

# The Performance and Protection of Bolts in Structural Connections at High Temperature



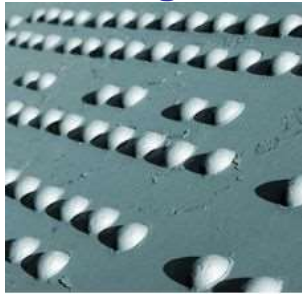
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# Types of Connections

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- Constructional steelwork unavoidably involves connections

## Riveting



Once popular  
now rare

## Bolting



Preferable for site  
construction

## Welding



Preferable for  
fabrication in shop



- Bolts
  - Ordinary bolts
  - High strength friction grip bolts



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# New Rapid Method of Fire Protection

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- Bolt caps – new **nano-additive heat shroud injection** moulding technology driven by
  - **Robust product**
  - **Aesthetics** – complementing intumescent coatings
  - **Easy of fitting** – 3 seconds gives 3 hours fire protection
  - **Speed of Build & Productivity** – can be fitted when floor levelling and bolt tightness checking **reducing build programme** time
- **Eliminates need for painting and wet trades on site** and working time at height
- Eliminates need to visit connections **several times** to apply intumescent to specification.
- **Reduced lifetime costs** – caps lasts building lifetime.



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# New Bolt Cap Technology

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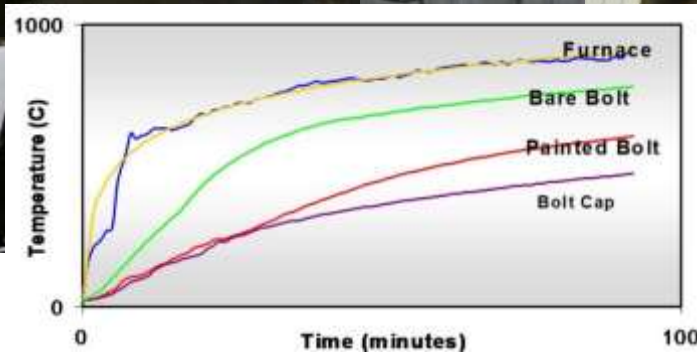
- **Pre-manufactured bolt cap**
  - One thickness
  - Self extinguishing material
- **Fire tested**
  - **3 hr Cellulosic** rating per ASTM UL263
  - **2 hr Cellulosic** rating per BS476
  - **2 hr Hydrocarbon** rating per UL1709
  - **2 hr Jet Fire** rating per ISO 22899
- **Installation**
  - Snapped into place
  - Corrosion resistant clips
  - No surface prep or primer
- **Successful Installation History** in external and internal sites with extensive testing
- **Not affected** by extremes of environment



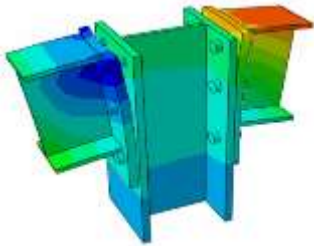
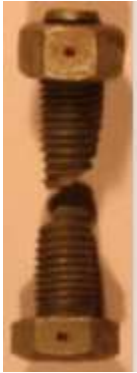
# Bolt Cap Fire Testing

## Extensively Tested, Evaluated, Certified & Accepted

- Lloyds Certified
- Astra Zeneca Best Design Practise
- Gulf Civil Defence Listed
- Aramco Accepted
- Foster Gold Standard



# Painting Connections



- The Twin Towers & WTC 7 demonstrated **the importance of bolted connection integrity**
- WTC towers & WTC 7 fire code provisions **did not specify a fire rating for the connections** & it is not clear what fire rating the connecting elements had and whether the applied fireproofing achieved it
- ASFP yellow book recommends the **same paint dft on bolts** as the structure
- This can mean for **2 hour protection 6-8 coats of intumescent paint plus top coat** and drying time
- Whether hand or spray applied even coating can be difficult & can have **uncoated areas as shown**
- A typical fire escape stair way alone can have ~7000 bolts
- This makes proper bolt protection a **daunting & time consuming task**
- **Bolt caps eliminate this uncertainty and risk**
- Bolt Caps can be applied when erecting the steel

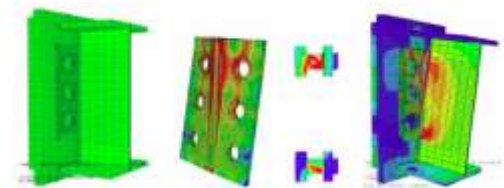


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# Summary

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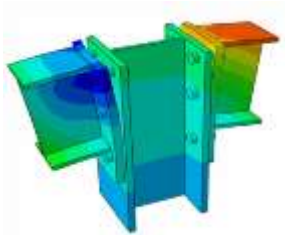
- **Bolted connections are critical** to structural integrity.
- **Paint protected bolted** connections can be under-protected in fire, potentially leading to premature structure collapse.
- New bolt cap technology ensures **optimal fire protection**
  - **Fast**, competitive installed cost
  - **Universal** application with variety of PFP systems
  - **Protection** from cellulosic, hydrocarbon & jet fire scenarios



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## Conclusion

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- Typical steel frame building means **large numbers of connection visits to paint** the bolted connection properly by cherry picker.
  - **Cost and time is eliminated** if the bolt cap is fitted when floor levelling.
  - **Quality assured protection** at minimum cost with no wet trades on site, no messy connections or connections with insufficient paint.
  - **Caps give cost saving over the proper painting cost** carried out to the fire certificate test standard, and **save significant build programme time**.
  - **Easy subsequent gloss/colour painting** for exposed connections.
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