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General  
Standards  
Board

**CAN/CGSB-138.2-96**

Supersedes CAN/CGSB-138.2-M80

# Steel Framework for Chain Link Fence



**National Standard of Canada**

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**NATIONAL STANDARD OF CANADA**

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# **STEEL FRAMEWORK FOR CHAIN LINK FENCE**

**Prepared by the**

Canadian General Standards Board 

**Approved by the**

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## CANADIAN GENERAL STANDARDS BOARD

## STEEL FRAMEWORK FOR CHAIN LINK FENCE

**1. SCOPE**

- 1.1 **This** standard applies to steel framework for chain link fence used in commercial and industrial applications.
- 1.2 The testing and evaluation of a product against this standard may require the use of materials and/or equipment that could be hazardous. **This** document does not purport **to** address all the safety aspects associated with its use. Anyone using **this** standard **has** the responsibility to consult the appropriate authorities and to establish appropriate health and safety practices in conjunction with any existing applicable regulatory requirements **prior to** its use.

**2. REFERENCED PUBLICATIONS**

- 2.1 The following publications are referenced in this standard:
- 2.1.1 Canadian General Standards Board (CGSB)  
CAN/CGSB-138.1 — Fabric for Chain Link Fence.
- 2.1.2 Canadian Standards Association (CSA)  
G162.1 — Methods of Determining ~~Mass~~ of Coating on Zinc-Coated (Galvanized) Steel Wire  
G164 — Hot-Dip Galvanizing of irregularly Shaped Articles.
- 2.1.3 National Research Council  
National Building Code and Supplement No. 1.
- 2.1.4 American Society for Testing and Materials (ASTM)  
A 53 — Pipe, Steel, Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless, for Ordinary Uses  
A 90 — Weight of Coating **on** Zinc-Coated (Galvanized) Iron or Steel Articles  
A 121 — Standard Specification for Zinc-Coated (Galvanized) Steel Barbed Wire  
A 428 — Standard Test Method for Weight of Coating on Aluminum-Coated iron or Steel Articles  
B 6 — Specification for Zinc (Slab Zinc)  
F 1043 — Strength and Protective Coatings on **Metal** Industrial Chain Link Fence Framework.
- 2.2 A reference to a regulation is always to the latest issue. A dated reference is to the issue specified. **An** undated reference is to the latest issue, unless otherwise specified by the authority applying this standard. The sources **are** given in the Notes section.

**3. TERMINOLOGY**

- 3.1 The following definitions apply in this standard:

**BWO (BES)**

Barbed wire overhang.

**Barbed Tape and Ribbon (Ruban barbelé)**

A singular stamped strip fabricated from galvanized or stainless steel and with razor type barbs positioned along both edges, intended for limited use in extreme security applications.

**Barbed Wire (Fil barbelé)**

Twisted longitudinal wires, termed line wires, to which barbs are attached.

**Brace Rail** (Traverse de renfort)

A tubular or fabricated steel section used for bracing terminal posts.

**Centre and/or Bottom Rails** (Traverse centrale et (ou) inférieure)

Tubular or fabricated steel sections joined at each fence post by means of fittings.

**FFH (CGPH)**

Fence with fabric full height.

**Fence Post** (Poteau de clôture)

An upright tubular or fabricated steel member for supporting fencing material.

**Fittings** (Dispositifs de fixation)

Mechanical connections of various designs, shapes and metals used in joining fence components into an integral structure.

**Line Posts** (Poteaux de ligne)

Fence posts spaced at regular intervals between terminal posts throughout each stretch of fence.

**Terminal Posts** (Poteaux terminaux)

Fence posts which include corner, end, gate and straining posts, as follows:

**Corner Posts** (Poteaux d'angle)

Fence posts positioned at corners and changes of direction greater than ten degrees.

**End Posts** (Poteaux d'extrémité)

Fence posts positioned at the ends of a stretch of fence.

**Gate Posts** (Poteau de barrière)

The two fence posts forming a gateway.

**Straining Posts** (Poteaux de renfort)

Fence posts positioned at changes in grade greater than thirty degrees.

**Top Rail** (Traverse supérieure)

A tubular or fabricated steel section continuously joined by means of sleeves or couplings throughout each stretch of fence extending **between** terminal posts.

**Truss Rod** (Tige de contreventement)

A solid steel rod used for bracing terminal posts.

#### 4. CLASSIFICATION

4.1 Framework shall be supplied in the following types and styles, as shown in Table 1 and as specified (par. 9.1):

TABLE 1

Types and Styles of Steel Framework

Type*	Style**
1 — Hot-Rolled, Butt or Electrical Resistance Welded	A — Heavy
2 — Cold-Rolled, Electrical Resistance Welded	B — Medium
3 — Fabricated	N/A

\*The user of this standard should note that Types 1, 2 (and 3) of this standard refer to the fence posts and rails. These types are to be distinguished from Types 1 and 2 of CAN/CGSB-138.1 which refer to fabric.

\*\* Style refers to the style of rail.

## 5. GENERAL REQUIREMENTS

- 5.1 **Materials and Workmanship** — Materials used for the construction of the fence framework shall be produced by methods recognized **as** good commercial practice. The framework shall be of uniform quality and condition and shall be free from any defects or imperfections that might adversely affect its serviceability and appearance.
- 5.2 **Zinc-Coated Components** — All framework components, excluding any aluminum components normally used in fence construction, shall be zinc-coated. The galvanized coatings shall be applied by either electrolytic or hot-dip process. All coated components shall be free from injurious defects or excessive roughness.

## 6. DETAILED REQUIREMENTS

### 6.1 Fence Posts and Rails

- 6.1.1 Type 1 fence **posts** and rails shall conform to the material requirements of ASTM A 53, Schedule 40.<sup>1</sup>  
Type 2 fence posts and rails shall conform to the material requirements of ASTM F 1043, Group 1C.
- 6.1.2 Type 1 and type 2 fence posts shall be of the lengths and dimensions shown in Table 2 and 3 respectively, unless otherwise specified (par. 9.1).
- 6.1.3 Type 1 and Type 2 rails shall be in random lengths **as** specified (par. 9.1) and of the dimensions shown in Tables 2 and 3 respectively, unless otherwise specified (par. 9.1).
- 6.1.4 Type 1 and 2 square or rectangular “tubular” steel members shall have material **and** dimensional requirements **as** specified (par. 9.1).

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<sup>1</sup> Conformance to ASTM A 53, schedule 40 does not require hydrostatic testing.

**TABLE 2**  
**Dimensions of Type 1 Posts and Rails (minimum yield strength 170 MPa)**

Height of Fence m	Line Post Outside Diameter mm		Length of Line Post m		End, Gate, Corner Posts Outside Diameter mm	Length of End & Gate Posts m		Length of Corner Post m		Rail Outside Diameter mm	
	mm	mm	FFH	BWO Included		FFH	BWO Included	FFH	BWO Included	Style A Rail	Style B Rail
1.0	48.3	48.3	1.8	—	73.0	2.1	—	2.1	—	42.2	33.4
1.2	48.3	48.3	2.0	—	73.0	2.3	—	2.3	—	42.2	33.4
1.5	48.3	48.3	2.3	—	73.0	2.6	—	2.6	—	42.2	33.4
1.8	60.3	60.3	2.6	—	88.9	2.9	—	2.9	—	42.2	33.4
2.1	60.3	60.3	2.9	2.6	88.9	3.2	3.5	3.2	3.2	42.2	—
2.4	60.3	60.3	3.2	2.9	88.9	3.5	3.8	3.5	3.5	42.2	—
3.0	73.0	73.0	3.8	3.5	114.3	4.1	4.4	4.1	4.1	42.2	—
3.6	73.0	73.0	4.4	4.1	114.3	4.7	5.0	4.7	4.7	42.2	—

**TABLE 3**  
**Dimensions\* of Type 2 Posts and Rails (minimum yield strength 344 MPa)**

Height of Fence m	Line Post Outside Diameter mm		Length of Line Post		End, Gate, Corner Posts Outside Diameter mm	Length of End & Gate Posts		Length of Corner Post		Rail Outside Diameter mm
	mm	mm	FFH m	BWO Included m		FFH m	BWO Included m	FFH m	BWO Included m	
1.0	48.3	48.3	1.8	—	73.0	2.1	—	2.1	—	42.2
1.2	48.3	48.3	2.0	—	73.0	2.3	—	2.3	—	42.2
1.5	48.3	48.3	2.3	—	73.0	2.6	—	2.6	—	42.2
1.8	60.3	60.3	2.6	—	88.9	2.9	—	2.9	—	42.2
2.1	60.3	60.3	2.9	2.6	88.9	3.2	3.5	3.2	3.2	42.2
2.4	60.3	60.3	3.2	2.9	88.9	3.5	3.8	3.5	3.5	42.2
3.0	73.0	73.0	3.8	3.5	114.3	4.1	4.4	4.1	4.1	42.2
3.6	73.0	73.0	4.4	4.1	114.3	4.7	5.0	4.7	4.7	42.2

\*Outside diameter      Nominal wall thickness

- 42.2 mm      2.1 mm
- 48.3 mm      3.1 mm
- 60.3 mm      3.3 mm
- 73.0 mm      4.1 mm
- 88.9 mm      4.1 mm
- 114.3 mm     4.6 mm

**TABLE 4**  
**Allowable Wind Values**

Allowable Wind Values (pascals) (par. 6.8.1.1) FFH (Note 1)		Height of Fence  m
Style 1 Fabric (Note 2)	Style 2 Fabric (Notes 2 and 3)	
1271	1618	1.0
883	1124	1.2
565	720	1.5
665	874	1.8
489	623	2.1
375	477	2.4
457	582	3.0
318	405	3.6

**Notes:**

1. *The same wind values for the BWO (Fence Height Including Barbed Wire Overhang) (see Tables 2 and 3) condition are acceptable and result in a small amount of overdesign.*
2. *Fabric styles are described in CAN/CGSB-138.1*
3. *The same wind values for light fabric (Style 3) apply and result in a small amount of overdesign.*

- 6.2 Fabricated Sections — Material and dimensional requirements of Type 3 steel sections (including shaped or formed) used as fence posts or rails shall be as specified (par. 9.1).
- 6.3 Truss Rods — Material and dimensional requirements shall be as specified (par. 9.1).
- 6.4 Fittings — Fittings shall be made from zinc-coated pressed steel, galvanized steel, zinc-coated malleable iron or aluminum alloy (par. 9.1). They shall be free from brittleness, porosity and defects affecting their durability, and of adequate strength for the intended purpose.
- 6.5 Barbed Wire — Barbed wire shall be constructed from zinc- or aluminum-coated steel wire of at least 2.49 mm diameter and shall be of either single strand or 2-strand construction, as specified (par. 9.1). Barbs shall be 4-point construction, formed of wire of at least 2.03 mm diameter, spaced at intervals of 150 ± 15 mm or a minimum of 61 barbs in 10 m. At the option of the producer, the barb on aluminum-coated barbed wire may be solid aluminum alloy (par. 9.1). For safety reasons, barbed wire shall not be installed on fences that are less than 1.8 m in height prior to installation of the barbed wire.
- 6.6 Barbed Tape or Ribbon — When specified (par. 9.1), in extreme security applications, barbed tape or ribbon may be installed on fences that have a minimum height of 3 m.
- 6.7 Top and Bottom Tension Wire — Top and bottom tension wire (used wherever top and/or bottom rail is not employed) shall consist of zinc-, vinyl- or aluminum-coated steel wire of the same or larger diameter specified for the chain link fence fabric in accordance with CAN/CGSB-138.1.

The same wire used in the construction of Style 2 fabric should be used as top and bottom tension wire for Style 3 fabric fence.<sup>2</sup> Sufficient wire ties, clips and hog rings of adequate strength and size shall be provided for the purpose of attaching the bottom wire at 600 mm intervals.

<sup>2</sup> *Fabric wire styles are described in CAN/CGSB-138.1.*

## 6.8 Framework Strength

### 6.8.1 General

- 6.8.1.1 All types of fence posts and rails shall exhibit wind strength characteristics conforming with or exceeding the minimum allowable wind values shown in Table 4<sup>3</sup> unless otherwise specified (par. 9.1). Local conditions shall dictate the required strength of the rails.
- 6.8.1.2 Maximum spacing of line posts shall be 3 m unless otherwise specified (par. 9.1). Excessive snow loads, particularly those resulting from snow piled mechanically against a fence, may require post spacing at less than 3 m intervals.
- 6.8.1.3 All fences shall have a top and bottom horizontal rail or top and bottom tension wire as specified (par. 9.1).
- 6.8.1.4 If a top and bottom tension wire is used, a brace rail and truss rod may be specified (par. 9.1) for added strength.
- 6.8.1.5 The design of fence framework components shall be based on the National Building Code.
- 6.8.1.6 The importance factor, if Limit States Design is used, shall be taken as 0.7.
- 6.8.1.7 The framework strength of Types 1, 2 and 3 shall meet the requirements of par. 6.8 of this standard when tested in accordance with ASTM A 53, Schedule 40 (Types 1 and 3) and ASTM F 1043 (Type 2).

### 6.8.2 Top Rail and Other Horizontal Rails

- 6.8.2.1 The top rail and other horizontal rails (e.g. centre and bottom rails) shall be capable of withstanding the following loads not occurring simultaneously:
- A horizontally or vertically applied load at midspan of the rail of 0.86 kN.
  - A vertically applied uniformly distributed load of 0.77 kN/m.<sup>4</sup>
- 6.8.2.2 The most critical of the following load patterns for the design load specified in par. 6.8.2.1 b., shall be used for design purposes:
- Full load applied along the entire length.
  - Full load applied along any one portion of the length and half load on the remainder of the length.

6.8.3 **Brace Rails** — Brace rails shall have strength requirements as specified (par. 9.1).

### 6.8.4 Line Posts

- 6.8.4.1 Line posts shall be capable of withstanding the three design loads specified in par. 6.8.4.2, 6.8.4.3 and 6.8.4.4, not occurring simultaneously.
- 6.8.4.2 Minimum design load applied horizontally parallel to the direction of the fence or perpendicular to it at 1.2 m above ground level shall be 0.9 kN.
- 6.8.4.3 Minimum design load applied horizontally perpendicular or parallel to the fence at the level of the top rail shall be 0.68 kN.
- 6.8.4.4 Minimum design wind pressure ( $p$  in pascals) applied horizontally perpendicular to the direction of the fence shall be:

$$p = C_n \cdot q \cdot C_g \cdot C_e \cdot R$$

<sup>3</sup> This requirement is not applicable to strength in a direction parallel to the fence line.

<sup>4</sup> In some locations, experience may indicate that the design load specified in par. 6.8.2 is insufficient and should be increased (Closer line post spacing for a fixed size of rail will sometimes compensate for the increased loading). In locations where ground snow loads do not exceed 2.4 kN/m<sup>2</sup> and there is no probability of snow drifting or being piled against the fence, or the height of rail is 1.5 m above the top of any anticipated snow level, the design load as specified in par. 6.8.2.1 b. may be reduced to 0.44 kN/m.

where:

$p$  = shall be applied to the gross tributary area of the line post (**post spacing x height of fabric**)

$C_n$  = force coefficient = **1.2**

$q$  = hourly wind pressure in pascals based on probability of being exceeded in any one year of **1 in 10**. (See supplement No. 1 of the National Building Code for value of  $q$ )

$C_g$  = gust factor = **2.0**

$C_e$  = exposure factor = **1.0** for fence located at ground level

$R$  = ratio of net and gross **areas** of fence<sup>5</sup>.

**6.8.4.5** Design wind load shall be based on no ice covering of the fence unless otherwise specified (par. **9.1**).

**6.8.4.6** The deflection of any line post shall not exceed **1/40** of the height, due to the loading specified in par. **6.8.4.2**, **6.8.4.3** and **6.8.4.4**.

**6.8.5** *Terminal Posts* — The section modulus of terminal posts shall be at least ~~three~~ times that of line posts, in terms of bending resistance.

**6.8.6** *Truss Rods* — Truss rods shall have strength requirements as specified (par. **9.1**).

## **6.9** COATINGS

### **6.9.1** *Type 1*

**6.9.1.1** Tubular steel members shall be zinc-coated inside and outside by either electrolytic or hot-dip methods.

**6.9.1.2** For zinc-coated tubular members, the average mass per unit area of zinc coating shall not be less than **550 g/m<sup>2</sup>** of uncoated base metal surface, as determined from the average results of the two specimens and not less than **490 g/m<sup>2</sup>** for either of the test specimens (see par. **8.2.1**).

**6.9.2** *Type 2* — Tubular steel members shall be zinc-coated in accordance with par. **7.1** and **7.2** of ASTM F **1043**.

**6.9.3** *Type 3* — Fabricated steel sections and truss rods shall be hot dip galvanized and shall have zinc coatings that conform to par. **6.9.1**.

**6.9.4** *Truss Rods* — Truss rods shall be hot dip galvanized and shall have zinc coatings that conform to par. **6.9.1**.

**6.9.5** *Zinc-Coated Barbed Wire* — It shall have a minimum coating of **244 g/m<sup>2</sup>** on line wire and **183 g/m<sup>2</sup>** on barbs, as determined in accordance with ASTM A **121**.

**6.9.6** *Aluminum-Coated Barbed Wire* — It shall have a minimum coating of **90 g/m<sup>2</sup>**, as determined in accordance with ASTM A **428**.

**6.9.7** *Fittings* — All steel and iron fittings shall be hot dip galvanized in accordance with CSA G164. The average mass per unit area of zinc coating shall be a minimum of **550 g/m<sup>2</sup>** as determined in par. **8.2.1**.

**6.9.8** *Top and Bottom Tension Wire* — Top and bottom tension wire shall be zinc-, vinyl- or aluminum-coated in accordance with **CAN/CGSB-138.1** and shall have the same coating weight (or greater) as the fence fabric.

**6.9.9** Slab zinc used for coating shall be of any grade in accordance with **ASTM B 6**.

**6.9.10** *Vinyl-Coated Framework* — Types **1**, **2** and **3** steel members and fittings may be vinyl-coated as per **CAN/CGSB-138.1**.

<sup>5</sup> For no ice covering on fence, "R" may be taken equal to 0.233 for fence with heavy fabric wire and equal to 0.183 for fence with medium, or light fabric. (See **CAN/CGSB-138.1** for description of heavy, medium and light fabric wire).

## 7. PREPARATION FOR DELIVERY

7.1 Unless otherwise specified (par. 9.1), normal commercial practice of packaging, labelling, packing and marking shall be acceptable.

## 8. INSPECTION

8.1 **Sampling** — Completed fence framework components shall be subject to inspection and testing according to requirements **as** specified. Sampling for *this* purpose shall be **as** specified (par. 9.1).

### 8.2 Testing

8.2.1 **Mass per Unit Area of Zinc-Coating** — For Type 1 determine the mass per unit area of zinc-coating on fence posts, rails, **truss** rods and fittings in accordance with ASTM A 90. For posts and rails use *two* tubular or fabricated test specimens taken from 'each end of one length of galvanized pipe, selected at random. Calculate the mass **per** unit area of the zinc-coating in grams per square metre by dividing the total mass of zinc, inside **and** outside, by the total area, inside and outside, of the coated surface.

## 9. NOTES

9.1 **Options** — The following options must be specified in the application of this standard:

- a. Type and style (par. 4.1)
- b. Material and dimensional requirements of fence posts, rails and truss rods (par. 6.1, 6.2 and 6.3)
- c. Material for fittings (par. 6.4)
- d. Barbed wire material and construction (par. 6.5)
- e. Requirement for solid aluminum barb (par. 6.5)
- f. Requirement for barbed tape or ribbon (par. 6.6)
- g. Wind strength characteristics, if other than **as** specified (par. 6.8.1.1)
- h. Spacing **of** line posts, if other than **as** specified (par. 6.8.1.2)
- i. Requirement for rails or tension wires (par. 6.8.1.3)
- j. Requirement for brace rail and **truss** rod (par. 6.8.1.4)
- k. Strength of brace rails (par. 6.8.3)
- l. Design wind load requirement (par. 6.8.4.5)
- m. Strength of truss rods (par. 6.8.6)
- n. Preparation for delivery, if other than **as** specified (par. 7.1)
- o. Sampling requirements (par. 8.1).

### 9.2 Sources of Referenced Publications

9.2.1 The publication referred to in par. 2.1.1 may be obtained from the Canadian General Standards Board, Sales Centre, Ottawa, Canada K1A 1G6. Telephone (613) 941-8703 or 1-800-665-CGSB (Canada only). Fax (613) 941-8705.

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