

vista pro architectural



Design Manual

Designers & Installers
Engineers & Architects

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1.0 INTRODUCTION

Permanent guardrail systems are required near or at the open sides of elevated walking/viewing surfaces for the purpose of minimizing the potential of an accidental fall to a lower level.

Aluminum guardrail assemblies are commonly comprised of straight sections of top rail elevated and supported above a floor by uniformly spaced posts. The posts are anchored to the floor structure by means of anchor screws or bolts. A bottom channel runs between support posts just above the floor system. The vertical space between the posts, the bottom channel and top rail is infilled with either glass panels or aluminum pickets. Figure 1 below illustrates the main elements of a glass panel and aluminum picket guardrail system.

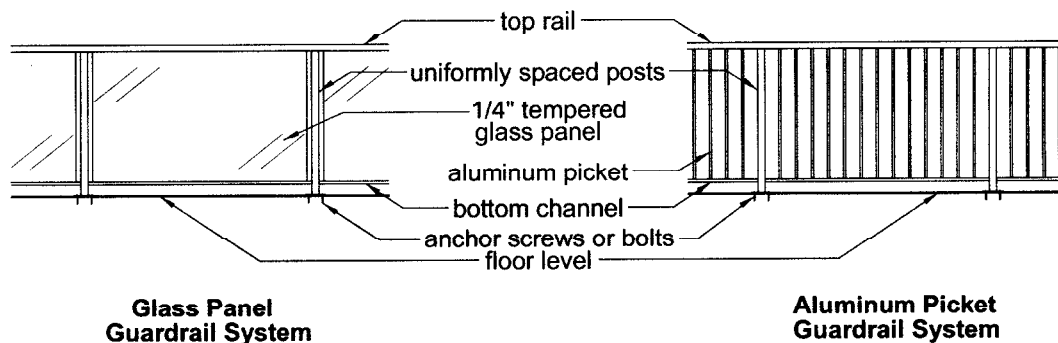


FIGURE 1: MAIN ELEMENTS OF GUARDRAIL SYSTEMS

2.0 GENERAL DESIGN

This manual has been compiled to provide relevant structural information which will enable designers, installers, architects, and engineers to select safe and code-conforming guardrail designs using BW Vista products.

The major considerations for the structural design of guardrails are:

1. Structural design criteria as established by governing building codes, bodies and authorities or by specific and unique established project design requirements,
2. Mechanical properties of material used in the manufacture of guardrail elements,
3. Physical properties of guardrail elements,
4. Load capacities of guardrail elements and component systems,
5. Load distribution characteristics of various guardrail elements and systems, and
6. Proper anchorage of support elements to surrounding supporting structures.

2.1 DESIGN CRITERIA

2.1.1 Loadings

Structural design loading requirements for guardrails are specified by governing building codes and bodies, local ordinances, project specifications and/or regulatory authorities. Usually a uniformly distributed load and/or a concentrated load applied to the top rail is specified. The loading requirements of The National Building Code of Canada (NBCC) 2015 for guardrails are provided under clauses 4.1.5.14. Loads on Guards and Handrails 1) to 7). The clauses are repeated below:

4.1.5.14. Loads on Guards and Handrails

- 1) The minimum specified horizontal load applied outward at the minimum required height of every required *guard* shall be
 - a) 3.0 kN/m for open viewing stands without fixed seats and for *means of egress* in grandstands, stadia, bleachers and arenas,
 - b) a concentrated load of 1.0 kN applied at any point, so as to produce the most critical effect, for access ways to equipment platforms, contiguous stairs and similar areas where the gathering of many people is improbable, and
 - c) 0.75 kN/m or a concentrated load of 1.0 kN applied at any point so as to produce the most critical effect, whichever governs for locations other than those described in Clauses (a) and (b).
- 2) The minimum specified horizontal load applied inward at the minimum required height of every required guard shall be half that specified in Sentence (1).
- 3) Individual elements within the *guard*, including solid panels and pickets, shall be designed for a load of 0.5 kN applied outward over an area of 100 mm by 100 mm located at any point in the element or elements so as to produce the most critical effect.
- 4) The size of the opening between any two adjacent vertical elements within a guard shall not exceed the limits required by Part 3 when each of these elements is subjected to a specified live load of 0.1 kN applied in opposite directions in the in-plane direction of the guard so as to produce the most critical effect.
- 5) The loads required in Sentence (3) need not be considered to act simultaneously with the loads provided for in Sentences (1), (2) and (6).
- 6) The minimum specified load applied vertically at the top of every required guard shall be 1.5 kN/m and need not be considered to act simultaneously with the horizontal load provided for in Sentence (1).
- 7) Handrails and their supports shall be designed and constructed to withstand the following loads, which need not be considered to act simultaneously:
 - a) a concentrated load not less than 0.9 kN applied at any point and in any direction for all handrails, and
 - b) a uniform load not less than 0.7 kN/m applied in any direction to handrails not located within dwelling units.

2.1.2 Factors Of Safety

Factors of safety are generally related to a mode of failure. Ductile failure, such as stable (no buckling) yielding of a metal element, is usually assigned a lower factor of safety than is brittle failure, such as screw fracture or anchor bolt pullout. Part 4 of the NBCC 2015 specifies a load factor of 1.5 to be applied to live loads. Since it is unlikely that the failure of any one component will cause the entire system to fail, a factor of safety of 1.5 for element and system design is applied. A higher or lower factor of safety may be appropriate depending upon the type of application and other considerations made by the certifying professional. For instance, a higher factor of safety may be more appropriate for glass infill panels since their failure is of a brittle nature. The guardrail configurations/design tables provided at the end of this manual have been developed using a minimum overall system factor of safety of 1.5.

2.2 MATERIALS AND PROPERTIES

2.2.1 Mechanical Properties Of Aluminum Alloys And Elements

Mechanical properties of aluminum alloys used in Vista Pro Railings Guardrail Systems are provided in CAN3-S157-M83 Strength Design in Aluminum and are listed in Table 1 below. Properties vary with the composition and temper of the material and also, to some degree, with the profile and the direction of stress.

TABLE 1: MECHANICAL PROPERTIES OF ALUMINUM ALLOYS AND PRODUCTS

Alloy & products	Tensile ultimate Fu	<u>NOT WELDED</u>		Tensile ultimate Fwu	<u>WELDED</u>	
		Tensile yield Fy	Compressive yield Fy		Tensile yield Fwy	Elastic modulus E
6063-T5 Extrusions up to 0.500	22 ksi (151.7 MPa)	16 ksi (110.3 MPa)	16 ksi (110.3 MPa)	17 ksi (117.2 MPa)	11 ksi (75.8 MPa)	10 100 ksi (69 640 MPa)
6063-T6 Extrusions	30 ksi (206.9 MPa)	25 ksi (172.4 MPa)	25 ksi (172.4 MPa)	17 ksi (117.2 MPa)	11 ksi (75.8 MPa)	10 100 ksi (69 640 MPa)
6061-T6 Extrusions	38 ksi (262.0 MPa)	35 ksi (241.3 MPa)	35 ksi (241.3 MPa)	24 ksi (165.5 MPa)	20 ksi (137.9 MPa)	10 100 ksi (69 640 MPa)
6005A-T61 Extrusions	38 ksi (262.0 MPa)	35 ksi (241.3 MPa)	35 ksi (241.3 MPa)	24 ksi (165.5 MPa)	20 ksi (137.9 MPa)	10 100 ksi (69 640 MPa)

2.2.2 Physical Properties Of Guardrail Elements

Physical properties of sections of commonly used elements in Vista Pro Railing Guardrail Systems are given in Table 2. Typical cross-sections of these elements are provided in Figure 2. Additional elements are shown in Vista Pro's Dealer Catalogue.

TABLE 2: PHYSICAL PROPERTIES OF COMMON ELEMENTS

ELEMENTS	ALLOY	AREA in ² (mm ²)	Ixx in ⁴ (10 ⁶ mm ⁴)	Sxx in ³ (10 ³ mm ⁴)	Iyy in ⁴ (10 ⁶ mm ⁴)	Syy 10in ³ (10 ³ mm ⁴)
TOP RAILS						
57.2 mm (2 1/4") round top rail for glass panel infill	6063-T5	.727 (469)	.237 (.099)	.228 (3.742)	.412 (.171)	.358 (5.861)
57.2 mm (2 1/4") square top rail for glass panel infill	6063-T5	.785 (507)	.298 (.124)	.292 (4.783)	.523 (.218)	.454 (7.440)
57.2 mm (2 1/4") round top rail for picket infill	6063-T5	.621 (401)	.238 (.099)	.226 (3.705)	.397 (.165)	.345 (5.654)
57.2 mm (2 1/4") square top rail for picket infill	6063-T5	.661 (426)	.298 (.124)	.289 (4.730)	.507 (.211)	.441 (7.221)
TOP RAIL SLEEVES/CORNERS						
inside round top rail sleeve/corner	6063-T5	.484 (312)	.121 (.050)	.155 (2.540)	.287 (.119)	.275 (4.503)
outside round top rail sleeve/corner	6063-T5	.541 (349)	.334 (.139)	.281 (4.603)	.395 (.164)	.318 (5.202)
outside square top rail sleeve/corner	6063-T5	.598 (385)	.407 (.169)	.360 (5.895)	.538 (.224)	.427 (6.995)
BOTTOM RAILS						
bottom rail for glass panel system	6063-T6	.310 (200)	.051 (.021)	.065 (1.057)	.097 (.040)	.144 (2.357)
bottom rail for picket panel system	6005A-T61	.208 (134)	.007 (.003)	.015 (.242)	.052 (.022)	.077 (1.254)
POSTS						
63.5 mm (2 1/2") square post	6005A-T61	.780 (503)	.772 (.321)	.617 (10.115)	.772 (.321)	.617 (10.115)
50.8 mm (2") square post	6005A-T61	.636 (411)	.393 (.163)	.393 (6.434)	.393 (.163)	.393 (6.434)
38.1 mm (1 1/2") square post	6005A-T61	.460 (297)	.156 (.065)	.208 (3.404)	.156 (.065)	.208 (3.404)
MISCELLANEOUS						
1 1/4" (31.8 mm) schedule 40 handrail pipe	6061-T6	.667 (430)	.194 (.081)	.234 (3.837)	.194 (.081)	.234 (3.837)
pickets	6063-T5	.113 (73)	.006 (.003)	.020 (.329)	.006 (.003)	.020 (.329)
various plates	6061-T5					

Legend
I - moment of inertia
S - section modulus

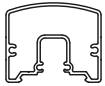
TOP RAILS



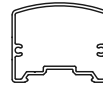
2 1/4" (57.2 mm)
round top rail for glass panel system



2 1/4" (57.2 mm)
round top rail for picket infill system



2 1/4" (57.2 mm)
square top rail for glass panel system



2 1/4" (57.2 mm)
square top rail for picket infill system

TOP RAIL SLEEVES/CORNERS



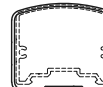
inside round top rail sleeve/corner



outside round top rail sleeve/corner



inside square top rail sleeve/corner



outside square top rail sleeve/corner

BOTTOM RAILS

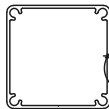


bottom rail for glass panel system



bottom rail for picket infill system

POSTS



2 1/2" (63.5 mm)
square post
0.080" wall thickness



2" (50.8 mm)
square post
0.072" wall thickness



1 1/2" (38.1 mm)
square post
0.065" wall thickness

PICKETS



5/8" x 5/8" (15.9 mm)
square picket
0.049" wall thickness



5/8" x 1 1/2" (15.9 x 38.1 mm)
square picket
0.050" wall thickness

FIGURE 2: TYPICAL CROSS-SECTIONS OF COMMON GUARDRAIL ELEMENTS

2.3 ELEMENT AND SYSTEM LOAD CAPACITIES

Canadian Standards Association Document CAN3-S157-M83 Strength Design In Aluminum can be used in determining individual component capacities using conventional engineering design procedures. This method is somewhat conservative and limiting since it does not give consideration to the varying interactions of the elements in determining the load carrying capacity of the guardrail system. Analysis and testing procedures are applied to achieve information for a more efficient design.

Alternatively, clause 1.4.1 of the aforementioned standard states, "In lieu of design calculations, the adequacy of a structural assembly may be proved by tests." Vista Pro Railings has conducted an extensive testing program using the services of Intertek Testing Services Na Ltd./Warnock Hershey, some of the results of which are provided in Table 3. Reports of the tests are available upon request. Since test results generally reflect more accurately the actual load carrying capacity of elements and systems, Vista Pro Railings recommends the use of test results, where possible, in determining acceptable guardrail designs.

2.4 LOAD DISTRIBUTION

Proper determination of load distribution is a necessary step in the efficient design of guardrail systems. Load distribution is affected by numerous factors, including but not limited to, the stiffness of the top rail relative to the stiffness of the posts, the continuity of the top rail, the length of each straight segment, the total number of spans in a segment, the type of panel infill and the end support conditions. Accurately determining the load distribution characteristics of a guardrail system requires a sophisticated analysis approach. Vista Pro Railings has developed specialized computer modelling used to determine the load distribution for its various systems and has performed extensive testing to verify the results.

Analysis and design of unique configurations requires specialized engineering which can be provided by Vista Pro Railings. Use of this information in combination with test results is essential for the efficient design of safe guardrail systems.

2.5 ANCHORAGE

Proper anchorage of guardrail posts and rails to a sound and structurally adequate supporting structure is essential for a guardrail system. These elements must be as secure and rigid as possible. A structurally adequate supporting structure is as important as the anchorage elements themselves. One without the other compromises the load carrying capacity and performance of the guardrail system. Building designers and general contractors must be made aware of their responsibility to provide for proper support conditions since this is beyond the normal scope and control of the guardrail system designer and installer.

The anchorage and supporting structure for each post must be designed to carry the applied loads and their associated overturning moments at the post base. These loads comprise of shear, tension and compression forces which must be resisted. Figure 3 indicates some common and approved post base connections.

The anchorage and supporting structure of each top (and bottom) rail to base building components (wall, column, etc) connection must be designed to carry the applied loads transferred from the top and bottom rail. The connection is assumed to provide pivot support with no flexural resistance. Shear loads and, depending upon the system configuration, pullout loads must be resisted. Figure 3 indicates some common and approved top and bottom rail to base building component connections.

TABLE 3: VISTA PRO RAILINGS TESTING RESULTS

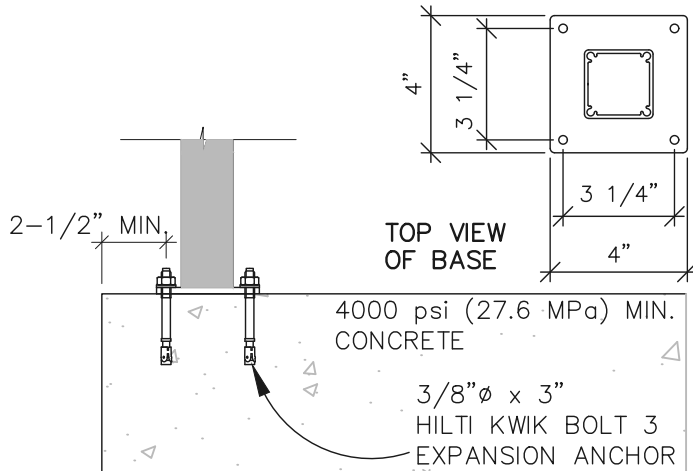
Element/Component System	Average Ultimate Load Applied	Mode of Failure
TOP RAILS		
2 1/4" (57.2 mm) round top rail for glass panel infill	872 lbs. (3879 N) total load applied at 1/3 span points	buckling @ load point
2 1/4" (57.2 mm) square top rail for glass panel infill	1047 lbs. (4657 N) total load applied at 1/3 span points	buckling @ support
2 1/4" (57.2 mm) round top rail for picket infill	1054 lbs. (4688 N) total load applied at 1/3 span points	buckling @ load point
2 1/4" (57.2 mm) square top rail for picket infill	1261 lbs. (5609 N) total load applied at 1/3 span points	buckling @ support
TOP RAILS WITH SLEEVES		
2 1/4" (57.2 mm) round top rail with inside sleeve for picket infill	892 lbs. (3966 N) total load applied at 1/3 span points	fastener tearing inner sleeve flange
2 1/4" (57.2 mm) square top rail with outside sleeve for picket infill	1071 lbs. (4763 N) total load applied at 1/3 span points	bending/deformation of rail ends at midspan connector
CORNERS		
90° round external corner	978 lbs. (4350 N) in tension and shear	bottom inner weld of sleeve mitre tore open
90° square external corner	670 lbs. (2980 N) in tension and shear	bottom inner weld of sleeve mitre tore open
135° round external corner	1193 lbs. (5308 N)	bottom inner weld of sleeve mitre tore open
135° square external corner	958 lbs. (4263 N)	bottom inner weld of sleeve mitre tore open
POSTS		
63.5mm (2 1/2") square post anchored to steel frame	1837 N (413lbs) horizontal load @ 1067 mm (42") height	bottom screws pulled through base plate
50.8mm (2") square post anchored to steel frame	1370 N (308lbs) horizontal load @ 1067 mm (42") height	bottom screws pulled through base plate
50.8mm (2") square post fascia mounted to steel frame	1815 N (408lbs) horizontal load @ 1067 mm (42") height	post wall buckling above upper support
38.1mm (1 1/2") square post anchored to steel frame	876 N (197lbs) horizontal load @ 1067 mm (42") height	post wall buckling above upper support
38.1mm (1 1/2") square post mounted to steel frame	946 N (213lbs) horizontal load @ 1067 mm (42") height	post wall buckling above upper support fascia
50.8mm (2") square post anchored to steel frame	1419 N (319lbs) horizontal load @ 1067 mm (42") height	restraining picket brace broke baseplate weld

TABLE 3: VISTA PRO RAILINGS TESTING RESULTS CONTINUED

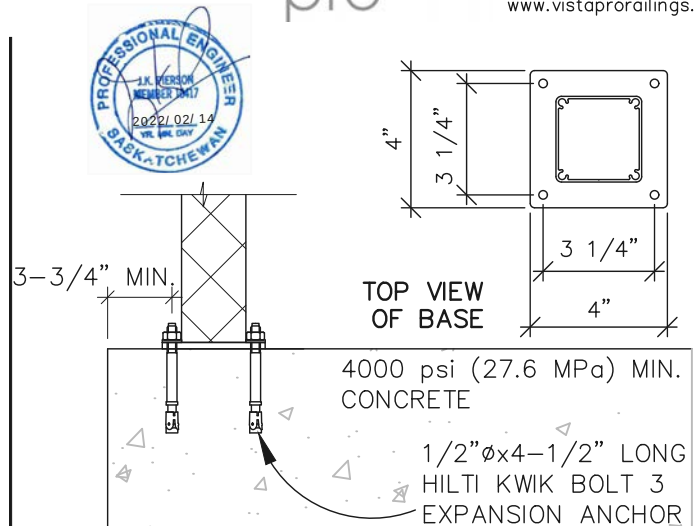
Element/Component System	Average Ultimate Load Applied	Mode of Failure
MISCELLANEOUS		
1 1/4"(31.8 mm) schedule 40 handrail	344 lbs. (1530 N) total load applied at 1/3 span points	uniform bending failure
top rail end clip	1447 lbs. (6437 N) in shear	top forward screw pulled laterally out of chase
bottom channel end clip	1779 lbs. (7915 N) in shear	top forward screw pulled laterally out of chase
handrail bracket	254 lbs. (1130 N)	bracket yielded
GLASS PANELS		
.25" (6 mm) tempered glass panel 36" (914.4 mm) x 12" (304.8 mm)	215 lbs. (955 N) at midspan edge	fracture
.25" (6 mm) tempered glass panel 36" (914.4 mm) x 48" (1219.2 mm)	366 lbs. (1627 N) at midspan edge	fracture
.25" (6 mm) tempered glass panel 36" (914.4 mm) x 48" (1219.2 mm)	92 psf (4.40 kPa) distributed load over entire panel	glass panels slips out of bottom rail
PICKET		
5/8" (15.9 mm) picket	256 lbs. (1140 N) at midspan	weld failure at end connection
5/8" (15.9 mm) picket panel 44" (1118 mm) x 38 1/4" (972mm)	696 psf (33.3 kPa) distributed loading at midspan over 12" (305 mm) x 12" (305 mm) area	weld failure at end connection
FASTENERS		
#14 x 2 1/2" screw secured to solid fir lumber	2104 lbs. (9359 N) withdrawal	screw pulled out of wood
#14 x 2 1/2" screw secured to solid spruce lumber	1491lbs. (6632 N) withdrawal	screw pulled out of wood
#14 x 2 " screw in post screw chase	4821 lbs. (21445 N) withdrawal	restraining bolt tore through the aluminum post
#8 x 1 1/2" screw in top rail sleeve	1120 lbs. (4982 N) withdrawal	screw neck elongated and broke below head

NOTES

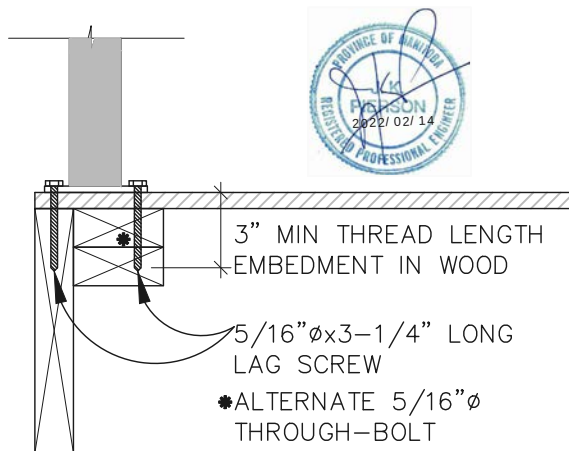
1. Tests conducted by Intertek Testing Services Na Ltd. / Warnock Hersey – reports available upon request.
2. Test procedures in general conformance with ASTM Standard Specification E 985-87 for Permanent Metal Railing Systems and Rails for Buildings and ASTM Standard Test Methods E 935-85a for Performance of Permanent Metal Railing Systems and Rails for Buildings.
3. Testing reviewed by Lang Structural Engineering Inc.
4. Design load for elements as specified by CSA CAN3-S157-M83 Strength Design in Aluminum for live loading is recommended to be the test load/1.5 (ultimate load capacity/1.5) .



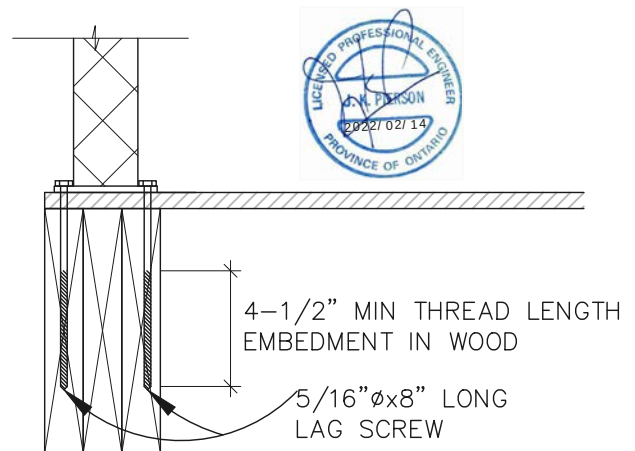
**1 1/2' OR 2' POST
TOP MOUNT TO CONCRETE**



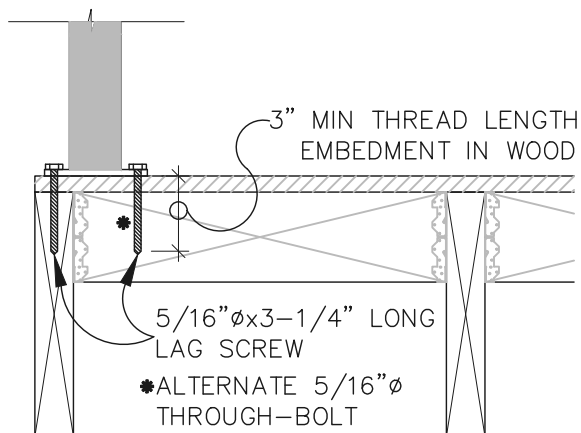
**2 1/2' POST
TOP MOUNT TO CONCRETE**



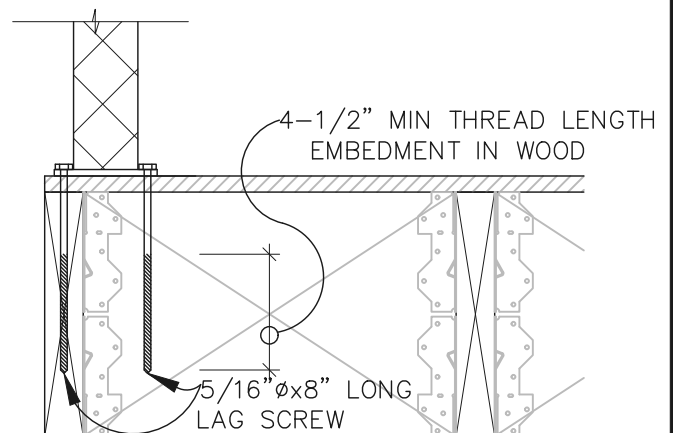
**1 1/2' OR 2' POST
TOP MOUNT TO S-P-F WOOD
FLOOR JOISTS PERPENDICULAR**



**2 1/2' POST
TOP MOUNT TO S-P-F WOOD
FLOOR JOISTS PERPENDICULAR**



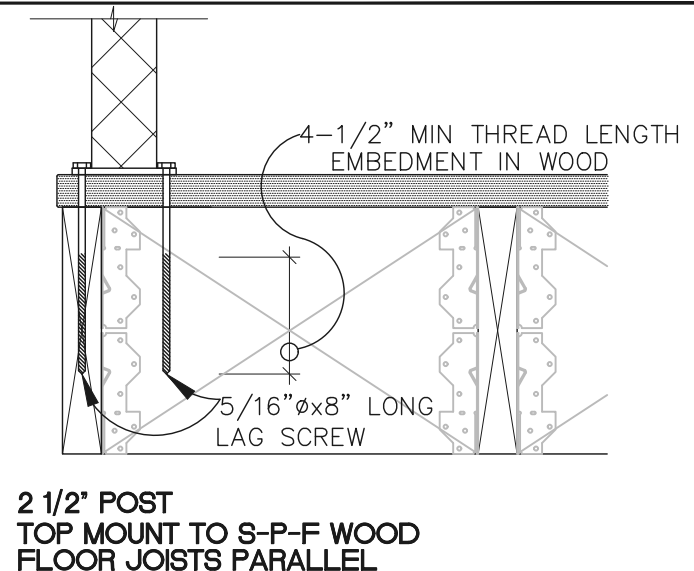
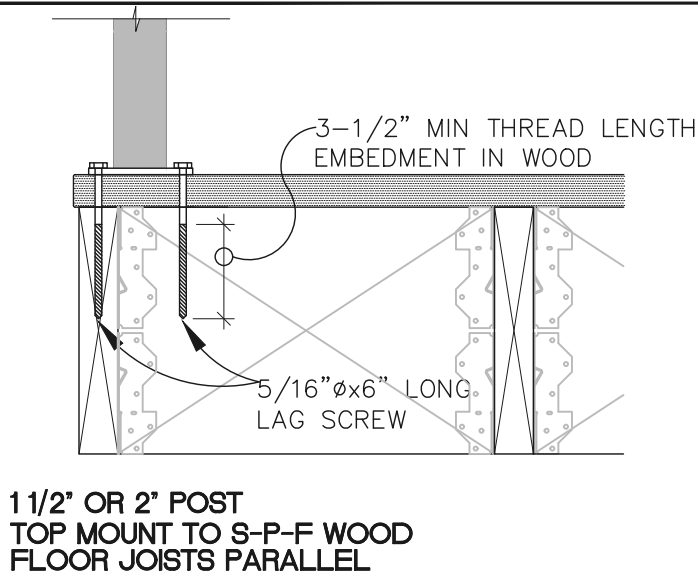
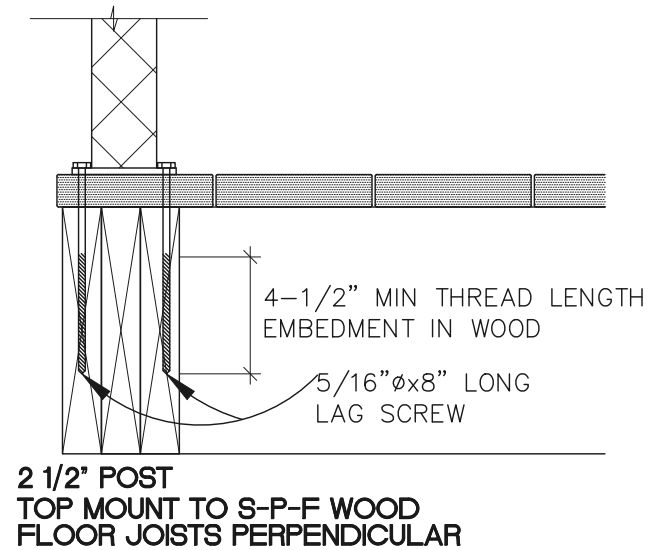
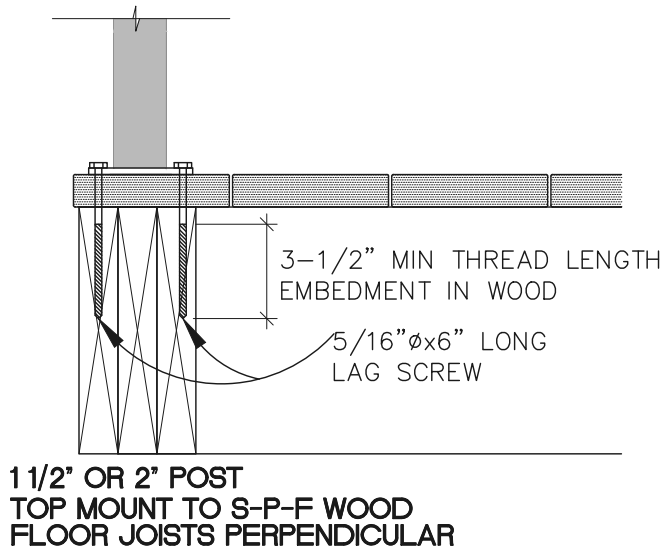
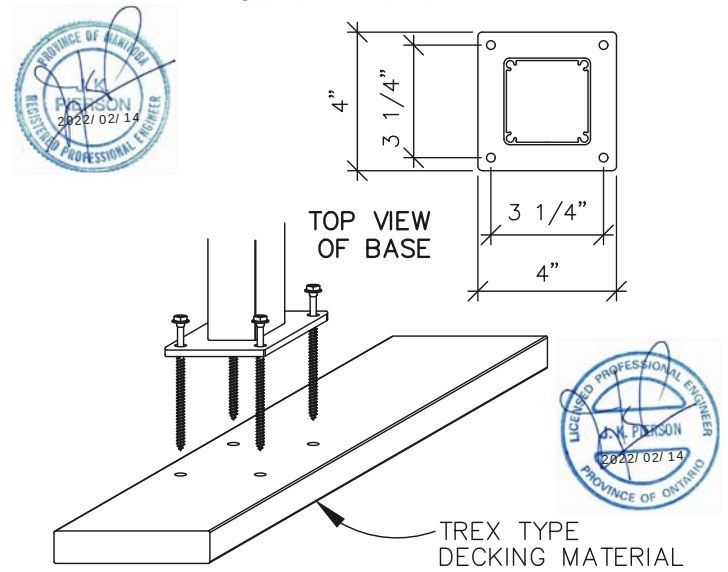
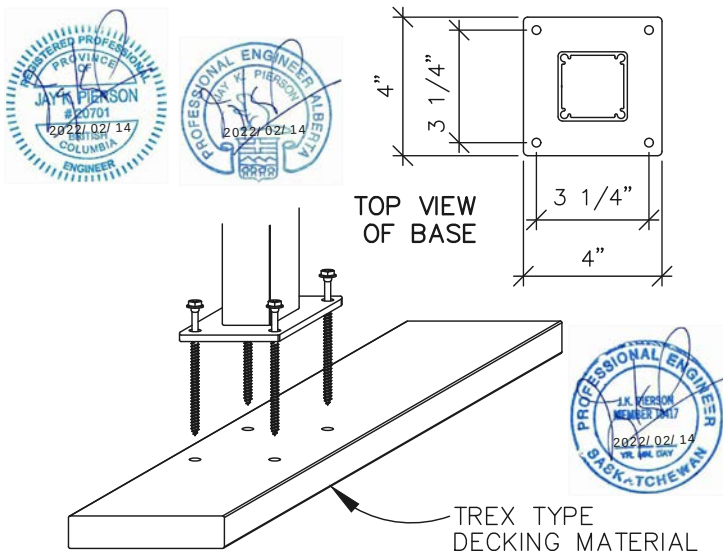
**1 1/2' OR 2' POST
TOP MOUNT TO S-P-F WOOD
FLOOR JOISTS PARALLEL**



**2 1/2' POST
TOP MOUNT TO S-P-F WOOD
FLOOR JOISTS PARALLEL**

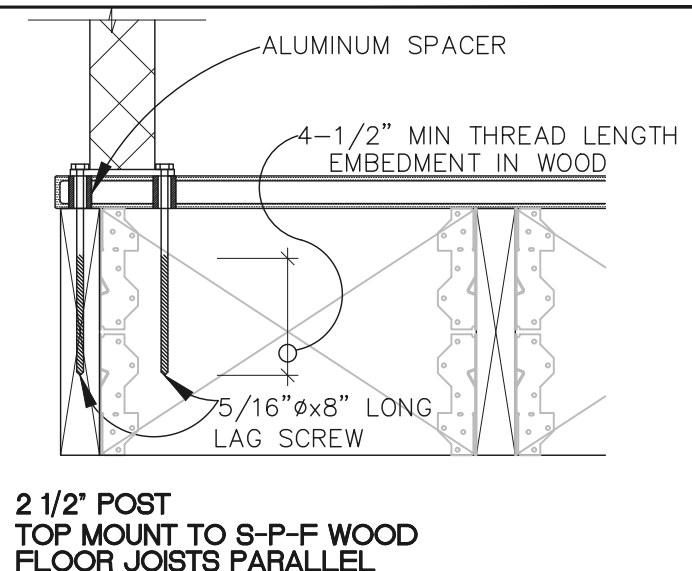
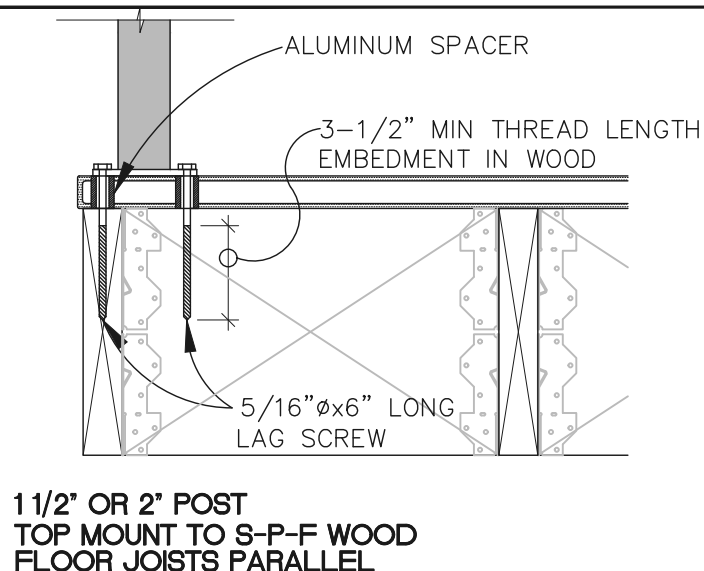
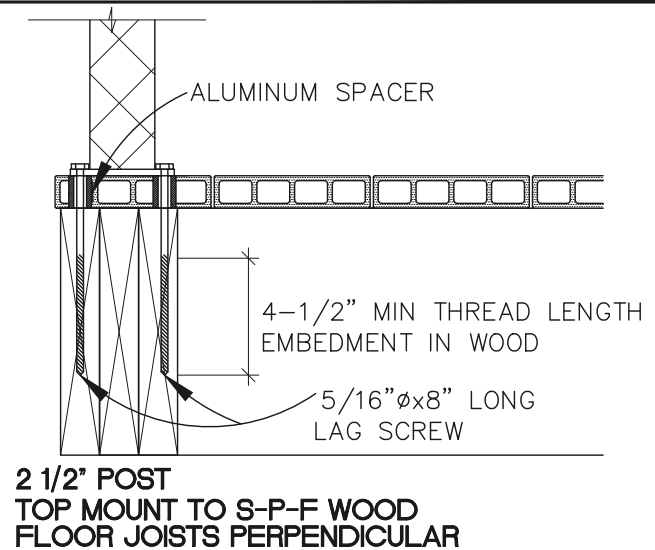
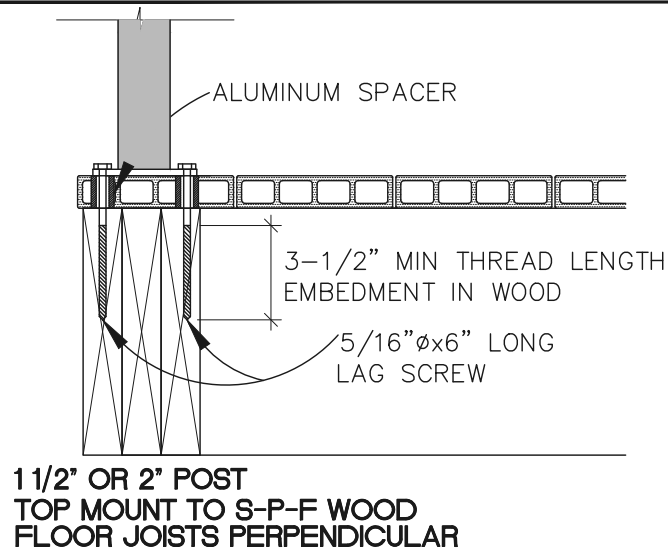
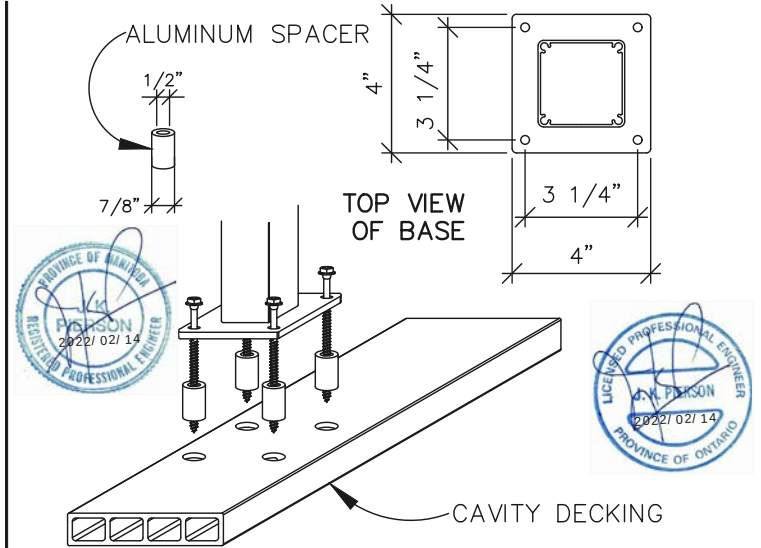
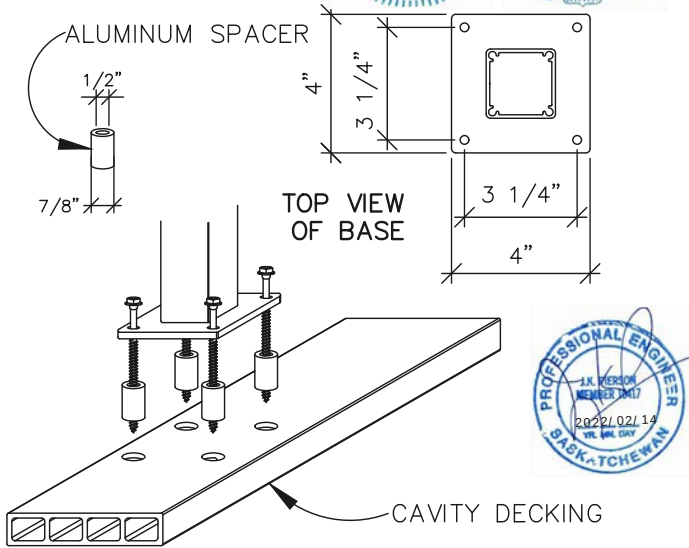
S-P-F WOOD BLOCKING ANCHORAGE TO MAIN STRUCTURE AND
 MAIN STRUCTURE LOAD CAPACITY RESPONSIBILITY OF OTHERS

FIGURE 3: ACCEPTABLE GUARDRAIL MOUNTING CONFIGURATIONS



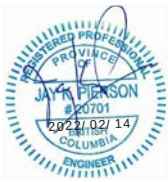
S-P-F WOOD BLOCKING ANCHORAGE TO MAIN STRUCTURE AND
MAIN STRUCTURE LOAD CAPACITY RESPONSIBILITY OF OTHERS

FIGURE 3continued: ACCEPTABLE GUARDRAIL MOUNTING CONFIGURATIONS



S-P-F WOOD BLOCKING ANCHORAGE TO MAIN STRUCTURE AND
 MAIN STRUCTURE LOAD CAPACITY RESPONSIBILITY OF OTHERS

FIGURE 3continued: ACCEPTABLE GUARDRAIL MOUNTING CONFIGURATIONS

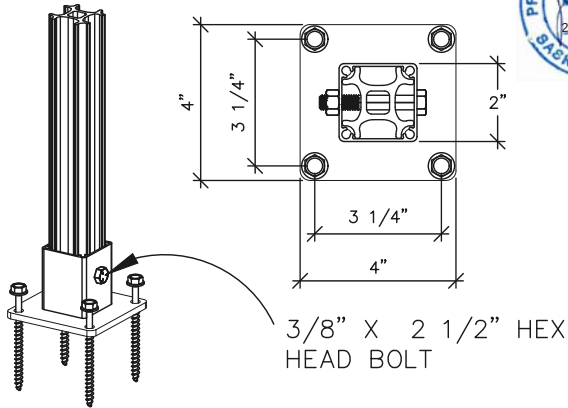


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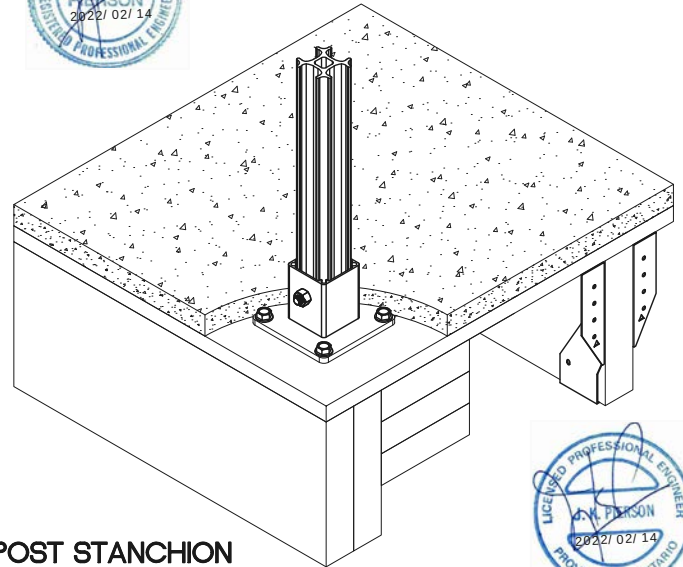


vista
pro

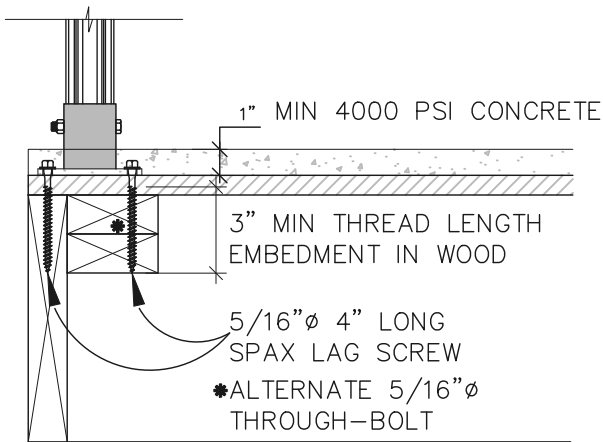
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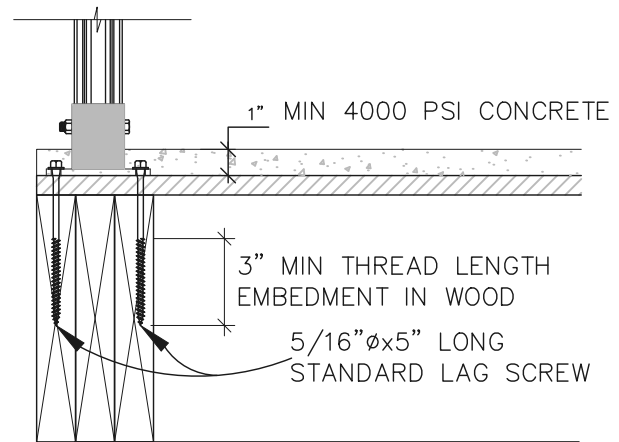
**2" POST STANCHION
TOP MOUNT WITH CONCRETE**



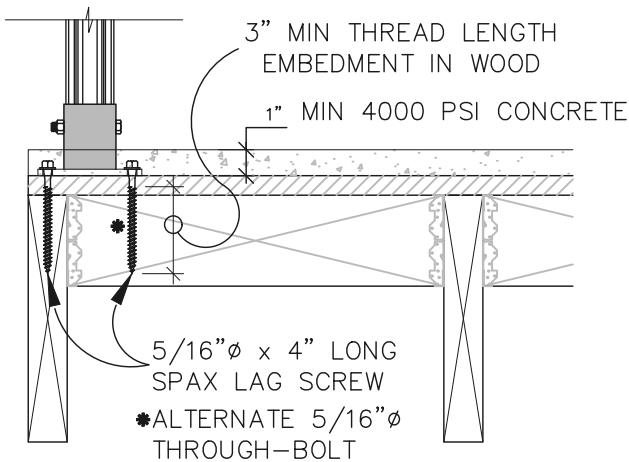
**2" POST STANCHION
TOP MOUNT WITH CONCRETE**



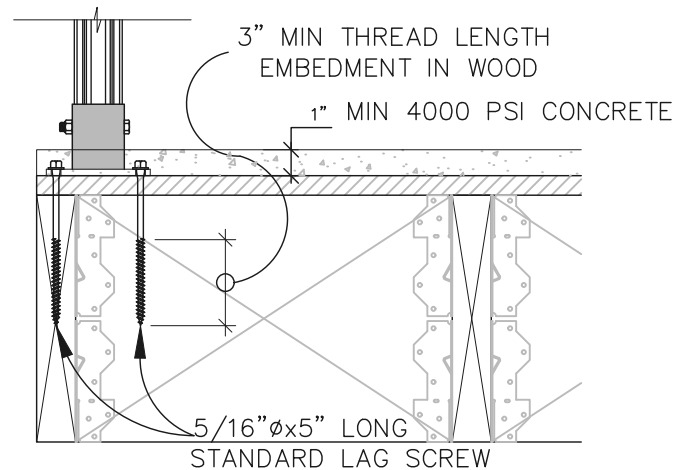
**2" POST STANCHION
TOP MOUNT TO S-P-F WOOD
FLOOR JOISTS PERPENDICULAR**



**2" POST STANCHION
TOP MOUNT TO S-P-F WOOD
FLOOR JOISTS PERPENDICULAR**



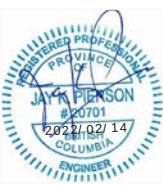
**2" POST STANCHION
TOP MOUNT TO S-P-F WOOD
FLOOR JOISTS PARALLEL**



**2" POST STANCHION
TOP MOUNT TO S-P-F WOOD
FLOOR JOISTS PARALLEL**

S-P-F WOOD BLOCKING ANCHORAGE TO MAIN STRUCTURE AND
MAIN STRUCTURE LOAD CAPACITY RESPONSIBILITY OF OTHERS

FIGURE 3continued: ACCEPTABLE GUARDRAIL MOUNTING CONFIGURATIONS

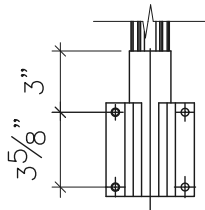


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FASCIA (SIDE) MOUNTING DETAILS RECOMMENDED MOUNTING AND FASTENING TO WOOD

NO.1/NO.2 OR BETTER WOOD BLOCKING ANCHORAGE TO MAIN STRUCTURE
AND MAIN STRUCTURE LOAD CAPACITY RESPONSIBILITY OF OTHERS

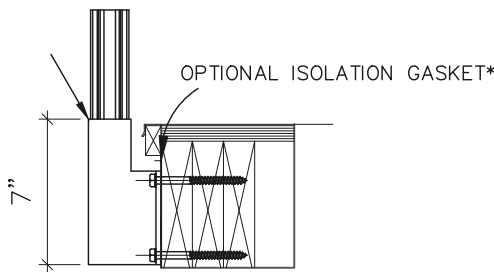


FRONT VIEW OF
BWC SLIM LINE
FASCIA BRACKET

*OPTIONAL CLOSED CELL ISOLATION GASKET
BETWEEN DISSIMILAR OR INCOMPATIBLE
MATERIALS. (Probuil catalogue No. 7000)
(NOT INTENDED AS A WATER PROOFING ITEM)

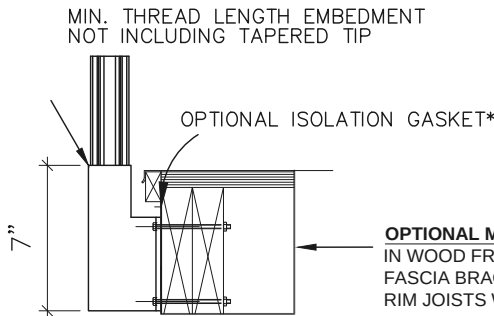
MOUNTING METHOD:

Ensure the top of the Slim Line Fascia Bracket is 1/4" above the top of the deck surface so that railing height is maintained.



MOUNTING METHOD:

Ensure the top of the Slim Line Fascia Bracket is 1/4" above the top of the deck surface so that railing height is maintained.



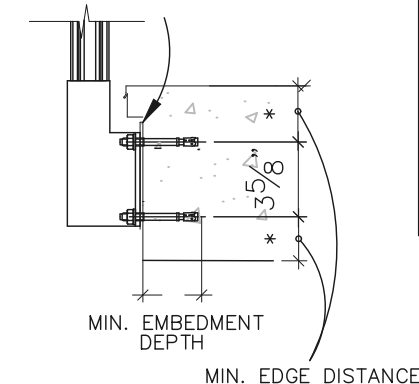
POST SIZE	LAG SCREW DIAMETER	WOOD BLOCKING SPECIES	MIN THREAD LENGTH EMBEDMENT
2"	5/16"	DOUGLAS FIR	3"
		SPRUCE-PINE-FIR	3 1/2"
	3/8"	DOUGLAS FIR	2 1/2"
		SPRUCE-PINE-FIR	3"
2 1/2"	5/16"	DOUGLAS FIR	4"
		SPRUCE-PINE-FIR	4 1/2"
	3/8"	DOUGLAS FIR	3 1/2"
		SPRUCE-PINE-FIR	4"
ALL LAGS SCREWS TO BE SET IN No.1/No.2 OR BETTER WOOD BLOCKING			

OPTIONAL MOUNTING METHOD:
IN WOOD FRAMING APPLICATIONS BWC SLIM LINE FASCIA BRACKET MAY ALSO BE ATTACHED TO THE RIM JOISTS WITH THRU BOLTS AS INDICATED.

FASCIA (SIDE) MOUNTING DETAILS RECOMMENDED MOUNTING AND FASTENING TO CONCRETE

MAIN STRUCTURE LOAD CAPACITY RESPONSIBILITY OF OTHERS

OPTIONAL ISOLATION GASKET*



POST SIZE	MIN. CONCRETE COMPRESSIVE STRENGTH	FASTENER TYPE	MIN. EDGE DISTANCE	MIN. EMBEDMENT DEPTH
2"	4000 psi (27.6 MPa)	3/8"Ø HILTI KWIK BOLT 3 EXPANSION ANCHOR	2 1/2"	3 1/2"
2 1/2"	4000 psi (27.6 MPa)	3/8"Ø HILTI KWIK BOLT 3 EXPANSION ANCHOR	3 3/4"	3 1/2"

CONCRETE ANCHORS WITH EQUIVALENT OR BETTER ALLOWABLE TENSION AND SHEAR LOADS CAN BE SUBSTITUTED.

*OPTIONAL CLOSED CELL ISOLATION GASKET
BETWEEN DISSIMILAR OR INCOMPATIBLE
MATERIALS. (Probuil catalogue No. 7000)
(NOT INTENDED AS A WATER PROOFING ITEM)

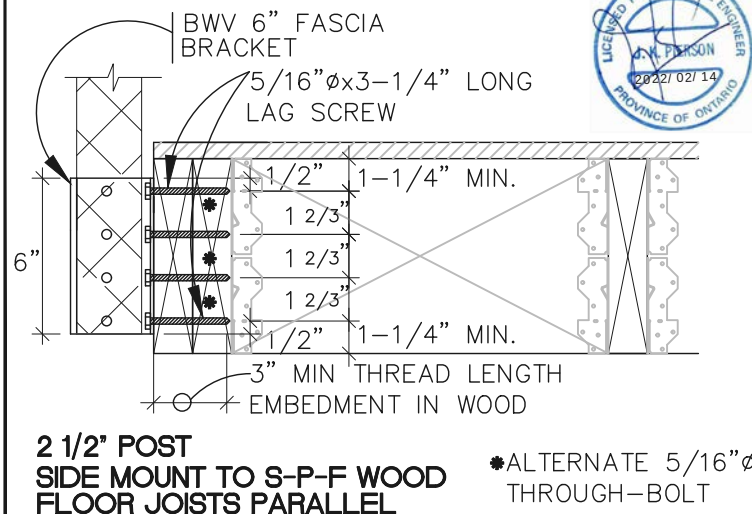
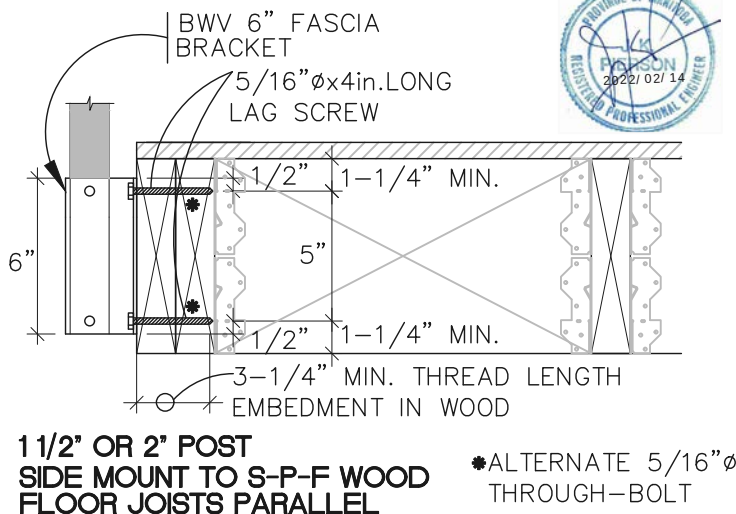
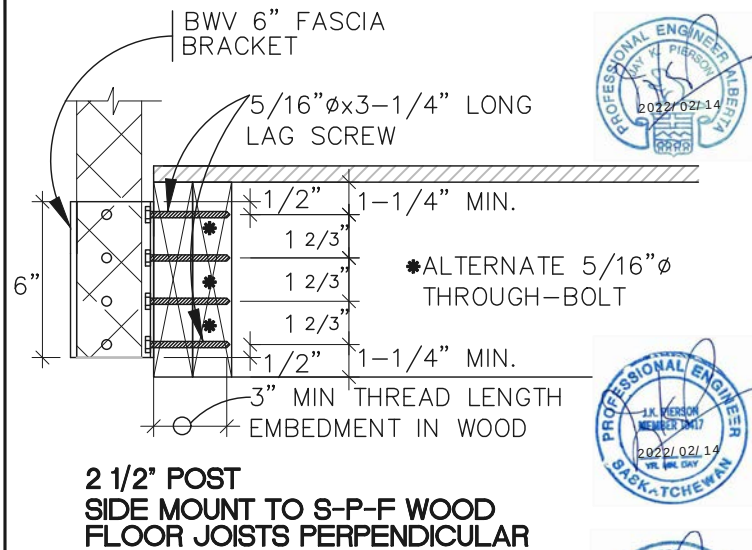
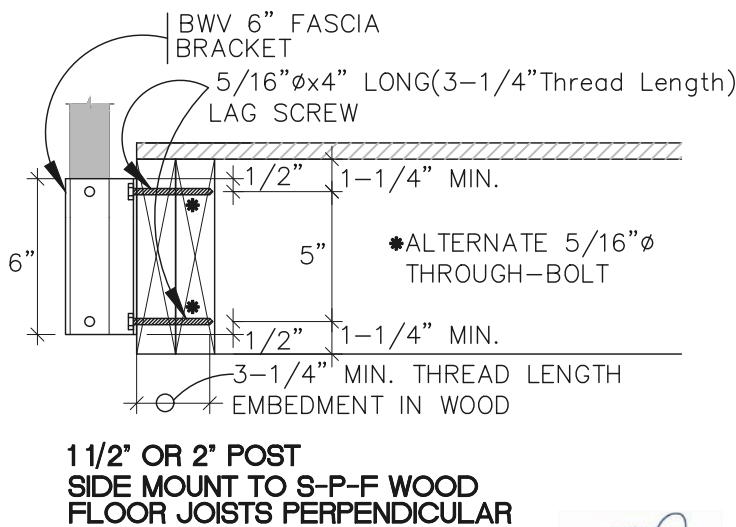
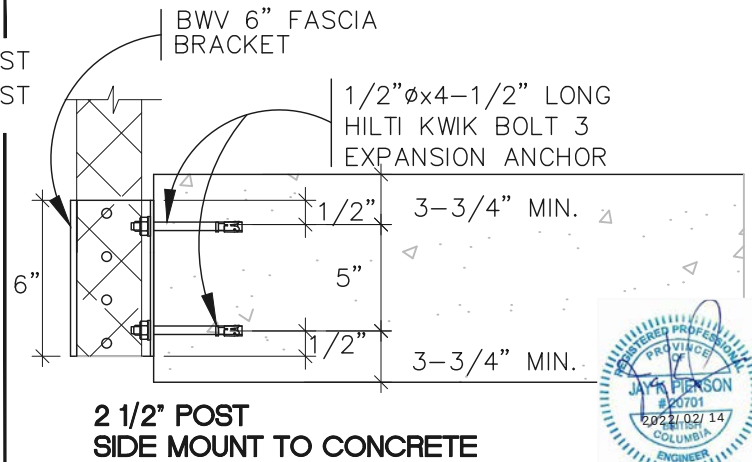
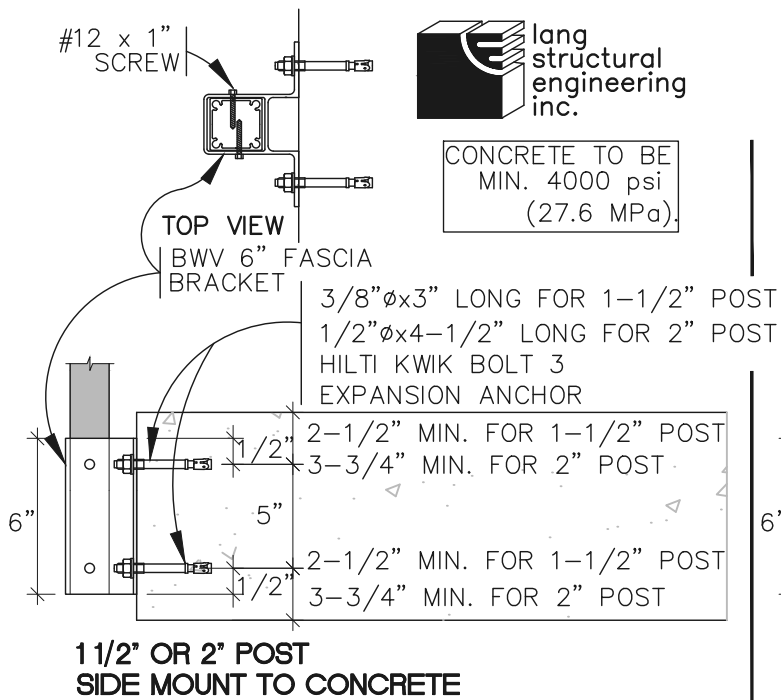
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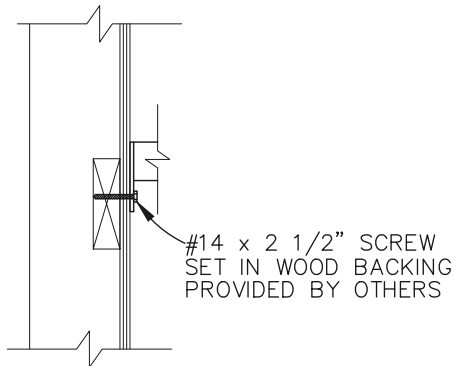
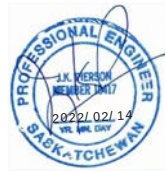
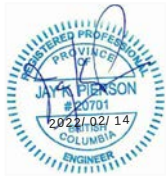
CONCRETE TO BE
MIN. 4000 psi
(27.6 MPa)

CONCRETE TO BE
MIN. 4000 psi
(27.6 MPa)

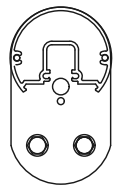


WOOD BLOCKING ANCHORAGE TO MAIN STRUCTURE AND
MAIN STRUCTURE LOAD CAPACITY RESPONSIBILITY OF OTHERS

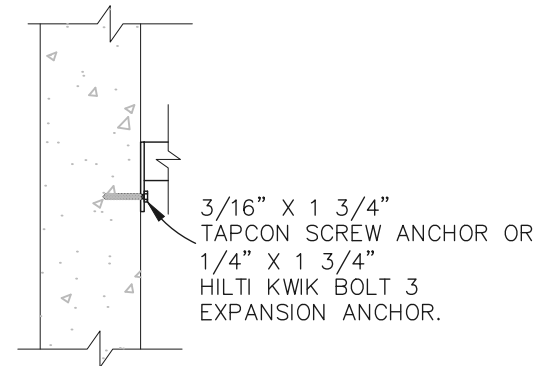
FIGURE 3continued: ACCEPTABLE GUARDRAIL MOUNTING CONFIGURATIONS



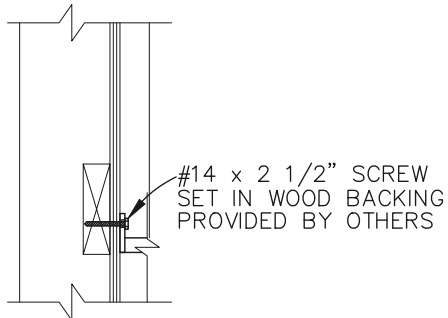
TOP RAIL MOUNT TO WOOD



TOP RAIL END CLIP



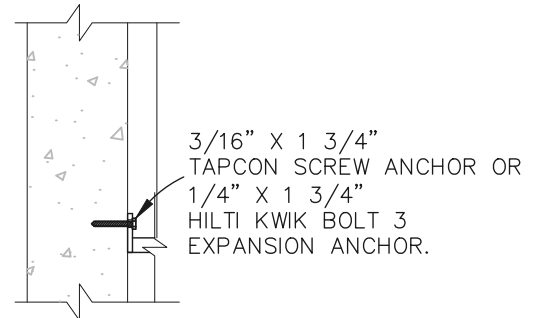
TOP RAIL MOUNT TO CONCRETE



BOTTOM RAIL MOUNT TO WOOD



BOTTOM RAIL END CLIP



BOTTOM RAIL MOUNT TO CONCRETE

FIGURE 3continued: ACCEPTABLE GUARDRAIL MOUNTING CONFIGURATIONS

To assist in design, the maximum service pull-out loads to be resisted by each anchor is summarized below for each type of post and anchorage configuration. These service (allowable) loads have safety factors (3-5) included:

Post	Anchorage Configuration				
	top mount using Vista Pro base plates	fascia mount to wood using double Vista Pro fascia brackets	fascia mount to concrete using double Vista Pro fascia brackets	fascia mount to wood using single Vista Pro fascia bracket	fascia mount to concrete using single Vista Pro fascia bracket
38.1mm (1 1/2 ")	3505 N (788 lbs)	2985 N (671 lbs.) 5 1/2" vertical spacing between anchors*	3830 N (861 lbs.) 3" vertical spacing between anchors*	2998 N (674 lbs.) 5 " vertical spacing between outer anchors*	2869 N (645 lbs.) 5 " vertical spacing between outer anchors*
50.8mm (2")	5480 N (1232 lbs.)	5720 N (1286 lbs.) 5 1/2" vertical spacing between anchors*	6432 N (1446 lbs.) 3 3/4" vertical spacing between anchors*	5738 N (1290 lbs.) 5 " vertical spacing between outer anchors*	5636 N (1267 lbs.) 5 " vertical spacing between outer anchors*
63.5mm (2 1/2")	7348 N (1652 lbs.)			3937 N (885 lbs.) 5 " vertical spacing between outer anchors*	5707 N (1283 lbs.) 5 " vertical spacing between outer anchors*

* As per Figure 3

2.6 WEAKNESS IN WELDED ALUMINUM

A review of the mechanical properties of aluminum alloys and elements in Table 1 indicates that tensile strength is significantly reduced in aluminum when it is welded. This has a significant impact on the strength capacity of aluminum guardrail components, connections and systems. At the bottom connection of posts to base plates, the connection and post capacity is substantially less in welded configurations compared to those using Vista mechanical fastening. Tests conducted by Intertek Testing Services Na Ltd./ Warnock Hershey indicate that 38.1mm (1 1/2") posts with welded base plates fail at loads an average of 35% lower than identical posts with Vista Pro Railings mechanical base plate connections. Tests conducted by Intertek Testing Services NA Ltd./Warnock Hershey of a 2 1/4" aluminium post of top deck mount configuration (an actual competitor of Vista Pro Railings) that uses a welded base plate failed at loads an average of 30% lower than the Vista Pro Railings 2" post. A copy of the report can be provided upon request. For these reasons, welded post base connections are generally not recommended.

2.7 DESIGN PROCEDURES

2.7.1 Top Rail Design

Top rail design normally involves using conventional engineering design procedures in determining and comparing section resisting moment capacities to resultant bending moments from applied loads. Connections between posts and rails are assumed to provide no flexural restraint. The bending moments in top rails are affected by the number and length of spans between posts in a straight run. Computer analysis of guardrail systems most accurately determines bending moments in top rails. The top rail moment capacity calculated using the section modulus (S) and material yield strength (Fy) (or alternatively from analysis of test results) must exceed the resultant bending moment from the applied loads.

2.7.2 Post Design

Posts in railing systems behave somewhat as vertical cantilevered beams in resisting horizontal loads applied to the top rail. Bending moments caused by horizontal loads normally control allowable post spacing and design. The first step in post design is determining the actual horizontal load that each post would be expected to carry. Horizontal load distribution from the top rail to each post is affected by a number of factors including the relative stiffness of the post and top rail, the length of each straight run, the number of spans in the railing, and the end support conditions.

Computer modelling and analysis based on test results of guardrail systems most accurately assimilates top rail load distribution to each of the supporting posts and end conditions. The post moment capacity is calculated using the section modulus (S) and material yield strength (Fy) or alternatively from analysis of test results. This must exceed the resultant bending moment from the applied loads or the post spacing is reduced to create an acceptable condition.

3.0 DESIGN TABLES

The design procedures described in the previous section have been carried out for a wide range of possible guardrail configurations. The results are summarized in the tables which follow. By knowing the overall dimensions and layout of the guardrail system under design, an acceptable configuration can be selected using the tables. **For each configuration, the maximum allowable post spacing indicated for the longest straight run shown is also the maximum allowable post spacing for straight runs exceeding in length what is shown.**

The design tables are based upon the loading criteria for exterior balconies of individual residential units as specified in clauses 4.1.5.14. 1) c) and 4.1.5.14. 2) to 6) of the NBCC 2015. The actual load conditions for the guardrail system under design must be identical to or less than those used in the development of the tables. The tables should not be used for other applications where different loading conditions and configurations exist.

3.1 WIND LOADING

For glass infill guardrail systems, the structural strength requirements imposed by design wind loading may exceed those imposed by specified guardrail design loads. For uniform lateral specified wind pressures of not greater than 1.25 kPa (26 psf), guardrail design loads are the governing criteria for 1070 mm high guardrail system design. This wind loading is generally associated with low-rise structures in most locations but must be verified as part of the design process. The allowable guardrail configurations indicated in figure 4 are all capable of withstanding this uniform lateral specified wind pressure. For wind pressure greater than 1.25 kPa (26 psf), adjust the allowable post spacing using the following formula:

$$\begin{array}{ccccccc} \text{modified} & & & & \text{allowable} & & \\ \text{post} & & & & \text{post} & & \\ \text{spacing} & = & & & \text{spacing} & \times & \frac{1.25}{\text{specified wind pressure (kPa)}} \end{array}$$

3.2 GUARDRAIL HEIGHT VARIATIONS

The most common guardrail system height is 42" (1070 mm). For guardrail heights other than 42" (1070 mm), adjust the allowable post spacings as indicated in the allowable guardrail configurations of figures 4 using the following formula:

$$\begin{array}{ccccc} \text{modified} & & \text{allowable} & & \text{allowable} \\ \text{post} & & \text{post} & \times & \text{post spacing} \\ \text{spacing} & = & \text{spacing} & & \text{multiplier} \\ & & & & \text{(see table below)} \end{array}$$

guardrail height	Allowable post spacing multiplier for picket infill guardrail	allowable post spacing multiplier for glass infill guardrail
457 mm (18")	2.33	2.33
610 mm (24")	1.75	1.75
762 mm (30")	1.40	1.40
914 mm (36")	1.17	1.17
1070 mm (42")	1.00	1.00
1219 mm (48")	0.88	0.76
1372 mm (54")	0.78	0.60
1524 mm (60")	0.70	0.49
1676 mm (66")	0.64	0.40
1829 mm (72")	0.58	0.34

3.3 GUARDRAIL SYSTEMS WITH ALUMINUM PICKET INFILL

Corner posts for aluminum picket infill guardrail systems may be eliminated and replaced with a picket corner provided one of the following conditions are met:

- 1) the end of the return portion of the top rail is anchored to the building, or
- 2) the return portion of the guardrail system is supported by a minimum of 2 posts.

3.4 GUARDRAIL SYSTEMS WITH GLASS PANEL INFILL

Post spacing for guardrail systems is generally determined by the strength of the supporting posts and applied loads. However, for guardrail systems with 5mm tempered glass panel infill, consideration must be given to the size of the glass panels. Although testing has shown that 5mm tempered glass panels supported by the top and bottom rails meet code requirements regardless of length of run, for practical purposes from the point of view of the installer, 5mm tempered glass panel infills should be limited to not greater than 1676 mm (5'-6") in length

3.5 FASCIA MOUNTED POSTS

Guardrail systems using fascia or side mounted posts instead of top mounted posts are becoming more widely used. These systems have the advantage of not penetrating the building envelope. Furthermore, test results for fascia or side mounted posts have produced higher load values for the same posts in top mounted configurations. Consequently the post spacing indicated for the allowable configurations in figure 4 may be increased using the following multiplies:

$$\begin{array}{ccccc} \text{modified} & & & & \text{allowable} \\ \text{post} & = & \text{post} & \times & \text{post spacing} \\ \text{spacing} & & \text{spacing} & & \text{multiplier} \\ & & & & \text{(see table below)} \end{array}$$

post	allowable post spacing multiplier
1 1/2" (38.1 mm) square post	1.10
2" (50.8 mm) square post	1.12

File No. 112-064

February 14, 2022

Vista Railing Systems Inc.
23282 River Road
Maple Ridge, B.C.
Canada V2W 1B6

Attention: Mr. Stephen Thornton

**RE: ALUMINUM GUARDRAIL SYSTEMS
BUILDING CODE COMPLIANCE**

As requested, a series of 1070mm high allowable guardrail configurations infilled with 5mm tempered glass or pickets and acceptable guardrail mounting configurations have been determined and are assembled on pages 24 to 46 inclusive and pages 12 to 18 inclusive respectively of the Canadian Vista Pro Railings 9th Edition Aluminum Guardrail Systems Design Manual. These configurations are in conformance with the structural load requirements for balcony guardrails as specified in the following codes:

- National Building Code of Canada 2015.
- Current edition of the British Columbia Building Code.
- Current edition of the Alberta Building Code.
- Current edition of the Saskatchewan Building Code.
- Current edition of the Manitoba Building Code.
- Ontario Building Code 2012.
- City of Vancouver Building By-Law No. 12511, 2019, plus the most current amendments.

Since these configurations are designed to meet the most stringent applicable structural requirements of the above mentioned codes, the 1070mm high allowable guardrail configurations infilled with 5mm tempered glass or pickets and guardrail mounting configurations referenced above are acceptable in any area of Canada in which these codes are enacted.

Where different guardrail heights are required, these acceptable configurations may be modified as indicated in section 3.2 Guardrail Height Variations of the above mentioned design manual.

The seals applied are current for the details and tables assembled for the codes indicated above. Annual resealing of these documents is not necessary.

Contact us with any further questions concerning this.

Yours truly,
LANG STRUCTURAL ENGINEERING INC.

Jay Pierson, P.Eng
JP:cm

VISTA PRO RAILINGS – 9TH EDITION - 2022



TYPE 1 – FREE-STANDING

TYPE 1A – END CONDITIONS – 2" POST EACH END
INTERMEDIATE CONDITIONS – 1-1/2" POSTS EVENLY SPACED

TYPE 1B – END CONDITIONS – 2-1/2" POST EACH END
INTERMEDIATE CONDITIONS – 1-1/2" POSTS EVENLY SPACED

TYPE 1C – END CONDITIONS – 2" POST EACH END
INTERMEDIATE CONDITIONS – 2" POSTS EVENLY SPACED

TYPE 1D – END CONDITIONS – 2-1/2" POST EACH END
INTERMEDIATE CONDITIONS – 2" POSTS EVENLY SPACED

TYPE 1E – END CONDITIONS – 2-1/2" POST EACH END
INTERMEDIATE CONDITIONS – 2-1/2" POSTS EVENLY SPACED

TYPE 2 – PARTIAL FIXED ONE END

TYPE 2A – END CONDITIONS – 45° CORNER w/ MIN 1- 1-1/2" POST
AND 1-2" POST AT END
& 2" POST OPPOSITE END
INTERMEDIATE CONDITIONS – 1-1/2" POSTS EVENLY SPACED

TYPE 2B – END CONDITIONS – 45° CORNER w/ MIN 2-2" POSTS
& 2" POST OPPOSITE END
INTERMEDIATE CONDITIONS – 2" POSTS EVENLY SPACED

TYPE 3 – FIXED ONE END

TYPE 3A – END CONDITIONS – TOP RAIL END CLIP TO STRUCTURE
OR 90° CORNER w/ MIN 1- 1-1/2" POST
AND 1-2" POST AT END
& 2" POST OPPOSITE END
INTERMEDIATE CONDITIONS – 1-1/2" POSTS EVENLY SPACED

TYPE 3B – END CONDITIONS – TOP RAIL END CLIP TO STRUCTURE
OR 90° CORNER w/ MIN 1- 1-1/2" POST
AND 1-2" POST AT END
& 2-1/2" POST OPPOSITE END
INTERMEDIATE CONDITIONS – 1-1/2" POSTS EVENLY SPACED

TYPE 3C – END CONDITIONS – TOP RAIL END CLIP TO STRUCTURE
OR 90° CORNER w/ MIN 2-2" POSTS
& 2" POST OPPOSITE END
INTERMEDIATE CONDITIONS – 2" POSTS EVENLY SPACED

TYPE 3D – END CONDITIONS – TOP RAIL END CLIP TO STRUCTURE
OR 90° CORNER w/ MIN 2-2" POSTS
& 2-1/2" POST OPPOSITE END
INTERMEDIATE CONDITIONS – 2" POSTS EVENLY SPACED

POST LEGEND

- 1-1/2" POST
- ◻ 1-1/2" BRACED POST
- 2" POST
- ◻ 2-1/2" POST
- ▨ TOP RAIL END CLIP TO STRUCTURE

TYPE 4 – PARTIAL FIXED BOTH ENDS

TYPE 4A – END CONDITIONS – 45° CORNERS w/ MIN 1- 1-1/2" POST
AND 1-2" POST AT END
INTERMEDIATE CONDITIONS – 1-1/2" POSTS EVENLY SPACED

TYPE 4B – END CONDITIONS – 45° CORNERS w/ MIN 2-2" POSTS
INTERMEDIATE CONDITIONS – 2" POSTS EVENLY SPACED

TYPE 5 – FIXED & PARTIAL FIXED ENDS

TYPE 5A – END CONDITIONS – TOP RAIL END CLIP TO STRUCTURE
OR 90° CORNER w/ MIN 1- 1-1/2" POST
AND 1-2" POST AT END
& 45° CORNER w/ MIN 1- 1-1/2" POST
AND 1-2" POST AT END
INTERMEDIATE CONDITIONS – 1-1/2" POSTS EVENLY SPACED

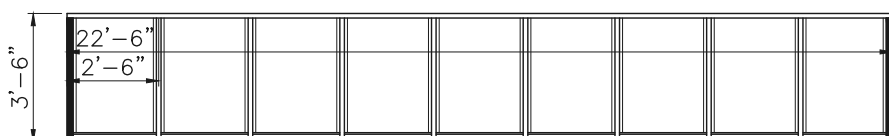
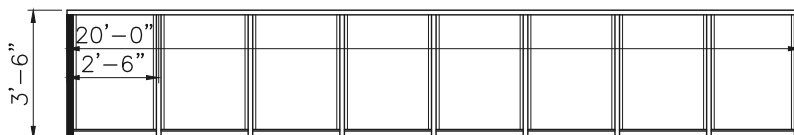
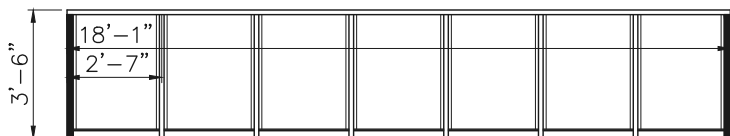
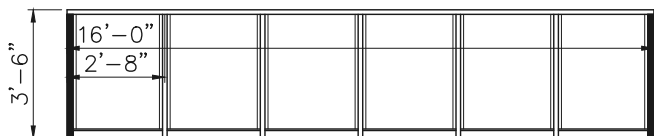
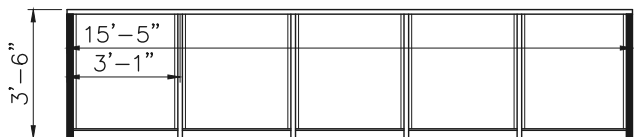
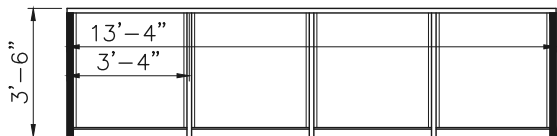
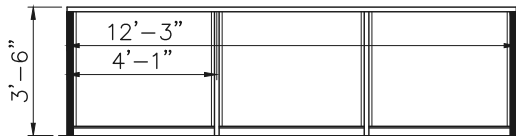
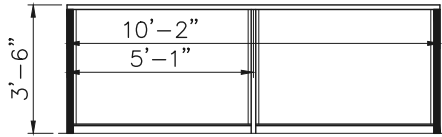
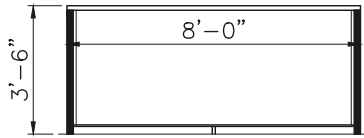
TYPE 5B – END CONDITIONS – TOP RAIL END CLIP TO STRUCTURE
OR 90° CORNER w/ MIN 2-2" POSTS
& 45° CORNER w/ MIN 2-2" POSTS
INTERMEDIATE CONDITIONS – 2" POSTS EVENLY SPACED

TYPE 6 – FIXED BOTH ENDS

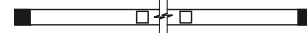
TYPE 6A – END CONDITIONS – TOP RAIL END CLIPS TO STRUCTURE
OR 90° CORNERS w/ MIN 1- 1-1/2" POST
AND 1-2" POST AT END
INTERMEDIATE CONDITIONS – 1-1/2" POSTS EVENLY SPACED

TYPE 6B – END CONDITIONS – TOP RAIL END CLIPS TO STRUCTURE
OR 90° CORNERS w/ MIN 2-2" POSTS
INTERMEDIATE CONDITIONS – 2" POSTS EVENLY SPACED

FIGURE 4: GUARDRAIL CONFIGURATIONS



TYPE 1 – FREE-STANDING



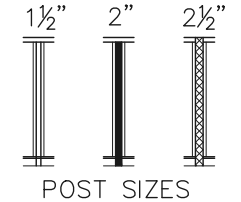
TYPE 1A – END CONDITIONS

– 2" POST EACH END

INTERMEDIATE CONDITIONS – 1 ½" POST EVENLY SPACED

SEE FIGURE 3 AND SECTION 2.5 ANCHORAGE OF THE DESIGN MANUAL FOR DETAILS REGARDING ACCEPTABLE GUARDRAIL MOUNTING CONFIGURATIONS AND MAXIMUM SERVICE PULL-OUT LOAD REQUIREMENTS FOR ANCHORS.

POST LEGEND



NOTES:

– CONFIGURATIONS SHOWN ACCEPTABLE FOR TOP MOUNT (AS SHOWN) AND SIDE/FASCIA MOUNT CONDITIONS FOR BOTH 5MM TEMPERED GLASS (AS SHOWN) AND PICKET GUARDRAIL SYSTEMS.

– ALLOWABLE CONFIGURATIONS ARE BASED UPON ANALYSIS, CALCULATIONS AND RESULTS OF TESTS CONDUCTED BY INTERTEK TESTING SERVICES NA LTD./WARNOCK HERSHEY.

– ALLOWABLE CONFIGURATIONS ARE IN CONFORMANCE WITH THE APPLICABLE STRUCTURAL REQUIREMENTS SPECIFIED IN THE CURRENT NATIONAL BUILDING CODE OF CANADA.

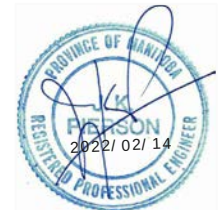
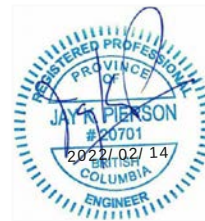
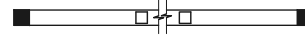


FIGURE 4A: 42" HIGH ALLOWABLE CONFIGURATIONS TYPE 1A

TYPE 1A ALTERNATE OPTIONAL CONFIGURATIONS w/ 2" POSTS ADDED IN INTERMEDIATE SPACES

TYPE 1 – FREE-STANDING

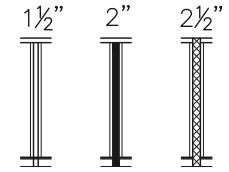


TYPE 1A – END CONDITIONS

– 2" POST EACH END

INTERMEDIATE CONDITIONS – 1 ½" POST EVENLY SPACED

POST LEGEND



POST SIZES

SEE FIGURE 3 AND SECTION 2.5 ANCHORAGE OF THE DESIGN MANUAL FOR DETAILS REGARDING ACCEPTABLE GUARDRAIL MOUNTING CONFIGURATIONS AND MAXIMUM SERVICE PULL-OUT LOAD REQUIREMENTS FOR ANCHORS.

NOTES:

–CONFIGURATIONS SHOWN ACCEPTABLE FOR TOP MOUNT (AS SHOWN) AND SIDE/FASCIA MOUNT CONDITIONS FOR BOTH 5MM TEMPERED GLASS (AS SHOWN) AND PICKET GUARDRAIL SYSTEMS.

–ALLOWABLE CONFIGURATIONS ARE BASED UPON ANALYSIS, CALCULATIONS AND RESULTS OF TESTS CONDUCTED BY INTERTEK TESTING SERVICES NA LTD./WARNOCK HERSHEY.

–ALLOWABLE CONFIGURATIONS ARE IN CONFORMANCE WITH THE APPLICABLE STRUCTURAL REQUIREMENTS SPECIFIED IN THE CURRENT NATIONAL BUILDING CODE OF CANADA.

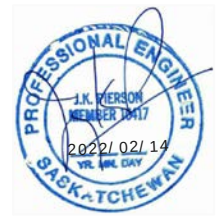
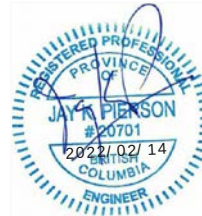
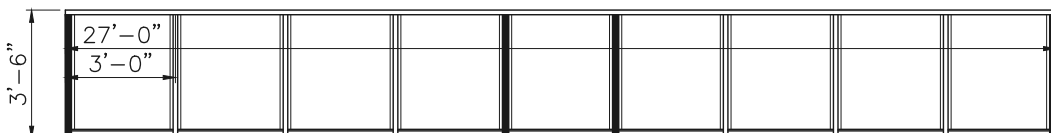
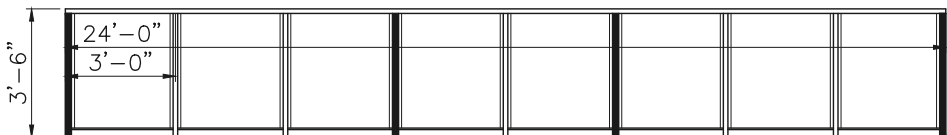
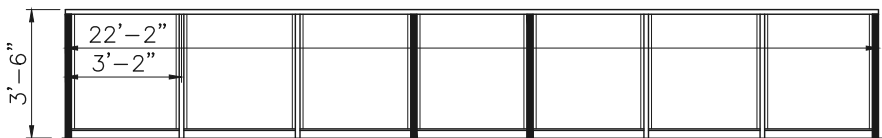
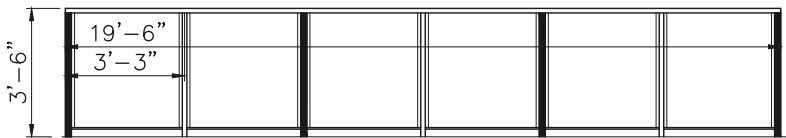
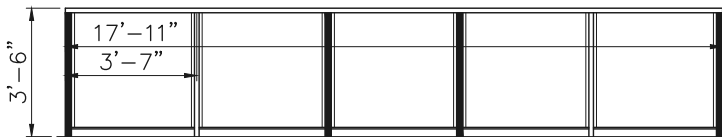
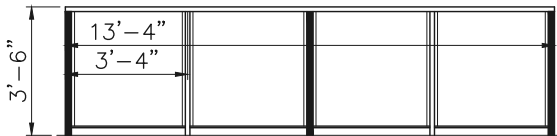
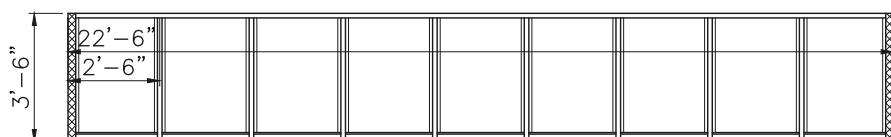
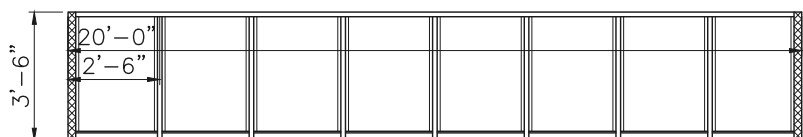
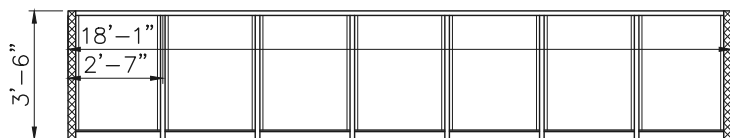
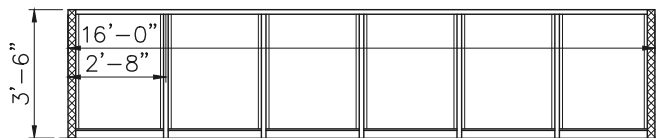
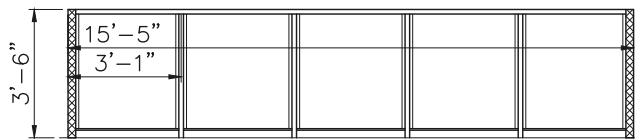
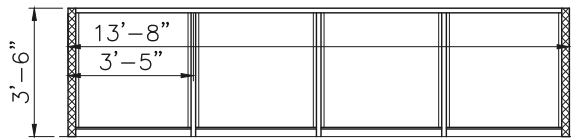
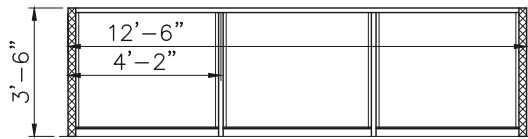
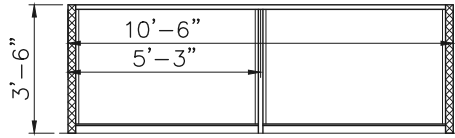
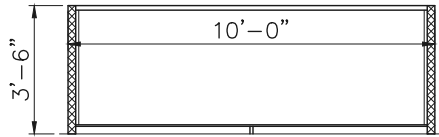


FIGURE 4A-A: 42" HIGH ALLOWABLE CONFIGURATIONS TYPE 1A-ALTERNATE



TYPE 1 – FREE-STANDING



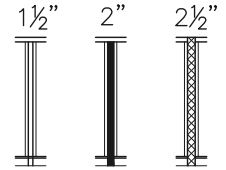
TYPE 1B – END CONDITIONS

– 2 1/2" POST EACH END

INTERMEDIATE CONDITIONS – 1 1/2" POST EVENLY SPACED

SEE FIGURE 3 AND SECTION 2.5 ANCHORAGE OF THE DESIGN MANUAL FOR DETAILS REGARDING ACCEPTABLE GUARDRAIL MOUNTING CONFIGURATIONS AND MAXIMUM SERVICE PULL-OUT LOAD REQUIREMENTS FOR ANCHORS.

POST LEGEND



POST SIZES

NOTES:

–CONFIGURATIONS SHOWN ACCEPTABLE FOR TOP MOUNT (AS SHOWN) AND SIDE/FASCIA MOUNT CONDITIONS FOR BOTH 5MM TEMPERED GLASS (AS SHOWN) AND PICKET GUARDRAIL SYSTEMS.

–ALLOWABLE CONFIGURATIONS ARE BASED UPON ANALYSIS, CALCULATIONS AND RESULTS OF TESTS CONDUCTED BY INTERTEK TESTING SERVICES NA LTD./WARNOCK HERSHEY.

–ALLOWABLE CONFIGURATIONS ARE IN CONFORMANCE WITH THE APPLICABLE STRUCTURAL REQUIREMENTS SPECIFIED IN THE CURRENT NATIONAL BUILDING CODE OF CANADA.

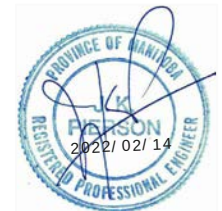
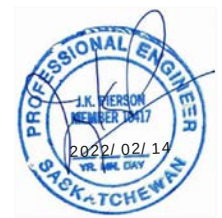
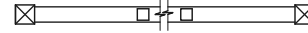


FIGURE 4B: 42" HIGH ALLOWABLE CONFIGURATIONS TYPE 1B

TYPE 1B ALTERNATE OPTIONAL CONFIGURATIONS w/ 2" POSTS ADDED IN INTERMEDIATE SPACES

TYPE 1 – FREE-STANDING



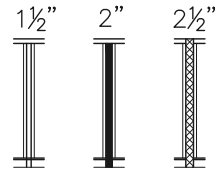
TYPE 1B – END CONDITIONS

– 2 ½" POST EACH END

INTERMEDIATE CONDITIONS – 1 ½" POST EVENLY SPACED

SEE FIGURE 3 AND SECTION 2.5 ANCHORAGE OF THE DESIGN MANUAL FOR DETAILS REGARDING ACCEPTABLE GUARDRAIL MOUNTING CONFIGURATIONS AND MAXIMUM SERVICE PULL-OUT LOAD REQUIREMENTS FOR ANCHORS.

POST LEGEND



POST SIZES

NOTES:

– CONFIGURATIONS SHOWN ACCEPTABLE FOR TOP MOUNT (AS SHOWN) AND SIDE/FASCIA MOUNT CONDITIONS FOR BOTH 5MM TEMPERED GLASS (AS SHOWN) AND PICKET GUARDRAIL SYSTEMS.

– ALLOWABLE CONFIGURATIONS ARE BASED UPON ANALYSIS, CALCULATIONS AND RESULTS OF TESTS CONDUCTED BY INTERTEK TESTING SERVICES NA LTD./WARNOCK HERSHEY.

– ALLOWABLE CONFIGURATIONS ARE IN CONFORMANCE WITH THE APPLICABLE STRUCTURAL REQUIREMENTS SPECIFIED IN THE CURRENT NATIONAL BUILDING CODE OF CANADA.

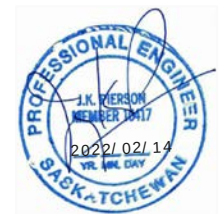
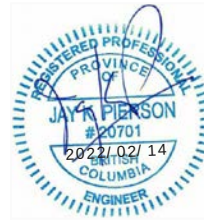
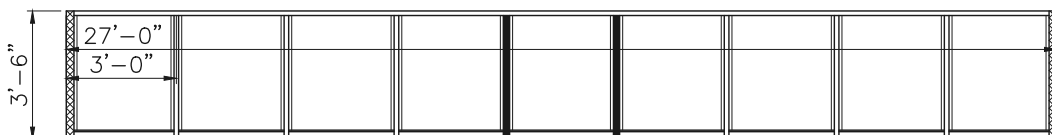
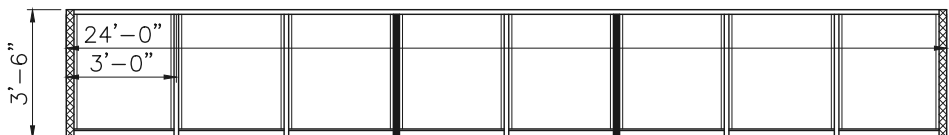
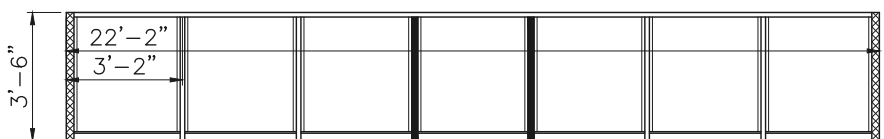
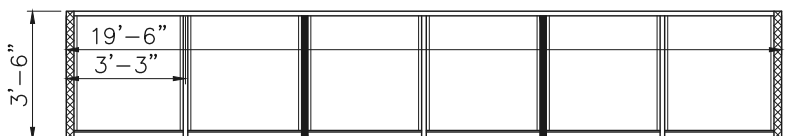
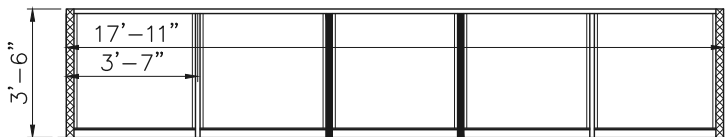
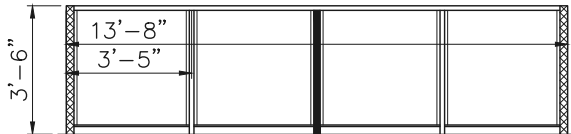


FIGURE 4B-A: 42" HIGH ALLOWABLE CONFIGURATIONS TYPE 1B-ALTERNATE

TYPE 1 – FREE-STANDING



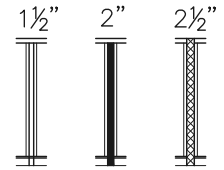
TYPE 1C – END CONDITIONS

– 2" POST EACH END

INTERMEDIATE CONDITIONS – 2" POSTS EVENLY SPACED

SEE FIGURE 3 AND SECTION 2.5 ANCHORAGE OF THE DESIGN MANUAL FOR DETAILS REGARDING ACCEPTABLE GUARDRAIL MOUNTING CONFIGURATIONS AND MAXIMUM SERVICE PULL-OUT LOAD REQUIREMENTS FOR ANCHORS.

POST LEGEND



POST SIZES

NOTES:

– CONFIGURATIONS SHOWN ACCEPTABLE FOR TOP MOUNT (AS SHOWN) AND SIDE/FASCIA MOUNT CONDITIONS FOR BOTH 5MM TEMPERED GLASS (AS SHOWN) AND PICKET GUARDRAIL SYSTEMS.

– ALLOWABLE CONFIGURATIONS ARE BASED UPON ANALYSIS, CALCULATIONS AND RESULTS OF TESTS CONDUCTED BY INTERTEK TESTING SERVICES NA LTD./WARNOCK HERSHEY.

– ALLOWABLE CONFIGURATIONS ARE IN CONFORMANCE WITH THE APPLICABLE STRUCTURAL REQUIREMENTS SPECIFIED IN THE CURRENT NATIONAL BUILDING CODE OF CANADA.

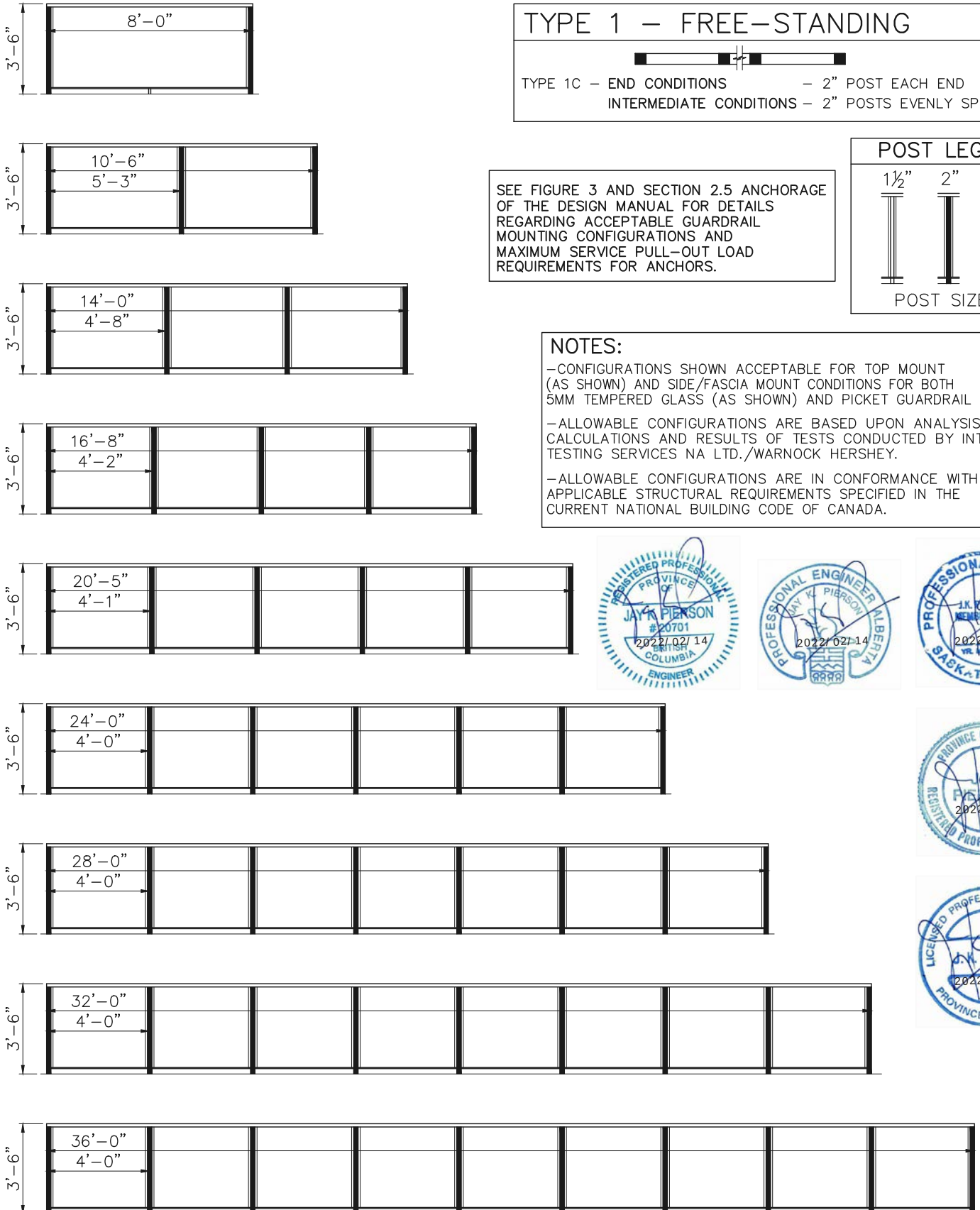
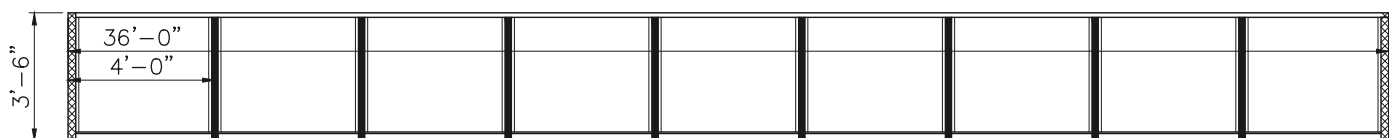
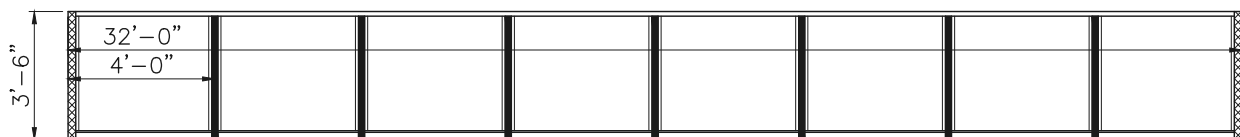
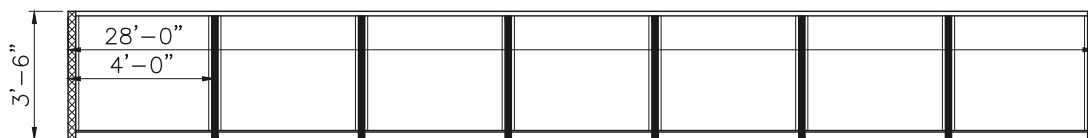
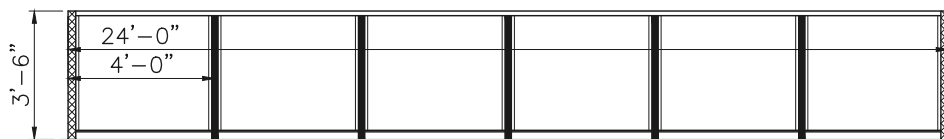
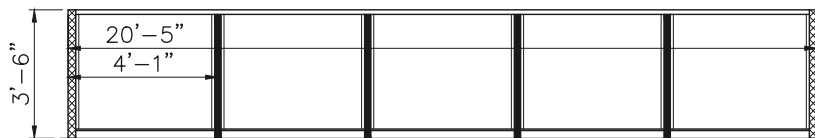
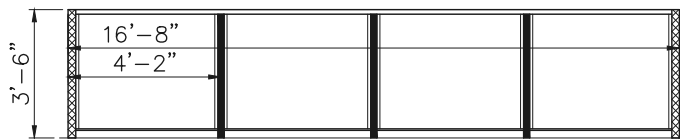
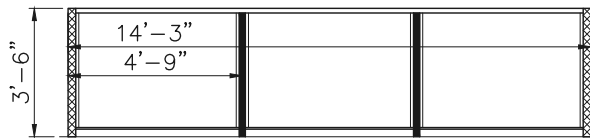
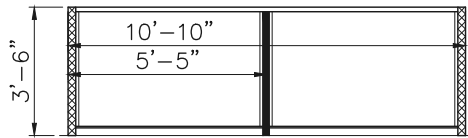
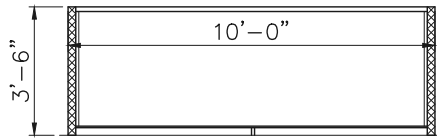


FIGURE 4C: 42" HIGH ALLOWABLE CONFIGURATIONS TYPE 1C



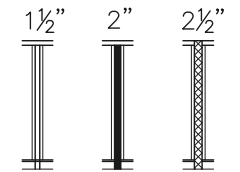
TYPE 1 – FREE-STANDING



TYPE 1D – END CONDITIONS – 2 ½" POST EACH END
INTERMEDIATE CONDITIONS – 2" POSTS EVENLY SPACED

SEE FIGURE 3 AND SECTION 2.5 ANCHORAGE OF THE DESIGN MANUAL FOR DETAILS REGARDING ACCEPTABLE GUARDRAIL MOUNTING CONFIGURATIONS AND MAXIMUM SERVICE PULL-OUT LOAD REQUIREMENTS FOR ANCHORS.

POST LEGEND



POST SIZES

NOTES:

–CONFIGURATIONS SHOWN ACCEPTABLE FOR TOP MOUNT (AS SHOWN) AND SIDE/FASCIA MOUNT CONDITIONS FOR BOTH 5MM TEMPERED GLASS (AS SHOWN) AND PICKET GUARDRAIL SYSTEMS.

–ALLOWABLE CONFIGURATIONS ARE BASED UPON ANALYSIS, CALCULATIONS AND RESULTS OF TESTS CONDUCTED BY INTERTEK TESTING SERVICES NA LTD./WARNOCK HERSHEY.

–ALLOWABLE CONFIGURATIONS ARE IN CONFORMANCE WITH THE APPLICABLE STRUCTURAL REQUIREMENTS SPECIFIED IN THE CURRENT NATIONAL BUILDING CODE OF CANADA.

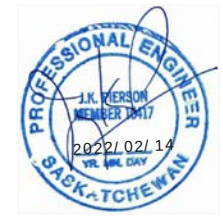
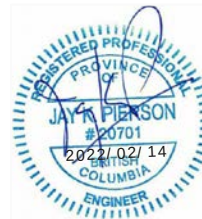
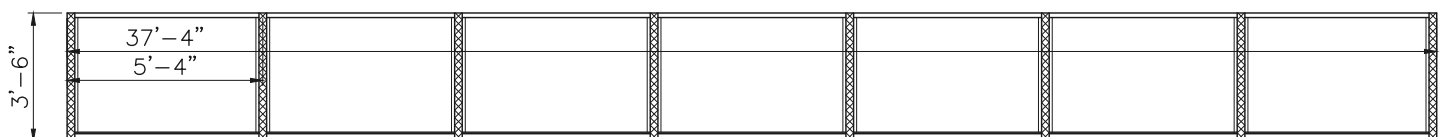
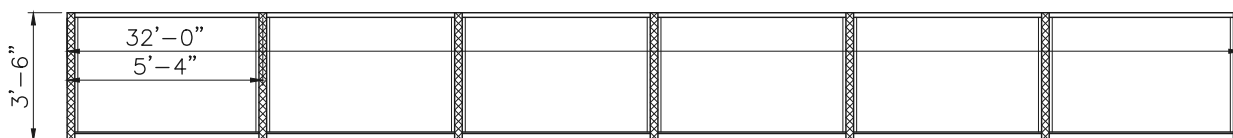
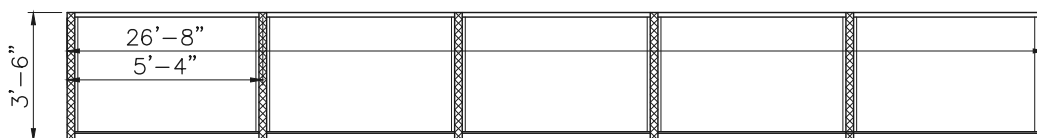
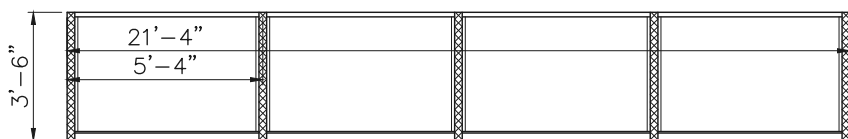
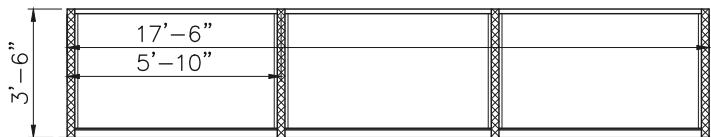
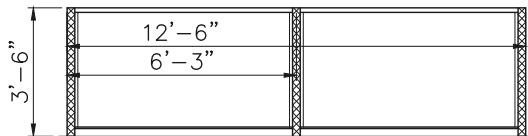
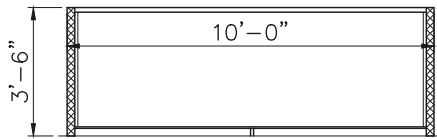


FIGURE 4D: 42" HIGH ALLOWABLE CONFIGURATIONS TYPE 1D

TYPE 1 – FREE-STANDING

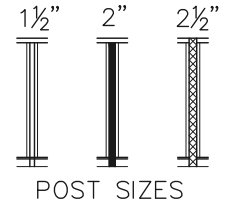


TYPE 1E – END CONDITIONS – 2 ½" POST EACH END
INTERMEDIATE CONDITIONS – 2 ½" POST EVENLY SPACED



SEE FIGURE 3 AND SECTION 2.5 ANCHORAGE OF THE DESIGN MANUAL FOR DETAILS REGARDING ACCEPTABLE GUARDRAIL MOUNTING CONFIGURATIONS AND MAXIMUM SERVICE PULL-OUT LOAD REQUIREMENTS FOR ANCHORS.

POST LEGEND



NOTES:

–CONFIGURATIONS SHOWN ACCEPTABLE FOR TOP MOUNT (AS SHOWN) AND SIDE/FASCIA MOUNT CONDITIONS FOR BOTH 5MM TEMPERED GLASS (AS SHOWN) AND PICKET GUARDRAIL SYSTEMS.

–ALLOWABLE CONFIGURATIONS ARE BASED UPON ANALYSIS, CALCULATIONS AND RESULTS OF TESTS CONDUCTED BY INTERTEK TESTING SERVICES NA LTD./WARNOCK HERSHEY.

–ALLOWABLE CONFIGURATIONS ARE IN CONFORMANCE WITH THE APPLICABLE STRUCTURAL REQUIREMENTS SPECIFIED IN THE CURRENT NATIONAL BUILDING CODE OF CANADA.

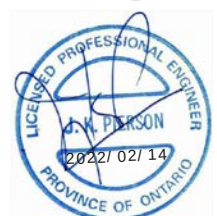
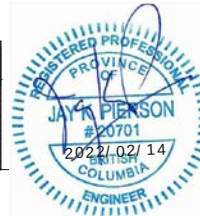
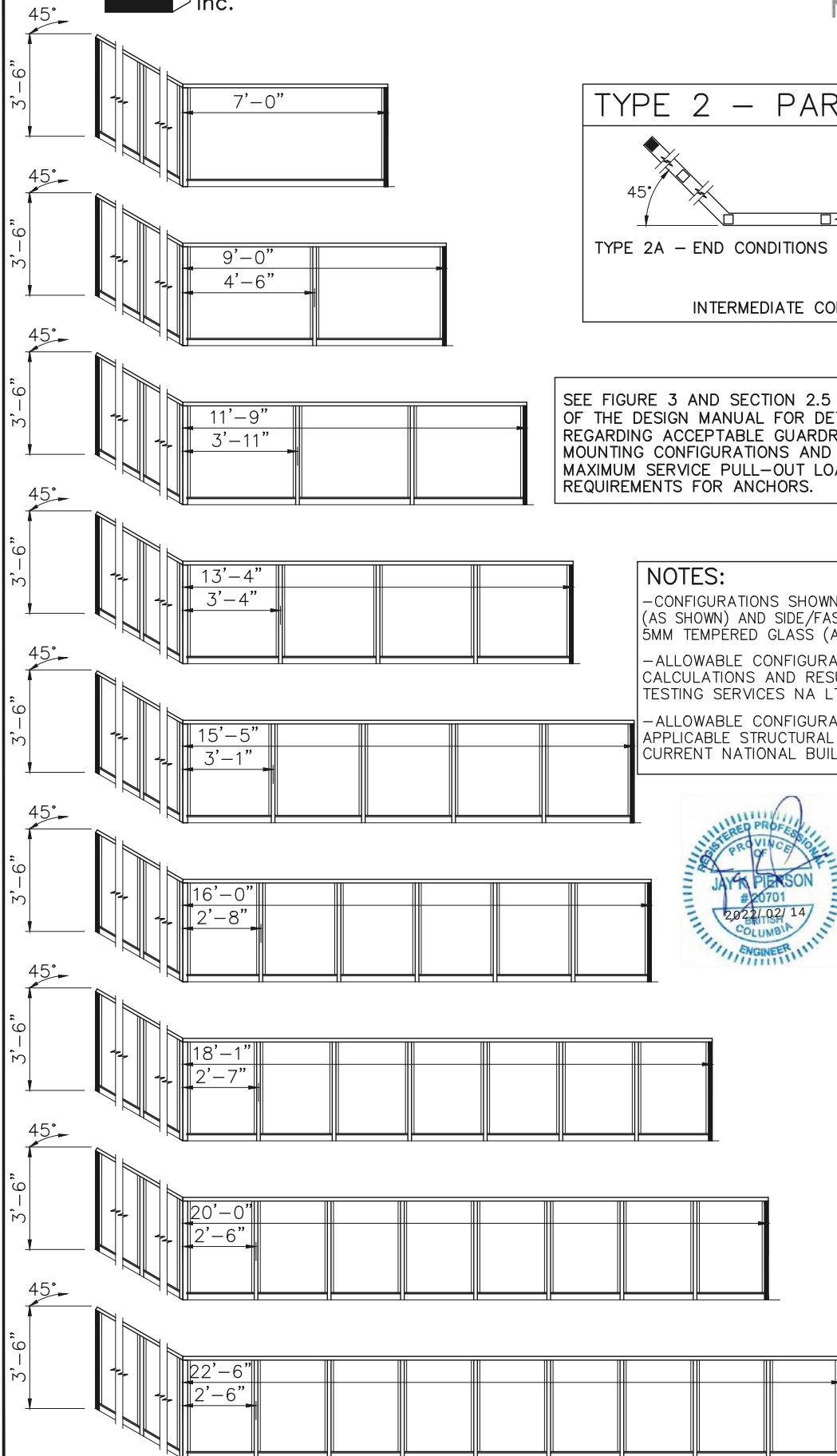
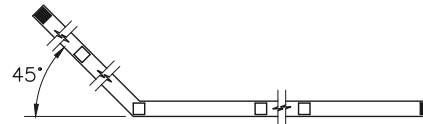


FIGURE 4E: 42" HIGH ALLOWABLE CONFIGURATIONS TYPE 1E



TYPE 2 – PARTIAL FIXED ONE END

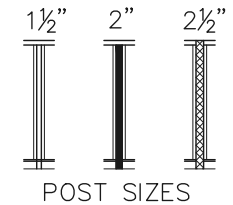


TYPE 2A – END CONDITIONS – 45° CORNER w/ MIN 1-1/2" POST AND 1-2" POST AT END & 2" POST OPPOSITE END

INTERMEDIATE CONDITIONS – 1 1/2" POST EVENLY SPACED

SEE FIGURE 3 AND SECTION 2.5 ANCHORAGE OF THE DESIGN MANUAL FOR DETAILS REGARDING ACCEPTABLE GUARDRAIL MOUNTING CONFIGURATIONS AND MAXIMUM SERVICE PULL-OUT LOAD REQUIREMENTS FOR ANCHORS.

POST LEGEND



NOTES:

- CONFIGURATIONS SHOWN ACCEPTABLE FOR TOP MOUNT (AS SHOWN) AND SIDE/FASCIA MOUNT CONDITIONS FOR BOTH 5MM TEMPERED GLASS (AS SHOWN) AND PICKET GUARDRAIL SYSTEMS.
- ALLOWABLE CONFIGURATIONS ARE BASED UPON ANALYSIS, CALCULATIONS AND RESULTS OF TESTS CONDUCTED BY INTERTEK TESTING SERVICES NA LTD./WARNOCK HERSHEY.
- ALLOWABLE CONFIGURATIONS ARE IN CONFORMANCE WITH THE APPLICABLE STRUCTURAL REQUIREMENTS SPECIFIED IN THE CURRENT NATIONAL BUILDING CODE OF CANADA.

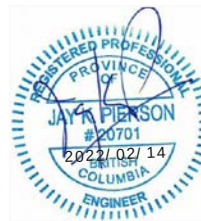


FIGURE 4F: 42" HIGH ALLOWABLE CONFIGURATIONS TYPE 2A

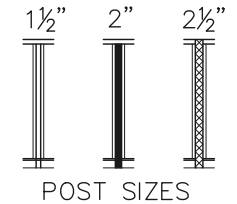
TYPE 2 – PARTIAL FIXED ONE END



TYPE 2B – END CONDITIONS – 45° CORNER w/ MIN 2-2" POSTS
& 2" POST OPPOSITE END

INTERMEDIATE CONDITIONS – 2" POSTS EVENLY SPACED

POST LEGEND



SEE FIGURE 3 AND SECTION 2.5 ANCHORAGE
OF THE DESIGN MANUAL FOR DETAILS
REGARDING ACCEPTABLE GUARDRAIL
MOUNTING CONFIGURATIONS AND
MAXIMUM SERVICE PULL-OUT LOAD
REQUIREMENTS FOR ANCHORS.

NOTES:

–CONFIGURATIONS SHOWN ACCEPTABLE FOR TOP MOUNT
(AS SHOWN) AND SIDE/FASCIA MOUNT CONDITIONS FOR BOTH
5MM TEMPERED GLASS (AS SHOWN) AND PICKET GUARDRAIL SYSTEMS.

–ALLOWABLE CONFIGURATIONS ARE BASED UPON ANALYSIS,
CALCULATIONS AND RESULTS OF TESTS CONDUCTED BY INTERTEK
TESTING SERVICES NA LTD./WARNOCK HERSHEY.

–ALLOWABLE CONFIGURATIONS ARE IN CONFORMANCE WITH THE
APPLICABLE STRUCTURAL REQUIREMENTS SPECIFIED IN THE
CURRENT NATIONAL BUILDING CODE OF CANADA.

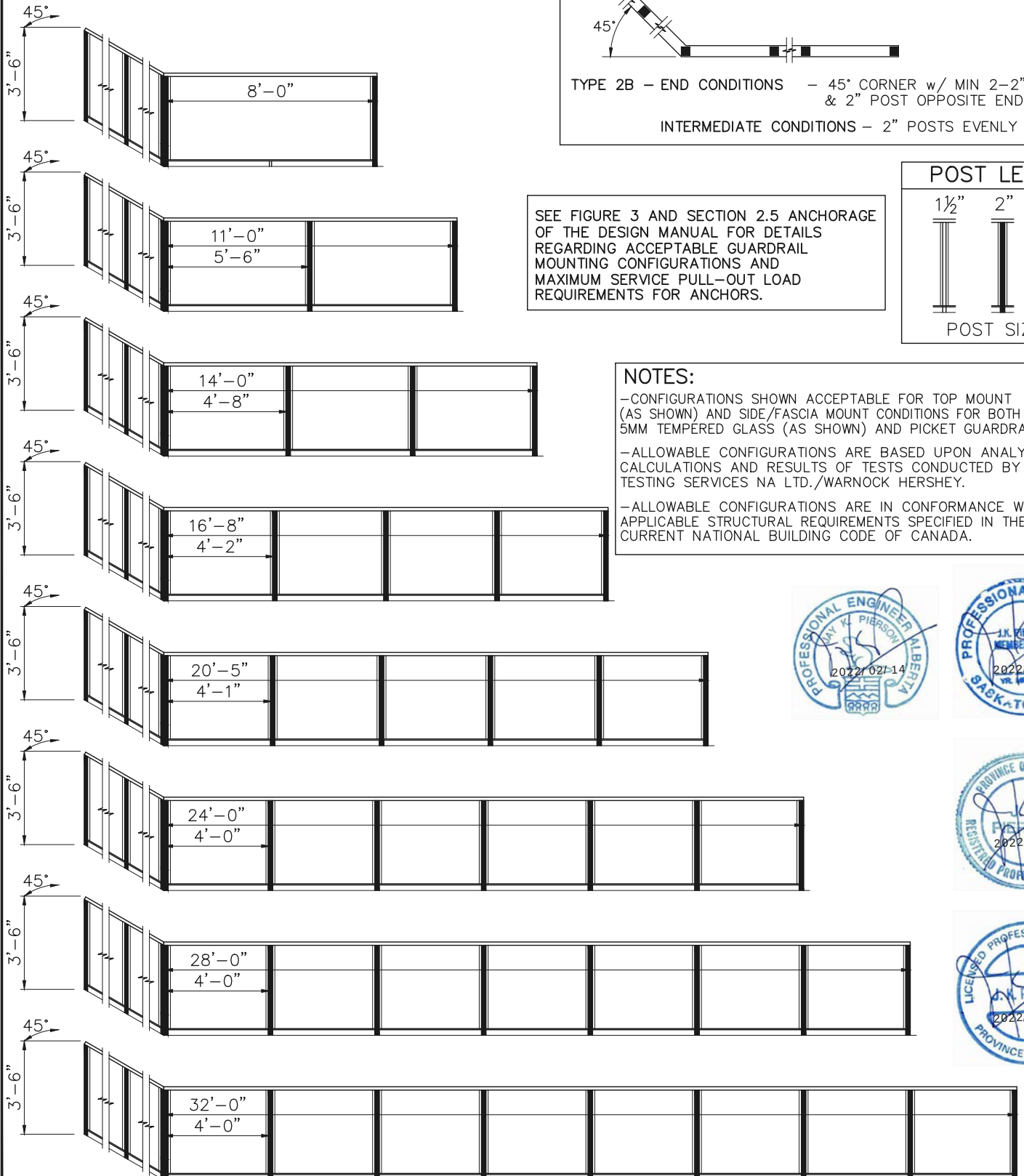
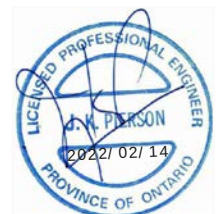
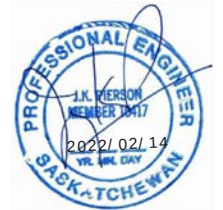
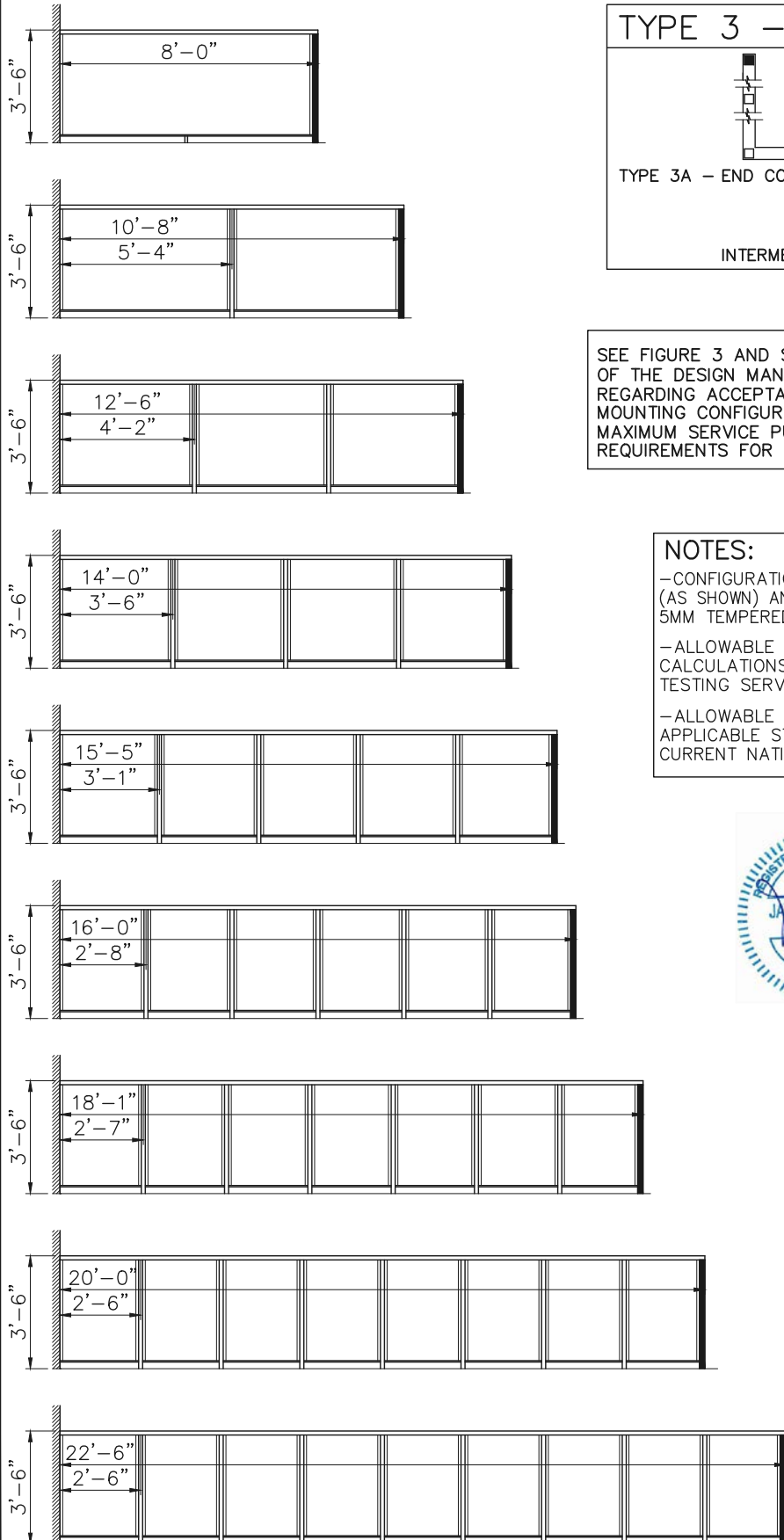
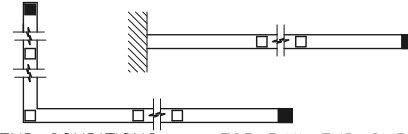


FIGURE 4G: 42" HIGH ALLOWABLE CONFIGURATIONS TYPE 2B



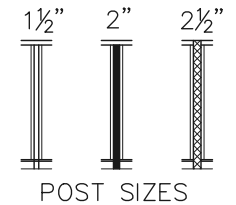
TYPE 3 – FIXED ONE END



TYPE 3A – END CONDITIONS – TOP RAIL END CLIP TO STRUCTURE
OR 90° CORNER w/ MIN 1-1/2" POST
AND 1-2" POST AT END
& 2" POST OPPOSITE END
INTERMEDIATE CONDITIONS – 1 1/2" POSTS EVENLY SPACED

SEE FIGURE 3 AND SECTION 2.5 ANCHORAGE
OF THE DESIGN MANUAL FOR DETAILS
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MOUNTING CONFIGURATIONS AND
MAXIMUM SERVICE PULL-OUT LOAD
REQUIREMENTS FOR ANCHORS.

POST LEGEND



NOTES:

–CONFIGURATIONS SHOWN ACCEPTABLE FOR TOP MOUNT
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5MM TEMPERED GLASS (AS SHOWN) AND PICKET GUARDRAIL SYSTEMS.

–ALLOWABLE CONFIGURATIONS ARE BASED UPON ANALYSIS,
CALCULATIONS AND RESULTS OF TESTS CONDUCTED BY INTERTEK
TESTING SERVICES NA LTD./WARNOCK HERSHEY.

–ALLOWABLE CONFIGURATIONS ARE IN CONFORMANCE WITH THE
APPLICABLE STRUCTURAL REQUIREMENTS SPECIFIED IN THE
CURRENT NATIONAL BUILDING CODE OF CANADA.

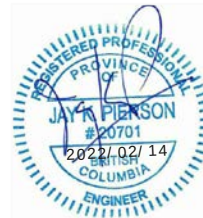
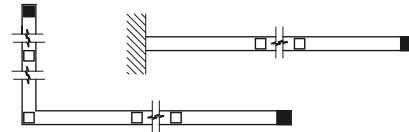


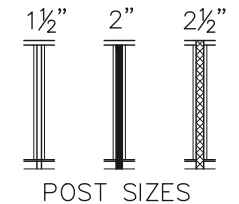
FIGURE 4H: 42" HIGH ALLOWABLE CONFIGURATIONS TYPE 3A

TYPE 3 – FIXED ONE END

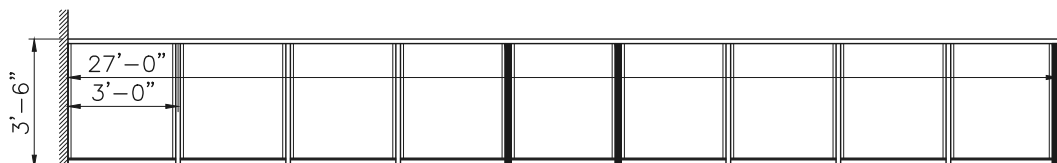
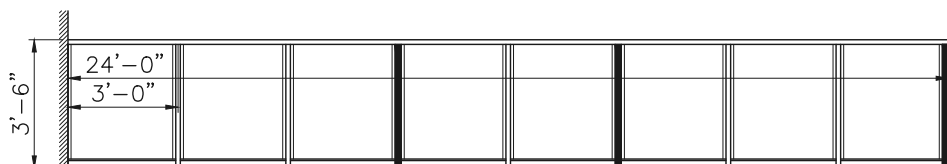
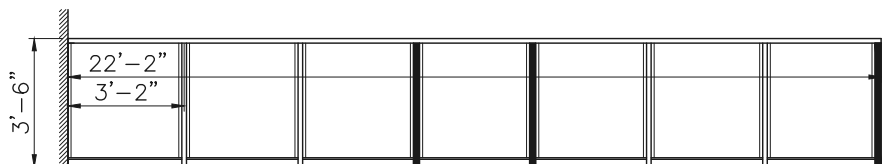
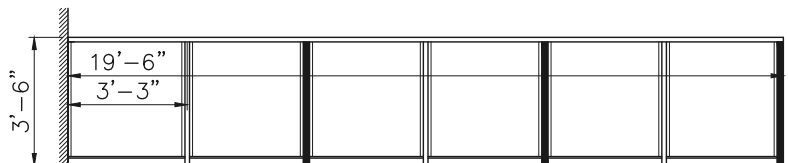
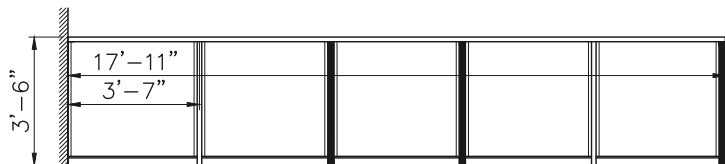
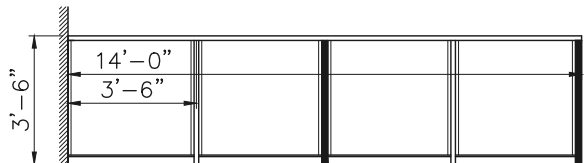


TYPE 3A – END CONDITIONS – TOP RAIL END CLIP TO STRUCTURE
OR 90° CORNER w/ MIN 1-1/2" POST
AND 1-2" POST AT END
& 2" POST OPPOSITE END
INTERMEDIATE CONDITIONS – 1 1/2" POSTS EVENLY SPACED

POST LEGEND



TYPE 3A ALTERNATE OPTIONAL CONFIGURATIONS w/ 2" POSTS ADDED IN INTERMEDIATE SPACES



SEE FIGURE 3 AND SECTION 2.5 ANCHORAGE
OF THE DESIGN MANUAL FOR DETAILS
REGARDING ACCEPTABLE GUARDRAIL
MOUNTING CONFIGURATIONS AND
MAXIMUM SERVICE PULL-OUT LOAD
REQUIREMENTS FOR ANCHORS.

NOTES:

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CALCULATIONS AND RESULTS OF TESTS CONDUCTED BY INTERTEK
TESTING SERVICES NA LTD./WARNOCK HERSHEY.

– ALLOWABLE CONFIGURATIONS ARE IN CONFORMANCE WITH THE
APPLICABLE STRUCTURAL REQUIREMENTS SPECIFIED IN THE
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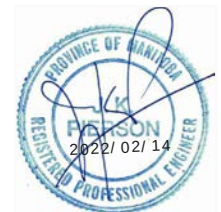
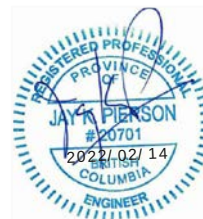
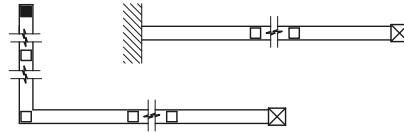


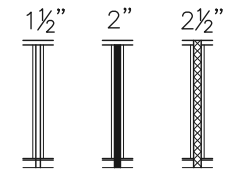
FIGURE 4H-A: 42" HIGH ALLOWABLE CONFIGURATIONS TYPE 3A-ALTERNATE

TYPE 3 – FIXED ONE END



TYPE 3B – END CONDITIONS – TOP RAIL END CLIP TO STRUCTURE
OR 90° CORNER w/ MIN 1-1 1/2" POST
AND 1-2" POST AT END
& 2 1/2" POST OPPOSITE END
INTERMEDIATE CONDITIONS – 1 1/2" POSTS EVENLY SPACED

POST LEGEND



POST SIZES

SEE FIGURE 3 AND SECTION 2.5 ANCHORAGE
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MAXIMUM SERVICE PULL-OUT LOAD
REQUIREMENTS FOR ANCHORS.

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- ALLOWABLE CONFIGURATIONS ARE BASED UPON ANALYSIS, CALCULATIONS AND RESULTS OF TESTS CONDUCTED BY INTERTEK TESTING SERVICES NA LTD./WARNOCK HERSHEY.
- ALLOWABLE CONFIGURATIONS ARE IN CONFORMANCE WITH THE APPLICABLE STRUCTURAL REQUIREMENTS SPECIFIED IN THE CURRENT NATIONAL BUILDING CODE OF CANADA.

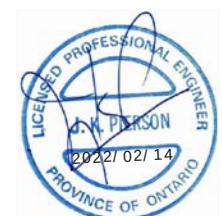
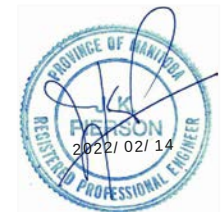
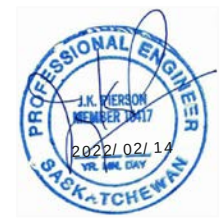
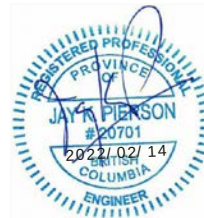
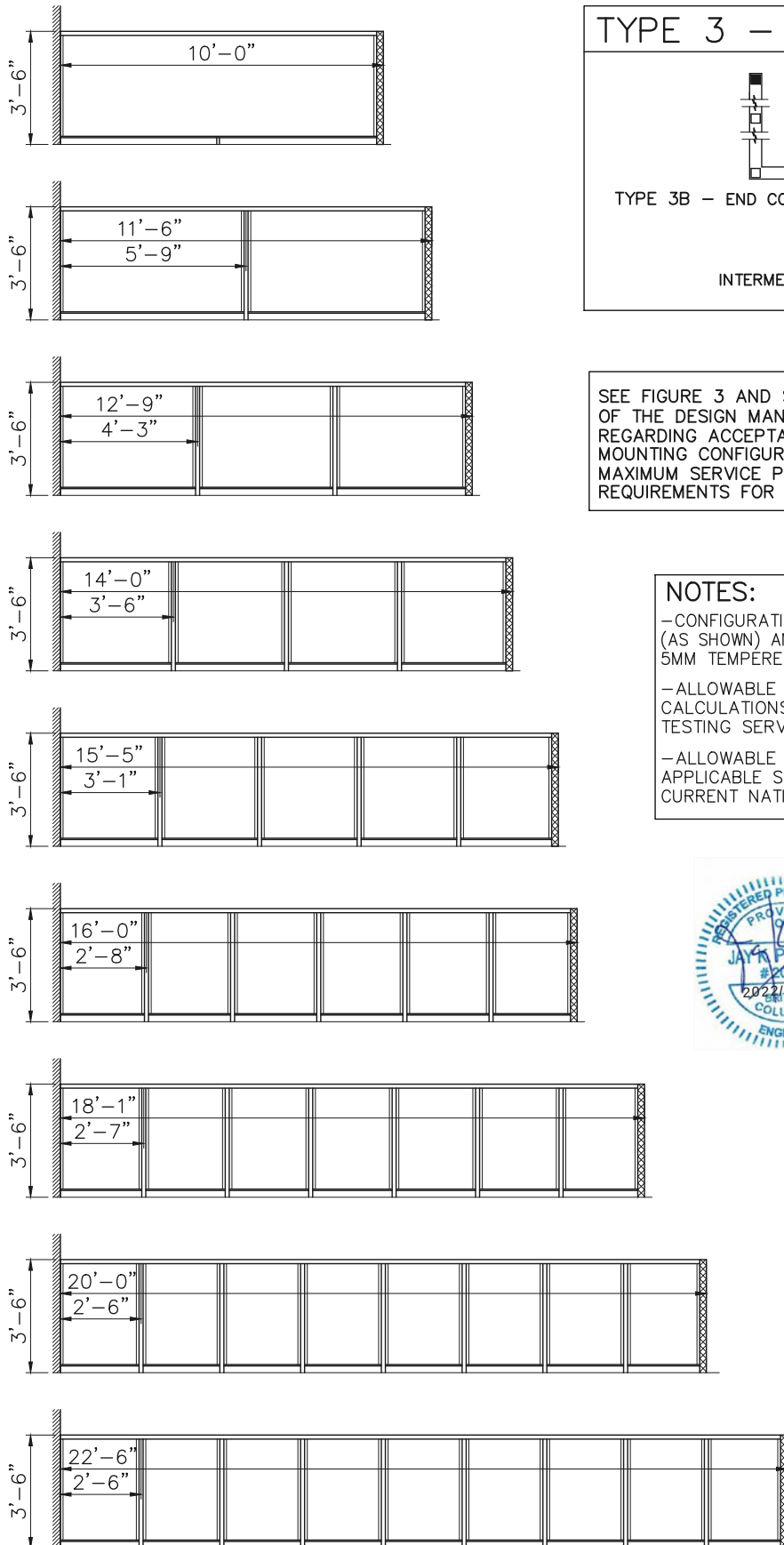
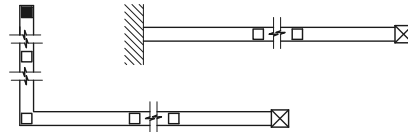


FIGURE 4: 42" HIGH ALLOWABLE CONFIGURATIONS TYPE 3B

TYPE 3 – FIXED ONE END

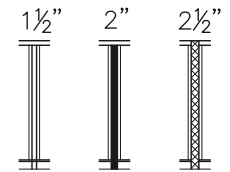


TYPE 3B – END CONDITIONS – TOP RAIL END CLIP TO STRUCTURE
OR 90° CORNER w/ MIN 1-1 1/2" POST
AND 1-2" POST AT END
& 2 1/2" POST OPPOSITE END
INTERMEDIATE CONDITIONS – 1 1/2" POSTS EVENLY SPACED

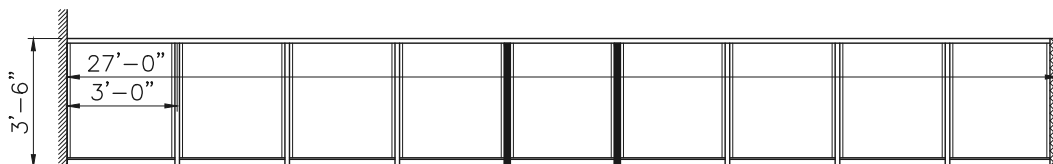
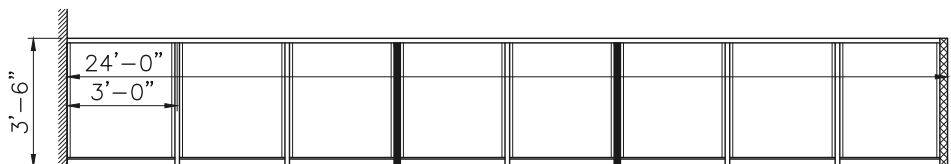
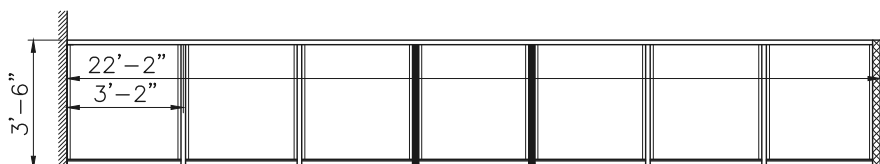
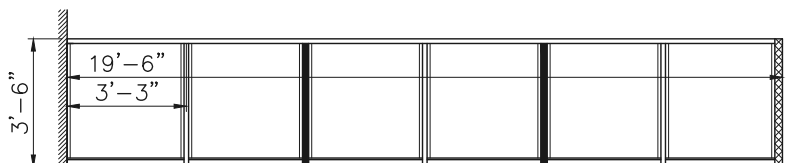
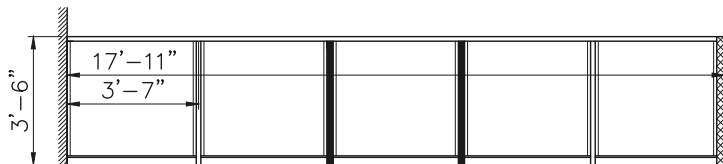
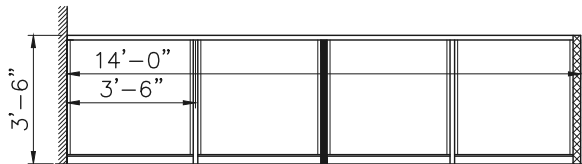
TYPE 3B ALTERNATE OPTIONAL CONFIGURATIONS w/ 2" POSTS ADDED IN INTERMEDIATE SPACES

SEE FIGURE 3 AND SECTION 2.5 ANCHORAGE
OF THE DESIGN MANUAL FOR DETAILS
REGARDING ACCEPTABLE GUARDRAIL
MOUNTING CONFIGURATIONS AND
MAXIMUM SERVICE PULL-OUT LOAD
REQUIREMENTS FOR ANCHORS.

POST LEGEND



POST SIZES



NOTES:

- CONFIGURATIONS SHOWN ACCEPTABLE FOR TOP MOUNT (AS SHOWN) AND SIDE/FASCIA MOUNT CONDITIONS FOR BOTH 5MM TEMPERED GLASS (AS SHOWN) AND PICKET GUARDRAIL SYSTEMS.
- ALLOWABLE CONFIGURATIONS ARE BASED UPON ANALYSIS, CALCULATIONS AND RESULTS OF TESTS CONDUCTED BY INTERTEK TESTING SERVICES NA LTD./WARNOCK HERSHEY.
- ALLOWABLE CONFIGURATIONS ARE IN CONFORMANCE WITH THE APPLICABLE STRUCTURAL REQUIREMENTS SPECIFIED IN THE CURRENT NATIONAL BUILDING CODE OF CANADA.

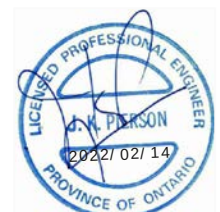
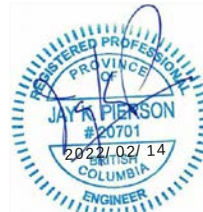
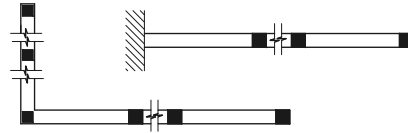


FIGURE 4I-A: 42" HIGH ALLOWABLE CONFIGURATIONS TYPE 3B-ALTERNATE



TYPE 3 – FIXED ONE END

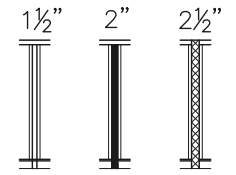


TYPE 3C – END CONDITIONS

– TOP RAIL END CLIP TO STRUCTURE
 OR 90° CORNER w/ MIN 2–2" POSTS
 & 2" POST OPPOSITE END

INTERMEDIATE CONDITIONS – 2" POSTS EVENLY SPACED

POST LEGEND



POST SIZES

SEE FIGURE 3 AND SECTION 2.5 ANCHORAGE
 OF THE DESIGN MANUAL FOR DETAILS
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 MAXIMUM SERVICE PULL-OUT LOAD
 REQUIREMENTS FOR ANCHORS.

NOTES:

–CONFIGURATIONS SHOWN ACCEPTABLE FOR TOP MOUNT
 (AS SHOWN) AND SIDE/FASCIA MOUNT CONDITIONS FOR BOTH
 5MM TEMPERED GLASS (AS SHOWN) AND PICKET GUARDRAIL SYSTEMS.

–ALLOWABLE CONFIGURATIONS ARE BASED UPON ANALYSIS,
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 TESTING SERVICES NA LTD./WARNOCK HERSEY.

–ALLOWABLE CONFIGURATIONS ARE IN CONFORMANCE WITH THE
 APPLICABLE STRUCTURAL REQUIREMENTS SPECIFIED IN THE
 CURRENT NATIONAL BUILDING CODE OF CANADA.

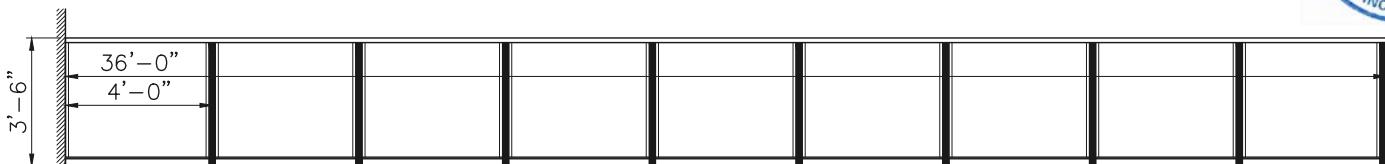
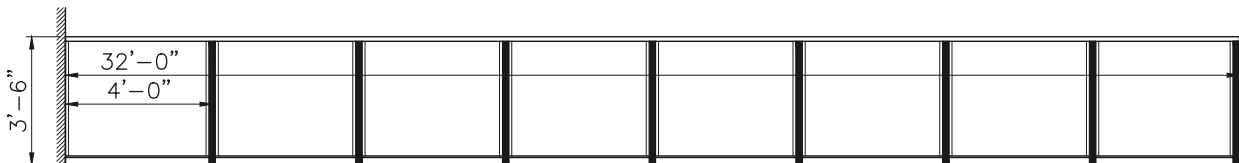
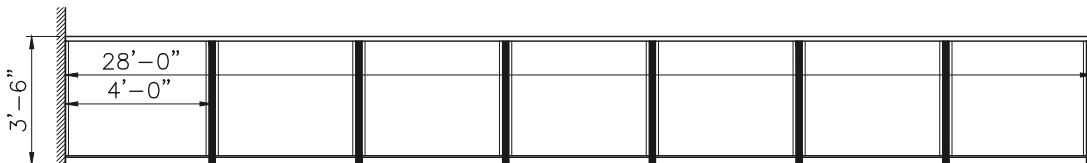
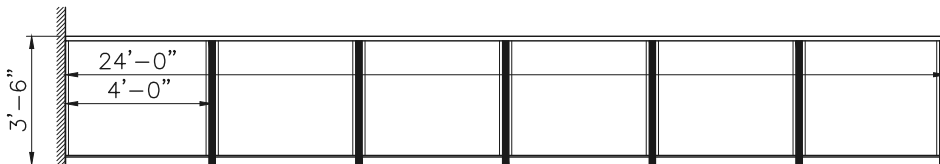
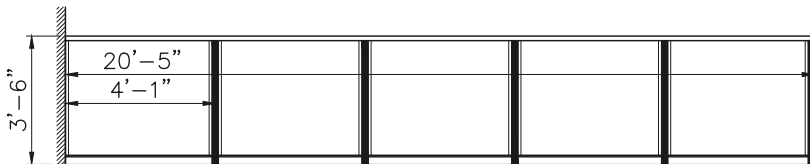
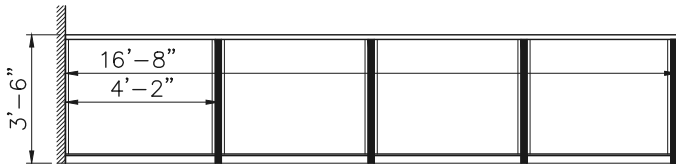
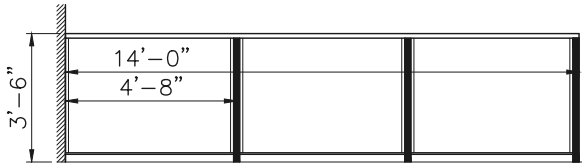
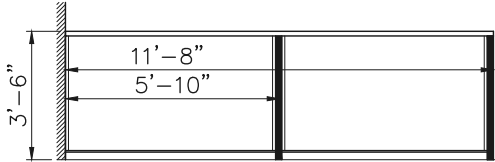
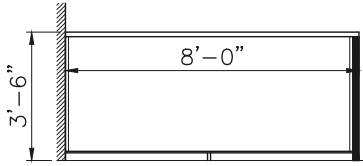
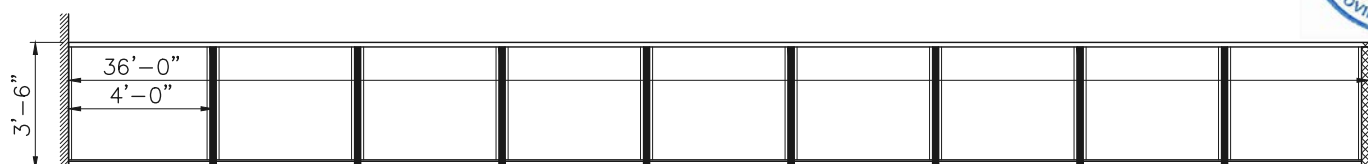
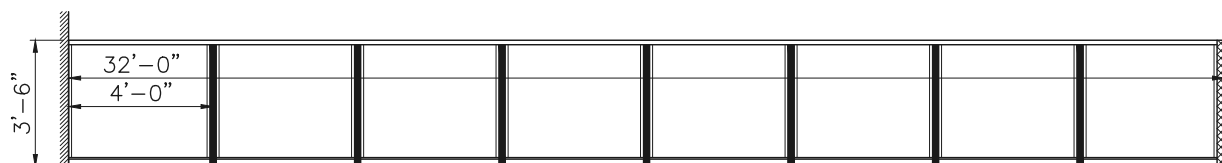
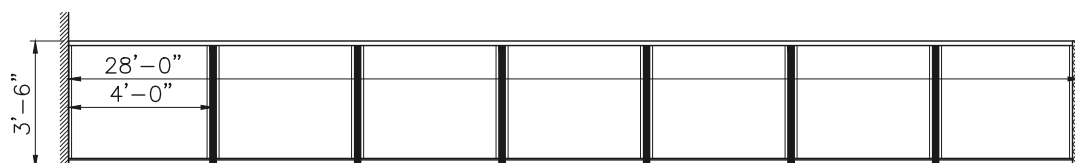
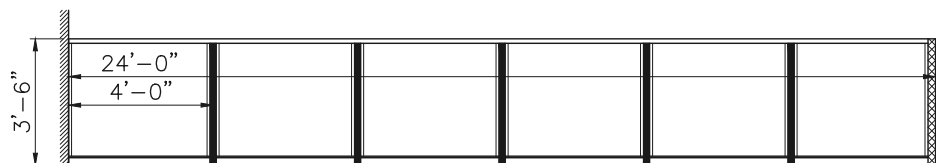
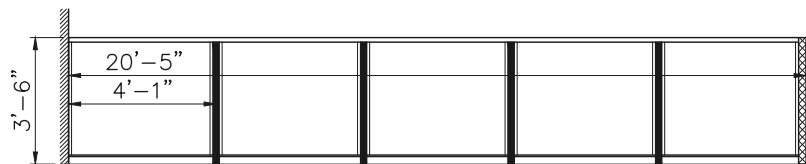
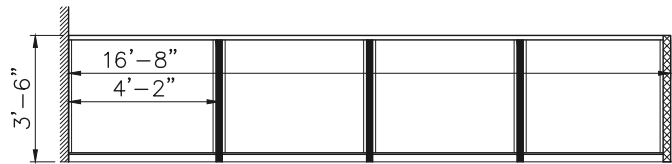
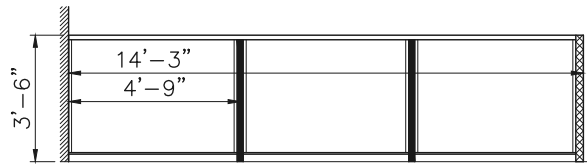
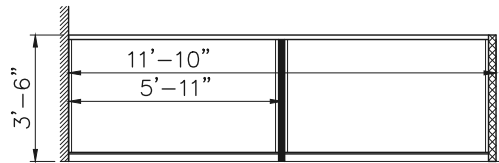
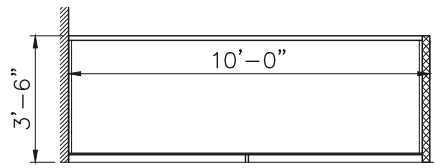
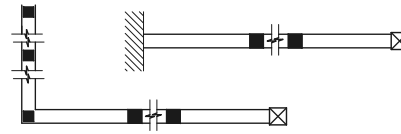


FIGURE 4J: 42" HIGH ALLOWABLE CONFIGURATIONS TYPE 3C



TYPE 3 – FIXED ONE END



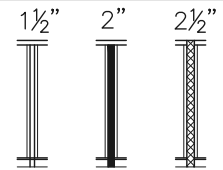
TYPE 3D – END CONDITIONS

– TOP RAIL END CLIP TO STRUCTURE
OR 90° CORNER w/ MIN 2–2" POSTS
& 2 1/2" POST OPPOSITE END

INTERMEDIATE CONDITIONS – 2" POSTS EVENLY SPACED

SEE FIGURE 3 AND SECTION 2.5 ANCHORAGE OF THE DESIGN MANUAL FOR DETAILS REGARDING ACCEPTABLE GUARDRAIL MOUNTING CONFIGURATIONS AND MAXIMUM SERVICE PULL-OUT LOAD REQUIREMENTS FOR ANCHORS.

POST LEGEND



POST SIZES

NOTES:

–CONFIGURATIONS SHOWN ACCEPTABLE FOR TOP MOUNT (AS SHOWN) AND SIDE/FASCIA MOUNT CONDITIONS FOR BOTH 5MM TEMPERED GLASS (AS SHOWN) AND PICKET GUARDRAIL SYSTEMS.

–ALLOWABLE CONFIGURATIONS ARE BASED UPON ANALYSIS, CALCULATIONS AND RESULTS OF TESTS CONDUCTED BY INTERTEK TESTING SERVICES NA LTD./WARNOCK HERSHEY.

–ALLOWABLE CONFIGURATIONS ARE IN CONFORMANCE WITH THE APPLICABLE STRUCTURAL REQUIREMENTS SPECIFIED IN THE CURRENT NATIONAL BUILDING CODE OF CANADA.

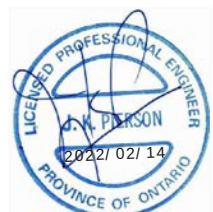
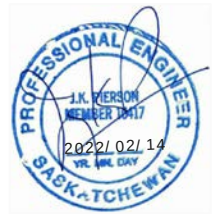
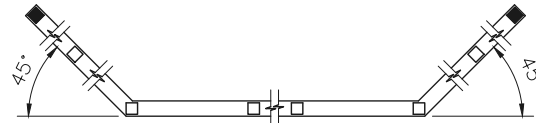


FIGURE 4K: 42" HIGH ALLOWABLE CONFIGURATIONS TYPE 3D

TYPE 4 – PARTIAL FIXED BOTH ENDS

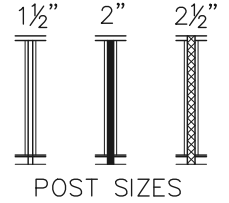


TYPE 4A – END CONDITIONS – 45° CORNERS w/MIN 1-1 1/2" POST
AND 1-2" POST AT END

INTERMEDIATE CONDITIONS – 1 1/2" POSTS EVENLY SPACED

SEE FIGURE 3 AND SECTION 2.5 ANCHORAGE
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MOUNTING CONFIGURATIONS AND
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POST LEGEND



NOTES:

- CONFIGURATIONS SHOWN ACCEPTABLE FOR TOP MOUNT (AS SHOWN) AND SIDE/FASCIA MOUNT CONDITIONS FOR BOTH 5MM TEMPERED GLASS (AS SHOWN) AND PICKET GUARDRAIL SYSTEMS
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- ALLOWABLE CONFIGURATIONS ARE IN CONFORMANCE WITH THE APPLICABLE STRUCTURAL REQUIREMENTS SPECIFIED IN THE CURRENT NATIONAL BUILDING CODE OF CANADA.

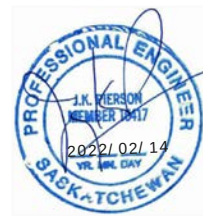
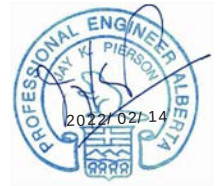
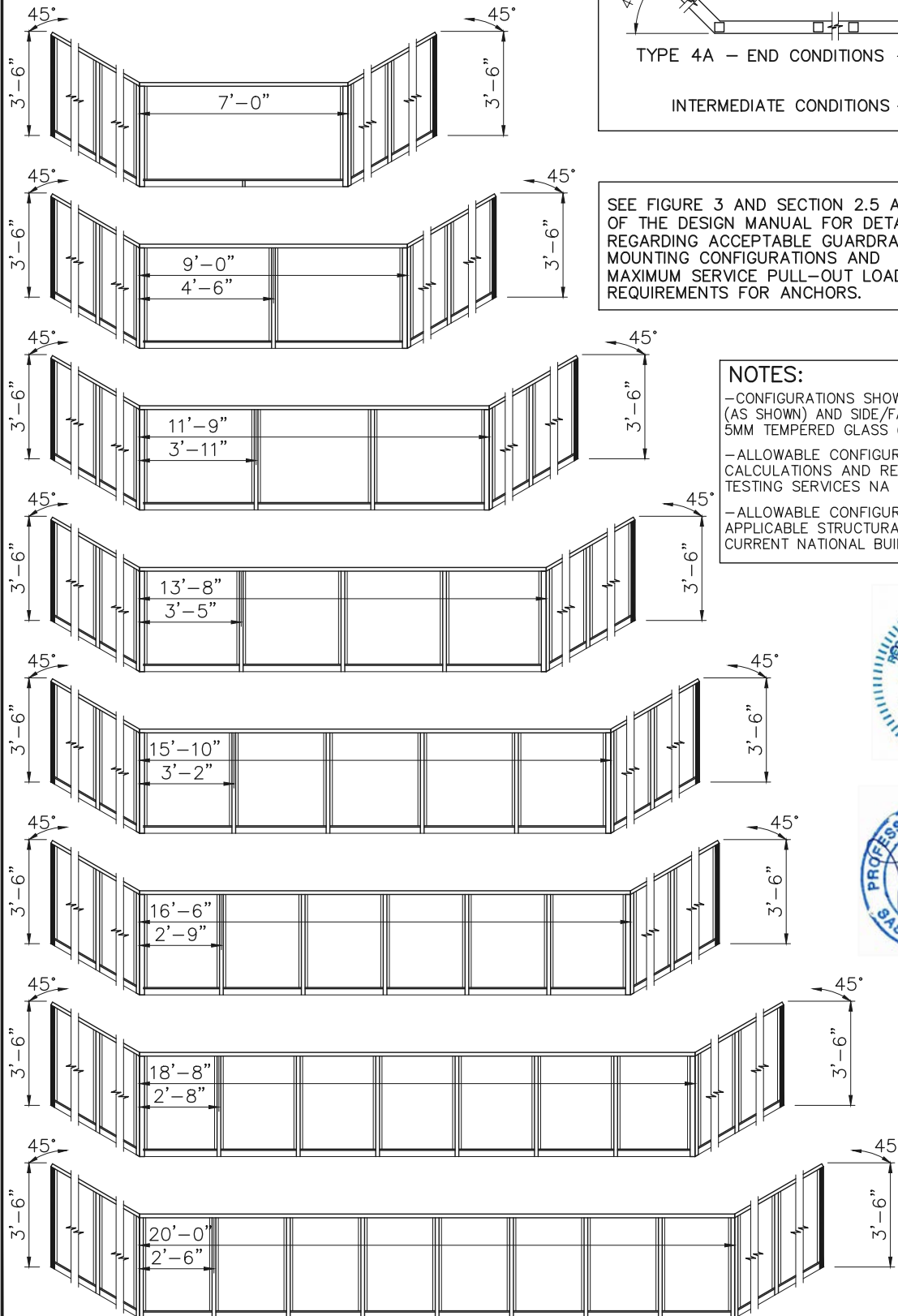


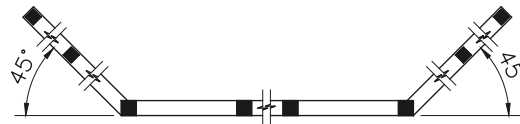
FIGURE 4L: 42" HIGH ALLOWABLE CONFIGURATIONS TYPE 4A

NOTES:

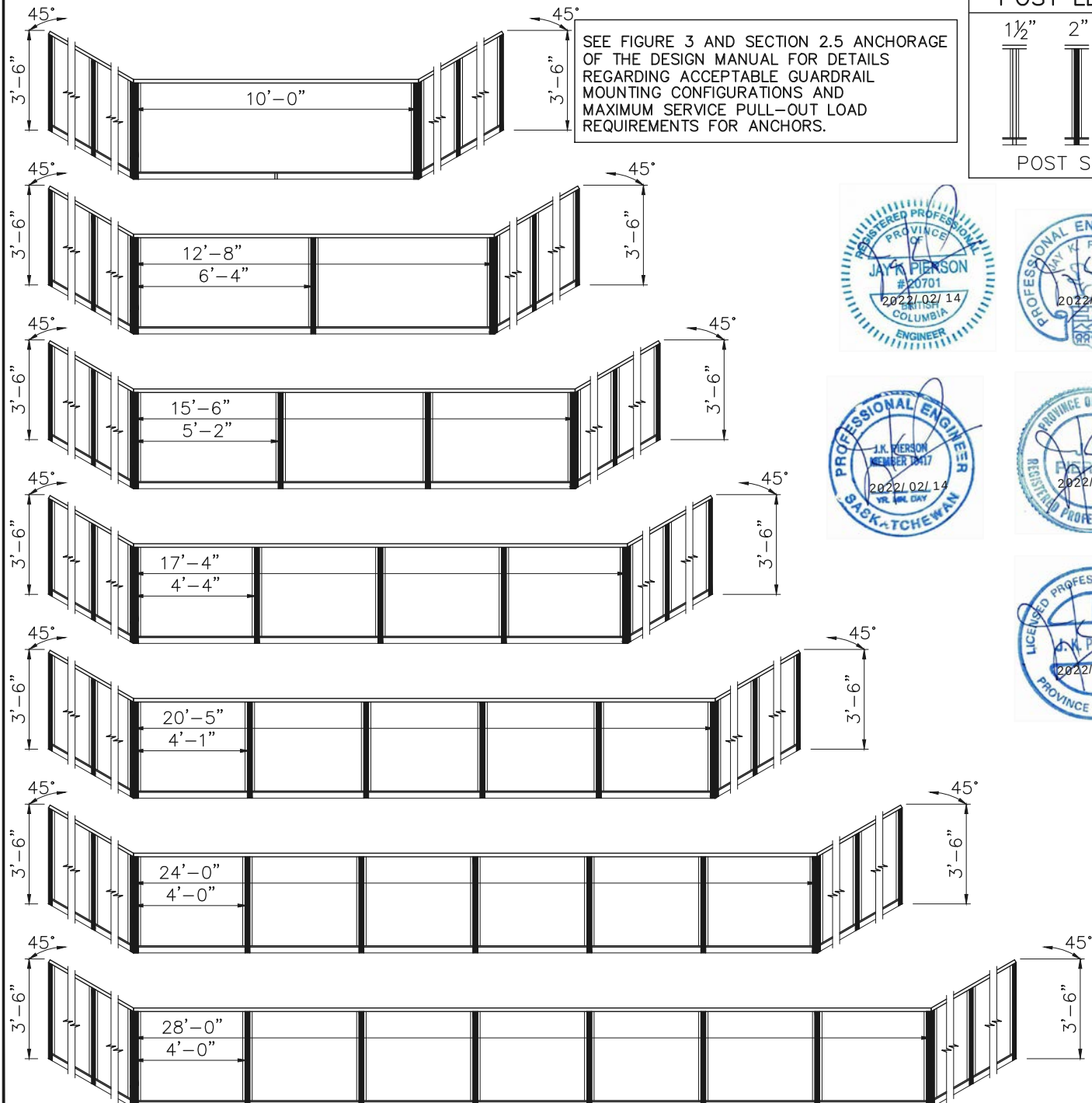
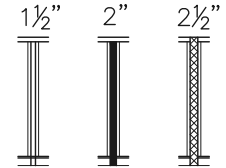
—CONFIGURATIONS SHOWN ACCEPTABLE FOR TOP MOUNT (AS SHOWN) AND SIDE/FASCIA MOUNT CONDITIONS FOR BOTH 5MM TEMPERED GLASS (AS SHOWN) AND PICKET GUARDRAIL SYSTEMS.

—ALLOWABLE CONFIGURATIONS ARE BASED UPON ANALYSIS, CALCULATIONS AND RESULTS OF TESTS CONDUCTED BY INTERTEK TESTING SERVICES NA LTD./WARNOCK HERSHEY.

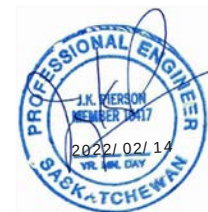
—ALLOWABLE CONFIGURATIONS ARE IN CONFORMANCE WITH THE APPLICABLE STRUCTURAL REQUIREMENTS SPECIFIED IN THE CURRENT NATIONAL BUILDING CODE OF CANADA.

TYPE 4 – PARTIAL FIXED BOTH ENDS

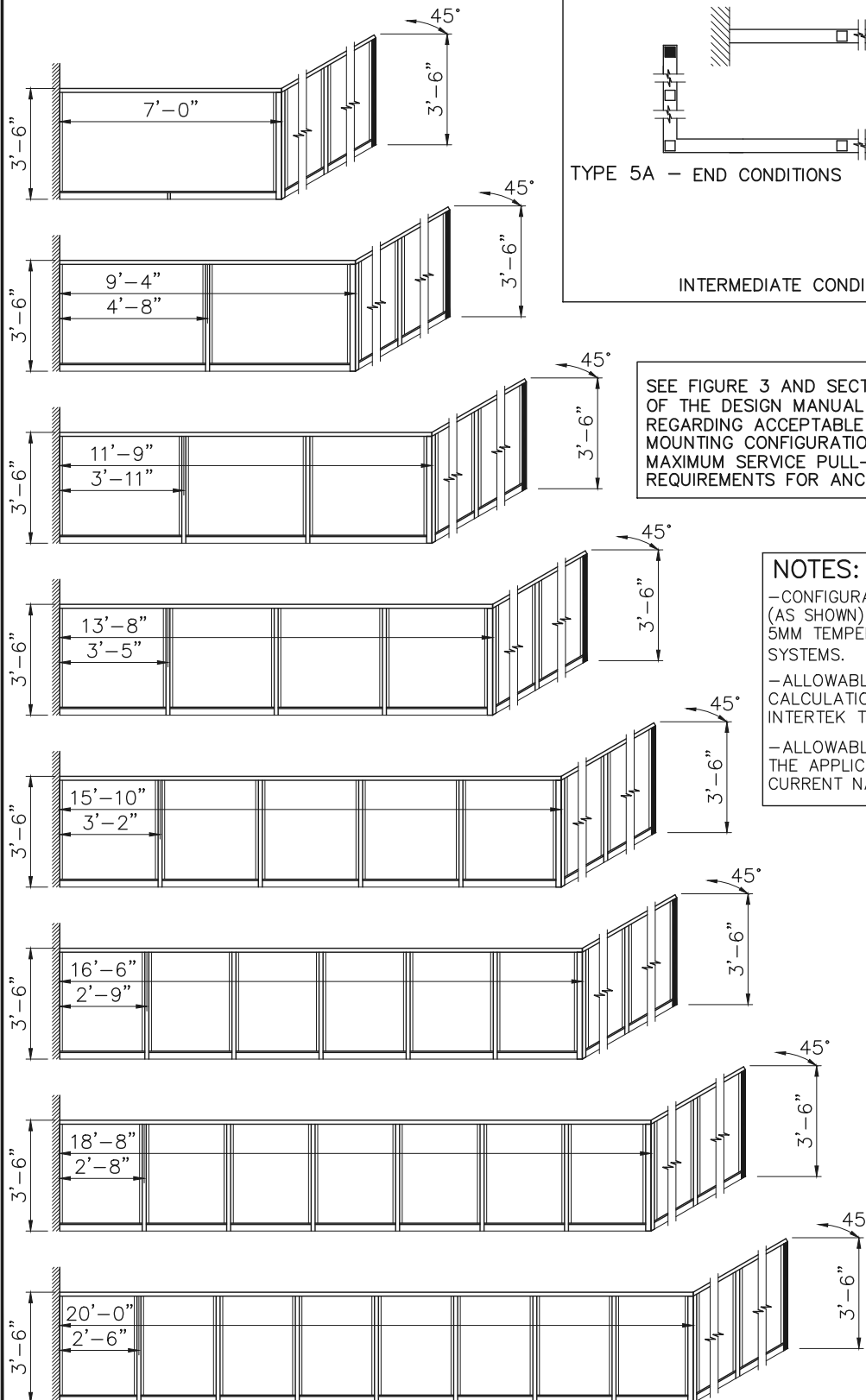
TYPE 4B – END CONDITIONS – 45° CORNERS w/ MIN 2–2" POSTS
 INTERMEDIATE CONDITIONS – 2" POSTS EVENLY SPACED

**POST LEGEND**

POST SIZES

**FIGURE 4M: 42" HIGH ALLOWABLE CONFIGURATIONS TYPE 4B**

TYPE 5 – FIXED & PARTIAL FIXED ENDS



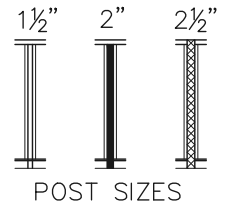
TYPE 5A – END CONDITIONS

– TOP RAIL END CLIP TO STRUCTURE OR 90° CORNER w/MIN 1-1 1/2" POST AND 1-2" POST AT END & 45° CORNER w/MIN 1-1 1/2" POST AND 1-2" POST AT END

INTERMEDIATE CONDITIONS – 1 1/2" POSTS EVENLY SPACED

SEE FIGURE 3 AND SECTION 2.5 ANCHORAGE OF THE DESIGN MANUAL FOR DETAILS REGARDING ACCEPTABLE GUARDRAIL MOUNTING CONFIGURATIONS AND MAXIMUM SERVICE PULL-OUT LOAD REQUIREMENTS FOR ANCHORS.

POST LEGEND



NOTES:

– CONFIGURATIONS SHOWN ACCEPTABLE FOR TOP MOUNT (AS SHOWN) AND SIDE/FASCIA MOUNT CONDITIONS FOR BOTH 5MM TEMPERED GLASS (AS SHOWN) AND PICKET GUARDRAIL SYSTEMS.

– ALLOWABLE CONFIGURATIONS ARE BASED UPON ANALYSIS, CALCULATIONS AND RESULTS OF TESTS CONDUCTED BY INTERTEK TESTING SERVICES NA LTD./WARNOCK HERSHEY.

– ALLOWABLE CONFIGURATIONS ARE IN CONFORMANCE WITH THE APPLICABLE STRUCTURAL REQUIREMENTS SPECIFIED IN THE CURRENT NATIONAL BUILDING CODE OF CANADA.

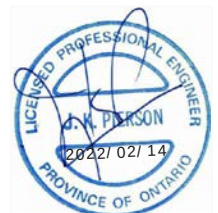
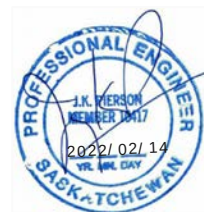
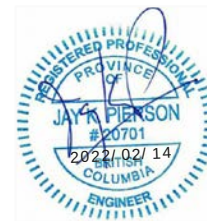


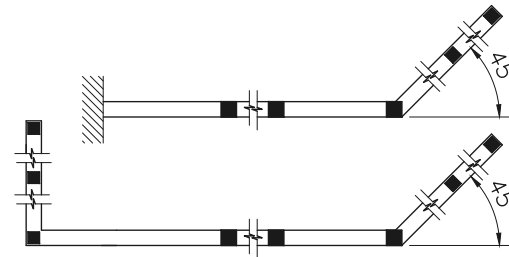
FIGURE 4N: 42" HIGH ALLOWABLE CONFIGURATIONS TYPE 5A

NOTES:

—CONFIGURATIONS SHOWN ACCEPTABLE FOR TOP MOUNT (AS SHOWN) AND SIDE/FASCIA MOUNT CONDITIONS FOR BOTH 5MM TEMPERED GLASS (AS SHOWN) AND PICKET GUARDRAIL SYSTEMS.

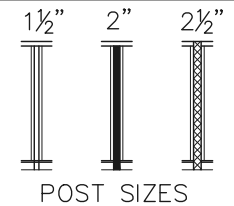
—ALLOWABLE CONFIGURATIONS ARE BASED UPON ANALYSIS, CALCULATIONS AND RESULTS OF TESTS CONDUCTED BY INTERTEK TESTING SERVICES NA LTD./WARNOCK HERSHEY.

—ALLOWABLE CONFIGURATIONS ARE IN CONFORMANCE WITH THE APPLICABLE STRUCTURAL REQUIREMENTS SPECIFIED IN THE CURRENT NATIONAL BUILDING CODE OF CANADA.

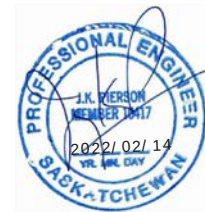
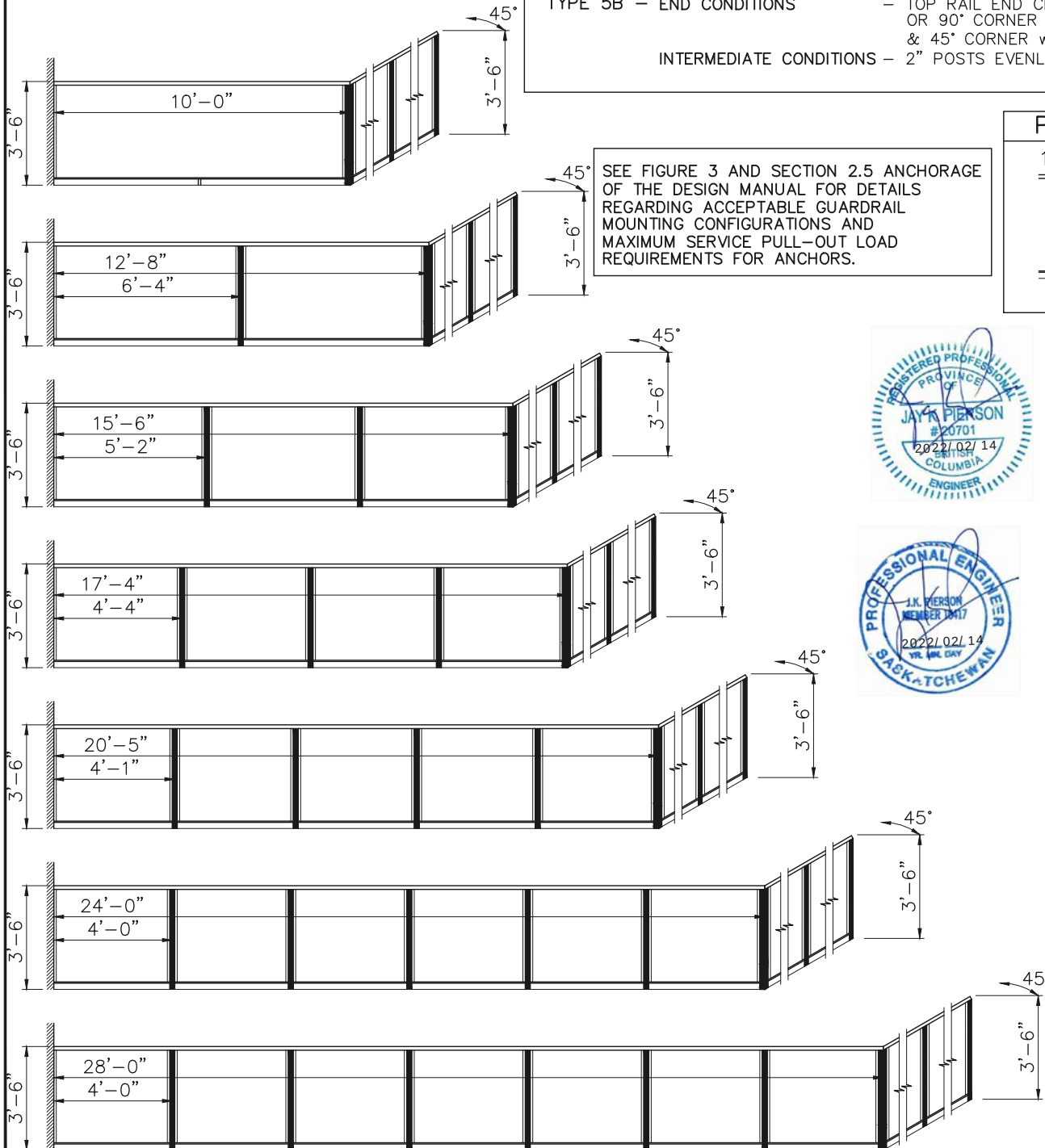
TYPE 5 – FIXED & PARTIAL FIXED ENDS**TYPE 5B – END CONDITIONS**

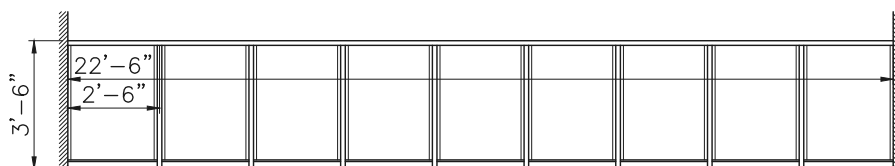
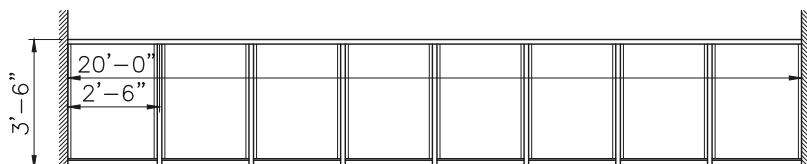
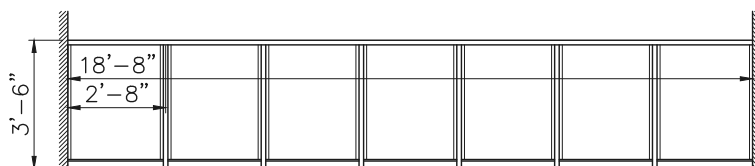
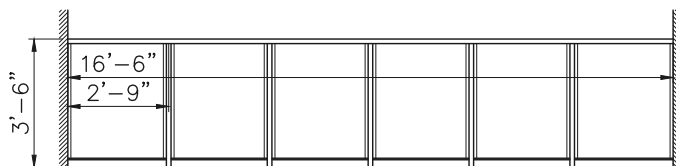
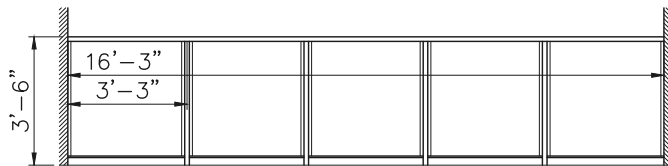
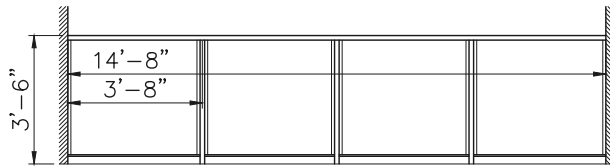
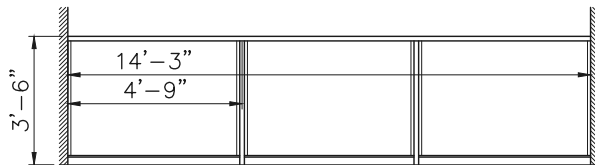
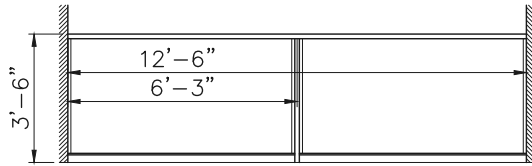
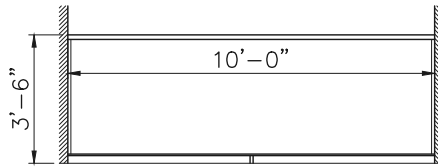
— TOP RAIL END CLIP TO STRUCTURE OR 90° CORNER w/ MIN 2–2" POSTS & 45° CORNER w/ MIN 2–2" POSTS

INTERMEDIATE CONDITIONS – 2" POSTS EVENLY SPACED

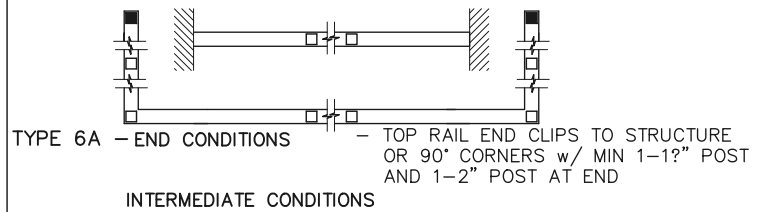
POST LEGEND

SEE FIGURE 3 AND SECTION 2.5 ANCHORAGE OF THE DESIGN MANUAL FOR DETAILS REGARDING ACCEPTABLE GUARDRAIL MOUNTING CONFIGURATIONS AND MAXIMUM SERVICE PULL-OUT LOAD REQUIREMENTS FOR ANCHORS.

**FIGURE 40: 42" HIGH ALLOWABLE CONFIGURATIONS TYPE 5B**

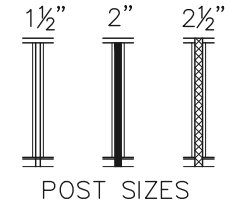


TYPE 6 – FIXED BOTH ENDS



SEE FIGURE 3 AND SECTION 2.5 ANCHORAGE OF THE DESIGN MANUAL FOR DETAILS REGARDING ACCEPTABLE GUARDRAIL MOUNTING CONFIGURATIONS AND MAXIMUM SERVICE PULL-OUT LOAD REQUIREMENTS FOR ANCHORS.

POST LEGEND



NOTES:

– CONFIGURATIONS SHOWN ACCEPTABLE FOR TOP MOUNT (AS SHOWN) AND SIDE/FASCIA MOUNT CONDITIONS FOR BOTH 5MM TEMPERED GLASS (AS SHOWN) AND PICKET GUARDRAIL SYSTEMS.

– ALLOWABLE CONFIGURATIONS ARE BASED UPON ANALYSIS, CALCULATIONS AND RESULTS OF TESTS CONDUCTED BY INTERTEK TESTING SERVICES NA LTD./WARNOCK HERSHEY.

– ALLOWABLE CONFIGURATIONS ARE IN CONFORMANCE WITH THE APPLICABLE STRUCTURAL REQUIREMENTS SPECIFIED IN THE CURRENT NATIONAL BUILDING CODE OF CANADA.

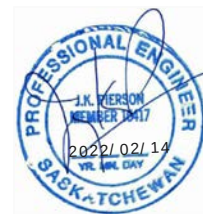
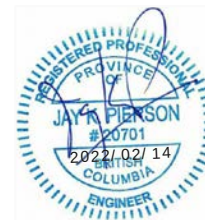
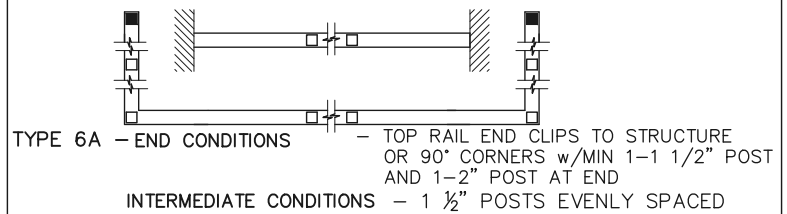
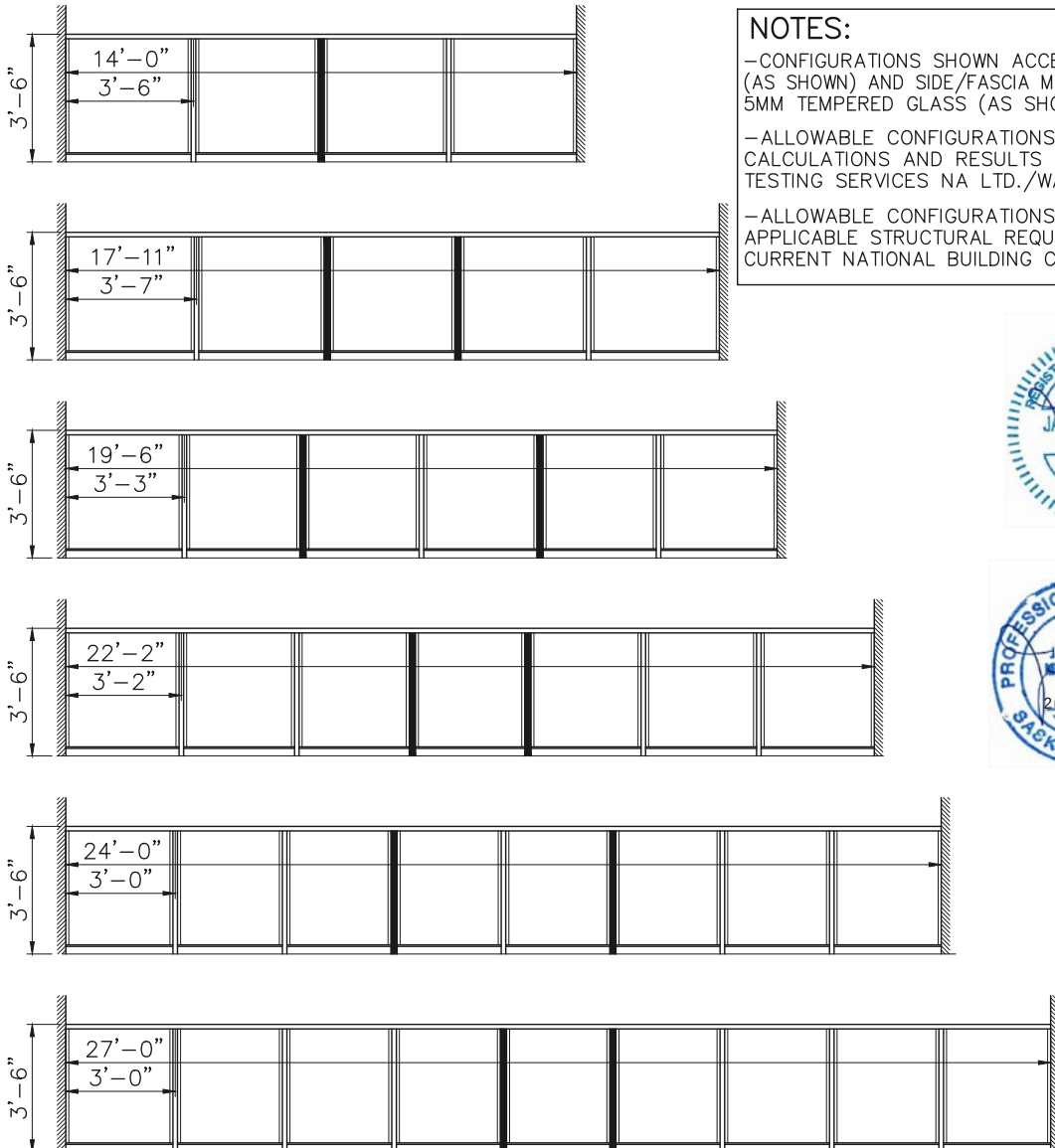


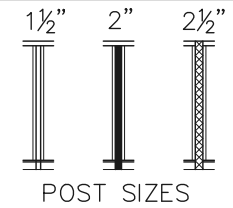
FIGURE 4P: 42" HIGH ALLOWABLE CONFIGURATIONS TYPE 6A

TYPE 6 – FIXED BOTH ENDS

TYPE 6A ALTERNATE
OPTIONAL CONFIGURATIONS
w/ 2" POSTS ADDED
IN INTERMEDIATE SPACES

SEE FIGURE 3 AND SECTION 2.5 ANCHORAGE OF THE DESIGN MANUAL FOR DETAILS REGARDING ACCEPTABLE GUARDRAIL MOUNTING CONFIGURATIONS AND MAXIMUM SERVICE PULL-OUT LOAD REQUIREMENTS FOR ANCHORS.

POST LEGEND



NOTES:

–CONFIGURATIONS SHOWN ACCEPTABLE FOR TOP MOUNT (AS SHOWN) AND SIDE/FASCIA MOUNT CONDITIONS FOR BOTH 5MM TEMPERED GLASS (AS SHOWN) AND PICKET GUARDRAIL SYSTEMS.

–ALLOWABLE CONFIGURATIONS ARE BASED UPON ANALYSIS, CALCULATIONS AND RESULTS OF TESTS CONDUCTED BY INTERTEK TESTING SERVICES NA LTD./WARNOCK HERSHEY.

–ALLOWABLE CONFIGURATIONS ARE IN CONFORMANCE WITH THE APPLICABLE STRUCTURAL REQUIREMENTS SPECIFIED IN THE CURRENT NATIONAL BUILDING CODE OF CANADA.

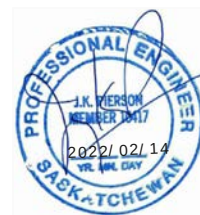
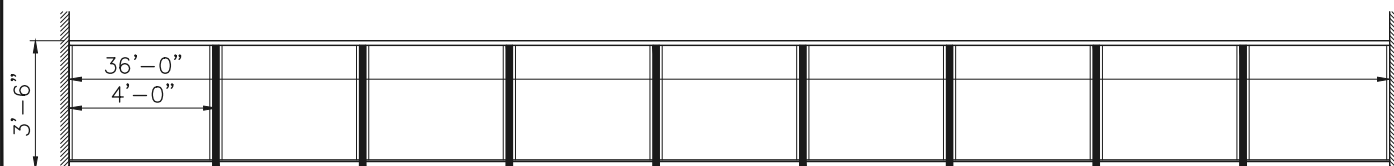
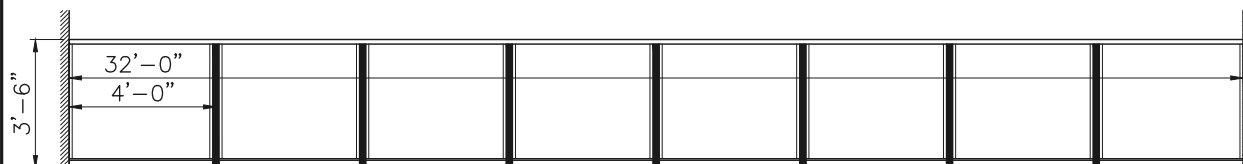
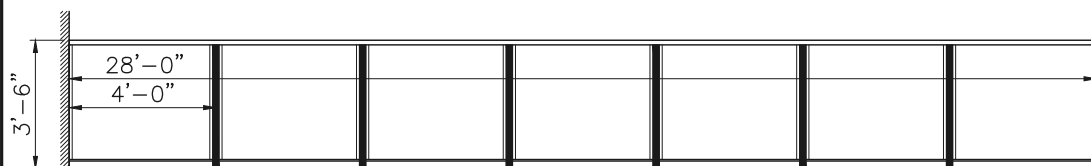
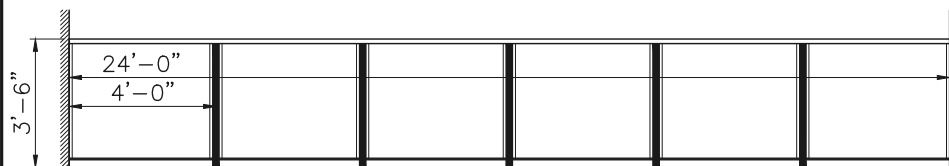
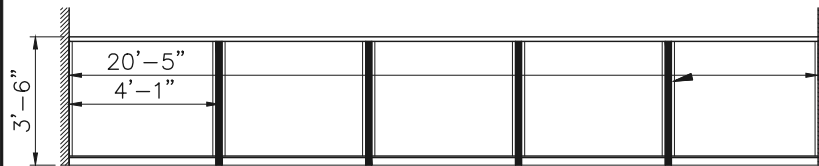
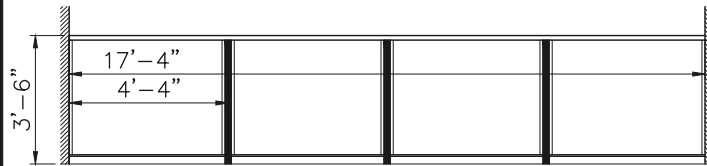
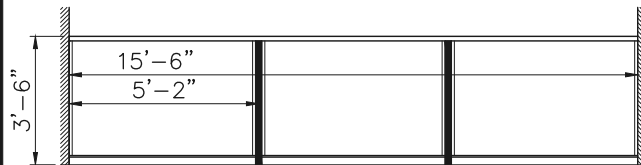
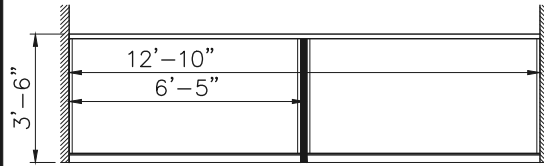
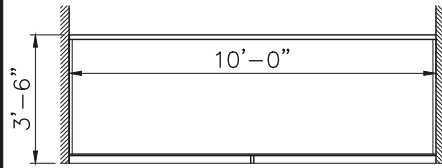
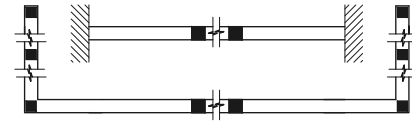


FIGURE 4P-A: 42" HIGH ALLOWABLE CONFIGURATIONS TYPE 6A ALTERNATE



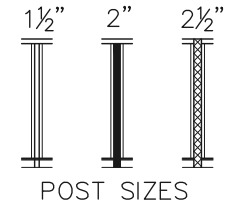
TYPE 6 – FIXED BOTH ENDS



TYPE 6B – END CONDITIONS – TOP RAIL END CLIPS TO STRUCTURE
 OR 90° CORNERS w/ MIN 2-2" POSTS
 INTERMEDIATE CONDITIONS – 2" POSTS EVENLY SPACED

SEE FIGURE 3 AND SECTION 2.5 ANCHORAGE
 OF THE DESIGN MANUAL FOR DETAILS
 REGARDING ACCEPTABLE GUARDRAIL
 MOUNTING CONFIGURATIONS AND
 MAXIMUM SERVICE PULL-OUT LOAD
 REQUIREMENTS FOR ANCHORS.

POST LEGEND



NOTES:

–CONFIGURATIONS SHOWN ACCEPTABLE FOR TOP MOUNT
 (AS SHOWN) AND SIDE/FASCIA MOUNT CONDITIONS FOR BOTH
 5MM TEMPERED GLASS (AS SHOWN) AND PICKET GUARDRAIL SYSTEMS.

–ALLOWABLE CONFIGURATIONS ARE BASED UPON ANALYSIS,
 CALCULATIONS AND RESULTS OF TESTS CONDUCTED BY INTERTEK
 TESTING SERVICES NA LTD./WARNOCK HERSHEY.

–ALLOWABLE CONFIGURATIONS ARE IN CONFORMANCE WITH THE
 APPLICABLE STRUCTURAL REQUIREMENTS SPECIFIED IN THE
 CURRENT NATIONAL BUILDING CODE OF CANADA.

NOTE:

–FOR STRAIGHT RUNS THAT EXCEED 36'-0"
 MAXIMUM POST SPACING NOT TO EXCEED 4'-0"

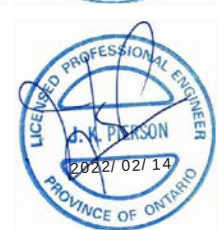
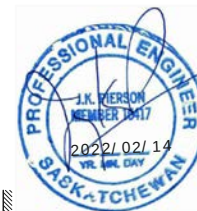


FIGURE 4Q: 42" HIGH ALLOWABLE CONFIGURATIONS TYPE 6B