 00 – Submittal procedures.
         2. Shop Drawings: Provide shop drawings including, but not be limited to, the following:

Sections and plans of stairs, railings and ladders indicating dimensions and assembly of components.

Indicate fasteners, welds, and connection details between stringers; treads; risers; headers; newels; platforms; struts, columns, and hangers; railings; handrails; brackets; reinforcements; anchors; and welded and bolted connections.

Methods and locations of all exposed fastenings.

Methods and locations of specified finishes.

Shop drawings requiring to be sealed by the professional engineer registered in province of work, responsible for the design.

* 1. QUALITY ASSURANCE
     + - 1. Detail and fabricate metal fabrications in accordance with the NAAMM AMP 510, 521, and 555; prepare fabrication and erection documents and materials lists in accordance with CSA S16-09.
         2. Fabricator shall have a minimum five (5) years documented experience fabricating metal stairs and railings and shall perform work of this Section to the highest standard of modern shop and field practice, by personnel experienced in architectural quality metalwork.
         3. Retain a Professional Engineer, registered in the Province of the work, to design fabrication and erection of the work of this Section in accordance with applicable Building Code and Contract Documents requirements including, but not limited to, the following:

Seal and signature to shop drawings and design submittals.

Field review of installed components.

* 1. SITE CONDITIONS
     + - 1. Verify dimensions by field measurements before fabrication and indicate measurements on Shop Drawings where metal fabrications are indicated to fit walls and other construction.
         2. Establish dimensions and proceed with fabricating metal fabrications where field measurements cannot be made without delaying the work; allow for trimming and fitting.
  2. DELIVERY, STORAGE AND HANDLING
     + - 1. Store materials in a location and manner to avoid damage; stack materials to prevent bending or applying stress to components; keep handling of materials on‑site to a minimum.
         2. Store [**aluminum**] [**stainless steel**] components and materials in clean, dry location, away from uncured concrete or masonry; cover with waterproof paper, tarpaulin or polyethylene sheeting in a manner that permits air circulation inside of covering.
         3. Correct damaged material and where damage is deemed irreparable by the Owner, replace the affected item at no additional expense to the Owner.
         4. Apply protective covering to face of all exposed finished metalwork before it leaves shop, covering to remain until item installed and ready for final finishing.
         5. Fabricate large assemblies so they can be safely and easily transported and handled to their place of installation.
  3. COORDINATION
     + - 1. Coordinate fabrication schedule with construction progress to avoid delaying the work.
         2. Coordinate with Contractor so that field dimensions correspond to established dimensions.
         3. Coordinate shop priming and finishing requirements.
         4. Coordinate installation of anchorages for metal stairs.
         5. Supply items required to be built‑in by other Sections, with instructions for installation for work not installed by this Section; install finish hardware and items supplied under other Sections required for completion of components of this Section.
         6. Coordinate nosing with specified stair finishes and set top of nosing level with top of floor finish; set materials flush with concrete surfaces where no floor finish is indicated.

1. PRODUCTS
   1. MATERIALS
      * + 1. Use only materials that are new, free from defects that would impair the strength, durability or appearance, and of the best commercial quality for the purposes specified.
          2. Structural Steel Sections, Steel Plates and Checker Plate:

New stock (not weathered or rusted); to conform to CAN/CSA-G40.21, Grade 300W (44W) and Grade 350W (50W) for wide flange shapes.

* + - * 1. Hollow Structural Sections (HSS):

New stock; to conform to CAN/CSA-G40.21, Grade 350W (50W), Class C, stress relieved.

* + - * 1. Sheet Steel (Structural Quality):

Conforms to ASTM A1011/A1011M

* + - * 1. Sheet Steel (Commercial Quality):

Conforms to ASTM A1011/A1011M, stretcher levelled, or temper rolled.

* + - * 1. Concrete Fill Stair Treads:

Concrete materials and properties shall be in accordance with specified requirements in Section 03 30 00, and as follows:

Concrete: Normal weight, ready mixed concrete conforming to CAN/CSA A3000-08 and having minimum 20 MPa compressive strength at 28 days.

Non‑slip aggregate finish: Factory packaged abrasive aggregate made from fused, aluminum‑oxide grit; rustproof and non‑glazing; unaffected by freezing, moisture, or cleaning materials.

* + - * 1. Steel Grating:

Pressure locked type steel grating with serrated upper edges where grating is exposed to exterior conditions, thicknesses as required to support loading and conforming to Metal Bar Grating Manuals, MBG 531-93 and MBG 532-93, type as approved by Consultant, by Borden Metal Products (Canada) Limited, or by Dominion Bridge Company Limited, or by Robertson Building Systems, or by Armtec Inc., or by Fisher & Ludlow, Division of Harris Steel Ltd.

Provide steel grating stair treads and landings with non-slip steel checker plate nosings.

Provide manufacturer's standard and saddle clip type fasteners for grating.

Hot dip galvanizes steel gratings and steel grating stair treads for exterior locations.

* + - * 1. Steel Pipe: Hot-dip galvanized, zinc coated, welded and seamless type steel pipe conforming to ASTM A53/A53M-12.
        2. Aluminum Materials:

Aluminum Sheet and Plate: In accordance with ASTM B209-10, Type 6063‑T6 having clear anodized Architectural Class II Coating.

Extruded Bar and Shapes: In accordance with ASTM B221-12, Type 6063‑T6 having clear anodized Architectural Class II Coating.

Extruded Tube and Pipe: In accordance with ASTM B241/B241M-10, Type 6063‑T6 having clear anodized Architectural Class II Coating.

* + - * 1. Welding Materials:

Conforms to CSA W59-03 (R2008).

* + - * 1. Primer:

Shop Applied Structural Steel Primer: Steel Spec Universal Primer (B50RV6227 Red), by Sherwin Williams Company of Canada Ltd., or approved equal. Apply a minimum of 2 mils dft./coat. Grey coloured primer is acceptable.

Zinc Rich Paint For Touch-up of Galvanized Metals: Ready mixed, zinc-rich primer conforming to CAN/CGSB-1.181-99, Sealtight Galvafroid Zinc-Rich Coating by W.R. Meadows of Canada Limited or Zinc Clad No. 5 Organic Zinc Rich Primer by Sherwin Williams Company of Canada Ltd., or approved equal.

Touch-up Primer (On Site): 'Procryl Universal Acrylic Primer' by Sherwin Williams Company of Canada Ltd, or approved equal. Touch-up primer shall be no less than 3 mil dft.

Refer to Section 09 90 00 "Painting and Finishing," and coordinate with the above.

* + - * 1. Non-Shrink Grout:

Premixed, high strength, maximum bearing, impact resistant, non-shrink metallic aggregate grout having minimum 76 Mpa 28 day compressive strength and conforms to ASTM C939-10 and ASTM C1107/C1107M-11, 'SikaGrout 212' by Sika Canada Inc., or approved equal.

* + - * 1. Bituminous Paint:

Conforms to CAN/CGSB-1.108-M89, Type 2.

* + - * 1. Building Paper:

Conforms to CAN/CGSB-51.32-M77.

* + - * 1. Butyl Tape:

Extruded, high grade, macro-polyisobutylene tape of thickness, width and shore hardness to suit conditions.

* + - * 1. Galvanizing:

All uncoated steel specified to be galvanized shall be galvanized after fabrication by the hot-dip process according to CAN/CSA-G164-M92 (R2003), with minimum coating of 2 oz./sq.ft. Galvanize after all welding is complete. Welding of galvanized material will not be permitted. Specially treat by phosphate conversion process conforming to CGSB 31-GP-105Ma ready to receive prime paint finish.

* 1. FABRICATION AND MANUFACTURE
     + - 1. Design Requirements:

Fabricate steel stairs to safely support live load of 100 pounds per square foot evenly distributed over treads and landings with maximum deflection of L/240. Fabricate railings to conform to the Ontario Building Code, latest edition, in particular Division B, Part 4, Sub-Section 4.1.5.

* + - * 1. General:

Fabricate steel stairs and railings to details indicated on Drawings and to Metal Stairs Manual, AMP 510-92.

Fabricate to reviewed shop drawings and in general to details indicated on drawings and specified herein. Where possible, fit and shop assemble and deliver to site in largest practicable sections.

Fabricated work shall be complete with components required for anchoring.

Fit joints and intersecting members accurately with hairline joints in least conspicuous locations and manner. Make work in true plane with adequate fastenings.

* + - * 1. Welding:

Except where bolted connections are indicated, make stairs of welded construction conforming to requirements of CSA W59-03(R2008).

Grind exposed welds smooth. Machine materials and straighten in such a way that no disfigurement will show in finished work.

* + - * 1. Fastenings and Connections:

Weld connections where possible. Where not possible bolt or otherwise secure in approved manner. Where approved, install exposed fastenings of same materials, colour and finish as base metal on which they occur.

Countersink screws unless noted otherwise and reinforce where necessary.

Use shop and field connections detailed. Where not detailed, connections shall comply with CSA S16-09.

* 1. COMPONENTS
     + - 1. Steel Grating Stairs:

Treads and Landings: Provide steel grating landings and stair treads where indicated on drawings, reinforced as required. Form open riser grating stair treads and landings from steel grating with checker plate nosings. Fasten open riser stair treads to stringers with concealed brackets.

Stringers: Steel stringer channel unless otherwise noted, with 14 gauge formed fascia where indicated.

Balusters and Handrails: Provide balustrades, railings and handrails as indicated on drawings, complete with brackets and anchoring devices.

Framing: Structural steel framing, angles, channels, trimmers, posts and columns, channel bearings, support angles and clip angle connections to floor slabs and walls.

Finish: Hot-dip galvanize after fabrication.

SPEC NOTE: Only use stainless-steel checker plate for exterior application. Use steel plate for interior applications.

* + - * 1. Floor Plate: [Stainless steel safety plate meeting ASTM A793] [Steel safety plate meeting ASTM A786/A786M-05(2009)], ¼" thick, checkered pattern 45° to edge of steel plate, raised 1-1/8" x 5/16" elongated pips at 90° to each other, 1" offset x 1-3/4" on centre.
        2. Railings and Handrails:

Provide floor and wall mounted railings and handrails as indicated on drawings, complete with brackets, anchoring devices and removable sections.

Handrails and Wall Brackets: Tubular [steel] [stainless steel] [aluminum], 38mm (1-1/2") dia. pipe rail with rod and mounting flange as detailed on Drawing A####.

Finishing:

Steel: After shop fabrication, thoroughly de-scale steelwork, remove roughness and irregularities by grinding, clean with wire brush, remove oil and grease from surface of steel and give one coat of primer. Give steelwork one coat of primer in shop working well into crevices and interstices. Leave ready for finish painting by Section 09 90 00. Hot-dip galvanized exterior steel railings and handrails.

Aluminum: Satin finish.

* + - * 1. Stair Nosing Tactile Warning Devices:

Extruded aluminum, 3" wide nosing with slip resistant inserts consisting of aluminum oxide and silicon carbide granules in an epoxy matrix locked into the extruded channels of the base, projecting minimum of 1/16" above extruded channels, colour [safety yellow] [contrasting colour to floor finish selected by Consultant from full colour range].

6" wide extruded aluminum nosing with slip resistant inserts consisting of aluminum oxide and silicon carbide granules in an epoxy matrix locked into the extruded channels of the base, projecting minimum of 1/16" above extruded channels, colour [safety yellow] [contrasting colour to floor finish selected by Consultant from full colour range].

6mm (1/4") wide cast abrasive strips; projecting 1.6mm (1/16") from top of cast tread, 13mm (1/2") deep, and set into mastic. Colour [safety yellow] [contrasting colour to floor finish selected by Consultant from full colour range].

SPEC NOTE: The Following System Is For Photoluminescent Stair Tread Products. This Will Be added in the Next Building Code Revision. Delete If Not Required On This Project.

Photoluminescent: Two (2) part epoxy combined with thermoplastic aggregate and high-grade strontium aluminate photoluminescent pigment.

1. EXECUTION
   1. EXAMINATION
      * + 1. Examine the work of other Sections upon which the work of this Section depends and report any defects to the Consultant. Do not commence installation until such time as all wet trades have been completed. Commencement of work implies acceptance of surface and conditions.
   2. PREPARATION
      * + 1. Provide anchorage devices and fasteners to other Sections where necessary for securing metal stairs to in place construction; include threaded fasteners for concrete and masonry inserts, through‑bolts, lag bolts, and other connectors.
          2. Perform cutting, drilling, and fitting required for installing metal stairs.
          3. Field check and verify that structural framing, enclosures, weld plates, blocking, and that size and location of pockets are placed in accordance with reviewed shop drawings.
          4. Report discrepancies to Contractor and Consultant and recommend corrective action by responsible parties.
          5. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
          6. Hand items over for casting into concrete or building into masonry to appropriate trades together with setting templates and instructions for installation.
   3. INSTALLATION
      * + 1. Furnish, set, and secure framing brackets, hangers, anchors, inserts or similar supports for proper erection of stairs before masonry and concrete is placed. Provide temporary supports and bracing required to position stairs and railings.
          2. Do all coring, drilling, and fitting necessary to attach work of this Section to adjoining work.
          3. Continuous weld connections between handrails and balusters and in lengths of handrails.
          4. Secure wall brackets to wall at 1220 (4') O.C. maximum with through-bolts and plate where these can be concealed, otherwise use bolts and expansion shields to achieve maximum rigidity of rail. Wood plugs for fixing to walls will not be permitted. Use metal anchoring devices.
          5. Grout bases of posts, balusters or newels occurring in concrete using non-shrink grout in accordance with manufacturer's instructions. Finish smooth, level and flush with surrounding finished surface.
          6. Isolate where necessary to prevent electrolysis due to dissimilar metal-to-metal contact or metal-to-masonry and concrete. Use 2 coats of bituminous paint, butyl tape, or building paper.
          7. Grind off surplus welding materials and provide sharp profiles and arises.
          8. Build and erect work plumb, true, square, straight, level, and accurate, to sizes detailed, to reviewed shop drawings, free from distortion or defects detrimental to appearance and performance.
          9. Touch up with matching primer, or zinc rich paint for galvanized components, field welds, damaged and abraded surfaces, and surfaces not previously primed. Leave ready for finish painting by Section 09 91 00 – Painting.
   4. PROTECTION
      * + 1. Protect completed work from damage during and after installation.
          2. Field repair or refinishing of damaged, marred, or discoloured finishes will not be accepted.
   5. CLEANING
      * + 1. Clean installations and assemblies progressively as work proceeds, and at completion of work.
          2. Remove protective coverings and clean metal work using cleaning solutions and methods to suit the metal and its finish at completion of work.
          3. Protect adjacent materials and finishes from damage or discolouring during cleaning.
          4. At completion, remove all equipment, tools, surplus materials, and debris from job site.
   6. STAIR AND RAILING SCHEDULE
      * + 1. Stair One:

Configuration: **[Straight Stair, [Parallel Run] [Straight Run] [Angled Run] after landing] [Circular Stair]**

Stringers: Structural Steel Channel, **[Closed] [Open]** Face, size in accordance with delegated design requirements; having a minimum 25mm (1") clear between tip of nosing and back of tread to face of channel; close ends of stringers where exposed.

Treads and Risers:

Construction: [**Concrete filled pan, [open] [closed] riser [with sanitary cove]**] [**Concrete filled channel**] [**Steel plate**] [**prepared to receive precast concrete tread**] [**checkered profile safety plate**] [**open**] [**closed**] riser] [**Steel grating [welded] [bolted] to stringer**] [**Precast concrete**].

Deflection: **[L/360] [L/480 for ceramic tile finished treads]**

Nosing: [**Cast abrasive**] [**extruded aluminum with abrasive ribs**] [**integral with steel grating treads**]

Landings **[and Platforms]**: **[Concrete filled steel pan reinforced with channels, to provide smooth soffit surface] [Composite steel deck and concrete; coordinate with Section 05 31 00] [Steel grating]**.

Railings: **[Pipe] [Baluster] [Glass panel] [Perforated metal panel] [other] [as detailed on Drawing <List Number>]**, return ends to wall.

Handrails**: [Pipe Rail] [Profiled Rail]**

Usage Classification: **[Industrial] [Service] [Commercial] [Architectural]**

SPEC NOTE: Copy and paste stairs paragraphs for additional stair types, as required for the project.

* + - * 1. Stair Two:

Configuration: [**Straight Stair, [Parallel Run] [Straight Run] [Angled Run] after landing**] [**Circular Stair**]

Stringers: Structural Steel Channel, [Closed] [Open] Face, size in accordance with delegated design requirements; having a minimum 25mm (1") clear between tip of nosing and back of tread to face of channel; close ends of stringers where exposed.

Treads and Risers:

Construction: [**Concrete filled pan, [open] [closed] riser [with sanitary cove]**] [**Concrete filled channel**] [**Steel plate**] [**prepared to receive precast concrete tread**] [**checkered profile safety plate**] [**open**] [**closed**] riser] [**Steel grating [welded] [bolted] to stringer**] [**Precast concrete**].

\*\*\*\*\*\*\*Deflection: **[L/360] [L/480 for ceramic tile finished treads]**

Nosing: [**Cast abrasive**] [**extruded aluminum with abrasive ribs**] [**integral with steel grating treads**]

Landings **[and Platforms]**: **[Concrete filled steel pan reinforced with channels, to provide smooth soffit surface] [Composite steel deck and concrete; coordinate with Section 05 31 00] [Steel grating]**.

Railings: **[Pipe] [Baluster] [Glass panel] [Perforated metal panel] [other] [as detailed on Drawing <List Number>]**, return ends to wall.

Handrails: **[Pipe Rail] [Profiled Rail]**

Usage Classification: **[Industrial] [Service] [Commercial] [Architectural]**

SPEC NOTE: Delete handrail schedule if not required on the project. First schedule is for hand rail welded to guardrail, and second schedule is for handrail attached to wall brackets.

* 1. PIPE HANDRAIL AND GUARDRAILING SCHEDULE
     + - 1. Provide handrails and guardrails of the minimum diameter, standard weight pipe required to resist design loads, and as follows:

Return ends of metal handrails toward guardrail after 305mm (12") of straight run, with radius corners, leaving 200mm (8") space between returned end and handrail.

Space guardrail pickets a maximum of 100mm (4") o.c.

Design railings, and supports, in accordance with loads specified in the Building Code.

Extend handrail horizontally not less than305mm (12") beyond top and bottom of stairway or ramp in accordance with Building Code.

Weld handrail and guardrail to stringer as indicated on Drawings.

Cap the ends of tube rails with 3mm (1/8") steel plate. Weld all around.

Usage Classification: [**Industrial**] [**Service**] [**Commercial**]

* 1. PIPE HANDRAIL AND WALL BRACKETS SCHEDULE
     + - 1. Provide handrails and brackets of the minimum diameter, standard weight pipe required to resist design loads, outer diameter 40mm (1.6") unless otherwise indicated on the drawings, and as follows:

Return ends of metal wall handrails toward wall with radius corner and stop handrail 13mm (1/2") from wall with flat end.

Space brackets at a maximum of 1220mm (4') and not more than 305mm (12") from the ends.

Design railings, and supports, in accordance with loads specified in the Building Code.

At least one handrail at side of stairway or ramp shall extend horizontally not less than 305mm (12") beyond top and bottom of stairway or ramp in accordance with Building Code.

Weld posts to cast‑in designed to resist post loads in accordance with the Building Code.

Cap the ends of tube rails with 3mm (1/8") steel plate. Weld all around.

Usage Classification: [**Industrial**] [**Service**] [**Commercial**]

* 1. LADDER SCHEDULE
     + - 1. Elevator Pit Ladders: Provide one (1) ladder for each pit and confirm location with elevator supplier, and as follows:

Side Rails: Nominal 63.5mm x 10mm (2-1/2" x 3/8") side rails at 457mm (18") O/C, extend side rails to 1220mm (4') above the entry floor level.

Rungs: Smooth bar stock, nominal 19mm (3/4") diameter shouldered and welded at maximum 305mm (12") O/C, starting at 305mm (12") above pit floor level.

Ladder Mounts: 63.5mm x 10mm (2-1/2" x 3/8") brackets mounted at maximum of 1524mm (5') O/C with a support at the top of the side rails, and the rungs at 150mm (6") from the wall face.

Usage Classification: [**Industrial**] [**Service**]

* + - * 1. High Parapet Access Ladder:

Construct with 2.54mm (0.1") minimum bent plate or steel channel stringers and grating treads, welded.

Include 32mm (1-1/4") outside dia. pipe handrails both sides.

At top landing form tread 100mm (4") wide, level with landing.

Usage Classification: Service

* + - * 1. Roof Access Ladders:

Construct access ladders in accordance with Ontario MOL safety codes.

Side Rails: Nominal 63.5mm x 10mm (2-1/2" x 3/8") at 457mm (18") O/C, extend side rails to 1220mm (4') above upper surface, loop and return side rails for roof access ladders.

Rungs: Nominal 19mm (3/4") diameter rungs shouldered and welded at 305mm (12") O/C maximum, rungs starting at 305mm (12") maximum above lower entry level or roof surface, finished with acceptable non‑slip tread surface.

Ladder Mounts: Nominal 63.5mm x 10mm (2-1/2" x 3/8") brackets at maximum spacing of 3048mm (10') with support at the top of the side rails, and centreline of rungs at 150mm (6") from the wall face.

Safety Cages: Provide acceptable steel safety cage for ladders greater than 6096mm (20') in height starting from 2439mm (8') maximum above bottom entry level and continuous to top, and as follows:

Primary Hoops: 8mm x 100mm (5/16" x 4") steel flat bar hoops at tops and bottoms of cages and spaced not more than 3658mm (12') O/C.

Secondary Intermediate Hoops: 8mm x 50mm (5/16" x 2") steel flat bar hoops, spaced not more than 1220mm (4') O/C. between primary hoops.

Vertical Bars: 8mm x 50mm (5/16" x 2") steel flat bars secured to each hoop, spaced approximately 229mm (9") O/C.

Fasten assembled safety cage to ladder rails and adjacent construction by welding or riveting, unless otherwise indicated.

END OF SECTION