



Casting Designs, Inc.

Glass Fiber Reinforced Gypsum & Cement

G.R.G GUIDE SPECIFICATIONS

SECTION 09290 – GLASS FIBER REINFORCED GYPSUM FABRICATIONS
(HEREINAFTER REFERRED TO AS G.R.G)

PART 1 – GENERAL

1.01 SCOPE:

Furnish all labor, materials, equipment and services necessary or incidental to the completion of molded glass fiber reinforced gypsum composites (G.R.G.) and associated work in accordance with the contract documents and all applicable building.

1.02 WORK INCLUDED:

- A. Manufacturer to provide all labor, materials equipment and related services required for the fabrication of G.R.G. shapes as shown in the contract document.
- B. Installer to provide all labor, materials, equipment and related services needed for the complete erection of G.R.G. and joint treatment, if required.

1.03 RELATED WORK SPECIFIED ELSEWHERE:

- A. Gypsum Drywall
- B. Framing and Suspension
- C. Finishes

1.04 MANUFACTURER:

Casting Designs, Inc.
9320 Crowley Road
Fort Worth, TX 76134-5903
Phone: (800) 329-7373 * Fax (817) 293-8644
Contact: David Sahaida; CK Specialties; 314 846 6200 / 6201 fax

1.05 SUBSTITUTIONS:

Manufacturers desiring consideration other than those specified must submit product data, samples and certified testing reports showing compliance to all guidelines set forth in the G.R.G. Specification ten days prior to the bid date. Before being considered, manufacturers must: Have five years experience in manufacturing G.R.G., provide photographs, copies of certified tests, shop drawings, names and contacts for architects and installing contractors of at least three projects. Projects must be of similar scope.

1.06 SUBMITTALS:

- A. Samples: Submit three (3) 6" x 6" flat samples for paint and finish selection.
- B. Submit shop drawings for approval showing plans sections, details, joint treatment, reinforcing fastening devices, and relation to adjacent construction as required.

Specifier's Option: If the G.R.G. scope and complexity warrant a mock-up, this section should be included. Manufacturer to provide one full size mock-up of (specify piece) to the jobsite for installation and review.

PART 2 – PRODUCTS

2.01 MATERIALS:

- A. Glass Fiber Reinforced Gypsum (G.R.G.) to be fabricated using long strand continuous glass fiber mats laminated with high strength gypsum cement.
- B. Embeds and reinforcement (if required by manufacturer) to be galvanized steel or wood.
- C. G.R.G. members to be stored in controlled conditions for a sufficient period of time to ensure product stability before being shipped.
- D. All G.R.G. members to have identification marks, as indicated on shop drawings, clearly displayed on backside of part.
- E. Miscellaneous Materials:
 - All other materials, i.e. screws, clips, adhesives, shims, hanger wire, etc., to be per manufacturer's shop drawings and/or job specifications and shall be supplied by installer of G.R.G. materials.

2.02 PHYSICAL PROPERTIES:

- 1. Glass Fiber = 5-6% by weight
- 2. Shell Thickness = 1/4" nominal
- 3. Weight = 2lbs/ft. +/-
- 4. Density = 115.7 lbs/ft.
- 5. Finish = Smooth
- 6. Tensile Strength = 1611 psi
(ASTM D790)
- 7. Flexural Strength = 4427 psi
(ASTM D790)
- 8. Compressive Strength = 7030 psi
- 9. Impact (D256) = 11 ft. lbs/in.
- 10. Humidified Deflection = 1/16"

2.03 TOLERANCES:

- A. Dimension – All Directions +/- 3/16"
- B. Thickness 1/4" +/- 1/8"
- C. Warpage or bowing 1/16" per foot

PART 3 – EXECUTION

3.01 DELIVERY, STORAGE AND HANDLING

A. Delivery and Handling

All G.R.G. pieces to be placed in specially built crates, and shipped in a manner that will protect pieces from damage, dirt, moisture and warpage.

Support pieces during shipment on nonstaining shock absorbing materials.

Lift and support only at points indicated for attachment on drawings.

Specifier's Option: Any limitations regarding crate size, weight or jobsite unloading facilities should be noted in this section.

B. Storage

Material to be stored inside and under climate controlled conditions and in crates provided.

Once uncrated, material to be stored in an upright position on a flat, smooth and level surface. Avoid stacking and leaning of pieces as much as possible.

Cover and protect pieces from excessive dirt, moisture, surface damage or other jobsite hazards.

Maintain a consistent temperature and humidity level throughout storage, installation and finishing.

3.02 INSPECTION:

A. Contractor shall be responsible for inspecting job conditions and providing lines, centers, grades and marks in sufficient detail for correct installation.

B. Installer will verify all marks and check jobsite conditions for clearance, working space and all marks provided before commencement of installation. Installer will also inspect all pieces prior to installation. Installer will be responsible for repairing all installed pieces except manufacturing defects. All discrepancies affecting the installation of the G.R.G. members will be brought to the attention of the General Contractor and resolved before installation begins.

C. General Contractor to provide sufficient space for unloading and transport of pieces as required.

3.03 ERECTION:

A. Safety: Installer is responsible for handling and installing the G.R.G. material in a safe manner. Report any unsafe conditions immediately to the General Contractor.

B. Installer will use experienced workmen to install the G.R.G. pieces. Material will be installed level and plumb and as shown in the approved shop drawings. All pieces will be securely anchored and joints finished as shown in the approved shop drawings.

C. The installer will protect the G.R.G. members from damage by other trades during construction and until accepted by the General Contractor.

D. After erection and acceptance of finished pieces, all damage and repair will be the responsibility of the General Contractor.

3.04 TAPING, PATCHING AND CONTROL JOINTS:

A. Tape, float and sand all joints and provide control joints (where required) as specified under gypsum drywall section of the specifications and as described in the U.S. Gypsum Construction Handbook – Second Edition.

B. Countersunk fasteners and damage are to be patched to match units' texture.

3.05 FINISHING:

A. See Painting/Texturing Section of Specifications.

B. The painting contractor shall comply with ASTM C-840 specifications specifically with regard to sealing.

C. G.R.G. is a "gypsum board" material and it's intended use is an interior product only. Unfinished G.R.G. may exhibit slight imperfections. These imperfections will be eliminated once parts are finished using typical drywall finishing methods. Due to the porosity differential between joint compounds and G.R.G. materials, the painting contractor must seal all surfaces properly prior to finishing.

PART 4 – WARRANTY

A. Manufacturer will warrant all materials against defect for one (1) year after acceptance of the materials.

B. Installer will warrant installed materials for one (1) year after acceptance.

C. The Manufacturer will, at his discretion, repair or replace defective pieces subject to approval of architect.



MANUFACTURER'S CERTIFICATE G.R.G.

The glass fiber reinforced gypsum cement (G.R.G.) material as manufactured by Casting Designs, Inc., 9320 Crowley Road, Ft. Worth, Texas 76134 (800) 329-7373, is a high strength reinforced gypsum product. We use Georgia-Pacific Densite Industrial Gypsum Cement, and our product is manufactured in accordance with their technical specifications. The glass fiber reinforcement is made up of multiple layers of long strand continuous filament glass mat, individually laminated to achieve a minimum thickness of 1/8" and a nominal thickness of 1/8" to 1/4", or it is sprayed using the multi-directional unlayered spray-up procedure. For either method, glass content is approximately 5% - 6% by weight.

G.R.G. is free of combustible material and has a 0% flame spread and 0% smoke.

G.R.G. contains NO asbestos.

Average finished piece weight is 1.50 to 2.1 pounds per square foot.

A. 1



JOINT REINFORCEMENT INSTRUCTIONS G.R.G.

Attach pieces at joints with construction adhesive (use a drywall adhesive such as Miracle DSA-20 or equal) and band or brace pieces together. Allow the adhesive to cure fully according to manufacturer's instructions before finishing joint.

Remove all dirt and oil from joint. Mix joint bedding mix as recommended by the bedding mix manufacturer. Apply a thin coat of bedding mix over the joint, center perforated reinforcement tape, embedding it into the bedding mix. Cover the tape with a skim coat of bedding material. Allow the first coat to dry as recommended by the manufacturer. Apply a second coat of bedding material flush with the surface of the piece. Sand smooth and apply topping coat to joint. Sand and clean the surface to match finished profile.

NOTE: When finishing G.R.G. members, follow the same guidelines as used for gypsum wallboard.

FASTENER CONCEALMENT AND PATCHING INSTRUCTIONS G.R.G.

Pre-drill all holes for fasteners to prevent cracking. Countersink flathead screws being careful not to penetrate glass layers with screw heads.

Clean fastener holes and areas to be patched to remove any loose material, dirt or oil. Apply bedding compound over holes. Apply second coat and topping coat as required. Sand area for a smooth level surface.

Large patches may require fiberglass reinforcing tape between the first and second layers of bedding compound.

NOTE: Because the porosity of the joint compound may differ from the G.R.G., it is advisable to seal/prime G.R.G. to ensure a uniform coverage by the finish coats.

Test Data



PROJECT NUMBER: 98-60386

PAGE:

DATE:

Maxim Tech. • Southwestern Lab
2200 Gravel Drive
Fort Worth, TX 76118-7123

Telephone: (817) 284-7755
1 of 4 Metro: (817) 589-7211
02/25/98 Fax: (817) 589-1420

Glass Reinforced Gypsum

(Interior)

Prepared for:
Casting Design Inc.
Attn: Mr. Marion Yancy
8909 Forum Way
Fort Worth, Texas 76140

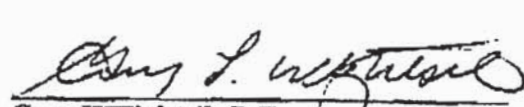
Project: Interior GRC

Client Purchase Order Number: Verbal

Prepared By:

Reviewed By:


Les Hall, S.E.T.
Mechanical/Metallurgical Department
Phone: METRO (817) 589-7211


Gary WHightsil, P.E.
Product Service Manager
Mechanical/Metallurgical Department

The test results contained in this report pertain only to the samples submitted for testing and not necessarily to all similar products.

2200 Gravel Drive Fort Worth, Texas 76118-7123

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Maxim Engineers • Nebraska Testing • Patzig Testing • Southwestern Laboratories • Thomas-Hartig • Twin City Testing

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Test Data

PROJECT NUMBER: 98-60386

PAGE: 2 of 4
DATE: 02/25/98

FIRE HAZARD EVALUATION USING THE MONSANTO TWO-FOOT FLAME TUNNEL AND SMOKE CHAMBER

INTRODUCTION:

The purpose of this testing was to determine the protection a material affords its substrate and the comparative burning characteristics of coatings. The testing was accomplished using equipment and procedures to evaluate the flame spread over the surface of the material under controlled conditions. This establishes a basis for comparing surface-burning characteristics of different coatings without specific consideration of all the end-use parameters that might affect these characteristics under actual fire conditions.

In addition to the predicted flame spread rate, the after flame time, afterglow time, smoldering and smoke developed rate may be measured. However a relationship should not be presumed among these measurements.

A number of laboratory procedures are used in evaluating the effectiveness of fire-retardant and fire-resistant treatments and coatings. In general, these methods measure the three stages of fire development: (1) ignition, (2) flame spread (rate of growth of the fire), and (3) conflagration extent. While all three are of extreme importance, flame spread has been recognized as the main factor associated with testing fire-retardant coatings. The Two-Foot Tunnel apparatus as produced by the Monsanto Company has been designed specifically to predict the performance by the ASTM E-84 (Steiner Tunnel) equipment. Flame spread ratings based upon ASTM E-84 have acquired common acceptance by regulatory agencies, but such large scale tests are seldom practical during the development or modification of a fire-retardant coating.

This method provides the relative flame spread in comparison with standard materials. Results from the Two-Foot Tunnel test have been shown to correlate to a predicted approximate ASTM E-84 result, according to the following equation:

$$y = 4.8 + 0.92 x$$

where x is the result obtained from the Monsanto test apparatus and y is the predicted result from ASTM E-84.

Degree of the density of the smoke, particulate matter, and other effluents given off by the test specimen are continuously recorded during the flame spread test and rated as a percentage of the degree of smoke density of red oak. Comparative smoke density determinations are made by use of the Monsanto Smoke Chamber which was developed as an approximation of the smoke density equipment utilized in the ASTM E-84 equipment. No direct correlation data is available between smoke density results obtained by the Monsanto Chamber and those obtained by ASTM E-84.

Test Data

PROJECT NUMBER: 98-60386

PAGE: 3 of 4

DATE: 02/25/98

SAMPLE IDENTIFICATION:

GRG (Interior)

TEST EQUIPMENT:

The Monsanto Two-Foot Flame Tunnel and Smoke Chamber consist of a 24 x 4 inch angle-iron frame inclined 28 degrees from the horizontal. The sides and fire-end of the tunnel are covered with 1/4" asbestos-cement board which is attached to the inside of the frame. The open end, flue end and cutout sides allow a natural draft through the tunnel. Heat, gases and smoke rise by convection flow. The sample holder is notched along the bottom, or supporting lip angle at one inch intervals to assist in measurement of the flame advance. An observation window, a two-inch wide strip of 1/8" polished vycor plate, is located just below the sample holder and extending the full length of the tunnel. The glass is calibrated every inch from 4 to 22. The burner, using local commercial gas fuel, is placed 2-1/4" horizontally from the interior of the fire-end of the tunnel. Thermocouple, ignition transformer, time and regulating valve are part of the assembly.

The Smoke Chamber is equipped with a light source, photoelectric cell, milliamperere recorder, necessary stacks, vents and accessories.

Test results are shown on the following page.

Test Data

PROJECT NUMBER: 98-60386

 PAGE: 4 of 4
 DATE: 02/25/98
TEST RESULTS:**Test and Calibration Data:**

Tunnel is calibrated prior to each day's operation by determining the difference in flame length of standard preconditioned mineral board and red oak boards.

<u>Data</u>	<u>Calibration Panels</u>		<u>Test Specimen</u>		
	<u>Red Oak</u>	<u>Mineral Board</u>	<u>No. 1</u>	<u>No. 2</u>	<u>No. 3</u>
Flame Length (L) (Avg. of three highest consecutive flame front readings)	16.5	8.0	8.0	8.0	8.0
Flame Spread (FS) (Flame length of test panel minus flame length of mineral board calib. panel)			0.0	0.0	0.0
Flame Spread Constant (k)					
$\frac{(100)}{L_o - L_a} = \frac{(100)}{(16.5 - 8)} = 11.76$					

EVALUATION OF TEST DATA:

<u>Determination</u>	<u>Test Specimen No. 1</u>	<u>Test Specimen No. 2</u>	<u>Test Specimen No. 3</u>	<u>Avg.</u>
Monsanto Flame Spread Rating (FS multiplied by k)	0.0	0.0	0.0	0.0
FLAME SPREAD - Predicted E-84 value by use of Monsanto formula	0.0	0.0	0.0	0.0
Afterflaming	None	None	None	None
Afterglow	None	None	None	None
Smoldering	None	None	None	None
Smoke Developed Rating Reported as a percentage of smoke developed by the Red Oak Calibration Panel	0.0	0.0	0.0	0.0

Test Data

PROJECT NUMBER: 98-60386**PAGE:** 5 of 4**DATE:** 02/25/98

NOTE: This test report contains only findings and results arrived at after employing the specified procedures listed herein. These findings and results apply only to the submitted sample or samples. This test report is not intended to constitute a recommendation for, or endorsement of, the product or material tested.

References:

ASTM D 3806, Small-scale Evaluation of Fire Retardant Paints (Two-Foot Tunnel Method).

ERDL Report No. 1226, Report No. 111939 Department of Commerce Vandersall, H.L.,
Journal of Paint Technology, Volume 39, No. 511494, Interior Federal Specification
TT-P-00193Z (GSA-FSS) Harland, W.J. Journal of Paint Technology, Vol. 44, No. 57564.



United States Testing Company, Inc.

291 FAIRFIELD AVENUE • FAIRFIELD, NEW JERSEY 07004 • 201-575-5252 • Fax: 201-575-8271

REPORT OF TEST

Engineering Services

Test Data

CLIENT: Casting Designs, Inc.
8909 Forum Way
Fort Worth, TX 76140

NUMBER: 106718-4

February 26, 1993

SUBJECT: Physical Properties

REFERENCE:

Casting Designs, Inc., Purchase Order No. 93-130.

SAMPLE IDENTIFICATION:

One (1) sample of material was submitted and identified by the Client as follows:

Glass Fiber Reinforced Gypsum (GRG) Long Strand Continuous
Fiber Glass Mat Laminated with High Strength Alpha
Hemihydrate Gypsum Cement

TEST PERFORMED:

The submitted sample was tested for Humidified Deflection in accordance with the procedures outlined in ASTM Test Method C-473.

TEST RESULTS:

Determination

Deflection, Inches

1
2

1/16
1/16

ASTM
1355

Avg.

1/16

5.2.1.5

Testing Supervised by:

Frank Savino
Frank Savino, Supervisor
Materials Engineering

SIGNED FOR THE COMPANY

By

Frank Pepe
Frank Pepe
Vice President



Member of the SGS Group (Société Générale de Surveillance)

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SOUTHWESTERN LABORATORIES

Test Data

Casting Design, Inc.
CLIENT NO. 5131690
DATE OF SERVICE: 1/09/90

REPORT NO. 0012
PAGE 3

REPORT OF TESTS (Continued)

TEST RESULTS - INTERIOR:

ASTM D-882 Method A Tensile Strength

Specimen Number	Dimensions (Inches)	Load Lbs.	Tensile Strength, PSI
1	1.007 x 0.422	607.0	1428
2	1.000 x 0.393	454.7	1157
3	1.005 x 0.440	651.0	1472
4	1.000 x 0.409	666.2	1629
5	1.024 x 0.450	509.9	1106
Average			1358

SAMPLES FOR TENSILE STRENGTH:

Test specimens for tensile strength were approximately 1.0 inches by 6.0 inches.

TEST RESULTS - INTERIOR:

ASTM D-695 Compressive Strength

Specimen Number	Dimensions (Inches)	Compressive Strength, PSI
1	1.0 x 1.0	7700
2	1.0 x 1.0	6900
3	1.0 x 1.0	6550
4	1.0 x 1.0	7120
5	1.0 x 1.0	6860
Average		7030

ASTM

5.1.2

Report Of Tests Continued On Page 4

CLIENT: Casting Designs, Inc.

NUMBER: 106991-1

TEST RESULTS

Barcol Hardness

Determination

Barcol Hardness

1	36
2	42
3	41
4	35
5	40
6	33
7	33
8	39
9	42
10	46
Avg.	39

ASTM

5.1.3

IENT: Casting Designs, Inc.

NUMBER: 106991-1

TEST RESULTS

Barcol Hardness

Determination

Barcol Hardness

1	36
2	42
3	41
4	35
5	40
6	33
7	33
8	39
9	42
10	46
Avg.	39

ASTM

5.1.3



United States Testing Company, Inc.

Test Data

291 FAIRFIELD AVENUE • FAIRFIELD, NEW JERSEY 07004 • 201-575-5252 • Fax: 201-575-8271

REPORT OF TEST

Engineering Services

CLIENT: Casting Designs, Inc.
8909 Forum Way
Fort Worth, TX 76140

NUMBER: 106718-3

February 24, 1993

SUBJECT: Physical Properties

REFERENCE:

Casting Designs, Inc., Purchase Order No. 93-130.

SAMPLE IDENTIFICATION:

One (1) sample of material was submitted and identified by the Client as follows:

Glass Fiber Reinforced Gypsum (GRG) Long Strand Continuous
Fiber Glass Mat Laminated with High Strength Alpha
Hemihydrate Gypsum Cement

TEST PERFORMED:

The submitted sample was tested for Flexural Properties in accordance with the procedures outlined in ASTM Test Method C-947. The test specimens were conditioned in an atmosphere of 73°F, 50% R.H. prior to testing per ASTM Method C-473, Paragraph 5.

Testing Supervised by:

Frank Savino
Frank Savino, Supervisor
Materials Engineering

SIGNED FOR THE COMPANY

By *Frank Pepe*
Frank Pepe
Vice President



Member of the SGS Group (Société Générale de Surveillance)

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CLIENT: Casting Designs, Inc.

NUMBER: 106718-3

TEST RESULTS

Flexural Properties

et.	<u>Dimensions, Inches</u>		<u>Proportional Elastic Limit, PSI</u>	<u>Modulus of Rupture, PSI</u>
	<u>Width</u>	<u>Thickness</u>		
	1.987	0.202	1010	2720
	1.992	0.212	1170	2810
	1.993	0.207	1110	3270
	1.993	0.204	1240	3790
	1.990	0.201	1220	3070
g.			1150	3130

- TES:
- 1) Major span was 12 inches.
 - 2) Minor span was 4 inches.
 - 3) Crosshead speed was 0.1 inches per minute.

According to the ASTM C 947-89 Standard Test Method for Flexural Properties of Thin-Section Glass-Fiber-Reinforced Concrete Point 6.2.

The test specimen shall have a ratio of the specimen major span length to the specimen depth between 16 to 1 and 30 to 1.

Our specimen length/depth ratio is $12 / 0.2052$ (average) = 58.48 to 1.

We can interpolate the results (and be in the safe side) using the formulas provided in 9.1 (ASTM C 947-89) $PEL = P_{eL} / bd^2$ and $MOR = P_{maxL} / bd^2$.

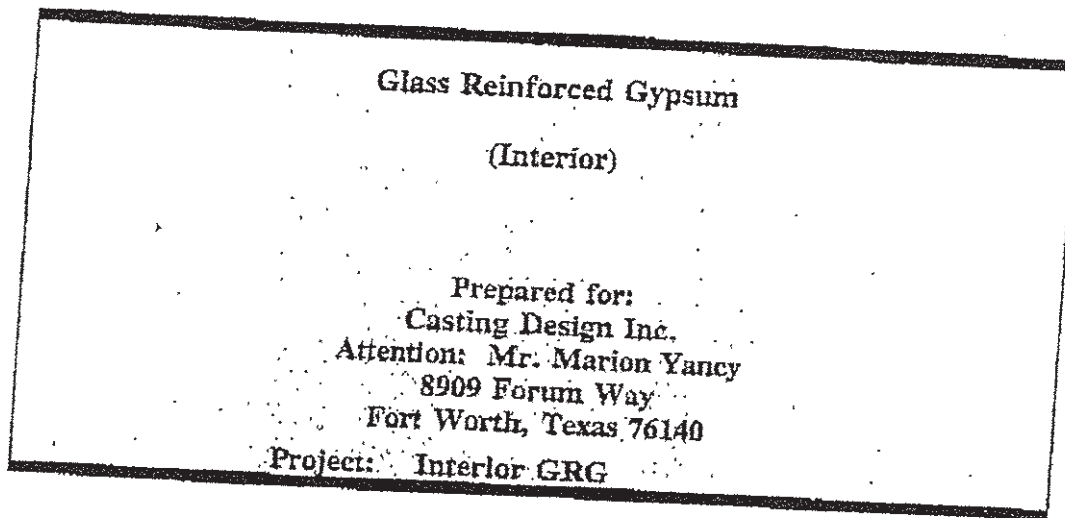
	Width	Thickness	PEL (Original)	MOR (Original)	PEL (30 to 1)	PEL(16 TO 1)
1	1.987	0.202	1010	2720	2020	3463
2	1.992	0.212	1170	2810	2340	4011
3	1.993	0.207	1110	3270	2220	3806
4	1.993	0.204	1240	3790	2480	4251
5	1.99	0.201	1220	3070	2440	4183
Avg.	1.991	0.2052	1150	3132	2300	3943
Major span		12				
Span 16 to	3.2832	3.5				
Span 30 to	6.156	6				

Test Data

**Test Data**

Maxim Tech. • Southwestern Labs
2200 Gravel Drive
Fort Worth, TX 76118-7123
Telephone: (817) 284-7755
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Fax: (817) 589-1420

PROJECT NUMBER: 98-60386-1

PAGE:
DATE:1 of 2
April 17, 1998

Prepared By:

Reviewed By:


Les Hall, S.E.T.
Mechanical/Metallurgical Department
Phone: METRO (817) 589-7211


Gary W. Whightsil
Product Service Manager
Mechanical/Metallurgical Department

The test results contained in this report pertain only to the samples submitted for testing and not necessarily to all similar products.

2200 Gravel Drive Fort Worth, Texas 76118-7123

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Test Data

PROJECT NUMBER: 98-60386-1

PAGE: 2 of 2
DATE: April 17, 1998**INTRODUCTION:**

Perform an anchor pullout test on three (3) test specimens received at this facility.

SUMMARY OF RESULTS:

Test Data

**LOAD TEST
SPECIMEN****TOTAL LOAD (lbs.)**

1	484
2	565
3	<u>525</u>
	525

TEST EQUIPMENT:

Instron 1011, Serial #177, this unit was calibrated 12/12/97 by Instron Corp.

This unit meets or exceeds ASTM E4.

TEST METHOD:

ASTM C473 (Modified for Anchor Pullout).

The test material will be retained for thirty days from the date of this report and then discarded unless otherwise notified.



PROJECT NUMBER: 98-60386

Test Data

Maxim Tech. • Southwestern Labs
2200 Gravel Drive
Fort Worth, TX 76118-7123

PAGE:

1 of 4

DATE:

Telephone: (817) 284-7755
Metro: (817) 589-7211
02/25/98 Fax: (817) 589-1420

Glass Reinforced Gypsum

(Interior)

Prepared for:
Casting Design Inc.
Attn: Mr. Marion Yancy
8909 Forum Way
Fort Worth, Texas 76140

Project: Interior GRC

Client Purchase Order Number: Verbal

Prepared By:

Reviewed By:

Les Hall, S.E.T.
Mechanical/Metallurgical Department
Phone: METRO (817) 589-7211Gary W. Hightail, P.E.
Product Service Manager
Mechanical/Metallurgical Department

The test results contained in this report pertain only to the samples submitted for testing and not necessarily to all similar products.

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Test Data

PROJECT NUMBER: 98-60386

PAGE: 2 of 4
DATE: 02/25/98**FIRE HAZARD EVALUATION USING THE MONSANTO TWO-FOOT
FLAME TUNNEL AND SMOKE CHAMBER****INTRODUCTION:**

The purpose of this testing was to determine the protection a material affords its substrate and the comparative burning characteristics of coatings. The testing was accomplished using equipment and procedures to evaluate the flame spread over the surface of the material under controlled conditions. This establishes a basis for comparing surface-burning characteristics of different coatings without specific consideration of all the end-use parameters that might affect these characteristics under actual fire conditions.

In addition to the predicted flame spread rate, the after flame time, afterglow time, smoldering and smoke developed rate may be measured. However a relationship should not be presumed among these measurements.

A number of laboratory procedures are used in evaluating the effectiveness of fire-retardant and fire-resistant treatments and coatings. In general, these methods measure the three stages of fire development: (1) ignition, (2) flame spread (rate of growth of the fire), and (3) conflagration extent. While all three are of extreme importance, flame spread has been recognized as the main factor associated with testing fire-retardant coatings. The Two-Foot Tunnel apparatus as produced by the Monsanto Company has been designed specifically to predict the performance by the ASTM E-84 (Steiner Tunnel) equipment. Flame spread ratings based upon ASTM E-84 have acquired common acceptance by regulatory agencies, but such large scale tests are seldom practical during the development or modification of a fire-retardant coating.

This method provides the relative flame spread in comparison with standard materials. Results from the Two-Foot Tunnel test have been shown to correlate to a predicted approximate ASTM E-84 result, according to the following equation:

$$y = 4.8 + 0.92 x$$

where x is the result obtained from the Monsanto test apparatus and y is the predicted result from ASTM E-84.

Degree of the density of the smoke, particulate matter, and other effluents given off by the test specimen are continuously recorded during the flame spread test and rated as a percentage of the degree of smoke density of red oak. Comparative smoke density determinations are made by use of the Monsanto Smoke Chamber which was developed as an approximation of the smoke density equipment utilized in the ASTM E-84 equipment. No direct correlation data is available between smoke density results obtained by the Monsanto Chamber and those obtained by ASTM E-84.

Test Data**PROJECT NUMBER:** 98-60386**PAGE:** 3 of 4**DATE:** 02/25/98**SAMPLE IDENTIFICATION:**

GRG (Interior)

TEST EQUIPMENT:

The Monsanto Two-Foot Flame Tunnel and Smoke Chamber consist of a 24 x 4 inch angle-iron frame inclined 28 degrees from the horizontal. The sides and fire-end of the tunnel are covered with 1/4" asbestos-cement board which is attached to the inside of the frame. The open end, flue end and cutout sides allow a natural draft through the tunnel. Heat, gases and smoke rise by convection flow. The sample holder is notched along the bottom, or supporting lip angle at one inch intervals to assist in measurement of the flame advance. An observation window, a two-inch wide strip of 1/8" polished vycor plate, is located just below the sample holder and extending the full length of the tunnel. The glass is calibrated every inch from 4 to 22. The burner, using local commercial gas fuel, is placed 2-1/4" horizontally from the interior of the fire-end of the tunnel. Thermocouple, ignition transformer, time and regulating valve are part of the assembly.

The Smoke Chamber is equipped with a light source, photoelectric cell, milliamperere recorder, necessary stacks, vents and accessories.

Test results are shown on the following page.

Test Data

PROJECT NUMBER: 98-60386

 PAGE: 4 of 4
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TEST RESULTS:**Test and Calibration Data:**

Tunnel is calibrated prior to each day's operation by determining the difference in flame length of standard preconditioned mineral board and red oak boards.

<u>Data</u>	<u>Calibration Panels</u>		<u>Test Specimen</u>		
	<u>Red Oak</u>	<u>Mineral Board</u>	<u>No. 1</u>	<u>No. 2</u>	<u>No. 3</u>
Flame Length (L) (Avg. of three highest consecutive flame front readings)	16.5	8.0	8.0	8.0	8.0
Flame Spread (FS) (Flame length of test panel minus flame length of mineral board calib. panel)			0.0	0.0	0.0
Flame Spread Constant (k)					
$\frac{(100)}{L_o - L_a} = \frac{(100)}{(16.5 - 8)} = 11.76$					

EVALUATION OF TEST DATA:

<u>Determination</u>	<u>Test Specimen No. 1</u>	<u>Test Specimen No. 2</u>	<u>Test Specimen No. 3</u>	<u>Avg.</u>
Monsanto Flame Spread Rating (FS multiplied by k)	0.0	0.0	0.0	0.0
FLAME SPREAD - Predicted E-84 value by use of Monsanto formula	0.0	0.0	0.0	0.0
Afterflaming	None	None	None	None
Afterglow	None	None	None	None
Smoldering	None	None	None	None
Smoke Developed Rating Reported as a percentage of smoke developed by the Red Oak Calibration Panel	0.0	0.0	0.0	0.0

Test Data**PROJECT NUMBER:** 98-60386**PAGE:** 5 of 4**DATE:** 02/25/98

NOTE: This test report contains only findings and results arrived at after employing the specified procedures listed herein. These findings and results apply only to the submitted sample or samples. This test report is not intended to constitute a recommendation for, or endorsement of, the product or material tested.

References:

ASTM D 3806, Small-scale Evaluation of Fire Retardant Paints (Two-Foot Tunnel Method).

ERDL Report No. 1226, Report No. 111939 Department of Commerce Vandersall, H.L.,
Journal of Paint Technology, Volume 39, No. 511494, Interior Federal Specification

TT-P-00193Z (GSA-FSS) Harland, W.J. Journal of Paint Technology, Vol. 44, No. 57564.

SOUTHWESTERN LABORATORIES

Test Data

Jasting Design, Inc.
CLIENT NO. 5131690
DATE OF SERVICE: 1/09/90

REPORT NO. 0012
PAGE 6

REPORT OF TESTS (Continued)

**120D IMPACT TEST:

RESULTS:

Sample	No.	Impact Str. Ft-lbs/in.	Type Failure
Interior	1	4.7	Complete break
	2	6.6	" "
	3	5.1	" "
	4	8.5	" "
	5	6.3	" "
	6	7.1	" "
	7	6.7	" "
	8	5.4	" "
	9	6.8	" "
	10	5.1	" "

	AVG.	6.2	
	S.D.	1.16	
Exterior	1	1.8	Complete break
	2	1.3	" "
	3	1.0	" "
	4	1.8	" "
	5	1.8	" "
	6	2.1	" "
	7	2.5	" "
	8	2.4	" "
	9	1.1	" "
	10	2.0	" "

	AVG.	1.8	
	S.D.	0.51	

Report Of Tests Continued On Page 7

SOUTHWESTERN LABORATORIES

Test Data

Casting Design, Inc.
CLIENT NO. 5131690
DATE OF SERVICE: 1/09/90

REPORT NO. 0012
PAGE 7

REPORT OF TESTS (Continued)

DENSITY:

Material

Lbs./Ft.

Exterior

102.8

Interior

101.7

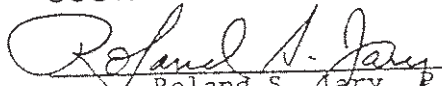
(**) ADDITION TO REPORT: 2/13/90

WA

Technician: Leslie C. Hall, S.E.T.
NICET 040729, Level IV

Port Distribution:
Casting Design, Inc.

SOUTHWESTERN LABORATORIES, INC.


Roland S. Gary, P.E.
Vice President

Our letters and reports are for the exclusive use of the client to whom they are addressed. The letters and reports shall not be reproduced except in full without the approval of the testing laboratory. The use of our name must receive our written approval.

Horton, Matt

From: Terri Vaughn <terriv@cdi-grg.com>
Sent: Tuesday, January 3, 2017 3:45 PM
To: Horton, Matt; 'David'
Cc: Gates, Devin
Subject: RE: Webster ISB 20160265 rev 01
Attachments: GRG Test Data.pdf

Compliance is with ASTM 1381.

Thank you
Terri

From: Horton, Matt [mailto:mrhorton@paric.com]
Sent: Tuesday, January 03, 2017 2:59 PM
To: David
Cc: Gates, Devin; Terri Vaughn
Subject: RE: Webster ISB 20160265 rev 01

David,

Thank you for your help. Going through the submittals and it looks like I need a few other items, besides shop drawings.

- Proof that products are fabricated in compliance with ASTM C 1381.

Thanks,

MATT HORTON LEED Green Associate
PROJECT ENGINEER

Direct: 636-561-9841
Main: 636-561-9500

- - - - -

77 Westport Plaza, Suite 250
St. Louis, MO 63146

- - - - -

PARIC.COM



Casting Designs, Inc.

Glass Fiber Reinforced Gypsum & Cement

LEED Green Building

CONTRIBUTIONS

CDI proudly participates in helping to reduce environmental impact and produce sustainable products consisting of natural materials. Non-toxic and inert.

With products lightweight in nature that reduce transportation costs, require less structural support also create a reduction of less material cost at point of installation.

Through innovative designs, our products help to light critical interior spaces with natural light. Reduce energy consumption costs while improving living spaces for occupants allowing large sums of natural light while also allowing for great views. Our GFRC material is durable and long lasting which require less structural support. It will also help to reduce the heat island impact.

Complies with IEQ 4.1 with no VOC content.

CDI products give off no VOC's therefore not adding to space pollution.

Our interior products weigh approximately 2 to 3 lbs per square foot consisting of 6% to 8% glass fiber which is made up 92% to 93% recycled material; the balance of our product is made of gypsum and water. Our exterior products weighs approximately 4 to 6 lbs per square foot consisting of 6% to 8% glass fiber which is made up of 92% to 93% recycled material; the balance of the material consist of polymers and water.

Casting Designs, Inc. purchases our glass fiber from Superior Fibers Inc. Our fiberglass is manufactured in Bremen, OH and Nippon Electric Glass America, Inc. manufactured in Notagowa, JA.

Our gypsum is mined in Blue Rapids, KS.
Our concrete is mined in San Antonio, TX



Superior Fibers Inc.®

Leaders In HVAC Filtration, Paint Arrestors & FRP Products

Mr. Jay Bransom
Mr. Bob Dix
Casting Design Inc. (CDI)
9320 Crawley Road
Ft. Worth, Tx. 76134

Dear Jay and Bob,

We wish to confirm that Superior Fibers produces CDI's continuous strand glass fiber reinforcing mats and continuous filament glass fiber surfacing veils using glass cullet, an industrial bi-product sourced from the plate glass and light bulb industries.

The glass cullet is remelted and fiberized; with the recycled content of the N-700 product at 93% of the total weight, and the recycled content of the Surmat product is 92% of the total weight.

The glass fiber is 100% lead-free and its chemical composition is referred to as A Glass; made for use in window panes, automotive windshields/side lites/backlites, light bulbs, bottles, etc.

Respectfully submitted,

David Shumaker
Dir. Business Development
Superior Fibers
Bremen, Ohio

