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Providing Quality Control, Testing, Inspection and Certification Services to the Building Industry

PFS TEST REPORT #93-65
ACCELERATED AGING OF PLASTICS

FOR

THE MILLENNIUM GROUP
WATERLOO, WISCONSIN

GENERAL

Accelerated aging test of plastics were conducted on February 14-28, 1994, at PFS Corporation, Madison, Wisconsin. Testing was conducted in accordance with ASTM D 756-78, *"Determination of Weight and Shape Changes of Plastics Under Accelerated Service Conditions."*

DESCRIPTION

The Nailers were manufactured by Zeier Plastic and Manufacturing, Inc. of Madison, Wisconsin. The Nailer is designed to be a construction materials fastening component and can be used as a drywall support clip for ceiling and corner fastening of drywall and drywall-to-wood construction. The Nailer's dimensions consist of an approximate 2.125 in.-by-1.5 in.-by-0.10 in.-thick rectangle with a projecting tab. On the backside of the main rectangle is a centrally-located approximate 0.28 in.-wide-by-2.125 in.-long-by-0.10-0.60 in.-thick rib. The projecting tab is approximately 1.5 in.-wide-by-0.94 in.-high-by-0.78-0.58 in.-thick. The projecting tab is located approximately 0.56 in. from the main rectangle end. Each Nailer was molded by the injection molding method using a plastic material of high density polyethylene.

TEST PROCEDURES

A minimum of five Nailer specimen were tested per Aging Cycle Procedure. All seven cycling procedures (A through G of the Standard) were conducted. One cycle of each procedure was conducted. After each stage of the cycling procedure, the test specimen were weighted, measured and visually examined.

See page 3 for the Procedure, Cycling Stage No., Hours, Conditioning Environment, Average Percent Changes in Weight, Dimensions, and Appearance Changes.

TEST RESULTS

There was no change in appearance of any tested specimen. Only a slight percent of change was measured in weight or dimension. See Tables 1-7 for test data.

Tests Conducted and
Report Prepared By:

Allan R. Adams
Laboratory Technician

Tests Witnessed and
Report Reviewed By:

James Van Schoyck
Laboratory Manager

Report Reviewed By:

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Technical Director

03/31/95
93-65/pb

Procedure	Cycling Stage No.	Cycling Stage Hrs.	Conditioning Environment	Avg. Weight Change (%)	Avg. Dimension Change (%)	Appearance Changes
	2	24	140 ± 1.8°F **	0.1	0.2	None
A	3	24	140 ± 1.8°F	0	0.2	None
	4	>40	73.4 ± 3.6°F *	0	-0.6	None
B	2	72	140 ± 1.8°F	0	0	None
	2	24	158 ± 1.8°F ***	0	0.6	None
C	3	24	158 ± 1.8°F	0	0	None
	4	>40	73.4 ± 3.6°F *	0	0	None
	2	24	176 ± 1.8°F ****	0	0.2	None
D	3	24	176 ± 1.8°F	0	0.2	None
	4	>40		0	0.2	None
	2	24	176 ± 1.8°F ***	0	-0.8	None
		24	-40 ± 3.6°F	0	-1.1	None
E	3	24	176 ± 1.8°F	0.1	0.4	None
	4	24	-40 ± 3.6°F	0	-1.5	None
	5					
	2	24	100 ± 1.8°F ****	0	0.2	None
F	3	24	140°F	0	0.8	None
	4			0	0	None
	2		120.2 ± 1.8°F ****	0	-0.6	None
G	3		120.2°F	0	-0.4	None
	4			0	-0.2	None

Stage No. 1 of data tables is the pre-conditioning state (73.4 ± 3.6°F and 50 ± 5% relative humidity) for Procedures A, C, D, E, F and G. Stage No. 1 of data tables is the "as received" condition for Procedure B. See data tables 1-7 for test data.

NOTE: (-) = decrease in dimension
* 50 ± 5% relative humidity
** Saturated solution of sodium sulfate
*** Saturated solution of sodium chloride
**** Distilled water

Procedure	Cycling Stage No.	Cycling Stage Hrs.	Conditioning Environment	Avg. Weight Change (%)	Avg. Dimension Change (%)	Appearance Changes
A	2	24	140 ± 1.8°F **	0.1	0.2	None
	3	24	140 ± 1.8°F	0	0.2	None
	4	>40	73.4 ± 3.6°F *	0	-0.6	None
B	2	72	140 ± 1.8°F	0	0	None
C	2	24	158 ± 1.8°F ***	0	0.6	None
	3	24	158 ± 1.8°F	0	0	None
	4	>40	73.4 ± 3.6°F *	0	0	None
D	2	24	176 ± 1.8°F ****	0	0.2	None
	3	24	176 ± 1.8°F	0	0.2	None
	4	>40		0	0.2	None
E	2	24	176 ± 1.8°F ***	0	-0.8	None
		24	-40 ± 3.6°F	0	-1.1	None
	3	24	176 ± 1.8°F	0.1	0.4	None
	4	24	-40 ± 3.6°F	0	-1.5	None
	5					
F	2	24	100 ± 1.8°F ****	0	0.2	None
	3	24	140°F	0	0.8	None
	4			0	0	None
G	2		120.2 ± 1.8°F ****	0	-0.6	None
	3		120.2°F	0	-0.4	None
	4			0	-0.2	None

Stage No. 1 of data tables is the pre-conditioning state (73.4 ± 3.6°F and 50 ± 5% relative humidity) for Procedures A, C, D, E, F and G. Stage No. 1 of data tables is the "as received" condition for Procedure B. See data tables 1-7 for test data.

NOTE: (-) = decrease in dimension
* 50 ± 5% relative humidity
** Saturated solution of sodium sulfate
*** Saturated solution of sodium chloride
**** Distilled water

TABLE 1

ACCELERATED AGING OF PLASTIC - PROCEDURE A

DATE (mo./day)	STAGE (no.)	SPECIMEN (no.)	WEIGHT (gm.)	WIDTH (in.)	LENGTH (in.)	THICKNESS (in.)	VOLUME (sq. in.)
02/21	1	1	8.62	1.476	2.085	0.174	0.535
02/22	2	1	8.62	1.476	2.085	0.174	0.535
02/23	3	1	8.62	1.476	2.085	0.174	0.535
02/25	4	1	8.62	1.475	2.082	0.173	0.531
02/21	1	2	8.75	1.478	2.083	0.173	0.533
02/22	2	2	8.75	1.478	2.083	0.173	0.533
02/23	3	2	8.75	1.479	2.083	0.173	0.533
02/25	4	2	8.75	1.482	2.083	0.173	0.534
02/21	1	3	8.61	1.472	2.084	0.168	0.515
02/22	2	3	8.61	1.472	2.084	0.168	0.515
02/23	3	3	8.61	1.472	2.084	0.168	0.515
02/25	4	3	8.61	1.474	2.081	0.167	0.512
02/21	1	4	8.73	1.472	2.085	0.171	0.525
02/22	2	4	8.74	1.475	2.086	0.171	0.526
02/23	3	4	8.73	1.477	2.086	0.171	0.527
02/25	4	4	8.73	1.481	2.082	0.170	0.524
02/21	1	5	8.61	1.475	2.081	0.171	0.525
02/22	2	5	8.61	1.475	2.082	0.172	0.528
02/23	3	5	8.61	1.475	2.082	0.172	0.528
02/25	4	5	8.61	1.476	2.078	0.169	0.518
Avg. Stage #1		All Specs	8.66	1.475	2.084	0.171	0.527
Avg. Stage #2		All Specs	8.67	1.475	2.084	0.172	0.528
Avg. Stage #3		All Specs	8.66	1.476	2.084	0.172	0.528
Avg. Stage #4		All Specs	8.66	1.478	2.081	0.170	0.524
Avg. % Change at Stage #2			0.1	0.0	0.0	0.6	0.2
Avg. % Change at Stage #3			0.0	0.1	0.0	0.6	0.2
Avg. % Change at Stage #4			0.0	0.2	-0.1	-0.6	-0.6

NOTE: (-) = Decrease in dimension
Specs = Specimen

TABLE 2

ACCELERATED AGING OF PLASTIC - PROCEDURE B

DATE (mo./day)	STAGE (no.)	SPECIMEN (no.)	WEIGHT (gm.)	WIDTH (in.)	LENGTH (in.)	THICKNESS (in.)	VOLUME (sq. in.)
02/18	1	1	8.75	1.478	2.087	0.170	0.524
02/21	2	1	8.75	1.478	2.087	0.170	0.524
02/18	1	2	8.63	1.470	2.080	0.170	0.520
02/21	2	2	8.63	1.470	2.080	0.170	0.520
02/18	1	3	8.74	1.479	2.085	0.172	0.530
02/21	2	3	8.74	1.479	2.085	0.172	0.530
02/18	1	4	8.61	1.479	2.082	0.175	0.539
02/21	2	4	8.61	1.479	2.082	0.175	0.539
02/18	1	5	8.74	1.480	2.087	0.176	0.544
02/21	2	5	8.74	1.480	2.087	0.176	0.544
Avg. Stage #1		All Specs	8.69	1.477	2.084	0.173	0.531
Avg. Stage #2		All Specs	8.69	1.477	2.084	0.173	0.531
Avg. % Change at Stage #2			0.0	0.0	0.0	0.0	0.0

NOTE: Specs = Specimen

TABLE 3

ACCELERATED AGING OF PLASTIC - PROCEDURE C

DATE (mo./day)	STAGE (no.)	SPECIMEN (no.)	WEIGHT (gm.)	WIDTH (in.)	LENGTH (in.)	THICKNESS (in.)	VOLUME (sq. in.)
02/21	1	1	8.61	1.474	2.081	0.166	0.509
02/22	2	1	8.61	1.474	2.081	0.167	0.512
02/23	3	1	8.61	1.476	2.079	0.166	0.509
02/25	4	1	8.61	1.478	2.077	0.166	0.510
02/21	1	2	8.69	1.481	2.077	0.169	0.520
02/22	2	2	8.69	1.481	2.077	0.169	0.520
02/23	3	2	8.69	1.480	2.075	0.168	0.516
02/25	4	2	8.69	1.479	2.079	0.168	0.517
02/21	1	3	8.73	1.479	2.086	0.169	0.521
02/22	2	3	8.73	1.476	2.086	0.171	0.526
02/23	3	3	8.73	1.477	2.083	0.168	0.517
02/25	4	3	8.73	1.478	2.084	0.169	0.521
02/21	1	4	8.75	1.482	2.077	0.169	0.520
02/22	2	4	8.75	1.482	2.079	0.170	0.524
02/23	3	4	8.75	1.482	2.079	0.169	0.521
02/25	4	4	8.75	1.481	2.079	0.169	0.520
02/21	1	5	8.74	1.476	2.083	0.168	0.517
02/22	2	5	8.74	1.476	2.085	0.169	0.520
02/23	3	5	8.74	1.479	2.082	0.170	0.523
02/25	4	5	8.74	1.479	2.082	0.168	0.517
Avg. Stage #1		All Specs	8.70	1.478	2.081	0.168	0.517
Avg. Stage #2		All Specs	8.70	1.478	2.082	0.169	0.520
Avg. Stage #3		All Specs	8.70	1.479	2.080	0.168	0.517
Avg. Stage #4		All Specs	8.70	1.479	2.080	0.168	0.517
Avg. % Change at Stage #2			0.0	0.0	0.0	0.6	0.6
Avg. % Change at Stage #3			0.0	0.1	0.0	0.0	0.0
Avg. % Change at Stage #4			0.0	0.1	0.0	0.0	0.0

NOTE: Specs = Specimen

TABLE 4

ACCELERATED AGING OF PLASTIC - PROCEDURE D

DATE (mo./day)	STAGE (no.)	SPECIMEN (no.)	WEIGHT (gm.)	WIDTH (in.)	LENGTH (in.)	THICKNESS (in.)	VOLUME (sq. in.)
02/14	1	1	8.83	1.481	2.091	0.176	0.545
02/15	2	1	8.83	1.481	2.091	0.176	0.545
02/16	3	1	8.83	1.483	2.091	0.176	0.546
02/18	4	1	8.83	1.480	2.089	0.176	0.544
02/14	1	2	8.71	1.478	2.080	0.168	0.516
02/15	2	2	8.71	1.478	2.081	0.167	0.514
02/16	3	2	8.71	1.478	2.081	0.168	0.517
02/18	4	2	8.71	1.478	2.081	0.168	0.517
02/14	1	3	8.70	1.477	2.086	0.167	0.515
02/15	2	3	8.70	1.477	2.086	0.167	0.515
02/16	3	3	8.70	1.477	2.086	0.167	0.515
02/18	4	3	8.70	1.477	2.085	0.167	0.514
02/14	1	4	8.75	1.477	2.084	0.169	0.520
02/15	2	4	8.75	1.480	2.082	0.169	0.521
02/16	3	4	8.75	1.480	2.082	0.169	0.521
02/18	4	4	8.75	1.479	2.082	0.169	0.520
02/14	1	5	8.60	1.469	2.078	0.168	0.513
02/15	2	5	8.60	1.477	2.078	0.169	0.519
02/16	3	5	8.60	1.477	2.078	0.169	0.519
02/18	4	5	8.60	1.475	2.079	0.169	0.518
Avg. Stage #1		All Specs	8.72	1.476	2.084	0.170	0.522
Avg. Stage #2		All Specs	8.72	1.479	2.084	0.170	0.523
Avg. Stage #3		All Specs	8.72	1.479	2.084	0.170	0.523
Avg. Stage #4		All Specs	8.72	1.478	2.083	0.170	0.523
Avg. % Change at Stage #2			0.0	0.2	0.0	0.0	0.2
Avg. % Change at Stage #3			0.0	0.2	0.0	0.0	0.2
Avg. % Change at Stage #4			0.0	0.1	0.0	0.0	0.2

NOTE: Specs = Specimen

TABLE 5

ACCELERATED AGING OF PLASTIC - PROCEDURE E

DATE (mo./day)	STAGE (no.)	SPECIMEN (no.)	WEIGHT (gm.)	WIDTH (in.)	LENGTH (in.)	THICKNESS (in.)	VOLUME (sq. in.)
02/14	1	1	8.75	1.480	2.083	0.169	0.521
02/16	2	1	8.75	1.478	2.082	0.169	0.520
02/17	3	1	8.75	1.478	2.083	0.170	0.523
02/18	4	1	8.76	1.472	2.072	0.177	0.540
02/21	5	1	8.75	1.477	2.073	0.170	0.521
02/14	1	2	8.75	1.482	2.083	0.174	0.537
02/16	2	2	8.75	1.482	2.082	0.172	0.531
02/17	3	2	8.75	1.482	2.082	0.173	0.534
02/18	4	2	8.76	1.477	2.080	0.177	0.544
02/21	5	2	8.75	1.479	2.074	0.172	0.528
02/14	1	3	8.73	1.473	2.079	0.170	0.521
02/16	2	3	8.73	1.480	2.077	0.172	0.529
02/17	3	3	8.73	1.480	2.081	0.171	0.527
02/18	4	3	8.74	1.476	2.075	0.174	0.533
02/21	5	3	8.73	1.475	2.075	0.171	0.523
02/14	1	4	8.74	1.474	2.082	0.167	0.513
02/16	2	4	8.74	1.472	2.078	0.169	0.517
02/17	3	4	8.74	1.477	2.083	0.170	0.523
02/18	4	4	8.75	1.471	2.075	0.172	0.525
02/21	5	4	8.74	1.476	2.081	0.170	0.522
02/14	1	5	8.75	1.478	2.082	0.169	0.520
02/16	2	5	8.75	1.477	2.080	0.170	0.522
02/17	3	5	8.75	1.477	2.082	0.170	0.523
02/18	4	5	8.76	1.476	2.081	0.172	0.528
02/21	5	5	8.75	1.478	2.078	0.170	0.522
02/14	1	6	8.60	1.470	2.079	0.178	0.544
02/16	2	6	8.60	1.469	2.074	0.172	0.524
02/17	3	6	8.60	1.475	2.075	0.168	0.514
02/18	4	6	8.61	1.471	2.074	0.172	0.525
02/21	5	6	8.60	1.474	2.077	0.168	0.514
02/14	1	7	8.60	1.479	2.079	0.171	0.526
02/16	2	7	8.60	1.467	2.074	0.171	0.520
02/17	3	7	8.60	1.471	2.081	0.168	0.514
02/18	4	7	8.60	1.471	2.081	0.171	0.523
02/21	5	7	8.60	1.473	2.075	0.167	0.510

TABLE 5
(cont.)

ACCELERATED AGING OF PLASTIC - PROCEDURE B

DATE (mo./day)	STAGE (no.)	SPECIMEN (no.)	WEIGHT (gm.)	WIDTH (in.)	LENGTH (in.)	THICKNESS (in.)	VOLUME (sq. in.)
02/14	1	8	8.60	1.475	2.078	0.170	0.521
02/16	2	8	8.60	1.472	2.076	0.168	0.513
02/17	3	8	8.60	1.473	2.076	0.166	0.508
02/18	4	8	8.60	1.469	2.071	0.170	0.517
02/21	5	8	8.60	1.472	2.075	0.166	0.507
02/14	1	9	8.60	1.480	2.083	0.175	0.539
02/16	2	9	8.61	1.471	2.075	0.168	0.513
02/17	3	9	8.61	1.473	2.077	0.166	0.508
02/18	4	9	8.61	1.470	2.082	0.168	0.514
02/21	5	9	8.61	1.477	2.076	0.165	0.506
02/14	1	10	8.91	1.480	2.086	0.172	0.531
02/16	2	10	8.91	1.480	2.086	0.174	0.537
02/17	3	10	8.91	1.481	2.087	0.174	0.538
02/18	4	10	8.92	1.481	2.087	0.176	0.544
02/21	5	10	8.91	1.482	2.085	0.174	0.538
Avg. Stage #1		All Specs	8.70	1.477	2.081	0.172	0.527
Avg. Stage #2		All Specs	8.70	1.475	2.078	0.171	0.523
Avg. Stage #3		All Specs	8.70	1.477	2.081	0.170	0.521
Avg. Stage #4		All Specs	8.71	1.473	2.078	0.173	0.529
Avg. Stage #5		All Specs	8.70	1.476	2.077	0.169	0.519
Avg. % Change at Stage #2			0.0	-0.1	-0.1	-0.6	-0.8
Avg. % Change at Stage #3			0.0	0.0	0.0	-1.2	-1.1
Avg. % Change at Stage #4			0.1	-0.3	-0.1	0.6	0.4
Avg. % Change at Stage #5			0.0	-0.1	-0.2	-1.7	-1.5

NOTE: (-) = Decrease in dimension
Specs = Specimen

TABLE 6

ACCELERATED AGING OF PLASTIC - PROCEDURE F

DATE (mo./day)	STAGE (no.)	SPECIMEN (no.)	WEIGHT (gm.)	WIDTH (in.)	LENGTH (in.)	THICKNESS (in.)	VOLUME (sq. in.)
02/23	1	1	8.61	1.478	2.082	0.166	0.511
02/24	2	1	8.61	1.478	2.082	0.167	0.514
02/25	3	1	8.61	1.478	2.083	0.167	0.514
02/28	4	1	8.61	1.476	2.082	0.166	0.510
02/23	1	2	8.60	1.477	2.078	0.166	0.509
02/24	2	2	8.60	1.477	2.078	0.166	0.509
02/25	3	2	8.60	1.476	2.080	0.168	0.516
02/28	4	2	8.60	1.475	2.078	0.166	0.509
02/23	1	3	8.61	1.479	2.079	0.166	0.510
02/24	2	3	8.61	1.479	2.080	0.166	0.511
02/25	3	3	8.61	1.477	2.082	0.168	0.517
02/28	4	3	8.61	1.477	2.081	0.166	0.510
02/23	1	4	8.75	1.480	2.080	0.169	0.520
02/24	2	4	8.75	1.480	2.084	0.168	0.518
02/25	3	4	8.75	1.480	2.084	0.169	0.521
02/28	4	4	8.75	1.479	2.084	0.169	0.521
02/23	1	5	8.76	1.482	2.080	0.170	0.524
02/24	2	5	8.76	1.482	2.083	0.171	0.528
02/25	3	5	8.76	1.481	2.083	0.171	0.528
02/28	4	5	8.76	1.481	2.082	0.170	0.524
Avg. Stage #1		All Specs	8.67	1.479	2.080	0.167	0.515
Avg. Stage #2		All Specs	8.67	1.479	2.081	0.168	0.516
Avg. Stage #3		All Specs	8.67	1.478	2.082	0.169	0.519
Avg. Stage #4		All Specs	8.67	1.478	2.081	0.167	0.515
Avg. % Change at Stage #2			0.0	0.0	0.0	0.6	0.2
Avg. % Change at Stage #3			0.0	-0.1	0.1	1.2	0.8
Avg. % Change at Stage #4			0.0	-0.1	0.0	0.0	0.0

NOTE: (-) = Decrease in dimension
Specs = Specimen

TABLE 7

ACCELERATED AGING OF PLASTIC - PROCEDURE G

DATE (mo./day)	STAGE (no.)	SPECIMEN (no.)	WEIGHT (gm.)	WIDTH (in.)	LENGTH (in.)	THICKNESS (in.)	VOLUME (sq. in.)
02/23	1	1	8.72	1.480	2.082	0.172	0.530
02/24	2	1	8.72	1.481	2.085	0.171	0.528
02/25	3	1	8.72	1.480	2.085	0.171	0.528
02/28	4	1	8.72	1.480	2.085	0.171	0.528
02/23	1	2	8.82	1.480	2.099	0.170	0.528
02/24	2	2	8.82	1.482	2.095	0.169	0.525
02/25	3	2	8.82	1.480	2.097	0.170	0.528
02/28	4	2	8.82	1.480	2.096	0.170	0.527
02/23	1	3	8.75	1.480	2.086	0.169	0.522
02/24	2	3	8.75	1.480	2.085	0.170	0.525
02/25	3	3	8.75	1.478	2.087	0.170	0.524
02/28	4	3	8.75	1.480	2.086	0.170	0.525
02/23	1	4	8.70	1.478	2.084	0.172	0.530
02/24	2	4	8.70	1.480	2.084	0.169	0.521
02/25	3	4	8.70	1.480	2.084	0.170	0.524
02/28	4	4	8.70	1.480	2.084	0.171	0.527
02/23	1	5	8.76	1.479	2.086	0.172	0.531
02/24	2	5	8.76	1.483	2.082	0.170	0.525
02/25	3	5	8.76	1.481	2.085	0.171	0.528
02/28	4	5	8.76	1.482	2.085	0.171	0.528
Avg. Stage #1		All Specs	8.75	1.479	2.087	0.171	0.528
Avg. Stage #2		All Specs	8.75	1.481	2.086	0.170	0.525
Avg. Stage #3		All Specs	8.75	1.480	2.088	0.170	0.526
Avg. Stage #4		All Specs	8.75	1.480	2.087	0.171	0.527
Avg. % Change at Stage #2			0.0	0.1	0.0	-0.6	-0.6
Avg. % Change at Stage #3			0.0	0.1	0.0	-0.6	-0.4
Avg. % Change at Stage #4			0.0	0.1	0.0	0.0	0.2

NOTE: (-) = Decrease in dimension
Specs = Specimen