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Guide Specifications for GFRP Reinforcing:

Development of New Edition of CSA S807 Standard - Specifications for Fiber Reinforced Polymers

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Canadian-CSA Specifications for Fiber Reinforced Polymers

CAN/CSA S807: "Specifications for Fibre Reinforced Polymers".

- ***1st Edition in 2010***
- ***Re-approved in 2015***
- ***2nd Edition in 2018***

CSA S807


CANADIAN STANDARDS ASSOCIATION
S807-10
Specification for fibre-reinforced polymers

Table of Contents of S807

CSA S807 - Technical Committee

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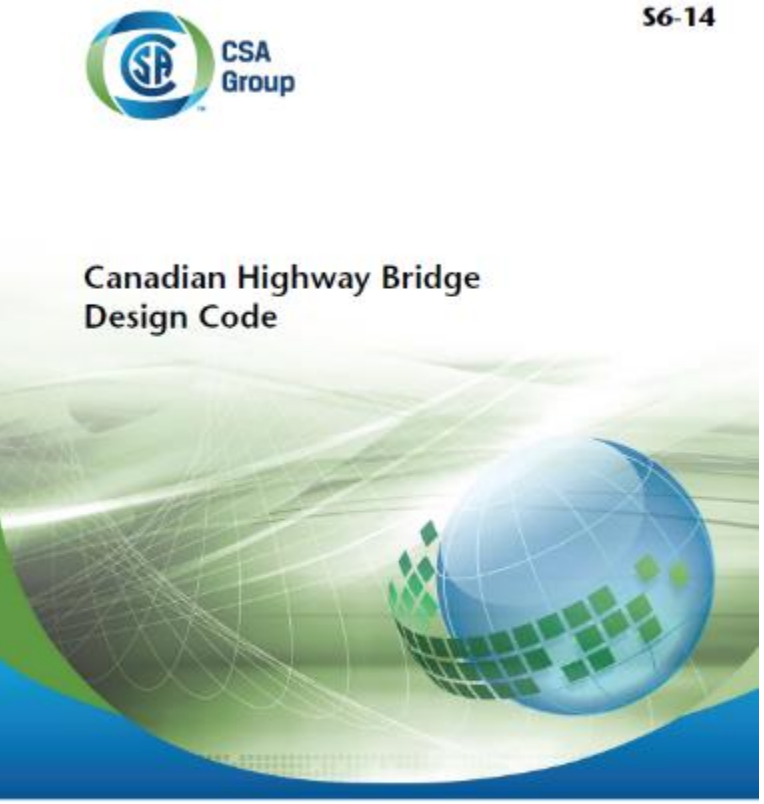
CSA S807

This Standard covers the material properties and the manufacturing requirements of fibre-reinforced polymer (FRP) bars or bars that are part of a grid for use in non-prestressed internal reinforcement of concrete components of structures (e.g., bridges, buildings, and marine structures).

CSA Design Codes – CSA S6 and CSA S806



CSA Material Specifications (CSA S807)

Describes permitted constituent materials, limits on constituent volumes, and minimum performance requirements .

Provides provisions governing testing and evaluation for product qualification and QC/QA.

CSA Material Specifications (CSA S807)

Example of Durability Related Provisions:

1. **Limit on Constituent Material, e.g.**
   - Limits on diluents and certain fillers
   - Limits on low-profile additives
   - No blended resins
2. **Lower Limit on Glass Transition Temperature (Tg) & Cure Ratio**
   - Minimum cure ratio and Tg
3. **Material Screening Through Physical & Durability Properties**
   - Maximum void content
   - Maximum water absorption
   - Limits on mechanical property loss in different environment conditioning (Alkali)

CSA Material Specifications (CSA S807)

As an example, the specified limits (acceptance/rejection criteria) are:

Property	Specified Limit
Void Content	Less than 1%
Water absorption	Less than 0.75%
Cure Ratio	Greater than 95%
Glass Transition Temperature	100 °C (DSC)
Alkali Resistance in High pH Solution	Greater than 80% (without load); Greater 70% (with load)
Creep Rupture	greater than 35% of UTS for GFRP bars

CSA Material Specifications (CSA S807)

Qualification Tests Per GFRP Bar Size

1. **Tensile Strength:** 24 specimens
2. **Bond Strength:** 24 specimens
3. **Transverse Shear Strength:** 24 specimens
4. **Strength of bent bars:** 24 specimens
5. **Tensile Strength at cold temperature:** 24 specimens
6. **Fibre Content:** 9 specimens
7. **Transverse Coefficient of Thermal Expansion:** 9 specimens
8. **Void Content:** 9 specimens
9. **Water Absorption:** 15 specimens
10. **Cure Ratio:** 15 specimens
11. **Glass Transition Temperature:** 15 specimens
12. **Alkaline Resistance without/load:** 24 specimens
13. **Alkaline Resistance with/load:** 24 specimens
14. **Creep Rupture :** 24 specimens

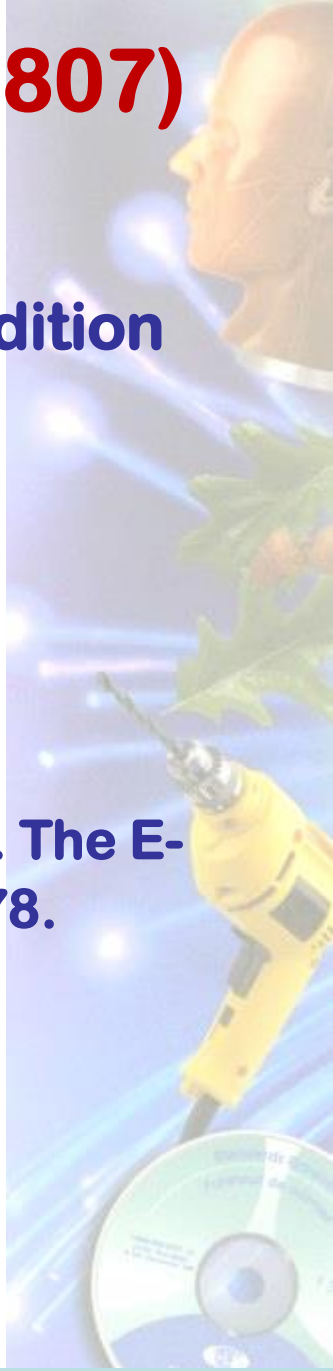
CSA Material Specifications (CSA S807)

At least five Canadian GFRP bar manufacturers qualified their products and obtained approvals from end-users and government authorities (such as MTO and MTQ):

1. **B&B FRP MANUFACTURING INC.** (MSTBAR)
2. **BP COMPOSITES INC.** (TUF-BAR)
3. **FIBERLINE COM POSITE CANADA INC.** (COMBAR)
4. **PULTRALL INC.** (V-ROD)
5. **TEMCORP INC.** (TEMBAR)

Hughes Brothers Inc., Marshall Composite Technologies Inc., Composite Rebar Technologies Inc., No Rust Rebar Inc., (USA), FiReP International AG (Switzerland), Asamer (Austria), Pultron Composites Ltd. (New Zealand), Magmatech Ltd (United Kingdom), Galen (Russia), etc.

CSA Material Specifications (CSA S807)



Summary of the major changes in the SECOND edition of CSA S807

- The new CSA S807 standard includes FRP bars made of **basalt fibres.**
- Only **E-CR glass fibers** is permitted for GFRP bars. The E-CR glass fibers shall meet the requirements of ASTM D578.

CSA Material Specifications (CSA S807)

Summary of the major changes/additions in the new edition of CSA S807

Fine Aggregate for Sand Coating:

Fine aggregate sources shall be demonstrably known to be free of reactions with concrete that produce expansion or cracking, owing to the criticality of the sand particles in the bond between the FRP reinforcing bar and concrete.

The fine aggregate sources shall be specifically free of alkali aggregate reactions with concrete, such as alkali-silica or alkali-carbonate, and come from sources that have demonstrated such compliance.

CSA Material Specifications (CSA S807)

Summary of the major changes/additions in the new edition of CSA S807

Production lot size (straight bars)

The production lot size of straight bars shall be divided in sub-lots of 20,000 m of bars up to a maximum of 60,000 m of bars of the same diameter.

QC tests as indicated in Tables 3 and 4 for the first sub-lot of 20,000 m.

For the two subsequent sub-lots of 20,000 m each, the QC tests shall include:

- fibre content;
- glass transition temperature;
- cure ratio;
- water absorption for one week; and
- apparent Horizontal Shear Strength.

CSA Material Specifications (CSA S807)

Summary of the major changes/additions in the new edition of CSA S807

Production lot size (bent bars)

The production lot size of bent bars of congruent shape and anchor-headed bars shall be divided in sub-lots of 2000 pieces up to a maximum number of 6000 pieces.

QC tests as indicated Tables 3 and 4 for the first sub-lot of 2000 pieces.

For the subsequent two sub-lots of 2000 pieces each, the QC tests shall include:

- fiber content;
- glass transition temperature;
- cure ratio;
- water absorption for one week; and
- apparent Horizontal Shear Strength.

CSA Material Specifications (CSA S807)

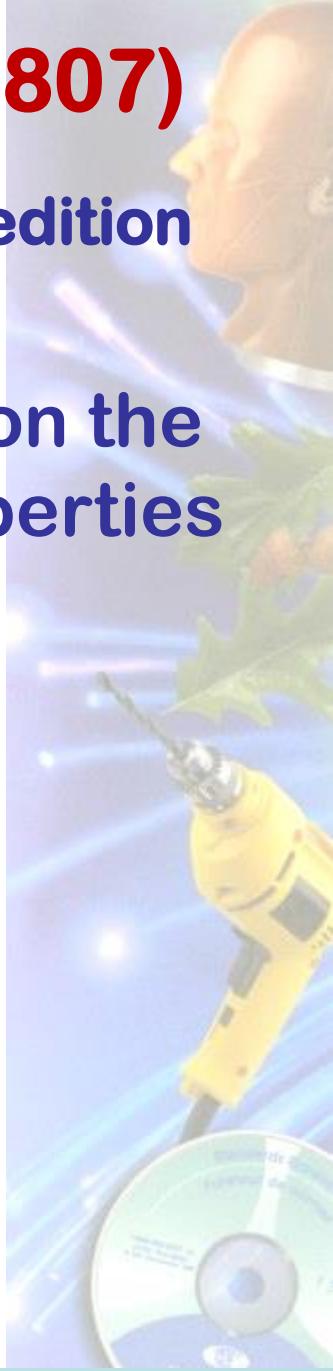
Summary of the major changes in the upcoming edition of CSA S807

- **Alkali resistance in high pH solution (without load), the tensile capacity retention ≥ increased from 80% to 85% UTS.**
- **Alkali resistance in high pH solution (with load), the tensile capacity retention ≥ increased from 70% to 75% UTS.**

CSA Material Specifications (CSA S807)

Summary of the major changes in the upcoming edition of CSA S807

- **Qualification testing** shall be performed on the mechanical, physical, and durability properties relating to both short- and long-term performance of **straight and bent bars.**

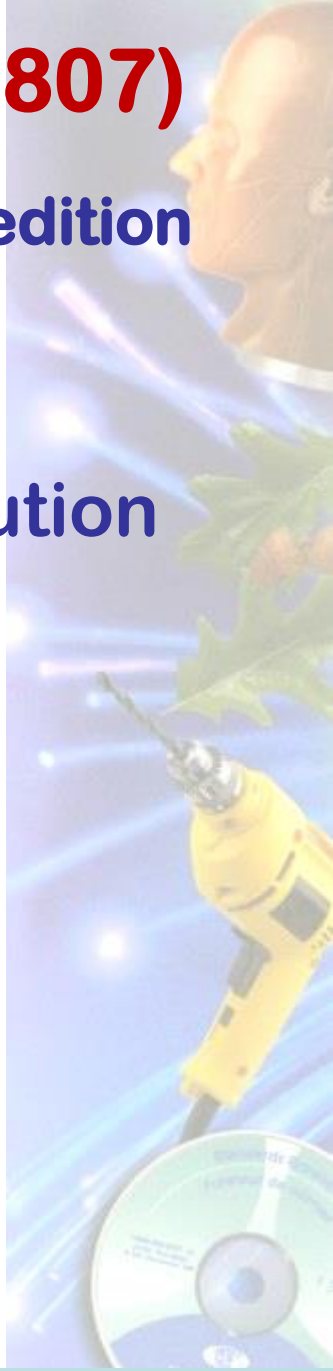


CSA Material Specifications (CSA S807)

Summary of the major changes in the upcoming edition of CSA S807

Interlaminar shear strength (Apparent Horizontal Shear Strength) in high pH solution at 60°C.

Reference: 50 MPa for GFRP Bars
Strength retention: 85%



CSA Material Specifications (CSA S807)

Cross Sectional Area:

A lower and an upper limit for cross-sectional area of GFRP bars have been defined. The lower limit will be 95 % of the nominal cross-sectional area. The upper limit will be ≤ 120 % of the nominal cross-sectional area for bars of 20 mm and smaller; and ≤ 115 % for bars larger than 20 mm.

Same as the New ASTM GFRP BAR SPECS

Diameter mm	Nominal cross-sectional area (mm2)	Minimum measured cross-sectional area (mm2)	Maximum measured cross-sectional area (mm2)
8	50	48	79
10	71	67	104
13	129	119	169
15	199	186	251
20	284	268	347
22	387	365	460
25	510	476	589
30	645	603	733
32	819	744	894
36	1006	956	1157

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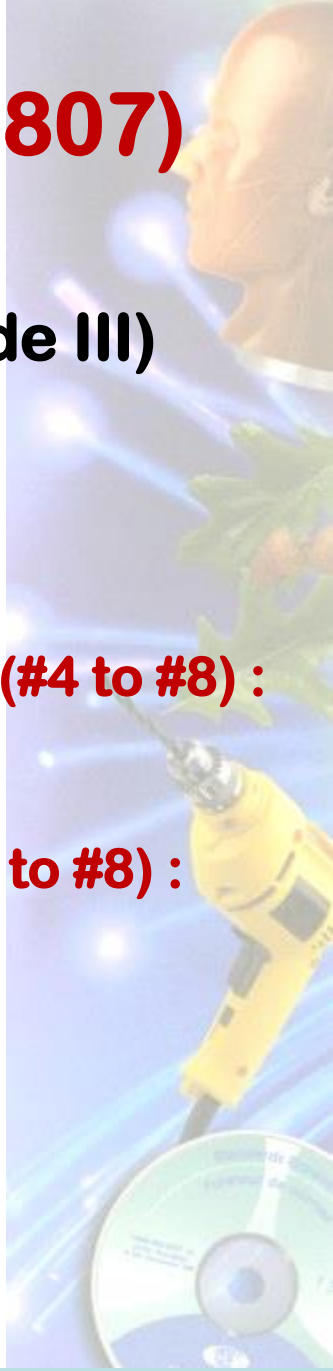
CSA Material Specifications (CSA S807)



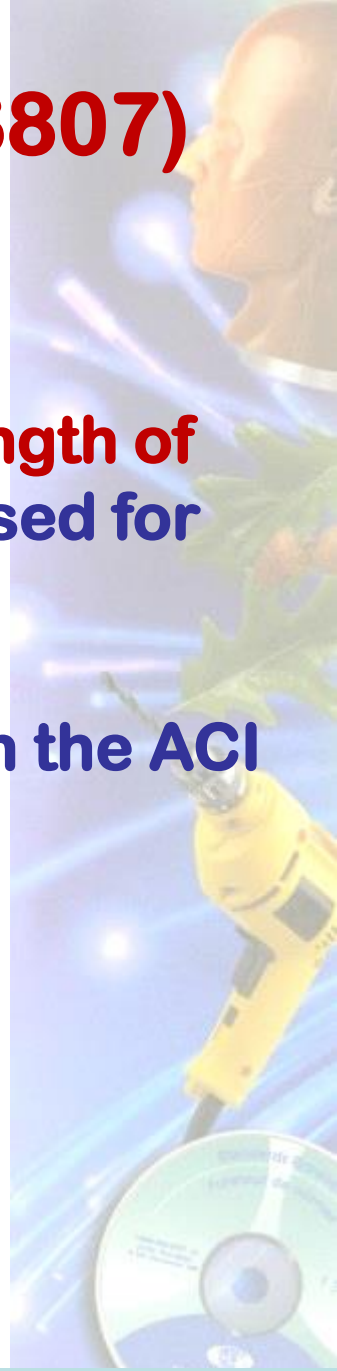
MinimumTensile Strength for GFRP Rebars (Grade III)

Minimum tensile strength for straight bars (#4 to #8) :
1000 MPa (145 ksi)

Minimum tensile strength for straight portion of bent bars (#4 to #8) :
1000 to 850 MPa (145 to 125 ksi)

Minimum tensile strength for bent portion of bent bars (#4 to #8) :
450 to 390 MPa (65 to 57 ksi)

CSA Material Specifications (CSA S807)



- A new testing method for determining the strength of the bent portion of GFRP bars has been proposed for qualification & quality control testing.
- This method is viewed as more convenient than the ACI 440.3R B.5.

Annex E (normative)
Method of Test for Determining the Strength of the Bent Portion of FRP Reinforcing Bars

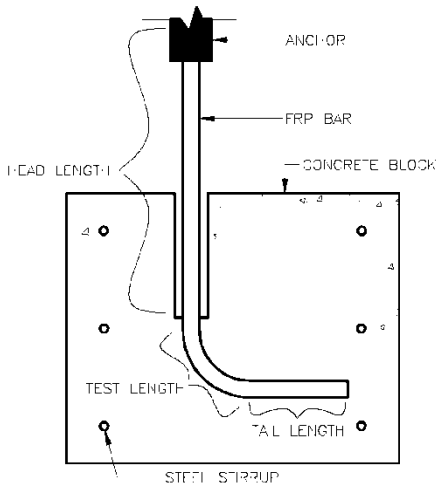


Figure 1 – General Arrangement

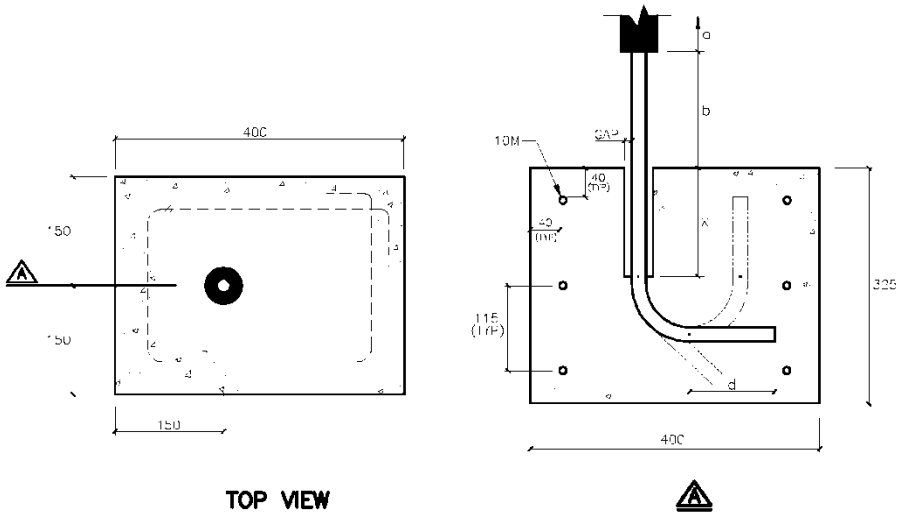
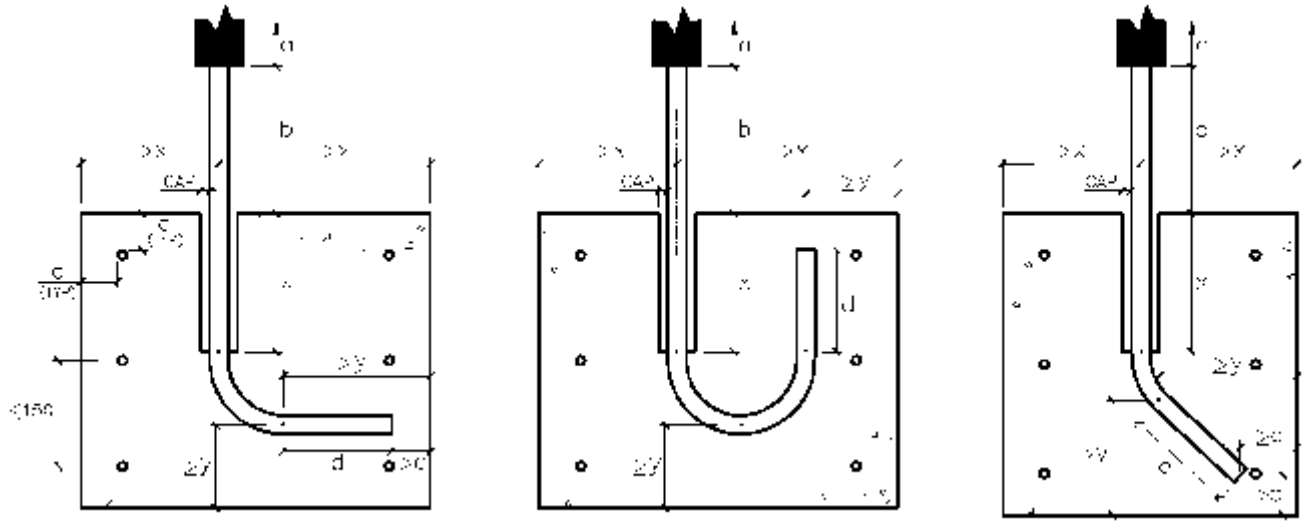


Figure 2 – Dimensional Arrangement of the Block
(nominal diameter of 20 mm or less, bent at an angle between 0 and 180 degrees, and manufactured with a bend-radius-to-bar-diameter ratio of 4 or less)

Annex E (normative)
Method of Test for Determining the Strength of the Bent Portion of FRP Reinforcing Bars



A custom block shall be made for large sizes of bars and bent

Thank you for your attention

Questions?

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