



FIRE INSTRUCTOR I

Student Presentation Lesson Plan

9-Impact of Fire on Metal

Outline of Instruction

Objective

Upon successful completion of this lesson, the student shall be able to:

- Describe the impact of fire on common building materials. [NFPA® 1001, 5.3.4, 5.3.10, 5.3.12]

Instructor Directions

1. Set up non-projectable training aids
 - a. Chart pad to include:
 - i. Title Page
 - ii. Acronym
 - iii. Summary
 - iv. 1 Application scenario
 - v. 2 Evaluation questions
2. Set up projectable training aids (LCD projector & computer)
3. Present lecture utilizing this outline of instruction, non-projectable and projectable audio visual aids.
 - a. Overall time 18 min. (set up, present topic, and take down of audio visuals)
 - b. Presentation time 8-12 min. (presentation time is part of the 18 min)
4. Breakdown of projectable training aids.

Reference Stowell, F.(2013). Essentials of Fire Fighting and Fire Department Operations (6th ed.). Upper Saddle River, N.J.: Brady Pub.; ISBN# 978-013-314080-4

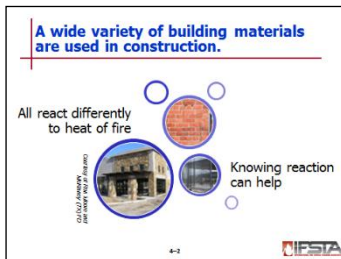
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Preparation

Introduction

- Instructor introduction
- Objectives
- Preparation Step

Presentation



Building Materials

Variety used in construction

All react differently when exposed to heat of fire

Knowledge of reaction will give an idea of what to expect from a fire in that type of construction

Metal

Used to provide structural support, decorative covering on exterior walls, stairs, door and window frames, ductwork, pipes, and fasteners

Effect of heat will depend on type of metal and if it is exposed or covered

Iron

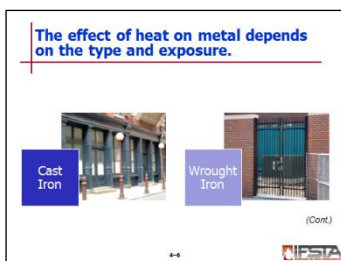
Cast iron

Commonly used in 19th Century for structural support beams and columns, stairs, balconies, railings, elevators, facades of buildings

Stands up well to fire, intense heat

May crack or shatter when rapidly cooled with water

During fire, bolts or other connections holding cast iron components can fail – Causing them to fall



Failure can also result from bolts rusting through, mortar becoming loose around bolt

Wrought iron

Used in buildings of early 1800s for nails, straps, tie rods, railings, balconies

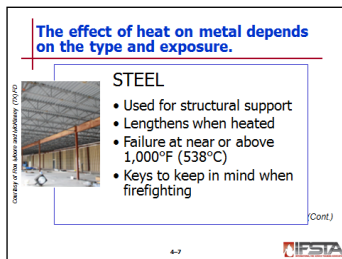
Used after 1850 for rail and I-beams, channels, support columns

Used today for decorations in construction of gates, fences, balcony railings

Construction

Cast iron – Bolted or screwed

Wrought iron – Usually riveted or welded together



Steel

Uses

Primary material used for structural support of large modern buildings

Stairs, wall studs, window and door frames, balconies, railings

Reinforce concrete floors, roofs, walls

Structural members lengthen (elongate) when heated

A 50 foot (15 m) beams may elongate as much as 4 inches (100 mm) when heated to about 1,000°F (538°C)

If restrained from movement at ends, buckles and fails somewhere in middle

Failure anticipated at temperatures near or above 1,000°F (538°C) –

Exact temperature varies based on variables

Size of member

Load it is under

Composition of steel

Geometry of member

Effect of heat reduced when fireproofing materials used – Such as sprayed-on concrete or sprayed-on insulation

When fire fighting

Be aware of type of members used in particular structure

Determine how long members have been exposed to heat – Gives indication when failure may occur

Remember critical temperature can be easily reached at ceiling level from rising heat, smoke

Always consider effect of heat on members even if you cannot see

Elongating steel can push out load-bearing walls, cause collapse

If walls withstand elongation, steel will fail and sag somewhere in middle causing collapse of upper floors, roof

Water can cool structural members and stop elongation – Reducing risk of collapse


Aluminum

Uses

Decorative/functional – Roofing, flashing, gutters, downspouts, window and door frames, exterior curtain wall panels

The effect of heat on metal depends on the type and exposure.

Aluminum	Tin	Copper	Lead
<ul style="list-style-type: none">• Many uses• Affected by heat more rapidly than steel	<ul style="list-style-type: none">• Used for ceiling tiles, roofs	<ul style="list-style-type: none">• Found in wiring, pipes, gutters, decorative elements	<ul style="list-style-type: none">• Found in pipes, flashing, stained or leaded glass windows

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Residential uses – Sun rooms,
screened porches, car ports,
awnings

Aluminum framing and support wires
support acoustical tile ceilings –
Can create entanglement hazard

Will be affected by heat more rapidly than
steel

Other metals – Fail when exposed to excessive
amounts of heat

Tin – Used to produce metal ceiling tiles,
also as roof covering

Copper – Found in wiring, pipes, gutters,
decorative elements

Lead – Found in pipes, flashing, as
component of stained or leaded glass
windows

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Chart Pad:

Title Page

- Name, Department, Title of Presentation

Acronym

- **L.I.P.** (Life Safety, Incident Stabilization, Property Conservation)
instructor relates these priorities to the lecture

Summary (2-4 key points)

- Instructor reviews 2-4 key points of the lesson plan to clarify uncertainties, prevent misconceptions, increase learning and improve retention

Application (1 scenario)

- The student is given a scenario where the student will apply all of the knowledge that was given in the lecture. *This is not a question*, it is merely the explanation of the scenario.

Evaluation (2 questions)

- Instructor should ask students 2 direct questions that were presented during the lesson. *Answer to the questions must be give after asking the question.*