Carboline Company
2150 Schuetz Road
St. Louis, MO 63146
Main: 314-644-1000
Fireproofing Tech: 314-665-3291
www.Carboline.com

Thermo-Sorb® VOC

Solvent Based Intumescent

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Thermo-Sorb® VOC

PRODUCT DATA SHEET

SELECTION & SPECIFICATION DATA

Generic Type	A single package, solvent based intumescent coating designed for the fire protection of interior structural steel.
Description	A decorative thin film intumescent coating designed for the fire protection of steelwork for up to a 3 hour fire rating, depending on the design. The recommended use for this product is fireproofing of interior steel beams, columns, tubes, and pipes.
Features	• UL/ULC listed – designs for many types of steel sections. Up to 3 hour fire ratings for both interior general purpose and interior conditioned space applications. • Decorative finish – provides a slightly textured, decorative finish. • Durable finish – provides a hard dust free surface resistant to normal wear. • VOC compliant • LEED compliant • Chemical resistant in EV Assembly, EV Battery, and Computer Chip Plants. • Extensive outgas testing for controlled cleanroom and sterile environments.
Color	S800 (White)
Finish	Smooth to slight orange peel
Primer	Product must be applied over a compatible primer. If the steel has already been coated with an existing primer, refer to Carboline Technical Service for advice before applying. Contact Carboline Technical Service for a complete list of approved primers.
Fireproofing Wet Film Thickness	45 mils (1.14 mm) per coat During the drying process, the coating will shrink due to the evaporation of solvent.
Fireproofing Dry Film Thickness	35 mils (0.89 mm) per coat Must be applied to the specified DFT and be dry before applying a topcoat. The dry film thickness shall be checked using an electronic or magnetic thickness gauge.
Practical Yield	1,259 ft² at 1 mil (116.9 m² at 25 microns) Practical yield based on ASTM D2697 (utilizing Linseed Oil). Testing performed after a 72 hour drying period of the sample. Allow for loss in mixing and application.
VOC Value(s)	Per EPA Method: 1.18 lb/gal (142 g/L) These are nominal values and may vary slightly with color. Product contains VOC-exempt dimethyl carbonate and t-butyl acetate. Check local regulations regarding product usage.
Mesh	Use High Temp Mesh for 3 hour hollow section ratings. Contact Carboline Technical Service for specific design details.
Limitations	Not for use in exterior environments or for interior steelwork that will be exposed to freeze/thaw cycling or long-term surface temperatures over 140°F (60°C) in normal use.
Topcoats	For interior conditioned space, topcoats are optional. For interior general purpose, Carboline approved topcoats are required. Product must be applied to the specified DFT and be dry before applying a topcoat. Shore DO readings are to be taken to verify level of cure. Press the Shore DO gauge firmly to the surface and hold for a minimum of 10 seconds. When the Shore DO value

SELECTION & SPECIFICATION DATA

is 80 and the drop off is less than 5 points, the material is considered dry and ready for top coat application. The choice of topcoat will depend on project requirements. Contact Carboline Technical Service for a complete list of approved topcoats.

SUBSTRATES & SURFACE PREPARATION

General

All surfaces must be primed with compatible primer and be clean, dry and free of oil, grease, loose mill scale, dirt, dust or other materials which would impair the bond of the product to the substrate. Surface preparation must meet the requirements of the primer being used. The general requirement for interior steel is SSPC-SP2 or SP3. Contact Carboline Technical Service for recommendations and specific primer requirements.

Painted/Primed Structural Steel

Existing coatings must attain a minimum 3A rating in accordance with ASTM D3359 Method A, X cut adhesion test. If acceptable, clean and lightly abrade in accordance with SSPC-SP2 or SP3 to roughen and de-gloss the surface. If not acceptable, the coating must be removed and areas re-primed with a compatible primer. If primer coating has acceptable adhesion, but is not compatible or compatibility is unknown, a tie-coat primer can be applied as a bonding or barrier coating. Contact Carboline Technical Service for a list of approved tie-coat primers and specific primer requirements.

Primer recoat intervals may vary from the published product datasheet when using under intumescent fireproofing products. Consult Carboline Technical Service for recommended cure times before applying Carboline intumescent products.

PERFORMANCE DATA

All test data was generated under laboratory conditions. Field testing results may vary.

Test Method	Results
ASTM D2240 Hardness	Shore DO - 85+ (fully dried) Shore DO - 80 (dry for top coating)*
ASTM D256 Impact	0.16 ft-lb/in
ASTM D4541 Bond Strength	550 psi (3.79 MPa)
ASTM D4541 Bond Strength	Typical Field Value 200 psi (1.38 MPa)
ASTM D695 Compressive Strength	1,187 psi (8.1 MPa)
ASTM E84 Surface Burning	Class A
Density	79 pcf (1.26 g/cm³)

All values derived under controlled laboratory conditions unless otherwise noted.
*Shore DO readings are to be taken to verify the level of cure. Press the Shore DO gauge firmly to the surface and hold for a minimum of 10 seconds. When the Shore DO value is 80 and the drop off is less than 5 points, the material is considered dry and ready for top coat application.

MIXING & THINNING

Mixing

Product must be mixed using a 1/2" (12.7 mm) electric or air driven drill with a slotted paddle or Jiffy mixer blade (300 rpm under load). Mix material for a minimum of 5 minutes to achieve the necessary texture required before spraying.

Thinning

Thinning is not required. For optimum aesthetics, product may be thinned up to 5% with Methyl Acetate, Thinner 242E, or Plasite Thinner 19 maximum 32 oz. (0.95 L) per 5 gallons (18.9 L). Thinning will affect the film build properties and extend the cure time of the coating.

APPLICATION EQUIPMENT GUIDELINES

Listed below are general equipment guidelines for the application of this product. Job site conditions may require modifications to these guidelines to achieve the desired results.

Airless Spray	Use 1.35 gal. (5.1 L) per minute electric airless (minimum) to provide an operating pressure of 3,000 psi (204 bar). Must have 30 mesh inline filter installed. Remove rock catcher from siphon tube.
Spray Gun	Silver Gun with gun swivel, Contractor Gun (with filter removed) or equilavent
Spray Tips	0.021-0.027" (Use Graco heavy duty RAC non diffuser tips and housing)
Fan Size	6-10" (152-254 mm) depending on section being sprayed
Hose Length	150' (45 m) 75’ (22 m) *
Material Hose	3/8" (9.5 mm) I.D. minimum 1/2” (12.7 mm) I.D. minimum *
Whip Hose	1/4" (6.3 mm) I.D. minimum (optional)

APPLICATION PROCEDURES

General	May be applied by spray, trowel, brush or roller. Spray application is recommended for the optimum production, coverage and finish. When applying by trowel, brush or roller, work from a small container and mix material frequently. The original pail should be kept tightly closed.
Airless Spray	A single coat built up with a number of quick passes allows greater control over quantities, thickness and finish. In most conditions, it is advantageous to apply two thin coats rather than one thick coat.
Application Rates	At an ambient temperature of 70°F (21°C), the following application rates are applicable: Spray / trowel: 45 mils (1.14 mm) per coat (wet) Brush / roll: 10 mils (0.25 mm) per coat (wet) 4 hour recoat time between coats
Wet Film Thickness	Frequent thickness measurements with a wet film gauge are recommended during the application process to ensure uniform thickness.
Dry Film Thickness	Final thickness must be measured using an electronic dry film thickness gauge. For method of thickness determination and tolerances refer to: AWCI Technical Manual 12-B (Standard Practice for the Testing and Inspection of Field Applied Thin Film Intumescent Fire Resistive Materials).

APPLICATION CONDITIONS

Condition	Material	Surface	Ambient	Humidity
Minimum	70°F (21°C)	41°F (5°C)	41°F (5°C)	0%
Maximum	100°F (38°C)	125°F (52°C)	110°F (43°C)	85%

* Thermo-Sorb VOC may be applied when the material temperature range is between 51°F (10.5°C) and 69°F (20.5°C) provided that the material hose used shall be a minimum 1/2” (12.7 mm) I.D., shall be no greater than 75’ (22 m) in length and no whip line is to be used.
Steel surface temperature should be a minimum of 5°F (3°C) above the dew point. Heavy rain or water running over the surface of recently applied material can cause surface patterning if the material has not formed a skin.

CURING SCHEDULE

Surface Temp.	Recoat
77°F (25°C)	4 Hours

For optimum curing, it is recommended to apply one coat at 45 mils (1143 microns) wet per day. Drying Time will vary with temperature and humidity conditions. Shore DO readings are to be taken to verify the level of cure. Press the Shore DO gauge firmly to the surface for a minimum of 10 seconds. When the Shore DO value is 80 and the drop off is less than 5 points, the material is considered dry and ready for top coat application. Air movement and thinner coats will assist drying. Higher film thicknesses will require longer drying times for topcoating. Consult Carboline Technical Service for specific details.

TESTING / CERTIFICATION / LISTING

Underwriters Laboratories, Inc.

Thermo-Sorb® VOC has been tested in accordance with ASTM E-119 (UL 263) at Underwriter's Laboratories, Inc. Thermo-Sorb® VOC is listed by UL and ULC for the following designs:
Wide Flange Columns: X660
Tube Columns: X661
Pipe Columns: X662
Restrained and Unrestrained Beams: N619
Beams (Unprotected Deck): D946

The product should be applied in accordance with the appropriate design.

City of Los Angeles | Report: RR 25484

CLEANUP & SAFETY

Cleanup | Pump, Gun, Tips and Hoses and mixer should be cleaned at least once per day with: Plasite Thinner 19, Thinner 242E, Thinner 2, Toluene, MEK, MIBK or Xylene.

Safety | Read and follow all caution statements on this product data sheet and on the SDS for this product. Employ normal workmanlike safety precautions. Use adequate ventilation. Keep container closed when not in use.

Overspray | All adjacent and finished surfaces shall be protected from damage and overspray.

Ventilation | When used in enclosed areas, thorough air circulation must be used during and after application until the coating is cured. The ventilation system should be capable of preventing the solvent vapor concentration from reaching the lower explosion limit for the solvents used. User should test and monitor exposure levels to insure all personnel are below guidelines. If not sure or if not able to monitor levels, use MSHA/NIOSH approved respirator.

MAINTENANCE

General | If coating becomes damaged, rebuild required thickness by spray or trowel. When dry, smooth and finish with approved topcoat to match. Damaged areas must be abraded back to a firm edge by sanding or scraping. The topcoat should be abraded back by 1" (25.4 mm) from the damaged area. The surface must be clean and dry before re-applying product. The coating shall then be built back to the original thickness, allowed to dry, then over-coated with the specified topcoat or system.

PACKAGING, HANDLING & STORAGE

Packaging | 5 gallons (18.9 L)

Shelf Life | 18 Months (when kept at recommended storage conditions and in original unopened containers).

PACKAGING, HANDLING & STORAGE

Storage	Store indoors in a dry environment between 32-100°F (0-38°C). Excursions down to 0°F (-18°C) are acceptable during material transportation.
Shipping Weight (Approximate)	60 lb. (27.2 kg) per 5 gallon pail (18.9 L)
Flash Point (Setaflash)	45°F (7°C)

WARRANTY

To the best of our knowledge the technical data contained herein is true and accurate on the date of publication and is subject to change without prior notice. User must contact Carboline Company to verify correctness before specifying or ordering. No guarantee of accuracy is given or implied. We guarantee our products to conform to Carboline quality control. We assume no responsibility for coverage, performance, injuries or damages resulting from use. Carbolines sole obligation, if any, is to replace or refund the purchase price of the Carboline product(s) proven to be defective, at Carbolines option. Carboline shall not be liable for any loss or damage. NO OTHER WARRANTY OR GUARANTEE OF ANY KIND IS MADE BY CARBOLINE, EXPRESS OR IMPLIED, STATUTORY, BY OPERATION OF LAW, OR OTHERWISE, INCLUDING MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. All of the trademarks referenced above are the property of Carboline International Corporation unless otherwise indicated.

Safety Data Sheet

Prepared in Accordance with HCS 29 C.F.R. 1910.1200

1. Identification of the Substance/Mixture and the Company/Undertaking

1.1 Product Identifier NC25S1NL

Product Name: THERMO-SORB VOC

Revision Date: 10/11/2023

Supercedes Date: 06/14/2023

1.2 Relevant identified uses of the substance or mixture and uses advised against

Monocomponent industrial coating - Industrial use.

1.3 Details of the supplier of the safety data sheet

Manufacturer:

Carboline Global Inc.
2150 Schuetz Road
St. Louis, MO USA 63146

Regulatory / Technical Information:
Contact Carboline Technical Services at
1-800-848-4645

Datasheet Produced by: Beebe, Hayli - regulatory@carboline.com

1.4 Emergency telephone number:

CHEMTREC 1-800-424-9300 (Inside US)
CHEMTREC +1 703 5273887 (Outside US)
HEALTH - Pittsburgh Poison Control 1-412-681-6669

2. Hazard Identification

2.1 Classification of the substance or mixture

Carcinogenicity, category 1A
Flammable Liquid, category 2
Reproductive Toxicity, category 2

2.2 Label elements

Symbol(s) of Product

Signal Word

Danger

Named Chemicals on Label

MELAMINE, TOLUENE

HAZARD STATEMENTS

Flammable Liquid, category 2	H225	Highly flammable liquid and vapour.
Carcinogenicity, category 1A	H350-1A	May cause cancer.
Reproductive Toxicity, category 2	H361	Suspected of damaging fertility or the unborn child.

PRECAUTION PHRASES

P201	Obtain special instructions before use.
P202	Do not handle until all safety precautions have been read and understood.
P210	Keep away from heat/sparks/open flames/hot surfaces. - No smoking.
P235	Keep cool.
P284	Wear respiratory protection.
P308+313	IF exposed or concerned: Get medical advice/attention
P403+233	Store in a well-ventilated place. Keep container tightly closed.

2.3 Other hazards

No Information

Results of PBT and vPvB assessment:

The product does not meet the criteria for PBT/VPvB in accordance with Annex XIII.

3. Composition/Information On Ingredients

3.2 Mixtures

Hazardous ingredients

Name According to EEC	EINEC No.	CAS-No.	%	Classifications	
DIMETHYL CARBONATE	210-478-4	616-38-6	10 - <25	H225	
MELAMINE	203-615-4	108-78-1	2.5 - <10	H351-361-373	Carc. 2, Repr. 2, STOT RE 2
TERT-BUTYL ACETATE	208-760-7	540-88-5	2.5 - <10	H225-332-335-336	Acute Tox. 4 Inhalation, Flam. Liq. 2, STOT SE 3 NE, STOT SE 3 RTI
TITANIUM DIOXIDE	236-675-5	13463-67-7	2.5 - <10		

TOLUENE	203-625-9	108-88-3	2.5 - <10	H225-304-315-319-332-335-336 -361-370-412	Acute Tox. 4 Inhalation, Aquatic Chronic 3, Asp. Tox. 1, Eye Irrit. 2, Flam. Liq. 2, Repr. 2, Skin Irrit. 2, STOT SE 1, STOT SE 3 NE, STOT SE 3 RTI
METHYL ISOAMYL KETONE	203-737-8	110-12-3	1.0 - <2.5	H226-332-361	
METHYL ETHYL KETONE	201-159-0	78-93-3	1.0 - <2.5	H225-319-336	Eye Irrit. 2, Flam. Liq. 2, STOT SE 3 NE
ALKANES, C14-16, CHLORO	287-477-0	1372804-76-6	1.0 - <2.5		
CERAMIC REFRACTORY FIBERS	604-314-4	142844-00-6	0.1 - <1.0	H350	

CAS-No.	M-Factors
616-38-6	
108-78-1	
540-88-5	
13463-67-7	
108-88-3	
110-12-3	
78-93-3	
1372804-76-6	
142844-00-6	

Remarks: CAS No 13463-67-7: Note 10

Additional Information: The text for GHS Hazard Statements shown above (if any) is given in Section 16.

4. First-aid Measures

4.1 Description of First Aid Measures

AFTER INHALATION: Give oxygen or artificial respiration if needed. Remove person to fresh air. If signs/symptoms continue, get medical attention.
AFTER SKIN CONTACT: In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. If skin irritation persists, call a physician.
AFTER EYE CONTACT: Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician.
AFTER INGESTION: Do NOT induce vomiting. Never give anything by mouth to an unconscious person. If swallowed, call a poison control centre or doctor immediately.

4.2 Most important symptoms and effects, both acute and delayed

Harmful if swallowed. Irritating to eyes and skin. Risk of serious damage to the lungs (by aspiration). Vapours may cause drowsiness and dizziness.

4.3 Indication of any immediate medical attention and special treatment needed

No information available on clinical testing and medical monitoring. Specific toxicological information on substances, if available, can be found in section 11.
When symptoms persist or in all cases of doubt seek medical advice.

5. Fire-fighting Measures

5.1 Extinguishing Media:

Carbon Dioxide, Dry Chemical, Foam, Water Fog

UNUSUAL FIRE AND EXPLOSION HAZARDS: Flammable liquid. Vapours are heavier than air and may spread along floors. Vapours may form explosive mixtures with air. Vapors may travel to areas away from work site before igniting/flashing back to vapor source. Provide adequate ventilation. Prevent the creation of flammable or explosive concentrations of vapour in air and avoid vapour concentration higher than the occupational exposure limits. Keep away from heat/sparks/open flames/hot surfaces. - No smoking. Electrical installations / working materials must comply with the

technological safety standards. Wear shoes with conductive soles.

FOR SAFETY REASONS NOT TO BE USED: Do not use a solid water stream as it may scatter and spread fire.

5.2 Special hazards arising from the substance or mixture

No Information

5.3 Advice for firefighters

SPECIAL FIREFIGHTING PROCEDURES: In the event of fire, wear self-contained breathing apparatus. Cool containers / tanks with water spray. Flammable.

SPECIAL FIREFIGHTING PROTECTION EQUIPMENT: No Information

6. Accidental Release Measures

6.1 Personal precautions, protective equipment and emergency procedures

Ensure adequate ventilation. Evacuate personnel to safe areas. Remove all sources of ignition. To avoid ignition of vapours by static electricity discharge, all metal parts of the equipment must be grounded. Wear personal protective equipment. For personal protection see section 8.

6.2 Environmental precautions

Do not allow material to contaminate ground water system. Prevent product from entering drains.

6.3 Methods and material for containment and cleaning up

Prevent further leakage or spillage if safe to do so. Contain spillage, soak up with non-combustible absorbent material, (e.g. sand, earth, diatomaceous earth, vermiculite) and transfer to a container for disposal according to local / national regulations (see section 13).

6.4 Reference to other sections

No Information

7. Handling and Storage

7.1 Precautions for safe handling

INSTRUCTIONS FOR SAFE HANDLING : Keep containers dry and tightly closed to avoid moisture absorption and contamination. Prepare the working solution as given on the label(s) and/or the user instructions. Do not breathe vapours or spray mist. Ensure all equipment is electrically grounded before beginning transfer operations. Do not use sparking tools. Do not get in eyes, on skin, or on clothing. Use only with adequate ventilation/personal protection. Wash thoroughly after handling.
PROTECTION AND HYGIENE MEASURES : Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday. When using, do not eat, drink or smoke.

7.2 Conditions for safe storage, including any incompatibilities

CONDITIONS TO AVOID: Heat, flames and sparks.
STORAGE CONDITIONS: Keep container closed when not in use. Store in a dry, well ventilated place away from sources of heat, ignition and direct sunlight.

7.3 Specific end use(s)

The mixing and application to be in accordance with the technical data sheets.

8. Exposure Controls/Personal Protection

8.1 Control parameters

Ingredients with Occupational Exposure Limits (US)

Name	CAS-No.	ACGIH TWA	ACGIH STEL	ACGIH Ceiling
DIMETHYL CARBONATE	616-38-6	N/E	N/E	N/E
MELAMINE	108-78-1	N/E	N/E	N/E

TERT-BUTYL ACETATE	540-88-5	50 PPM	150 PPM	N/E
TITANIUM DIOXIDE	13463-67-7	10 mg/m3	N/E	N/E
TOLUENE	108-88-3	20 PPM	N/E	N/E
METHYL ISOAMYL KETONE	110-12-3	20 PPM	50 PPM	N/E
METHYL ETHYL KETONE	78-93-3	200 PPM	300 PPM	N/E
ALKANES, C14-16, CHLORO	1372804-76-6	N/E	N/E	N/E
CERAMIC REFRACTORY FIBERS	142844-00-6	N/E	N/E	N/E

Name	CAS-No.	OSHA PEL	OSHA STEL
DIMETHYL CARBONATE	616-38-6	N/E	N/E
MELAMINE	108-78-1	N/E	N/E
TERT-BUTYL ACETATE	540-88-5	950 MGM3, 200 PPM	N/E
TITANIUM DIOXIDE	13463-67-7	15 MGM3	N/E
TOLUENE	108-88-3	200 ppm	560 MGM3, 150 PPM
METHYL ISOAMYL KETONE	110-12-3	240 MGM3, 50 PPM	N/E
METHYL ETHYL KETONE	78-93-3	590 MGM3, 200 PPM	885 MGM3, 300 PPM
ALKANES, C14-16, CHLORO	1372804-76-6	N/E	N/E
CERAMIC REFRACTORY FIBERS	142844-00-6	0.5 FIBR/CC/8H	N/E

FURTHER ADVICE: Refer to the regulatory exposure limits for the workforce enforced in each country. Some components may not have been classified under the EU CLP Regulation.

8.2 Exposure controls

Personal Protection

RESPIRATORY PROTECTION: In order to avoid inhalation of spray-mist and sanding dust, all spraying and sanding must be done wearing adequate respiratory protection.

EYE PROTECTION: Safety glasses with side-shields.

HAND PROTECTION: Gloves should be discarded and replaced if there is any indication of degradation or chemical breakthrough. Impervious gloves. Request information on glove permeation properties from the glove supplier. Lightweight protective clothing

OTHER PROTECTIVE EQUIPMENT: Ensure that eyewash stations and safety showers are close to the workstation location.

ENGINEERING CONTROLS: Avoid contact with skin, eyes and clothing. Ensure adequate ventilation, especially in confined areas.

9. Physical and Chemical Properties

9.1 Information on basic physical and chemical properties

Appearance:	Grey, Viscous Liquid
Physical State	Liquid
Odor	Solvent
Odor threshold	N/D
pH	N/D
Melting point / freezing point (°C)	N/D

Boiling point/range (°C)	149 F (65 C) - 601 F (316 C)
Flash Point (°C)	45F (7C)
Evaporation rate	Slower Than Ether
Flammability (solid, gas)	Not determined
Upper/lower flammability or explosive limits	1.0 - 36.0
Vapour Pressure, mmHg	N/D
Vapour density	Heavier than Air
Relative density	Not determined
Solubility in / Miscibility with water	N/D
Partition coefficient: n-octanol/water	Not determined
Auto-ignition temperature (°C)	Not determined
Decomposition temperature (°C)	Not determined
Viscosity	Unknown
Explosive properties	Not determined
Oxidising properties	Not determined

9.2 Other information

VOC Content g/l:	142
Specific Gravity (g/cm3)	1.33

10. Stability and Reactivity

10.1 Reactivity
No reactivity hazards known under normal storage and use conditions.

10.2 Chemical stability
Stable under normal conditions.

10.3 Possibility of hazardous reactions
Hazardous polymerisation does not occur.

10.4 Conditions to avoid
Heat, flames and sparks.

10.5 Incompatible materials
Strong oxidizing agents.

10.6 Hazardous decomposition products
Carbon dioxide (CO2), carbon monoxide (CO), oxides of nitrogen (NOx), dense black smoke.

11. Toxicological Information

11.1 Information on toxicological effects

Acute Toxicity:

Oral LD50: N/D

Inhalation LC50: N/D

Irritation: Unknown

Corrosivity: Unknown

Sensitization: Unknown

Repeated dose toxicity: Unknown

Carcinogenicity: Carcinogenicity, category 1A

Mutagenicity: Unknown

Toxicity for reproduction: Reproductive Toxicity, category 2

STOT-single exposure: Unknown

STOT-repeated exposure: Unknown

Aspiration hazard: Unknown

If no information is available above under Acute Toxicity then the acute effects of this product have not been tested. Data on individual components are tabulated below:

CAS-No.	Chemical Name	Oral LD50	Dermal LD50	Vapor LC50	Gas LC50	Dust/Mist LC50
616-38-6	DIMETHYL CARBONATE	12900 mg/kg, oral, rat	>2000 mg/kg, dermal, rabbit	Not Available	0.000	0.000
108-78-1	MELAMINE	3161 mg/kg, oral, rat	Not Available	3248 mg/m3 8 Hr, Inh, Rat	0.000	0.000
540-88-5	TERT-BUTYL ACETATE	3160 mg/kg, oral, rat	Not Available	4000 ppm/6 hours, rat inhalation	0.000	0.000
13463-67-7	TITANIUM DIOXIDE	25000 mg/kg, oral (rat)	No Information	No Information	No Information	No Information
108-88-3	TOLUENE	5000 mg/kg rat oral	12267 mg/kg, dermal, rabbit	8000 ppm/4 hrs, rat, inhalation	No Information	No Information
110-12-3	METHYL ISOAMYL KETONE	5700 mg/kg, oral, rat		3813 ppm, 6 hours	0.000	0.000
78-93-3	METHYL ETHYL KETONE	2194 mg/kg rat, oral	Not Available	34.5 mg/L/ 4 hour rat, inhalation	0.000	0.000
1372804-76-6	ALKANES, C14-16, CHLORO	N/E		N/E	0.000	0.000
142844-00-6	CERAMIC REFRACTORY FIBERS	Not Available		Not Available	0.000	0.000

Additional Information:
No Information

12. Ecological Information

12.1 Toxicity:

EC50 48hr (Daphnia):	Unknown
IC50 72hr (Algae):	Unknown
LC50 96hr (fish):	Unknown

12.2 Persistence and degradability: Unknown

12.3 Bioaccumulative potential: Unknown

12.4 Mobility in soil: Unknown

12.5 Results of PBT and vPvB assessment: The product does not meet the criteria for PBT/VPvB in accordance with Annex XIII.

12.6 Other adverse effects: Unknown

CAS-No.	Chemical Name	EC50 48hr	IC50 72hr	LC50 96hr
616-38-6	DIMETHYL CARBONATE	100 mg/l (Daphnia magna)	100 mg/l (Algae)	100 mg/l (Zebra Fish)
108-78-1	MELAMINE	No information	No information	No information
540-88-5	TERT-BUTYL ACETATE	No information	No information	No information
13463-67-7	TITANIUM DIOXIDE	No information	No information	No information
108-88-3	TOLUENE	6 mg/l (Daphnia magna)	12.5 mg/L (Algae)	5.8 mg/L (Fish)
110-12-3	METHYL ISOAMYL KETONE	No information	No information	159 mg/l (Fish)
78-93-3	METHYL ETHYL KETONE	308 mg/l (Daphnia magna)	No information	2993 mg/l (Pimephales promelas)
1372804-76-6	ALKANES, C14-16, CHLORO	No information	No information	No information
142844-00-6	CERAMIC REFRACTORY FIBERS	No information	No information	No information

13. Disposal Considerations

13.1 WASTE TREATMENT METHODS: Do not burn, or use a cutting torch on, the empty drum. If recycling is not practicable, dispose of in compliance with local regulations. Dispose of in accordance with local regulations. Empty containers should be taken to an approved waste handling site for recycling or disposal.

14. Transport Information

14.1	UN number	UN 1263
14.2	UN proper shipping name	Paint
	Technical name	N/A
14.3	Transport hazard class(es)	3
	Subsidiary shipping hazard	N/A
14.4	Packing group	PG II
14.5	Environmental hazards	Unknown
14.6	Special precautions for user	Unknown
	EmS-No.:	F-E, S-E
14.7	Transport in bulk according to Annex II of MARPOL 73/78 and the IBC code	Unknown

15. Regulatory Information

15.1 Safety, health and environmental regulations/legislation for the substance or mixture:

U.S. Federal Regulations: As follows -

CERCLA - Sara Hazard Category

This product has been reviewed according to the EPA 'Hazard Categories' promulgated under Sections 311 and 312 of the Superfund Amendment and Reauthorization Act of 1986 (SARA Title III) and is considered, under applicable definitions, to meet the following categories:

Flammable (gases, aerosols, liquids, or solids), Carcinogenicity, Reproductive toxicity

Sara Section 313:

This product contains the following substances subject to the reporting requirements of Section 313 of Title III of the Superfund Amendment and Reauthorization Act of 1986 and 40 CFR part 372:

No SARA 313 substances exist in this product above de minimis concentrations.

Toxic Substances Control Act:

All components of this product are either listed on the TSCA Inventory or are exempt.

This product contains the following chemical substances subject to the reporting requirements of TSCA 12(B) if exported from the United States:

Chemical Name	CAS-No.
ALKANES, C20-28, CHLORO	2097144-43-7
ALKANES, C14-16, CHLORO	1372804-76-6

U.S. State Regulations: As follows -

New Jersey Right-to-Know:

The following materials are non-hazardous, but are among the top five components in this product.

Chemical Name	CAS-No.
AMMONIUM POLYPHOSPHATE	68333-79-9
PENTAERYTHRITOL	115-77-5
ACRYLIC COPOLYMER	60381-61-5
ALKANES, C20-28, CHLORO	2097144-43-7

Pennsylvania Right-To-Know

The following non-hazardous ingredients are present in the product at greater than 3%.

Chemical Name	CAS-No.
AMMONIUM POLYPHOSPHATE	68333-79-9
PENTAERYTHRITOL	115-77-5
ACRYLIC COPOLYMER	60381-61-5
ALKANES, C20-28, CHLORO	2097144-43-7

CALIFORNIA PROPOSITION 65

WARNING: Cancer and Reproductive Harm -- www.P65Warnings.ca.gov

International Regulations: As follows -

* Canadian DSL:

All chemical ingredients included on inventory (DSL)

15.2 Chemical Safety Assessment:

No Chemical Safety Assessment has been carried out for this substance/mixture by the supplier.

16. Other Information

Text for GHS Hazard Statements shown in Section 3 describing each ingredient:

H225	Highly flammable liquid and vapour.
H226	Flammable liquid and vapour.
H304	May be fatal if swallowed and enters airways.
H315	Causes skin irritation.
H319	Causes serious eye irritation.
H332	Harmful if inhaled.
H335	May cause respiratory irritation.
H336	May cause drowsiness or dizziness.
H350	May cause cancer.
H351	Suspected of causing cancer.
H361	Suspected of damaging fertility or the unborn child.
H370	Causes damage to organs.
H373	May cause damage to organs through prolonged or repeated exposure.
H412	Harmful to aquatic life with long lasting effects.

Reasons for revision

No Information

The information contained herein is, to the best of our knowledge and belief accurate. However, since the conditions of handling and use are beyond our control, we make no guarantee of results, and assume no liability for damages incurred by use of this material. It is the responsibility of the user to comply with all applicable federal, state, and local laws and regulations.

PART 1 GENERAL

1.01 WORK INCLUDED

A. This specification covers labor, materials, equipment, and application necessary for, and incidental to, the complete and proper installation of intumescent fire protection for application to steel structures and supports in accordance with all applicable requirements of contract documents.

B. This specification shall be supplemented by the applicable requirements of building codes, insurance rating organizations and all other authorities having jurisdiction.

1.02 RELATED WORK

A. Specified elsewhere:
   1. 01010 - Project Summary
   2. 01410 - Testing Laboratory Services
   3. 05100 - Structural Metal Framing
   4. 05120 - Structural steel and metal fabrications with reference to primer receiving fire protection materials
   5. 05500 - Structural steel and metal fabrications with reference to primer receiving fire protection materials
   6. 07270 – Firestopping and Smoke Seals
   7. 09900 - Painting

1.03 QUALITY ASSURANCE

A. Application of fireproofing shall be performed by a qualified applicator acceptable to the Carboline Company, St. Louis, MO.

B. A Certified Installation Certificate must be completed and submitted at end of project.

C. Provide materials and construction for hourly ratings listed in the Underwriters Laboratories, Inc. Fire Resistance Directory or as calculated by the American Iron and Steel Institute formula.

D. The intumescent fire resistive material shall be manufactured under the Follow-Up Service program of UL/ULC and/or Intertek and bear the UL/ULC and/or Intertek label (mark).

E. Field constructed mock-up: Apply sample section to representative substrates on site. Mock-up should include primer, fireproofing at required thickness, density, and finished surface, and all finish coatings.

F. The product shall be approved by the architect and applicable authorities having jurisdiction.

1.04 REFERENCES

A. American Society for Testing and Materials (ASTM)
   1. E84 Surface Burning Characteristics
   2. E119 Fire Tests of Building Construction
   3. D2240 Durometer Hardness
   4. D2794 Impact Resistance
   5. D4060 Abrasion Resistance
   6. D4541 Bond Strength

B. Underwriters Laboratories, Inc. Fire Resistance Directory (UL 263 / ASTM E119).

C. CAN/ULC-S101 Standard Methods of Fire Endurance Tests of Building Construction and Materials

D. Steel Structures Painting Council (SSPC) Surface Preparation Standards

E. American Iron and Steel Institute, Designing Fire Protection for Steel Columns.

F. AWCI Technical Manual 12-B "Standard Practice for the Testing and Inspection of Field Applied Thin-Film Intumescent Fire-Resistive Materials; an Annotated Guide", Latest Edition

1.05 SUBMITTALS

A. Product Data: Submit manufacturer's current Product Data and Application Instructions.

B. Fireproofing manufacturer's certification that the materials to be supplied comply with the specifications and are suitable for the use intended.

C. Fireproofing manufacturer's certification that the minimum performance standards as required under Section 2.01-A can be met and test reports supplied as requested.

D. Schedule of Underwriters Laboratories, Inc. designs or American Iron and Steel Institute calculations to achieve the required hourly ratings.

E. At completion of project, Certified Installation Certificate.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to the project in manufacturer's unopened packages, fully identified as to trade name, type and other identifying data. Packaged materials shall bear the appropriate labels, seals and UL label (mark) for fire resistive ratings and shall be stored at temperatures between 32º F (0º C) and 100º F (38º C), in a dry interior location away from direct sunlight.

B. Materials shall be used prior to expiration date.

1.07 SITE CONDITIONS

A. When the temperature at the job site is less than 41º F (5º C), a minimum substrate and ambient temperature of 41º F (5º C) shall be maintained prior to and during application. If necessary for job schedule, the General Contractor shall provide enclosures and heat to maintain proper temperatures and humidity levels in the application areas.

B. General Contractor shall provide ventilation for proper drying of the fireproofing during and after its application. In poorly ventilated areas, forced air shall be used to achieve a total air exchange of four times per hour until the material is substantially dry.

C. Relative humidity shall not exceed 85% throughout the total period of application and drying for the intumescent fire resistive material, and must not exceed 85% throughout the application and drying for the protective decorative topcoat.

1.08 SEQUENCING

A. Coordinate application of fireproofing with related work specified in other sections to comply with the following requirements:
   1. Prevent deterioration due to exposure to unfavorable environmental conditions.
   2. Protect fireproofing from abrasion and other damage likely to occur during construction operations after its application.
   3. The installation of piping, ducts, conduit or other suspended equipment shall not commence until the application of the thin-film fire resistive material is complete in that area.
   4. Install fireproofing allowing sufficient time for inspection, testing, and correction of defective fireproofing.

PART 2 PRODUCTS

2.01 MATERIALS

A. Compatible metal primer shall be approved and applied in full accordance with the primer manufacturer’s written instructions.

B. The intumescent fire resistive material shall be supplied by Carboline. Intumescent fire resistive material shall be applied in accordance with drawings and/or specifications, and shall have been tested in accordance with the procedures of UL 263 or ASTM E119 or CAN/ULC-S101, and reported by Underwriters Laboratories, Inc., Underwriters Laboratories of Canada or Intertek.

C. Intumescent fireproofing shall be applied to provide compliance with all drawings, specifications, and the following performance criteria:
   1. ASTM E84 (UL723, CAN/ULC-S102): Surface Burning Characteristics of Building Materials. Flame Spread Maximum: 0 and Smoke Developed Maximum: 0.
   2. ASTM D2240: Durometer Hardness (Shore D Only). Minimum: 70 Shore D.
   3. ASTM D2794: Impact Resistance. Intrusion minimum: 0.16 ft. lbs/in.
   4. ASTM D4541: Bond Strength. Minimum: 200 psi (1,378 kPa).

D. Fireproofing shall be investigated for interior use by Underwriters Laboratories, Inc.
E. Fireproofing shall be free of asbestos, mineral fibers, polystyrene, or other known materials which may be considered hazardous either during mixing, application curing, or chemical release in a fire.
F. Topcoat materials shall be as required for color-coding, aesthetics or additional surface protection, approved by the thin-film fire resistive material manufacturer and applied in full accordance with the coating manufacturer's written instructions.

PART 3 EXECUTION

3.01 EXAMINATION
A. All surfaces to receive thin-film fire resistive material shall be clean, dry and free of oil, grease, loose mill scale, dirt, dust or other materials which would impair bond of the thin-film fire resistive material to the surface. Any cleaning of the surfaces to receive fire resistive material shall be the responsibility of the General Contractor or steel erector, as outlined in the structural steel section.
B. Confirm compatibility of surfaces to receive thin-film fire resistive material. Steel surfaces shall be primed with a compatible primer approved by the thin-film fire resistive material manufacturer.
C. Verify that objects which will penetrate fireproofing such as clips, hangers, support sleeves, etc. are securely attached to the substrate.
D. Verify that substrates are not obstructed by ducts, piping, equipment, or other construction which might interfere with fireproofing application. If obstruction(s) are evident, General Contractor to have responsible trade remove obstruction until fireproofing is completed in the area.
E. Do not proceed with fireproofing application until all unsatisfactory conditions have been corrected.

3.02 PREPARATION
A. Clean substrates, removing dirt, dust, oil, grease, loose material, incompatible primers, or other substances which may impair bonding of fireproofing to the substrate.
B. Provide drop cloths, masking, or other satisfactory protection for surfaces not to receive fireproofing to prevent damage from overspray.

3.03 APPLICATION
A. The thin-film fire resistive material shall be applied at the required dry film thickness per the appropriate design number guidelines and manufacturers written application instructions.
B. Comply with manufacturers current instructions for equipment and application procedures.
B. Apply fireproofing in thickness required to achieve fire resistance ratings.
C. Before proceeding with the work, the applicator shall apply the thin-film fire resistive material to a section witnessed by the architect's or owner's representative. The application shall be subject to their approval and shall be used as a guide for texture and thickness of the finished work.

3.04 FIELD QUALITY CONTROL
A. In addition to continuous Wet Film Thickness checks performed by applicator during application, the installed intumescent material shall be inspected by a qualified independent testing laboratory for thickness in accordance with the AWCI Technical Manual 12-B "Standard Practice For The Testing and Inspection Of Field Applied Thin-Film Intumescent Fire-Resistive Materials; an Annotated Guide", Latest Edition, before application of the topcoat.
B. The results of the above tests shall be made available to all parties at the completion of each area and approved prior to the application of topcoat.

3.05 PROTECTION
A. Coordinate installation of fireproofing with other trades in order to minimize the need to cut or remove fireproofing. As other trades successfully complete installation of their work, maintain protection of fireproofed portions of the structure by repairing any areas which have been removed or damaged.
B. If applicable, the General Contractor shall install barriers to prevent other trades from entering the application area till the material dries.
C. Areas subject to overspray that are to remain permanently exposed as detailed on the drawings, must be covered by drop cloths or other satisfactory protection to prevent contact with fireproofing material.

3.06 PATCHING AND REPAIR
A. All patching of and repair to thin-film fire resistive material, due to damage by other trades, shall be performed under this section and paid for by the trade responsible for the damage. Patching shall be performed by an applicator with expertise in the installation of fire resistive or similar materials. Repair shall be in accordance with design number guidelines and manufacturers written application instructions.

3.07 CLEANING
A. Upon completion of installation, all excess material, overspray and debris shall be cleared and removed from the job site.
B. At completion of fireproofing work, application equipment shall be removed from site.

3.08 SCHEDULE
A. Fire resistance rating in hours shall be the following:

	Hour	Rest.	Unrest.
Floor Assembly	_____	_____	_____
Primary Floor Beams	_____	_____	_____
Secondary Floor Beams	_____	_____	_____
Roof Beams	_____	_____	_____
Columns, Supporting Floor			_____
Columns, Supporting Roof			_____
Rapid Rise Fire Exposure			_____

END OF SECTION

CERTIFICATE OF COMPLIANCE

Certificate Number 20131210-R11193
Report Reference R11193-20040127
Issue Date 2013-DECEMBER-10

Issued to: CARBOLINE CO
350 HANLEY INDUSTRIAL CT
ST LOUIS MO 63144

This is to certify that representative samples of INTUMESCENT COATINGS, THIN-FILM
Intumescent coating designated as Thermo-Sorb, Thermo-Sorb VOC or FireFilm S1.

Have been investigated by UL in accordance with the Standard(s) indicated on this Certificate.

Standard(s) for Safety: CAN/ULC-S101-07 - Standard Methods of Fire Endurance Tests of Building Construction and Materials

Additional Information: See the UL Online Certifications Directory at www.ul.com/database for additional information

Only those products bearing the UL Classification Mark for the U.S. and Canada should be considered as being covered by UL's Classification and Follow-Up Service and meeting the appropriate U.S. and Canadian requirements.

The UL Classification Mark includes: the UL in a circle symbol: with the word "CLASSIFIED" (as shown); a control number (may be alphanumeric) assigned by UL; a statement to indicate the extent of UL's evaluation of the product; and the product category name (product identity) as indicated in the appropriate UL Directory. The UL Classification Mark for Canada includes: the UL Classification Mark for Canada: with the word "CLASSIFIED" (as shown); a control number (may be alphanumeric) assigned by UL; a statement to indicate the extent of UL's evaluation of the product; and the product category name (product identity) in English, French, or English/French as indicated in the appropriate UL Directory.

Look for the UL Classification Mark on the product.

William R. Carney

William R. Carney, Director, North American Certification Programs

UL LLC

FIRE-RESISTANCE DESIGN

Assembly Usage Disclaimer

BXUV - Fire Resistance Ratings - ANSI/UL 263 Certified for United States

BXUV7 - Fire Resistance Ratings - CAN/ULC-S101 Certified for Canada

See General Information for Fire-resistance Ratings - ANSI/UL 263 Certified for United States
Design Criteria and Allowable Variances

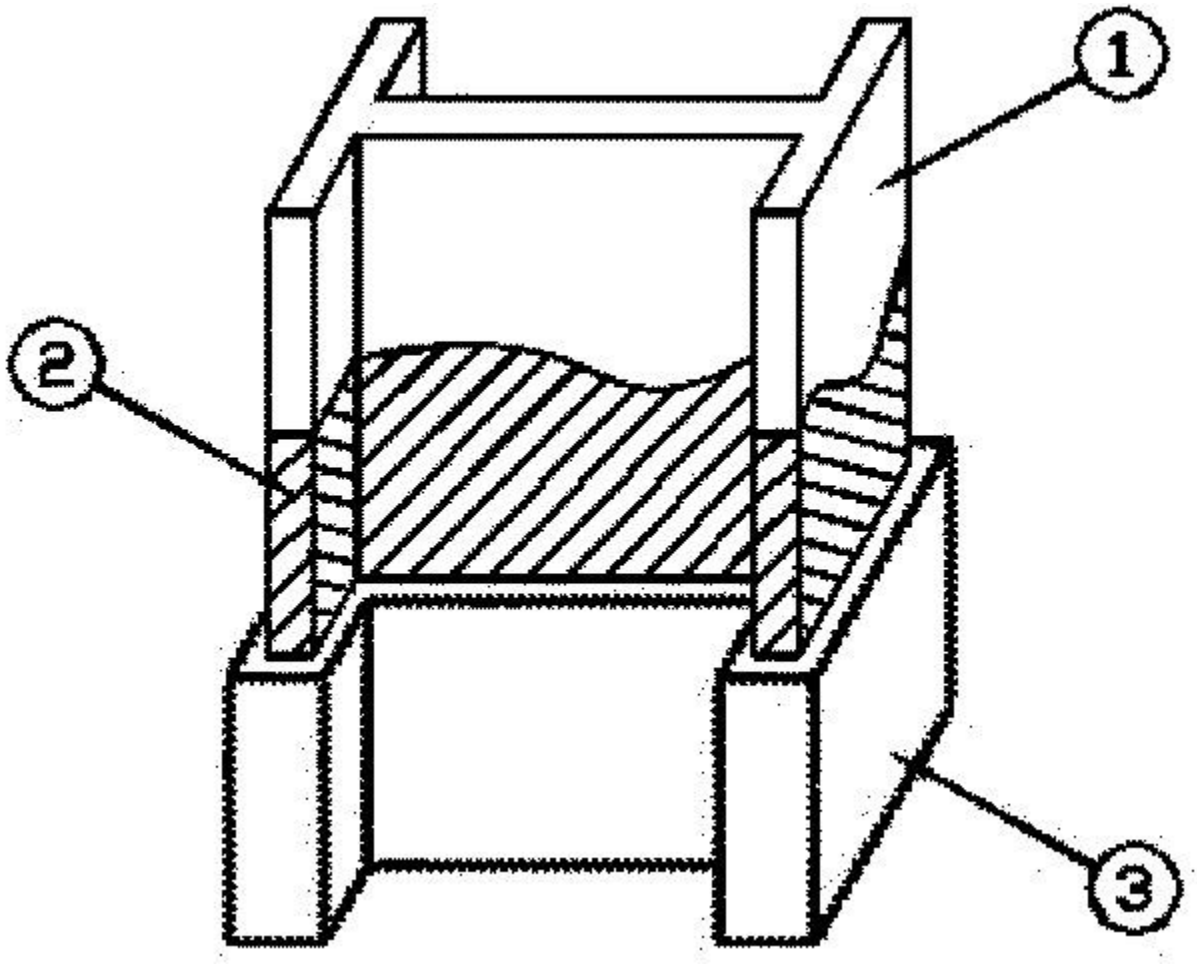
See General Information for Fire Resistance Ratings - CAN/ULC-S101 Certified for Canada
Design Criteria and Allowable Variances

Design No. X660

December 13, 2013

Ratings - 1, 1-1/2, 2, 2-1/2 and 3 Hr. (See Item 3)

*** Indicates such products shall bear the UL or cUL Certification Mark for jurisdictions employing the UL or cUL Certification (such as Canada), respectively.**



1. **Steel Column —** Wide flange steel columns with the minimum sizes shown in the tables below. Columns shall be free of dirt, loose scale and oil.

2. **Primer Coating —** Two Component Epoxy or Phenolic Modified Alkyd applied at 0.002 in. dry film thickness.

3. **Mastic & Intumescent Coating* —** Coating spray or brush applied in accordance with the manufacturer's instructions at the minimum average dry thickness shown in the table below. The thickness in the table shown below does not include primer thickness.

Size	W/D	Hp/A	1 hr	1.5 hr in.	2 hr in.	3 hr in.
W8x24	0.59	227	0.063	0.137	0.248	NR
W10x26	0.61	220	0.061	0.135	0.244	NR
W14x34	0.63	213	0.060	0.133	0.240	NR
W10x33	0.66	203	0.057	0.129	0.234	NR
W8x31	0.66	203	0.057	0.129	0.234	NR
W21x44	0.67	200	0.056	0.128	0.232	NR
W16x40	0.68	197	0.055	0.127	0.230	NR
W18x40	0.68	197	0.055	0.127	0.230	NR
W8x28	0.68	197	0.055	0.127	0.230	NR

W6x25	0.69	194	0.055	0.126	0.228	NR
W10x30	0.70	191	0.054	0.125	0.227	NR
W12x35	0.70	191	0.054	0.125	0.227	NR
W14x38	0.70	191	0.054	0.125	0.227	NR
W12x40	0.74	181	0.050	0.122	0.220	NR
W8x35	0.74	181	0.050	0.122	0.220	NR
W14x43	0.75	179	0.050	0.121	0.218	NR
W24x55	0.75	179	0.050	0.121	0.218	NR
W16x45	0.76	176	0.049	0.120	0.217	NR
W21x50	0.76	176	0.049	0.120	0.217	NR
W18x50	0.77	174	0.048	0.119	0.215	NR
W10x39	0.78	172	0.047	0.118	0.213	NR
W18x46	0.78	172	0.047	0.118	0.213	NR
W12x45	0.82	163	0.044	0.115	0.207	NR
W14x48	0.83	161	0.043	0.114	0.206	NR
W24x68	0.83	161	0.043	0.114	0.206	NR
W10x49	0.84	160	0.042	0.113	0.204	0.387
W16x50	0.84	160	0.042	0.113	0.204	0.387
W24x62	0.84	160	0.042	0.113	0.204	0.387
W8x40	0.84	160	0.042	0.113	0.204	0.387
W12x53	0.85	158	0.042	0.112	0.203	0.384
W18x55	0.85	158	0.042	0.112	0.203	0.384
W21x57	0.85	158	0.042	0.112	0.203	0.384
W21x62	0.85	158	0.042	0.112	0.203	0.384
W10x45	0.89	151	0.042	0.109	0.197	0.374
W12x50	0.91	147	0.041	0.108	0.195	0.369
W14x53	0.91	147	0.041	0.108	0.195	0.369
W10x54	0.92	146	0.041	0.107	0.194	0.367
W12x65	0.92	146	0.041	0.107	0.194	0.367
W14x61	0.92	146	0.041	0.107	0.194	0.367
W18x60	0.92	146	0.041	0.107	0.194	0.367

W21x68	0.92	146	0.041	0.107	0.194	0.367
W27x84	0.92	146	0.041	0.107	0.194	0.367
W12x58	0.93	144	0.041	0.106	0.192	0.364
W16x67	0.93	144	0.041	0.106	0.192	0.364
W24x76	0.93	144	0.041	0.106	0.192	0.364
W16x57	0.95	141	0.041	0.105	0.190	0.359
W18x76	0.96	140	0.041	0.104	0.189	0.357
W18x65	0.99	135	0.041	0.102	0.185	0.350
W21x73	0.99	135	0.041	0.102	0.185	0.350
W30x99	1.00	134	0.041	0.102	0.184	0.348
W8x48	1.00	134	0.041	0.102	0.184	0.348
W10x60	1.02	131	0.040	0.100	0.182	0.344
W12x72	1.02	131	0.040	0.100	0.182	0.344
W24x84	1.02	131	0.040	0.100	0.182	0.344
W27x94	1.02	131	0.040	0.100	0.182	0.344
W14x68	1.03	130	0.040	0.100	0.180	0.342
W16x77	1.06	126	0.040	0.098	0.177	0.335
W14x90	1.07	125	0.040	0.097	0.176	0.333
W24x104	1.07	125	0.040	0.097	0.176	0.333
W18x71	1.08	124	0.040	0.097	0.175	0.331
W18x86	1.08	124	0.040	0.097	0.175	0.331
W33x118	1.08	124	0.040	0.097	0.175	0.331
W30x108	1.09	123	0.040	0.096	0.174	0.329
W12x79	1.11	121	0.040	0.095	0.172	0.326
W14x74	1.11	121	0.040	0.095	0.172	0.326
W27x102	1.11	121	0.040	0.095	0.172	0.326
W21x101	1.12	120	0.040	0.095	0.171	0.324
W21x83	1.12	120	0.040	0.095	0.171	0.324
W24x94	1.13	119	0.039	0.094	0.170	0.322
W10x68	1.14	118	0.039	0.093	0.169	0.320
W30x116	1.16	116	0.039	0.092	0.167	0.316

W36x135	1.16	116	0.039	0.092	0.167	0.316
W14x99	1.17	115	0.039	0.092	0.166	0.314
W33x130	1.18	114	0.039	0.091	0.165	0.313
W8x58	1.19	113	0.039	0.091	0.164	0.311
W24x117	1.20	112	0.039	0.090	0.163	0.309
W18x97	1.21	111	0.039	0.090	0.162	0.307
W12x87	1.22	110	0.039	0.089	0.161	0.306
W14x82	1.22	110	0.039	0.089	0.161	0.306
W16x89	1.22	110	0.039	0.089	0.161	0.306
W21x111	1.23	109	0.039	0.089	0.161	0.304
W27x114	1.23	109	0.039	0.089	0.161	0.304
W21x93	1.24	108	0.038	0.088	0.160	0.302
W30X124	1.24	108	0.038	0.088	0.160	0.302
W10x77	1.28	105	0.038	0.086	0.156	0.296
W14x109	1.28	105	0.038	0.086	0.156	0.296
W33x141	1.28	105	0.038	0.086	0.156	0.296
W36x150	1.28	105	0.038	0.086	0.156	0.296
W30x132	1.31	102	0.038	0.085	0.154	0.291
W18x106	1.32	102	0.038	0.085	0.153	0.290
W24x131	1.33	101	0.038	0.084	0.152	0.288
W12x96	1.34	100	0.038	0.084	0.151	0.287
W21x122	1.34	100	0.038	0.084	0.151	0.287
W27x146	1.35	99	0.038	0.083	0.151	0.285
W16x100	1.36	99	0.037	0.083	0.150	0.284
W36x160	1.36	99	0.037	0.083	0.150	0.284
W8x67	1.36	99	0.037	0.083	0.150	0.284
W33x152	1.37	98	0.037	0.082	0.149	0.282
W14x120	1.40	96	0.037	0.081	0.147	0.278
W36x170	1.44	93	0.037	0.080	0.144	0.273
W10x88	1.45	92	0.037	0.079	0.143	0.271
W21x132	1.45	92	0.037	0.079	0.143	0.271

W12x106	1.46	92	0.037	0.079	0.143	0.270
W30x173	1.46	92	0.037	0.079	0.143	0.270
W18x119	1.47	91	0.036	0.078	0.142	0.269
W24x146	1.48	91	0.036	0.078	0.141	0.267
W27x161	1.48	91	0.036	0.078	0.141	0.267
W14x132	1.54	87	0.036	0.076	0.137	0.260
W36x182	1.54	87	0.036	0.076	0.137	0.260
W33x201	1.58	85	0.035	0.074	0.135	0.255
W21x147	1.60	84	0.035	0.074	0.133	0.253
W30x191	1.60	84	0.035	0.074	0.133	0.253
W10x100	1.63	82	0.035	0.073	0.132	0.249
W14x145	1.63	82	0.035	0.073	0.132	0.249
W24x162	1.63	82	0.035	0.073	0.132	0.249
W27x178	1.63	82	0.035	0.073	0.132	0.249
W36x194	1.63	82	0.035	0.073	0.132	0.249
W12x120	1.64	82	0.035	0.072	0.131	0.248
W36x230	1.71	78	0.035	0.070	0.127	0.241
W33x221	1.72	78	0.035	0.070	0.126	0.240
W30x211	1.76	76	0.035	0.069	0.124	0.235
W36x210	1.76	76	0.035	0.069	0.124	0.235
W14x159	1.77	76	0.035	0.068	0.124	0.234
W10x112	1.81	74	0.035	0.067	0.122	0.231
W36x245	1.82	74	0.035	0.067	0.121	0.230
W12x136	1.84	73	0.035	0.066	0.120	0.228
W33x241	1.88	71	0.035	0.065	0.118	0.224
W36x260	1.92	70	0.035	0.064	0.116	0.220
W14x176	1.95	69	0.035	0.064	0.115	0.218
W12x152	2.04	66	0.035	0.061	0.111	0.210
W36x280	2.06	65	0.035	0.061	0.110	0.209
W14x193	2.12	63	0.035	0.060	0.108	0.204
W36x300	2.19	61	0.035	0.058	0.105	0.199

W12x170	2.26	59	0.035	0.057	0.103	0.194
W14x211	2.30	58	0.035	0.057	0.102	0.194
W12x190	2.49	54	0.035	0.057	0.102	0.194
W14x233	2.52	53	0.035	0.057	0.102	0.194

CARBOLINE CO — TYPE THERMO-SORB, THERMO-SORB VOC. Investigated for Interior Conditioned Space and Interior General Purpose.

4. **Top Coat —** (Not Shown) - No topcoat required for Interior Conditioned Space. Finishing topcoat for Interior General Purpose, Types Carboguard 893 SG or Santile 655 applied at 0.006 in. dry film thickness or Carbocrylic 3350 or Carbocoat 30R applied at 0.003 in. dry film thickness.

*** Indicates such products shall bear the UL or cUL Certification Mark for jurisdictions employing the UL or cUL Certification (such as Canada), respectively.**

Last Updated on 2013-12-13

Design/System/Construction/Assembly Usage Disclaimer

- Authorities Having Jurisdiction should be consulted in all cases as to the particular requirements covering the installation and use of UL Certified products, equipment, system, devices, and materials.
- Authorities Having Jurisdiction should be consulted before construction.
- Fire resistance assemblies and products are developed by the design submitter and have been investigated by UL for compliance with applicable requirements. The published information cannot always address every construction nuance encountered in the field.
- When field issues arise, it is recommended the first contact for assistance be the technical service staff provided by the product manufacturer noted for the design. Users of fire resistance assemblies are advised to consult the general Guide Information for each product category and each group of assemblies. The Guide Information includes specifics concerning alternate materials and alternate methods of construction.
- Only products which bear UL's Mark are considered Certified.

FIRE-RESISTANCE DESIGN

Assembly Usage Disclaimer

BXUV - Fire Resistance Ratings - ANSI/UL 263 Certified for United States

BXUV7 - Fire Resistance Ratings - CAN/ULC-S101 Certified for Canada

See General Information for Fire-resistance Ratings - ANSI/UL 263 Certified for United States
Design Criteria and Allowable Variances

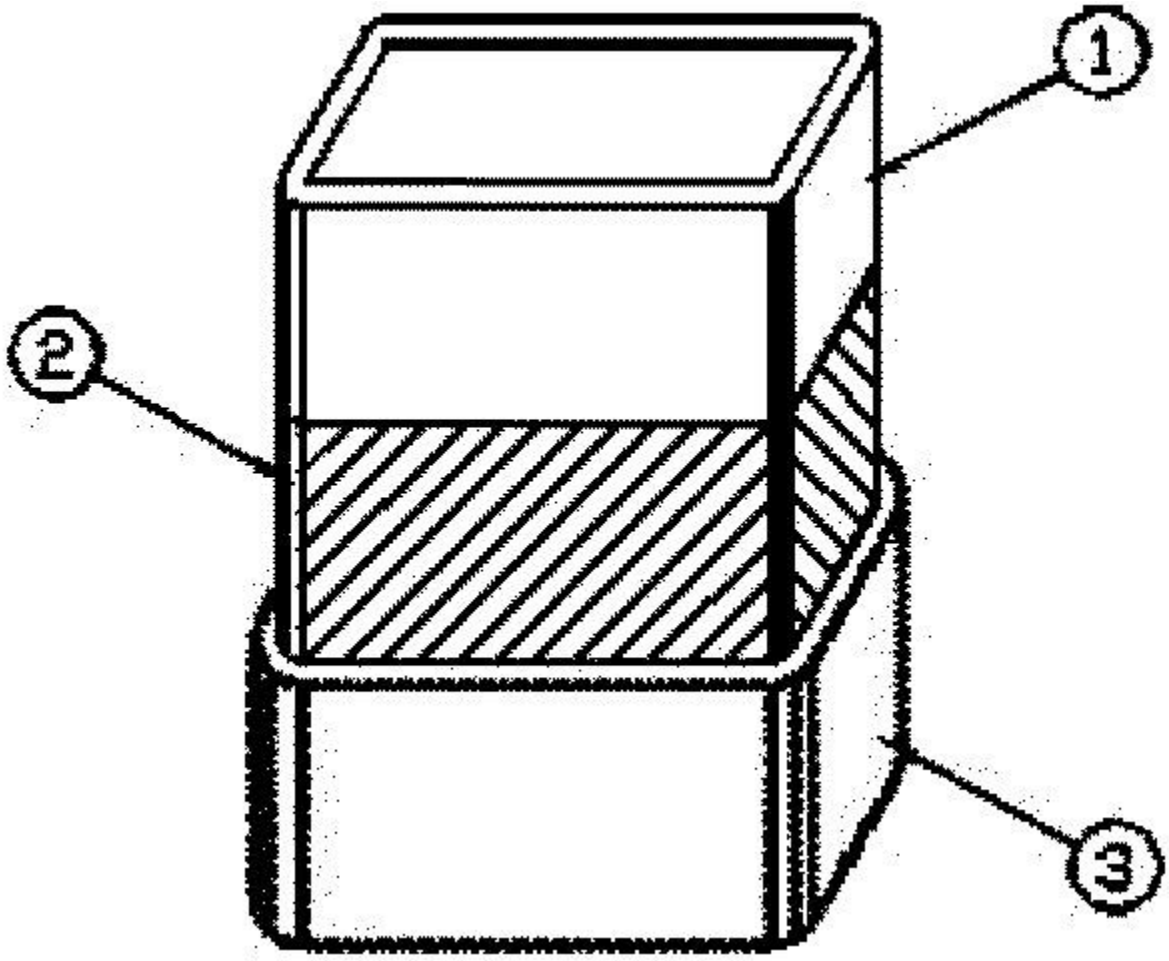
See General Information for Fire Resistance Ratings - CAN/ULC-S101 Certified for Canada
Design Criteria and Allowable Variances

Design No. X661

December 11, 2013

Ratings - 1, 1-1/2, 2, and 3 Hr. (See Item 3 and 4)

*** Indicates such products shall bear the UL or cUL Certification Mark for jurisdictions employing the UL or cUL Certification (such as Canada), respectively.**



1. **Steel Tube Column —** Hollow structural steel columns with the minimum sizes shown in the tables below. Columns shall be free of dirt, loose scale and oil.

2. **Primer Coating —** Two Component Epoxy or Phenolic Modified Alkyd applied at 0.002 in. dry film thickness.

3. **Mastic & Intumescent Coating* —** Coating spray or brush applied in accordance with the manufacturer's instructions at the minimum average dry thickness shown in the table below. The thickness shown does not include primer thickness.

Size	A/P	1 Hr. In.	1-1/2 Hr. In.	2 Hr. In.	3 Hr. In.
TS4x4x 1/4	0.24	0.073	0.226	0.367	NR
TS4.5x4.5x 1/4	0.24	0.073	0.226	0.367	NR
TS5x4x 1/4	0.24	0.073	0.226	0.367	NR
TS5x5x 1/4	0.24	0.073	0.226	0.367	NR
TS6x4x 1/4	0.24	0.073	0.226	0.367	NR
TS5.5x5.5x 1/4	0.24	0.073	0.226	0.367	NR
TS6x5x 1/4	0.24	0.073	0.226	0.367	NR
TS7x4x 1/4	0.24	0.073	0.226	0.367	NR
TS6x6x 1/4	0.24	0.073	0.226	0.367	NR

TS7x5x 1/4	0.24	0.073	0.226	0.367	NR
TS8x4x 1/4	0.24	0.073	0.226	0.367	NR
TS7x7x 1/4	0.24	0.073	0.226	0.367	NR
TS8x6x 1/4	0.24	0.073	0.226	0.367	NR
TS9x5x 1/4	0.24	0.073	0.226	0.367	NR
TS10x4x 1/4	0.24	0.073	0.226	0.367	NR
TS10x5x 1/4	0.24	0.073	0.226	0.367	NR
TS8x8x 1/4	0.24	0.073	0.226	0.367	NR
TS9x7x 1/4	0.24	0.073	0.226	0.367	NR
TS10x6x 1/4	0.24	0.073	0.226	0.367	NR
TS12x4x 1/4	0.24	0.073	0.226	0.367	NR
TS9x9x 1/4	0.24	0.073	0.226	0.367	NR
TS10x8x 1/4	0.24	0.073	0.226	0.367	NR
TS12x6x 1/4	0.24	0.073	0.226	0.367	NR
TS14x4x 1/4	0.24	0.073	0.226	0.367	NR
TS10x10x 1/4	0.24	0.073	0.226	0.367	NR
TS12x8x 1/4	0.24	0.073	0.226	0.367	NR
TS14x6x 1/4	0.24	0.073	0.226	0.367	NR
TS16x4x 1/4	0.24	0.073	0.226	0.367	NR
TS12x10x 1/4	0.25	0.069	0.212	0.348	NR
TS12x12x 1/4	0.25	0.069	0.212	0.348	NR
TS14x10x 1/4	0.25	0.069	0.212	0.348	NR
TS16x8x 1/4	0.25	0.069	0.212	0.348	NR
TS18x6x 1/4	0.25	0.069	0.212	0.348	NR
TS20x4x 1/4	0.25	0.069	0.212	0.348	NR
TS16x16x 1/4	0.25	0.069	0.212	0.348	NR
TS4x4x 5/16	0.29	0.056	0.160	0.273	NR
TS4.5x4.5x 5/16	0.29	0.056	0.160	0.273	NR
TS5x4x 5/16	0.29	0.056	0.160	0.273	NR
TS5x5x 5/16	0.30	0.055	0.157	0.267	NR
TS6x4x 5/16	0.30	0.055	0.157	0.267	NR

TS5.5x5.5x 5/16	0.30	0.055	0.157	0.267	NR
TS6x5x 5/16	0.30	0.055	0.157	0.267	NR
TS7x4x 5/16	0.30	0.055	0.157	0.267	NR
TS6x6x 5/16	0.30	0.055	0.157	0.267	NR
TS7x5x 5/16	0.30	0.055	0.157	0.267	NR
TS8x4x 5/16	0.30	0.055	0.157	0.267	NR
TS7x7x 5/16	0.30	0.055	0.157	0.267	NR
TS8x6x 5/16	0.30	0.055	0.157	0.267	NR
TS9x5x 5/16	0.30	0.055	0.157	0.267	NR
TS10x4x 5/16	0.30	0.055	0.157	0.267	NR
TS10x5x 5/16	0.30	0.055	0.157	0.267	NR
TS8x8x 5/16	0.30	0.055	0.157	0.267	NR
TS9x7x 5/16	0.30	0.055	0.157	0.267	NR
TS10x6x 5/16	0.30	0.055	0.157	0.267	NR
TS12x4x 5/16	0.30	0.055	0.157	0.267	NR
TS9x9x 5/16	0.30	0.055	0.157	0.267	NR
TS10x8x 5/16	0.30	0.055	0.157	0.267	NR
TS12x6x 5/16	0.30	0.055	0.157	0.267	NR
TS14x4x 5/16	0.30	0.055	0.157	0.267	NR
TS10x10x 5/16	0.30	0.055	0.157	0.267	NR
TS12x8x 5/16	0.30	0.055	0.157	0.267	NR
TS14x6x 5/16	0.30	0.055	0.157	0.267	NR
TS16x4x 5/16	0.30	0.055	0.157	0.267	NR
TS12x10x 5/16	0.31	0.053	0.151	0.258	NR
TS12x12x 5/16	0.31	0.053	0.151	0.258	NR
TS14x10x 5/16	0.31	0.053	0.151	0.258	NR
TS16x8x 5/16	0.31	0.053	0.151	0.258	NR
TS18x6x 5/16	0.31	0.053	0.151	0.258	NR
TS20x4x 5/16	0.31	0.053	0.151	0.258	NR
TS14x14x 5/16	0.31	0.053	0.151	0.258	NR
TS16x12x 5/16	0.31	0.053	0.151	0.258	NR

TS20x8x 5/16	0.31	0.053	0.151	0.258	NR
TS18x12x 5/16	0.31	0.053	0.151	0.258	NR
TS16x16x 5/16	0.31	0.053	0.151	0.258	NR
TS20x12x 5/16	0.31	0.053	0.151	0.258	NR
TS20x16x 5/16	0.31	0.053	0.151	0.258	NR
TS20x18x 5/16	0.31	0.053	0.151	0.258	NR
TS4x4x 3/8	0.34	0.047	0.128	0.224	NR
TS4.5x4.5x 3/8	0.35	0.047	0.128	0.224	NR
TS5x4x 3/8	0.35	0.047	0.128	0.224	NR
TS5x5x 3/8	0.35	0.047	0.128	0.224	NR
TS6x4x 3/8	0.35	0.047	0.128	0.224	NR
TS5.5x5.5x 3/8	0.35	0.047	0.128	0.224	NR
TS6x5x 3/8	0.35	0.047	0.128	0.224	NR
TS7x4x 3/8	0.35	0.047	0.128	0.224	NR
TS6x6x 3/8	0.36	0.046	0.123	0.217	NR
TS7x5x 3/8	0.36	0.046	0.123	0.217	NR
TS8x4x 3/8	0.36	0.046	0.123	0.217	NR
TS7x7x 3/8	0.36	0.046	0.123	0.217	NR
TS8x6x 3/8	0.36	0.046	0.123	0.217	NR
TS9x5x 3/8	0.36	0.046	0.123	0.217	NR
TS10x4x 3/8	0.36	0.046	0.123	0.217	NR
TS10x5x 3/8	0.36	0.046	0.123	0.217	NR
TS8x8x 3/8	0.36	0.046	0.123	0.217	NR
TS9x7x 3/8	0.36	0.046	0.123	0.217	NR
TS10x6x 3/8	0.36	0.046	0.123	0.217	NR
TS12x4x 3/8	0.36	0.046	0.123	0.217	NR
TS9x9x 3/8	0.36	0.046	0.123	0.217	NR
TS10x8x 3/8	0.36	0.046	0.123	0.217	NR
TS12x6x 3/8	0.36	0.046	0.123	0.217	NR
TS14x4x 3/8	0.36	0.046	0.123	0.217	NR
TS10x10x 3/8	0.36	0.046	0.123	0.217	NR

TS12x8x 3/8	0.36	0.046	0.123	0.217	NR
TS14x6x 3/8	0.36	0.046	0.123	0.217	NR
TS16x4x 3/8	0.36	0.046	0.123	0.217	NR
TS12x10x 3/8	0.36	0.046	0.123	0.217	NR
TS12x12x 3/8	0.37	0.045	0.119	0.211	NR
TS14x10x 3/8	0.37	0.045	0.119	0.211	NR
TS16x8x 3/8	0.37	0.045	0.119	0.211	NR
TS18x6x 3/8	0.37	0.045	0.119	0.211	NR
TS20x4x 3/8	0.37	0.045	0.119	0.211	NR
TS14x12x 3/8	0.37	0.045	0.119	0.211	NR
TS14x14x 3/8	0.37	0.045	0.119	0.211	NR
TS16x12x 3/8	0.37	0.045	0.119	0.211	NR
TS20x8x 3/8	0.37	0.045	0.119	0.211	NR
TS18x12x 3/8	0.37	0.045	0.119	0.211	NR
TS16x16x 3/8	0.37	0.045	0.119	0.211	NR
TS20x12x 3/8	0.37	0.045	0.119	0.211	NR
TS18x16x 3/8	0.37	0.045	0.119	0.211	NR
TS18x18x 3/8	0.37	0.045	0.119	0.211	NR
TS20x16x 3/8	0.37	0.045	0.119	0.211	NR
TS20x18x 3/8	0.37	0.045	0.119	0.211	NR
TS20x20x 3/8	0.37	0.045	0.119	0.211	NR
TS4x4x 1/2	0.45	0.038	0.097	0.175	0.319
TS4.5x4.5x 1/2	0.45	0.038	0.097	0.175	0.319
TS5x4x 1/2	0.45	0.038	0.097	0.175	0.319
TS5x5x 1/2	0.46	0.037	0.094	0.172	0.319
TS6x4x 1/2	0.46	0.037	0.094	0.172	0.319
TS6x5x 1/2	0.46	0.037	0.094	0.172	0.319
TS7x4x 1/2	0.46	0.037	0.094	0.172	0.319
TS6x6x 1/2	0.46	0.037	0.094	0.172	0.319
TS7x5x 1/2	0.46	0.037	0.094	0.172	0.319
TS8x4x 1/2	0.46	0.037	0.094	0.172	0.319

TS7x7x 1/2	0.47	0.037	0.092	0.168	0.319
TS8x6x 1/2	0.47	0.037	0.092	0.168	0.319
TS9x5x 1/2	0.47	0.037	0.092	0.168	0.319
TS10x4x 1/2	0.47	0.037	0.092	0.168	0.319
TS8x8x 1/2	0.47	0.037	0.092	0.168	0.319
TS9x7x 1/2	0.47	0.037	0.092	0.168	0.319
TS10x6x 1/2	0.47	0.037	0.092	0.168	0.319
TS12x4x 1/2	0.47	0.037	0.092	0.168	0.319
TS9x9x 1/2	0.48	0.036	0.091	0.166	0.319
TS10x8x 1/2	0.48	0.036	0.091	0.166	0.319
TS12x6x 1/2	0.48	0.036	0.091	0.166	0.319
TS14x4x 1/2	0.48	0.036	0.091	0.166	0.319
TS10x10x 1/2	0.48	0.036	0.091	0.166	0.319
TS12x8x 1/2	0.48	0.036	0.091	0.166	0.319
TS14x6x 1/2	0.48	0.036	0.091	0.166	0.319
TS16x4x 1/2	0.48	0.036	0.091	0.166	0.319
TS12x10x 1/2	0.48	0.036	0.091	0.166	0.319
TS12x12x 1/2	0.48	0.036	0.091	0.166	0.319
TS14x10x 1/2	0.48	0.036	0.091	0.166	0.319
TS16x8x 1/2	0.48	0.036	0.091	0.166	0.319
TS18x6x 1/2	0.48	0.036	0.091	0.166	0.319
TS20x4x 1/2	0.48	0.036	0.091	0.166	0.319
TS14x12x 1/2	0.48	0.036	0.091	0.166	0.319
TS14x14x 1/2	0.49	0.036	0.089	0.164	0.319
TS16x12x 1/2	0.49	0.036	0.089	0.164	0.319
TS20x8x 1/2	0.49	0.036	0.089	0.164	0.319
TS18x12x 1/2	0.49	0.036	0.089	0.164	0.319
TS16x16x 1/2	0.49	0.036	0.089	0.164	0.319
TS20x12x 1/2	0.49	0.036	0.089	0.164	0.319
TS18x16x 1/2	0.49	0.036	0.089	0.164	0.319
TS18x18x 1/2	0.49	0.036	0.089	0.164	0.319

TS20x16x 1/2	0.49	0.036	0.089	0.164	0.319
TS20x18x 1/2	0.49	0.036	0.089	0.164	0.319
TS20x20x 1/2	0.49	0.036	0.089	0.164	0.319
TS6x6x 5/8	0.57	0.033	0.078	0.146	0.319
TS7x5x 5/8	0.57	0.033	0.078	0.146	0.319
TS8x4x 5/8	0.57	0.033	0.078	0.146	0.319
TS7x7x 5/8	0.58	0.032	0.078	0.145	0.319
TS9x5x 5/8	0.58	0.032	0.078	0.145	0.319
TS10x4x 5/8	0.58	0.032	0.078	0.145	0.319
TS8x8x 5/8	0.58	0.032	0.078	0.145	0.319
TS9x7x 5/8	0.58	0.032	0.078	0.145	0.319
TS10x6x 5/8	0.58	0.032	0.078	0.145	0.319
TS12x4x 5/8	0.58	0.032	0.078	0.145	0.319
TS9x9x 5/8	0.59	0.032	0.076	0.143	0.319
TS10x8x 5/8	0.59	0.032	0.076	0.143	0.319
TS12x6x 5/8	0.59	0.032	0.076	0.143	0.319
TS14x4x 5/8	0.59	0.032	0.076	0.143	0.319
TS10x10x 5/8	0.59	0.032	0.076	0.143	0.319
TS12x8x 5/8	0.59	0.032	0.076	0.143	0.319
TS14x6x 5/8	0.59	0.032	0.076	0.143	0.319
TS12x12x 5/8	0.60	0.032	0.076	0.141	0.319
TS14x10x 5/8	0.60	0.032	0.076	0.141	0.319
TS16x8x 5/8	0.60	0.032	0.076	0.141	0.319
TS18x6x 5/8	0.60	0.032	0.076	0.141	0.319
TS14x14x 5/8	0.60	0.032	0.076	0.141	0.319
TS16x12x 5/8	0.60	0.032	0.076	0.141	0.319
TS20x8x 5/8	0.60	0.032	0.076	0.141	0.319
TS18x12x 5/8	0.60	0.032	0.076	0.141	0.319
TS16x16x 5/8	0.61	0.031	0.075	0.140	0.319
TS20x12x 5/8	0.61	0.031	0.075	0.140	0.319
TS18x16x 5/8	0.61	0.031	0.075	0.140	0.319

TS18x18x 5/8	0.61	0.031	0.075	0.140	0.319
TS20x16x 5/8	0.61	0.031	0.075	0.140	0.319
TS20x18x 5/8	0.61	0.031	0.075	0.140	0.319
TS20x20x 5/8	0.61	0.031	0.075	0.140	0.319
TS12x6x 3/4	0.70	0.029	0.068	0.129	0.319
TS16x16x 1	0.95	0.026	0.058	0.112	0.319
TS16x16x 1.5	1.38	0.023	0.050	0.099	0.319

CARBOLINE CO — TYPE THERMO-SORB, THERMO-SORB VOC. Investigated for Interior Conditioned Space and Interior General Purpose.

4. **Carbon Fiber Mesh —** (Optional, Not Shown) For three hour rating. Nom. 3/16 in. by 3/16 in. 3.50 oz/sq yd carbon fiber mesh to cover the entire surface. The depth at which the reinforcing mesh is placed shall be approximately 0.120 inches from the steel substrate.

5. **Top Coat —** (Not Shown) - No topcoat required for Interior Conditioned Space. Finishing topcoat for Interior General Purpose, Types Carboguard 893 SG or Santile 655 applied at 0.006 in. dry film thickness or Carbocrylic 3350 or Carbocoat 30R applied at 0.003 in. dry film thickness.

*** Indicates such products shall bear the UL or cUL Certification Mark for jurisdictions employing the UL or cUL Certification (such as Canada), respectively.**

Last Updated on 2013-12-11

Design/System/Construction/Assembly Usage Disclaimer

- Authorities Having Jurisdiction should be consulted in all cases as to the particular requirements covering the installation and use of UL Certified products, equipment, system, devices, and materials.
- Authorities Having Jurisdiction should be consulted before construction.
- Fire resistance assemblies and products are developed by the design submitter and have been investigated by UL for compliance with applicable requirements. The published information cannot always address every construction nuance encountered in the field.
- When field issues arise, it is recommended the first contact for assistance be the technical service staff provided by the product manufacturer noted for the design. Users of fire resistance assemblies are advised to consult the general Guide Information for each product category and each group of assemblies. The Guide Information includes specifics concerning alternate materials and alternate methods of construction.
- Only products which bear UL's Mark are considered Certified.

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should be considered to be Certified and covered under UL's Follow-Up Service. Always look for the Mark on the product.

FIRE-RESISTANCE DESIGN

Assembly Usage Disclaimer

BXUV - Fire Resistance Ratings - ANSI/UL 263 Certified for United States

BXUV7 - Fire Resistance Ratings - CAN/ULC-S101 Certified for Canada

See General Information for Fire-resistance Ratings - ANSI/UL 263 Certified for United States
Design Criteria and Allowable Variances

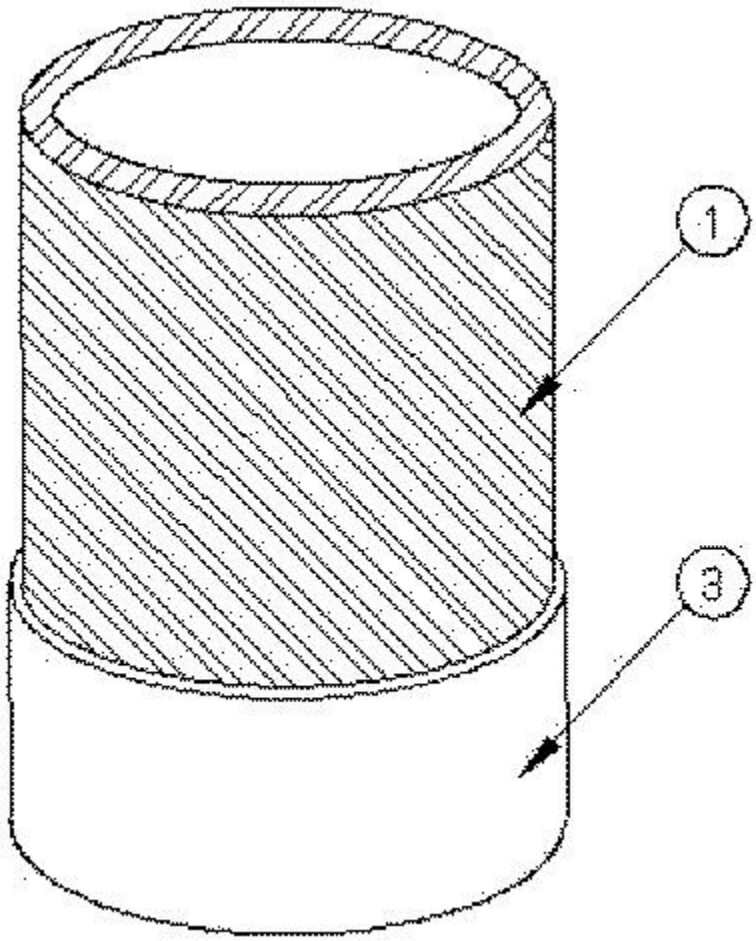
See General Information for Fire Resistance Ratings - CAN/ULC-S101 Certified for Canada
Design Criteria and Allowable Variances

Design No. X662

December 11, 2013

Ratings - 1, 1-1/2, 2, and 3 Hr. (See Item 3 and 4)

*** Indicates such products shall bear the UL or cUL Certification Mark for jurisdictions employing the UL or cUL Certification (such as Canada), respectively.**



1. **Steel Tube Column —** Hollow structural steel tube with the minimum sizes shown in the tables below. Columns shall be free of dirt, loose scale and oil.

2. **Primer Coating —** (Not Shown) Two Component Epoxy or Phenolic Modified Alkyd applied at 0.002 in. dry film thickness.

3. **Mastic & Intumescent Coating* —** Coating spray or brush applied in accordance with the manufacturer's instructions at the minimum average dry thickness shown in the table below. The thickness shown does not include primer thickness.

Size	A/P	1 Hr. In.	1-1/2 Hr. In.	2 Hr. In.	3 Hr. In.
SP 8X0.25	0.24	0.073	0.226	0.353	NR
SP 10X0.25	0.24	0.073	0.226	0.353	NR
SP 12X0.25	0.25	0.069	0.212	0.348	NR
SP 14X0.25	0.25	0.069	0.212	0.348	NR
SP 5X0.258	0.25	0.069	0.212	0.348	NR
SP 16X0.25	0.25	0.069	0.212	0.348	NR
SP 18X0.25	0.25	0.069	0.212	0.348	NR
SP 20X0.25	0.25	0.069	0.212	0.348	NR
SP 6X0.28	0.27	0.062	0.183	0.305	NR

SP 14X0.312	0.31	0.053	0.151	0.258	NR
SP 16X0.312	0.31	0.053	0.151	0.258	NR
SP 8X0.322	0.31	0.053	0.151	0.258	NR
SP 4X0.337	0.31	0.053	0.151	0.258	NR
SP 5X0.375	0.35	0.047	0.126	0.221	NR
SP 10X0.365	0.35	0.047	0.126	0.221	NR
SP 12X0.375	0.36	0.046	0.123	0.217	NR
SP 14X0.375	0.36	0.046	0.123	0.217	NR
SP 16X0.375	0.37	0.045	0.119	0.211	NR
SP 18X0.375	0.37	0.045	0.119	0.211	NR
SP 20X0.375	0.37	0.045	0.119	0.211	NR
SP 8X0.406	0.39	0.043	0.111	0.199	NR
SP 12X0.406	0.39	0.043	0.111	0.199	NR
SP 6X0.432	0.40	0.041	0.106	0.191	NR
SP 14X0.438	0.42	0.040	0.102	0.183	NR
SP 16X0.438	0.43	0.039	0.101	0.182	NR
SP 18X0.438	0.43	0.039	0.101	0.182	NR
SP 8X0.5	0.47	0.037	0.092	0.168	0.319
SP 10X0.5	0.48	0.036	0.091	0.166	0.319
SP 12X0.5	0.48	0.036	0.091	0.166	0.319
SP 14X0.5	0.48	0.036	0.091	0.166	0.319
SP 16X0.5	0.48	0.036	0.091	0.166	0.319
SP 18X0.5	0.49	0.036	0.089	0.164	0.319
SP 20X0.5	0.49	0.036	0.089	0.164	0.319
SP 6X0.562	0.51	0.035	0.085	0.157	0.319
SP 12X0.562	0.54	0.034	0.082	0.152	0.319
SP 18X0.562	0.54	0.034	0.082	0.150	0.319
SP 8X0.594	0.55	0.033	0.080	0.149	0.319
SP 10X0.594	0.56	0.033	0.079	0.147	0.319
SP 14X0.594	0.57	0.033	0.078	0.146	0.319
SP 4X0.674	0.57	0.033	0.078	0.146	0.319

SP 20X0.625	0.61	0.031	0.075	0.140	0.319
SP 16X0.656	0.63	0.031	0.073	0.137	0.319
SP 6X0.719	0.64	0.030	0.072	0.136	0.319
SP 5X0.75	0.65	0.030	0.071	0.135	0.319
SP 12X0.688	0.65	0.030	0.071	0.134	0.319
SP 8X 0.719	0.66	0.030	0.071	0.134	0.319
SP 10X0.719	0.67	0.030	0.070	0.132	0.319
SP 14X0.75	0.71	0.029	0.067	0.128	0.319
SP 18X0.75	0.72	0.029	0.067	0.127	0.319
SP 20X0.75	0.72	0.029	0.067	0.127	0.319
SP 8X0.812	0.74	0.029	0.066	0.126	0.319
SP 6X0.864	0.75	0.028	0.065	0.125	0.319
SP 10X0.844	0.78	0.028	0.064	0.122	0.319
SP 20X0.812	0.78	0.028	0.064	0.122	0.319
SP 8X0.875	0.79	0.028	0.064	0.122	0.319
SP 12X0.844	0.79	0.028	0.064	0.122	0.319
SP 16X0.844	0.80	0.028	0.063	0.121	0.319
SP 18X0.938	0.89	0.026	0.060	0.115	0.319
SP 10X1.0	0.91	0.026	0.059	0.114	0.319
SP 12X1.0	0.92	0.026	0.059	0.114	0.319
SP 20X1.031	0.98	0.026	0.057	0.111	0.319
SP 14X 1.094	1.01	0.025	0.056	0.110	0.319
SP 16X1.219	1.13	0.024	0.054	0.106	0.319
SP 14X 1.25	1.14	0.024	0.054	0.105	0.319
SP 20X1.281	1.20	0.024	0.053	0.103	0.319
SP 14X1.406	1.26	0.024	0.052	0.102	0.319

CARBOLINE CO — TYPE THERMO-SORB, THERMO-SORB VOC. Investigated for Interior Conditioned Space and Interior General Purpose.

4. **Carbon Fiber Mesh —** (Option, Not Shown) For three hour rating. Nom 3/16 in. by 3/16 in. 3.50 oz/sq yd carbon fiber mesh to cover the entire surface. The depth at which the reinforcing mesh is placed shall be approximately 0.120 inches from the steel substrate.

5. **Top Coat —** (Not Shown) - No topcoat required for Interior Conditioned Space. Finishing topcoat for Interior General Purpose, Types Carboguard 893 SG or Santile 655 applied at 0.006 in. dry film thickness or Carbocrylic 3350 or Carbocoat 30R applied at 0.003 in. dry film thickness.

*** Indicates such products shall bear the UL or cUL Certification Mark for jurisdictions employing the UL or cUL Certification (such as Canada), respectively.**

Last Updated on 2013-12-11

Design/System/Construction/Assembly Usage Disclaimer

- Authorities Having Jurisdiction should be consulted in all cases as to the particular requirements covering the installation and use of UL Certified products, equipment, system, devices, and materials.
- Authorities Having Jurisdiction should be consulted before construction.
- Fire resistance assemblies and products are developed by the design submitter and have been investigated by UL for compliance with applicable requirements. The published information cannot always address every construction nuance encountered in the field.
- When field issues arise, it is recommended the first contact for assistance be the technical service staff provided by the product manufacturer noted for the design. Users of fire resistance assemblies are advised to consult the general Guide Information for each product category and each group of assemblies. The Guide Information includes specifics concerning alternate materials and alternate methods of construction.
- Only products which bear UL's Mark are considered Certified.

FIRE-RESISTANCE DESIGN

Assembly Usage Disclaimer

BXUV - Fire Resistance Ratings - ANSI/UL 263 Certified for United States

BXUV7 - Fire Resistance Ratings - CAN/ULC-S101 Certified for Canada

See General Information for Fire-resistance Ratings - ANSI/UL 263 Certified for United States
Design Criteria and Allowable Variances

See General Information for Fire Resistance Ratings - CAN/ULC-S101 Certified for Canada
Design Criteria and Allowable Variances

Design No. N619

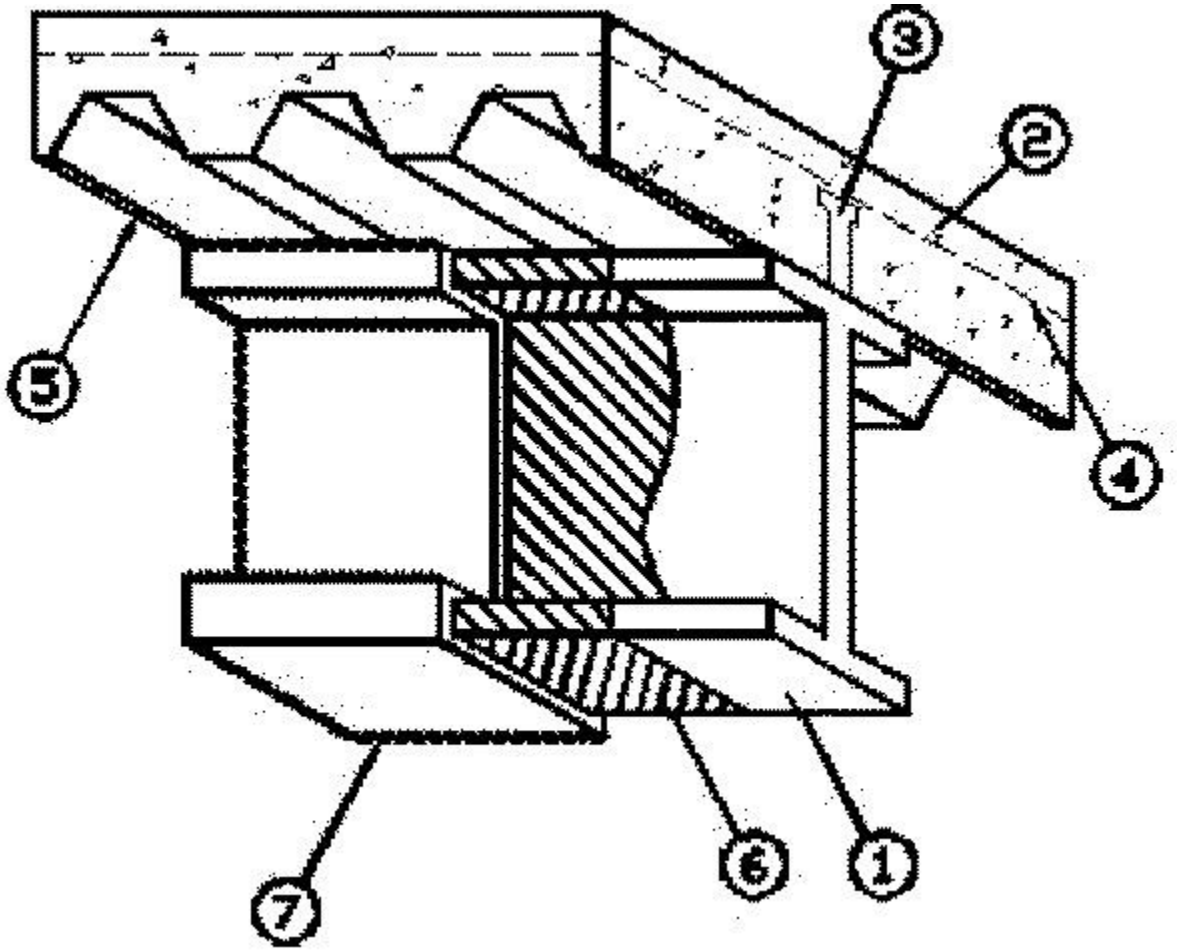
December 11, 2013

Restrained Beam Rating — 1, 1-1/2 and 2 Hr (See Item 7 and 8)

Unrestrained Beam Rating — 1, 1-1/2 and 2 Hr (See Item 7 and 8)

This design was evaluated using a load design method other than the Limit States Design Method (e.g., Working Stress Design Method). For jurisdictions employing the Limit States Design Method, such as Canada, a load restriction factor shall be used — See Guide BXUV or BXUV7

*** Indicates such products shall bear the UL or cUL Certification Mark for jurisdictions employing the UL or cUL Certification (such as Canada), respectively.**



1. **Steel Beam —** Min size as shown in the table below (See Item 7).

2. **Normal Weight or Lightweight Concrete —** Compressive strength 3000 psi. For normal weight concrete either carbonate or siliceous aggregate may be used. Unit weight 148 lbs / cu ft for normal weight concrete and 110 lbs / cu ft for lightweight concrete.

3. **Shear Connectors —** (Optional) Studs, headed type or equivalent per AISC specifications welded to the top flange of beam through the steel floor units.

4. **Welded Wire Fabric —** 6x6 SWG.

5. **Steel Floor Units —** 1-1/2, 2 or 3 in. deep fluted units, welded to beam.

6. **Primer Coating —** Two Component Epoxy or Phenolic Modified Alkyd applied at 0.002 in. dry film thickness.

7. **Mastic and Intumescent Coating* —** Coating spray or brush applied in accordance with the manufacturer's instructions at the minimum dry thickness shown in the table below. The thickness shown does not include primer.

UNRESTRAINED BEAM RATINGS

	W/D	Hp/A	1 hr (inches)	1.5 hr (inches)	2 hr (inches)
W18x35	0.67	200	0.061	NR	NR

W6x16	0.67	200	0.061	NR	NR
W8x21	0.67	200	0.061	NR	NR
W6x20	0.68	197	0.061	NR	NR
W12x30	0.69	194	0.060	NR	NR
W10x26	0.70	191	0.060	NR	NR
W16x36	0.70	191	0.060	NR	NR
W8x24	0.70	191	0.060	NR	NR
W14x34	0.72	186	0.059	NR	NR
W21x44	0.74	181	0.059	NR	NR
W18x40	0.76	176	0.058	NR	NR
W16x40	0.77	174	0.057	NR	NR
W5x19	0.78	172	0.057	NR	NR
W10x33	0.79	170	0.057	NR	NR
W12x35	0.80	168	0.056	NR	NR
W8x31	0.80	168	0.056	NR	NR
W10x30	0.81	165	0.056	NR	NR
W14x38	0.81	165	0.056	NR	NR
W8x28	0.81	165	0.056	NR	NR
W24x55	0.83	161	0.055	NR	NR
W21x50	0.84	160	0.055	NR	NR
W6x25	0.84	160	0.055	NR	NR
W12x40	0.86	156	0.054	NR	NR
W14x43	0.87	154	0.054	NR	NR
W16x45	0.87	154	0.054	NR	NR
W18x46	0.87	154	0.054	NR	NR
W18x50	0.88	152	0.053	NR	NR
W8x35	0.90	149	0.053	NR	NR
W10x39	0.92	146	0.052	NR	NR
W24x62	0.93	144	0.051	NR	NR
W24x68	0.94	143	0.051	NR	NR
W21x57	0.95	141	0.051	NR	NR

W21x62	0.95	141	0.051	NR	NR
W14x48	0.96	140	0.050	NR	NR
W16x50	0.96	140	0.050	NR	NR
W18x55	0.96	140	0.050	NR	NR
W12x45	0.97	138	0.050	NR	NR
W10x49	1.01	133	0.048	NR	NR
W12x53	1.01	133	0.048	NR	NR
W8x40	1.02	131	0.048	NR	NR
W27x84	1.03	130	0.048	NR	NR
W18x60	1.04	129	0.047	NR	NR
W21x68	1.04	129	0.047	NR	NR
W24x76	1.04	129	0.047	NR	NR
W10x45	1.05	128	0.047	NR	NR
W14x53	1.05	128	0.047	NR	NR
W12x50	1.07	125	0.046	NR	NR
W16x57	1.08	124	0.046	NR	NR
W16x67	1.08	124	0.046	NR	NR
W14x61	1.09	123	0.045	NR	NR
W12x58	1.10	122	0.045	NR	NR
W10x54	1.11	121	0.045	NR	NR
W12x65	1.11	121	0.045	NR	NR
W21x73	1.11	121	0.045	NR	NR
W18x65	1.12	120	0.044	NR	NR
W18x76	1.12	120	0.044	NR	NR
W30x99	1.12	120	0.044	NR	NR
W24x84	1.14	118	0.044	NR	NR
W27x94	1.15	117	0.043	NR	NR
W8x48	1.20	112	0.041	NR	NR
W14x68	1.21	111	0.041	NR	NR
W30x108	1.21	111	0.041	NR	NR
W33x118	1.21	111	0.041	NR	NR

W18x71	1.22	110	0.041	NR	NR
W10x60	1.23	109	0.040	NR	NR
W12x72	1.23	109	0.040	NR	NR
W24x104	1.23	109	0.040	NR	NR
W16x77	1.24	108	0.040	NR	NR
W27x102	1.24	108	0.040	NR	NR
W18x86	1.26	106	0.039	NR	NR
W21x83	1.26	106	0.039	NR	NR
W24x94	1.27	106	0.039	NR	NR
W14x90	1.29	104	0.038	NR	NR
W36x135	1.29	104	0.038	NR	NR
W21x101	1.30	103	0.038	NR	NR
W30x116	1.30	103	0.038	NR	NR
W14x74	1.31	102	0.037	NR	NR
W33x130	1.32	102	0.037	NR	NR
W12x79	1.34	100	0.036	NR	NR
W10x68	1.38	97	0.035	NR	NR
W24x117	1.38	97	0.035	NR	NR
W27x114	1.38	97	0.035	NR	NR
W30X124	1.38	97	0.035	NR	NR
W21x93	1.40	96	0.034	NR	NR
W18x97	1.41	95	0.033	NR	NR
W14x99	1.42	94	0.033	NR	NR
W16x89	1.42	94	0.033	NR	NR
W21x111	1.42	94	0.033	NR	NR
W33x141	1.43	94	0.033	NR	NR
W36x150	1.43	94	0.033	NR	NR
W8x58	1.43	94	0.033	NR	NR
W14x82	1.44	93	0.032	NR	NR
W12x87	1.46	92	0.032	NR	NR
W30x132	1.47	91	0.031	NR	NR

W36x160	1.52	88	0.030	NR	NR
W18x106	1.53	88	0.030	NR	NR
W24x131	1.53	88	0.030	NR	NR
W33x152	1.53	88	0.030	NR	NR
W10x77	1.55	86	0.030	NR	NR
W14x109	1.55	86	0.030	NR	NR
W21x122	1.55	86	0.030	NR	NR
W27x146	1.55	86	0.030	NR	NR
W16x100	1.58	85	0.030	NR	NR
W12x96	1.61	83	0.030	NR	NR
W36x170	1.61	83	0.030	NR	NR
W8x67	1.63	82	0.030	NR	NR
W21x132	1.67	80	0.030	NR	NR
W30x173	1.67	80	0.030	NR	NR
W14x120	1.69	79	0.030	NR	NR
W24x146	1.70	79	0.030	NR	NR
W27x161	1.70	79	0.030	NR	NR
W18x119	1.71	78	0.030	NR	NR
W36x182	1.71	78	0.030	NR	NR
W10x88	1.75	77	0.030	0.051	0.081

RESTRAINED BEAM RATINGS

	W/D	Hp/A	1 hr (inches)	1.5 hr (inches)	2 hr (inches)
W18x35	0.67	200	0.061	0.061	0.096
W6x16	0.67	200	0.061	0.061	0.096
W8x21	0.67	200	0.061	0.061	0.096
W6x20	0.68	197	0.061	0.061	0.095
W12x30	0.69	194	0.060	0.060	0.095
W10x26	0.70	191	0.060	0.060	0.095
W16x36	0.70	191	0.060	0.060	0.095
W8x24	0.70	191	0.060	0.060	0.095

W14x34	0.72	186	0.059	0.059	0.094
W21x44	0.74	181	0.059	0.059	0.094
W18x40	0.76	176	0.058	0.058	0.093
W16x40	0.77	174	0.057	0.057	0.093
W5x19	0.78	172	0.057	0.057	0.093
W10x33	0.79	170	0.057	0.057	0.092
W12x35	0.80	168	0.056	0.056	0.092
W8x31	0.80	168	0.056	0.056	0.092
W10x30	0.81	165	0.056	0.056	0.092
W14x38	0.81	165	0.056	0.056	0.092
W8x28	0.81	165	0.056	0.056	0.092
W24x55	0.83	161	0.055	0.055	0.091
W21x50	0.84	160	0.055	0.055	0.091
W6x25	0.84	160	0.055	0.055	0.091
W12x40	0.86	156	0.054	0.054	0.090
W14x43	0.87	154	0.054	0.054	0.090
W16x45	0.87	154	0.054	0.054	0.090
W18x46	0.87	154	0.054	0.054	0.090
W18x50	0.88	152	0.053	0.053	0.090
W8x35	0.90	149	0.053	0.053	0.089
W10x39	0.92	146	0.052	0.052	0.089
W24x62	0.93	144	0.051	0.051	0.088
W24x68	0.94	143	0.051	0.051	0.088
W21x57	0.95	141	0.051	0.051	0.088
W21x62	0.95	141	0.051	0.051	0.088
W14x48	0.96	140	0.050	0.050	0.088
W16x50	0.96	140	0.050	0.050	0.088
W18x55	0.96	140	0.050	0.050	0.088
W12x45	0.97	138	0.050	0.050	0.087
W10x49	1.01	133	0.048	0.048	0.086
W12x53	1.01	133	0.048	0.048	0.086

W8x40	1.02	131	0.048	0.048	0.086
W27x84	1.03	130	0.048	0.048	0.086
W18x60	1.04	129	0.047	0.047	0.085
W21x68	1.04	129	0.047	0.047	0.085
W24x76	1.04	129	0.047	0.047	0.085
W10x45	1.05	128	0.047	0.047	0.085
W14x53	1.05	128	0.047	0.047	0.085
W12x50	1.07	125	0.046	0.046	0.084
W16x57	1.08	124	0.046	0.046	0.084
W16x67	1.08	124	0.046	0.046	0.084
W14x61	1.09	123	0.045	0.045	0.084
W12x58	1.10	122	0.045	0.045	0.084
W10x54	1.11	121	0.045	0.045	0.083
W12x65	1.11	121	0.045	0.045	0.083
W21x73	1.11	121	0.045	0.045	0.083
W18x65	1.12	120	0.044	0.044	0.083
W18x76	1.12	120	0.044	0.044	0.083
W30x99	1.12	120	0.044	0.044	0.083
W24x84	1.14	118	0.044	0.044	0.082
W27x94	1.15	117	0.043	0.043	0.082
W8x48	1.20	112	0.041	0.041	0.081
W14x68	1.21	111	0.041	0.041	0.081
W30x108	1.21	111	0.041	0.041	0.081
W33x118	1.21	111	0.041	0.041	0.081
W18x71	1.22	110	0.041	0.041	0.080
W10x60	1.23	109	0.040	0.040	0.080
W12x72	1.23	109	0.040	0.040	0.080
W24x104	1.23	109	0.040	0.040	0.080
W16x77	1.24	108	0.040	0.040	0.080
W27x102	1.24	108	0.040	0.040	0.080
W18x86	1.26	106	0.039	0.039	0.079

W21x83	1.26	106	0.039	0.039	0.079
W24x94	1.27	106	0.039	0.039	0.079
W14x90	1.29	104	0.038	0.039	0.078
W36x135	1.29	104	0.038	0.039	0.078
W21x101	1.30	103	0.038	0.038	0.078
W30x116	1.30	103	0.038	0.038	0.078
W14x74	1.31	102	0.037	0.038	0.078
W33x130	1.32	102	0.037	0.038	0.077
W12x79	1.34	100	0.036	0.038	0.077
W10x68	1.38	97	0.035	0.037	0.076
W24x117	1.38	97	0.035	0.037	0.076
W27x114	1.38	97	0.035	0.037	0.076
W30X124	1.38	97	0.035	0.037	0.076
W21x93	1.40	96	0.034	0.037	0.075
W18x97	1.41	95	0.033	0.036	0.075
W14x99	1.42	94	0.033	0.036	0.075
W16x89	1.42	94	0.033	0.036	0.075
W21x111	1.42	94	0.033	0.036	0.075
W33x141	1.43	94	0.033	0.036	0.074
W36x150	1.43	94	0.033	0.036	0.074
W8x58	1.43	94	0.033	0.036	0.074
W14x82	1.44	93	0.032	0.036	0.074
W12x87	1.46	92	0.032	0.035	0.074
W30x132	1.47	91	0.031	0.035	0.073
W36x160	1.52	88	0.030	0.034	0.072
W18x106	1.53	88	0.030	0.034	0.072
W24x131	1.53	88	0.030	0.034	0.072
W33x152	1.53	88	0.030	0.034	0.072
W10x77	1.55	86	0.030	0.034	0.071
W14x109	1.55	86	0.030	0.034	0.071
W21x122	1.55	86	0.030	0.034	0.071

W27x146	1.55	86	0.030	0.034	0.071
W16x100	1.58	85	0.030	0.033	0.070
W12x96	1.61	83	0.030	0.033	0.069
W36x170	1.61	83	0.030	0.033	0.069
W8x67	1.63	82	0.030	0.032	0.069
W21x132	1.67	80	0.030	0.031	0.068
W30x173	1.67	80	0.030	0.031	0.068
W14x120	1.69	79	0.030	0.031	0.067
W24x146	1.70	79	0.030	0.031	0.067
W27x161	1.70	79	0.030	0.031	0.067
W18x119	1.71	78	0.030	0.031	0.067
W36x182	1.71	78	0.030	0.031	0.067
W10x88	1.75	77	0.030	0.030	0.065

CARBOLINE CO — TYPE THERMO-SORB, THERMO-SORB VOC. Investigated for Interior Conditioned Space and Interior General Purpose.

8. **Top Coat —** (Not Shown) - No topcoat required for Interior Conditioned Space. Finishing topcoat for Interior General Purpose, Types Carboguard 893 SG or Santile 655 applied at 0.006 in. dry film thickness or Carbocrylic 3350 or Carbocoat 30R applied at 0.003 in. dry film thickness.

*** Indicates such products shall bear the UL or cUL Certification Mark for jurisdictions employing the UL or cUL Certification (such as Canada), respectively.**

Last Updated on 2013-12-11

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- Authorities Having Jurisdiction should be consulted before construction.
- Fire resistance assemblies and products are developed by the design submitter and have been investigated by UL for compliance with applicable requirements. The published information cannot always address every construction nuance encountered in the field.
- When field issues arise, it is recommended the first contact for assistance be the technical service staff provided by the product manufacturer noted for the design. Users of fire resistance assemblies are advised to consult the general Guide Information for each product category and each group of

assemblies. The Guide Information includes specifics concerning alternate materials and alternate methods of construction.
- Only products which bear UL's Mark are considered Certified.

FIRE-RESISTANCE DESIGN

Assembly Usage Disclaimer

BXUV - Fire Resistance Ratings - ANSI/UL 263 Certified for United States

BXUV7 - Fire Resistance Ratings - CAN/ULC-S101 Certified for Canada

See General Information for Fire-resistance Ratings - ANSI/UL 263 Certified for United States Design Criteria and Allowable Variances

See General Information for Fire Resistance Ratings - CAN/ULC-S101 Certified for Canada Design Criteria and Allowable Variances

Design No. D946

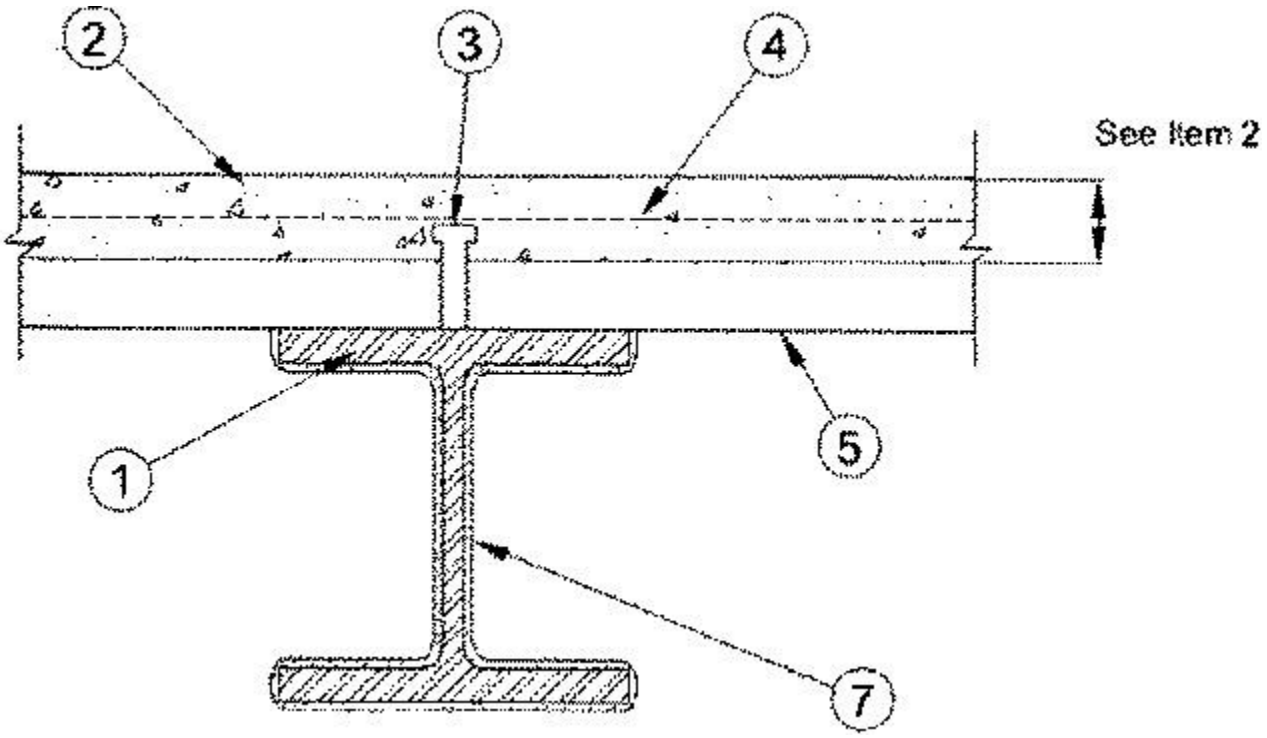
January 18, 2019

Restrained Assembly Rating - 2 Hr. (See Items 2, 5 and 7)

Unrestrained Beam Rating - 1 Hr. (See Items 2, 5 and 7)

This design was evaluated using a load design method other than the Limit States Design Method (e.g., Working Stress Design Method). For jurisdictions employing the Limit States Design Method, such as Canada, a load restriction factor shall be used — See Guide BXUV or BXUV7

*** Indicates such products shall bear the UL or cUL Certification Mark for jurisdictions employing the UL or cUL Certification (such as Canada), respectively.**



1. **Steel Beams —** Any wide flange steel size shown in the table in Item 7. Beams shall be primed with a two Component Epoxy or Phenolic Modified Alkyd applied at 0.002 in. dry film thickness.

2. **Normal Weight or Lightweight Concrete —** Normal weight concrete, carbonate or siliceous aggregate, 145 lb/ft plus or minus 3 lb/ft weight, 3000 psi compressive strength, vibrated. Lightweight concrete, expanded shale, clay or slate aggregate by rotary-kiln method, 107-120 lb/ft weight, 3000 psi compressive strength, vibrated, 4 to 7 percent entrained air. Min thickness shown in the table below:

Restrained Assembly Rating Hr	Concrete (Type)	Concrete Unit Weight pcf	Concrete Thkns In.
2	Normal Weight	147-153	4-1/2
2	Lightweight	107-113	3-1/4
2	Lightweight	107-116	3-1/4*
2	Lightweight	114-120	3-1/2

*For use with 2 or 3 in. steel floor and form units only.

3. **Shear Connectors (Optional) —** Studs, 3/4 in. diam by 4-1/2 in. long, headed type or equivalent per AISC specification. Welded to the top flange of the beam, through the deck.

4. **Welded Wire Fabric —** 6x6 — W1.4xW1.4.

5. **Steel Floor and Form Units* —** Composite 1-1/2, 2, or 3 in. deep galv Units. Fluted units may be uncoated. Min gauges 22 MSG for fluted and 20/20 MSG for cellular. Any combination of fluted and cellular units may be used. Spacing of welds attaching units to supports shall be 12 in. OC max unless specified otherwise, adjacent units button-punched

or welded together at side joints and, unless specified otherwise for specific unit types, spacing of all side joint fastening systems shall not exceed 36 in. OC.
NEW MILLENNIUM BUILDING SYSTEMS L L C — 12, 24 or 36 in. wide Types Mac-Lok 2, Mac-Lok 3; 12 in. wide Mac-Way Cellular Types 2-633MTWA, 3-633MTWA, 2-633MTWV, 3-633MTWV. For the 2h Restrained Assembly Ratings and the 1h Unrestrained Beam Rating, 12 in. wide, Type 1.5-633 MTWA may be used. Types Mac-Lok 2, Mac-Lok 3 may be phos/ptd. Two rows of steel studs with discs (Item 7) shall be welded along the sides of the Types 2-633MTWV, 3-633MTWV cellular units a max of 22 in. OC.

NEW MILLENNIUM BUILDING SYSTEMS L L C — 24 or 36 in. wide Types 2.0CFD, 3.0CFD, 3.0CFDES; 24, 30 or 36 in. wide Types 1.5CFD. Fluted units may be uncoated, phos/painted or galvanized.

VULCRAFT, DIV OF NUCOR CORP — 24, 30 or 36 in. wide Type 1.5VLI, 1.5VLP;24 or 36 in. wide Types 2VLI, 3VLI, 2VLP, 3VLP. Types 1.5VLI, 2VLI, 3VLI units may be phos/ptd; 24 or 36 in. wide Types 2VLJ, 3VLJ units (+) may be used for max 2 hr. Restrained Assembly.

(+)Side joints of Type 2VLJ or 3VLJ units may be fastened together with No. 8-3/4 in. long self-drilling Tek screws driven diagonally from the top side through the joint of the units at 36 in. OC max.

6. **Joint Cover —** (Not Shown) —2 in. wide pressure sensitive cloth tape.

7. **Mastic & Intumescent Coating* —** Coating spray, brush or trowel applied directly from containers to desired thickness. See table below for appropriate final dry thickness. Flutes above beam to be completely filled with mineral wool insulation having a minimum density of 6 lb/ft^3. Thickness shown does not include primer thickness.

			2 Hr Restrained Assembly
	W/D	**Hp/A**	**1 Hr Unrestrained Beam (inches)**
W18x35	0.67	200	0.076
W6x16	0.67	200	0.076
W8x21	0.67	200	0.076
W6x20	0.68	197	0.076
W12x30	0.69	194	0.075
W10x26	0.70	191	0.075
W16x36	0.70	191	0.075
W8x24	0.70	191	0.075
W14x34	0.72	186	0.074
W21x44	0.74	181	0.074

W18x40	0.76	176	0.073
W16x40	0.77	174	0.073
W5x19	0.78	172	0.072
W10x33	0.79	170	0.072
W12x35	0.80	168	0.072
W8x31	0.80	168	0.072
W10x30	0.81	165	0.072
W14x38	0.81	165	0.072
W8x28	0.81	165	0.072
W24x55	0.83	161	0.071
W21x50	0.84	160	0.071
W6x25	0.84	160	0.071
W12x40	0.86	156	0.070
W14x43	0.87	154	0.070
W16x45	0.87	154	0.070
W18x46	0.87	154	0.070
W18x50	0.88	152	0.069
W8x35	0.90	149	0.069
W10x39	0.92	146	0.068
W24x62	0.93	144	0.068
W24x68	0.94	143	0.067
W21x57	0.95	141	0.067
W21x62	0.95	141	0.067
W14x48	0.96	140	0.067
W16x50	0.96	140	0.067
W18x55	0.96	140	0.067
W12x45	0.97	138	0.066
W10x49	1.01	133	0.065
W12x53	1.01	133	0.065
W8x40	1.02	131	0.065
W27x84	1.03	130	0.065

W18x60	1.04	129	0.064
W21x68	1.04	129	0.064
W24x76	1.04	129	0.064
W10x45	1.05	128	0.064
W14x53	1.05	128	0.064
W12x50	1.07	125	0.063
W16x57	1.08	124	0.063
W16x67	1.08	124	0.063
W14x61	1.09	123	0.063
W12x58	1.10	122	0.062
W10x54	1.11	121	0.062
W12x65	1.11	121	0.062
W21x73	1.11	121	0.062
W18x65	1.12	120	0.062
W18x76	1.12	120	0.062
W30x99	1.12	120	0.062
W24x84	1.14	118	0.061
W27x94	1.15	117	0.061
W8x48	1.20	112	0.059
W14x68	1.21	111	0.059
W30x108	1.21	111	0.059
W33x118	1.21	111	0.059
W18x71	1.22	110	0.059
W10x60	1.23	109	0.058
W12x72	1.23	109	0.058
W24x104	1.23	109	0.058
W16x77	1.24	108	0.058
W27x102	1.24	108	0.058
W18x86	1.26	106	0.057
W21x83	1.26	106	0.057
W24x94	1.27	106	0.057

W14x90	1.29	104	0.056
W36x135	1.29	104	0.056
W21x101	1.30	103	0.056
W30x116	1.30	103	0.056
W14x74	1.31	102	0.056
W33x130	1.32	102	0.056
W12x79	1.34	100	0.055
W10x68	1.38	97	0.054
W24x117	1.38	97	0.054
W27x114	1.38	97	0.054
W30X124	1.38	97	0.054
W21x93	1.40	96	0.053
W18x97	1.41	95	0.053
W14x99	1.42	94	0.052
W16x89	1.42	94	0.052
W21x111	1.42	94	0.052
W33x141	1.43	94	0.052
W36x150	1.43	94	0.052
W8x58	1.43	94	0.052
W14x82	1.44	93	0.052
W12x87	1.46	92	0.051
W30x132	1.47	91	0.051
W36x160	1.52	88	0.049
W18x106	1.53	88	0.049
W24x131	1.53	88	0.049
W33x152	1.53	88	0.049
W10x77	1.55	86	0.048
W14x109	1.55	86	0.048
W21x122	1.55	86	0.048
W27x146	1.55	86	0.048
W16x100	1.58	85	0.047

W12x96	1.61	83	0.046
W36x170	1.61	83	0.046
W8x67	1.63	82	0.046
W21x132	1.67	80	0.045
W30x173	1.67	80	0.045
W14x120	1.69	79	0.044
W24x146	1.70	79	0.044
W27x161	1.70	79	0.044
W18x119	1.71	78	0.043
W36x182	1.71	78	0.043
W10x88	1.75	77	0.042

CARBOLINE CO — TYPE THERMO-SORB, THERMO-SORB VOC.

Investigated for Interior Conditioned Space and Interior General Purpose.

8. **Top Coat —** (Not Shown) - No topcoat required for Interior Conditioned Space. Finishing topcoat for Interior General Purpose, Types Carboguard 893 SG or Santile 655 applied at 0.006 in. dry film thickness or Carbocrylic 3350 or Carbocoat 30R applied at 0.003 in. dry film thickness.

*** Indicates such products shall bear the UL or cUL Certification Mark for jurisdictions employing the UL or cUL Certification (such as Canada), respectively.**

Last Updated on 2019-01-18

Design/System/Construction/Assembly Usage Disclaimer

- Authorities Having Jurisdiction should be consulted in all cases as to the particular requirements covering the installation and use of UL Certified products, equipment, system, devices, and materials.
- Authorities Having Jurisdiction should be consulted before construction.
- Fire resistance assemblies and products are developed by the design submitter and have been investigated by UL for compliance with applicable requirements. The published information cannot always address every construction nuance encountered in the field.
- When field issues arise, it is recommended the first contact for assistance be the technical service staff provided by the product manufacturer noted for the design. Users of fire resistance assemblies are advised to consult the general Guide Information for each product category and each group of assemblies. The Guide Information includes specifics concerning alternate materials and alternate methods of construction.
- Only products which bear UL's Mark are considered Certified.

The appearance of a company's name or product in this database does not in itself assure that products so identified have been manufactured under UL's Follow-Up Service. Only those products bearing the UL Mark should be considered to be Certified and covered under UL's Follow-Up Service. Always look for the Mark on the product.

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Chemical, Metallurgical, Mechanical, Nondestructive, Environmental Testing, Analyses and Field Service.

CARBOLINE COMPANY –R&D
350 Hanley Industrial Ct.
St. Louis, MO 63144

September 13, 2017
Lab No. 17P-4161
P.O. No. 0818171BEV

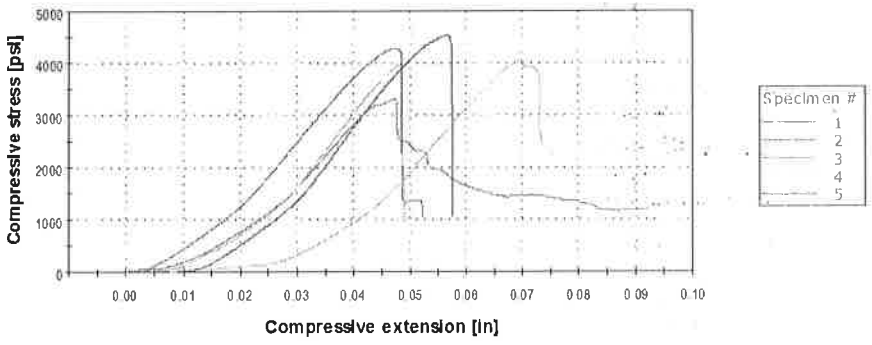
Attention: Brooke Grau

REPORT OF MECHANICAL TESTS

MATERIAL: 5 Each, Thermo-Sorb VOC
SUBJECT: Compressive Properties
PROCEDURE: ASTM D695-15
TEST CONDITIONING: Temp: 71°F RH: 51%
TEST INSTRUMENT: Instron 5500R w/ Bluehill 3 Software
RESULTS:

Sample #	Width (in)	Thickness (in)	Modulus (psi)	Load at Compressive Strength (lbf)	Compressive Strength (psi)
1	0.490	0.538	518632.0	1126.0	4271.2
2	0.499	0.541	487268.3	895.1	3315.7
3	0.499	0.541	555088.0	1071.4	3968.7
4	0.490	0.538	497925.7	1069.0	4055.0
5	0.500	0.538	583270.7	1216.1	4520.9
Average			528436.9	1075.5	4026.3

Load vs Deflection



KS/ceh

Karl Schmitz, Director
Materials Testing

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St. Louis, MO 63144

September 13, 2017
Lab No. 17P-4161
P.O. No. 0818171BEV

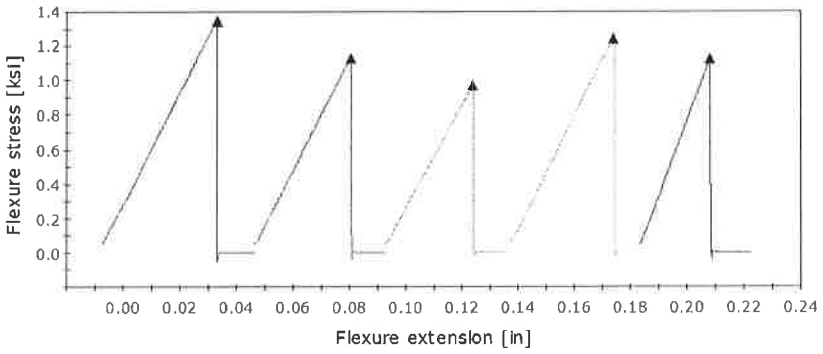
Attention: Brooke Grau

REPORT OF MECHANICAL TESTS

MATERIAL: 5 Each, Thermo-Sorb VOC
SUBJECT: Flexural Properties
PROCEDURE: ASTM D790-15e2
TEST CONDITIONING: Temp: 71°F RH: 51%
TEST INSTRUMENT: Instron 5500R w/ Bluehill 3 Software
RESULTS:

Sample #	Thickness (in)	Maximum Flexural Strength (psi)	Tangent Modulus (psi)	Strain @ Maximum Flexural Strength (in)
1	0.483	1345.5	734994.3	0.033
2	0.500	1132.1	700187.7	0.034
3	0.498	968.4	646983.3	0.031
4	0.500	1242.5	717059.5	0.038
5	0.448	1117.9	597083.4	0.093
Average		1161.3	679261.7	0.046

Specimen 1 to 5



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CARBOLINE COMPANY –R&D
350 Hanley Industrial Ct.
St. Louis, MO 63144

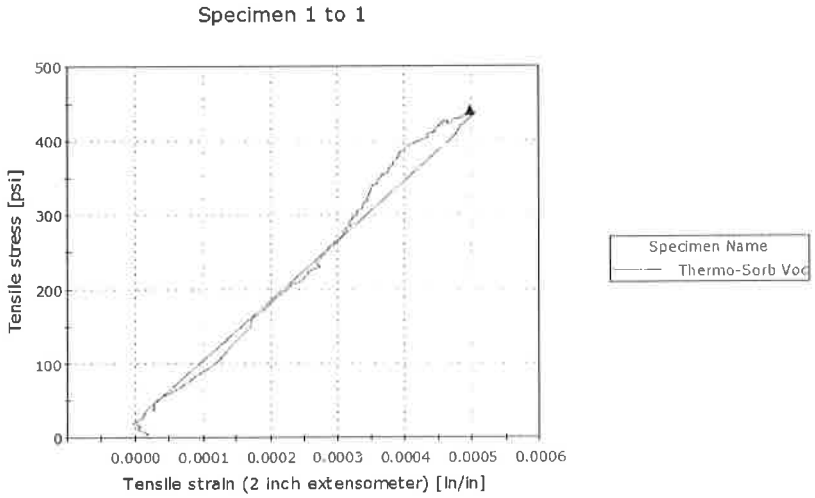
September 13, 2017
Lab No. 17P-4161
P.O. No. 0818171BEV

Attention: Brooke Grau

REPORT OF MECHANICAL TESTS

MATERIAL: 4 Each, Thermo-Sorb VOC, 3 Samples Received Broken
SUBJECT: Tensile and Elongation
PROCEDURE: ASTM D638-14RL
TEST CONDITIONING: Temp: 71°F RH: 51%
TEST INSTRUMENT: Instron 5500R w/ Bluehill 3 Software
RESULTS:

Sample #	Width [in]	Thickness [in]	Area [in^2]	Maximum Load [lbf]	Tensile Strength [psi]	Modulus [psi]	Elongation at Break [%]
1	0.503	0.157	0.07897	34.8	441	1222025.1	0.047



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Karl Schmitz, Director
Materials Testing

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Chemical, Metallurgical, Mechanical, Nondestructive, Environmental Testing, Analyses and Field Service

CARBOLINE COMPANY – R&D
350 HANLEY IND CT.
ST. LOUIS, MO 63044

September 13, 2017
Lab No. 17P-4161
P.O. No. 0818171BEV

Attention: Brooke Grau

REPORT OF HARDNESS TESTING

SUBJECT: Durometer Hardness testing of Thermo-Sorb VOC sample.

SAMPLES: 1 each, Cube, Thermo-Sorb VOC

METHOD: ASTM D2240; Shore D

INSPECTION RESULTS:

SAMPLE	HARDNESS SHORE D
1	76.9
2	66.5
3	73.0
4	64.0
5	77.5
AVG.	71.6

KS/ceh

Karl Schmitz, Director
Materials Testing

FTL Project: Adhesion ***Date:*** 3/19/2017

Report #: 1 ***Requested by:*** Sean_Younger

Title: **Adhesion Study of Thermo-Sorb VOC Intumescent with Carbocrylic 3359 DTMC as a Primer System**

Purpose: Determine the adhesion values of Thermo-Sorb VOC using Carbocrylic 3359 DTMC as the primer system

References: ASTM D4541-09

Background: Thermo-Sorb VOC was tested for adhesion to Carbocrylic 3359 DTMC as a primer system as a routine test for primer compatibility. The results are reported here:

Sample Descriptions: Four 3" x 6" x 1/4" pieces of steel plate were grit blasted to a surface cleanliness of SSPC 6 with an anchor profile of 1.5 – 2 mils coated with Carbocrylic 3359 DTMC and Thermo-Sorb VOC.

Equipment:

- Adhesive: Scotch Weld DP460 Epoxy Adhesive
- Patti Quantum Digital Adhesion Tester utilizing the F-4 piston

Procedure:

- Steel panels were grit blasted to a surface cleanliness of SSPC SP6 with a profile of 1.5 – 2 mils (.0015" - .0020")
- Carbocrylic 3359 DTMC was applied to the panels to a thickness of approximately 5 mils (.005") and allowed to dry for 10 days.
- The Thermo-Sorb was then applied to a thickness of 50 - 60 mils dft, (.050" - .600") and allowed to dry for 10 days.
- Adhesion dollies were applied using the adhesive and allowed to dry for a minimum of 48 hours prior to testing
- Testing was performed (un-scored to the steel)

Results:

Test Pull #	Fracture Strength (psi)	Comments
1	1169	100 % Cohesive Break in Thermo-Sorb VOC
2	1072	100 % Cohesive Break in Thermo-Sorb VOC
3	1192	100 % Cohesive Break in Thermo-Sorb VOC
4	1018	100 % Cohesive Break in Thermo-Sorb VOC
Average	1112	Un scored

Conclusions:

The Thermo-Sorb VOC tested has acceptable adhesion to the Carbocrylic 3359 DTMC system. These tests were performed under laboratory conditions and may not be indicative of any field testing results.

Field and jobsite conditions are variable in thickness of primer / fireproofing, temperature, humidity etc. and cannot be controlled. For these reasons, field testing if performed should only be required to show results of 200psi or greater, (scored or un scored) after the fireproofing has fully dried / cured. Timing of dry / cure is dependent upon site conditions and thickness of fireproofing applied.

FTL Project: Adhesion ***Date:*** 3/14/2018

Report #: 1 ***Requested by:*** Sean_Younger

Title: **Adhesion Study of Thermo-Sorb VOC Intumescent with Carbocoat 8239 as a Primer System**

Purpose: Determine the adhesion values of Thermo-Sorb VOC using Carbocoat 8239 as the primer system

References: ASTM D4541-09

Background: Thermo-Sorb VOC was tested for adhesion to Carbocoat 8239 as a primer system as a routine test for primer compatibility. The results are reported here:

Sample Descriptions: Four 3" x 6" x 1/4" pieces of steel plate were grit blasted to a surface cleanliness of SSPC 6 with an anchor profile of 1.5 – 2 mils coated with Carbocoat 8239 and Thermo-Sorb VOC.

Equipment:

- Adhesive: Scotch Weld DP460 Epoxy Adhesive
- Patti Quantum Digital Adhesion Tester utilizing the F-4 piston

Procedure:

- Steel panels were grit blasted to a surface cleanliness of SSPC SP6 with a profile of 1.5 – 2 mils (.0015" - .0020")
- *Carbocoat 8239* was applied to the panels to a thickness of approximately 4 mils (.004") and allowed to dry for 10 days.
- The Thermo-Sorb was then applied to a thickness of 50 - 60 mils dft, (.050" - .600") and allowed to dry for 10 days.
- Adhesion dollies were applied using the adhesive and allowed to dry for a minimum of 48 hours prior to testing
- Testing was performed (un-scored to the steel)

Results:

Test Pull #	Fracture Strength (psi)	Comments
1	838	100 % Cohesive Break in Thermo-Sorb VOC
2	865	100 % Cohesive Break in Thermo-Sorb VOC
3	859	100 % Cohesive Break in Thermo-Sorb VOC
4	958	100 % Cohesive Break in Thermo-Sorb VOC
Average	880	Un scored

Conclusions:

The Thermo-Sorb VOC tested has acceptable adhesion to the *Carbocoat 8239* system. These tests were performed under laboratory conditions and may not be indicative of any field testing results.

Testing was performed on 4/11/16. Report written on 3/14/2018

Field and jobsite conditions are variable in thickness of primer / fireproofing, temperature, humidity etc. and cannot be controlled. For these reasons, field testing if performed should only be required to show results of 200psi or greater, (scored or un scored) after the fireproofing has fully dried / cured. Timing of dry / cure is dependent upon site conditions and thickness of fireproofing applied.

LEED® v4 Technical Bulletin
Building Design + Construction

Background
This document outlines Carboline's contributions towards available LEED v4 credits. Carboline is committed to developing and manufacturing environmentally compliant coatings and fire protection products. Carboline fireproofing products can contribute towards points under the LEED Green Building Rating System. The LEED Green Building Rating System does not certify construction products and materials. Instead, entire projects are certified on the basis of the environmental impact of the building materials employed and the overall building design.

What is LEED?
Leadership in Energy and Environmental Design (LEED) is the most widely used green building rating system in the world. LEED was developed by the United States Green Building Council (USGBC) to evaluate the environmental performance of buildings and promote sustainable design methods. LEED certification provides independent verification of environmental features which allow for efficient, high performance, cost-effective building design and construction. There are four levels of certification that can be reached for LEED v4 which are awarded based on achieving a minimum number of points (Certified, Silver, Gold and Platinum).

Carboline products can contribute toward the following LEED v4 credit categories:

Energy & Atmosphere
- ✓ EA Prerequisite – Minimum Energy Performance
- ✓ EA Credit – Optimize Energy Performance

Materials and Resources
Materials and Resources
- ✓ MR Prerequisite: Construction and Demolition Waste Management Planning
- ✓ MR Credit: Building Life Cycle Impact Reduction
- ✓ MR Credit: Building Product Disclosure and Optimization – Sourcing of Raw Materials
- ✓ MR Credit: Building Product Disclosure and Optimization – Material Ingredients

Indoor Environmental Quality
- ✓ EQ Credit: Low-Emitting Materials

Energy and Atmosphere

EA Prerequisite: Minimum Energy Performance

Intent: To reduce the environmental and economic harm of excessive energy use by achieving a minimum level of energy efficiency for the building and its systems.

Requirements: Follow the criteria in the LEED New Construction Energy Design Guide as specified in LEED v4 (page 66).

Carboline Contributions: Carboline wet mix materials provide thermal resistance and noise reduction coefficient values. This will reduce the amount of energy needed for climate control and any added materials needed for soundproofing. This credit only applies to Carboline materials when used within the building envelope.

Carboline Products That Contribute: Pyrolite® 15, Pyrolite® 22, Southwest™ Type 5GP, Southwest™ Type 5MD, Southwest™ Type 5EF, Southwest™ Type 1XR, Southwest™ Type 7GP, Southwest™ Type 7HD, Southwest™ Type 7TB, Southwest™ Type DK 3 Spattercoat, Pyrocrete® 239, Pyrocrete® 40, Pyrocrete® 240 HY, Pyrocrete® 241, Pyrocrete® 241 HD, Hardcoat 4500

EA Credit: Optimize Energy Performance (1-18 points)

Note: This credit requires that an energy analysis be done that includes all energy costs within and associated with the building project. Points for this credit are assigned from 1-18 based on the percentage of energy cost savings the building materials or systems will provide.

Intent: Achieve increasing levels of energy performance above the baseline in the prerequisite standard to reduce environmental and economic impacts associated with excessive energy use.

Requirements: Follow the criteria in EA Prerequisite Minimum Energy Performance to demonstrate a percentage improvement in the proposed building performance rating compared with the baseline. Points are awarded according to Table 1 in LEED v4 (page 75). Demonstrate a percentage improvement in the proposed building performance rating compared to the baseline building.

Carboline Contributions: Carboline wet mix materials provide thermal resistance and noise reduction coefficient values. This will reduce the amount of energy needed for climate control and reduce any added materials needed for soundproofing. This credit only applies to Carboline materials when used within the building envelope.

Carboline Products That Contribute: Pyrolite® 15, Pyrolite® 22, Southwest™ Type 5GP, Southwest™ Type 5MD, Southwest™ Type 5EF, Southwest™ Type 1XR, Southwest™ Type 7GP, Southwest™ Type 7HD, Southwest™ Type 7TB, Southwest™ Type DK 3 Spattercoat, Pyrocrete® 239, Pyrocrete® 40, Pyrocrete® 240 HY, Pyrocrete® 241, Pyrocrete® 241 HD, Hardcoat 4500

Materials and Resources

MR Prerequisite: Construction and Demolition Waste Management Planning

Intent: To reduce construction and demolition waste disposed of in landfills and incineration facilities by recovering, reusing, and recycling materials.

Requirements:
Option 1 (page 106) Diversion (1–2 points)
Path1: Divert 50% and Three Material Streams (1 point)
Divert at least 50% of the total construction and demolition material; diverted materials must include at least three material streams.

OR

Path 2: Divert 75% and Four Material Streams (2 points)
Divert at least 75% of the total construction and demolition material; diverted materials must include at least four material streams. The minimum percentage debris to be recycled or salvaged for each point threshold is as follows: 50%: 1 point, 75%: 2 points

Carboline Contributions: Carboline products are supplied in paper bags, plastic pails or metal pails which can be recycled. The pallets used for shipment are also recyclable.

Carboline Products That Contribute: Pyrolite® 15, Pyrolite® 22, Southwest™ Type 5GP, Southwest™ Type 5MD, Southwest™ Type 5EF, Southwest™ Type 1XR, Southwest™ Type 7GP, Southwest™ Type 7HD, Southwest™ Type 7TB, Southwest™ Type DK 3 Spattercoat, A/D Type TC-55, Pyroprime® 775 WB, Pyrocrete® 239, Pyrocrete® 40, Pyrocrete® 240 HY, Pyrocrete® 241, Pyrocrete® 241 HD, Hardcoat 4500, A/D Firefilm® III, A/D Firefilm® III C, Firefilm® IV, Thermo-Sorb®, Thermo-Sorb® VOC, Thermo-Sorb® E, Thermo-Sorb® 263, Thermo-Lag® 3000, Thermo-Lag® E100, Thermo-Lag® E100 S

MR Credit: Building Life-Cycle Impact Reduction (2-5 points)

Intent: To encourage adaptive reuse and optimize the environmental performance of products and materials.

Requirements: Reuse or salvage building materials from offsite or onsite as a percentage of the surface area as listed in Table 1 (page 91). Include structural elements (e.g., floors, roof decking), enclosure materials (e.g., skin, framing), and permanently installed interior elements (e.g., walls, doors, floor coverings, ceiling systems). Exclude from the calculation window assemblies and any hazardous materials that are remediated as a part of the project.

Materials contributing toward this credit may not contribute toward MR Credit Material Disclosure and Optimization.

Percentage of completed project surface area reused	Points BD&C	Points BD&C (Core and Shell)
25%	2	2
50%	3	3
75%	4	5

Carboline Contributions: Carboline wet mix and intumescent materials are utilized for retrofit and rehab construction. These materials provide fire resistance ratings to unprotected structural members which will bring the existing building up to code. This will eliminate the need to replace the structural elements that were not code compliant.

Carboline Products That Contribute: Pyrolite® 15, Pyrolite® 22, Southwest™ Type 5GP, Southwest™ Type 5MD, Southwest™ Type 5EF, Southwest™ Type 1 XR, Southwest™ Type 7GP, Southwest™ Type 7HD, Southwest™ Type 7TB, Southwest™ Type DK3 Spattercoat, A/D Type TC-55, Pyroprime® 775 WB, Pyrocrete® 239, Pyrocrete® 40, Pyrocrete® 240 HY, Pyrocrete® 241, Pyrocrete® 241 HD, Hardcoat 4500, A/D Firefilm® III, A/D Firefilm® III C, Firefilm® IV, Thermo-Sorb®, Thermo-Sorb® VOC, Thermo-Sorb® E, Thermo-Sorb® 263, Thermo-Lag® 3000, Thermo-Lag® E100, Thermo-Lag® E100 S

MR Credit: Building Product Disclosure and Optimization-Sourcing of Raw Materials (1-2 points)

Intent: To encourage the use of products and materials for which life cycle information is available and that have environmentally, economically, and socially preferable life cycle impacts. To reward project teams for selecting products verified to have been extracted or sourced in a responsible manner.

Requirements:
Option 1 (page 95) Raw Material Source and Extraction Reporting (1 point)
Use at least 20 different permanently installed products from at least five different manufacturers that have publicly released a report from their raw material suppliers which include raw material supplier extraction locations, a commitment to long-term ecologically responsible land use, a commitment to reducing environmental harms from extraction and/or manufacturing processes, and a commitment to meeting applicable standards or programs voluntarily that address responsible sourcing criteria

Carboline Contributions: Carboline has publicly released reports from their raw material suppliers which include raw material supplier extraction locations for our wet mix and intumescent materials fire resistive materials.

Carboline Products That Contribute: Pyrolite® 15, Pyrolite® 22, Southwest™ Type 5GP, Southwest™ Type 5MD, Southwest™ Type 5EF, Southwest™ Type 1XR, Southwest™ Type 7GP, Southwest™ Type 7HD, Southwest™ Type 7TB, Southwest™ Type DK 3 Spattercoat, A/D Type TC-55, A/D Firefilm® III, A/D Firefilm® III C, Firefilm® IV, Thermo-Sorb®, Thermo-Sorb® VOC, Thermo-Sorb® E, Thermo-Sorb® 263, Thermo-Lag® 3000, Thermo-Lag® E100, Thermo-Lag® E100 S

Option 2 (page 95). Leadership Extraction Practices (1 point)
Use products that meet at least one of the responsible extraction criteria below for at least 25%, by cost, of the total value of permanently installed building products in the project.

Recycled content: Recycled content is the sum of postconsumer recycled content plus one-half the preconsumer recycled content, based on cost. Products meeting recycled content criteria are valued at 100% of their cost for the purposes of credit achievement calculation.

Carboline Contributions: Carboline wet-mix products are manufactured with post-consumer recycled materials.

Carboline Products That Contribute: Southwest™ Type 5GP (10% recycled content), Southwest™ Type 5MD (10% recycled content), Southwest™ Type 5EF (10% recycled content).

MR Credit: Building Product Disclosure and Optimization-Material Ingredients (1-2 points)

Intent: To encourage the use of products and materials for which life-cycle information is available and that have environmentally, economically, and socially preferable life-cycle impacts. To reward project teams for selecting products for which the chemical ingredients in the product are inventoried using an accepted methodology and for selecting products verified to minimize the use and generation of harmful substances. To reward raw material manufacturers who produce products verified to have improved life-cycle impacts.

Requirements:
Option 1 (Page 97) Material Ingredient Reporting (1 point)
Use at least 20 different permanently installed products from at least five different manufacturers that use any of the following programs to demonstrate the chemical inventory of the product.

Carboline Contributions: Carboline wet mix and intumescent products have complete Declare Health Product Declaration: The end use product has a published, complete Health Product Declaration with full disclosure of known hazards in compliance with the Health Product Declaration open standard.

Carboline Products That Contribute: Southwest™ Type 5GP, Southwest™ Type 5MD, Southwest™ Type 7GP, Southwest™ Type 7HD, Southwest™ Type 7TB, Southwest™ Type DK 3 Spattercoat, A/D Type TC-55, Pyrocrete® 239, Pyrocrete® 40, Pyrocrete® 241, A/D Firefilm® III, A/D Firefilm® III C, Firefilm® IV, Thermo-Sorb® VOC, Thermo-Sorb® E, Thermo-Sorb® 263, Thermo-Lag® 3000, Thermo-Lag® E100, Thermo-Lag® E100 S

MR Credit: Construction and Demolition Waste Management (1-2 points)

Intent: To reduce construction and demolition waste disposed of in landfills and incineration facilities by recovering, reusing, and recycling materials.

Requirements:
Option 1 (page 106) Diversion (1–2 points)
Path 1: Divert 50% and Three Material Streams (1 point)
Divert at least 50% of the total construction and demolition material; diverted materials must include at least three material streams.

OR

Path 2: Divert 75% and Four Material Streams (2 points)
Divert at least 75% of the total construction and demolition material; diverted materials must include at least four material streams. The minimum percentage debris to be recycled or salvaged for each point threshold is as follows: 50%: 1 point, 75%: 2 points

Carboline Contributions: Carboline products are supplied in paper bags, plastic pails or metal pails which can be recycled. The pallets used for shipment are also recyclable.

Carboline Products That Contribute: Pyrolite® 15, Pyrolite® 22, Southwest™ Type 5GP, Southwest™ Type 5MD, Southwest™ Type 5EF, Southwest™ Type 1XR, Southwest™ Type 7GP, Southwest™ Type 7HD, Southwest™ Type 7TB, Southwest™ Type DK 3 Spattercoat, A/D Type TC-55, Pyroprime® 775 WB, Pyrocrete® 239, Pyrocrete® 40, Pyrocrete® 240 HY, Pyrocrete® 241, Pyrocrete® 241 HD, Hardcoat 4500, A/D Firefilm® III, A/D Firefilm® III C, Firefilm® IV, Thermo-Sorb®, Thermo-Sorb® VOC, Thermo-Sorb® E, Thermo-Sorb® 263, Thermo-Lag® 3000, Thermo-Lag® E100, Thermo-Lag® E100 S

Indoor Environmental Quality

EQ Credit: Low Emitting Materials (1-3 points)

Intent: To reduce concentrations of chemical contaminants that can damage air quality, human health, productivity, and the environment.

Requirements: This credit includes requirements for product manufacturing as well as project teams. It covers volatile organic compound (VOC) emissions in the indoor air and the VOC content of materials as well as the testing methods by which indoor VOC emissions are determined. Different materials must meet different requirements to be considered compliant for this credit. The building interior and exterior are organized in seven categories, each with different thresholds of compliance. The building interior is defined as everything within the waterproofing membrane. The building exterior is defined as everything outside and inclusive of the primary and secondary weatherproofing system such as waterproofing membranes and air- and water-resistive barrier materials.

Option 1 (Page 118) Product Category Calculations (1-3 points)

Achieve the threshold level of compliance with emissions and content standards for the number of product categories listed in Table 2 (page 118).

Category	Threshold	Emission & Content Requirements
Interior paints and coatings applied onsite	At least 90% by volume for emissions, 100% for VOC content	• General Emissions Evaluation for paints and coatings applied to walls, floors and ceilings • VOC content requirements for wet applied products
Interior adhesives and sealants applied onsite	At least 90% by volume, for emissions 100% for VOC content	• General Emissions Evaluation • VOC content requirements for wet applied products
Ceilings, walls, thermal and acoustic insulation	100%	• General Emissions Evaluation • Healthcare, schools only
Healthcare and schools projects only: Exterior applied products	At least 90% by volume	• General Emissions Evaluation • Exterior applied products

Emissions and Content Requirements

To demonstrate compliance, a product or layer must meet all of the following requirements, as applicable.

Inherently non-emitting sources: Products that are inherently non-emitting sources of VOCs (stone, ceramic, powder-coated metals, plated or anodized metal, glass, concrete, clay brick, and unfinished or untreated solid wood flooring) are considered fully compliant without any VOC emissions testing if they do not include integral organic-based surface coatings, binders, or sealants.

General emissions evaluation: Building products must be tested and determined compliant in accordance with California Department of Public Health (CDPH) Standard Method v1.1–2010, using the applicable exposure scenario. The default scenario is the private office scenario. The manufacturer's or third-party certification must state the exposure scenario used to determine compliance. Claims of compliance for wet-applied products must state the amount applied in mass per surface area.

Manufacturers' claims of compliance with the above requirements must also state the range of total VOCs after 14 days (336 hours), measured as specified in the CDPH Standard Method v1.1:

- 0.5 mg/m3 or less;
- between 0.5 and 5.0 mg/m3; or
- 5.0 mg/m3 or more.

Additional VOC content requirements for wet-applied products: In addition to meeting the general requirements for VOC emissions (above), on-site wet-applied products must not contain excessive levels of VOCs, for the health of the installers and other trade workers who are exposed to these products. To demonstrate compliance, a product or layer must meet the following requirements, as applicable. Disclosure of VOC content must be made by the manufacturer. Any testing must follow the test method specified in the applicable regulation.

- All paints and coatings wet-applied on site must meet the applicable VOC limits of the California Air Resources Board (CARB) 2007, Suggested Control Measure (SCM) for Architectural Coatings, or the South Coast Air Quality Management District (SCAQMD) Rule 1113, effective June 3, 2011.
- All adhesives and sealants wet-applied on site must meet the applicable chemical content requirements of SCAQMD Rule 1168, July 1, 2005, Adhesive and Sealant Applications as analyzed by the methods specified in Rule 1168. The provisions of SCAQMD Rule 1168 do not apply to adhesives and sealants subject to state or federal consumer product VOC regulations.
- For projects outside the U.S., all paints, coatings, adhesives, and sealants wet-applied on site must either meet the technical requirements of the above regulations or comply with applicable national VOC control regulations such as the European Decopaint Directive (2004/42/EC), the Canadian VOC Concentration Limits for Architectural Coatings, or the Hong Kong Air Pollution Control (VOC) Regulation.

As there is no fireproofing category in the LEED v4, the SCAQMD regulations are commonly used to designate specialty coatings classifications for LEED applications. The SCAQMD (Rule #1113) outlines the current VOC limits as of January 1, 2014 for several categories of specialty coatings as follows:

Specialty Coating Type	Current VOC Limit (g/l)
Concrete surface retarders	50
Driveway Sealers	50
Faux finishing coatings	200
Fireproofing coatings	**150**
Graphic art coatings	150
Mastic coatings	100
Metallic pigmented coatings	150
Anti-graffiti coatings	50

The following Carboline products meet current VOC requirements:

Carboline Compliant Fireproofing Products	VOC Limit (EPA Method 24) (g/l)
A/D Firefilm® III	20 g/l
A/D Firefilm® III C	20 g/l
Firefilm® IV	4 g/l
Thermo-Sorb® VOC	142 g/l
Thermo-Sorb® E	147 g/l
Thermo-Sorb® 263	148 g/l
Thermo-Lag® E100	13 g/l
Thermo-Lag® E100 S	64 g/l
Thermo-Lag® 3000 A	13 g/l
Thermo-Lag® 3000 SA	64 g/l
A/D Type TC-55	0 g/l
Pyroprime® 775 WB	81 g/l
Southwest™ Series	0 g/l
Pyrolite® Series	0 g/l
Pyrocrete® Series	0 g/l

Carboline Contributions: Carboline has wet mix and intumescent materials that meet the required VOC limits and VOC emissions requirements for this credit.

Carboline Products That Contribute: Pyrolite® 15, Pyrolite® 22, Southwest™ Type 5GP, Southwest™ Type 5MD, Southwest™ Type 5EF, Southwest™ Type 1XR, Southwest™ Type 7GP, Southwest™ Type 7HD, Southwest™ Type 7TB, Southwest™ Type DK 3 Spattercoat, A/D Type TC-55, Pyroprime® 775 WB, Pyrocrete® 239, Pyrocrete® 40, Pyrocrete® 240 HY, Pyrocrete® 241, Pyrocrete® 241 HD, Hardcoat 4500, A/D Firefilm® III, A/D Firefilm® III C, Firefilm® IV, Thermo-Sorb® VOC, Thermo-Sorb® E, Thermo-Sorb® 263, Thermo-Lag® 3000, Thermo-Lag® E100, Thermo-Lag® E100 S

Manufacturing Locations

Products manufactured in Louisa, VA:
Pyrolite® 15, Pyrolite® 22, Southwest™ Type 5GP, Southwest™ Type 5MD, Southwest™ Type 5EF, Southwest™ Type 1XR, Southwest™ Type 7GP, Southwest™ Type 7HD, Southwest™ Type 7TB, Southwest™ Type DK 3 Spattercoat, Pyrocrete® 239, Pyrocrete® 40, Pyrocrete® 240 HY, Pyrocrete® 241, Pyrocrete® 241 HD, Hardcoat 4500

Products manufactured in Green Bay, WI:
Pyroprime® 775, Thermo-Sorb® E, Thermo-Sorb® 263,

Products manufactured in Dayton, NV:
Thermo-Sorb®, Thermo-Sorb® VOC, Thermo-Sorb® E, Thermo-Sorb® 263, Thermo-Lag® 3000, Thermo-Lag® E100, Thermo-Lag® E100 S

Products manufactured in Lake Charles, LA:
A/D Firefilm® III, A/D Firefilm® III C, Firefilm® IV, A/D Type TC-55, Thermo-Sorb®, Thermo-Sorb® VOC, Thermo-Sorb® E, Thermo-Sorb® 263, Thermo-Lag® 3000, Thermo-Lag® E100, Thermo-Lag® E100 S

Raw Material Extraction Locations

NOTE: For raw material extraction locations and distance to manufacturing plants, please contact your local Carboline technical sales representative or Carboline fireproofing technical service.

COMPLIANCE TESTED by berkeley analytical

VOC Emission Test Certificate

Product Name: Thermo-Sorb® VOC - 21DD5849L

Product Sample Information	
Company:	Carboline
Company Website:	www.carboline.com
Product Type:	Paints & Coatings - Fire Resistive Material
Date Produced:	1/24/2022

Certificate Information	
Certificate No:	220217-02
Certified By:	Raja S. Tannous, Laboratory Director
Date:	February 17, 2022

Reference Standard: California Department of Public Health CDPH/EHLB/Standard Method Version 1.2, 2017 (Emission testing method for CA Specification 01350)

Acceptance Criteria and Results Demonstrating Compliance of Product Sample to Referenced Standard:

Exposure Scenario[1]	Individual VOCs of Concern[2]		Formaldehyde[3]		TVOC[4]
	Criterion	Compliant?	Criterion	Compliant?	Range
School Classroom	≤½ Chronic REL	YES	≤9.0 µg/m^3	YES	≤ 0.5 mg/m^3
Private Office	≤½ Chronic REL	YES	≤9.0 µg/m^3	YES	≤ 0.5 mg/m^3

Product Coverage[5]: 800 g/m^2 (25 mil as dry film)

1. Exposure scenarios & product quantities for classroom & office are defined in Tables 4-2 – 4-5 (CDPH Std. Mtd. V1.2-2017)
2. Maximum allowable concentrations of individual target VOCs are specified in Table 4-1 (*ibid.*)
3. Maximum allowable formaldehyde concentration is ≤9 µg/m^3, effective Jan 1, 2012; previous limit was ≤16.5 µg/m^3 (ibid.)
4. Informative only; predicted TVOC Range in three categories, i.e., ≤0.5 mg/m^3, >0.5 – 4.9 mg/m^3, and ≥5.0 mg/m^3
5. Informative and applicable only to tests of wet-applied products; grams of sample applied per square meter of substrate

Standards & Codes Recognizing CDPH Standard Method V1.2 (partial list)

- USGBC LEED Version 4/4.1, BD&C, ID&C, Residential BD&C Multifamily
- The WELL Building Standard, WELL v2, Feature X06
- ANSI/GBI 01-2019 Green Globes Assessment Protocol
- ANSI/ASHRAE/USGBC/IES Standard 189.1

Narrative: Carboline selected a sample representative of its Thermo-Sorb VOC - 21DD5849L intumescent fire proofing product and submitted it on 1/26/2022 for testing. Berkeley Analytical measured and evaluated the emissions of VOCs from this sample following CDPH/EHLB/Standard Method V1.2-2017. The results of the test are presented in Berkeley Analytical report, 904-016-04A-Feb1722.

Berkeley Analytical is an independent, third-party laboratory specializing in the analysis of organic chemicals emitted by and contained in building products, finishes, furniture, and consumer products. We are an ISO/IEC 17025 accredited laboratory (IAS, TL-383); all standards used in performing this test are in Berkeley Analytical's scope of accreditation.

Declare.

Thermo-Sorb VOC
Carboline Global, Inc.

Final Assembly: Dayton, Nevada, USA
Life Expectancy: Life of Structure Year(s)
Embodied Carbon: 8.25E+01 kg CO_2
Declared Unit: One Square Meter
End of Life Options: Landfill (100%)

Ingredients:

1,3-Propanediol, 2,2-bis(hydroxymethyl)-; 2-Propenoic acid, 2-ethylhexyl ester, polymer with ethenylmethylbenzene; Ammonium polyphosphate; Carbonic acid, dimethyl ester; Acetic acid, 1,1-dimethylethyl ester; Alkanes, C18-28, chloro; Melamine; Titanium dioxide; Toluene; 2-Hexanone, 5-methyl-; Alkanes, C14-17, chloro; 2-Pentanone, 4-hydroxy-4-methyl-; Aluminosilicate Refractory Ceramic Fibres; Octadecanoic acid, zinc salt; Carbon black

Living Building Challenge Criteria: Compliant

I-13 Red List:

- ■ LBC Red List Free
- ☐ LBC Red List Approved
- ☐ Declared

% Disclosed: 100% at 100ppm
VOC Content: 142 g/L

I-10 Interior Performance: CDPH Standard Method v1.2-2017
I-14 Responsible Sourcing: Not Applicable

CRB-0001
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