Hollow Structural Sections

CSA G40.21 50W or Metric 350W Class H

What is CSA G40.21 50W/350W Class H?

In accordance with CSA G40.21, hollow sections—welded or seamless round, square, rectangular or special-profile structural tubing—are available in two classes:

Class C
Hollow sections that are cold-formed from a section produced either by a seamless process or by an automatic electric-welding process producing a continuous weld.

Class H
(i) Hollow sections made by a seamless or furnace-butt welding (continuous welding) or automatic electric-welding process, and hot-formed to final shape; or

(ii) Hollow sections made by a seamless automatic electric-welding process producing a continuous weld, and cold-formed to final shape; subsequently stress-relieved by heating to a temperature of 450°C (850°F) or higher, followed by cooling in air.

CSA G40.21-2013

Description: General requirements for rolled or welded structural quality steel.

Intended use: General specification for plates, shapes, hollow sections, sheet, sheet piling, cold-formed channels and bars used in construction.

What are the benefits of Class H?

- ✔ Increased axial capacity in accordance with CSA S16-14
- ✔ Savings in mass up to 20%
- ✔ Produced every 2 weeks in our Harrow Plant

Why do we produce material to a Class H Specification?

In cold-formed HSS, we induce residual stresses in the finished product due to the rolling process. We begin with flat strip, form it into a round, weld it and subsequently shape it into to a square or rectangular section.

The residual stresses we induce are concentrated in the four corners and the weld line. Heat treating in a furnace will stress-relieve the product. The chemical properties of the material are not altered in any way; the physical properties might see a slight decline in the yield and tensile strength and an increase in the elongation, but all changes would be minimal. As can be seen Table 1, the properties required by the specification for Class H are identical with Class C.

It is important to note that Class H is only available under the CSA G40.21 specification. It is not available for ASTM A500 in the United States.

TABLE 1

Specification	G40.21
Strength Levels	50W/350W
Yield Strength	50,000 PSI (350 MPa) Minimum
Tensile Strength	65,000–90,000 PSI (450–620 MPa)
Elongation % in 2"	22 Minimum
Chemistry Levels	50W/350W
Carbon	.23 Maximum
Manganese	.50–1.50
Phosphorous	.040 Maximum
Sulphur	.050 Maximum
Silicon	.40 Maximum
Grain Refining Elements	.10 Maximum

Atlas Tube is the leading producer of HSS in Canada.

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How do we produce Class H material?

Material produced for CSA G40.21 50W/350W Class H is run just as we would run CSA G40.21 50W/350W Class C. This material is then moved to the furnace for heat treating. The furnace cycle begins by heating the material from the ambient temperature of the warehouse at a rate of 125°F (52°C) per hour to the maximum temperature of 890°F (476°C). Once stable at 890°F (476°C), the temperature is held for 30 minutes. The load is then allowed to cool at a rate of 200°F (93°C) per hour from 890°F (476°C) back to ambient temperature. The material is removed from the furnace and moved to the shipping area for direct shipment to our customers. Tensile samples (heat-treated with the load) are pulled, and the results are recorded for each heat number, tube size and gauge. The material is checked for straightness and surface condition.

Savings in mass of almost 20% are possible.

CSA S16-14, Clause 13.3.1 allows for n = 2.24 when specifying CSA Class H material. This will lead to higher axial capacities than those calculated for CSA Class C or ASTM A500 (see Table 2). This higher axial capacity could lead to using smaller sections and subsequent mass savings over Class C and A500, as much as 20%. Even though there is a cost premium for Class H over Class C and A500, the potential for mass savings will translate to project cost savings.

TABLE 2 — AXIAL CAPACITY

8 X 8 X ¼

	A500, GRADE C	CSA CLASS C	CSA CLASS H
KL= 6m (19'–8')	829 Kn (186 kips)	920 Kn (207 kips)	1130 Kn (254 kips)

Class H:
36% more capacity than A500
23% more capacity than Class C

12 X 8 X ¼

	A500, GRADE C	CSA CLASS C	CSA CLASS H
KL= 8m (26'–3")	675 Kn (152 kips)	780 Kn (178 kips)	951 Kn (214 kips)

Class H:
41% more capacity than A500
20% more capacity than Class C

** Source: CISC Handbook of Steel Constructions, Tenth Edition (2014).*

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