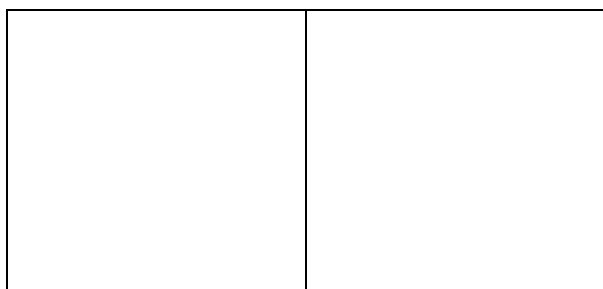


Project **Parks Canada**

Date: September 4, 2020

Project No.: R.089317.002

This document shall be read with and forms an integral part of the Contract Documents. It modifies and clarifies the drawings and the specifications of the above-mentioned project. The modifications described herein come into force immediately.

**1. ARCHITECTURAL****1.1. MODIFICATIONS TO ARCHITECTURAL SPECIFICATIONS****1.1.1. SECTION 05 41 00**

1.1.1.1. Article 3.7.8: Dimensions of steel nailer plate shall be as indicated on drawings.

1.1.2. SECTION 10 56 26

1.1.2.1. Article 2.3.7.3: For the drive shaft, a solid steel rod of equal strength and performance is acceptable.

1.1.2.2. Article 2.3.12.1: Cross-members, braces and footplate shall be either welded or bolted together.

1.1.2.3. Article 2.3.13.6: Shelf supports to be prepainted.

END OF ADDENDUM No. A07

1.0 GENERAL

1.1 Related Sections

- .1 Division 01 – General Requirements shall be read in conjunction with and shall govern this Section.
- .2 Sections or Divisions for coordination, or for reference to related products:
 - .1 **Section 05 05 00** Basic metal materials and finishes
 - .2 **Section 07 84 00** Fire and Smoke Protection
 - .3 **Section 07 92 00** Joint Sealants

1.2 References

- .1 ASTM International
 - .1 ASTM A123/A123M-17, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - .2 ASTM A653/A653M-19a, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - .3 ASTM A792/A792M-[10 (2015)], Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
 - .4 ASTM C514 - 04(2014), Standard Specification for Nails for the Application of Gypsum Board
 - .5 ASTM C645 – 18, Standard Specification for Nonstructural Steel Framing Members
 - .6 ASTM C840 – 19, Standard Specification for Application and Finishing of Gypsum Board
 - .7 ASTM C954 – 18 Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs
 - .8 ASTM C1002 – 18, Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs
 - .9 ASTM C1177/C1177M - 17, Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing
 - .10 ASTM C1278/C1278M - 07a (2015), Standard Specification for Fiber-Reinforced Gypsum Panel
 - .11 ASTM C1280 – 18, Standard Specification for Application of Exterior Gypsum Panel Products for Use as Sheathing
 - .12 ASTM D1056-14, Standard Specification For Flexible Cellular Materials – Sponge or Expanded Rubber
 - .13 ASTM D3273-16, Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber
- .2 CSA Group
 - .1 CSA W47.1-09 (R2014), Certification of Companies for Fusion Welding of Steel
 - .2 CSA W55.3-08 (R2018), Certification of companies for resistance welding of steel and aluminum
 - .3 CSA W59-18, Welded Steel Construction
 - .4 CSA S136-16, North American specification for the design of cold-formed steel structural members
- .3 Canadian Sheet Steel Building Institute (CSSBI)

- .1 CSSBI 51-06E, Lightweight Steel Framing Design Manual.
- .2 CSSBI Fact Sheet #3 February 2006, Care and Maintenance of Prefinished Sheet Steel Building Products.
- .3 CSSBI Technical Bulletin Vol. 7, No. 2 September 2011, Changing Standard Thicknesses for Canadian Lightweight Steel Framing Applications.
- .4 CSSBI S5-19, Guide Specification for Wind Bearing Steel Studs.
- .4 Gypsum Association Publication
 - .1 GA-253-2018, Application of Gypsum sheathing
- .5 Master Painters Institute (MPI)
 - .1 Architectural Painting Specification Manual - current edition.

1.3 Design Criteria

- .1 The calculations for the wind-load bearing stud system shall be done by a professional engineer, member in good standing of the Ordre des Ingénieurs du Québec.
- .2 The calculations shall be based on the principles of limit states design, using weighted loads and resistances.
- .3 The calculations shall be determined in conformity with the prescriptions of the National Building Code (NBC) and CSA S136; nonetheless, the walls should resist a minimum of 1.25kPa positive and negative wind pressure.
- .4 Soffits, if any, must also resist positive and negative wind pressures.
- .5 Parapets must resist a tensile force of at least 223 kg/m, linear.
- .6 Calculate adequate bracing to prevent rotation and translation of the elements when the stud system is subjected to wind loads.
- .7 Calculate elements and assemblies so that tolerances for the installation of the structure are respected.
- .8 Design stud system assemblies subject to wind loads to accommodate deflections of slabs or roofs and avoid axial loading of studs.
- .9 Fasteners shall include bolts, metal screws and welding. CSA S136 prescriptions shall be respected in calculating resistance of metal screws.
- .10 Comply with NBC Section 4.1.10.3 (Loads on walls acting as guards) for all wall areas adjacent to a floor level above ground level.

1.4 Sustainability Criteria

- .1 Comply with all requirements of **Section 01 47 15 SUSTAINABLE REQUIREMENTS: CONSTRUCTION**, as well as the following.
- .2 Submit Product information to identify life cycle impact (EPD), reduced environmental impact through Leadership Extraction practices, as well as report on material ingredients and compliance with Red List criteria. Refer to table below for specific requirements.

PRODUCT	EPD	Leadership Extraction Practices	HPD	LBC Red List Free/ Compliant
Type ST.STD.2/GV – Exterior Structural Steel Stud System, Galvanized	√	√	√	

1.5 Submittals for Review

- .1 Submit the documents and elements as per **Section 01 33 00** and the following requirements:
 - .1 Shop drawings (S.D.): shop drawings shall be signed and stamped by a professional engineer registered in the province and must include the calculations.
 - .2 Sustainable development documentation (D.D.): see **Sustainability Criteria**, above.
 - .3 Certificates of conformity (C.C.): the engineer who signed the shop drawings shall provide written confirmation that work is installed in accordance with reviewed shop drawings.
 - .4 Mock-ups (M.U.):
 - .1 Erect a full-sized mock-up of a wall and a parapet as per instructions from the Departmental Representative.
 - .2 Once the mock-up(s) have been satisfactorily reviewed by the Departmental Representative, these may be incorporated into the final installation.
 - .5 Field reports (F.R.): see **Field Quality Control** below.

1.6 Closeout Submittals

- .1 Submit documents and elements as per **Section 01 33 00** and **Section 01 78 00**.

1.7 Qualifications (P.Q.)

- .1 Welders: to be accredited from the Canadian Welding Bureau, in accordance to CSA W47.1/W47.1-S1 Suppl.1 requirements for fusion welding of steel structures and/or CSA W55.3 for resistance welding of structural components.
- .2 Provide proof of qualification.

1.8 Delivery, Handling and Storage

- .1 Deliver materials to job site in perfect condition, uniform shape and size, and free of chips, cracks or broken corners.
- .2 Store under waterproof cover on pallets or plank platforms held off ground by means of plank or timber skids, protected from the sun and contamination due to corrosion or other damage from work on site, and in such a manner as to avoid deflection.
- .3 Protect and handle galvanized materials with care, to avoid damage to zinc finish, chipping of edges or any damage to adjacent surfaces or materials, such as gypsum boards.
- .4 Remove damaged material from site.

1.9 Waste Management and Disposal

- .1 Waste management and disposal to be performed as per **Section 01 74 21**.

2.0 PRODUCTS

2.1 General

- .1 Unless otherwise instructed, certain related products, specified elsewhere as indicated, are to be supplied and installed by this Section for the work of this Section.
- .2 See **Section 05 05 00** for description of basic metal materials and finishes and welding procedures.
- .3 See **Section 09 20 00** for the interior gypsum boards of the exterior walls.

2.2 Type ST.STD.2/GV – Exterior Structural Steel Stud System, Galvanized

- .1 System and components: as per ASTM C645, ASTM A653/A653M, CAN/CSA-S136 and ULC requirements for fire rated assemblies.
- .2 Studs: fabricated from Type ST.PL/GV steel, as per CSA S136, hot dipped galvanized finish minimum Type GV.F.2A, with 152 mm or 92 mm width and 41 mm depth, or as indicated. Minimum bare steel thickness of 1.087 mm, or more, as per structural calculations. Stud spacing as per structural calculations, max. 406 mm, o.c. Provide for multiplication of studs and required reinforcement at jambs of openings. Each stud shall be identified as per CSSBI nomenclature and colour.
- .3 Stud tracks, top and bottom: fabricated from same material and finish as steel studs, width to suit, minimum depth 63.5 mm or as noted, cold rolled, hot dipped galvanized steel sheet, same sheet thickness as studs.
- .4 Type DF.TR.1 – Top tracks for deflection, Type 1: similar to regular tracks with perforated flanges of 63.5 mm, with 38 mm slots allowing vertical movement; width as needed.
- .5 Gasket strip: Type JOIN.5A/SA – **See Below**.
- .6 Girt: fabricated from same material and finish as steel studs, 38 mm x 12 mm, x 1.087 mm thickness.
- .7 Angle clips: fabricated from same material and finish as studs, 38 mm x 38 mm x depth of steel studs, 1.087 mm minimum thickness.
- .8 Anchor backing: steel sheet: Type ST.PL/GV, 76 mm wide, or as indicated or required, 1.367 mm bare metal thickness, galvanized, Type GV.F.2.
- .9 Stiffeners and accessories: as recommended by the manufacturer.

.4

2.3 Sub-Girt Systems

- .1 Type S.GRT/GV/W – Galvanized steel sub-girt system for walls, and Type S.GRT/GV/S – Galvanized steel sub-girt system for soffits:

- .1 In Type ST.PL/GV steel sheet, finish Type GV.F.2, of appropriate thickness according to prescribed loads, minimum 1.2 mm, compliant with ASTM A653/A653M, category A.
- .2 Single, double, triple systems, profiles "Z" or adjustable "L", and "U" profiles, continuous or discontinuous, installed horizontally or vertically, maximum 1220 mm c.c., as indicated.
- .3 Exterior and interior surfaces of each layer of sub-girts isolated with a thermal break consisting of Type JOIN.4A/SA insulating strip, See **below**.
- .4 Colour code: in accordance with CSSBI Technical Bulletin Vol.7, No. 2.

.2 See **Section 07 40 00**.

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~~2.4 Type SUSP.1/E – Suspension System for Exterior Soffits~~

- ~~.1 Cold rolled runner channels: 152 mm or 89 mm deep, 1.52 mm base thickness, or as indicated, with Type GV.F.2 galvanized finish.~~
- ~~.2 Structural steel stud system elements Type ST.STD.2/GV and sub girts Type S.GRT/GV/S, to dimensions indicated.~~
- ~~.3 Hangers: galvanized soft annealed steel wire, with minimum 2.68 mm diameter.~~
- ~~.4 Other accessories: galvanized, as per ASTM C645 and according to indications on drawings.~~

2.5 Sheathing

- .1 Type GYP.3/E/W – Glass fibre mat faced, silicone core gypsum exterior wall sheathing board, and Type GYP.3/E/W/FR – Glass fibre mat faced, silicone core gypsum exterior wall sheathing board, fire-resistive: humidity and mildew resistant core (score of 10 as per ASTM D3273), exterior face also covered with a primer coating, as per ASTM C1177/C1177M, 12.7 mm thick or fire-resistive (Type X) 15.8 mm thick, as indicated; 1220 mm wide by maximum practical length, ends square cut.
- .2 Type GYP.7/R – Gypsum-fiber roof sheathing board, and Type GYP.7/R/FR – Gypsum-fiber roof sheathing board, fire-resistive: humidity and mildew resistant core consisting of gypsum and cellulose fibers, (score of 10 as per ASTM D3273), as per ASTM C1278/C1278M, regular 12.7 mm and fire-resistive (Type X) 15.8 mm thick respectively over steel deck for mechanically fastened roofing systems, as indicated; 1220 mm wide by maximum practical length, square edges. Recycled content of 97%. For membranes mechanically attached or adhered, including torch applied.
- .3 Type WD.P.1: G1S (good one side) plywood for rough carpentry and exterior work: See **Section 06 41 00**.

2.6 Fasteners for Drywall Work

- .1 Connections with sheet metal screws to be calculated in accordance with CSA-S136 and respect CSSBI requirements; material, diameter, head type, spacing, corrosion resistance and other properties as per usage, thickness of sheet metal, nature of other materials as substrates and forces to resist.
- .2 Type FAST.2 – Fasteners for steel studs:
 - .1 Type FAST.2A – Screws for steel studs: wafer or pan head, self-drilling, self-tapping sheet metal screws, corrosion protected (galvanized finish Type GV.F.1, with minimum zinc coating thickness of 0.008 mm) with length 5 mm longer than twice the thickness of steel.

- .2 Type FAST.2B – Anchors for steel studs: concrete expansion anchors or other suitable drilled type fasteners, galvanized finish Type GV.F.1 or stainless steel.
- .3 Type FAST.2C – Bolts, nuts, washers for steel studs: galvanized finish Type GV.F.1 or stainless steel.
- .3 Type FAST.10 – Fasteners for gypsum and lightweight concrete or cement boards:
 - .1 Type FAST.10A – Nails, screws and staples for gypsum and lightweight concrete or cement boards, interior: as per ASTM C514, ASTM C1002 or ASTM C954 according to substrate; flat head counter-sunk screws; length and diameter according to the boards and the support, with ribs to prevent pull-out and with anticorrosion coating for use with lightweight concrete or cement boards, as per panel manufacturer's recommendation.
 - .2 Type FAST.10B – Nails, screws and staples for gypsum and lightweight concrete or cement board sheathing: as per ASTM C954; flat head counter-sunk self tapping screws, 32 mm long or more, as required, galvanized finish Type GV.F.1 or stainless steel, as per panel manufacturer's recommendations.
- .4 Type FAST.14 – Fasteners for metal furrings and other elements:
 - .1 Type FAST.14A – Fasteners for metal furrings and other elements, interior: galvanized anchors, with countersunk heads, of appropriate length, penetrating at least 38 mm into the concrete.
 - .2 Type FAST.14B – Fasteners for metal furrings and other elements, exterior: vibration resistant anchors, 6 mm diameter, of high grade hardened steel, coated with fluoro-polymer ("Perma-Seal") for corrosion protection, with flat mushroom head, of appropriate length, penetrating at least 38 mm into the concrete.
- .5 See **Section 05 05 00** for fasteners for metals in general (Type FAST.3).

2.7 Related Materials

- .1 Type LOUV/AL.PP – Aluminum louvres, prepainted: by **Section 07 40 00**.
- .2 Type MCP.E.1/PP – Exterior metal siding panels, prepainted: by **Section 07 40 00**.
- .3 Types MFL/GV et MFL/PP– Prepainted metal flashing and/or coping: by **Section 07 40 00**.
- .4 Type WD.P.1– Plywood panel, pressure treated, fire-resistant: see **Section 06 10 00**.
- .5 Type MEMB.11 – Modified bitumen air/vapour barrier sheet membrane, self-adhesive: by **Section 07 10 00**.
- .6 Type MEMB.13 – Modified bitumen air/vapour barrier sheet membrane, thermofusible grade: by **Section 07 10 00**.
- .7 Type MEMB.21 – Modified bitumen one-ply vapour barrier or flashing membrane: self-adhesive variant, by **Section 07 52 00**.
- .8 Type MEMB.26A - Modified bitumen two-ply exposed flashing membrane, granule surfaced: by **Section 07 52 00**.
- .9 Type INSUL.1/W – Extruded expanded polystyrene board wall insulation: by **Section 07 20 00**.

- .10 Type INSUL.12/W.1A – Mineral fibre semi-rigid board wall insulation, for cavity walls: by **Section 07 20 00.**
- .11 Type INSUL.12D - Insulation: see **Section 07 20 00.**
- .12 Type M.FUR.2 – Metal furring, for application with rigid insulation: see **Section 07 20 00.**
- .13 Type S.GRT/GV/W – Steel subgirt system for walls, galvanized: see **Section 07 40 00.**
- .14 AL.GRT/TC/W Aluminum girt system for terracotta walls: see **Section 07 40 00.**
- .15 Type TC.T – Terracotta clay tile elements: see **Section 07 40 00.**
- .16 Type JOIN.4A/SA – Closed cell neoprene joint filler, self-adhesive: neoprene/EPDM/SBR composition, as per ASTM D1056, class SCE41/2A1.
- .17 Type JOIN.4B/SA – Closed cell gasket strip, self-adhesive: neoprene/EPDM/SBR as per ASTM D1056, Class SCE-42/2A3, self-adhesive one or two faces, as required.
- .18 Type DF.CL/W.1 – Deflection clip for head of studs: galvanised steel clip Type ST.PL/GV, finish Type GV.F.2, 82 or 120 mm width, 1.9 mm thickness bare metal, with slotted holes to permit deflection.
- .19 Type DF.JT/W.2 – Deflection joint trim for walls: joint trim in Type ST.PL/GV galvanized metal pieces, with Type GV.F.2 finish; with oval openings or other means to allow deflection. Select according to the indication or the need.
- .20 Touch-up primer for steel surfaces: Type PR.TU/GV: see **Section 05 05 00.**
- .21 Wooden elements: see **Section 06 10 00.**
- .22 Sealants and related products: see **Section 07 92 00.**

3.0 EXECUTION

3.1 General

- .1 Do stud work in accordance with CSSBI S5 and CSA standards
- .2 Do sheathing work as per GA-253, ASTM C1280 and the manufacturer's instructions.
- .3 See **Section 07 10 00** and **Section 07 20 00** for installation of membranes and insulation.
- .4 Coordinate with **Section 07 50 00** to install vapour barrier membrane under the steel stud runners of the parapets.
- .5 See **Related Sections** for installation of membranes and insulation.
- .6 Coordinate other work with other Sections mentioned in **Related Sections** above.

3.2 Erection of Stud System

- .1 Erect components as per requirements of reviewed shop drawings, with adequate spacing to resist the wind loads specified or calculated.
- .2 Anchor tracks securely to the structure or support, at max. 600 mm spacing, or as indicated on the shop drawings.
- .3 Erect studs plumb, aligned and securely attached with not less than two No. 8 screws or welded at each side of flange of bottom tracks, as well as top tracks in the case of parapets only.
- .4 Seat studs into bottom and top tracks.
- .5 Where indicated, install 50 mm minimum top track and double it, or install deflection track Type DF.TR.1 to accommodate vertical deflection. Do not fasten studs to track; leave 20 mm space for deflection or as indicated on reviewed shop drawings.
- .6 Install a backer plate at 150 mm lower than the top of the studs, for the upper limit to fasten the gypsum boards.
- .7 Where indicated, install joint deflection trim Type DF.JT/W.2, and/or deflection clip Type DF.CL/W.1, to respond to vertical deflections. Use only deflection screws recommended by manufacturer, installed as per manufacturer's instructions.
- .8 Install studs at not more than 50 mm from abutting walls, openings, and each side of corners and terminations with dissimilar materials.
- .9 Brace steel studs with horizontal internal bridging as required. Fasten bridging to 1.22 mm steel clips fastened to steel studs with 4, No. 8 screws or by welding.
- .10 Frame openings in stud walls to adequately carry loads by use of additional framing members and bracing as detailed on shop drawings.
- .11 Touch up welds with coat of zinc rich primer.
- .12 Attach the anchors to the studs after the installation of the air/vapour barrier membrane, seal around screw penetrations with Type CLKG.7 (See **Section 07 10 00**).

3.3 Erection Tolerances

- .1 Plumb: not to exceed 1/500th of member length.
- .2 Camber: not to exceed 1/1000th of member length.
- .3 Spacing: no more than 3 mm from design spacing.
- .4 Gap between end of stud and track web: not more than 4 mm.

3.4 Cutouts

- .1 Provide cutouts for services as recommended by manufacturer, to maximum dimensions of 65 mm across member depth and 115 mm along member depth, and at not less than 200 mm c.c. spacing.
- .2 Limit distance from centerline of last unreinforced cutout to end of member to less than 300 mm.

3.5 Installation of Sheathing

- .1 Install sheathing according to details on drawings and as per the manufacturer's instructions.
- .2 Install sheathing boards horizontally and fix at 200 mm spacing on studs and tracks, at 12.7 mm from edges and extremities.
- .3 Ensure that the boards and the vertical joints between the boards are supported by continuous metal elements, adequately fixed, except at the junction with the structure, the steel deck or the concrete slab above.
- .4 Avoid joints along door frames or other openings in walls or ceilings. These joints should be at least at 305 mm from the frames or openings, in one direction as in the other.
- .5 Maintain clearance under structural elements to avoid transmission of structural loads to studs.

3.6 Soffit Construction

- .1 Construct soffits as indicated on **drawings**.
- .2 Do not erect soffit suspension system until work above ceiling has been reviewed by the Departmental Representative.
- .3 Erect suspension and framing for ceiling systems composed of lightweight concrete or gypsum panels in conformity with the prescriptions of ASTM C840, at a maximum spacing of 915 mm and the furring at 400 mm, except where specified otherwise.
- .4 Install "L", "C", "Z" or omega profiles, at max. 400 mm o.c. or as indicated, in a manner capable of resisting all wind pressures.
- .5 Individually support lighting fixtures, if applicable.
- .6 Install work level to tolerance of 1:1200.
- .7 Frame openings for access panels, lighting fixtures, etc., with appropriate framing members, as required.
- .8 Install sheathing as per the manufacturer's instructions.
- .9 Attach panels at 400 mm o.c. maximum, as per the manufacturer's instructions.
- .10 Apply air/vapour barrier - See Section **07 10 00**.
- .11 Install insulation – See **Section 07 20 00**.

- .12 See **Section 07 20 00** for the installation of backing panels and the acrylic plaster.
- .13 Install aluminum sheathing panels – See **Section 08 40 00**.

3.7 Construction of Parapets and Curbs

- .1 Construct parapets and curbs as indicated on **drawings**.
- .2 Install Type WD.P.1 panels on the steel deck and ensure they are covered by the vapour barrier membrane before stud tracks are installed.
- .3 Erect steel stud system Type ST.STD.2/GV according to details and attach firmly to structural elements.
- .4 Install studs in top and bottom runner tracks, and add required members to support the sheathing.
- .5 Brace steel studs with horizontal internal bridging as required.
- .6 Install vapour barrier, galvanized sheet steel Type ST.PL/GV on inside of curb openings.
- .7 Install insulation, Type INSUL.12D, between studs, taking care to fill all cavities.
- Rev.02 .8 Install Type ST.PL/GV, galvanized steel-plate nailers on framing, to anchor roof membrane to perimeter of roof. Dimensions as indicated on **drawings**.
- .9 Touch up welds with coat of zinc rich primer.
- .10 Install rigid insulation, Type INSUL.1/W, followed by backer boards, and mechanically attach boards horizontally at 200 mm spacing on the studs and stud tracks, and at 12.7 mm from edges and ends.
- .11 Do not leave backer boards exposed to the weather.

3.8 Field Quality Control during Application (F.R.)

- .1 The manufacturer's representative must visit, inspect the sheathing panel installation and submit a written report.

3.9 Cleaning

- .1 Perform cleaning as per **Section 01 74 11**

End of Section

1.0 GENERAL

1.1 Related Sections

- .1 Division 01 – General Requirements shall be read in conjunction with and shall govern this Section.
- .2 Sections or Divisions for coordination, or for reference to related products:
 - .1 **Section 03 30 00** – Cast in Place Concrete
 - .2 **Section 03 53 00** – Concrete Topping
 - .3 **Section 05 05 00** – Basic Metal Materials and Finishes
 - .4 **Section 09 61 00** – Floor Preparation
 - .5 **Section 09 65 00** – Resilient Flooring
 - .6 **Section 09 67 00** – Special Flooring
 - .7 **Section 21 13 13** – Wet Pipe Sprinklers System

1.2 References

- .1 Comply with all standards mentioned in this specification, unless more stringent requirements are given herein.
- .2 American Architectural Manufacturers Association
 - Rev.01 .1 AAMA 2603-2017a, Voluntary specification, performance requirements and test procedures for pigmented organic coatings on aluminum extrusions and panels (with coil coating appendix)
- .3 American Society for Testing and Materials International (ASTM)
 - .1 ASTM A307-14e1, Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60000 PSI Tensile Strength
 - .2 ASTM A325-14, Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength (Withdrawn 2016)
 - .3 ASTM A490M-14a, Standard Specification for High-Strength Steel Bolts, Classes 10.9 and 10.9.3, for Structural Steel Joints.
 - .4 ASTM A500 / A500M – 18, Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
 - .5 ASTM A653/A653M-19a, Standard Specification for Steel Sheet, Zinc-Coated,(Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- .4 Canadian Institute of Steel Construction
 - .1 CISC Guide for Specifying Architecturally Exposed Structural Steel, 2nd Edition
- .5 Canadian Standards Association (CSA International)
 - .1 CSA-S16-19, Design of Steel Structures
 - .2 CSA-S136-16, North American Specification for the design of Cold-formed Steel Structural Members.
 - .3 CSA A344.1/A344.2, User Guide for Steel Storage Racks/Standard for design and Construction of Steel Storage Racks.
 - .4 CSA-G40.20-13/G40.21-13 (R2018), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
 - .5 CSAW48-18, Filler metals and allied materials for metal arc welding
 - .6 CSA W59-18, Welded Steel Construction.

- .6 National Fire Protection Association (Agency) (NFPA):
 - .1 NFPA 13-2016 Standard for the Installation of Sprinkler Systems.

1.3 Design Criteria and Performance Requirements

- .1 Systems shall be designed, manufactured and installed to meet the requirements of the seismic zone relevant to the project, as determined according to NBC 2015.
- .2 Ensure that the structural floor system is capable of supporting live and dead loads required by prevailing building codes, including loads of storage units to be installed and that the structural floor deflection is the least possible under the requirements of the specified loads of the shelving systems.
- .3 Ensure provision is made by **Structure** for a 50 mm thick concrete topping where track/rail system is to be installed.
- .4 Bolted or welded connections must not sag or slip under normal conditions of use.
- .5 All shelving systems shall meet the requirements of NFPA 13-2016 – 16.2.3.1. As such, their design shall meet the following:
 - .1 All racks shall be designed as open rack as defined by NFPA 13-2016 – 3.9.3.7.4. Shelving in racks that are fixed in place and loads put in racks shall have a shelf area or a solid surface equal to or less than 1.858 m².
 - .2 Shelving shall be protected by wet pipe sprinklers system (see **Section 21 13 13**).
 - .3 A nominal 150 mm transverse flue space shall be maintained between loads or shelves at rack uprights
 - .4 A nominal 150 mm longitudinal flue space shall be maintained at all time between mobile racks and fixed obstacles.
 - .5 Maximum storage height shall be 7 620 mm and maximum ceiling height 9 144 mm.
- .6 All storage racking systems shall also respect the following requirements:
 - .1 Deflections: at maximum working load, the deflection of rack beams must not exceed 1/180th of the span of the beam.
 - .2 Base plate design: a base plate must provide for anchorage and be designed to support the entire profile of the column placed on it. The base plate must transfer the column load in a uniform manner to the supporting floor.
 - .3 Beam connection: in addition to the design loads, beams must have support connections that are capable of withstanding an upwards force of 4.5 kN per connection, without failure.
 - .4 Design details and connections in accordance with requirements of CSA-S16 and CSA-S136 to resist forces, moments and shears, as required by the design loads.
- .7 Support structure for the trolleys shall not deviate more than 6 mm from a straight line.
- .8 Maximum variation rail levelness:
 - .1 9.5 mm on 6.1 m variation from true level within any system.
 - .2 12.7 mm in height on 6.1 m length of rail for any rail.
 - .3 1.6 mm with the adjacent rails, perpendicular to rail direction.
- .9 Maximum variation of floor level: level within 9.5 mm in 6.1 m with respect to the actual level within the whole system – by **Structure**.

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- .10 Shelving capacity:

- .1 Each shelf shall have a capacity of ~~minimum~~ 227 kg, unless otherwise indicated.
- .2 For ~~minimum~~ weight capacity of pallet racking refer to **2.0 PRODUCTS**.

- Rev.01
- .11 Drawer capacity:
 - .1 Each drawer shall have a capacity of 22.7 kg, unless otherwise indicated.
 - .12 Finish:
 - .1 All exposed steel must meet the criteria of AESS 3 as in the CISC-AESS Guide.

1.4 Submittals for Review

- .1 Submit the documents and elements as per **Section 01 33 00** and the following requirements:
 - Rev.01
 - .1 Shop drawings (S.D.):
 - .1 Submit complete drawings including plans and elevations and engineering calculations (to meet design criteria and performance requirements as prescribed above) signed and sealed by a member of the Ordre des ingénieurs du Québec in good standing.
 - .2 Indicate dimensions and spacings of depressions for mounting rails to be provided in floor slab by Structure, allowing a tolerance of 50 mm in all directions.
 - .3 Indicate dimensions and spacings of all elements, including all base plates and anchor bolts.
 - .4 Exact dimensions to be coordinated prior to pouring the floor slab.
 - .5 Provide engineering calculations showing capability of carriage motion and control mechanisms to move specialized loads and to meet performance criteria.
 - .6 Base plate reaction loads must be provided on the plans to allow for a verification of the supporting floor capacity by the Departmental Representative.
 - .2 Product samples (P.S.):
 - .1 Provide a minimum of 3 colour selections.
 - .2 Provide sample for each exposed product and for each colour required.
 - .3 Submit manufacturer's colour charts consisting of actual product sample, showing full range of colours and textures available.
 - .3 Mock-ups (M.U.):
 - .1 Install in the manufacturer's facility full-size mock-ups of each shelving type, including variations, accessories and inserted modules.
 - .2 In the presence of the grout manufacturer's representative, install sample length (typical rail length) of rail complete with anchors, rail and grout bed, in accordance with manufacturer's certified procedures to demonstrate adherence and consistency of grout interface with concrete and rail.
 - .3 After the above mock-ups are reviewed by the Departmental Representative, install at their final location on site full-size mock-ups of each shelving type, not necessarily including variations and accessories but including the inserted modules, if applicable.
 - .4 See also **Section 01 45 00**.
 - .4 Field reports (F.R.): submit manufacturer's written reports within **5 days** of review, verifying compliance of work – See **Field Quality Control** below.
 - .5 Manufacturer's instructions (M.I.): submit installation instructions and special handling criteria, installation sequence, cleaning procedures.

1.5 Closeout Submittals

- .1 Submit the documents and elements as per **Section 01 33 00**, **Section 01 78 00** and the following requirements:

- .1 Extra materials, special tools and spare parts (E.M.): supply 2 complete sets of special tools required for maintenance, assembly and disassembly of washroom accessories, if applicable.

1.6 Qualifications (P.Q.)

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- .1 The storage shelving installer shall be manufacturer's authorized contractor, with experience in installing system of comparable size and complexity, employing a skilled workforce.
- .2 The manufacturer must be certified ISO 9001-2015 and ISO 14001-2015. In lieu of the latter, submission of corporate environmental policy is acceptable, provided it clearly shows that an environmental management system has been implemented in line with ISO 14001 requirements. Submit written proof of qualification.
- .4 Provide support for **24-hour** service call.

1.7 Delivery, Storage and Handling

- .1 All materials and accessories must be carefully packed and protected from the weather while in transit, while stored and during installation on site.
- .2 Do not deliver products to site until installation spaces are ready to receive them.
- .3 Follow manufacturer's instructions and recommendations for delivery, storage and handling requirements.
- .4 Take necessary precautions to avoid damaging members and their painted surfaces during handling and transportation.
- .5 Ensure that painted surfaces are not placed face to face but rather separated by wooden blocks, styrofoam spacers, or other suitable materials.
- .6 Use nylon straps to raise materials, and if necessary, use cradles or crates.
- .7 Firmly secure steel using chains and protective cushions to transportation vehicles to avoid horizontal motion. Protect metal edges with rubber, burlap or wood. Do not load small sections within 'U' channels or beams.
- .8 Unload in location as indicated. Provide equipment and labour to unload without causing damage and place on wooden blocks.
- .9 Choose suitably sized wooden blocks and space them correctly to avoid steel from coming into contact with ground.

1.8 Job Conditions

- .1 Verify location and dimensions of storage system by taking on-site measurements prior to manufacturing.
- .2 Coordinate installation of storage system with other work to reduce risk of dirt or damage to system.
- .3 Conduct a shop visit and a start-up meeting at the manufacturer's facility in the presence of Departmental Representative.

- .4 Conduct pre-installation meeting on site in the presence of Departmental Representatives, as well as the manufacturer's representative. Review methods and procedures for installing storage units.

1.9 Waste Management and Disposal

- .1 Waste management and disposal to be done as per **Section 01 74 21**

2.0 PRODUCTS

2.1 General

- .1 See **Section 05 05 00** for description of basic metal materials and finishes, and welding procedures.
- .2 Provide permanent labels, or other permanent identifying method, indicating the maximum load capacity for each unit. Locate the load identification in the same location on each unit.
- .3 See **drawings** for types and location of products included, as well as details not specified herein.

2.2 Materials and Finishes

- .1 Steel: unless otherwise indicated, Type ST.PL/PP cold formed steel shapes, prepainted with manufacturer's electrostatically applied Type PP.F.5 epoxy-polyester hybrid powder coating finish for all exposed metal surfaces, 35-65% glossy, minimum 38 microns (1.5 mil) thick, high adhesion (Cross Hatch Adhesion 100 %), pencil hardness 2H, resisting methyl ethyl ketone (passing the MEK test), salt spray, impacts, abrasion, printing and all normal usage wear; colour to be confirmed by Departmental Representative.
- .2 Laminated or welded channels, plates and bars: to CSA-G40.20 and CSA-G40.21. Grade 350W, except angles ("L") and channels ("C") and plates that may be Grade 300W.
- .3 Tubular steel channels: in compliance with specifications of CSA-G40.20 and CSA-G40.21 or ASTM A500. Use Grade 350W, Class C, unless otherwise indicated on drawings.
- .4 Anchor bolts: to ASTM A307 minimum.
- .5 Bolts, nuts and washers: to ASTM A325 or ASTM A490.
- .6 Welding materials: to CSA W48 Series, CSA W59 and certified by Canadian Welding Bureau.

2.3 Type SHELF.1 – High Density Mobile Shelving, Manual (Mechanical Assist)

- .1 Variants:
 - .1 Type SHELF.1A – For large historical collections.
 - .2 Type SHELF.1B – For domestic collections.
 - .3 Type SHELF.1C – For domestic collections.
 - .4 Type SHELF.1D – For indigenous collections.
 - .5 Type SHELF.1E – For bankers' boxes.
 - .6 Type SHELF.1F – For bankers' boxes.
 - .7 Type SHELF.1G – For domestic collections.
- .2 General:

- .1 The system shall be of the mechanical assisted manual type.
 - .2 The system consists of manufactured high-density mobile storage units mounted on manufacturer's track-guided carriages to form a compact storage system. System design permits access to any single aisle by manually moving units until the desired aisle is opened. The carriage/rail system provides uniform carriage movement along the total length of travel, even with unbalanced loads.
 - .3 The carriage system to consist of a formed structural steel frame with hardened steel wheel riding on steel rails recessed into the floor.
 - .4 Face and back panels, as well as carriage faces shall provide a smooth, clean appearance without any assembly holes or protruding hardware (except for the movement control system) and assembled without cutting edges.
 - .5 High bay, with flues, tops as indicated, low-height lateral panel.
 - .6 See **drawings** for particularities of variants.
 - .7 Supply insertion modules of drawers or casework as shown on **drawings** and specified below in the article **Accessories**.
- .3 Rails:
- .1 Rails shall be machined to ensure smooth operation and self-centering of mobile storage units during travel without end play or binding, designed to disperse concentrated wheel point load.
 - .2 Rails shall be designed and manufactured with a form and dimensions to carry loads applied on each carriage. They shall be made of cold rolled steel (CRS), mill finish. The steel rail shall be replaceable.
 - .3 Rails shall be recessed and designed to be anchored in a structural concrete floor, with provision for leveling of rails to compensate for variations in floor surface level. Rails shall provide smooth transition for material handling equipment. See depth of concrete topping shown on **drawings**.
 - .4 Main rail section shall be a maximum of 1.22 m each with shorter sections of 305 mm minimum used to complete each individual rail assembly.
 - .5 Rail joints shall be designed to provide as minimal of a gap as possible and prevent twisting or slippage.
 - .6 Rail connections shall have interlock steel rail connectors. All rail connections shall be designed to provide horizontal and vertical continuity between rail sections, to gradually transfer the concentrated wheel point load to and from adjoining sections. To insure vertical and horizontal stability, tongue-and-groove joints connections are not permitted.
 - .7 Built-in anti-tip device shall be provided to meet local building code and high height-to-width ratio.
 - .8 Anchor bolts: Type SST.1 stainless steel, Type MF.SS (mill finish), when anchoring into concrete.
- .4 Floor / Ramp:
- .1 No floor ramp shall be required – install mobile shelving units in depressions provided in floor slab.
 - .2 Install rails at exact height such that floor level between units is level with surrounding floor.
- .5 Carriages:
- .1 Design of the carriage is such that the weight-bearing of the upright rests directly over the wheel channels, thus transmitting the load directly to the rail.
 - .2 All carriages shall be riveted-bonding construction for flexibility and potential reconfiguration. Welded carriages or carriages with formed lips are unacceptable.

- .3 Carriages and stationary platforms shall be constructed of a full "C" shape profiles 38 mm deep x 79.4 mm high, in 50W steel, minimum 3 mm thick.
- .4 Wheel support sections shall be in 50W steel, minimum 4.7 mm thick and must measure 82.6 mm deep x 95.3 mm high. They must be welded and support a load of up to 3 632 kg and in tandem configuration up to 7 264 kg.
- .5 Wheel support sections shall be riveted between the main support face sections, one per aisle assembly. Support sections shall be embossed to eliminate the need of filler plates between the shelving/cabinet and the "C" shape supports.
- .6 Necessary carriage splices shall be bolted type designed to maintain proper unit alignment and weight load distribution.
- .7 Carriage straightness shall have no more than 12.7 mm deviation from a true straight line. There shall be no permanent set or slippage in any spliced or welded joint when exposed to forces encountered in normal operating circumstances.
- .8 Carriage construction shall be designed to allow the shelving uprights to be secured to the carriage frame with vibration-proof graded bolts, nut, and clamp anchor assemblies and so that there is no visible hardware on carriage face. Recess design carriages are not permitted. Self-drilling screw attachment is not acceptable method of attachment shelving units to the carriage. No shelving or cabinet attachment hardware shall be visible on exterior face of carriages.
- .9 Carriages must:
 - .1 Not have deflection exceeding L/320 between the wheels with their own weight plus weight of drive mechanisms plus the applied live load specified above.
 - .2 Be free of distortion for any loading configuration.
- .10 Locked (immobilized) carriages at the middle or at the ends of movable row modules must have exactly the same design and construction as movable rows, with wheels/carriage assembly locked to rails.
- .11 Joints or connections, spliced or welded, must be free of permanent slippage when exposed to forces encountered during normal operation.
- .12 Straightness of carriages must have a maximum deviation of L/1200 over the length of the carriage.
- .13 Each carriage shall have at least two wheels per rail.
- .6 Carriage bumpers:
 - .1 In an inert material, provided to avoid metal-to-metal contact between rows, dissipate energy and assure reasonably smooth stops.
- .7 Drive/guide system:
 - .1 The system shall be designed to provide a quiet and reliable operation, with a direct drive system which minimizes end play, ensures there is no play in the drive handle, and that carriages will stop without drifting. All system components shall be selected to ensure a smooth, even movement along the entire carriage length, without jerky movements.
 - .2 All wheels shall include a chain sprocket direct drive system connected to a full-length drive shaft on one side of each movable carriage, at each rail location, to ensure that carriages are always perpendicular to rails, preventing whipping, binding and excessive wheel/rail wear under normal operation and also to ensure that carriages move uniformly along the total length of travel, even with unbalanced loads. The chain and sprocket shall be minimum ANSI # 35.
 - .3 Torque-resistant tubular drive shaft: minimum of 33.4 mm outside diameter by maximum 26.5 mm inside diameter. Solid steel rod may be acceptable if is equally strong and performant.
 - .4 Drive system gearing shall be designed to permit 454 g of force applied to the drive handle to move a minimum of 1814.4 kg of load (maximum 45N to operate one carriage).
 - ~~.5 Must be able to push 5 fully loaded carriages with 1 fully loaded carriage.~~

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- ~~.6 Must be able to push 2 fully loaded map carriages with 1 fully loaded map carriage.~~
- .7 A tensioning device shall be provided on each chain drive with provision for adjusting tension without removing end pane.
- .8 All bearings used in the drive mechanism shall be permanently shielded and lubricated.
- .9 Allow access to drive system components through readily removable base shelf assemblies and protection case (required) for maintenance purposes.
- .8 Wheels:
 - .1 Materials: cold rolled steel (CRS) SAE 1010/1020, precision machined, same material and hardness as track with two permanently shielded and lubricated self-aligning flanged bearings.
 - .2 Drive wheels shall have a minimum 90.5 mm outside diameter. They shall be dual-flanged and sloped to insure efficient guidance. Single center flanged wheels are not acceptable.
 - .3 Due to carriage length and shelving/racking heights, guide wheels shall be at all wheel locations.
- .9 Mechanical column:
 - .1 All exposed components of the face column shall be made of steel. Mechanical columns (stanchions) shall be located at all operating ends as shown on drawings.
 - .2 The front drive unit shall be a mechanical column made from 1.9 mm galvanized steel covered by a 1.2 mm Type ST.PL/PP prepainted steel box. The column dimensions shall correspond to the full width of mobile units by the manufacturer's standard height.
 - .3 The mechanical column shall be assembled at the factory including the drive mechanism and the chain for a fast installation.
- .10 Movement controls:
 - .1 Operating handles, located on the mechanical columns, shall be three-spoke type (swivel type) transmitting power through a chain drive to the drive wheels. Provide operating handles on drive end of carriages as noted on drawings. Each mechanical device shall come with a chain-tensioner. Handle must be mounted at $\pm 1\ 003$ mm from the bottom of the carriage.
- .11 Safety features:
 - .1 Colour-coded visual indicators shall provide verification that carriages are in a locked or unlocked mode.
 - .2 A safety lock button will permit moving a carriage in either direction to create a new access aisle unlocking the carriage when pulled out or locking when pushed in. This lock shall prevent carriages from being moved while personnel access open aisle.
 - .3 Aisle safety push-button lock (for single access) shall be located at the center of the handle. The user shall press the aisle safety push-button, which will lock the respective carriage. After being pressed, the aisle safety push-button shall protrude from the handle face to display a red band visible to users. After being re-pressed, the aisle safety push-button shall return to its unlocked state. Pull-out pins are unacceptable. Both carriages on either side of the aisle must be secured. In case of rows accessible from both sides, a similar warning device must indicate the presence of someone in the aisle.
 - ~~.4 Toe level safety sweep (for single or dual access) for all mobile units: consisting of hinged aluminum safety bar running full length of the mobile carriages, flush with bottom of carriage frame and on both sides of carriage. Upon activation of the sweep, an internal device shall interlock with drive train resulting in positive stop anywhere in the module. A 0.68 kg (1½ lb) pressure applied on the safety bar will activate the safety. The safety shall automatically reset upon removal of the obstruction or if carriage is backed away from the obstruction. This active safety shall not require any electricity or battery to be activated (mandatory).~~

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- Rev.01 .5 Lever arm for dual access, of 900 mm length, for all mobile units accessible from both sides: once engaged after a 90° rotation, this device will lock the mechanism, preventing movement of the carriage. Carriages on both sides of the aisle must be secured. A full-length shaft will connect devices at both ends of carriage.
- Rev.01 .6 Lever Arm for single access, of 900 mm length, for all mobile units accessible from one side.
- Rev.01 ~~.7 Mechanical ratchet backup override to be on each carriage, connected to the full length shaft, in order to move carriage manually too, where indicated.~~
- .8 Provide a safety feature that will prevent any movement of the carriages on their own (no creep) after the carriage has been moved to the desired location and stopped.
- .9 Rails shall be flush to finished floor level, and designed to reduce tripping hazard, facilitate the passage of carts, and for ease of cleaning.
- .10 Install on each face panel of mobile units, with the operating handle, a sign for instructions of the use of the safety devices.
- .11 Additional safety devices, active or passive, may be proposed by the supplier.
- Rev.05 .12 Upright frame:
- Rev.01 .1 Made of posts, cross-members, braces and a footplate welded or bolted together, as per **drawings**. The dimensions indicated below must be validated or modified according to structural (capacity) requirements and may also vary according to manufacturer's standards.
- Rev.01 .2 Each post shall be a 51 mm or 76 mm by 51 mm tube made of 1.90 mm or 2.28 mm cold roll steel on all four faces, or according to the manufacturer's standards, corresponding to the loads prescribed. The post shall be slotted at every 25.4 mm on lateral faces. The side perforations are 4.7 mm wide x 16 mm long and shall be designed to accommodate full shelves or any kind of cantilever or four-post accessory.
- .3 Cross members and braces shall be 25.4 mm or 35 mm by 25.4 mm or 35 mm "U"-shaped channel made of 1.90 mm steel. Cross members shall be the horizontal link between two posts. Braces are placed in diagonal, between two cross members to reinforce the upright frame. Each brace shall be placed in alternating directions.
- .4 The footplate shall be formed of a 6.4 mm thick steel base plate, 64 mm or 89 mm wide by 114 mm long, factory welded to the post.
- .5 The upright frames shall act as ventilation flues where indicated on **drawings**.
- .13 Shelving:
- Rev.01 .1 The full shelf kit shall be made of 1 plain shelf supported by 2 lateral shelf supports. reinforcements can be added under the shelf to reach higher loading requirements. The full shelf height can be adjusted on 25.4 mm increments and does not require any tools.
- Rev.03 .2 Shelves Types SHELF.1A, -1B, -1C, -1D: shall be 25.4 mm thick and constructed of 1.6 mm Type ST.PL/PP cold formed perforated steel sheet, prepainted (powder coated), with edges having four bends. To be used with shelf supports.
- Rev.03 .3 Shelves Types SHELF.1E, -1F, -1G: shall be wire mesh in Type ST.PP/BR steel bars with manufacturer's electrostatically applied Type PP.F.5 epoxy-polyester hybrid powder coating finish similar as the rest of the shelving unit, with a diameter of 1.27 mm or more to bear the loading prescribed, with a square grid of 25.4 mm x 25.4 mm formed with two sets of bars, top ones running perpendicular to side of shelving unit to facilitate handling of loaded articles, with edges bent over the shelf supports.
- .4 Finish: see **above**.
- Rev.05 .5 Roofs (top shelves) shall not be perforated, unless otherwise indicated.
- Rev.05 .6 Shelf supports, prepainted (powder coated), shall be as per manufacturer's standards, designed to safely support the required loads. The shelf clips must secure the shelf in place once installed.

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- .7 Provide braces and all other standard devices to maintain stability of shelving units.
 - .8 Provide anchors according to capacities of elements to fix the units to the floor where required.
 - .9 For weight capacity requirements see design criteria and performance requirements prescribed **above**.
 - .10 For dimensions and shelving configurations: see **drawings**.
- .14 Face panels:
- .1 Materials: Type ST.PL/PP cold formed steel sheet, prepainted (powder coated), perforated where indicated on **drawings**.
 - .2 Finish: see **above**.
 - .3 Face panels shall be located on all operating ends of ranges (with the operating handles) and as end panels on the opposite extremities as shown on **drawings**.
 - .4 Face panels must cover partially or entirely the full height and the width of shelving, as shown on **drawings**.
 - .5 Face panels: of 1.2 mm thick steel using a 2-bend structural design that forms a 19 mm thick edge channel that runs the full length of each vertical edge; a minimum of three 1.2 mm structural hat channel supports shall be welded into the back of the panel at the top, base and centre to provide unit rigidity; free of any exposed assembly holes or protruding hardware, and assembled without any exposed sharp edges.
 - .6 Two 78 mm x 127 mm card holders shall be provided per aisle entry location and attached to the end panels with centres located 1 524 mm above the finished floor.
- .15 Hooks:
- .1 Hooks shall be "S"-shaped, in stainless steel, with a special security device at top and bottom of the hook to hold hangings in place in case of earthquakes, with 5 mm diameter; supply 50 hooks 180 mm high and 50 hooks 130 mm high.
 - ~~.1 MuSE NT RH 180S and MuSE NT RH 130KS by Takiya.~~

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2.4 Type SHELF.3 – Shelving for Documentation Centre

- .1 General:
- .1 The system shall be of the mechanical assisted manual type.
 - .2 The system consists of manufactured high-density mobile storage units mounted on manufacturer's track-guided carriages to form a compact storage system. System design permits access to any single aisle by manually moving units until the desired aisle is opened. The carriage/rail system provides uniform carriage movement along the total length of travel, even with unbalanced loads.
 - .3 The carriage system to consist of a formed structural steel frame with hardened steel wheels riding on steel rails recessed into the floor.
 - .4 Face and back panels, as well as carriage faces shall provide a smooth, clean appearance without any assembly holes or protruding hardware (except for the movement control system) and assembled without cutting edges.
 - .5 Low-height, without flues, solid top, full-height lateral panel.
- .2 Rails:
- .1 Rails shall be machined to ensure smooth operation and self-centering of mobile storage units during travel without end play or binding, designed to disperse concentrated wheel point load.
 - .2 Rails shall be designed and manufactured with a form and dimensions to carry loads applied on each carriage. They shall be made of cold rolled steel (CRS), mill finish. The steel rail shall be replaceable.

- .3 Rails shall be recessed and designed to be anchored in a structural concrete floor, with provision for leveling of rails to compensate for variations in floor surface level. Rails shall provide smooth transition for material handling equipment. See depth of concrete topping on **drawings**.
 - .4 Main rail section shall be a maximum of 1.22 m each with shorter sections of 305 mm minimum used to complete each individual rail assembly.
 - .5 Rail joints shall be designed to provide as minimal of a gap as possible and prevent twisting or slippage.
 - .6 Rail connections shall have interlock steel rail connectors. All track connections shall be designed to provide horizontal and vertical continuity between rail sections, to gradually transfer the concentrated wheel point load to and from adjoining sections. To insure vertical and horizontal stability, tongue-and-groove joints connections are not permitted.
 - .7 Built-in anti-tip device shall be provided to meet local building code and high height-to-width ratio.
 - .8 Anchor bolts: Type SST.1 stainless steel, Type MF.SS (mill finish), when anchoring into concrete.
- .3 Floor / Ramp:
- .1 No floor ramp shall be required – install mobile shelving units in depressions provided in floor slab.
 - .2 Install rails at exact height such that floor level between units is level with surrounding floor.
- .4 Carriages:
- .1 Design of the carriage is such that the weight-bearing of the upright rests directly over the wheel channels, thus transmitting the load directly to the rail.
 - .2 All carriages shall be riveted-bonding construction for flexibility and potential reconfiguration. Welded carriages or carriages with formed lips are unacceptable.
 - .3 Carriages and stationary platforms shall be constructed of a full "C" shape profiles 38 mm deep x 127 mm high, minimum 2.66 mm steel, with 1 488 kg/m maximum capacity.
 - .4 Wheel support sections shall be minimum 2.66 mm steel and shall be riveted between the main support face sections, one per aisle assembly. Support sections shall be embossed to eliminate the need of filler plates between the shelving/cabinet and the "C" shape supports.
 - .5 Necessary carriage splices shall be bolted type designed to maintain proper unit alignment and weight load distribution.
 - .6 Carriage straightness shall have no more than 6.35 mm maximum deviation from a true straight line. There shall be no permanent set or slippage in any spliced or welded joint when exposed to forces encountered in normal operating circumstances.
 - .7 Carriage construction shall be designed to allow the shelving uprights to be secured to the carriage frame with vibration-proof graded bolts, nut, and clamp anchor assemblies and so that there is no visible hardware on carriage face. Recess design carriages are not permitted. Self-drilling screw attachment is not acceptable method of attachment shelving units to the carriage. No shelving or cabinet attachment hardware shall be visible on exterior face of carriages.
 - .8 Carriages must:
 - .1 Support as a minimum the load capacities indicated herein or on **drawings**.
 - .2 Not have deflection exceeding $L/320$ between the wheels with their own weight plus weight of drive mechanisms plus the applied live load specified above.
 - .3 Be free of distortion for any loading configuration.
 - .9 Locked (immobilized) carriages at the middle or at the ends of movable row modules must have exactly the same design and construction as movable rows, with wheels/carriage assembly locked to rails.

- .10 Joints or connections, spliced or welded, must be free of permanent slippage when exposed to forces encountered during normal operation.
- .11 Straightness of carriages must have a maximum deviation of L/1200 over the length of the carriage.
- .12 Each carriage shall have at least two wheels per rail.

.5 Carriage bumpers:

- .1 In an inert material, provided to avoid metal-to-metal contact between rows, dissipate energy and assure reasonably smooth stops.

.6 Drive/guide system:

- .1 The direct drive system shall be designed to provide a quiet and reliable operation, which minimizes end play, ensures there is no play in the drive handle, and that carriages will stop without drifting. All system components shall be selected to ensure a smooth, even movement along the entire carriage length, without jerky movements.
- .2 All wheels shall include a chain sprocket direct drive system connected to a full-length drive shaft on one side of each movable carriage, at each rail location, to ensure that carriages are always perpendicular to rails, preventing whipping, binding and excessive wheel/rail wear under normal operation and also to ensure that carriages move uniformly along the total length of travel, even with unbalanced loads., with drive wheels at every rail location on one side of the carriage. The chain and sprocket shall be minimum ANSI # 35.
- .3 All bearings used in the drive mechanism shall be permanently shielded and lubricated.
- .4 Carriage deviation (racking): maximum L/600 from a true line perpendicular to rails (where "L" is the length of the carriage).
- .5 Torque-resistant tubular drive shaft: minimum of 33.4 mm outside diameter by maximum 26.5 mm inside diameter. Solid steel rod may be acceptable if is equally strong and performant.
- .6 Drive system gearing shall be designed to permit 454 g of force applied to the drive handle to move a minimum of 1 814.4 kg of load (maximum 45N to operate one carriage).
- ~~.7 Must be able to push 5 fully loaded carriages with 1 fully loaded carriage.~~
- ~~.8 Must be able to push 2 fully loaded map carriages with 1 fully loaded map carriage.~~
- .9 A tensioning device shall be provided on each chain drive with provision for adjusting tension without removing end pane.
- .10 Allow access to drive system components through readily removable base shelf assemblies and protection case (required) for maintenance purposes.
- .11 Shaft connections: secured couplings ("key" type).
- .12 Dual-flange wheels: provide positive guidance and tracking. Guidance requiring cam followers and ball bearings running on either side of the rail is unacceptable.
- .13 Narrow guidance channels: provide a maximum 9.5 mm between sub-rail and rail sections to reduce tripping hazards, allow carts to easily roll over, prevent debris accumulation, and facilitate cleaning.

.7 Wheels:

- .1 Materials: minimum type 1045 cold rolled steel (CRS) SAE 1010/1020, precision machined, same material and hardness as track with two permanently shielded and lubricated self-aligning flanged bearings.
- .2 Minimum load capacity per wheel: 1452 kg.
- .3 Drive wheels shall have a minimum 127 mm outside diameter. They shall be dual-flanged and sloped to insure efficient guidance. Single center flanged wheels are not acceptable.
- .4 Due to carriage length and shelving/racking heights, guide wheels shall be at all wheel locations.

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.8 Mechanical columns:

- .1 All exposed components of the face column shall be made of steel. Mechanical columns (stanchions) shall be located at all operating ends as shown on drawings.
- .2 The front drive unit shall be a mechanical column made from 1.9 mm galvanized steel covered by a 1.2 mm Type ST.PL/PP prepainted steel box. The column dimensions shall correspond to the full width of mobile units by the manufacturer's standard height.
- .3 The mechanical column shall be assembled at the factory including the drive mechanism and the chain for a fast installation.

.9 Movement controls:

- .1 Operating handles, located on the mechanical columns, shall be three-spoke type (swivel type) transmitting power through a chain drive to the drive wheels. Provide operating handles on drive end of carriages as noted on drawings. Each mechanical device shall come with a chain-tensioner. Handle must be mounted at $\pm 1\ 003$ mm from the bottom of the carriage.

.10 Safety features:

- .1 Colour-coded visual indicators shall provide verification that carriages are in a locked or unlocked mode.
- .2 A safety lock button, will permit moving a carriage in either direction to create a new access aisle unlocking the carriage when pulled out or locking when pushed in. This lock shall prevent carriages from being moved while personnel access open aisle.
- .3 Aisle safety push-button lock (for single access) shall be located at the center of the handle. The user shall press the aisle safety push-button, which will lock the respective carriage. After being pressed, the aisle safety push-button shall protrude from the handle face to display a red band visible to users. After being re-pressed, the aisle safety push-button shall return to its unlocked state. Pull-out pins are unacceptable. Both carriages on either side of the aisle must be secured. In case of rows accessible from both sides, a similar warning device must indicate the presence of someone in the aisle.
- ~~.4 Toe level safety sweep (for single or dual access) for all mobile units: consisting of hinged aluminum safety bar running full length of the mobile carriages, flush with bottom of carriage frame and on both sides of carriage. Upon activation of the sweep, an internal device shall interlock with drive train resulting in positive stop anywhere in the module. A 0.68 kg (1½ lb) pressure applied on the safety bar will activate the safety. The safety shall automatically reset upon removal of the obstruction or if carriage is backed away from the obstruction. This active safety shall not require any electricity or battery to be activated (mandatory).~~
- .5 Lever arm for dual access, of 900 mm length, for all mobile units accessible from both sides: once engaged after a 90° rotation, this device will lock the mechanism, preventing movement of the carriage. Carriages on both sides of the aisle must be secured. A full-length shaft will connect devices at both ends of carriage.
- .6 Lever Arm for single access, of 900 mm length, for all mobile units accessible from one side.
- .7 Mechanical ratchet backup override to be on each carriage, connected to the full-length shaft, in order to move carriage manually too, where indicated.
- .8 Provide a safety feature that will prevent any movement of the carriages on their own (no creep) after the carriage has been moved to the desired location and stopped.
- .9 Rails shall be flush to finished floor level, and designed to reduce tripping hazard, facilitate the passage of carts, and for ease of cleaning.
- .10 Additional safety devices, active or passive, may be considered as proposed by the supplier.

.11 Upright frame:

- Rev.05 .1 Made of posts, cross-members, braces and a footplate welded or bolted together, as per **drawings**. The dimensions indicated below must be validated or modified according to structural (capacity) requirements and may also vary according to manufacturer's standards.
- Rev.01 .2 Each post shall be a 51 mm or 76 mm by 51 mm tube made of 1.90 mm or 2.28 mm cold roll steel on all four faces, or according to the manufacturer's standards, adequate for the loads prescribed. The post shall be slotted at every 25.4 mm on lateral faces. The side perforations are 4.7 mm wide x 16 mm long and shall be designed to accommodate full shelves or any kind of cantilever or four-post accessory.
- .3 Cross members and braces shall be 25.4 mm or 35 mm by 25.4 mm (1") or 35 mm "U"-shaped channel made of 1.90 mm steel. Cross members shall be the horizontal link between two posts. Braces are placed in diagonal, between two cross members to reinforce the upright frame. Each brace shall be placed in alternating directions.
- .4 The footplate shall be formed of a 6.4 mm thick steel base plate, 64 mm or 89 mm wide by 114 mm long, factory welded to the post.
- .12 Shelving:
- .1 The full shelf kit shall be made of 1 plain shelf supported by 2 lateral shelf supports. Reinforcements can be added under the shelf to reach higher loading requirements. The full shelf height can be adjusted on 25.4 mm increments and does not require any tools.
- .2 Shelves shall be 25.4 mm thick and constructed of 1.6 mm Type ST.PL/PP cold formed unperforated steel sheet, prepainted (powder coated), as per required capacities, with edges having four bends. To be used with shelf supports.
- .3 Finish: see **above**.
- .4 Canopies (top shelves) shall not be perforated, unless otherwise indicated.
- Rev.05 .5 Shelf supports, prepainted (powder coated), shall be as per manufacturer's standards, designed to safely support the required loads. The shelf clips must secure the shelf in place once installed.
- .6 Provide braces and all other standard devices to maintain stability of shelving units.
- .7 Provide anchors according to capacities of elements fix the units to the floor where required.
- Rev.01 .8 Provide 4 adjustable file dividers per shelf, 203 mm x 280 mm, 0.953 mm thick, punched to include two tabs on the base and one on the rear.
- Rev.01 .9 For weight capacity requirements see design criteria and performance requirements prescribed **above**.
- .10 For dimensions and shelving configurations: see **drawings**.
- .13 Face panels:
- .1 Materials: Type ST.PL/PP cold formed steel sheet, prepainted (powder coated), unperforated.
- .2 Finish: see **above**.
- .3 Face panels shall be located on all operating ends of ranges (with the operating handles) and as end panels on the opposite extremities as shown on **drawings**.
- .4 Face panels must cover entirely the full height and the width of shelving.
- .5 Face panels: of 1.2 mm thick steel using a 2-bend structural design that forms a 19 mm thick edge channel that runs the full length of each vertical edge; a minimum of three 1.2 mm structural hat channel supports shall be welded into the back of the panel at the top, base and centre to provide unit rigidity; free of any exposed assembly holes or protruding hardware, and assembled without any exposed sharp edges.
- .6 Two 78 mm x 127 mm card holders shall be provided per aisle entry location and attached to the end panels with centres located 1 524 mm above the finished floor.
- Rev.01 ~~.14 Provide overhead automatic lighting at each aisle, activated by human presence detector.~~

2.5 Type SHELF.4 – Shelving for Cooler Storage

- .1 Similar to SHELF.3, with modifications as indicated **below** and on **drawings**.
- Rev.01 .2 In stainless steel frame, open shelving, mechanism.
- Rev.01 .3 Wire mesh shelves in Type SST.1/BR stainless steel bars, grade 304, with Type SS.F.1 satin finish or Type SS.F.2 polished, with a diameter of 1.27 mm or more to bear the loading prescribed, with a square grid of 25.4 mm x 25.4 mm formed with two sets of bars, top ones running perpendicular to side of shelving unit to facilitate extraction of loaded articles, with edges bent over the shelf supports.
- .4 Low-height, without flues, with top shelf.

2.6 Type SHELF.5 – High Density Shelving

- .1 Modular fixed storage for special collection, similar to SHELF.1A, with modifications as indicated **below** and on **drawings**.
- .2 With flues.
- Rev.01 .3 With drawer insertion modules Type DR.03 – See **drawings (8/A-786)**.

2.7 Type SHELF.7 – Pocket Slide Art Rack

- .1 General:
 - .1 Pull-out art storage screens, ceiling suspended and floor guided.
 - .2 The trolley assembly that supports the weight of the system shall be located at the top of the screen.
 - .3 This system shall provide a soft displacement without noise or oscillation. Art screens are assembled on site without welding.
- .2 Screens:
 - .1 Mesh assembly: shall be made of 4 pieces metal frame welded to 2 metal grids, which make a double-sided assembly; the pieces of the metal frame are "U"-shaped 32 mm x 30 mm and made of 1.6 mm steel; depending on the size of the mesh assembly one or several 13 mm x 30 mm "U"-shaped reinforcements are added to the main frame. These dimensions and thicknesses may vary as per manufacturer's standards. The grid is made of 1.8 mm thick (or thicker as per manufacturer's standards) Type ST.PL/PP steel sheet with rectangular 51 mm x 25.4 mm openings; the load capacity shall be 36.6 kg/m² on each side.
 - .2 Connector and perimeter channels: screen assemblies shall be linked together by means of 1.6 mm connector and perimeter channels; an "H"-shaped 70 mm x 40 mm joint makes the link between two mesh screens; at the top, front and rear extremities 35 mm x 40 mm "U"-shaped steel parts provide a smooth finish. At the top, a 2.66 mm steel "C" shaped channel, 75 mm wide by 28.6 mm high, is fastened to the upper channel of the mesh assembly. At least a pair of trolley supports is welded to it. A trolley support shall be made of 4.7 mm thick steel and shall be 305 mm long by 38 mm high with three holes of 14 mm diameter.
 - .3 Bumpers: in an inert material fixed at both front and rear end of mesh screens to act as shock absorbers.
 - .4 Hooks not in contract.

.3 Rails:

- .1 Ceiling suspension channels: the suspension channels shall be 1.9 mm steel, "U"- shaped and be 51 mm high by 76 mm wide. They shall be installed perpendicular to the mesh screens with the opening upward. The channels shall be fastened to ceiling and to beam joint support by means of 12.7 mm diameter adjustable threaded rods and, when possible, secured to the wall with a 3 mm steel angle. Beam joint supports: they shall be designed to carry up to 544 kg. They shall be 100 mm high by 55 mm wide by 41 mm long with one 11 mm hole or 89 mm long with three 11 mm holes and made of 6.4 mm thick stainless steel. Rail: top suspended rails shall be 2.66 mm steel "U"-shaped channels 41 mm or 62 mm high wall by 41 mm wide with 9.5 mm flanges bent toward the interior. Rails shall be supported by beam joint supports and held in place with one to three 9.5 mm diameter bolts, depending on the system configuration. Rails shall be installed parallel to the screens. Carriages:
- .1 The trolley assembly is composed of 4 wheels and a 6.4 mm stainless steel plate of 86 mm by 79 mm. The plate shall have three 14 mm diameter holes to link with trolley supports on screens. One to three 12.7 mm diameter bolts shall be used, depending on the system configuration. The trolley shall have a load capacity of not less than 272 kg and their quantity depends on the screen dimension and the loading capacity required.

.5 Drive-guide system:

- .1 A bottom guiding pin shall prevent sideways movements of the screen. The pin is a 38 mm high by 32 mm diameter nylon block which slides into the bottom "H" shaped perimeter channel of the mesh screen. The nylon block is mounted on a 102 mm x 203 mm, 4.7 mm thick steel plate which is fixed to the floor.

.6 Wheels:

- .1 Each trolley shall have four ball bearing loaded wheels. Wheel shall have 29 mm diameter.

.7 Movement controls:

- .1 Movement is achieved manually, with minimal effort, by means of pulling/pushing a handle mounted on the end panel of each mobile range or directly on the upright.
- .2 Each moveable screen shall be equipped with a handle installed on operator's side of screen.

Rev.03 2.8 Components and Hardware for Racking (Type SHELF.8 and Type SHELF.9)

- .1 Supply and install the type of hardware shown on **drawings**. All hardware specified or not shall be commercial type and heavy-duty construction.
- .2 Uprights (Type SHELF.8):
 - .1 Cold rolled steel open or closed "U" shapes with slots to accommodate different configurations.
 - .2 Size and thickness of upright determined by manufacturer to support specified loads.
 - .3 Provide extra reinforcement within the rolled shape to allow for additional impact damage protection. Additional reinforcement may be an "I" shape or a box shape tube added inside the "U" shape. Manufacturer shall provide test data to demonstrate the added benefit of the impact protection reinforcement.
- .3 Uprights (Type SHELF.9):
 - .1 Hot rolled structural steel "I" section, with slots to accommodate different configurations.
 - .2 Size and thickness of upright determined by manufacturer to support specified loads.
- .4 Beams (Type SHELF.8):
 - .1 Cold or hot rolled formed steel. Shape according to manufacturer.

- .2 Size and thickness of beams determined by manufacturer to support specified loads.
- .3 Bolted beam to columns connections, designed to resist an uplift force of 4.5 kN.

.5 Beams (Type SHELF.9):

- .1 Cold or hot rolled formed steel. Shape according to manufacturer.
- .2 Size and thickness of beams determined by manufacturer to support specified loads.
- .3 Bolted beam to columns connections, designed to resist an uplift force of 4.5 kN.
- .4 Provide a vertical stopper at cantilever end.

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- .6 Shelves (Type SHELF.8): shall be wire mesh in Type ST.PP/BR steel bars with manufacturer's electrostatically applied Type PP.F.5 epoxy-polyester hybrid powder coating finish similar as the rest of the shelving unit, with a diameter of 4.88 mm (6 ga) or more to bear the loading prescribed, with a rectangular grid of 63.5 mm x 104 mm formed with two sets of bars, top ones running perpendicular to side of shelving unit to facilitate handling of loaded articles, with edges bent over the shelf support; with 3 support channels 2.28 mm (13 ga) thick or more.
- .7 Pallet stops: provide wherever pallets are to be stored. See **drawings** for locations.
- .8 Column guards: provide a column guard on each column base exposed to forklift circulation.
- .9 Row-to-wall spacer: provide a row-to-wall spacer at each upright situated near a wall.
- .10 Crossbars: provide the necessary crossbars to the loads and decking option identified on the **drawings**.
- .11 Braces: provide sway braces where necessary.
- .12 Bases: upright base plates bolted to the structural slab with 114.3 mm wedge anchor bolts with expandable shells, inserted into predrilled holes.

2.9 Type SHELF.8 – Pallet Rack

.1 Variants:

- .1 Type SHELF.8 (Pallet Rack).
- .2 Type SHELF.8A (Pallet Rack).
- .3 Type SHELF.8B (Pallet Rack).
- .4 Type SHELF.8C (Pallet Rack).
- .5 Type SHELF.8D (Pallet Rack).

.2 Dimensions: refer to **drawings**.

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- .3 Shelving capacity: each shelf shall have a capacity of 1135 kg, unless otherwise indicated.
- .4 Provide accessories listed in **Components and Hardware for Racking** above, where required.
- .5 Provide also vertical blocker at the end of the beams.
- .6 Provide slotted uprights to allow for adjustments on a minimum of 100 mm centers. Provide also bolt holes in the uprights.

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- .7 Prepainted same colour as Type SHELF.1.

Rev.01 2.10 Type SHELF.9 – Structural Cantilever Rack

- .1 Dimensions: refer to **drawings**.
- .2 Provide shelving options as identified on drawings: for pallets, with steel deck or with wire mesh.
- .3 Capacity of 1800 kg per arm.
- .4 Provide accessories listed in **Components and Hardware for Racking** above, where required.
- .5 Provide slotted uprights to allow for adjustments on a minimum of 100 mm centers.
- .6 Prepainted same colour as Type SHELF.1.

Rev.01 2.11 Type SHELF.11 – Weapon Storage Shelving

- .1 Similar as SHELF.3, with modifications as follows:
 - .1 Mobile, with top, no flues, with drawer inserts, as indicated **below** and on **drawings**.
 - .2 Drawers shall have three heights, as indicated.
 - .3 Drawers shall have removable bottoms.
 - .4 Each drawer shall have a capacity of 227 kg.

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2.12 Type SHELF.12 – Packaging Storage Shelving

- .1 General:
 - .1 The system shall be of the fixed heavy-duty wide-span shelving type.
 - .2 Supply insertion modules of drawers or casework as shown on **drawings** and specified below in the article **Accessories**.
- .2 Upright frame:
 - .1 Made of posts, cross-members, braces and a footplate welded together, as per **drawings**. The dimensions indicated below must be validated or modified according to structural (capacity) requirements and may also vary according to manufacturer's standards.
 - .2 Each post shall be a 51 mm or 76 mm by 51 mm tube made of 1.90 mm or 2.28 mm cold roll steel on all four faces, or according to the manufacturer's standards, adequate for the loads prescribed. The post shall be slotted at every 25.4 mm on lateral faces. The side perforations are 4.7 mm wide x 16 mm long and shall be designed to accommodate full shelves or any kind of cantilever or four-post accessory.
 - .3 Cross members and braces shall be 25.4 mm or 35 mm by 25.4 mm or 35 mm "U"-shaped channel made of 1.90 mm steel. Cross members shall be the horizontal link between two posts. Braces are placed in diagonal, between two cross members to reinforce the upright frame. Each brace shall be placed in alternating directions.
 - .4 The footplate shall be formed of a 6.4 mm thick steel base plate, 64 mm or 89 mm wide by 114 mm long, factory welded to the post.
 - .5 The upright frames shall act as ventilation flues where indicated on **drawings**.
- .3 Shelving:
 - .1 The full shelf kit shall be made of 1 plain shelf supported by 2 lateral shelf supports. reinforcements can be added under the shelf to reach higher loading requirements. The full shelf height can be adjusted on 25.4 mm increments and does not require any tools.

- .2 Shelves shall be 25.4 mm thick and constructed of 1.6 mm Type ST.PL/PP cold formed steel sheet, prepainted (powder coated), with edges having four bends. To be used with shelf supports.
- .3 Finish: see **above**.
- .4 Shelf supports shall be as per manufacturer's standards, designed to safely support the required loads. The shelf clips must secure the shelf in place once installed.
- .5 Provide braces and all other standard devices to maintain stability of shelving units.
- .6 Provide anchors according to capacities of elements to fix the units to the floor where required.
- .7 For weight capacity requirements see design criteria and performance requirements prescribed **above**.
- .8 For dimensions and shelving configurations see **drawings**.

2.13 Fabrication

- .1 All materials shall be new.
- .2 All structural elements must be factory manufactured.
- .3 Metal thicknesses, specified as minimums, shall be validated or increased by the manufacturer according the load requirements indicated herein or on the **drawings**.
- .4 Verify mobile carriages and shelving unit location by field measurements before fabrication and indicate measurements on shop drawings.
- .5 Fit and shop-assemble equipment prior to shipping.
- .6 Fabricate work square, true, straight, to suit installation conditions and as indicated.
- .7 Any member in which fabrication tolerances have not been respected or has poorly executed welds may be rejected by the Department Representative.

2.14 Shop Finishing

- .1 After fabrication, clean and paint all components according to AAMA 2603, using an electrostatic hot airless process with powder coating.

2.15 Accessories

- .1 Type MORT.5D - Hydraulic cement grout: as supplied and installed by the shelving manufacturer, non-shrink, non-staining cement compound, with compressive strength of 31 MPa after 1 hour and 55 MPa after 7 days, when tested as per ASTM standards on a Balding-Southward machine of 27 216 kg capacity.
- .2 Types DR-01a and DR-01b drawer module inserts and Type DR-02 quarter unit inserts:
 - .1 Complete and integral self-supporting cabinets, of rigid construction in Type ST.PL/PP prepainted steel, completely welded, with drawers, doors and trays as indicated on **drawings**, finished top, sides and back panels, reinforced toe space.
 - .2 Metal thicknesses of 1.2 mm for cabinet sides, bottoms, tops, frame elements and 0.91 mm for drawer bodies and cabinet backs.

- .3 Drawers, reinforced and removable, with rigid one piece 19 mm thick front panel, operating on 25 mm diameter nylon wheels with steel ball bearings. One (1) such wheel shall be on each drawer slide and one (1) on each drawer suspension track.
- .4 Drawer tracks to eliminate metal to metal contact and minimize surface to surface contact and side to side play. Drawer slides with built-in stops to prevent inadvertent removal of the drawers, but they shall be removable by an upward and forward motion.
- .5 The closing action of the drawers cushioned by two (2) rubber bumpers, screwed in place.
- .6 Two recessed or surface mounted pulls per drawer.
- .7 Divider holders on four sides, spot welded to drawer body and divider panels, 3 or more per drawer, as indicated, with plastic top and bottom edges.
- Rev.01 .8 Doors: plain or glazed with Type GL.2-6 glazing, as indicated, of double-wall telescoping construction, with front panel and inner liner formed on four sides, completely filled with an acoustical insulation; the outside panel shall lip over the inside panel on the pull side of door and both shall be secured together to form a rigid one piece 19 mm (¾") thick door; door closing to be against grommetted rubber bumpers to prevent rattling; doors shall have two or more hinges, as necessary, and hinge position shall be reinforced with heavy duty concealed tapping plates to ensure a perfect adjustment and avoid any sagging; all corners of outer door panels to be welded and ground smooth; recessed or surface mounted pulls.
- Rev.01 .9 Trays shall be in seamless Type SST.1 stainless steel sheets, grade 304, with finishes Types SS.F.1 or SS.F.2, 1.27 mm thick or thicker as required for the loads to carry, 700 mm x 400 mm, by 25 mm depth, with molded lip.

3.0 EXECUTION

3.1 General

- .1 Installation to be performed as per manufacturer's instructions and as indicated on **drawings**.
- .2 Conduct pre-installation conference at project site. Review methods and procedures related to installation of shelving units, the existing conditions and any other consideration to avoid delays or inconveniences.

3.2 Examination

- .1 Examine existing conditions for compliance with requirements for capacity, installation tolerances and other conditions affecting performance of shelving. Notify the Departmental Representative of any adverse or unfavorable condition.
- .2 Proceed with installation only after unsatisfactory conditions have been corrected.
- .3 Do not install movable and fixed storage units in place until after concrete topping is in place and fully cured, all wet work in space, including application of paints or special coatings to walls, ceilings and floors, is completed and dry, and overhead mechanical and electrical work is completed so that the risks that the system may subsequently be dirtied or damaged.
- .4 To begin work implies acceptance of job conditions.

3.3 Coordination

- .1 Coordinate installation of the rail system with **Section 03 53 00** and **Structure**.

- .2 Coordinate installation and anchoring to floor with **Structure**, use X-ray to avoid damaging rebars.
- .3 Coordinate also with **Sections 09 61 00, 09 65 00 and 09 67 00**.

3.4 Installation of Rails

- .1 Rails are to be verified for integrity of position and levelness, as well as anchored into structural concrete slab, using anchors in sizes and quantities as determined by the manufacturer.
- .2 Embed rail in a grout bed and fill voids around rail with grout Type MORT.5B.
- .3 Install rails into structural concrete slab at intervals that meet the seismic requirement but do not exceed 1200 mm. Use fasteners compatible with structural requirements of carriage loads and configuration of rail design.
- .4 Install rail with the top of rail flush with finished floor datum established in contract documents and as executed, with the rail anchored to the concrete slab located 55 mm below the finished floor surface. See **details**.
- .5 Lay, position and stagger rails properly to ensure a smooth weight transfer from one track to the other.
- .6 Ensure rails are exactly parallel and level.
- .7 Use shorter rail lengths at end of rail-runs.
- .8 Include setting of anchors, placing, adjusting and grouting rails in place (if grout required) and levelling. Use Type MORT.5D grout; allow at least 6 mm for grout under high point; grout to be worked under rail, any voids completely filled and trimmed upsides and flush with rails, to allow proper weight distribution from rail to concrete slab.
- .9 Provide protection for rails during pouring of remainder of topping to fill space left between rails and the pre-poured general topping, using polyethylene or other suitable material. Protect the rails also when floor finishes are installed.

3.5 Installation of Shelving

- .1 Install carriages and test for smooth carriage rolling operation.
- .2 Ensure 150 mm gap is provided between rows for bumpers.
- .3 Adjust and align as necessary prior to placement of drive units and shelving units.
- .4 Install and test drive mechanism prior to shelving unit installation.
- .5 Install components in place, plumb, straight and level.
- .6 Make bolted assembly joints between carriages in such a manner as to maintain a good alignment between the units and ensure a uniform distribution of weight.
- .7 Anchor fixed carriages to rails.

- .8 Brace, secure and anchor fixed shelving units to adjacent walls, floor, structure or concrete pads, etc., as required. Use vibration proof fasteners.
- .9 Install shelving at uniform, equal height spacing, unless instructed otherwise.
- .10 Install various types of shelving and other elements as per reviewed shop drawings.

3.6 Erection of Racking (Type SHELF.8 and Type SHELF.9)

- .1 The proposed technique and equipment used to erect the frame are subject to the Department Representative's review. However, such review does not relieve the Contractor of his sole responsibility for selection of technique and equipment mobilization to perform the work quickly and safely.
- .2 Frame shall be erected in strict compliance with the requirements of article 29 of CSA-S16 standard.
- .3 Notify the Department Representative as soon as possible of any defects in the assembly of factory fabricated structural members and comply with Department Representative's decision with regard to corrections to be made.
- .4 It is strictly forbidden to make assembly welds on site unless indicated on shop drawings or previously agreed bthe Department Representative.
- .5 It is strictly forbidden to cut, pierce or modify structural members in any manner on site by flame cutting unless the Department Representative's prior written permission has been obtained.
- .6 After erection is complete, apply a coat of paint to field welds and bolted joints, and touch up surfaces that were burned or scratched during work.

3.7 Field Quality Control

- .1 Verification of proper installation and operation of mobile storage units shall be by the manufacturer's representative, and in the presence of the Departmental Representative.
- .2 The work of this Section shall include for full-time on-site technical assistance for installation of mobile storage units in order to assure that the related concrete topping work is compatible with an optimal operation of the mobile shelving system.
- .3 Verify rails for integrity of position and levelness, as well as anchoring into structural concrete slab, using anchors in sizes and quantities as determined by the manufacturer.
- .4 Verify shelving unit alignment and plumb after installation. Correct if required following manufacturer's instructions.
- .5 Provide manufacturer's field services for racking consisting of product use recommendations and at least one site visit for inspection of product installation in accordance with manufacturer's instructions.
- .6 A site visit report must be submitted to the Departmental Representative to confirm installation.

- .7 Remove components which are chipped, scratched, or otherwise damaged and which do not match adjoining work. Replace with new matching units, installed as specified and in manner to eliminate evidence of replacement
- .8 Make good painted surfaces damaged during shipment or installation.

3.8 Adjusting

- .1 Adjust components and accessories to provide smoothly operating, visually acceptable installation.

3.9 Cleaning

- .1 Immediately upon completion of installation, clean components and surfaces.
- .2 Remove surplus materials, rubbish and debris resulting from installation upon completion of work and leave areas of installation in neat, clean, dust-free condition, as per **Section 01 74 11**.

3.10 Demonstration / Training

- .1 Schedule and conduct demonstration of installed equipment and features with the personnel of the building.
- .2 The manufacturer's representative must demonstrate the functioning of the mobile shelving systems in the presence of the Departmental Representative, to his satisfaction. If need be, proceed with the required adjustments and modifications.
- .3 Schedule and conduct maintenance training with Departmental Representative's maintenance personnel. Training session should include lecture and demonstration of all maintenance and repair procedures that end user personnel would normally perform.
- .4 See also **Section 01 79 00**.

3.11 Protection

- .1 Protect system against all damage during and after installation until time of substantial completion.

End of Section