



RICK SNYDER
GOVERNOR

STATE OF MICHIGAN
DEPARTMENT OF LICENSING AND REGULATORY AFFAIRS
BUREAU OF CONSTRUCTION CODES
IRVIN J. POKE
DIRECTOR

STEVE ARWOOD
DIRECTOR

CONSTRUCTION CODE COMMISSION

Conference Room 3, First Floor
2501 Woodlake Circle
Okemos, Michigan 48864

AGENDA

April 2, 2014
9:30 a.m.

1. Call to Order and Determination of Quorum
2. Approval of Agenda (1-2)
3. Approval of Minutes – January 8, 2014 (3-7)
4. Director’s Report I. Poke
5. Applications to Administer and Enforce M. Somers
Osceola County – Document #14-15 (8-9)
6. Report of Assistance Requests – Document #14-19 (10) K. Lambert
7. Royal Oak Performance Evaluation Report – Document #14-14 (11-16) M. Somers
8. Applications for Program Approval – Document #14-16 (17-21) L. Lehman
9. Applications for Instructor Approval – Document #14-17 (22-23) L. Lehman
10. 1986, Act 54 Registration Applicants – Document #14-18 a-e, f (24-30) L. Lehman
11. Recommended Product Approvals
 - a.) REHAU RAUPEX K. Kalakay
Document #14-13 (31-95)
 - b.) Hepvo, Sanitary Waste Valve J. Madziar
Document # 14-20 (96-99)
 - c.) Custom Building Products, Inc., RedGard Fabric Membrane J. Madziar
Document #14-21 (100-103)

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Agenda - Construction Code Commission – April 2, 2014

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- d.) Custom Building Products, Inc., RedGard Crack Prevention and Waterproofing Membrane
Document #14-22 (104-111) J. Madziar
- e.) Custom Building Products, Inc., Custom 9240 Waterproofing and Anti-Fracture Membrane
Document #14-23 (112-117) J. Madziar

12. Public Comment

13. Unfinished Business

14. New Business

15. Adjournment

The meeting site and parking is accessible. Individuals attending the meeting are requested to refrain from using heavily scented personal care products, in order to enhance accessibility for everyone. People with disabilities requiring additional services (such as materials in alternative format) in order to participate in the meeting should call Hillary Cushman at (517) 241-9302 at least 10 business days before the event.



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MINUTES
January 8, 2014
9:30 a.m.

MEMBERS PRESENT

- Mr. William Benoit, Jr. (Chair)
- Mr. Thomas Baldwin
- Mr. Michael Boss
- Mr. Roger Donaldson
- Mr. Thomas Erdman
- Mr. David Jones
- Mr. Clifton (Jack) Lewis
- Mr. Richard Miller
- Mr. Kenneth D. Misiewicz
- Mr. Sean O'Neil
- Mr. Roger Papineau
- Mr. Matthew Reno
- Mr. Donald Staley

MEMBERS ABSENT

- Mr. Frederick Butters
- Mr. William Duffield
- Mr. Nelson McMath
- Ms. Beth Yorke

DEPARTMENT PERSONNEL PRESENT

- Mr. Irvin J. Poke, Director, BCC
- Mr. Keith Lambert, Deputy Director, BCC
- Ms. Hillary Cushman, Assistant to Mr. Poke
- Mr. David Vigas, Director, Office of Management Services
- Ms. Deb Young, Director, Office of Administrative Services
- Ms. Jessica Lightner, Assistant to Ms. Young
- Mr. Michael Somers, Analyst, Office of Administrative Services
- Mr. Charles Curtis, Assistant Chief, Building Division
- Mr. Dan O'Donnell, Chief, Electrical Division
- Mr. Jim Hennesey, Assistant Chief, Electrical Division
- Mr. Kevin Kalakay, Chief, Mechanical Division
- Mr. Jonathon Paradine, Assistant Chief, Mechanical Division
- Mr. Todd Cordill, Chief, Plan Review Division
- Mr. Joseph Madziar, Chief, Plumbing Division

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OTHERS IN ATTENDANCE

Mr. Glen Dempsey, City of East Lansing

Mr. Tom Yedon, City of East Lansing

1. CALL TO ORDER AND DETERMINATION OF QUORUM

Chairperson Benoit called the meeting to order at approximately 9:30 a.m. A quorum was determined present at that time.

2. APPROVAL OF AGENDA

Commissioner Donaldson moved to approve the agenda. Commissioner Lewis seconded the motion. **MOTION CARRIED.**

3. APPROVAL OF MINUTES

Commissioner O'Neil moved to approve the minutes of the October 2, 2013 meeting. Commissioner Reno seconded the motion. **MOTION CARRIED.**

4. DIRECTOR'S REPORT

Director Poke reported that the new Detroit office is now open. It is part of the "Hardest Hit" program with the City of Detroit. There will be two inspectors and one administrative support staff. The office is located on the 11th floor of Cadillac Place. The office is primarily for the City of Detroit, it is a full service office. Permits for any municipality enforced by the bureau can be issued out of this office.

Director Poke stated that the 5th Annual COCM and BCC Joint Training conference is scheduled for February 4th & 5th. COCM sponsors the event and the bureau provides the training.

Director Poke reported that the Accela Automation project is on schedule. It is anticipated that the program will be implemented in the fall of 2014. This phase will include permitting, inspections and plan review. The plan review phase will not include the electronic seal portion.

Director Poke reported on various items of legislation including PA 150 of 2013, PA 178 of 2013. There was discussion regarding the details and requirements of the Act.

Director Poke spoke regarding the memorandum that was previously sent to the members of the Commission regarding reference standards and the list of standards are required for municipalities to properly enforce the code. After a detailed discussion, Commissioner Papineau moved for the Commission to instruct Director Poke to send a letter to the municipalities with existing code enforcement authority, recommending they update their standards to match the list compiled by bureau staff. Commissioner Boss seconded the motion. **MOTION CARRIED.**

5. APPLICATIONS TO ADMINISTER AND ENFORCE

Plainfield Township, Kent County - Document #14-01

Mr. Somers presented an Application to Administer and Enforce for the Township of Plainfield, Kent County. It is the recommendation of staff to approve this Application to Administer and Enforce subject to the conditions set forth in the affidavits.

After discussion, Commissioner Misiewicz moved to approve the Township of Plainfield's Application to Administer and Enforce. Commissioner Jones seconded the motion. **MOTION CARRIED.**

6. REPORT OF ASSISTANCE REQUESTS

Document #14-12

Mr. Lambert provided the Report of Assistance Requests to the commission for informational purposes.

7. PERFORMANCE EVALUATION STATUS UPDATE

Texas Township – Document #14-02

Mr. Somers presented a status update for the Performance Evaluation #12-001 for Texas Township.

Commissioner Baldwin moved to accept the status update regarding the Texas Township Performance Evaluation. Commissioner O'Neil seconded the motion. **MOTION CARRIED.**

8. PERFORMANCE EVALUATION SUMMARY REPORT

City of East Lansing – Document #14-03

Mr. Somers presented the Summary Report for the Performance Evaluation #13-001 for the City of East Lansing.

Commissioner O'Neil moved to accept staff's recommendation to close the City of East Lansing Performance Evaluation. Commissioner Reno seconded the motion. **MOTION CARRIED.**

9. APPLICATIONS FOR PROGRAM APPROVAL

Document #14-07

Mr. Curtis presented a list of continuing education program applications for approval. The programs were reviewed and found to be in compliance with the registration rules and it is the recommendation of staff that the programs be approved.

Commissioner Reno moved to approve the applications as submitted. Commissioner Lewis seconded the motion. **MOTION CARRIED.**

10. APPLICATIONS FOR INSTRUCTOR APPROVAL

Document #14-08

Mr. Curtis presented a list of Instructors of Continuing Education Programs for approval. The applications were reviewed and found to be in compliance with the registration rules and it is the recommendation of staff that the applications be approved.

Commissioner O'Neil moved to approve the instructors. Commissioner Donaldson seconded the motion. **MOTION CARRIED.**

11. 1986, ACT 54 REGISTRATION APPLICANTS

Document #14-09 a-f

Mr. Curtis presented a list of applications for registration as building officials, building inspectors, plan reviewers, electrical inspectors, and plumbing inspectors. It is the recommendation of staff that the individuals listed be approved.

Commissioner Reno moved to approve the applications as submitted. Commissioner Erdman seconded the motion. Commissioner O'Neil abstained from the vote due to a conflict of interest. **MOTION CARRIED.**

12. RECOMMENDED PRODUCT APPROVALS

a.) See Water Inc., Liquid Smart Pump Systems (Plumbing) – Document #14-10

Mr. Madziar presented the Liquid Smart Pump Systems device for installation and use in the State of Michigan. It is the recommendation of staff and the State Plumbing Board that this product be approved.

b.) Penner Manufacturing Inc., Cascade Contour Bathing System (Plumbing) – Document #14-11

Mr. Madziar presented the Cascade Contour Bathing System device for installation and use in the State of Michigan. It is the recommendation of staff and the State Plumbing Board that this product be approved.

Commissioner Baldwin moved to approve the applications as submitted. Commissioner Jones seconded the motion. **MOTION CARRIED.**

13. CERTIFICATE OF ACCEPTABILITY

- a.) Restroom Facilities LTD. – CA #553 Document #14-04
- b.) Speed Space – CA #544 Document #14-05
- c.) Kings Custom Builders Inc – CA #546 Document #14-06

Mr. Cordill presented Certificates of Acceptability for approval.

Commissioner Reno moved to approve the Certificate of Acceptability. Commissioner Lewis seconded the motion. **MOTION CARRIED.**

14. PUBLIC COMMENT

NONE

15. UNFINISHED BUSINESS

NONE

16. NEW BUSINESS

NONE

17. ADJOURNMENT

Commissioner Reno moved to adjourn the meeting at approximately 10:29 a.m. Commissioner Donaldson seconded the motion. **MOTION CARRIED.**

APPROVED:

Chairman, Construction Code Commission

Date



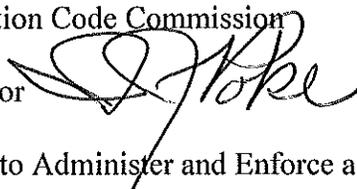
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DOCUMENT #14-15

February 26, 2014

TO: Members of the Construction Code Commission
FROM: Irvin J. Poke, AIA, Director 
SUBJECT: Application for Approval to Administer and Enforce a Code

The following unit of government has submitted an application for approval to administer and enforce the Michigan code, along with an ordinance:

1. **M-14-01 Osceola County**
Michigan Mechanical Code
Inspector/Plan Reviewer: None listed on Application
Currently state enforced

FINDINGS

1. There is no cost analysis provided to establish the fee charged by the County for an hour of mechanical plan review.
2. There is no cost analysis provided to establish the fee charged by the County for an hour of mechanical inspection.
3. The County did not provide verification that a library of the essential mechanical code referenced standards within Chapter 15 of the 2009 Michigan Mechanical Code is available for use by the public and its inspector/plan reviewer.
4. The County did not provide the name and registration number of its mechanical inspector upon the Application to Administer and Enforce form.

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5. The County did not provide a copy of executed and signed mechanical inspector employment agreements or third party contracts for review.
6. The County did not provide the means and method of mechanical inspector compensation.

RECOMMENDATION: Due to concerns listed above regarding the County's Application to Administer and Enforce, staff recommends that the unit of government listed not be approved to administer and enforce the code.

IJP/ms



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DOCUMENT #14-19

March 21, 2014

TO: Members of the Construction Code Commission

FROM: Keith Lambert, Deputy Director *KEZ*

SUBJECT: Report of Assistance Requests

The bureau has **granted** assistance as follows:

- a.) Central Michigan University, Isabella County
Project: Foust Hall Fire Alarm Upgrade
Services: Electrical plan review, permit and inspection
Effective: 01/29/2014 until completion of project
- b.) Wayne State University, Wayne County
Project: Tenants of Wayne State University Center, 5221 Gullen Mall, Detroit, MI 48202
Services: Electrical, mechanical and plumbing plan review, permit and inspection
Effective: 01/29/2014 until completion of project
- c.) Wayne State University, Wayne County
Project: Shapero Hall – Interior Renovation of Lecture Hall 100, 5501 Gullen Mall Detroit, MI 48202
Services: Electrical plan review, permit and inspection
Effective: 02/26/2014 until completion of project
- a.) Wayne State University, Wayne County
Project: Towers Cafeteria Renovation – Towers Residence Hall, 655 West Kirby Avenue, Detroit, MI 48202
Services: Building, electrical, mechanical and plumbing plan review, permit and inspection
Effective: 02/26/2014 until completion of project

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February 28, 2014

DOCUMENT NO. 14-14

TO: Members of the Construction Code Commission

FROM: Irvin J. Poke, AIA
Director, Bureau of Construction Codes

SUBJECT: Charter Township of Royal Oak
Summary Report PE 11-002

The performance evaluation for the Charter Township of Royal Oak was conducted on September 29, 2011. The Township did not provide timely responses to address the recommendations within the performance evaluation report. On January 4, 2012, the Construction Code Commission issued a notice of intent to withdraw the township's code enforcement authority. On February 22, 2012, the Township transmitted an appeal of the Commission's notice of intent and submitted information to address the recommendations. The bureau's review of the information found the Township had not adequately addressed the recommendations.

The bureau submitted a request for hearing to the Michigan Administrative Hearings System on March 6, 2012. An initial pre-hearing conference was held on April 2, 2012, and subsequent pre-hearing conferences were held on May 16, June 7, August 9, and October 11, 2012. On June 7, 2012, the township submitted additional information. The bureau's review of the information found that three recommendations had not been adequately addressed. The Township submitted additional information on September 25, and October 11, 2012. The pre-hearing conference scheduled for January 2, 2013, was rescheduled for March 5, 2013. On March 1, 2013, the Township submitted materials that adequately addressed the three outstanding recommendations and the March 5 pre-hearing conference was adjourned. On April 3, 2013, the Commission issued an order that a re-evaluation be conducted to verify the Township's level of compliance with the recommendations. After unsuccessful attempts to schedule the re-evaluation in November and December, 2013, and January, 2014, a re-evaluation of the Township's enforcing agency was conducted on February 13, 2014.

The following summary report provides the recommendations from the performance evaluation report submitted to the Commission, the Township's responses to the recommendations, and the Bureau's analysis of the Township's responses.

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Recommendation No. 1

The Township shall prepare a written report listing the electrical permits issued and electrical inspections performed by the unregistered inspector, and shall conduct re-inspections of an initial batch of 25% of the permits to verify that the work completed under the selected permits complies with code. If the Township determines violations exist within the initial re-inspections, the Township shall re-inspect an additional 25% of the permits until compliance with the code has been achieved. The Township shall not charge for the re-inspections. The Township's electrical inspector must complete the additional training required in recommendation number six (6) below *before* conducting the re-inspections. The Township shall provide the inspection list report to the bureau within 30 days of approval of this report, and shall provide a status report to the bureau every 30 days detailing the Township's progress until all inspections have been completed. The Township's information was requested to be provided by November 7, 2011, and a subsequent report every 30 days.

Township Response

On February 22, 2012, the Township provided a list of 78 electrical permits issued and electrical inspections performed by the unregistered inspector. The Township also provided information indicating 33 re-inspections (39.7%) had been performed with no violations of the code identified. The Township was also required to provide verification that its electrical inspector had completed (9) hours of educational training in the electrical, technical and specialty categories (which will include inspection techniques) in addition to the amount of hours required for re-registration within 60 days of approval of this report (see Recommendation No. 6). However, since the Township notified the bureau that the inspector is no longer employed by the Township, it has been determined that compliance with the recommendation has been achieved.

Recommendation No. 2

The Township shall develop and maintain inspection procedures directing the Township's inspectors to cite code sections upon written inspection reports and correction notices that include the date the inspection was performed, the type of inspection performed, and shall bear the true signature of the inspector performing the inspection. The Township shall consistently utilize an inspection report form to document all inspections performed and that the inspection report form shall be placed within the corresponding master permit file to document the performance of inspections. The Township shall provide a copy of its inspection procedures and report form to the bureau within 60 days of approval of this report.

Township Response

On February 22, 2012, the Township provided a copy of instructions to staff to operate the BS&A software program for the issuance of permits and other documents. The Township did not provide a copy of its inspection procedures and inspection report form as recommended. On June 7, 2012, the Township provided a Building Department Policies and Procedures Manual.

On Page 8 of the manual, an inspection sequence is provided. On October 11, 2012, the Township provided a copy of its inspection report form and additional inspection procedures for review. On February 13, 2014, it was confirmed the Township is utilizing the proper procedures and forms. Therefore, it is determined that the Township has achieved compliance with the recommendation.

Recommendation No. 3

The Township shall document the performance of plan reviews and the approval of plans prior to permit issuance. The Township shall require plans of sufficient clarity to accompany all applications for building permits, except those that are minor in nature, and shall develop procedures to document the review of plans to determine compliance with the codes prior to the issuance of permits. The Township shall perform plan reviews as required by the code and shall maintain copies of the plan review reports in the permit file. The Township shall review plans during inspections to verify construction is being performed in accordance with approved plans, and the code. If construction deviates from the plans, approval must be obtained from the building inspector. The Township shall develop and consistently utilize proper plan review procedures and plan review record keeping procedures and shall provide the bureau with a copy of those procedures within 60 days of approval of this report.

Township Response

On February 22, 2012, the Township provided copies of a plan review checklist for a commercial project, deck, and generator. The Township did not provide plan review and plan review recordkeeping procedures as recommended. On June 7, 2012, the Township provided a Building Department Policies and Procedures Manual. Page 1 Section B of the manual contains a plan review procedure outline. On October 11, 2012, the Township provided a copy of its plan review report form and additional plan review procedures that were deemed to be acceptable. On February 13, 2014, it was confirmed the Township is utilizing the proper procedures and forms. Therefore, it has been determined that the Township has achieved compliance with the recommendation.

Recommendation No. 4

The Township shall establish and maintain a Construction Board of Appeals staffed with individuals qualified by experience and training, and shall develop procedures for processing and hearing appeals related to code decisions rendered by the Township inspectors in accordance with Section 14 of the Act, MCL 125.1514. The Township shall provide a written set of procedures governing its Construction Board of Appeals, and shall provide the names and qualifications of the members of its board of appeals to the bureau within 60 days of approval of this report.

Township Response

On February 22, 2012, the Township provided a certified copy of its ordinance establishing its board of appeals, a written set of procedures governing its Construction Board of Appeals, and the names and qualifications of the members of its board of appeals. The Township's information was reviewed and deemed acceptable. On February 13, 2014, it was confirmed that the Township has maintained its procedures. Therefore, it has been determined that the Township has achieved compliance with the recommendation.

Recommendation No. 5

The Township shall develop and maintain a written procedure to actively monitor the registration status of each inspector employed by the Township to assure that the code is being enforced by properly registered code officials in accordance with 1986 PA 54 and shall provide a copy of the procedure to the bureau within 60 days of approval of this report.

Township Response

On February 22, 2012, the Township provided list of its current inspectors. However, the Township did not provide a procedure to monitor the registration status of the inspectors employed by the Township as recommended. On June 7, 2012, the Township provided a Building Department Policies and Procedures Manual. Page 6 of the manual contains the requested procedure. On February 13, 2014, it was confirmed that the Township is utilizing its procedure. Therefore, it has been determined that the Township has achieved compliance with the recommendation.

Recommendation No. 6

a) The Township shall review the electrical and mechanical permit and inspection records for the structures located at 21056 and 21094 Woodside, Ferndale, Michigan, and shall prepare a report that addresses the violations listed in Exhibits 1 and 2. The Township's report should identify the party responsible for creating the violations and shall include copies of the electrical and mechanical permits, inspection reports, code violation/correction notices, and shall document all enforcement actions undertaken by the Township until compliance with the code has been achieved. The Township shall submit its report to the bureau within 60 days of approval of this report.

b) Due to the lack of proper inspection and violations described within this finding, the Township's mechanical inspector shall complete (9) hours of educational training in the mechanical technical and specialty categories (which will include inspection techniques) and the Township's electrical inspector shall complete (9) hours of educational training in the electrical technical and specialty categories (which will include inspection techniques) in addition to the amount of hours required for re-registration. This additional training must be completed within 60 days of approval of this report.

Township Response

a) On February 22, 2012, the Township provided copies of final mechanical and electrical inspection approvals for 21056 and 21094 Woodside, Ferndale, Michigan, that document code enforcement actions, and copies of its electrical inspector's registration certificate. The Township has achieved compliance with Section A of the recommendation.

b) The mechanical inspector involved during the evaluation has subsequently left the employ of the Township. The Township has indicated that it believes the requirement for its electrical inspector to complete (9) hours of continuing education is no longer applicable due to an acknowledgment by the commission of an error of omission in its report. Additionally, the electrical inspector is no longer employed by the Township. The Township has achieved compliance with Section B of the recommendation.

Recommendation No. 7

The Township shall conduct a review of its Schedule of Fees to determine if sufficient fees are being charged to recover the cost of providing construction code services to the public.

Township Response

On February 22, 2012, the Township provided information that indicated a review of its Schedule of Fees was underway and that the review would be completed within 30 days. On September 25, 2012, the Township provided a proposed schedule of fees. Upon review, corrections were required to delete references to the registration of contractor's licenses on an annual basis and to provide a cost analysis for inspector and plan reviewer services. On March 1, 2013, the Township submitted a revised Schedule of Fees containing the proper statutory registration time frame and the financial analysis of the cost of one hour of plan review and one hour of inspection services. On February 13, 2014, it was confirmed that the Township is consistently utilizing the approved fee schedule. Therefore, it has been determined that the Township has achieved compliance with the recommendation.

Recommendation No. 8

The Township shall take the appropriate action to assure follow-up on active permits, pursue timely compliance on open and expired permits, organize and properly maintain permit files and file documentation to adequately discharge its code administration and enforcement responsibilities to provide for the public's safety in the built environment.

Township Response

The Township provided a general written statement indicating its willingness to continue to administer and enforce the code. On October 11, 2012, the Township submitted its procedures for the monitoring of open permits. On February 13, 2014, it was confirmed that the Township

is consistently utilizing its open permits monitoring procedure and is reviewing all permits issued on a monthly basis, and is issuing letters to permit holders when applicable. Therefore, it has been determined that the Township has achieved compliance with the recommendation.

Conclusion:

Based on the bureau's review of the materials and information submitted by the Township, and the verification gained as a result of the re-evaluation that determined the Township is utilizing the procedures approved by the bureau, it has been confirmed that compliance has been achieved addressing the recommendations contained within the Performance Evaluation report.

Recommendation:

Based upon the confirmation that the Township is performing its duties in compliance with the Act and the codes, it is the recommendation of staff to close the Performance Evaluation file.

IJP/ms



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DOCUMENT #14-16

March 6, 2014

TO: Members of the Construction Code Commission

FROM: Larry Lehman, Chief
Building Division

SUBJECT: Continuing Education Program Applicants

The programs listed on the attached pages are those for which approval has been requested by providers or sponsors of continuing education programs required of building officials, inspectors and plan reviewers to renew their registrations. Document #14-16 is a list of programs that have been submitted for approval for the cycle beginning September 17, 2012 through September 16, 2015.

Each provider has documented appropriate content in relation to one or more of the continuing education categories and registrant classifications set forth in the administrative rules promulgated pursuant to 1986 PA 54.

It is the recommendation of Bureau staff that the programs submitted pursuant to the provisions of Act 54 be approved by the Commission.

LL/kja

Attachments

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* Registrants holding one or more Inspector classification are required to attend Technical and Specialty training to be eligible for reregistration at the end of the present code cycle. If that is successfully accomplished, there are no additional Technical or Specialty credits necessary to also become eligible for reregistration as either a Building Official and/or Plan Reviewer. A person who is registered **only** as a Building Official and/or Plan Reviewer **without any Inspector classification** will receive the listed Technical and/or Specialty credit towards reregistration qualification for attending this program.

Specialty approvals are granted for one of the four Inspector (trade) classifications. Inspectors receive credits only for attending programs associated with their trade; a Mechanical Inspector does not satisfy those requirements by attending a Building, Electrical or Plumbing program. Someone registered **only** as a Building Official and/or Plan Reviewer **without any Inspector classification** will receive credit for all Specialty programs attended, regardless of the trade(s).

Technical approvals are granted for programs addressing a specific code. Inspectors receive Technical credit only for programs addressing the code they enforce. Someone registered **only** as a Building Official and/or Plan Reviewer without any Inspector classification will receive credit for all Technical programs **in their cycle** which they attended, regardless of the trade.

** Programs approved for Plan Review credits satisfy unique requirements placed on Plan Reviewer registrants. Even though the title of an individual program may refer to a specific trade or code, all Plan Review program credits apply to any Plan Reviewer.

**** Credit for documented participation in/attendance at formal code change hearings conducted and reported by a nationally recognized code-promulgating organization will be recognized when the subject is a code enforced by the registrant. Credit is granted in one-hour increments and is divided between Technical and Specialty. The first hour is Technical, the second Specialty, the third Technical, the fourth Specialty, etc. Seven hours would be credited as four Technical and three Specialty, for example.

ISC = Independent Study Course

I = Internet Course

CR = Classroom

Department of Licensing and Regulatory Affairs-Bureau of Construction Codes-2012/2015 Inspector Continuing Education Programs

Program Number	Credit Hours						Contact	Organization	Phone	Title
	Admin	Comm	Spec	Tech	PR	Classification				
17691					2	PR**	James R. Russell	Tri-County Plumbing Inspectors Assoc	(248) 330-7699	Roundtable Plan Review
17692	3	1				ALL	James R. Russell	Tri-County Plumbing Inspectors Assoc	(248) 330-7699	Information Highway
17693	1					ALL	Frank D. Waters	LARA	(517) 373-7486	Legislative Advocacy
17694			3			BI*	Dale G. Stevens	Integrity Diagnostics LLC	(231) 492-5010	Common Envelope Failures
17695					8	PR**	Tom S. Dorsey		(865) 573-8355	Electrical Plan Review for Residential and Commercial Installations
17696		2				ALL	Tom S. Dorsey		(865) 573-8355	Communications for the Inspector
17697			5			EI*	Tom S. Dorsey		(865) 573-8355	Commercial Installations
17698				15		EI*	Tom S. Dorsey		(865) 573-8355	2011 National Electrical Code Updates an Internet Based Program
17699				15		EI*	Tom S. Dorsey		(865) 573-8355	2011 National Electrical Code Updates
17700			4			EI*	Tom S. Dorsey		(865) 573-8355	Electrical Load Calculations Based on the 2011 NEC
17701			1	1	1	EI*, PR**	Phil Clark	Clark Associates	(313) 929-6383	Overlapping Code Requirements for Fire Protection
17702	1	1		10	3	ALL, EI*, PR**	Phil Clark	Clark Associates	(313) 929-6383	2011 Michigan Electrical Code Update
17703	2					ALL	Mark Uribe	Michigan State Police BAYANET	(989) 790-6581	Methamphetamine Awareness
17704				4		BI*	Dennis S. Smith	D.S. Smith Enterprises	(810) 577-1113	Principles of Fire Resistive Rated Construction
17705			1	3		PI*	Ivory B. Sims Jr.	1 Slms Code Classes	(734) 845-0798	2012 Code Update Class
17706	2		3	3		ALL (Admin Only), EI*, PR**	George Little	Reciprocal Electrical Council, Inc.	(248) 542-7567	8 Hour Sign Class

Department of Licensing and Regulatory Affairs-Bureau of Construction Codes-2012/2015 Inspector Continuing Education Programs

17707			3		BI*	John M. Tisdale	BCC/Building Division	(517) 241-9317	Manufactured Housing Rules & HUD Part 3280 & 3285
17708			1		MI*	Jim Ritcey Jr.	Victaulic Company	(248) 670-8625	Correct installation procedures for Victaulic Fire Protection products and what to look for during inspections
17709			1		BI*	Thomas J. Geltz	Amerhart Ltd.	(800) 236-2211	Proper Attic Ventilation
17710	2				ALL	Dan O'Donnell	BCC/Electrical Division	(517) 241-9320	Public Acts and Administrative Rules
17711			1	3	PI*	Marvin Schierbeck		(616) 813-9229	Code Update 2012 MPC
17712			1	3	PI*	James R. Russell	Tri-County Plumbing Inspectors Assoc	(248) 330-7699	2012 Michigan Plumbing Code
17713			3		EI*	David M. Pabis	Western Code Consultants	(269) 214-6418	Inspection of Industrial Plants
17714			1		ALL	John M. Tisdale	BCC/Building Division	(517) 241-9317	Residential Builder Code
17715			3		BI*	Karol L. Grove	Flood Zone Specialists	(248) 807-1456	FEMA and Flood Zone Construction Issues
17716	3				ALL	Barbara Lajiness	Washtenaw Community College/HuVaco	(374) 677-5289	Testifying and Code Officials
17717	1			14	All (Admin Only), EI*	Darrick Whitaker	Monroe County Community College	(734) 755-4630	2011 NEC & Part 8 Rules Update
17718			1		ALL	Keith Langworthy	LARA-MIOSHA-CSHD	(517) 242-8096	Asbestos and Demolition
17719				3	BI*	Robert DeBerardino	City of Detroit BSEED	(313) 628-2457	Michigan Commercial Energy Code training and implementation program
17720	3			3	ALL (Admin Only), BI*	Robert DeBerardino	City of Detroit BSEED	(313) 628-2457	Michigan Residential Energy Code training and implementation program
17721	3			3	ALL (Admin Only), BI*	Robert DeBerardino	City of Detroit BSEED	(313) 628-2457	Swimming Pool 2009 MBC and MRC Code Requirements
17722	3				ALL	Robert DeBerardino	City of Detroit BSEED	(313) 628-2457	Legal Aspects of Code Enforcement

Department of Licensing and Regulatory Affairs-Bureau of Construction Codes-2012/2015 Inspector Continuing Education Programs

17723			1	3		PI*	John Gross		(517) 490-1010	2012 4hr Plumbing Code Update Class
17724				15		EI*	Steve Egyed	South Bend Electrical JATC	(574) 233-1721	2011 Michigan Electrical Code
17725				15		EI*	Sue Nanninga	UPBOA	(906) 396-3248	Significant Changes to the 2011 NEC
17726	1	1	1		1	ALL (Admin & Comm), EI*, PR**	George Little	International Asc. Of Electrical Inspectors - MI Chapter	(248) 933-1129	Employee Safety, What is the IA EI? And Swimming Pools
17727				2		EI*	George Little	International Asc. Of Electrical Inspectors - MI Chapter	(248) 933-1129	Mark Shapiro Code Breakfast 3/7/14
17728				3		MI*	Mark Riley	MMIA	(248) 649-5443	Michigan Mechanical Code and International Fuel Gas Code 2012 Updates
17729				3		MI*	Jeffrey Koss	Multi County Mechanical Inspectors Association	(248) 542-5072	2012 Mechanical Code and Fuel Gas Code Changes and update (CR)
17730	2	1				ALL	Donald L. Pratt		(248) 475-5770	Construction Board of Appeals
17731	4					ALL	Lawrence R. Rospierski		(248) 939-0264	Effective Administration of the Department of Building Safety
17732			3			BI*	Ira (Jim) Rowell		(517) 861-6372	Swimming Pool, Hot Tub and Spa Requirements
17733	4		5	5		EI*, PR**	Gary B. Gray	Mister Green Energy LLC	(313) 433-6923	Inspection & Plan Review of Solar Photovoltaic Systems



RICK SNYDER
GOVERNOR

STATE OF MICHIGAN
DEPARTMENT OF LICENSING AND REGULATORY AFFAIRS
BUREAU OF CONSTRUCTION CODES
IRVIN J. POKE
DIRECTOR

STEVE ARWOOD
DIRECTOR

DOCUMENT #14-17

March 6, 2014

TO: Members of the Construction Code Commission

FROM: Larry Lehman, Chief
Building Division

SUBJECT: Continuing Education Instructor Applications

Attached is a list of those individuals who have applied for approval as instructors of continuing education programs required of building officials, inspectors and plan reviewers. The instructors listed have been granted lifetime approval.

Each has documented training and experience in the topic which they propose to teach.

It is the recommendation of Bureau staff that they be approved as instructors by the Commission.

LL/kja

Attachments

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Department of Licensing and Regulatory Affairs-Bureau of Construction Codes-2012/2015 New Instructors

Instructor Number	Last Name	First Name	MI	Affiliation/Experience
2093	Fleet	Donald	S	
2094	Waters	Frank		LARA
2095	Dorsey Jr.	Tommy	S	
2096	Purvis	Joshua	L	
2097	Uribe	Mark		Michigan State Police BAYANET
2098	Ritcey Jr.	James	G	Victaulic Company
2099	Geltz	Thomas	J	Amerhart Ltd.
2100	Grove	Karol	L	Flood Zone Specialists
2101	Simpson	John	C	Washtenaw Community College/HuVaco
2102	VanderWoude	Thomas	C	International Asc. Of Electrical Inspectors - MI Ch
2103	Gray	Gary	B	Mister Green Energy LLC

BUILDING OFFICIALS RECOMMENDED FOR CCC APPROVAL

JAMES, Joseph E.
Registered Building Inspector and Plan Reviewer since 07/2011
Additional Building Official
Commerce Charter Township – Oakland County

JEROME, Darrin P.
Registered MI/PI/PR since 10/1997
Additional Building Official
City of Saginaw – Saginaw County

LOWE, Douglas R.
Registered MI/PI since 04/2011 and PR since 07/2011
Additional Building Official
Addison Township – Oakland County

PALMER, Bruce R.
Previously registered BO since 04/2011 and BI/PR since 05/2008
Additional Building Official
Kochville Township – Saginaw County

QUERTERMOUS, Todd S.
Registered BI since 10/2003 and PR since 09/2004
Additional Building Official
City of Fraser – Macomb County

SHALTZ, Joseph M.
Registered MI/PI since 04/1990 and PR since 01/1997
Replacing Phillippe Arend (005401)
Keweenaw County

BUILDING INSPECTORS RECOMMENDED FOR CCC APPROVAL

CHACKO, Money
19,344 hours experience in Building
Additional Inspector
City of Detroit – Wayne County

FORD, Michael S.
14,200 hours experience in Building
Additional Inspector
City of Rockford – Kent County

JACKSON, Lawrence D.
16,600 hours experience in Building
Additional Inspector
City of Detroit- Wayne County

JAMISON-KING, Brenda R.
16,640 hours of experience in Building
Additional Inspector
City of Detroit – Wayne County

JERGOVICH, John J.
34,840 hours of experience in Building
Additional Inspector
City of Dearborn – Wayne County

KUUTTILA, Eric K.
20,800 hours experience in Building
Additional Inspector
City of Detroit – Wayne County

LINDAHL, Michael J.
28,480 hours experience in Building
Additional Inspector
City of Gladstone – Delta County

MUHAMMAD, Lawrence A.
13,728 hours experience in Building
Additional Inspector
City of Detroit – Wayne County

PALMER, Bruce R.
Previously registered BO since 04/2011 and BI/PR since 05/2008
Additional Inspector
Kochville Township – Saginaw County

PARIZON, Jeremiah J.
9,875 hours experience in Building
Additional Inspector
City of Harper Woods – Wayne County

PIKE, Kenneth L.
17,040 hours experience in Building
Additional Inspector
City of Lapeer – Lapeer County

REED, Charles O.
Licensed Architect #1301046652 (07/2000)
Additional Inspector
City of Detroit – Wayne County

ROY, Stephen A.
20,000 hours experience in Building
Additional Inspector
Oshtemo Township – Kalamazoo County

TYSON, Karen
Licensed Architect #1301027990 (05/1981)
Additional Inspector
City of Detroit – Wayne County

WALDRON, Gregory S.
21,840 hours experience in Building
Replacing Edward Gordon (003012)
Holland Charter Township – Ottawa County

PLAN REVIEWERS RECOMMENDED FOR CCC APPROVAL

BECKMAN, Daniel J.
Master Electrical License#6211141 (01/2002)
Additional Plan Reviewer
City of Warren – Macomb County

BLETCH, Bradley J.
Master Electrical License#6212463 (01/2002)
Additional Plan Reviewer
Village of Almont – Lapeer County

CHACKO, Money
19,344 hours experience in Building
Additional Plan Reviewer
City of Detroit – Wayne County

CHRISTIANSEN, Ray H.
Registered MI/PI since 1992/93
Additional Plan Reviewer
Washtenaw County

FALLERT, Paul J.
Mechanical Contractor License#7100982 (01/1985)
Replacing David Murray (001053)
Green Oak Charter Township – Livingston County

FORD, Michael S.
14,200 hours experience in Building
Additional Plan Reviewer
City of Rockford – Kent County

JACKSON, Lawrence D.
16,600 hours experience in Building
Additional Plan Reviewer
City of Detroit- Wayne County

JAMISON-KING, Brenda R.
16,640 hours of experience in Building
Additional Plan Reviewer
City of Detroit -- Wayne County

JERGOVICH, John J.
34,840 hours of experience in Building
Additional Plan Reviewer
City of Dearborn – Wayne County

KUUTTILA, Eric K.
20,800 hours experience in Building
Additional Plan Reviewer
City of Detroit – Wayne County

LINDAHL, Michael J.
28,480 hours experience in Building
Additional Inspector
City of Gladstone – Delta County

MUHAMMAD, Lawrence A.
13,728 hours experience in Building
Additional Plan Reviewer
City of Detroit – Wayne County

PALMER, Bruce R.
Previously registered BO since 04/2011 and BI/PR since 05/2008
Additional Plan Reviewer
Kochville Township – Saginaw County

PIKE, Kenneth L.
17,040 hours experience in Building
Additional Plan Reviewer
City of Lapeer – Lapeer County

REED, Charles O.
Licensed Architect #1301046652 (07/2000)
Additional Plan Reviewer
City of Detroit – Wayne County

TOKARZ, Timothy J.
Master Electrical License#6213994 (04/2005)
Additional Plan Reviewer
City of Warren – Macomb County

TYSON, Karen
Licensed Architect #1301027990 (05/1981)
Additional Plan Reviewer
City of Detroit – Wayne County

ELECTRICAL INSPECTORS RECOMMENDED FOR CCC APPROVAL

BECKMAN, Daniel J.
Master License#6211141 (01/2002)
Additional Inspector
City of Warren – Macomb County

BLETCH, Bradley J.
Master License#6212463 (01/2002)
Additional Inspector
Village of Almont – Lapeer County

INGERSOLL, Brandon M.
Master License#6217487 (12/2011)
Additional Inspector
State of Michigan

KOLOGE, Karl (Lon)
Master License#6206494 (06/1986)
Additional Inspector
State of Michigan

TOKARZ, Timothy J.
Master License#6213994 (04/2005)
Additional Inspector
City of Warren – Macomb County

MECHANICAL INSPECTORS RECOMMENDED FOR CCC APPROVAL

FALLERT, Paul J.
Mechanical Contractor License#7100982 (01/1985)
Replacing David Murray (001053)
Green Oak Charter Township – Livingston County

FILL, James D.
Mechanical Contractor License#7101397 (01/1985)
Additional Inspector
City of Wayne – Wayne County



RICK SNYDER
GOVERNOR

STATE OF MICHIGAN
DEPARTMENT OF LICENSING AND REGULATORY AFFAIRS
BUREAU OF CONSTRUCTION CODES
IRVIN J. POKE
DIRECTOR

STEVE ARWOOD
DIRECTOR

March 5, 2014

Document #14-13

TO: Members of the Board of Mechanical Rules
FROM: Kevin Kalakay, Chief, Mechanical Division
SUBJECT: Product Approval for REHAU RAUPEX 10.1mm Crosslink Polyethylene Tubing

The applicant has filed a petition application for approval of a product.

APPLICANT REPRESENTATIVE:

Mr. David Nickelson

APPLICANT:

REHAU Construction LLC.
1501 Edwards Ferry Rd.
Leesburg, Virginia, 20176

AUTHORITY:

MCL 125.1521 of 1972 PA 230.
MCL 338.975 of 1984 PA 192

APPLICATION:

REHAU RAUPEX is Cross-linked Polyethylene tubing for use in mechanical systems that are permanently installed and utilized to provide control of environmental conditions and related processes within buildings.

BACKGROUND:

REHAU has been manufacturing PEXa pipe since 1968 with more than 1 billion feet of installation worldwide for Radiant Floor Heating applications. In order to save cost and provide a more energy efficient product REHAU has decided to introduce the 10.1mm PEXa product to North America.

The goal of REHAU North America is to utilize this pipe in a wood aluminum panel system in Radiant Floor Heating applications. The 10.1mm RAUPEX has a larger inside diameter than the North American sized pipes used for the same application. This allows for higher flow rates

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leading to greater output of the system. The 10.1mm RAUPEX has been used in Europe for over five years under the trade name RAUTHERM S.

LISTINGS REPORTS:

ICC-ES PMG-1013

NSF SE 1091

CERTIFICATIONS:

DIN Certco 4726

COMPLIANCE WITH THE FOLLOWING STANDARDS:

ASTM F886-2010

ASTM F877-2011

NSF 14-2011

NSF 61-2012

ICC-ES LC1004-2009

LICENSING AND INSTALLATION REQUIREMENTS:

The manufacturer shall provide training on proper installation to all installing contractors.

CONDITIONS OF USE AND INSTALLATION:

1. All applicable requirements of the Michigan Residential and the Michigan Mechanical Code most current editions shall apply.
2. Installation shall be in accordance with the manufacturer's installation instructions.
3. Shall only be installed by a properly licensed State of Michigan mechanical contractor who has been properly trained by the manufacturer.
4. All installations shall be pressure tested in the presence of the code official.
5. This approval shall become void if the product no longer conforms to the current Michigan Mechanical, Michigan Residential codes.

RECOMMENDATION:

The Board of Mechanical Rules at their February 12, 2014 meeting recommended the product for approval to the State of Michigan Construction Code Commission with the above stipulations.

CC: David Nickleson



RICK SNYDER
GOVERNOR

STATE OF MICHIGAN
DEPARTMENT OF LICENSING AND REGULATORY AFFAIRS
BUREAU OF CONSTRUCTION CODES
IRVIN J. POKE
DIRECTOR

STEVE ARWOOD
DIRECTOR

January 14, 2014

BCCM-13-001

TO: Members of the Board of Mechanical Rules
FROM: Kevin Kalakay, Chief, Mechanical Division
SUBJECT: Product Approval for REHAU RAUPEX 10.1mm Crosslink Polyethylene Tubing

The applicant has filed a petition application for approval of a product.

APPLICANT REPRESENTATIVE:
Mr. David Nickelson

APPLICANT:
REHAU Construction LLC.
1501 Edwards Ferry Rd.
Leesburg, Virginia, 20176

AUTHORITY:
MCL 125.1521 of 1972 PA 230.
MCL 338.975 of 1984 PA 192

APPLICATION:
REHAU RAUPEX is Cross-linked Polyethylene tubing for use in mechanical systems that are permanently installed and utilized to provide control of environmental conditions and related processes within buildings.

BACKGROUND:
REHAU has been manufacturing PEXa pipe since 1968 with more than 1 billion feet of installation worldwide for Radiant Floor Heating applications. In order to save cost and provide a more energy efficient product REHAU has decided to introduce the 10.1mm PEXa product to North America.

The goal of REHAU North America is to utilize this pipe in a wood aluminum panel system in Radiant Floor Heating applications. The 10.1mm RAUPEX has a larger inside diameter than the North American sized pipes used for the same application. This allows for higher flow rates

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leading to greater output of the system. The 10.1mm RAUPEX has been used in Europe for over five years under the trade name RAUTHERM S.

LISTINGS REPORTS:

ICC-ES PMG-1013

NSF SE 1091

CERTIFICATIONS:

DIN Certco 4726

COMPLIANCE WITH THE FOLLOWING STANDARDS:

ASTM F886-2010

ASTM F877-2011

NSF 14-2011

NSF 61-2012

ICC-ES LC1004-2009

LICENSING AND INSTALLATION REQUIREMENTS:

The manufacturer shall provide training on proper installation to all installing contractors.

CONDITIONS OF USE AND INSTALLATION:

1. All applicable requirements of the Michigan Residential and the Michigan Mechanical Code most current editions shall apply.
2. Installation shall be in accordance with the manufacturer's installation instructions.
3. Shall only be installed by a properly licensed State of Michigan mechanical contractor who has been properly trained by the manufacturer.
4. All installations shall be pressure tested in the presence of the code official.
5. This approval shall become void if the product no longer conforms to the current Michigan Mechanical, Michigan Residential codes.

RECOMMENDATION:

Staff recommends that the product be recommended to the State of Michigan Construction Code Commission for acceptability with the above stipulations.

CC: David Nickleson

Petition Application for Certificate of Acceptability
Michigan Department of Licensing and Regulatory Affairs
Bureau of Construction Codes
P.O. Box 30255, Lansing, MI 48909
www.michigan.gov/bcc

Agency Use Only

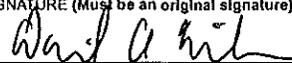
Application Fee: \$1,000.00 (Each Approval Requested Requires a Separate Application and Fee)

BCCM-13-001

Authority: 1972 PA 230
Completion: Mandatory
Penalty: Use of material, product, or method/manner of construction or installation will not be approved

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APPROVAL REQUESTED			
NATURE OF PETITION (Limited to One Item Per Petition)			
<input type="checkbox"/> Material		<input checked="" type="checkbox"/> Product	<input type="checkbox"/> Method/Manner of Construction or Installation
CODE UNDER WHICH APPROVAL IS SOUGHT (Limited to One Code Per Petition)			
<input type="checkbox"/> Building (140)		<input type="checkbox"/> Electrical (115)	<input checked="" type="checkbox"/> Mechanical (130)
<input type="checkbox"/> Plumbing (98)			
NAME OF MATERIAL, PRODUCT, OR METHOD/MANNER OF CONSTRUCTION OR INSTALLATION			
Crosslinked Polyethylene (PEX) tubing--hydronic piping			
OTHER IDENTIFICATION (Model Number)			
REHAU RAUPEX O2 Barrier 10.1mm x 1.1mm SDR 11 (136549) NSF-rfh			
DESCRIPTION (Use Additional Sheets If Necessary)			
Hydronic PEX tubing conforming to ASTM F876/F877. Dimensions in accordance with NSF SE 1091.			
INTENDED USE (Use Additional Sheets If Necessary)			
Hydronic pipe for Radiant Heating Applications for use in mechanical systems that are permanently installed and utilized to provide control of environmental conditions and related processes within buildings.			
DATA SUBMITTED			
<input type="checkbox"/> Letter	Reports	<input type="checkbox"/> Product Sample or Model	
<input type="checkbox"/> Manual	<input type="checkbox"/> ICC - ES	<input checked="" type="checkbox"/> Prior Approvals by Other Agencies	
<input checked="" type="checkbox"/> Standards	<input type="checkbox"/> BOCA - NES	<input type="checkbox"/> Recommendations by Model Code Bodies	
<input checked="" type="checkbox"/> Installation Instructions	<input type="checkbox"/> ICBO	<input checked="" type="checkbox"/> Laboratory Test/Evaluation	
<input type="checkbox"/> Display Catalog	<input type="checkbox"/> SBCC		
	<input type="checkbox"/> NRB		
	<input checked="" type="checkbox"/> Other		
LABORATORY TEST AND/OR EVALUATION BY			
NSF International and DIN Certco			
PILOT SERVICE EXPERIENCE AND CONDITIONS (Use Additional Sheets If Necessary)			
Five + years experience with 10.1 x 1.1 SDR 11 tubing (under tradename RAUTHERM S) in Radiant Hydronic installations in Europe in accordance with ISO 15875 and DIN 16892			
RESTRICTIONS FOR USE (Use Additional Sheets If Necessary)			
Not for potable.			

APPLICANT INFORMATION (Note: All correspondence will be sent to this address)			
NAME OF COMPANY		APPLICANT NAME	
REHAU Construction LLC		David Nickelson	
ADDRESS			
1501 Edwards Ferry Rd			
CITY	STATE	ZIP CODE	TELEPHONE NUMBER (Include Area Code)
Leesburg	VA	20176	(703) 777-5255
SIGNATURE (Must be an original signature)		DATE	FAX NUMBER (Include Area Code)
		28-Aug-2013	(703) 777-3053



RICK SNYDER
GOVERNOR

STATE OF MICHIGAN
DEPARTMENT OF LICENSING AND REGULATORY AFFAIRS
BUREAU OF CONSTRUCTION CODES
IRVIN J. POKE
DIRECTOR

STEVE ARWOOD
DIRECTOR

October 9, 2013

Mr. David Nicholson
REHAU Construction LLC
1501 Edwards Ferry Rd
Leesburg, VA 20176

Dear Mr. Nicholson:

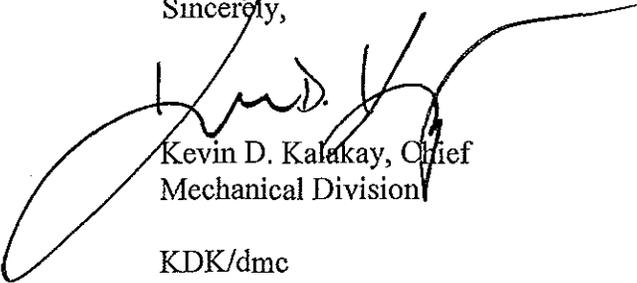
In review of your application for product approval, it has come to my attention that we are in need of some additional information.

Before we may continue the review, please submit the following information:

- Copy of ALL certifications
- Copies of testing and listing reports in regard to hydronic piping application.
- Sample of the product for Board of Mechanical Rules review.

Please contact me at (517) 241-9325 if you have any further questions in this matter.

Sincerely,



Kevin D. Kalakay, Chief
Mechanical Division

KDK/dmc

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RICK SNYDER
GOVERNOR

STATE OF MICHIGAN
DEPARTMENT OF LICENSING AND REGULATORY AFFAIRS
BUREAU OF CONSTRUCTION CODES
IRVIN J. POKE
DIRECTOR

STEVE ARWOOD
DIRECTOR

January 3, 2014

Mr. David Nicholson
REHAU Construction LLC
1501 Edwards Ferry Rd
Leesburg, VA 20176

Dear Mr. Nicholson:

The Bureau of Construction Codes, Mechanical Division, has received your Product Approval application for REHAU RAUPEX Crosslink Polyethylene Tubing.

Your request will be scheduled for the State Board of Mechanical Rules meeting. The next meeting will be held on **February 12, 2014**, located at 2501 Woodlake Circle, Okemos, Michigan. If approved by the board, your product will be referred to the Construction Code Commission for final approval. Please call this office for attendance information should you desire to represent your product at the Construction Code Commission meeting.

Please contact me at (517) 241-9325, if you have any further questions in this matter prior to providing the requested information.

Sincerely,

A handwritten signature in black ink, appearing to read "K. Kalakay".

Kevin D. Kalakay, Chief
Mechanical Division

KDK/dmc

Enclosure

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REHAU RADIANT HEATING SYSTEMS
INSTALLATION GUIDE

1. SCOPE

This technical information applies to the installation, testing and operation of REHAU radiant heating systems using PEXa crosslinked polyethylene pipe.

Persons using this guide must be experienced and appropriately licensed hydronic heating system installers, who have an understanding of the principles and practices for hydronic installations.

The information presented in this guide is intended to demonstrate general methods and ~~is not specific to your project conditions~~. It is the responsibility of the installer to check the prevailing local codes and to verify that technical information presented in this guide is appropriate for a particular installation. This guide does not supersede the recommendations of other manufacturers. If there is conflicting information, the installer must consult with the other manufacturer or manufacturer's representative prior to installing, connecting and operating the REHAU radiant heating system.

After reading this guide, the installer should attend the appropriate REHAU Academy seminar, where installation techniques for radiant heating systems are more fully explored.

This guide assumes the installer has already been provided with a REHAU radiant heating system design or approved equivalent in accordance to the REHAU *Radiant Heating Systems Design Guide*. This guide should be used in conjunction with the REHAU *Sustainable Building Technology Product Catalog* which provides a detailed description of each system component. The installer should also review the REHAU *PEXa Limited Warranty* and pertinent supplemental REHAU *Technical Bulletins* before beginning to install a radiant heating system. Installers should also periodically check the REHAU Resource Center for the latest updates.

If you do not have prior experience with hydronic heating systems or require additional assistance, please contact your regional REHAU sales representative.

5. PREPARING FOR INSTALLATION

If there are potential problems with the design and/or job site construction that could affect the quality of the radiant heating installation or system performance, notify the appropriate designer, contractor(s) or owner immediately.

5.1 Reviewing Local Codes

The installer is responsible for checking with applicable code authorities to determine specific local code requirements.

5.2 Gathering Documents

The radiant heating system design should be complete before attempting installation. You should have the details for the floor, wall and ceiling construction and the schedule outlining manifold size(s) and pipe size, spacing and circuit lengths for each heated area. Building drawings may also be necessary before proceeding with your installation.

5.3 Inspecting the Job Site

Before beginning the installation, you should perform a site inspection.

1. Familiarize yourself with the installation sequence and scheduling for the construction of the building.

Changes in the construction schedule may be required to ensure the integrity of your installation. REHAU recommends that other construction that might interfere with the pipe installation (e.g., drywall, plumbing) is not scheduled during your installation. Make sure that any other work that is to follow the installation of the radiant heating system will not damage the system components.

2. Confirm that the job site as-built matches your building plans or drawings.

Check for anything that might interfere with pipe installation such as changes to concrete walls or footings and changes to the layout of walls or floors. Note any changes; a redesign of the pipe layout might be required.

If pipes are to pass into rooms through doorways or follow along walls that are not yet installed, we recommend that you use the building plans to measure and mark their planned locations with paint or wood studs. These "virtual" walls will act as a guide when installing pipe.

3. Inspect the condition of the building site.

Inspect the site for possible hazards that could damage RAUPEX pipe, such as nails, staples, materials or tools from other trades, or chemicals that could spill and damage the pipe. Eliminate potential hazards before installing pipe.

Confirm that the additional floor height for overpour and heat transfer panel construction has been taken into account. Door moldings, base plates and electrical outlets may need to be raised. Doors, thresholds and stairs may need to be modified.

Confirm the sub-grade for the heated areas has been properly prepared. It should be level, compacted and drained. If required, ensure the vapor barrier and insulation are installed and per local code.

Ensure the existing subfloor or slab for heated areas is flat, level, structurally sound, free of noise and debris before installing pipe.

A typical overpour thickness adds 13 to 17 lb/ft (63 to 80 kg/m) "dead load" to a suspended floor structure. Confirm the floor structure has been approved to carry this weight by an architect or engineer.

Correct any discrepancies before installing pipe.

5.4 Check the Design

It is the full responsibility of the installer to thoroughly review the design documents and determine the suitability of the plans for the installer's intended use prior to ordering materials and installing the system.

1. Check the manifold locations are correct (see Section 6.1)
2. Check the orientation of the pipes in the layout is correct (see Section 9.2)
3. Check the circuit lengths are not too long (see Section 9.4)
4. Check the finished floor coverings are per the design (see Section 12.1)

5.5 Organize Tools

Typical construction tools are required to complete a radiant heating system installation.

REHAU uncoilers speed the RAUPEX pipe installation.

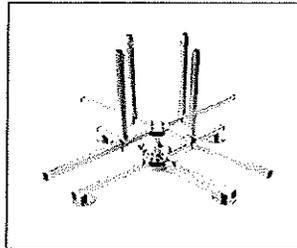


Fig. 5.1: RAUPEX horizontal uncoiler

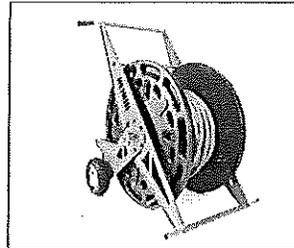


Fig. 5.2: RAUPEX universal uncoiler

REHAU tools provide fast, easy, professional installations and are required to assemble EVERLOC fittings to RAUPEX pipes. It is important to use a proper cutter when cutting RAUPEX pipes. A clean, square cut is required.

RAUCUTTER™ provides a clean, square and accurate cut for pipes up to 1 in. Do not cut RAUPEX with a saw blade or pocket knife as the rough edges will interfere with fitting connections.

RAUTOOL™ K10 combination manual tool for the expansion and compression of 10.1 mm RAUPEX.

COMBOLOC® combination manual tool for the expansion and compression of 3/8 and 1/2 in. RAUPEX. This tool is used with expander heads and may also be used to expand pipe sizes up to 1 in.

Pipe Expander manual expansion tool and **Expander Heads** for the expansion of 3/8 to 1 1/4 in. RAUPEX.

VERSALOC® manual compression tool and compression jaws for the compression of 3/8 to 1 1/4 in. RAUPEX.



Fig. 5.3: RAUTOOL K10 tool kit for installations of EVERLOC fittings 10.1 mm

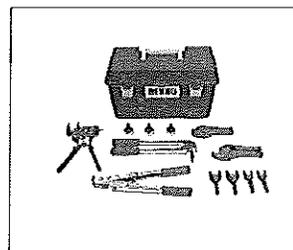


Fig. 5.4: EVERLOC deluxe tool kit for installations of EVERLOC fittings 1/2, 3/4 and 1 in.

8. HANDLING PIPE

When handling RAUPEX pipe, it is important to avoid:

- Dragging it over rough objects such as gravel or concrete
- Crushing it by driving overtop with wheelbarrow or power equipment
- Contact with oil or oily products (e.g., gasoline, paint thinner)
- Soldering operations or any open flame
- Excessive exposure to sunlight as per the allowable exposure time

8.1 Uncolling Pipe

The uncoller should be located in an area that will not interfere with the installation.

First, carefully cut the outer binding strings of the coiled pipe. When working with 1,000 ft (305 m) coils, cut only the outer binding strings at first. This will release approximately half the pipe for uncoiling.

An uncoiling device such as the RAUPEX uncoiler makes it easy to unwind a pipe coil. If you don't have an uncoiler, have one person hold the pipe coil off the ground between their arms while another person pulls pipe from the top or the bottom of the coil. RAUPEX should not be pulled off of a coil that is lying flat on the ground.

Occasional twisting in the pipe may occur during installation, particularly when installing without the benefit of an uncoiler. This must be corrected before installing additional pipe. If the pipe becomes twisted, simply rotate the coil 90° or more, in the direction of the twist, until the pipe lays flat.

8.2 Bending Pipe

RAUPEX pipe may be bent, even when cold. The minimum bend radius is 5X the OD for cold bends. For an even smaller bend radius, the pipe may be heated with a hot air gun and bent to no less than 3X the OD.

REHAU support bends make it fast and easy to create tight bends without kinking, such as where the pipe rises out of a slab or overpour straight up to the manifold.

Table 8.1: Minimum 90° Bend Radius of RAUPEX Pipe

Pipe Size				
Nominal	Cold Bend		Heated Bend	
in	in	(mm)	in	(mm)
3/8	2.5	(64)	1.5	(38)
1/2	3.125	(79)	1.875	(48)
5/8	3.75	(95)	2.25	(57)
3/4	4.375	(111)	2.625	(67)
1	5.625	(143)	3.375	(86)

When pipes are laid out in parallel, the minimum pipe spacing is determined by the minimum bend radius shown in Table 8.1.

Table 8.2: Minimum Parallel Pipe Spacing

Pipe Size Nominal in	Minimum Loop Diameter = Minimum Pipe Spacing			
	Cold Loop		Heated Loop	
	in	(mm)	in	(mm)
3/8	5.0	(128)	3.0	(72)
1/2	6.25	(158)	3.75	(96)
5/8	7.5	(190)	4.5	(114)
3/4	8.75	(222)	5.25	(134)
1	11.25	(246)	6.75	(172)

Bend Diameter = 2X Bend Radius = 180° Loop

8.3 Connecting Two Pipes

EVERLOC fittings are designed for use with RAUPEX pipe and should only be assembled with REHAU tools.

For completed connections, the sleeve should close tightly against the collar of the fitting. A maximum gap of 0.030 in (0.8 mm) is acceptable. If the gap is too large or there is misalignment, rotate the tool 90 to 180° and repeat the compression steps.

Once complete, the fitting is immediately ready for system pressure.

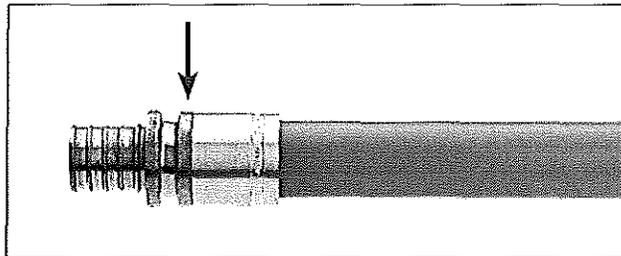


Fig. 8.1: Completed EVERLOC fitting with sleeve closed tightly to collar

Connections Using Pipe Expander and VERSALOC® Compression Tool for Sizes 3/8 in. and Greater

To make an EVERLOC fitting connection the following tools are required: a set of VERSALOC jaws and the VERSALOC tool, the RAUCUTTER tool, and an expander head and pipe expander.

1. Open the pipe expander arms so they are at least 90° apart. Thread the appropriate expander head clockwise onto the expander tool and screw the head on fully until it stops. Inspect the expander head to ensure all segments are not broken or chipped. Do not use if the expander head is damaged. Move the expander arms back together so the arms are parallel.

2. Separate the VERSALOC arms. Install compression jaws. Make sure to insert pins in opposite directions. Press the release to fully close the VERSALOC tool.
3. Inspect the RAUCUTTER blade for any damage. Using the RAUCUTTER, cut the RAUPEX pipe to the desired length. The cut must be clean and square, and must be free of burrs, nicks and jagged ends.
4. Select the proper size EVERLOC sleeve. The tapered end of the sleeve must face the fitting when installed. Slide the sleeve down the pipe at least two pipe diameters to avoid damaging the pipe or tool during expansion.
5. Open the expander arms again so they are approximately 120° apart. Insert the expander head into the end of the pipe. Place the pipe all the way onto the expander head until it makes contact with the first step. Close the expander arms until the arms are parallel. Hold closed for 5 seconds. Then open the tool enough to rotate the expander head 30° inside the pipe.
6. Repeat the expansion process. Then open the tool and remove the expander head from the pipe. Before the pipe shrinks back to its original shape, insert the EVERLOC fitting into the expanded pipe so that the pipe is approximately 1/16 in (2 mm) from the last raised rib on the fitting. If the fitting does not insert far enough, simply pull the fitting out and repeat the expansion process.
7. Separate the VERSALOC tool arms so that the jaws are open as far as possible. Place the jaws on to the fitting, with one jaw behind the EVERLOC sleeve and the other jaw behind the collar of the fitting.

⚠ CAUTION! Compression jaws and tool can pinch. Do not place fingers between jaws or near ratchet mechanism.

Once the jaws are firmly in place, begin to ratchet the tool arms toward each other. As the tool is ratcheted, the sleeve will slide up over the fitting. Continue to ratchet until the sleeve meets the collar of the fitting. When completed, separate the arms again and remove the tool from the fitting.

8. Inspect the completed EVERLOC connection.

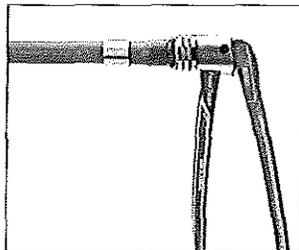


Fig. 8.2: Expansion

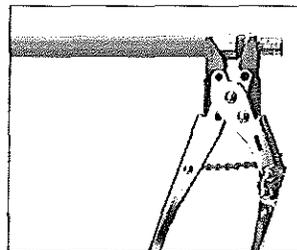


Fig. 8.3: VERSALOC compression

Connections Using COMBOLOC Expansion and Compression Tool for Sizes 3/8 and 1/2 in.

To make an EVERLOC fitting connection the following tools are required: the COMBOLOC combination expansion and compression tool, an expander head and a RAUCUTTER tool.

1. Push the release lever up into the COMBOLOC tool to open it. This will open the sliding compression jaw and retract the expander cone. Install the REHAU expander head by threading it on clockwise until it stops. Inspect the expander head to ensure segments are not broken or chipped. Push the release lever. COMBOLOC tool is now ready for use.
2. Inspect the RAUCUTTER blade for any damage. Using the RAUCUTTER, cut the RAUPEX pipe to the desired length. The cut must be clean and square and must be free of burrs, nicks and jagged ends.
3. Select the proper size EVERLOC sleeve. The tapered end of the sleeve must face the fitting when installed. Slide the sleeve down the pipe at least two pipe diameters to avoid damaging the pipe or tool during expansion.
4. Insert the expander head into the end of the pipe. Place the pipe all the way onto the expander head until it makes contact with the first step. Pump the handles together until you hear a click. Pump the handles 6 times until the expander head is fully open. On the final pump, hold pipe open for 5 seconds. Further pumping of the handles will produce no more clicks or expansion of the RAUPEX pipe. Open the tool by pushing the release lever. Rotate the expander head 30° inside the pipe.
5. Repeat the expansion process. Then remove the tool from the pipe. Push the release lever up into the tool to open it and remove the expander head from the pipe.
6. Before the pipe shrinks back to its original shape, insert the EVERLOC fitting into the expanded pipe so that the pipe is approximately 1/16 in (2 mm) from the last raised rib on the fitting. If the fitting does not insert far enough, simply pull the fitting out and repeat the expansion process.
7. Place COMBOLOC onto fitting. Fully insert EVERLOC fitting and sleeve into the compression jaws of the tool with the EVERLOC sleeve pulled close to the fitting.

⚠ CAUTION! Compression jaws can pinch. Do not place fingers between jaws.

Pump the handles 6 times, until the sliding compression jaw moves no further. Do not tilt fittings during compression. Further squeezing of the handles will not produce any more clicks. Open the handles to allow the completed fitting to be removed.

8. Inspect the completed EVERLOC connection.

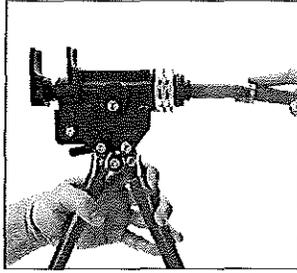


Fig. 8.4: COMBOLOC expansion

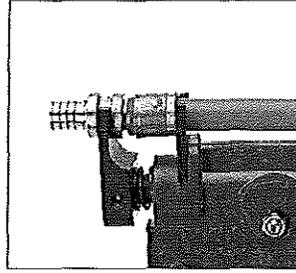


Fig. 8.5: COMBOLOC compression

Connections Using K10 Tool for Sizes 10.1 mm

To make an EVERLOC fitting connection the following tools are required: the K10 manual tool and a RAUCUTTER tool.

1. Inspect the RAUCUTTER blade for any damage. Using the RAUCUTTER, cut the RAUPEX pipe to the desired length. The cut must be clean and square and must be free of burrs, nicks and jagged ends.
2. Bring K10 tool into starting position. Open movable lever completely ($\geq 50^\circ$).
3. Slide compression sleeve into tool. Inside taper of the compression sleeve must point forward.
4. Slide pipe through the compression sleeve into the tool up to the stop.
5. Press lever together and maintain in position for 5 seconds.
6. Bring tool into starting position and remove expanded pipe. (Open movable lever completely.)
7. Insert fitting into pipe up to the stop. After a brief period the fitting will sit tightly in the pipe (memory effect).
8. Attach tool completely to the joint.
9. Press lever together rapidly, avoiding jerky movements, and compress sleeve up to the fitting collar.
10. Inspect the completed EVERLOC connection.

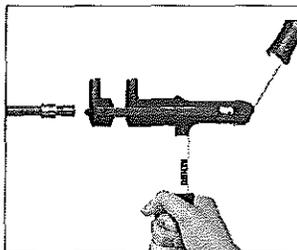


Fig. 8.6: K10 expansion

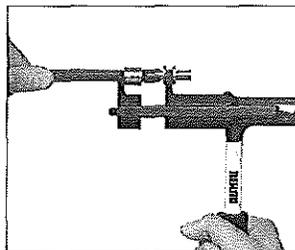


Fig. 8.7: K10 compression

8.4 Burying Pipe Connections in a Slab or Overpour

REHAU permits the use of EVERLOC couplings, elbows and tees to be buried in a concrete slab or gypsum cement overpour or buried underground in soil. This applies to brass compression-sleeve fittings certified to ASTM F2080 (EVERLOC) for use in hydronic heating.

Compression nut and threaded adapter fittings are intended to transition RAUPEX pipe to the building service piping and should be accessible for periodic inspection.

NOTICE: REHAU recommends that threaded connections should not be buried. Operational failure or expensive repair costs can result if a leak develops from a buried threaded connection.

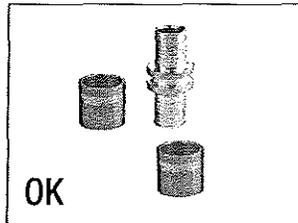


Fig. 8.8: OK to bury EVERLOC connections

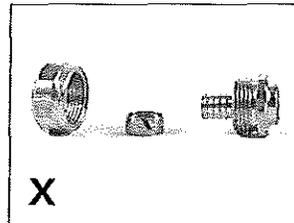


Fig. 8.9: Do not bury threaded connections

Burial of an EVERLOC coupling, elbow or tee requires that:

- Joint must be encased in RAUCROSS™ Heat Shrink sleeving or a waterproof rubber tape.
- The location of each joint should be marked on the “as-built” drawings.
- The installer should visually inspect each joint prior to burial.
- A system pressure test must be performed prior to and during the pour.
- Verify that these instructions comply with local codes.

Applying RAUCROSS Heat Shrink

1. Use the appropriate size of RAUCROSS from the REHAU *Sustainable Building Technology Product Catalog*.
2. Cut RAUCROSS to length. There should be at least 1 in (25 mm) of overlap past the fitting.
3. Slide RAUCROSS over the end of the pipe.
4. Connect pipes with EVERLOC connection.
5. Slide RAUCROSS back over the fitting, ensuring that there is adequate overlap.
6. Using a hot air gun, apply heat to RAUCROSS. Rotate heat gun around the fitting while moving along its length to ensure even shrinkage. As soon as RAUCROSS has shrunk evenly along its entire length, remove heat.

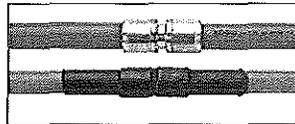


Fig. 8.10: EVERLOC connection protected by RAUCROSS heat shrink

Applying Waterproof Rubber Tape

1. Use the waterproof rubber tape from the REHAU *Sustainable Building Technology Product Catalog* or an approved equivalent.
2. Apply two layers of tape. There should be at least 1 in (25 mm) of overlap past the fitting.

8.5 Repairing Kinked Pipe

RAUPEX pipe is flexible and resists kinking even at temperatures well below freezing. If the pipe becomes kinked due to excessive bending, flow may be obstructed or reduced. Kinked pipe must be repaired.

You can straighten the pipe by simply heating the area with a hot air gun. Rotate the heat gun around the pipe to evenly heat the surface. Always use caution when operating a heat gun and never use a torch or open flame to heat the pipe.

When fully heated, the pipe will get soft. When the kink is gone, turn off the heat gun and let the area cool. (It is normal for small bubbles or wrinkles to appear on red or blue pipe.) This type of heating will anneal or stiffen the pipe, making it stronger but also less flexible in the heated area. Therefore, do not try to bend the pipe in the same spot. This may require a slight adjustment of fasteners so that the previously kinked section of pipe is installed without being bent.

8.6 Replacing Damaged Pipe

If the pipe is damaged, it might need to be replaced. Cut out the damaged area and connect the pipes with an EVERLOC coupling and sleeve. In some cases it may be necessary to use two couplings and additional pipe to replace the damaged area. Follow the instructions in Section 8.3 Connecting Two Pipes.

A scrape in the oxygen diffusion barrier of RAUPEX O₂ Barrier does not necessitate repair with a coupling. However, when the pipe wall is gouged, the damaged section of pipe must be removed and replaced.

8.7 Disassembling of a Completed EVERLOC Pipe Connection

Select an appropriate tool for holding the EVERLOC fitting while it is heated. Be careful not to damage the fitting.

Heat the EVERLOC sleeve directly using either a torch or a hot air gun. Typically the hot air gun is used for fittings up to 1/2 in. Rotate the joint several times. Open flames may be used when heating fittings for disassembly, but never when heating pipe for kink repairing.

After 1 to 3 minutes, the sleeve will back away from the fitting slightly. Remove heat and use pliers to pull the compression sleeve off the fitting. Then pull the fitting out of the pipe.

The end of the pipe where the previous fitting had been installed must be cut off prior to making a new joint.

EVERLOC fittings can be reused as long as the holding tool did not damage the rib area during removal. Remove and discard the EVERLOC sleeve.

PRODUCT SUBMITTAL 802

Product: RAUTOOL™ K10 Manual Tool Kit

Date: 30 April 2013



Article No.	Description	Package Quantity
228396-001	RAUTOOL K10 Manual Tool Kit	1

FUNCTIONAL DESCRIPTION

The K10 manually operated tool is used for the assembly of REHAU RAUPEX® SDR 11 PEXa pipes in size 10.1 mm.

Each K10 tool kit comes complete with:

- K10 basic tool
- RAUCUTTER™ pipe cutter for up to 1 in. RAUPEX (Art. 137495-)
- Rugged plastic transport case
- Operating instructions

For updates to this publication, visit na.rehau.com/resourcecenter

The information contained herein is believed to be reliable, but no representations, guarantees or warranties of any kind are made as to its accuracy, suitability for particular applications or the results to be obtained therefrom. Before using, the user will determine suitability of the information for user's intended use and shall assume all risk and liability in connection therewith. © 2013 REHAU

10. TESTING THE SYSTEM

A pressure test ensures the radiant heating system is leak free. The pressure test must be performed prior to and during the installation of the slab/overpour and the floor/wall/ceiling coverings. Tests of hydronic heating systems shall comply with local codes and where required, shall be witnessed by the code official.

Pressure tests must be done with all circuit valves on the manifold fully open. Pressure gauges should show pressure increments of 2 psig (20 kPa) and should be located at or near the lowest points in the distribution system. Do not exceed the pressure and temperature ratings of the pipe. Never exceed 150 psig (10 bar) test pressure.

Pressure testing should be performed periodically throughout the construction of the building. If any leak is detected during the construction phase, the leak must be found and repaired immediately. Retest before covering the repair.

Complete inspection and test reports as required.

10.1 Air Pressure Testing

Use an air compressor that is capable of achieving the pressure test requirements. The air supply should have an adjustable regulator to ensure the maximum pressure requirements are not exceeded.

Do not perform compressed air tests on plastic fittings, plastic valves or plastic manifolds.

Air temperature will affect the gauge pressure, so perform pressure test at a constant temperature.

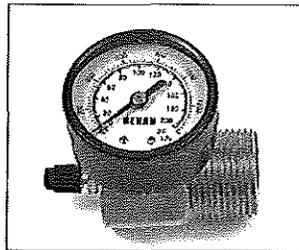


Fig. 10.1: Air pressure tester with 1 in. MPT to connect to PRO-BALANCE 1 in. brass manifold

1. Verify maximum pressure requirements for all system components prior to performing the test.
2. Install REHAU air pressure tester into the PRO-BALANCE 1 in. brass manifold supply isolation ball valve. A transition fitting is needed to adapt the air pressure tester to the PRO-BALANCE 1 1/4 in brass manifold. A standard air chuck will connect to the Schrader valve on the end of tester.
3. Make sure all flow meters and balancing valves are completely open by turning the vent key counter clockwise. Make sure the return isolation valve and the drain valves are completely closed.

4. Perform a preliminary pressure test pressurizing the system to the greater of 1.5 times the maximum operating pressure or 100 psig (6.9 bar) for 30 minutes. As the pipe expands, restore pressure, first at 10 minutes and again at 20 minutes. At the end of the 30 minute preliminary test, pressure must not fall by more than 5 psig (0.3 bar) from the maximum.
5. After performing the preliminary test, perform the main pressure test immediately. The main pressure test shall last at least 2 hours. The test pressure should be restored and must not fall more than 3 psig (0.2 bar) after 2 hours. No leakage should be detected.

10.2 Water Pressure Test

The municipal or well water supply may be used as long as the pressure test requirements are met, a pressure gauge is used, and the water quality is acceptable. Or use a liquid test pump that is capable of achieving the pressure test requirements.

If there is a chance that water could freeze in the radiant heating system after the pressure test and before the commissioning of the heating system, then use a well mixed water/glycol solution when filling the system or perform an air test. Frozen pipes might burst resulting in leaks and operational failures.

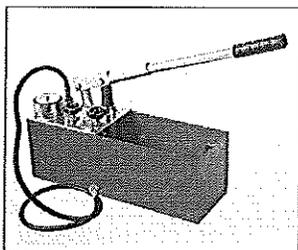


Fig. 10.2: Typical liquid test pump with in-line pressure gauge (not provided by REHAU)

1. Flush, fill and purge the system according to Section 13 Starting the System. Take necessary precautions to prevent water from freezing in the radiant heating system.
2. Make sure all flow meters and balancing valves are completely open by turning the vent key counter clockwise. Make sure the isolation valves and the drain valves are completely closed.
3. Connect the hose from either the test pump or water supply to the drain valve 3/4 in. garden hose thread (GHT) connection on the supply header.
5. Apply pressure to the system, then open this drain valve by turning the handle 90° to be aligned with the valve body.
6. Check for air through the PRO-BALANCE air vents.
7. Perform a preliminary pressure test pressurizing the system to the greater of 1.5 times the maximum operating pressure or 100 psig (690 kPa) for 30 minutes.
8. As the pipe expands, restore pressure, first at 10 minutes and again at 20 minutes.
9. At the end of the 30 minute preliminary test, pressure must not fall by more than 5 psig (34 kPa) from the maximum.
10. After performing the preliminary test, perform the main pressure test immediately. The main pressure test shall last 2 hours. The test pressure should be restored and must not fall more than 3 psig (20 kPa) after 2 hours. Use a liquid leak detector or soap solution to check for leakage at manifold connections.

11. POURING SLAB OR OVERPOUR

Slabs and overpours must be installed according to the manufacturer's instructions, recommendations and best practices.

The pressure test should be repeated during the installation of the slab or overpour. Pipe should be under pressure with no loss during the pour. Keep EVERLOC couplings, sleeves and installation tools on the job site in case repair is necessary. If the pipe is damaged and these items are not available, isolate the damaged area (at least 12 in [300 mm] in length) by building a dam or bond-out so that a coupling can be installed later.

Before installation of the slab or overpour, the pipe must be inspected to ensure that:

- The pipe is free of kinks and punctures.
- The pipe is fastened as described in this guide to prevent floating too close to the top of the thermal mass. If pipe has moved due to expansion, install additional fasteners.
- EVERLOC couplings are sleeved in heat shrink or wrapped with two layers of waterproof rubber tape and the buried locations are noted on plans.
- PE Protection sleeves are installed at expansion or movement joints, and anywhere that the pipe could rub against an abrasive surface.
- Nailing plates are installed above the pipe where required.

In a structural slab, the pipe must be embedded in the concrete with a minimum of 2 in (50 mm) of coverage. In a non-structural slab or overpour, the pipe must be embedded in the gypsum or lightweight concrete with a minimum of 3/4 in (2 cm) of coverage.

Before the pour, notify the contractor that pipes have been installed. This will help the contractor choose the most appropriate equipment for the project. Instruct the contractor to make wooden "bridges" for transporting wheelbarrows over pipe and warn that pipe could be cut or gouged by rakes or other tools used during the pour.



REHAU[®]

Unlimited Polymer Solutions



REHAU RADIANT HEATING SYSTEMS

DESIGN GUIDE

4. SYSTEM COMPONENTS

REHAU offers pipes, fittings, manifolds, heat transfer panels and plates, controls, and a variety of installation accessories for radiant heating systems. For a detailed description of our system components, refer to REHAU *Sustainable Building Technology Product Catalog*.

4.1 Pipes

RAUPEX[®] crosslinked polyethylene (PEXa) pipe is manufactured using REHAU's high-pressure peroxide extrusion method that typically yields the highest, most consistent level of crosslinking. Pioneered by REHAU in 1968, PEXa technology enhances flexibility and thermal memory, providing ease of handling and kink repair while supporting the use of REHAU EVERLOC[®] compression-sleeve fittings.



Fig. 4.1: RAUPEX pipe

RAUPEX has distinct advantages over metal and other polymer pipes:

- Resists pitting and stress corrosion
- Resists scaling and deposit build-up when used with both hard and softened water
- Minimizes noise that is transmitted through pipes
- Withstands the high temperatures and pressures of hydronic heating systems
- Resists notching and abrasion damage

RAUPEX is manufactured by REHAU in a facility whose quality management system is ISO 9001 certified. Within the facility, REHAU receives and mixes the raw materials, then extrudes and ships the finished product. In addition, RAUPEX production is independently monitored at least annually by Underwriters Laboratories Inc. (UL), NSF International and CSA International.

4.1.1 Pipe Standards and Certifications

RAUPEX pipes are designed for use in radiant heating systems. They may also be used in other hydronic heating systems including baseboard radiators, fan coils, convective fin tube, panel radiators and kick space heaters as long as the temperature and pressure ratings are not exceeded.

RAUPEX pipes may not be used for applications such as steam systems, refrigerant lines and medical gases to name a few.

RAUPEX pipes meet the following requirements in the United States and Canada:

- NSF International Standard 14, *Plastic Piping System Components and Related Materials*
- NSF Standard 61, *Health Effects*
- CSA B137.5, *Cross-linked Polyethylene (PEX) Piping Systems for Pressure Applications*
- ASTM F876, *Standard Specification for Cross-linked Polyethylene (PEX) Piping*
- ASTM F877, *Standard Specification for Cross-linked Polyethylene (PEX) Plastic Hot and Cold Water Distribution Systems*
- ASTM F2080, *Standard Specification for Cold-expansion Fittings with Metal Compression Sleeves for Cross-linked Polyethylene (PEX) Pipe*
- ASTM F2023, *Chlorine Resistance of Cross-linked Polyethylene (PEX) Pipe*
- Plastic Pipe Institute TR-3, *Standard Grade Listing Complying with the Full Data Requirements of ASTM D2837, Listed in PPI TR-4*
- ICC Evaluation Report, ESR-1576
- U.S. Department of Housing and Urban Development (HUD) Material Release No. MR1296c

RAUPEX pipes are accepted by the following model codes:

- IMC International Mechanical Code (IMC)
- International Building Code (IBC)
- International Residential Code (IRC)
- Uniform Building Code (UBC)
- Uniform Mechanical Code (UMC)
- National Building Code of Canada (NBC)

RAUPEX pipes can be used in radiant systems as described in:

- CSA B214, *Installation Code for Hydronic Heating Systems*
- Radiant Panel Association *Guidelines for the Design and Installation of Radiant Panel Heating and Snow/Ice Melt Systems*
- ASHRAE 2008 *Handbook HVAC Systems and Equipment, Chapter 6 Panel Heating and Cooling*

4.1.2 Pipe Applications

REHAU provides three types of RAUPEX pipes for different applications; all three types have the same temperature and pressure capabilities.

4.1.3 Pipe Dimensions

RAUPEX pipe is available in nominal sizes ranging from 3/8 to 2 in. Pipe is in accordance to the dimensional standards defined in ASTM F876. RAUPEX pipe is copper pipe size (CTS) outside diameter (OD), which means that the actual OD of the pipe is 1/8 in (3.18 mm) larger than the nominal OD.

Wall thickness is defined by the standard dimensional ratio (SDR).

RAUPEX pipe is SDR 9, which equates to the outside diameter being approximately nine times the wall thickness.

Table 4.1: Types of RAUPEX Pipes

RAUPEX Type	Typical Application	Characteristics	Description
RAUPEX O ₂ Barrier	Radiant Heating	- Has oxygen diffusion barrier (EVOH) to limit oxygen permeation - Color: bright red	Pipe provides superior protection to ferrous components
RAUPEX UV Shield	Potable Plumbing	- Has colored HDPE outer layer to improve protection against UV light - Does not have oxygen diffusion barrier - Colors: matte red, blue, white	Pipe is protected (for a limited time) from UV exposure during construction before the wall coverings are installed
RAUPEX Non-Barrier	Fire Protection	- Does not have oxygen diffusion barrier - Has limited UV protection - Color: natural white	Pipe markings are permanent which is a mandatory requirement

Note: UV Shield and Non-Barrier pipe may be used with radiant heating systems in conjunction with non-ferrous components.

Table 4.2: RAUPEX Pipe Dimensions per ASTM F876

Pipe Size	Average OD in (mm)	Minimum Wall Thickness in (mm)	Weight lb/ft (kg/m)	Capacity gal/ft (l/m)
3/8 in	0.500±0.003 (12.70±0.08)	0.070 (1.78)	0.05 (0.07)	0.0050 (0.0624)
1/2 in	0.625±0.004 (15.88±0.10)	0.070 (1.78)	0.06 (0.08)	0.0098 (0.1222)
5/8 in	0.750±0.004 (19.05±0.10)	0.083 (2.12)	0.08 (0.11)	0.0134 (0.1671)
3/4 in	0.875±0.004 (22.22±0.10)	0.097 (2.47)	0.10 (0.15)	0.0189 (0.2356)
1 in	1.125±0.005 (28.58±0.12)	0.125 (3.18)	0.17 (0.26)	0.0316 (0.3939)
1-1/4 in	1.375±0.005 (34.92±0.12)	0.153 (3.88)	0.25 (0.37)	0.0467 (0.5827)
1-1/2 in	1.625±0.006 (41.28±0.16)	0.181 (4.59)	0.35 (0.52)	0.0650 (0.8118)
2 in	2.125±0.006 (53.98±0.16)	0.236 (6.00)	0.60 (0.90)	0.1114 (1.3906)

4.1.4 Pipe Performance Characteristics

Pressure and Temperature Ratings

RAUPEX pipe has been tested in accordance with the Plastic Pipe Institute (PPI) TR-3/2003 policy to determine the long-term hydrostatic strength of the pipe. The PPI policy is based on ASTM D2837, Standard Test Method for Obtaining Hydrostatic Design Basis for Plastic Pipe Materials. Accordingly, RAUPEX pipe has continuous ratings at the following pressures and temperatures:

- 160 psi (11 bar) @ 73.4°F (23°C)
- 100 psi (7 bar) @ 180°F (82°C)

These pressure ratings are derived from an extrapolated time-to-failure prediction based on minimum requirements as defined in ASTM F876. Refer to PPI TR-3 for further explanation of these continuous use ratings.

NOTICE: To avoid damage to the pipe and reduction of expected operating lifetime, radiant heating designs must not exceed the pipe pressure and temperature ratings.

- Designer must properly determine the maximum operating pressure, taking elevation differences within the piping system into account.
- Designer must not locate RAUPEX pipe near heat sources such as recessed canned lights or exhaust flues. Refer to the recommendations of the heat source manufacturer as well as the local code requirements to ensure proper clearances are incorporated into the design layout.

Table 4.3: UV Exposure Limits for RAUPEX Pipe

Types of RAUPEX Pipes	Maximum UV Exposure Time
RAUPEX Non-Barrier	15 days accumulated
RAUPEX O ₂ Barrier	30 days accumulated
RAUPEX White UV Shield	3 months accumulated
RAUPEX Red and Blue UV Shield	1 year accumulated

Ultraviolet Resistance

Plastics are susceptible to damage from exposure to the ultraviolet (UV) radiation in sunlight. PEX pipes can be designed to protect against short-term UV damage, but after some time, UV radiation will reduce the lifespan of the pipe. The extent of the reduction depends on factors such as temperature, pressure and chlorination levels in potable water. If excessive UV exposure occurs, a PEX pipe may not last its full design life.

REHAU has performed extensive testing of RAUPEX pipes exposed to natural sunlight, leading to the maximum UV exposure times expressed in accumulated days shown in Table 4.3. Once the pipes leave the manufacturing plant, any exposure to UV, including transportation and storage by the wholesaler, is part of the accumulated exposure time.

RAUPEX pipes must not be stored outdoors and are not designed for permanent outdoor exposure (with the exception of buried applications).

NOTICE: Failure to follow maximum UV exposure limits may damage the pipe resulting in leaks and operational failures, and will negate any warranty provided by REHAU for RAUPEX pipes.

Oxygen Diffusion Properties

In typical radiant heating systems, hundreds or thousands of feet of RAUPEX pipe will be used, providing a large surface area for potential permeation of oxygen. The uncontrolled diffusion of oxygen into closed radiant heating systems is an important issue for system designers. The oxygen diffusion barrier on RAUPEX O₂ Barrier pipe limits oxygen permeability as defined within DIN 4726, the accepted German standard for limiting oxygen diffusion. Without an oxygen diffusion barrier, oxygen (O₂) can pass through the pipe wall, dissolve in the heating water and corrode any ferrous components such as pipes, valves, pumps and boilers. Concrete does not protect the system because it is porous and oxygen can easily pass through it.

NOTICE: Use only O₂ Barrier pipe in heating systems with ferrous components. Excessive oxygen in system may damage ferrous components resulting in leaks and operational failures.

Chemical Compatibility

RAUPEX pipe is compatible with ethylene and propylene glycol, and common corrosion inhibitors used in hydronic piping systems. Chemicals that may damage RAUPEX pipe include (but are not limited to):

- Adhesives
- Oil or petroleum-based products
- Paints
- Solvents
- Oxidizing agents (e.g., bleach)
- Disinfectants (e.g., separate dosing unit integrated into building distribution system)

Many factors, such as exposure time, temperature, pressure and other operating parameters, can influence the performance of a pipe that is exposed to a chemical. To determine the impact of a particular chemical, short- and long-term pressure testing may be required. In some cases, a pipe may be resistant to short-term exposure to the chemical, but not resistant to continuous exposure. Each chemical must be evaluated individually.

NOTICE: Check compatibility before allowing chemicals to come in contact with the exterior or interior of RAUPEX pipe. Chemicals may damage the pipe resulting in leaks and operational failures.

Excessive Temperature and Pressure Capability

Temperature and pressure (T&P) relief valves are safety mechanisms in case the system overheats (mandatory in hot water distribution systems). These valves act quickly to relieve excess temperature or pressure if either one of these conditions is reached. In the event of a water heating system failure or T&P relief valve failure, RAUPEX pipe has been tested to accommodate short-term exposure conditions of 210°F (99°C) at 150 psi (10 bar) for 48 hours. The actual test to obtain this short-term excessive temperature pressure capability requires that the pipe and fittings withstand these conditions for at least 720 continuous hours (30 days). This properly ensures that all safety factors are met.

NOTICE: Failure to follow pressure and temperature limits may damage the pipe resulting in leaks and operational failures, and will negate any warranty provided by REHAU for RAUPEX pipes. The designer must incorporate proper controls into the system to ensure the pressure and temperature capability of the pipe is not exceeded.

Friction Loss

RAUPEX pipe has a Hazen-Williams coefficient C-value of 150. Tables 4.8 to 4.12 list pressure loss per 100 ft of pipe for various flow rates, water temperatures and propylene glycol concentrations. This information is based on ASTM F876 size PEX pipe.

Table 4.4: Physical Properties of RAUPEX Pipes

Specification	Imperial	SI	Standard
Minimum Density	58 lb/ft ³	926 kg/m ³	ASTM F876
Degree of Crosslinking	70-89%	70-89%	ASTM F876
Thermal Conductivity	0.24 Btu-in/h-ft ² -°F	0.41 W/m-°C	DIN 52612
Linear Expansion	9.33 x10 ⁻⁴ in/ft°F @ 68°F	0.14 mm/(m°C) @ 20°C	DIN 42328
	1.33 x10 ⁻³ in/ft°F @ 212°F	0.2 mm/(m°C) @ 100°C	
IZOD Impact Resistance	No Break	No Break	DIN 53453
Modulus of Elasticity	87,000 - 130,500 psi @ 68°F	600-900 N/mm ² @ 20°C	DIN 53457
	43,500 - 58,000 psi @ 176°F	300-400 N/mm ² @ 80°C	
Minimum Burst Pressure (1/2 in. Pipe)	480 psi @ 73.4°F	33.1 bar @ 23°C	ASTM F876
	215 psi @ 180°F	14.8 bar @ 82°C	
	185 psi @ 200°F	12.8 bar @ 93°C	
Tensile Strength	4194-4355 psi @ 68°F	26-30 N/mm ² @ 20°C	DIN 53455
	2610-2900 psi @ 176°F	18-20 N/mm ² @ 80°C	ASTM D638
O ₂ Permeability	<=0.32 mg / m ² / day @ 40°C	<=0.32 mg / m ² / day @ 40°C	DIN 4726
Temperature Working Range	-40°F to 200°F	-40°C to 93°C	N/A
Roughness	e=0.00028 in	e=0.007 mm	N/A
Maximum Short-term Exposure	150 psi @ 210°F (48 hr)	10.3 bar @ 99°C (48 hr)	ASTM F876
Melt Temperature	752°F	400°C	N/A

Fire Resistance in Fire-Rated Assemblies

It is common to install radiant heating pipes through fire-rated wall and floor/ceiling assemblies. Building codes require this be done without diminishing the overall fire rating of the assembly. The fire-resistance of RAUPEX pipe has been tested to the following standards for the assemblies listed in Table 4.5:

- ANSI/UL 263, *Fire Tests of Building Construction and Materials*
- CAN/ULC-S101, *Standard Methods of Fire Endurance Tests of Building Construction and Materials*

The listing covers RAUPEX Non-Barrier, UV Shield and O₂ Barrier pipes ranging from 3/8 to 2 in.

Table 4.5: UL and ULC Design Listings

Fire-rated Assembly Description	UL Design	ULC Design
Reinforced Concrete Slab	No. K917	No. J900
Wood Framed Floor/Ceiling Assembly	No. L588	No. M516
Framed Bearing Wall	No. U383	No. W316
Framed Non-Bearing Wall	No. V461	No. W458

Refer to the online certifications directories from UL (www.ul.com) or ULC (www.ulc.ca) for additional details on the design listings.

▲ WARNING: When using RAUPEX pipe in fire-rated assemblies, the specifying engineer and designer must evaluate the design listing to ensure that local code requirements are met. Fire or smoke that is not contained may lead to death or serious injury. The Authority Having Jurisdiction should review and approve the design before installation.

Building codes require installation of an approved through-penetration firestop system where pipes penetrate through a fire-rated assembly (i.e., floor, ceiling or wall). Some firestop products are listed for all assembly types, while others are listed for only specific assembly types. RAUPEX pipe is fire-stopped at both points of entry through the fire-rated assembly.

The firestop system must be tested in accordance with one or all of the following standards and listed by an independent third-party listing agency such as UL, ULC or ITS (Warnock-Hersey). The firestop system must meet all local code requirements prior to installation. The most common firestop system standards are:

- ASTM E-814, *Fire Tests of Through-Penetration Firestops*
- UL 1479, *Fire Tests of Through-Penetration Firestops*
- CAN/ULC S115-M, *Tests of Fire Resistance of Building Joint Systems*

When choosing an approved firestop system for each specific installation, the following information must be known:

- Nominal size of PEX pipe penetrating the fire-rated assembly
- Number of PEX pipes penetrating through one opening
- Construction of fire-rated assembly (e.g., wood or concrete)
- The "F" and "T" ratings of the fire-rated assembly
- Type of assembly being penetrated (e.g., floor, ceiling or wall)

NOTICE: The designer must ensure the firestop materials are compatible with the RAUPEX pipe. Chemicals may damage the pipe resulting in leaks and operational failures.

Flame and Smoke Spread Ratings

A plenum is an enclosed portion of a building structure that is designed to allow air movement, thereby serving as part of an air distribution system. Plenums can serve as supply, return, exhaust and ventilation portions of the air distribution system.

Typically, building codes require that combustible materials installed within air plenums have a flame spread rating of not more than 25, and a smoke developed rating of not more than 50. These ratings are assigned during standardized laboratory tests that burn the combustible pipe and measure the speed of flame spread and the volume of smoke developed. Pipes that meet these requirements are sometimes said to have a "plenum rating."

United States and Canada have different, but similar, standards for this test. These standards are:

- ASTM E84, *Surface Burning Characteristics of Building Materials*
- CAN/ULC S102.2, *Standard for Surface Burning Characteristics of Flooring, Floor Covering and Miscellaneous Materials and Assemblies*

RAUPEX Non-Barrier, UV Shield and O₂ Barrier pipes (1/2 to 2 in. sizes) have been tested to both the US and Canadian standards. Based on this testing, some sizes and types of RAUPEX require an outer jacket of fiberglass insulation that is listed to the E-84 and S102.2 standards.

Table 4.6: Fiberglass Insulation Requirements for RAUPEX in Plenum Spaces

Pipe Size and Type	ASTM E-84	CAN/ULC S102.2
1/2 in. RAUPEX O ₂ Barrier	Ø	Ø
1/2 in. RAUPEX UV Shield	Ø	Ø
1/2 in. RAUPEX Non-Barrier	Ø	Ø
3/4 in. RAUPEX O ₂ Barrier	+	Ø
3/4 in. RAUPEX UV Shield	+	Ø
3/4 in. RAUPEX Non-Barrier	+	Ø
1 in. RAUPEX O ₂ Barrier	+	+
1 in. RAUPEX UV Shield	+	+
1 in. RAUPEX Non-Barrier	+	Ø
1 1/4 in. RAUPEX O ₂ Barrier	+	+
1 1/4 in. RAUPEX UV Shield	+	+
1 1/4 in. RAUPEX Non-Barrier	+	+
1 1/2 in. RAUPEX O ₂ Barrier	+	+
1 1/2 in. RAUPEX UV Shield	+	+
1 1/2 in. RAUPEX Non-Barrier	+	+
2 in. RAUPEX O ₂ Barrier	+	+
2 in. RAUPEX UV Shield	+	+
2 in. RAUPEX Non-Barrier	+	+

+ required Ø not required

Freeze Break Resistance

The flexibility of the RAUPEX pipe allows it to expand as water freezes in the pipe as long as the pipe has room to expand. When the water thaws, the pipe returns to its original shape. If the pipe is not allowed to expand (e.g., it is encased in concrete), it may burst.

NOTICE: Designers must take precautions to ensure that pipes do not freeze. Frozen pipes may burst resulting in leaks and operational failures.

Chlorine Resistance

RAUPEX pipe has been tested by NSF International in accordance with ASTM F2023, *Standard Test Method for Evaluating the Oxidative Resistance of Cross-linked Polyethylene (PEX) Tubing and Systems to Hot Chlorinated Water* as required in ASTM F876. RAUPEX pipe exceeds the minimum extrapolated test lifetime as certified by NSF and PPI for cold water applications, intermittent hot water applications and timed hot water applications.

Linear Expansion and Contraction of RAUPEX Pipe

Embedding RAUPEX pipe in concrete or securing it in RAUPANEL or RAUPLATE restricts its ability to expand and contract. Unrestrained pipe will expand and contract when heated and cooled. To accommodate the operating expansion and contraction of RAUPEX pipe, a deflection leg may need to be incorporated into the pipe layout.

The amount of expansion or contraction in a length of RAUPEX pipe is calculated using the equation:

$$\Delta L = L \times \Delta T \times \alpha$$

where

- ΔL change in length
- L original length
- ΔT change in temperature
- α coefficient of expansion.

In general, RAUPEX pipe expands approximately 1 inch per 100 ft for every 10°F rise in temperature (or approximately 10 mm per 10 m for every 6°C).

4.1.5 Pipe Markings

Pipe markings are repeated every 3 ft (0.9 m), list all certifications and approvals, and include an incremental footage marking to assist with installing the pipe. RAUPEX pipe is further identified with a PEX Material Designation code in accordance to ASTM F876.

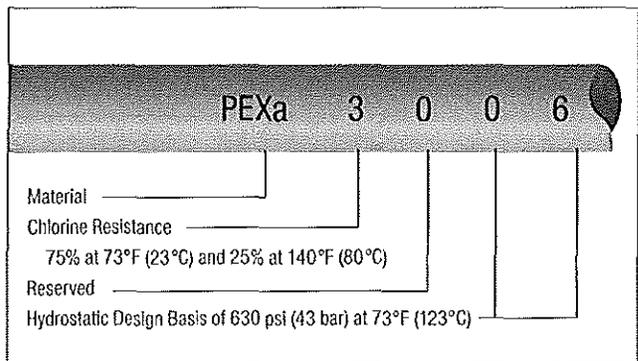


Fig. 4.2: Example RAUPEX O₂ Barrier Pipe Material Designation Code

4.1.6 Pipe Compatibility With PEX Fitting Systems

RAUPEX pipe is marked with the ASTM standard specification numbers of compatible PEX fitting systems.

4.1.7 Pipe Material Safety Data Sheet (MSDS)

The Occupational Safety and Health Administration (OSHA) Hazard Communication Standard requires suppliers and manufacturers to issue an MSDS for chemicals defined as "hazardous" by OSHA. Under normal conditions of use, RAUPEX pipe does not expose employees to potentially harmful chemicals. RAUPEX pipe meets the definition of articles in OSHA 29 CFR 1910.1200 and is exempt from the requirement to provide an MSDS.

4.1.8 Pipe Packaging, Handling and Storage

RAUPEX pipe coils are shipped in cardboard boxes to protect them from sunlight, rain, dirt and other hazards. Straight lengths of RAUPEX pipe are packaged and shipped in durable black polyethylene bags.

Keep pipe in the original packaging until it is required for installation. Return unused pipe to the packaging.

RAUPEX must be handled with care. Avoid the following:

- Dragging it over rough objects such as gravel or concrete
- Contact with oil or oily products such as gasoline and paint thinner
- Exposure to soldering or any open flame
- Excessive or permanent exposure to sunlight

4.1.9 Pipe Bending

RAUPEX pipe sizes up to 1 1/4 in. may be bent, even when cold. REHAU Support Bends make it fast and easy to create tight bends without kinking. The typical bend radius used by the installer is 8X the OD. The minimum bend radius is 5X the OD for cold bends. For an even smaller bend radius, the pipe may be heated with a hot air gun and bent to no less than 3X the OD. If a tighter bend radius is required, then the designer should consider using a smaller diameter pipe. Pipe bends are classified according to the centerline radius (CLR) of the bend as a ratio to the outer pipe diameter.

Note: A pipe may become kinked from excessive bending which may obstruct or reduce the flow. Kinked pipes may be repaired with a hot air gun.

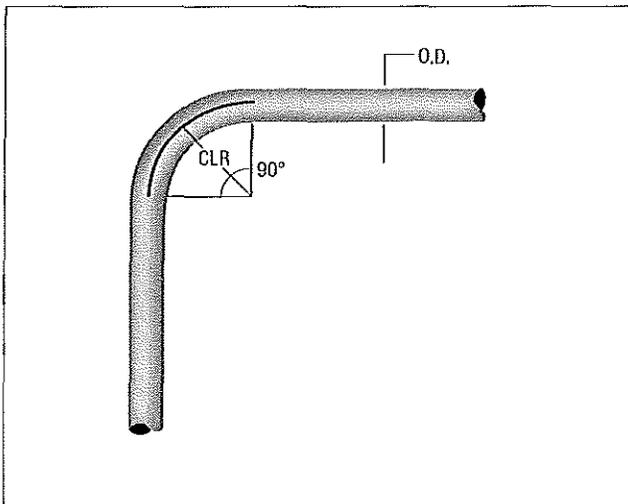


Fig. 4.3: Centerline radius (CLR) of RAUPEX pipe

4.1.10 Pipe Repair of Kinks

RAUPEX pipe is flexible and resists kinking even at temperatures well below freezing. Should the pipe become accidentally kinked, it is possible to restore the pipe to its original shape by removing any stress from the pipe and gently heating the pipe, taking care not to overheat and damage the surface of the pipe. Due to the memory effect, the pipe will return to its original shape.

Refer to the REHAU *Radiant Heating Installation Guide* for instructions on performing kink repairs.

4.1.11 Pipe Protection

Place pipe protection around RAUPEX pipe to prevent abrasion when passing through holes in the building's framework. Protection is not required for installation in wood studs, walls, floor plates or joists if the following provisions are met:

- The hole is at least 1/4 in (6 mm) larger than the outside diameter (OD) of the pipe
- The pipe is free to move for expansion and contraction
- The hole is clean (e.g., free of splinters, burrs, and rough edges)
- The hole has smooth, non-abrasive interior surface (e.g., bushing)

Note: To minimize noise associated with joist space installations, REHAU highly recommends use of pipe protection at all joist penetrations.

At concrete slab penetrations, RAUPEX pipes should be protected. Where RAUPEX pipe passes through holes in concrete, masonry or steel, pipe protection is always required.

Table 4.7: Bend Radius of RAUPEX Pipe

Bend Radius	Typical	Min. Cold	Min. Heated
	8X OD	5X OD	3X OD
Pipe Size	in (mm)	in (mm)	in (mm)
3/8 in	4.0 (102)	2.500 (64)	1.500 (38)
1/2 in	5.0 (127)	3.125 (79)	1.875 (48)
5/8 in	6.0 (152)	3.750 (95)	2.250 (57)
3/4 in	7.0 (178)	4.375 (111)	2.625 (67)
1 in	9.0 (229)	5.625 (143)	3.375 (86)
1 1/4 in	11.0 (279)	6.875 (175)	4.125 (105)

For RAUPEX pipe sizes 1 1/2 in. and greater, use elbow and other fittings to accomplish tight bends.

4.2 Fittings - EVERLOC

The REHAU EVERLOC fitting system employs the memory inherent in RAUPEX pipe to form a secure joint. The RAUPEX pipe is expanded to allow the fitting to be inserted. Because of its crosslinked structure, the pipe tries to return to its original shape, placing significant force on the fitting and forming a tight joint.

A properly installed EVERLOC fitting can be placed in areas that will become inaccessible after installation, such as behind sheetrock walls or under a floor or slab. Always check with local codes to verify which types of joints, if any, may be used in inaccessible locations.

Note: EVERLOC fittings are designed for use exclusively with RAUPEX pipe and must be assembled only with REHAU EVERLOC fitting tools. REHAU does not monitor the compatibility of EVERLOC fittings with other brands of PEX pipe. The designer must verify all combinations other than EVERLOC and RAUPEX.

All EVERLOC fittings are produced for RAUPEX pipe manufactured to ASTM F2080. The EVERLOC fitting system offers a variety of configurations to meet different radiant piping system applications. Threaded EVERLOC adapter fittings have tapered threads and are National Pipe Thread. EVERLOC offers the following adapter connections: female NPT, male NPT and sweat and street solder connections.

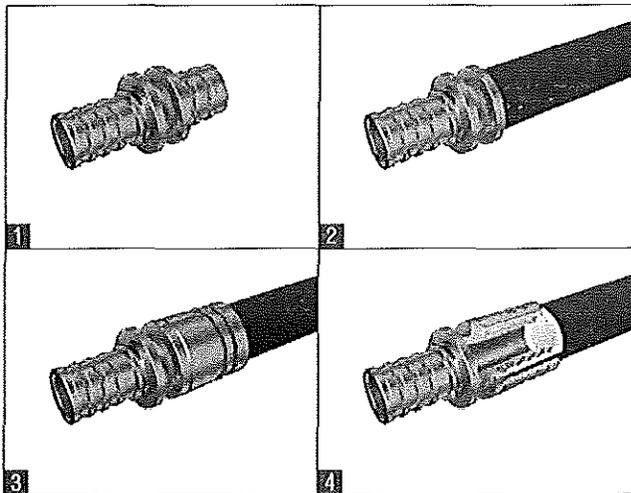


Fig. 4.4: (1) EVERLOC fitting, (2) fitting inserted in expanded pipe, (3) REHAU EVERLOC joint, (4) cutaway

4.2.1 Fitting Material

EVERLOC fittings are manufactured from UNS C36000 or C37700 brass, or equivalent European standard.

4.2.2 Fitting Performance Characteristics

Stress Crack Resistance

Brass fittings and components can be susceptible to stress corrosion cracking. Radiant systems subject fittings to stresses from thermal cycling, mechanical loading (e.g., caused by over tightening of a threaded fitting) and the presence of chemicals in the interior water or exterior air.

NOTICE: Brass fittings and components should not be exposed to harmful chemicals or aggressive water conditions. Failure to follow this instruction may damage the parts resulting in leaks and operational failures.

Friction Loss

The pressure loss due to friction through an EVERLOC fitting may be determined using a two-step calculation. First, using Table 4.13, the pressure loss through the fitting is represented by the equivalent length of RAUPEX pipe. Second, from Tables 4.8 to 4.12, the equivalent pipe length is used to calculate the pressure loss of the fitting.

Table 4.13: Fitting Pressure Loss Expressed as Equivalent Length of Pipe

Fitting Size	Equivalent Length of RAUPEX Pipe in ft (m)				
	Tee Run	Tee Branch	90° Elbow	Coupling	RAUPEX 90° Pipe Bend
3/4 in	1.0 (0.3)	6.4 (2.0)	6.2 (1.9)	0.8 (0.2)	0.6 (0.2)
1 in	1.4 (0.4)	8.2 (2.5)	8.3 (2.5)	1.1 (0.3)	0.6 (0.2)
1 1/4 in	1.0 (0.3)	12.0 (3.7)	12.0 (3.7)	1.0 (0.3)	1.0 (0.3)
1 1/2 in	1.0 (0.3)	13.0 (4.0)	13.0 (4.0)	1.0 (0.3)	1.0 (0.3)
2 in	1.0 (0.3)	15.0 (4.6)	15.0 (4.6)	1.0 (0.3)	1.0 (0.3)

4.2.3 Protecting Buried EVERLOC Fittings

EVERLOC brass is designed for rugged conditions and long life. However some materials, such as Portland cement, may corrode brass. All buried EVERLOC fittings must be covered with tightly wrapped, waterproof, silicone tape or heat shrink sleeving to prevent contact with corrosive chemicals.

Note: EVERLOC fittings may be buried in concrete when properly protected. Check the local codes to determine if this is an acceptable practice.

4.2.4 Installing EVERLOC Fittings

Installing EVERLOC fittings requires special REHAU tooling. Refer to the REHAU *Radiant Heating Installation Guide* for the tools required depending on the fitting and pipe sizes.

The basic process of completing an EVERLOC joint is to:

- Install sleeve over end of pipe
- Expand the RAUPEX pipe
- Insert fitting into end of pipe
- Compress the sleeve over the pipe and fitting

4.3 Fittings - Compression Nut

The REHAU compression nut fitting is used where pipe remains accessible after installation. It allows easy disassembly of the pipe from the connected device such as a manifold, another fitting or a piece of equipment. The fitting can be assembled with a pipe wrench and does not require special REHAU tooling. REHAU compression nut fittings meet the requirements of ASTM F877 and CSA B137.5.

The basic process of completing a compression nut joint is to:

- Install compression union nut, then split clamping ring over end of pipe
- Insert fitting into end of pipe
- Tighten nut onto fitting

R20 Fittings are removable, threaded connections that transition the RAUPEX heating circuit pipe into the PRO-BALANCE or HLV manifold.

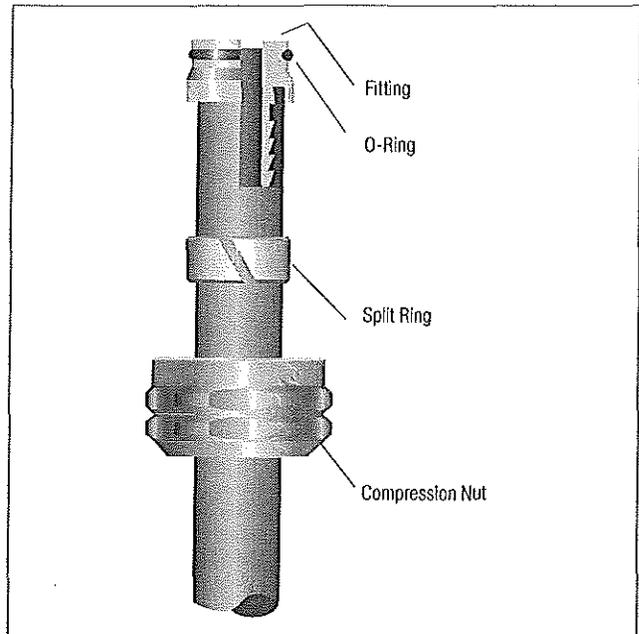


Fig. 4.5: R20 connection to manifold

Copper Adapters Fittings transition the RAUPEX distribution pipe to copper pipe.

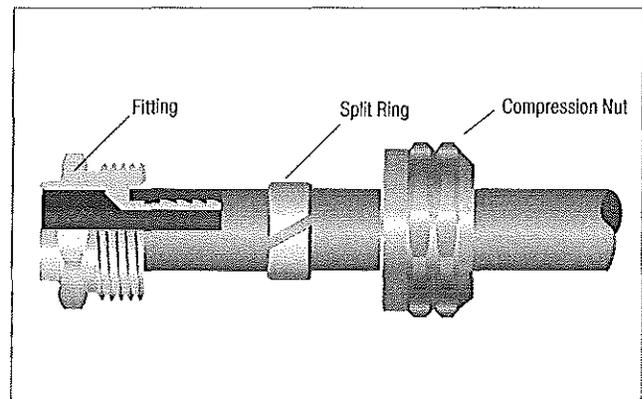


Fig. 4.6: Adapter connection to copper pipe

NOTICE: Adapter fittings may leak if not properly maintained. Periodically check and retighten adapter fittings to reduce risk of leaks.

4.4 Manifolds

Manifolds distribute and control the heating water to the different circuits in a radiant heating system. Manifolds may be mounted in any orientation (e.g., inverted, horizontal or sideways).

PRO-BALANCE and **PRO-BALANCE XL** Manifolds have separate supply and return headers. Circuit connections branch off from the headers and balancing valves control the flow rate to each circuit connection. A valve actuator may be installed to the header balancing valve to open and close the circuit.

HLV Manifolds have separate supply and return headers. These "valve-less" manifolds have circuit connections that connect directly to the pipe. Manifolds may be used when circuit lengths are within 10% and flow rate requirements are the same for all circuits.

Ball Valve and **Cut-to-Length** Manifolds have a single header and the pipe circuit connections are accomplished with the permanent EVERLOC fitting.

Pre-cut and **Header Stock** Manifolds have a single header and smaller copper tube outlet tees for connecting to the radiant heating circuit.

Manifold Cabinets are used with the PRO-BALANCE and HLV manifolds in commercial, industrial and institutional applications.

4.5 Heat Transfer Panels

Heat transfer panels overlay the subfloor and contain channels which accept the RAUPEX pipe. REHAU's patented RAUPANEL Radiant Heating System consists of RAUPEX pipes, aluminum panels, plywood return bends and plywood furring strips. These components are designed for ease of installation as well as excellent thermal performance. The system allows for either 6 or 8 in (15 or 20 cm) on-center pipe

spacing, as required to meet radiant panel performance requirements.

RAUPANEL is an extruded aluminum panel which has a custom Omega-shaped groove that allows pipe to be tightly snapped into place, maintaining excellent thermal contact between the pipe and panel. The pipe installation does not require silicone or other filler materials. The unique profile of the highly-conductive aluminum panel makes it responsive, strong and lightweight. Five integral legs on the bottom support the panels, the weight of the flooring and the loads above, while reducing the thermal contact with the subfloor below. This reduced contact increases the directional efficiency of the panels, since the majority of the heat drawn from the RAUPEX pipe is conducted across the top surface of the panel and to the floor, wall or ceiling panel. This often means that no insulation is required in a joist cavity below the panel system, saving installation time and material costs.

Plywood Return Bends are configured to maintain the pipe spacing during installation. The 6 in (15 cm) on-center return bends allow for aluminum panels to be installed side-by-side, providing maximum aluminum coverage in areas where even more heat delivery is required. The 8 in (20 cm) on-center return bends are specially notched to align the aluminum panels and the pipe groove, simplifying system installation. Return bends are machined from construction-grade plywood to match the height of the aluminum panels, and are pre-grooved for easy pipe installation.

Plywood Furring Strips provide nailing surfaces for certain types of flooring. These precision-cut furring strips are used primarily with 8 in (15 cm) return bends to fill the gaps between the aluminum panels. They are also used at the edges of panel layouts to provide nailing surfaces and to keep a space between the aluminum panels and outside wall plates and studs, reducing heat loss through exterior walls. Furring strips are machined from construction-grade plywood to match the height of the aluminum panels.

Table 4.14: Manifold Comparison

	Distribution Supply and Return Sizes	Number of Circuits	Maximum Flow (GPM)	Circuit Isolation	Flow Gauges with Manual Balancing Adjustment	Automatic Control Valves	Circuit Connections
PRO-BALANCE	1 in NPT	2 to 12	20	✓	✓	✓*	R20
PRO-BALANCE XL	1 1/4 in NPT	2 to 10	40	✓	✓	✓*	R20
HLV	1 in NPT	2 to 5	20	✓			R20
Ball Valve	1 in Cu pipe	12	20	✓			EVERLOC
	1 1/4 in Cu pipe	12	32	✓			EVERLOC
Cut-to-Length	1 in Cu pipe	12 or 24	20				EVERLOC
	1 1/4 in Cu pipe	12 or 24	32				EVERLOC
Pre-cut	1 in Cu pipe	2 to 4	20				Cu pipe
Header Stock	1 in Cu pipe	24	20				Cu pipe
	1 1/4 in Cu pipe	24	32				Cu pipe
	1 1/2 in Cu pipe	24	44				Cu pipe
	2 in Cu pipe	18 or 24	75				Cu pipe

4.6 Heat Transfer Plates

Heat transfer plates are installed below the subfloor in the joist cavity and contain channels which accept the RAUPEX pipe. Installations are typically 8 in (20 cm) on-center with two pipes running the length of each joist cavity.

RAUPLATE™ Heat Transfer Plates are fixed to the underside of a suspended joist space floor. Each plate has two channels spaced 8 in (20 cm) on-center. The RAUPEX pipes clip quickly and firmly into the channels. RAUPLATE typically offers faster and easier installation than other heat transfer plates.

Heavy Gauge Heat Transfer Plates are fixed to the underside of a suspended joist space floor. The single-channel plates are used when there is only one run of pipe in the joist cavity or to position the pipe around obstructions where the two-channel plates do not fit. The RAUPEX pipes clip firmly into the channel.

4.7 Installation Accessories

Accessories are used in a variety of radiant heating construction methods.

4.7.1 Pipe Assembly Guides

Steel and Polymer Support Bends assists the installer in creating 90° bends of the distribution piping and circuit tails without kinking the pipe. The support bends snap over the pipe.

4.7.2 Pipe and Fitting Protection

PVC Bend Guides provide protection at slab penetrations and create a professional appearance. Pipe is inserted into the 90° rigid PVC guides, then half of each guide is embedded in the slab.

PE Protection Sleeves protect the pipe at slab, wall and joist penetrations, expansion and construction joints, and abrasive surfaces. The protection sleeves reduce abrasion and minimize noise caused by the expansion and contraction of the pipe.

RAUCROSS™ Sleeving is ideal for sealing around EVERLOC brass fittings installed in corrosive environments or buried in a slab. The heat shrink sleeving tightly seals around the fitting with heat from a hot air gun.

4.7.3 Pipe Hangers

Locking Clips allow for rapid installation of pipe. The pipe snaps into the clips and can be removed without damaging the clips. The polymer clips attach to the surface with a screw or nail (not included).

Pipe Talons clip onto the pipe. **Single Nail Clamps** completely encircle the pipe. Both the polymer talon and polymer clamp secure the pipe to the wood framework with a pre-installed barbed nail.

Isolating Suspension Clamps secure suspended pipe to both wood and metal framework.

Plastic Pipe Clamps secure pipe to both wood and metal framework.

Nylon Pipe Ties safely secure pipe directly to slab reinforcing bars or wire mesh. This installation method is most common in commercial applications.

Insulation Screw Clips secure the pipe directly to rigid board insulation which is an aid when laying pipe, and prevents the pipe from floating up to the surface with wet construction methods. The polymer screw clips insert easily into the insulation with the aid of the screw clip tool provided separately.

Plastic Holding Pins secure the pipe directly to rigid insulation which is an aid when laying pipe, and prevents the pipe from floating up to the surface with wet construction methods.

Soil Hooks anchor pipe in compacted soil.

4.7.4 Pipe Rails

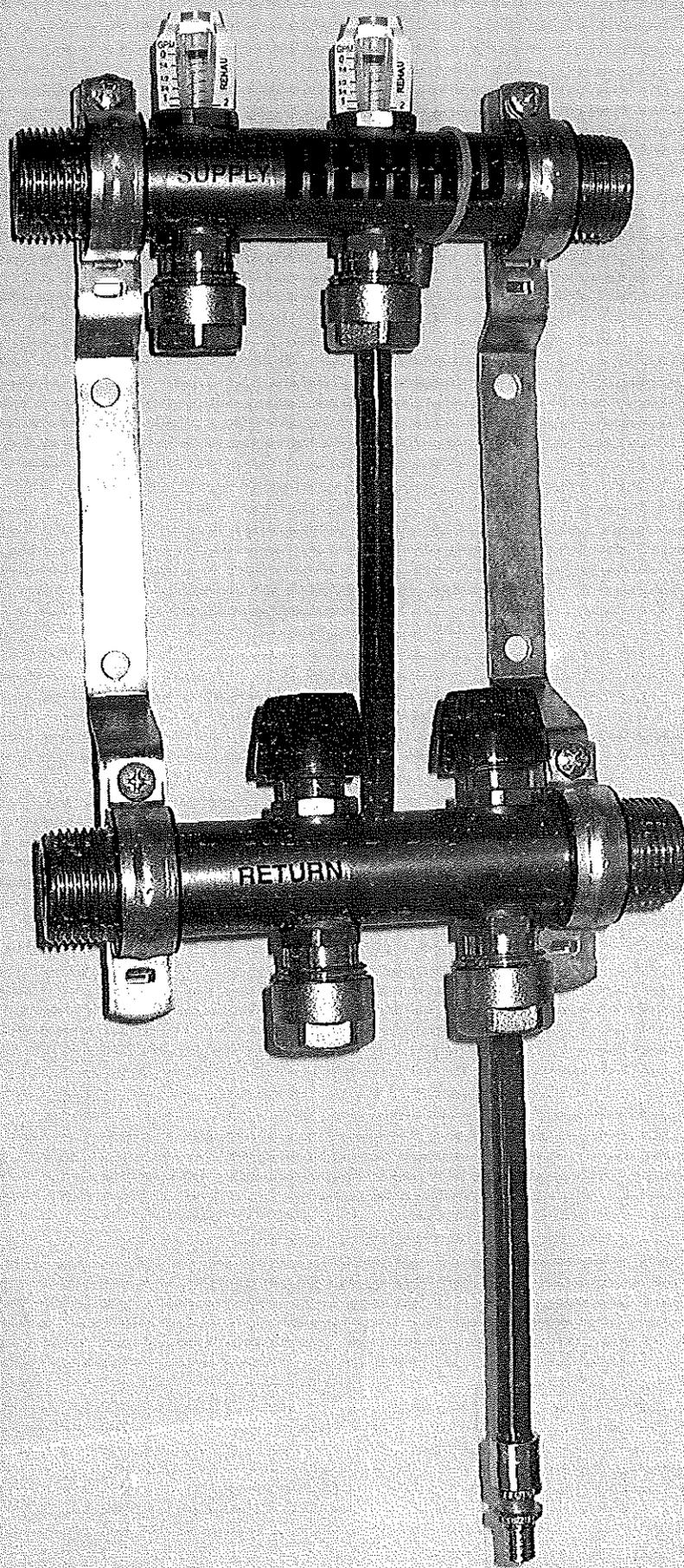
RAILFIX™ Rails allow for rapid installation by securing the pipe prior to pouring the slab or overpour in a wet construction method. The rigid polymer channel has fixed pipe slots spaced every 2 in (5 cm),

Universal Fixing Rails allow for the same rapid installation as the RAILFIX with the added benefit that four different pipe sizes, ranging from 3/8 to 3/4 in., may be secured. The rigid polymer molding has alternating small and large pipe tabs spaced every 4 in (10 cm).

Fixing rails may be mounted onto insulation with Plastic Holding Pins or onto concrete and wood floors with screws.

Table 4.15: Accessory Comparison

	Construction Methods		Distribution Piping and Circuit Tails
	Wet	Dry	
Support Bends			√
Bend Guides	√		
Protection Sleeves	√	√	
RAUCROSS Sleeving	√		
Locking Clips			√
Pipe Talons		√	√
Single Nail Clamps			√
Plastic Pipe Clamps			√
Isolating Suspension Clamps			√
Nylon Pipe Ties	√		
Insulation Screw Clips	√		
Plastic Holding Pin	√		
Soil Hooks	√		√
RAILFIX Rails	√	√	√
Universal Fixing Rails	√	√	√



7. SYSTEM TESTING

A pressure test must be performed on the system to ensure the RAUPEX pipe and connections are leak-free. Local jurisdictions may have additional testing requirements.

For wet construction methods, the pressure test must be performed prior to and during the installation of the thermal mass. For dry construction methods, the pressure test must be performed prior to and during the installation of the floor, wall and ceiling coverings. Typically, the system is filled with water and pressurized to 1.5 times the operating pressure or 100 psi (6.9 bar), whichever is greater.

NOTICE: If there is a chance that the water could freeze, use a water/glycol mixture when filling the system or performing an air test. Frozen pipes may burst resulting in leaks and operational failures.

Refer to the REHAU *Radiant Heating Installation Guide* for instructions on performing the purging and pressure testing.



SATURN SERVICE CENTER

RADIANT HEATING SYSTEM

PROJECT PROFILE

REHAU's Radiant Heating System Increases Energy Savings, Comfort for Saturn Service Center

Severe winters are no longer a bear for technicians working at the Saturn Service Center in White Bear Lake, Minnesota. They stay as warm as if it were summer outside, thanks to the installation of a REHAU radiant floor heating system.

The 10,000 ft² (930 m²) service department presented a particular challenge in that it was designed with two large lifting garage doors and five standard lifting garage doors, all of which were significant sources of heat loss. In addition, an existing oil reclamation boiler system that disposes used motor oil in an environmentally friendly manner was to be incorporated as the heat source.

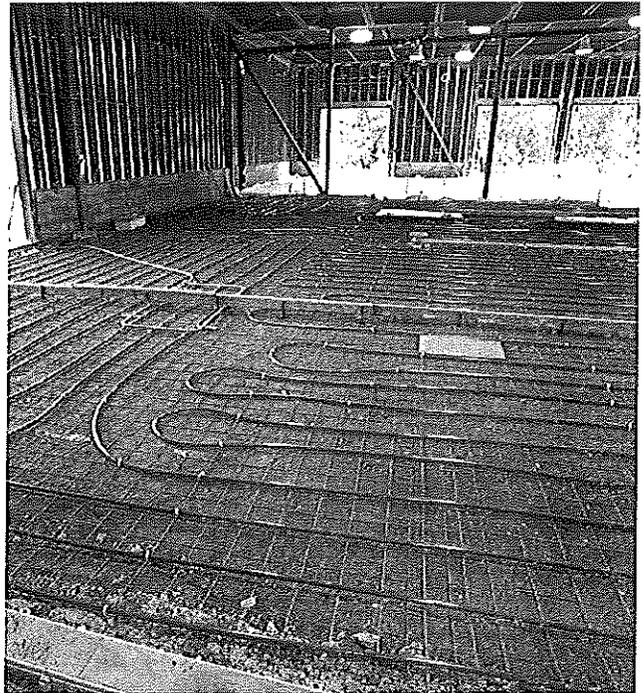
Spriggs Plumbing, Heating and Process Piping of St. Paul, the mechanical contractors for the project, worked in partnership with Harold Bruner, design engineer for Michel Sales Co., to finalize a design of the system.

To accommodate the reclamation boiler's location, the design incorporated 1 in. RAUPEX O₂ Barrier crosslinked polyethylene (PEXa) pipe as the distribution piping to the PRO-BALANCE manifolds. Conventional distribution piping typically utilizes rigid steel or copper pipe which is more expensive and harder to install than the flexible RAUPEX pipe.

To calculate water temperature and flow rates for the system, REHAU designed the system to ensure the floor could deliver the proper amount of heat. A sophisticated outdoor reset system also plays a major role in determining the temperature of the water flowing through the radiant system.

The system's 3/4 in. RAUPEX heating pipe was installed in the center of a 4 in. concrete slab-on-grade, at 12 in. on-center spacing. A 3/4 in. pipe was chosen instead of the 1/2 or 5/8 in. pipe typically used, in order to accommodate installation of the longer loop lengths of 350 to 450 ft (170 to 137 m).

A PRO-BALANCE manifold is employed in each of the four individual zones, with flow gauges on each manifold circuit. "The result is a much more targeted supply of heat and heat recovery, especially compared to forced-air systems which heat an entire space at once," explained Bruner.



Project: Saturn Service Center in White Bear Lake, MN

Type of Construction: Automotive service center renovation, 2002

Scope of Project: 10,000 ft² (930 m²)

Engineer: Michel Sales Company

Contractor: Spriggs Plumbing, Heating and Process Piping

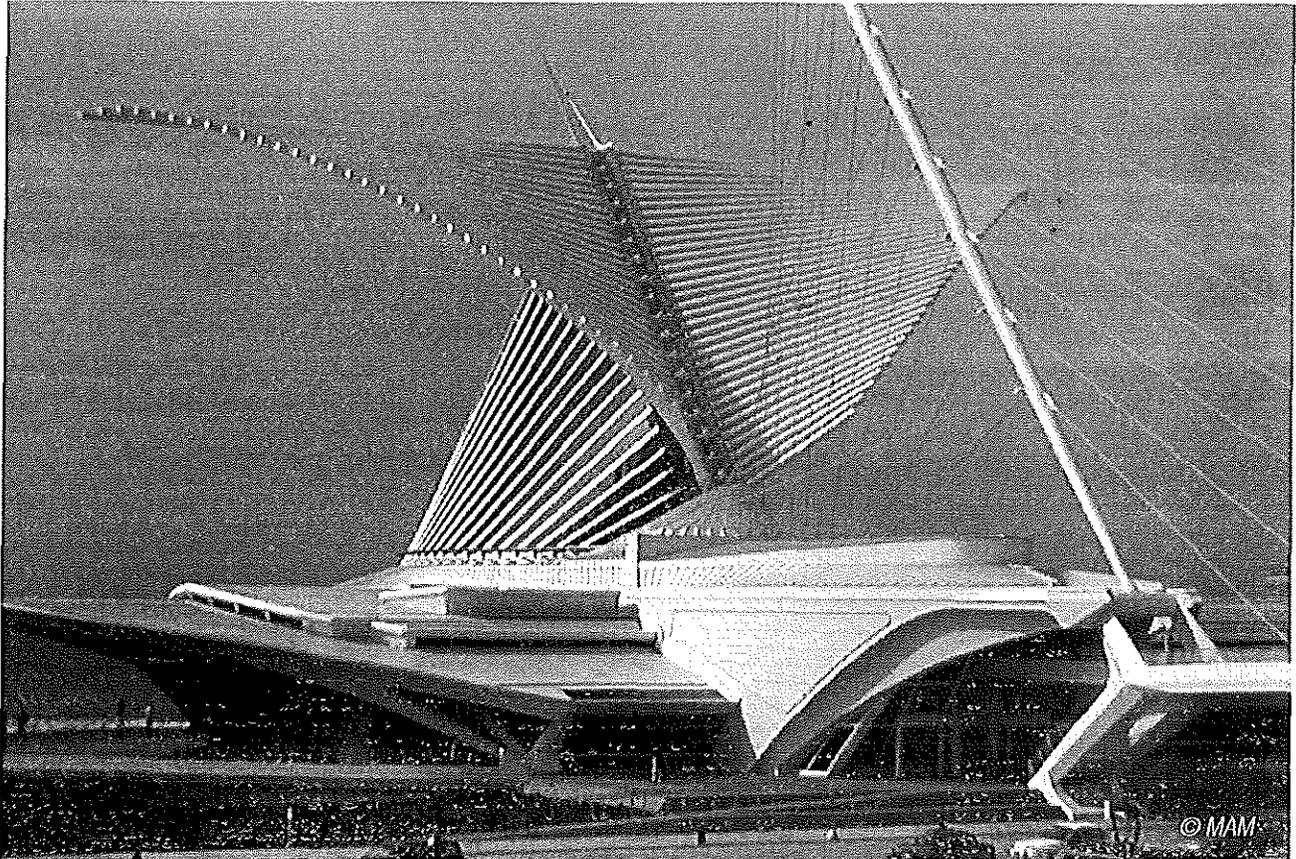
REHAU System Used: Radiant heating (RAUPEX[®] pipe, PRO-BALANCE[®] manifolds)

"Our heat savings has been noticeable, between the efficiency of the radiant system and the fact that we're basically self-sustaining on waste use from oil changes," said Mike Griffith, service manager for the Saturn Service Center. "We really couldn't have asked for more between the savings and the comfort this system provides."

For updates to this publication, visit na.rehau.com/resourcecenter

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MILWAUKEE ART MUSEUM
RADIANT HEATING SYSTEM
PROJECT PROFILE

REHAU's Radiant Heating System Increases Comfort for Museumgoers

Milwaukee's "masterpiece on the lakefront" not only offers visitors an impressive collection of nearly 20,000 works from antiquity to present; its ambitious five-year, 140,000 ft² (13,000 m²) expansion and renovation project also breaks the boundaries between the fields of art and architecture.

During initial planning, the Milwaukee Art Museum's unique design and choice of materials left the architect and builder with a major challenge – how to keep museum guests warm. Visitors would be positioned between two beautiful but innately cold elements: buffed, imported marble flooring and a cathedral-like ceiling made of glass. Considering Wisconsin's long winters, as well as the museum's waterfront location, cold exposure was inevitable. The structure would ultimately allow hot air to rise toward the glass ceiling, and cold air to force itself through the windows, thereby compromising the comfort of museumgoers.

"Calatrava knew that forced air would be a problem, so he recommended radiant heating," states Andrew Csoke, unit manager for REHAU's building technology group. "Forced air would result in dry heat, centering above the heads of visitors, while keeping their feet cold. Radiant heating on the other hand distributes heat efficiently from the floor up, offering a comfortable heat level for visitors. In addition, radiant heating presented considerable cost savings because the heat source eliminates wasted energy of heat pushed against the cold windows."

REHAU's building technology group and Rundle-Spence Manufacturing Company were called upon to design their "masterpiece." Approximately 25,000 ft (7,620 m) of RAUPEX O₂ Barrier cross-linked polyethylene (PEXa) 1/2 in. piping was laid out in a counter-flow spiral design, and joined with the EVERLOC fitting system where necessary.

"Our decision to use EVERLOC was based upon the need for worry-free connections," says Ed Sharpe, owner of Sharpe Sales. According to Sharpe, "The EVERLOC fitting system also sold the job due to its ease of installation. The locations of the fittings are difficult to access, so the installers wanted to make each connection only once. The piping normally relaxes within 24 hours and other fittings would require re-tightening. By not having to retighten the EVERLOC fittings, valuable time and money was saved."



Project: Milwaukee Art Museum in Milwaukee, WI

Construction: Museum renovation, 2001

Scope of Project: 140,000 ft² (13,000 m²) expansion and renovation

Architect, Engineer: Santiago Calatrava

Distributor: Rundle-Spence Manufacturing Company

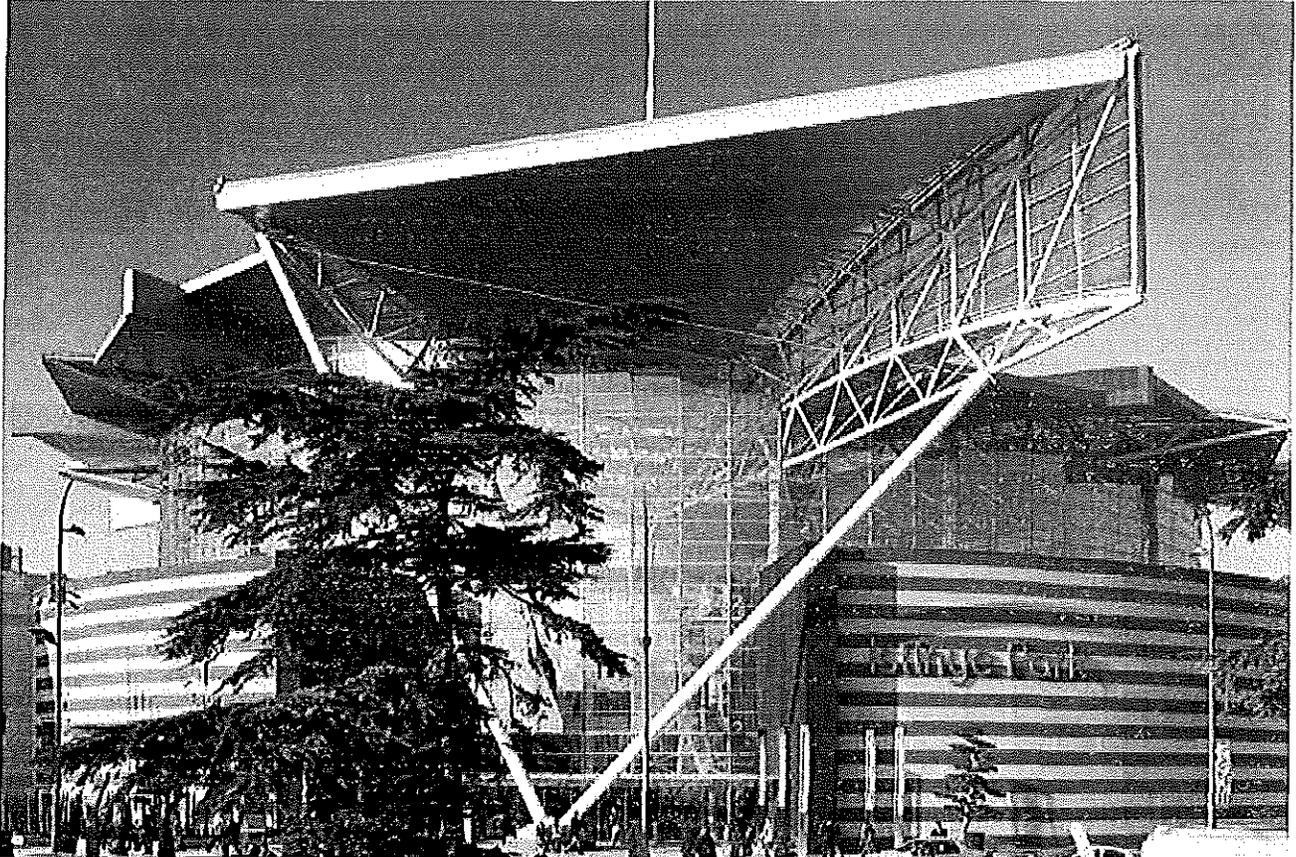
REHAU System Used: Radiant heating (RAUPEX[®] pipe, EVERLOC[®] fittings, PRO-BALANCE[®] manifolds)

Website: www.mam.org

"Because of the size of the job, and the exposure of serving such a fine museum, it was an honor to be a part of a project with such worldwide recognition," concludes Ed Sharpe. "The museum required the best available products and REHAU was able to provide them."

For updates to this publication, visit na.rehau.com/resourcecenter

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SUSTAINABLE BUILDING TECHNOLOGY

REHAU PEXa LIMITED WARRANTY

PIONEERING PEXa SOLUTIONS SINCE 1968

REHAU crosslinked polyethylene (PEXa) pipes are backed by more than 35 years and more than 1 billion feet (300 million meters) of installation experience worldwide. As the central component in our ever-expanding range of sustainable building technologies, REHAU PEXa pipes address some of our world's greatest challenges – rising energy costs, water shortages and decaying infrastructure.

Dear Property Owner:

As the owner of a REHAU crosslinked polyethylene (PEXa) piping system, you play an important role in ensuring proper operation over the lifetime of the system and ensuring that REHAU's PEXa limited warranty remains in effect. We recommend that you adhere to the following guidelines.

- Consult with a licensed professional contractor to develop the appropriate inspection and maintenance schedule for your system.
- Perform visual inspection, at least annually, of all accessible system components to ensure products are functioning as intended.
- Do not modify or alter the piping system. Only a licensed professional contractor who is familiar with its operation should service or alter the system.
- Follow all manufacturer recommendations for service and operation.
- Do not expose REHAU products to harmful chemicals, oil or petroleum products, paint, adhesives, solvents, household cleaners or aggressive water.
- Ensure that REHAU PEXa pipe is insulated or concealed to protect it from exposure to UV radiation from sunlight or artificial sources.
- Do not expose the piping system to freezing conditions. If the system will remain inoperative for a period of time, arrange for the proper winterization of the system by a licensed professional contractor. For heating and geothermal applications, if freezing conditions are likely to occur, then a freeze protection fluid should be used.
- Do not allow the piping system to be exposed to temperatures and pressures above those printed on the pipe.
- Use caution when drilling or nailing into the area where the REHAU PEXa pipes are installed. Identify the location of the pipes to ensure that nails or screws do not puncture the pipe.
- Use caution when digging in the vicinity of REHAU PEXa pipes as you would with any buried utility system.

Any updates to this publication will be available at na.rehau.com/warranties.

Sincerely,

REHAU

REHAU PEXa LIMITED WARRANTY

Subject specifically to the terms of this Limited Warranty, including the General Warranty Terms set forth below, REHAU Construction LLC or REHAU Industries Inc., as applicable, ("REHAU") provides solely and specifically to the owner of the applicable real property at the time of the installation and the first transferee thereafter of such real property the following Application-Specific Warranties.

Terms in *italics* shall have the meanings set forth below in the Definitions section.

Application-Specific Warranties

Radiant Heating/Cooling, Snow and Ice Melting, Soil Conditioning

(i) *Pipe* sold as RAUPEX® or RAUTHERM™ shall be free of defects in material and workmanship for a period of twenty-five (25) years; and (ii) *EVERLOC® Fittings* shall be free of defects in material and workmanship for a period of twenty-five (25) years; and (iii) *Other REHAU Fittings* shall be free of defects in material and workmanship for a period of five (5) years; and (iv) *Hardware* shall be free of defects in material and workmanship for a period of two (2) years; and (v) *EVERLOC Tools* shall be free of defects in material and workmanship for a period of one (1) year.

Geothermal Ground Loop Heat Exchange

(i) *Pipe* sold as RAUGEO™ *Pipe* shall be free of defects in material and workmanship for a period of twenty-five (25) years; and (ii) *U-bends* shall be free of functional defects in material and workmanship for a period of twenty-five (25) years; and (iii) *EVERLOC Fittings* shall be free of defects in material and workmanship for a period of twenty-five (25) years; and (iv) *PP Manifolds* shall be free of defects in material and workmanship for a period of two (2) years; and (v) *Other REHAU Fittings* shall be free of defects in material and workmanship for a period of five (5) years; and (vi) *Hardware* shall be free of defects in material and workmanship for a period of two (2) years; and (vii) *Geothermal Accessories* shall be free of defects in material and workmanship for a period of one (1) year; and (viii) *EVERLOC Tools* shall be free of defects in material and workmanship for a period of one (1) year.

PEX Plumbing and Water Service

(i) *Pipe* sold as RAUPEX or MUNICIPEX® shall be free of defects in material and workmanship for a period of twenty-five (25) years; and (ii) *Hardware* shall be free of defects in material and workmanship for a period of two (2) years.

Residential Fire Protection

(i) *Pipe* sold as RAUPEX shall be free of defects in material and workmanship for a period of twenty-five (25) years; and (ii) *EVERLOC Fittings* shall be free of defects in material and workmanship for a period of twenty-five (25) years; and (iii) *Hardware* shall be free of defects in material and workmanship for a period of two (2) years; and (iv) *EVERLOC Tools* shall be free of defects in material and workmanship for a period of one (1) year.

Energy Transfer and Outdoor Wood Boiler

For *Pipe with Insulation Cover* sold as INSULPEX®, OWB Pipe or RAUVTHERM™: (i) *Pipe* sold as RAUPEX or RAUTHERM shall be free of defects in material and workmanship for a period of twenty-five (25) years; and (ii) *Insulation Cover* shall be free of defects in material and workmanship for a period of one (1) year; and (iii) *EVERLOC Fittings* shall be free of defects in material and workmanship for a period of twenty-five (25) years; and (iv) *Other REHAU Fittings* shall be free of defects in material and workmanship for a period of five (5) years; and (v) *EVERLOC Tools* shall be free of defects in material and workmanship for a period of one (1) year.

General Warranty Terms

All of the above Application-Specific Warranties are subject to the following General Warranty Terms:

All warranty periods begin on the date REHAU sells the products in question and only apply to *Products* sold by REHAU.

In order for this Limited Warranty to apply: (i) the handling, use, installation and maintenance of *Products* must continually comply with REHAU technical requirements as set forth in *REHAU Technical Guidelines*; (ii) design, installation, inspection and testing of the system, including testing under pressure of *Products* after installation, must have been carried out in accordance with applicable building, mechanical and electrical codes and industry accepted guidelines; (iii) installation of *Products* must have been carried out by a registered and licensed installer; (iv) *Products* must not be damaged during or after installation from freezing, improper backfill or grouting, or any other circumstances beyond the control of REHAU; (v) *Products* must not be damaged by tear, break or other stress due to concrete stress cracks or any other external forces; (vi) *Products* must not be subjected to damage or wear caused by abnormal operating conditions, accident, abuse, misuse, unauthorized alteration or repair; (vii) *Products* must not be exposed to ultraviolet light beyond the published UV exposure limits; (viii) *Products* must not be exposed to temperature and/or pressure conditions beyond their rated value; (ix) *Products* must not be exposed to harmful chemicals, aggressive water conditions or any

external influences that cause damage to the *Products*; (x) *Products* must be stored in a clean, dry environment; and (xi) *Products* must be installed for their intended use and in the applications defined by the applicable *REHAU Technical Guidelines*.

The above warranty periods do not apply if the *Pipe* is operated in permitted *Elevated Temperature Applications* as set forth in *REHAU Technical Guidelines*. Instead, in these applications, the warranty period for the *Pipe* shall be equal to the published lifetime in *REHAU Technical Guidelines*.

THE LIMITED WARRANTY HEREIN PROVIDED IS EXPRESSLY IN LIEU OF ALL OTHER WARRANTIES EXPRESSED OR IMPLIED ON THE PART OF REHAU. REHAU DISCLAIMS ANY WARRANTY, EXPRESSED OR IMPLIED, OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

In order to make a claim under this Limited Warranty, REHAU must be informed immediately and no later than thirty (30) days after the occurrence of an event giving rise to a breach of the Limited Warranty and while the damaged portion of the project is still open for inspection to enable REHAU to determine whether REHAU has any liability for the defective Product. If this notice is not given, and inspection is not possible, then this Limited Warranty is void. Additionally, in order for this Limited Warranty to be valid, at the request of REHAU, a claimant will provide a sample of the allegedly defective product to REHAU for examination.

If a *Product* is defective, REHAU's liability shall be limited, at REHAU's option, to replacing or repairing the defective *Product* in question or providing a refund of the defective *Product's* purchase price. REHAU will not be liable for any costs of labor, removal, reinstallation, transportation, or any other charges which may arise in connection with a warranty claim. THE SOLE AND EXCLUSIVE REMEDY PURSUANT TO ANY CLAIM OF ANY KIND, INCLUDING BUT NOT LIMITED TO A CLAIM IN CONTRACT, NEGLIGENCE OR STRICT LIABILITY, AGAINST REHAU OR ANY OF REHAU'S AFFILIATES, SHALL BE LIMITED TO THE LIMITED LIABILITY OF REHAU DESCRIBED IN THIS PARAGRAPH. REHAU SHALL NOT BE HELD RESPONSIBLE FOR DAMAGE TO PERSON OR PROPERTY, INCIDENTAL OR CONSEQUENTIAL LOSS, LOSS OF PROFIT, LOSSES ON GOODS IN STORE OR THE LIKE, IRRESPECTIVE OF THE CAUSE. Some States and Provinces do not allow the exclusion or limitation of incidental or consequential damages and some States and Provinces do not allow limitations on how long implied warranties may last. Therefore, the limitations or exclusions above may not apply to you. This Limited Warranty gives you specific legal rights and you may also have other legal rights which

vary by State or Province. Any action for breach of warranty must be commenced within one (1) year of the date of the breach of warranty, unless such limitation is barred by law. This limited warranty applies to the United States and Canada, other than the Province of Québec.

Definitions

For purposes of this Limited Warranty, the following definitions shall apply:

- *EVERLOC Fittings*: REHAU cold-expansion compression-sleeve fittings sold under the EVERLOC brand
- *Elevated Temperature Applications*: Applications where the continuous temperature operating conditions are greater than 180°F (82.2°C)
- *EVERLOC Tools*: Assembly tools for use with EVERLOC fittings; exclusive of plastic pipe cutters
- *Geothermal Accessories*: Bulkhead seals, ball valves, flow gauges, tridicators
- *Hardware*: Brass manifolds, distribution headers, thermostats and valve actuators
- *Insulation Cover*: Thermal insulation and/or outer casing surrounding *Pipe*
- *Other REHAU Fittings*: Other types of fittings used for connecting *Pipe* not included in the EVERLOC brand
- *Pipe*: REHAU crosslinked polyethylene (PEXa) pipe
- *PP Manifolds*: Fused polypropylene header with polypropylene drops exclusive of ball valves, flow gauges, tridicators, fittings and brackets
- *Product(s)*: EVERLOC Fittings, Hardware, Insulation Cover, Other REHAU Fittings, *Pipe*, PP Manifolds, Tools and U-bends referenced individually or collectively
- *RAUGEO Pipe*: *Pipe* for geothermal ground loop heat exchange applications, including RAUGEO double U-bend, single U-bend, Helix Coil and Collect
- *REHAU Technical Guidelines*: The most current and applicable versions of all the technical literature available on the REHAU North America website at na.rehau.com/resourcecenter, including but not limited to technical manuals, installation guides, technical bulletins, Skill Builders training presentations and submittals
- *U-bends*: The tip of a RAUGEO double or single U-bend, consisting of RAUGEO pipe reinforced with a polyester resin casing



NSF International
Special Engineered Specification
NSF SE 1091

**10.1mm SDR 11 PEX
Tubing**





**SPECIFICATIONS FOR A SPECIAL ENGINEERED (SE) PRODUCT
NSF SE 1091
10.1mm SDR 11 PEX Tubing**

1. Purpose:

This Special Engineered Specification addresses the performance of Crosslinked PE (PEX) tubing, which has been designated for use in potable water or radiant floor heating applications.

2. Scope of Specification:

This document addresses testing, marking, in-plant QC and the Listing format requirements for the specified product. This specification covers PEX tubing in metric dimensional sizes from 10.1 mm OD size in an SDR of 11.

3. Application:

This tubing has been evaluated for use in potable water or radiant heating applications.

4. Referenced Standards:

ASTM Standards:

- ASTM D618 – Practice for Conditioning Plastics for Testing
- ASTM D792 – Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement
- ASTM D1505 – Test Method for Density of Plastics by the Density Gradient Technique
- ASTM D1598 – Test Method for Time-to-Failure of Plastic Pipe Under Constant Internal Pressure
- ASTM D1599 – Test Method for Resistance to Short-Time Hydraulic Pressure of Plastic Pipe, Tubing, and Fittings
- ASTM D1600 – Terminology for Abbreviated Terms Relating to Plastics
- ASTM D1898 – Practice for Sampling Plastics
- ASTM D2122 – Test Method for Determining Dimensions of Thermoplastic Pipe and Fittings
- ASTM D2765 – Test Methods for Determination of Gel Content and Swell Ratio of Crosslinked Ethylene Plastics
- ASTM D2837 – Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials
- ASTM D3895 – Test Method for Oxidative-Induction Time of Polyolefin's by Differential Scanning Calorimetry
- ASTM F412 – Terminology Relating to Plastic Piping Systems
- ASTM F493 – Standard Specification for Solvent Cements for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe and Fittings
- ASTM F876 – Standard Specification for Crosslinked Polyethylene (PEX) Tubing
- ASTM F877 – Standard Specification for Crosslinked Polyethylene (PEX) Plastic Hot and Cold Water Distribution Systems
- ASTM F2023 – Test Method for Evaluating the Oxidative Resistance of Crosslinked Polyethylene (PEX) Tubing and Systems to Hot Chlorinated Water

NSF Standards:

- NSF/ANSI Standard 14 – Plastic Piping System Components and Related Materials
- NSF/ANSI Standard 61 – Drinking Water Systems Components – Health Effects

5.0 – Testing Requirements:

Material Designation Code Cells

DR/SDR	Rated Temperature		Hydrostatic Design Stress		Pressure Rating for Water	
	°F	°C	psi	MPa	Psig	MPa
DR 11	73.4	23	630	4.34	125	0.86
	180	82.2	400	2.76	80	0.55
	200	93.3	315	2.17	60	0.41

5.1 – Dimensional Requirements – Tubing certified against the requirements of this document shall meet the dimensional specifications detailed in Table 1 for solid wall PEX tubing and Table 2 for Barrier PEX tubing.



Table 1

Dimensional Data for SDR 11 PEX – Base Pipe									
Nominal Pipe Size		Average Outside Diameter		Tolerances for Average Outside Diameter		Wall Thickness		Tolerances for Wall Thickness	
in.	mm	in.	mm	in.	mm	in.	mm	in.	mm.
0.375	10.1	0.394	10.0	+0.011	+0.3	0.039	1.0	+0.020	+0.5
				-0.000	-0.0			-0.000	-0.0

Table 2

Dimensional Data for SDR 11 PEX – Pipe with EVOH Layer									
Nominal Pipe Size		Average Outside Diameter		Tolerances for Average Outside Diameter		Wall Thickness		Tolerances for Wall Thickness	
in.	mm	in.	mm	in.	mm	in.	mm	in.	mm.
0.375	10.1	0.406	10.3	+0.011	+0.3	0.045	1.15	+0.020	+0.5
				-0.006	-0.15			-0.003	-0.075

5.2 – Degree of Cross-linking (Percent Gel Content) – PEX tubing produced against these specifications shall meet the minimum percent gel content as defined in ASTM F876 Section 6.8 and 7.9

5.3 – Density – PEX tubing produced against these specifications shall meet the density requirements of ASTM F876 Section 6.4 and 7.5

5.4 – Hydrostatic Sustained Pressure Test – PEX tubing produced against these specifications shall meet or exceed the requirements given in ASTM F876 Section 6.5 and 7.6 and Table 3 of this document when tested for 73°, 180°, and 200° F.

Table 3 Minimum Hydrostatic Sustained Pressure Requirements for PEX

Nominal Size		Pressure Required for Test, psi (MPa)					
mm	in	73.4°F (23°C)	180°F (82.2°C)	200°F (93.3°C)			
10.1	(3/8)	300 (2.08)	180 (1.24)	150 (1.04)			

5.5 – Hydrostatic Burst Pressure Test – PEX tubing produced against these specifications shall meet or exceed the requirements given in ASTM F876 Section 6.6 and 7.7 and Table 4 of this document when tested for 73°, 180°, and 200° F.

Table 4 Burst Pressure Requirements for Water at Different Temperatures for PEX Pipe

Nominal Size		Minimum Burst Pressures at Different Temperatures, psi (MPa)					
mm	in	73.4°F (23°C)	180°F (82.2°C)	200°F (93.3°C)			
10.1	(3/8)	445 (3.05)	200 (1.37)	170 (1.16)			

5.6 – ESCR (Environmental Stress Crack Resistance) – PEX tubing produced against these requirements shall meet the ESCR requirements as identified in ASTM F876 Section 6.7, 7.8, and table 3 of this document for 100 hours.

5.7 – Bent Tube Hydrostatic Sustained Pressure Strength– PEX tubing produced against this specification shall meet the Bent Tubing requirements as identified in ASTM F876 Section 6.12, 7.12, and Table 3 of this document.

5.8 – Stabilizer Functionality – PEX tubing produced against this specification shall meet the Stabilizer Functionality requirements as identified in ASTM F876 Section 6.9 and 7.10.



5.9 – Thermocyclic – PEX tubing produced against this specification shall meet the Thermocyclic requirements as identified in ASTM F877 Section 6.6 and 7.5.

5.10 – Excessive Temperature – PEX tubing produced against this specification shall meet the Excessive Temperature requirements as identified in ASTM F876 Section 6.13 and 7.12

5.11 – Oxidative Stability in Potable Chlorinated Water Applications – PEX tubing produced against this specification and intended for use with in Potable Water applications shall meet the requirements as identified in ASTM F876 Section 6.10 and 7.11.

6.0 – Material Requirements

6.1 – PEX tubing produced against this specification and is intended for use in potable water system shall meet the applicable sections of NSF/ANSI Standard 61.

6.2 – PEX tubing produced against this specification shall meet the requirements of ASTM F877 Appendix X.1 Hydrostatic Design Stress

7.0 – Marking Requirements (Content of Marking)

7.1 – Product marking shall be applied in such a manner that it remains legible under normal handling and installation conditions.

7.2 – The Following minimal information shall be placed upon the tubing in no less than 5' intervals:

- Nominal pipe size
- SDR 11
- Material designation as defined by ASTM F876 Section 3.2.7
- Pressure rating and temperature
- Manufacturer's Name and / or trademark
- Code to identify date and material used in production of tubing
- NSF rfh SE 'or' NSF pw SE

8.0 – In-Plant Quality Control Testing

Test	Frequency
Bent tube hydrostatic sustained pressure (hot and cold)	Annually
Burst pressure ¹	24 h
Degree of crosslinking	Weekly
Dimensions	
Pipe OD or ID	2 h
Pipe wall thickness	2 h
Environmental stress crack resistance	Annually
Excessive temperature and pressure capability of tubing and pipe	Annually
Sustained pressure	Annually
¹ If one material is continuously used in several machines or sizes, then when a steady-state operation is obtained on each machine, sample selection shall be from a different extruder each day and rotated in sequence among all machines or sizes.	

ICC-ES PMG Listing

PMG-1013

Effective date: January 1, 2013

This listing is subject to re-examination in one year.

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CSI: DIVISION: 22 00 00—PLUMBING
Section: 22 11 16—Domestic Water Piping
DIVISION: 23 00 00—HEATING, VENTILATING AND AIR CONDITIONING (HVAC)
Section: 23 21 13—Hydronic Piping

Product certification system:

The ICC-ES product certification system includes testing samples taken from the market or supplier's stock, or a combination of both, to verify compliance with applicable codes and standards. The system also involves factory inspections, and assessment and surveillance of the supplier's quality system.

Products: REHAU RAUPEX, UV-SHIELD, MUNICIPEX, and O₂ Barrier Tube and Fittings

Listee: REHAU Construction LLC
1501 Edwards Ferry Road
Leesburg, Virginia 20176
www.rehau.com

Compliance with the following codes:

2012 and 2009 *International Plumbing Code*® (IPC)
2012 and 2009 *International Residential Code*® (IRC)
2012 and 2009 *International Mechanical Code*® (IMC)
2012 and 2009 *Uniform Plumbing Code*® (UPC)*
2012 and 2009 *Uniform Mechanical Code*® (UMC)*

*UPC and UMC are copyrighted publications of International Association of Plumbing and Mechanical Officials.

Compliance with the following standards:

ASTM F876-2010, Specification for Cross-linked Polyethylene (PEX) Tubing
ASTM F877-2011, Specification for Cross-linked Polyethylene (PEX) Plastic Hot and Cold Water Distribution Systems
NSF 14-2011, Plastic Piping System Components and Related Materials
NSF 61-2012, Drinking Water System Components – Health Effects
ICC-ES LC1004-2009 (Editorially revised June 2010), PMG Criteria for PEX, PEX-AL-PEX and PP-AL-PP Piping, Tubing and Fittings Used in Radiant Heating and Water Supply Systems

Identification:

Tubing: The tubing is marked every 3 feet (914 mm) with the following: REHAU company name, product designation (REHAU RAUPEX, MUNICIPEX, RAUPEX UV-Shield or RAUPEX O₂ BARRIER), nominal tube size, material designation (PEX 3006 or PEX 3306), potable water designation (PW), standard dimension ratio (SDR9), temperature and pressure ratings,

Listings are not to be construed as representing aesthetics or any other attributes not specifically addressed, nor are they to be construed as an endorsement of the subject of the listing or a recommendation for its use. There is no warranty by ICC Evaluation Service, LLC, express or implied, as to any finding or other matter in this listing, or as to any product covered by the listing.



ASTM F876 / F 877 designation, production code, the name of the inspection agency (NSF International AA-633), and the ICC-ES PMG listing mark.

Fittings: REHAU fittings are marked with the following: REHAU name, nominal diameter, letter designation of fitting manufacturer, logo of the inspection agency (NSF International), and the ICC-ES PMG listing mark.

Installation:

REHAU tubing and fittings must be installed in accordance with the manufacturer's published installation instructions, the applicable codes and this listing.

Water Distribution: Horizontally-laid pipe must be secured in such a manner that temperature-induced expansion and contraction are accommodated. In jurisdictions enforcing the IAPMO UPC, PEX tubing must not be installed within the first 18 inches (457 mm) of piping connected to a water heater.

Inspection of Water Distribution Tubing: Installed piping must be pressure-tested and inspected as required by IPC Section 312, IRC Section P2503.7 or IAPMO UPC Sections 103.5 and 609.4.

 **Radiant Heating Systems:** The tubing must be pressure-tested for leaks before installation of the cover, as noted in IRC Section M2103.4, IMC Section 1208 or IAPMO UMC Section 1207, as applicable. The leak test must be witnessed by the code official.

Clearance from heat-producing equipment must be in accordance with IFGC Section 503.7.8, IRC Section M1306 or IAPMO UMC Section 802.10.5, as applicable.

Models:

Tubing: REHAU tubing products are manufactured from cross linked polyethylene (PEX) materials.

RAUPEX tube is white.

O₂ Barrier is similar to RAUPEX but has an added red-colored oxygen barrier coating.

RAUPEX UV SHIELD and MUNICIPEX are similar to RAUPEX but have an added white-, red- or blue-colored polyethylene coating.

The tube is available in $\frac{3}{8}$ -, $\frac{1}{2}$ -, $\frac{5}{8}$ -, $\frac{3}{4}$ -, 1-, $1\frac{1}{4}$ -, $1\frac{1}{2}$ - and 2-inch (10, 13, 16, 19, 25, 32, 38 and 51 mm) nominal diameter sizes, and in coils 100, 300, 500 and 1000 feet (30.4, 91.4, 152.4 and 304.8 m) long, or in straight lengths 20 feet (6.2 m) long. REHAU tube and fitting products are pressure-rated for 100 psi (689 kPa) at 180° F (82° C), and 160 psi (1100 kPa) at 73° F (23° C), for a standard dimension ratio of 9. Standard dimension ratio is the ratio of outside diameter to wall thickness and is constant for all REHAU tube sizes.

Fittings:

Two REHAU brass compression fitting types are utilized: compression sleeve fittings and compression nut fittings.

The permanent compression sleeve fittings, identified as EVERLOC, are used to join tubes for couplings, elbows, tees and adapters, and consist of fittings and sleeves. The compression sleeve fitting requires proprietary equipment for installation.

Compression nut fittings are used for adapters and to connect tubing to manifolds, and consist of an insert, a split brass compression ring and a compression nut.

When used with RAUPEX tubing and when installed in accordance with this listing, the REHAU compression fittings described above comply with ASTM F877. The compression fittings are illustrated in Figure 1.

Conditions of Listing:

1. Details on the design and installation of the heating system must be submitted to the code official for approval.
2. During placement of cover over the tubing, the tube must be maintained at the greater of 1½ times the working pressure or 100 psi (689.4 kPa).
3. The tubing installation must be pressure-tested for leaks in the presence of the code official or the code official's designated representative.
4. When installation is in fire-resistance-rated assemblies, evidence of compliance with IBC Section 713 (penetrations), UBC Section 709 (walls and partitions) or UBC Section 710 (floor/ceiling or roof/ceiling), as applicable, must be provided to the code official.
5. The potable water connections must be protected against backflow from the hydronic heating system.
6. The tubing must not be used as a source of electrical ground.
7. The minimum cold bending radius is six times the outside tube diameter for cold-bent tube and three times the outside diameter for hot-bent tube. The outside diameter is the nominal diameter plus 1/8 inch (3.2 mm).
8. The tubing serving as a component of radiant systems is limited to applications using potable water as the transfer fluid.
9. When the system is embedded in concrete, tubing must be covered a minimum of 3/4 inch (19.1 mm) and installation must comply with IBC Section 1906.3 or UBC Section 1906.3, as applicable.
10. REHAU tubing and fittings must be protected from exposure to direct sunlight. Tubing and fittings must be protected from physical damage with an oversized flexible corrugated sleeve at structural mass penetrations and when the tube is uncovered. Annular spaces between sleeves and pipes must be filled or tightly caulked in an approved manner.
11. The tubing is manufactured by REHAU in Viechtach, Germany and Cullman, Alabama. The fittings are manufactured for REHAU in Frankfort, Illinois, under a quality control program with inspections by NSF International (AA-633).

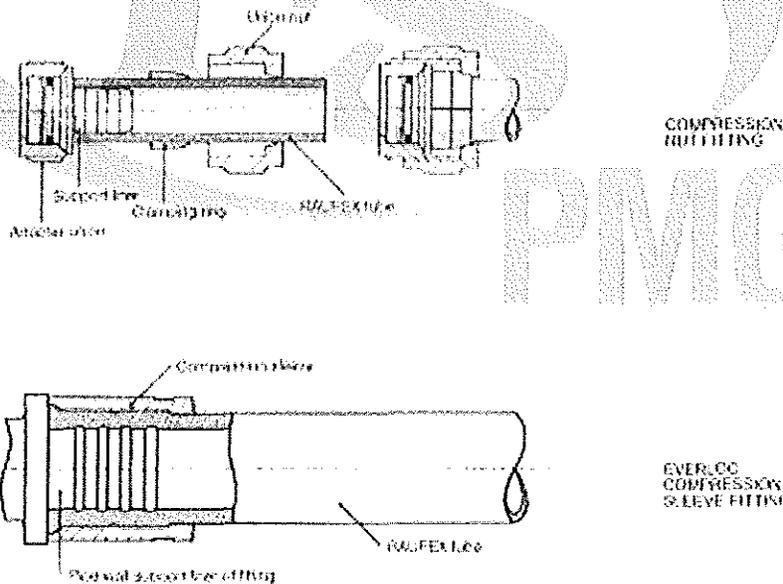


FIGURE 1—REHAU FITTINGS

Registration Number 3V356 PE-Xa

Certificate / Registration Holder:	<p>REHAU AG + Co Ytterbium 4 91058 Erlangen - Eltersdorf Germany</p> <p>Phone: +499283770 Fax: +499131771430</p>	
Product:	Plastic piping systems for warm water floor heating systems and radiator connecting	
Type / Model:	RAUPEX O2 Barrier 10 ✓	
Testing Basis:	<p>DIN 4726:2008-10 DIN EN ISO 15875-5:2004-03 DIN EN ISO 15875-3:2004-03 DIN EN ISO 15875-2:2004-03 Certification scheme plastic piping systems for warm water floorheating systems and radiator connecting (as of 2011-06)</p>	
Mark of Conformity:		
Registration Number:	3V356 PE-Xa	
Valid until:	<div style="border: 1px solid black; border-radius: 50%; padding: 5px; display: inline-block;">2018-04-30</div>	
Technical Data:	<p>Pipe:</p> <ul style="list-style-type: none"> - Production plant: 2424 Industrial Drive S. W. CULLMAN, AL 35055 - Material designation: PE-Xa - Nominal-outside diameter x nominal thickness: 10,1 x 1,1 mm - Application class and operating pressure: Class 5 / 6 bar <p>Fitting/Connector:</p> <ul style="list-style-type: none"> - Name of the manufacturer: Rehau AG + Co - Production plant: 07819 Triptis - Type of fitting: Schiebehülsenverbinder - Material designation: Metall - Type designation: - Article number: 	

Section 23 83 16
Radiant-Heating Hydronic Piping
(REHAU Radiant Heating Systems)

This draft specification is for hydronic radiant heating systems using PEXa pipe. REHAU supplies these systems under the name REHAU Radiant Heating Systems.

This draft specification is provided only as an aid in architect's/engineer's development of the final specification and is not intended as a substitute for sound architectural/engineering judgment. The architect/engineer shall be responsible to convert this draft specification into a final specification that meets the functional and aesthetic needs of his/her client, as well as to comply with all applicable codes.

Part 1 - General

1.01 Summary

- A. Radiant heating systems, where shown on the Drawings and Schedules, shall be hydronic, and shall include the following:
 - 1. Crosslinked polyethylene (PEXa) piping.
 - 2. Distribution manifold(s) with balancing and flow control valves where required.
 - 3. Pipe-to-manifold compression nut fittings.
 - 4. Cold-expansion and compression-sleeve fittings.
 - 5. Pipe fasteners as approved by the manufacturer of the PEXa piping.
 - 6. Controls.
 - 7. Supervision and field engineering required for the complete and proper function of the system.

1.02 Related Sections

- A. Section 23 01 00 – Operation and Maintenance of HVAC Systems
- B. Section 23 21 00 – Hydronic Piping and Pumps
- C. Section 23 52 00 – Heating Boilers
- D.

1.03 References

- A. Publications listed here are part of this specification to the extent they are referenced. Where no specific edition of the standard or publication is identified, the current edition shall apply.
- B. ASTM – American Society for Testing and Materials
 - 1. ASTM E84, Standard Test Method for Surface Burning Characteristics of Building Materials
 - 2. ASTM F876, Standard Specification for Crosslinked Polyethylene (PEX) Tubing
 - 3. ASTM F877, Standard Specification for Crosslinked Polyethylene (PEX) Plastic Hot- and Cold-Water Distribution Systems
 - 4. ASTM F2080, Standard Specification for Cold-Expansion Fittings With Metal Compression-Sleeves for CrossLinked Polyethylene (PEX) Pipe
- C. CSA – Canadian Standards Association
 - 1. CSA B137.5, Crosslinked Polyethylene (PEX) Tubing Systems for Pressure Applications
 - 2. CSA B214, Installation Code for Hydronic Heating Systems
- D. DIN – German Institute for Standardization (Deutsches Institut für Normung)

1. DIN 4726, Plastic Piping Used in Warm Water Floor Heating (Warmwasser-Fußbodenheizungen und Heizkörperanbindungen - Rohrleitungen aus Kunststoffen)
- E. IAPMO – International Association of Plumbing and Mechanical Officials
- F. ICC – International Code Council
 1. ICC-ES PMG 1013
- G. ISO – International Organization for Standardization
 1. ISO 9001, Quality Management Systems – Requirements
- H. ULC – Underwriters' Laboratories of Canada
 1. CAN/ULC S102.2, Surface Burning Characteristics of Flooring, Floor Covering and Miscellaneous Materials
 2. CAN/ULC S101, Standard Methods of Fire Endurance Tests of Building Construction and Materials
- I. PPI – Plastic Pipe Institute
 1. PPI TR-3 / 2007, Policies and Procedures for Developing Hydrostatic Design Basis (HDB), Pressure Design Basis (PDB), Strength Design Basis (SDB), and Minimum Required Strength (MRS) Ratings for Thermoplastic Piping Materials or Pipe

1.04 Definitions

- A. Crosslinked polyethylene, commonly abbreviated PEX, is made from high density polyethylene (HDPE). Crosslinking is accomplished during manufacturing. Crosslinking enhances the physical & mechanical properties of the polymer. The high-temperature properties are improved. Chemical resistance is enhanced by resisting dissolution. Low temperature properties are also improved; its impact and tensile strength, scratch resistance, and resistance to brittle fracture are enhanced. The required degree of crosslinking, according to ASTM Standard F876, is between 70-89%. This specification requires PEX to be designated as PEXa and be manufactured by the high-pressure peroxide method.

1.05 Submittals

- A. Comply with Section 01 33 00, Submittal Procedures. Approval and/or acceptance of all submittals is required prior to fabrication.
- B. Product Data: Submit manufacturer's Technical Manual, submittal forms, catalog cuts, brochures, specifications, and installation instructions. Submit data in sufficient detail to indicate compliance with the contract documents.
 1. Submit manufacturer's instructions for installation.
 2. Submit data for equipment, fittings, fasteners and associated items necessary for the installation of the piping and manifolds.
- C. Submit computer-generated radiant heating system design indicating heat flux, pipe sizing, spacing, flow rates and temperatures. Design calculations shall be performed on pipe manufacturer's software or equivalent.
- D. Drawings: Provide plans drawn to scale for all installation areas.
 1. Indicate dimensions, descriptions of materials, general construction, component connections, anchorage methods and installation procedures.
 2. Indicate design, schematic layout of system, including equipment, critical dimensions and piping/slab penetration details as well as details for protecting exposed PEX piping.
- E. Certification
 1. Submit independent certification results for the piping systems from an accredited independent testing laboratory.

2. The design shall be approved by a professional appropriately licensed in the jurisdiction where the installation will take place, as being complete and accurate.
 3. Fittings shall be third-party certified to applicable referenced standards as part of the manufacturer's PEX piping system, with independent listings from NSF, CSA and ICC, as applicable.
 4. Fittings embedded within the thermal mass or encased behind walls or ceilings shall be certified to ASTM F2080.
- F. Maintenance Instructions: Submit product instructions for any maintenance required or recommended by manufacturer.

1.06 Quality Assurance

- A. Comply with Section 01 43 00, Quality Assurance.
- B. Manufacturer: Must be a company specializing in the Work of this Section with a minimum of 10 years documented experience.
- C. Pipe shall be manufactured in a facility whose quality management system is ISO 9001 certified.
- D. Crosslinked polyethylene (PEXa) pipe shall conform and be certified to ASTM F876, F877 and CSA B137.5, and shall have the PPI TR-3 listing. Pipes with an oxygen diffusion barrier shall conform to the requirements for oxygen permeability DIN 4726.

1.07 Delivery, Storage, and Handling

- A. Comply with Section 01 60 00, Product Requirements.
- B. Deliver and store piping and equipment in shipping containers with labeling in place.
 1. Pipe shall be kept in original shipping boxes until required for installation.
- C. Store piping and equipment in a safe place, dry, enclosed, under cover, in a well-ventilated area.
 1. Do not expose pipe to ultraviolet light beyond exposure limits recommended by manufacturer.
 2. Protect piping and manifolds from entry of contaminating materials. Install suitable plugs in open pipe ends until installation.
 3. Where possible, connect pipes to assembled manifolds to eliminate possibility of contaminants and cross-connections.
 4. Piping shall not be dragged across the ground or other surfaces, and shall be stored on a flat surface with no sharp edges.
- D. Protect materials from damage by other trades.
- E. Pipe shall be protected from oil, grease, paint, direct sunlight and other elements as recommended by manufacturer.

1.08 Warranty

- A. Provide manufacturer's standard written warranty.
 1. To repairing or replacing the defective product in question or providing a refund of the defective product's purchase price.
 2. The radiant heating pipe manufacturer shall warrant the crosslinked polyethylene piping to be free from defects in material and workmanship for a period of twenty-five (25) years.
 3. Cold-expansion compression-sleeve fittings shall be warranted to be free from defects in material and workmanship for a period of twenty-five (25) years.
 4. All manifolds, distribution headers, thermostats and actuators shall be warranted to be free from defects in material and workmanship for a period of one (1) year starting at completion of successful pressurized water tests immediately following system installation.
- B. Provide installer's guarantee as appropriate.

Part 2 - Products

2.01 Acceptable Manufacturer

- A. REHAU Construction LLC, 1501 Edwards Ferry Road, NE; Leesburg, VA 20176; email: rehaus.mailbox@rehau.com; website: www.na.rehau.com; upon whose products and equipment these specifications are based.
- B. No Substitutions allowed.

2.02 Piping

- A. All radiant heating pipe shall be high-density crosslinked polyethylene manufactured using the high-pressure peroxide method of crosslinking (PEXa). Pipe shall conform to ASTM F876, ASTM F877 and CSA B137.5.
- B. Pipe shall be rated for continuous operation of 100 psi gauge pressure at 180°F temperature (690 kPa @ 82°C), and 80 psi gauge pressure at 200°F temperature (550 kPa @ 93°C).
- C. When required, pipe shall have a co-extruded oxygen diffusion barrier capable of limiting oxygen diffusion through the pipe to less than 0.32 mg/(m²/d) @ 104°F (40°C) water temperature, in accordance with DIN 4726.
- D. Bend Radius
 - 1. The minimum bend radius for cold bending of the pipe shall be not less than five (5) times the outside diameter.
 - 2. Bends with a radius less than this shall require the use of a bending template as supplied by the pipe manufacturer, and/or hot air.
- E. Compliant to the following standards:
 - 1. ANSI/UL 263 through certification listings with Underwriters Laboratories, Inc. (UL).
 - a. UL Design No. L588— 1 hour wood frame floor/ceiling assemblies
 - b. UL Design No. K917 — 2 hour concrete floor/ceiling assemblies
 - c. UL Design No. U383 — 1 hour wood stud/gypsum wallboard wall assemblies
 - d. UL Design No. V461 — 1 hour steel stud/gypsum wallboard wall assemblies
- F. Pipe to have a Flame Spread Index and a Smoke Developed Index listing to ASTM E84 (in U.S.) or CAN/ULC S102.2 (in Canada).

2.03 Fittings

- A. Fittings shall be third-party certified to applicable standards ASTM F877, ASTM F2080 and CSA B137.5 as part of the manufacturer's PEX piping system, with independent listings from NSF, CSA and ICC, as applicable.
- B. Compression nut manifold fittings shall be manufactured of brass with a barbed insert and a reusable split compression ring.
- C. Compression-sleeve fittings shall be manufactured of brass and shall be approved by the piping manufacturer to be part of a proven cataloged system.
- D. Fittings embedded within the thermal mass or encased behind walls or ceilings shall be cold-expansion compression-sleeve fittings certified to ASTM F2080. Where required by the manufacturer, fittings shall be protected from external environmental conditions.

2.04 Manifolds

- A. Material: Distribution manifolds shall be manufactured of brass or copper and be supplied by the piping manufacturer as a proven cataloged part of the manufacturer's system.

- B. Brass manifolds shall be produced from extruded brass round pipe with tapped holes for connections, and be pre-assembled by the manufacturer. 100% of manifolds used shall have been air tested by the manufacturer with no indication of leaks.
- C. Balancing Manifolds
 - 1. Where required by design, brass balancing manifolds shall be equipped with integral visual flow gauges, circuit balancing and flow control valves, isolation valves with integral thermometer housings, and air vent/fill ports.
 - 2. Each circuit valve shall be supplied with a manual actuating handle for filling/purging operation.
- D. Copper Manifolds
 - 1. Copper manifolds shall be manufactured from Type L copper.
 - 2. Copper and/or brass outlets shall be high-temperature brazed (lead-free) into headers.
 - 3. Outlets in copper headers shall be made using the T-drill process according to ASTM F2014.

2.05 Controls

- A. Room thermostats shall be low-voltage devices with electronic temperature sensing, and shall be supplied by the pipe manufacturer as part of a proven cataloged system.
- B. Circuit actuators shall be low-voltage thermo-electric design for actuation of valves on manifold with visual indication of position, and built-in end switches, and shall be supplied by the pipe manufacturer as part of a proven cataloged system.
- C. Note to Specifier: There are several control strategies that may apply to your specific project. You should consider your requirements and add control specifications to this section as required. Electronic Weather Compensating Mixing controls are recommended, as these match water supply temperature to heat loss, based on outdoor air temperature. Your local REHAU Technical Associate or regional Sales Office can assist with design and specification of a control system. Please be aware of the need, in some cases, to regulate the supply water temperature to the radiant heating system so as not to exceed limits of flooring materials.

Part 3 - Execution

3.01 Acceptable Installers

- A. As a minimum, installation shall be performed by qualified laborers trained by the manufacturer in the procedures of PEX radiant heating systems and appropriately licensed for the jurisdiction where the installation will take place.

3.02 Examination

- A. Examine areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of Work. Do not proceed until unsatisfactory conditions are corrected.
- B. Beginning of installation means acceptance of existing conditions.

3.03 Preparation

- A. Coordinate with related trades and manufacturer's recommendations with regard to installation in conjunction with:
 - 1. Reinforcing wire mesh or rebar.
 - 2. Preparation of space for manifold installation.
- B. Prepare the installation site as appropriate:

1. For Concrete Slab-on-Grade: Sub-grade should be compacted, flat and smooth to prevent damage to pipe or insulation. Approved vapor barrier material should be installed. Approved thermal insulation, according to the design, shall be installed. Reinforcing wire mesh, if required by structural design, must be flat and level, with all sharp ends pointing down. Finished grade of the thermal mass must be a minimum of 3/4 in (19 mm) above the top of PEX heating pipes.
 2. For Wood Sub-floor: Sub-floor must be structurally sound, clean and free from all construction debris which could potentially damage the pipe. Replace any areas that appear weak. To facilitate installation of pipe, remove all unnecessary studwall baseplates in doorways and other areas. Treat the wood sub-floor with a sealant in accordance with the specifications set forth by the screed installation section, or use pressure-treated wood, as per local code requirements. Finished grade of the thermal mass overpour must be a minimum of 3/4 in (19 mm) above the top of PEX heating pipes.
 3. For Precast Concrete Sub-floor: Sub-floor must be clean and free from all construction debris which could potentially damage the pipe. Finished grade of the thermal mass overpour must be a minimum of 3/4 in (19 mm) above the top of PEX heating pipes.
- C. Preparation of wall cavity for manifold installation: See drawings to determine the width of the wall cabinet (if required) and required wall opening dimensions. Mount the manifold cabinet allowing space for the screed to fill up the front of the pipe opening. If a cabinet is not used, prepare a suitable cavity for the manifold, with a secure mounting plate that will secure the manifold at least 30 in (75 cm) above floor level. Manifold must be installed in an area that will allow easy access for supply/return piping as well as future access maintenance.

3.04 Installation

- A. Install in accordance with manufacturer's published installation manual and/or published guidelines and final drawings.
- B. Mount manifolds in the locations previously prepared or in previously installed cabinets, if used. Manifolds shall be mounted as level as possible.
- C. Route piping in an orderly manner, according to layout and spacing shown in final drawings. All installation notes shown on the drawings shall be followed.
- D. At connections and fittings, use a plastic pipe cutter to ensure square and clean cuts, and join pipes immediately or cap ends of pipe to seal from contaminants. Where fittings are installed within the thermal mass, they shall be wrapped in non-adhesive waterproof silicone tape or sealed within a heat-shrink material approved by the manufacturer.
- E. Pipe shall be dispensed using a suitable uncoiling device. Remove twists prior to securing pipe. Pipe shall lie flat on an even plane. Finished grade of a thermal mass shall be a minimum of 3/4 in (19 mm) above the top of PEX heating pipes. Fasten piping at no more than 3 ft (90 cm) intervals, being careful not to twist the pipe. In thin concrete slabs, secure piping every 2 ft (60 cm). Use only fasteners supplied or approved by the manufacturer of the PEX pipe.
- F. Piping that passes through expansion joints shall be covered in protective polyethylene corrugated sleeving (flexible conduit) extending 15 in (38 cm) on each side of the joint. Sleeving shall be secured on pipe to prevent movement during installation of thermal mass.
- G. Where piping exits the thermal mass, a protective conduit shall be placed around the pipe, with the conduit extending a minimum of 6 in (15 cm) into the floor and exiting by a minimum of 6 in (15 cm). For penetrations at manifolds, use rigid PVC bend guides secured in place to prevent movement.
- H. At the time of installation of each circuit of pipe, connect the pipe to the correct manifold outlet and record pipe length for balancing. If manifold is not installed, cap the end of the pipe and label the pipe's circuit numbers along with S for supply and R for return. Connect pipes to manifold as soon

as possible and record circuit lengths. All circuits shall be labeled to indicate circuit length and serviced area.

- I. The following precautions shall be taken in areas intended for carpet:
 - 1. Notify carpet installer that radiant heating pipes have been installed.
 - 2. Keep pipes 6 in (15 cm) from all wall baseplates.
 - 3. Install metal guards where pipe will pass through wall baseplates and where carpet tack strips will be installed.
- J. The following precautions shall be taken in areas intended for hardwood flooring:
 - 1. Ensure that nailing areas for hardwood flooring, if nailing is required, are clearly marked and known for hardwood installers.
- K. If the radiant heating system substrate material (thermal mass) requires curing and/or has other limitations which can be influenced by the radiant heating system while in operation, then the radiant heating system shall not be put into operation until such time that the substrate material has fully cured or set according to the material requirements of the substrate manufacturer.
- L. The installer shall confirm minimum and maximum exposure temperatures for the substrate material (thermal mass) and shall ensure proper radiant heating operating temperatures.

3.05 Field Quality Control

- A. Filling, Testing & Balancing: Tests of hydronic heating systems shall comply with authorities having jurisdiction, and, where required, shall be witnessed by the building official.
- B. Pressure gauges used in testing and balancing shall show pressure increments of 1 psig and shall be located at or near the lowest points in the distribution system.
- C. Air Test
 - 1. Charge the completed, yet unconcealed pipes with air at a minimum of 40 psig.
 - 2. Do not exceed 150 psig.
 - 3. Use liquid gas detector or soap solution to check for leakage at manifold connections.
- D. Water Test
 - 1. Purge air from pipes.
 - 2. Charge the completed, yet unconcealed pipes with water.
 - 3. Take necessary precautions to prevent water from freezing.
 - 4. Check the system for leakage, especially at all pipe joints.
- E. Perform a preliminary pressure test pressurizing the system to the greater of 1.5 times the maximum operating pressure or 100 psig for 30 minutes.
 - 1. As the piping expands, restore pressure, first at 10 minutes into the test and again at 20 minutes.
 - 2. At the end of the 30-minute preliminary test, pressure shall not fall by more than 8 psig from the maximum, and there shall be no leakage.
- F. After successfully performing the preliminary pressure test, perform the main pressure test immediately.
 - 1. The test pressure shall be restored and continued as the main test for 2 hours.
 - 2. The main test pressure shall not fall more than 3 psig after 2 hours.
 - 3. No leakage shall be detected.
- G. Pressure shall be maintained and monitored during installation of the thermal mass.
 - 1. If any leak is detected during installation of thermal mass, leak shall be found immediately and the area cleared for repair using manufacturer's approved repair coupling.
 - 2. Retest before covering repair.

- H. Complete inspection and furnish test reports supplied by the manufacturer of the system.
 - I. All low-voltage equipment shall be tested. The following 3 items should be checked as a minimum:
 - 1. Inputs
 - 2. Outputs
 - 3. Sequence of Operations
- 3.06 Cleaning
- A. Clean exposed surfaces upon completion of installation using clean, damp cloth. No cleaning agents are allowed.
 - B. Comply with manufacturer's recommendations.
- 3.07 Protection
- A. Protect installation throughout construction process until date of final completion.
 - B. Replace components that cannot be repaired.

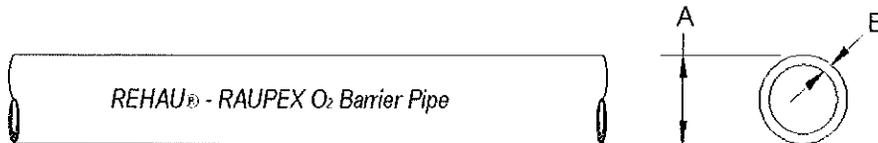
END OF SECTION



PRODUCT SUBMITTAL 104

Product: RAUPEX[®] O₂ Barrier Pipe, SDR 11

Date: 30 April 2013



Article No.	Nominal Size mm	Average O.D. (A) in (mm)	Minimum Wall Thickness (B) in (mm)	Weight lb/ft (kg/m)	Capacity gal/ft (l/m)	Bend Radius in (mm)
136549	10.1	0.415 (10.55)	0.047 (1.20)	0.03 (0.04)	0.0039 (0.049)	2.0 (50)

TECHNICAL DESCRIPTION

Specification	English	SI	Standard
Minimum Density	58 lb/ft ³	926 kg/m ³	ASTM F876
Minimum Degree of Crosslinking	70%	70%	ASTM F876
Max. Thermal Conductivity	2.84 Btu in/(ft ² °F hr)	0.41 w/(m ² K)	DIN 16892
Coefficient of Linear Expansion	1.00x10 ⁻³ in/ft°F @ 68°F 1.33x10 ⁻³ in/ft°F @ 212°F	0.15 mm/(m°C) @ 20°C 0.2 mm/(m°C) @ 100°C	Mean @ 20- 70°C per DIN 16892
IZOD Impact Resistance	No Break	No Break	--

Specification	English	SI	Standard
Modulus of Elasticity	87,000- 130,500 psi @68°F 43,500- 58,000 psi @ 176°F	600- 900 N/mm ² @ 20°C 300- 400 N/mm ² @ 80°C	Minimum @ 20°C per DIN 16892
O ₂ Permeability	--	<=0.32 mg/m ² /day @ 40°C	DIN 4726
Roughness	0.00028 in.	0.007 mm	--
Max. Short-term Temperature Exposure	150 psig @ 210°F (48 hr) 212°F at 100 hrs at 87 psi	1035 kPa @ 99°C (48 hr) 100°C at 100 hrs at 600 kPa	ASTM F876 ISO 15875
Maximum UV Exposure	15 days	15 days	--

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REHAU SIGNIERVORSCHRIFT / MARKING INSTRUCTION

FÜR / FOR RAUPEX O₂ BARRIER

STAND / ISSUE REV D – ERSATZ FÜR AUSGABE VOM / REPLACES ISSUE FROM 2012-11-28



Unlimited Polymer Solutions

Ersteller / Editor: Mr. Nickelson lee 2269 Datum / Date: 2013-07-11
 Prüfer / Revisor: Mr. Bittenbender lee 2289 Datum / Date: 2013-07-11

Size	Article	Printline of RAUPEX O ₂ Barrier (10mm) plant culm only – black printline color
10 mm	136549	"000ft" RAUPEX O ₂ BARRIER 10,1 x 1,1 mm 136549 PEX-a SDR 11 NSF rfh SE <small>Oxygen Barrier According To</small> DIN 4726 Design Pressure acc. EN ISO 15875 Class 5/6bar DIN 16892 3V356 PE-Xa 125psi/73.4°F 80psi/180°F Made in USA "mm.dd.yy" "24h" "M00" www.na.rehau.com

Size	Article	Printline of RAUPEX O ₂ Barrier plant culm & vie05– black printline color
3/8"	136008	"000ft" RAUPEX O ₂ BARRIER 3/8 Inch PEXa 3206 136008 CTS SDR9 POTABLE TUBING ASTM F876/ F877/F1960/F2080 B137.5 NSF-61-G PMG-1013 HUD MR1296 NSF-fs ASTM E-84 FS/SD <=25/50 <small>CLASSIFIED US</small> CAN/ULC S101 CAN/ULC S102.2 <small>Oxygen Barrier According To</small> DIN 4726 160psi/73.4°F 100psi/180°F 80psi/200°F "mm.dd.yy" "24h" "M00" www.na.rehau.com
1/2"	136031	"000ft" RAUPEX O ₂ BARRIER 1/2 Inch PEXa 3206 136031 CTS SDR9 POTABLE TUBING ASTM F876/ F877/F1960/F2080 B137.5 NSF-61-G PMG-1013 HUD MR1296 NSF-fs ASTM E-84 FS/SD <=25/ 50 <small>CLASSIFIED US</small> CAN/ULC S101 CAN/ULC S102.2 <small>Oxygen Barrier According To</small> DIN 4726 160psi/73.4°F 100psi/180°F 80psi/200°F "mm.dd.yy" "24h" "M00" www.na.rehau.com

TABLE 1: REHAU CERTIFICATIONS AND LISTINGS

PEX PIPE CERTIFICATIONS - SEPTEMBER 2011

Agency Responsible for Certification

Applicable Standards for Testing

Official Logo for Certification

RAUPEX® O₂ BARRIER

Product Code	Product Description
136008	3/8" RAUPEX O ₂ Barrier Pipe
136031	1/2" RAUPEX O ₂ Barrier Pipe
136880	5/8" RAUPEX O ₂ Barrier Pipe
136051	3/4" RAUPEX O ₂ Barrier Pipe
136011	1" RAUPEX O ₂ Barrier Pipe
136293	1 1/4" RAUPEX O ₂ Barrier Pipe
136293	1 1/2" RAUPEX O ₂ Barrier Pipe
136303	2" RAUPEX O ₂ Barrier Pipe

RAUPEX NON-BARRIER

Product Code	Product Description
261683	3/8" RAUPEX Non-Barrier Pipe
261026	1/2" RAUPEX Non-Barrier Pipe
261036	5/8" RAUPEX Non-Barrier Pipe
261046	3/4" RAUPEX Non-Barrier Pipe
261066	1" RAUPEX Non-Barrier Pipe
261086	1 1/4" RAUPEX Non-Barrier Pipe
261106	1 1/2" RAUPEX Non-Barrier Pipe
136331	2" RAUPEX Non-Barrier Pipe

RAUPEX RED/WHITE/BLUE UV SHIELD

Product Code	Product Description
235331	3/8" RAUPEX UV Shield Pipe
235351	1/2" RAUPEX UV Shield Pipe
235371	3/4" RAUPEX UV Shield Pipe
235381	1" RAUPEX UV Shield Pipe
132571	1 1/4" RAUPEX UV Shield Pipe
132581	1 1/2" RAUPEX UV Shield Pipe
132591	2" RAUPEX UV Shield Pipe

MUNICIPEX®

Product Code	Product Description
261056	3/4" MUNICIPEX Pipe
261076	1" MUNICIPEX Pipe
261096	1 1/4" MUNICIPEX Pipe
261116	1 1/2" MUNICIPEX Pipe
261136	2" MUNICIPEX Pipe

MUNICIPEX PROTECT

Product Code	Product Description
131287	1 1/2" MUNICIPEX Pipe
131288	2" MUNICIPEX Pipe

RAUGEO™

Product Code	Product Description
235371	3/4" RAUGEO Pipe
235381	1" RAUGEO Pipe
235391	1 1/4" RAUGEO Pipe

RAUPEX COMPRESSED AIR PIPE

Product Code	Product Description
204887	3/4" RAUPEX Black UV Shield Pipe
204888	1" RAUPEX Black UV Shield Pipe
204889	1 1/4" RAUPEX Black UV Shield Pipe
204893	1 1/2" RAUPEX Black UV Shield Pipe
204896	2" RAUPEX Black UV Shield Pipe

		NSF International				ASTM		CSA	Underwriters Laboratories			IAPMO	ICC	PPI	DIN	AWWA	IGSHPA
		NSF-pw (NSF14/61/G)	ANS/NSF 61/ Annex G	UL1821	NSF rth	F876/F877/ F2023/F2080	E-84	B137.5	UL1821/1713/1285 ULC/ORD C199P	ULC S102.2	ULC S101	U.P. Code	PMG-1013	TR-3/TR-4	DIN 4726	C 904	
												U.P. Code			DIN 4726	AWWA C904	
RAUPEX® O₂ BARRIER																	
136008	3/8" RAUPEX O ₂ Barrier Pipe		✓			✓	✓	✓		✓	✓		✓	✓	✓	✓	
136031	1/2" RAUPEX O ₂ Barrier Pipe		✓			✓	✓	✓		✓	✓		✓	✓	✓	✓	
136880	5/8" RAUPEX O ₂ Barrier Pipe		✓			✓		✓		✓	✓		✓	✓	✓	✓	
136051	3/4" RAUPEX O ₂ Barrier Pipe		✓			✓		✓		✓	✓		✓	✓	✓	✓	
136011	1" RAUPEX O ₂ Barrier Pipe		✓			✓		✓		✓	✓		✓	✓	✓	✓	
136293	1 1/4" RAUPEX O ₂ Barrier Pipe		✓			✓		✓		✓	✓		✓	✓	✓	✓	
136293	1 1/2" RAUPEX O ₂ Barrier Pipe		✓			✓		✓		✓	✓		✓	✓	✓	✓	
136303	2" RAUPEX O ₂ Barrier Pipe		✓			✓		✓		✓	✓		✓	✓	✓	✓	
RAUPEX NON-BARRIER																	
261683	3/8" RAUPEX Non-Barrier Pipe	✓				✓	✓	✓		✓	✓		✓	✓	✓		
261026	1/2" RAUPEX Non-Barrier Pipe	✓				✓	✓	✓		✓	✓		✓	✓	✓		
261036	5/8" RAUPEX Non-Barrier Pipe	✓				✓		✓		✓	✓		✓	✓	✓		
261046	3/4" RAUPEX Non-Barrier Pipe	✓		✓		✓		✓		✓	✓		✓	✓	✓		✓
261066	1" RAUPEX Non-Barrier Pipe	✓		✓		✓		✓		✓	✓		✓	✓	✓		✓
261086	1 1/4" RAUPEX Non-Barrier Pipe	✓		✓		✓		✓		✓	✓		✓	✓	✓		✓
261106	1 1/2" RAUPEX Non-Barrier Pipe	✓		✓		✓		✓		✓	✓		✓	✓	✓		✓
136331	2" RAUPEX Non-Barrier Pipe	✓		✓		✓		✓		✓	✓		✓	✓	✓		✓
RAUPEX RED/WHITE/BLUE UV SHIELD																	
235331	3/8" RAUPEX UV Shield Pipe	✓				✓	✓	✓		✓	✓		✓	✓	✓		
235351	1/2" RAUPEX UV Shield Pipe	✓				✓	✓	✓		✓	✓		✓	✓	✓		
235371	3/4" RAUPEX UV Shield Pipe	✓				✓		✓		✓	✓		✓	✓	✓		
235381	1" RAUPEX UV Shield Pipe	✓				✓		✓		✓	✓		✓	✓	✓		
132571	1 1/4" RAUPEX UV Shield Pipe	✓				✓		✓		✓	✓		✓	✓	✓		
132581	1 1/2" RAUPEX UV Shield Pipe	✓				✓		✓		✓	✓		✓	✓	✓		
132591	2" RAUPEX UV Shield Pipe	✓				✓		✓		✓	✓		✓	✓	✓		
MUNICIPEX®																	
261056	3/4" MUNICIPEX Pipe	✓				✓		✓		✓	✓		✓	✓	✓		✓
261076	1" MUNICIPEX Pipe	✓				✓		✓		✓	✓		✓	✓	✓		✓
261096	1 1/4" MUNICIPEX Pipe	✓				✓		✓		✓	✓		✓	✓	✓		✓
261116	1 1/2" MUNICIPEX Pipe	✓				✓		✓		✓	✓		✓	✓	✓		✓
261136	2" MUNICIPEX Pipe	✓				✓		✓		✓	✓		✓	✓	✓		✓
MUNICIPEX PROTECT																	
131287	1 1/2" MUNICIPEX Pipe	✓				✓		✓		✓	✓		✓	✓	✓		✓
131288	2" MUNICIPEX Pipe	✓				✓		✓		✓	✓		✓	✓	✓		✓
RAUGEO™																	
235371	3/4" RAUGEO Pipe				✓	✓				✓	✓			✓			✓
235381	1" RAUGEO Pipe				✓	✓				✓	✓			✓			✓
235391	1 1/4" RAUGEO Pipe				✓	✓				✓	✓			✓			✓
RAUPEX COMPRESSED AIR PIPE																	
204887	3/4" RAUPEX Black UV Shield Pipe				✓	✓				✓	✓			✓			✓
204888	1" RAUPEX Black UV Shield Pipe				✓	✓				✓	✓			✓			✓
204889	1 1/4" RAUPEX Black UV Shield Pipe				✓	✓				✓	✓			✓			✓
204893	1 1/2" RAUPEX Black UV Shield Pipe				✓	✓				✓	✓			✓			✓
204896	2" RAUPEX Black UV Shield Pipe				✓	✓				✓	✓			✓			✓



RICK SNYDER
GOVERNOR

STATE OF MICHIGAN
DEPARTMENT OF LICENSING AND REGULATORY AFFAIRS
BUREAU OF CONSTRUCTION CODES
IRVIN J. POKE
DIRECTOR

STEVE ARWOOD
DIRECTOR

DOCUMENT #14-20

March 10, 2014

TO: Members of the Construction Code Commission
FROM: Joseph T. Madziar, Plumbing Division Chief *J Madziar*
SUBJECT: Certificate of Acceptance for the Hepvo, Sanitary Waste Valve, BCCP-13-004

The applicant has requested product approval to provide product acceptance through approval clarification for a new product that could replace a tubular trap for 1 ½ inch and 1 ¼ inch installations. The product for consideration is the Hepvo, Sanitary Waste Valve, models BV1B/UA (1 ¼ in.) and BV1/UB (1½ in.).

APPLICANT REPRESENTATIVE:

Mr. Ron George

APPLICANT:

Wavin Overseas BV
P.O. Box 47
Newport, MI 48166

AUTHORITY:

Section 21 of Act 230, 1972 being section 125.1521 of the Michigan Compiled Laws

PRODUCT:

Hepvo, Sanitary Waste Valve, models BV1B/UA (1 ¼ in.) and BV1/UB (1½ in.)

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PRODUCT DESCRIPTION:

The product is a self sealing valve designed to close the waste connection below a sanitary fixture to prevent the escape of sewer gas. This product does not rely on trapped water to create a seal. The product relies on a self sealing membrane which performs the same function as a water seal trap. This product is an alternative to a P-trap and can be installed horizontally and vertically.

APPLICATION:

The product would replace the standard P-trap used for lavatories, kitchen sinks with garbage disposal (vertical only), bathtubs, bidets, and showers.

APPROVALS/ TESTS:

Certified Listing by IAPMO to ASME A112.18.8-2009 File number C-6606. Tested by IAPMO report 659-09003-002

CONDITIONS OF USE AND INSTALLATION:

1. All requirements of the Michigan Plumbing Code shall be applicable.
2. Installations shall be in accordance with the manufacturer's specifications.
3. This approval shall become void if and when the product no longer meets the requirements of the Michigan Plumbing Code or a change in design/designation occurs.

RECOMMENDATION:

The State Plumbing Board recommended the product to the commission for denial at the December 3, 2013 meeting due to concerns regarding the rubber membrane part of the product and view of performance foresight.

TECHNICAL DESIGN GUIDE



Sanitary Waste Valve

- A HYGIENIC ALTERNATIVE TO CONVENTIONAL TRAPS

HepvO is a self sealing valve designed to close the waste connection below a sanitary fixture to prevent the escape of foul sewer air into the dwelling.

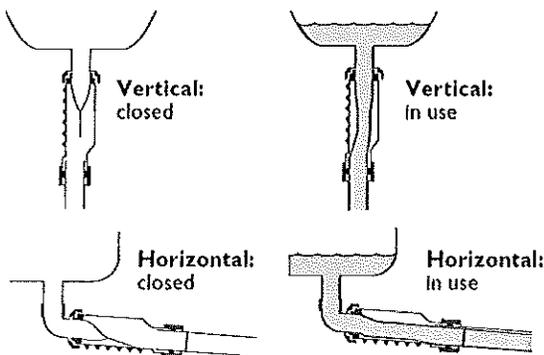
HepvO unlike conventional waste traps, does not rely on trapped water to create a seal. Water seals are prone to failure by Evaporation, Siphonage and other mechanisms. Instead, HepvO uses a self sealing membrane which performs the same function as a water seal trap but without the risk of depletion or freezing.

The HepvO Sanitary Waste Valve means enhanced plumbing design and system efficiency, without compromising performance or risking the escape of foul air into the living space from the drain or sewer.

HepvO - Operation

HepvO a Barrier between Living Space and the Drainage System.

Foul sewer gas must be prevented from entering the building. The loss of the water seal in a conventional trap can cause gurgling noises, objectionable smells, allow insect ingress, and has the potential to allow the spread of health hazards (such as SARS).



The HepvO Sanitary Waste Valve opens under the water pressure of a fixture emptying and closes to form a tight seal after the fixture has discharged.



HepvO - Product Features

- Dry Seal Technology - cannot fail by evaporation or siphonage
- Admits Air - Auxiliary Venting Not Required
- One Way Valve - Prevents Foul Odors

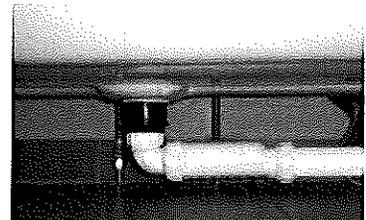
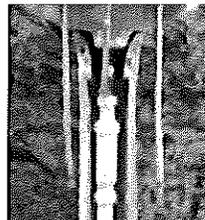
HepvO will out-perform a conventional trap by preventing the escape of foul air under excessive operating conditions up to 10 times greater than those normally experienced in a correctly designed Soil & Waste system. By comparison, conventional traps allow foul sewer air to bubble-through the seal at relatively low positive pressures.

In addition because HepvO does not trap water that may contain food scraps or other waste, microbiological growth of a fungal, bacterial or viral nature is less likely.

HepvO - Applications

- Lavatories
- Bath Tubs
- Sink
- Bidet
- Washing Machine
- Garbage Disposal (Vertical Only)
- Urinal (Vertical Only)*
- Air Conditioning Condensate*
- Overflow
- Dishwasher
- Shower

* applications outside the scope of the ASME/ANSI A112.18.8 Standard and approval

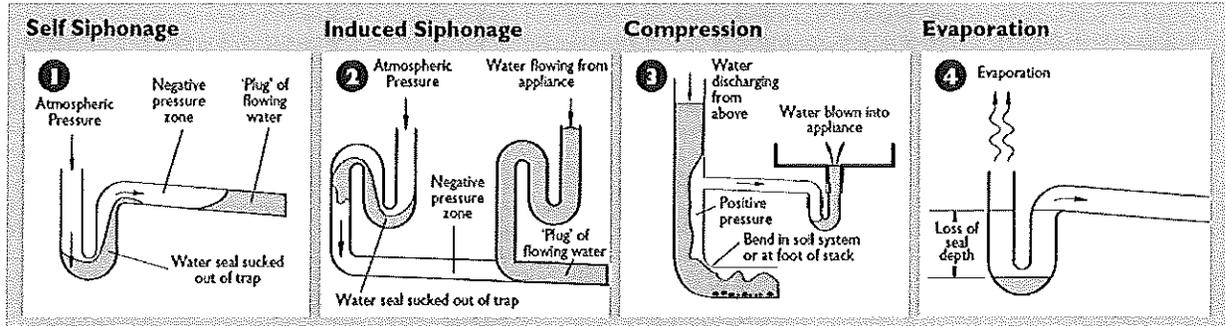


Minimizes the space required behind a lavatory or beneath a bath tub/shower tray.

Hep_o - Design and Performance

The PROBLEM: Conventional waste traps work by having a water seal to prevent foul odors entering buildings. However a water trap can fail under a number of conditions.

The following diagrams show several problems that result in loss of water seal, gurgling and foul smells.

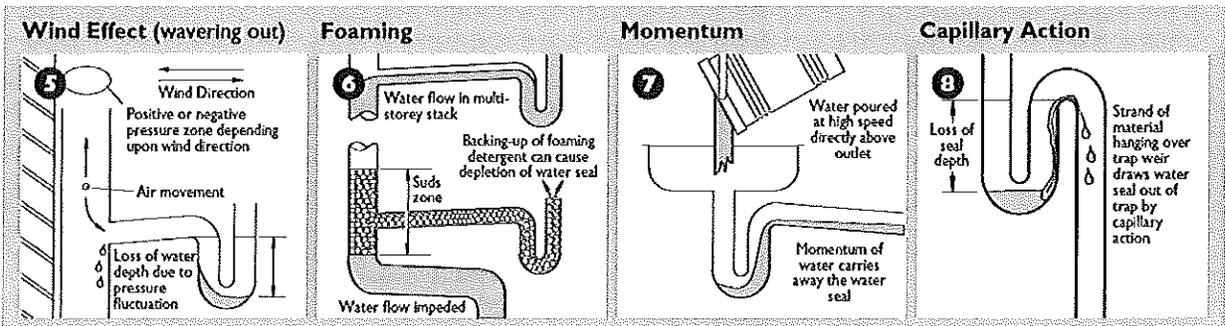


Self Siphonage: water flowing down the discharge pipe draws the water from the trap.

Induced Siphonage: the water seal is drawn out of the trap by water discharging from a fixture downstream (e.g. washing machine).

Compression: water is pushed out of the trap by a positive pressure caused by discharging of fixtures located above (e.g. WC).

Evaporation: water in the trap evaporates during periods of non-use (e.g. during vacation or when fixtures are not being used).

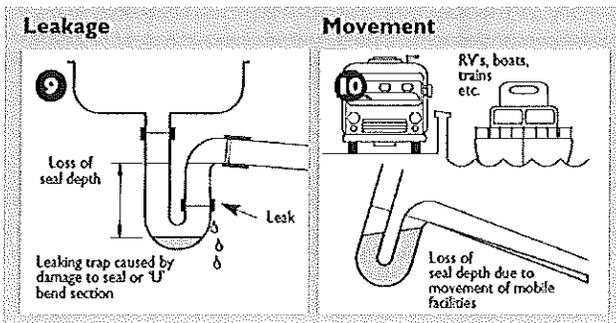


Wind Effect: air movement across the top of the Soil & Vent Pipe causes reciprocation of water in the trap and potential for loss of seal depth.

Foaming: agitation of waste water containing detergents in the Soil and Vent pipe creates foaming which pushes water out of the trap.

Momentum: waste water from a bowl or pail poured directly in to the waste outlet carries water out of the trap due to speed of discharge. This is also common with modern, funnel shaped basin designs.

Capillary Action: fibrous material retained in the trap and hanging over the weir draws water out of the trap.



Leakage: badly fitting or loose components and/or damaged seals can allow water to leak causing loss of seal depth.

Movement: In mobile facilities such as RV's and boats movement can cause potential for loss of water in the trap.

Hep_o - The SOLUTION

When installed in accordance with manufacturer's instructions the unique Hep_o Sanitary Waste Valve is the solution to all these problems.

Hep_o provides a constant seal against sewer gas ingress, which is maintained under all normal operating conditions.

Hep_o Sanitary Waste Valve actively eliminates negative pressure within the waste system by opening and allowing in fresh air until a state of equilibrium with atmosphere is reached.

Hep_o Sanitary Waste Valve resists blockages, prevents nasty smells, gurgling sounds and stagnant water under all circumstances.



RICK SNYDER
GOVERNOR

STATE OF MICHIGAN
DEPARTMENT OF LICENSING AND REGULATORY AFFAIRS
BUREAU OF CONSTRUCTION CODES
IRVIN J. POKE
DIRECTOR

STEVE ARWOOD
DIRECTOR

DOCUMENT #14-21

March 7, 2014

TO: Members of the Construction Code Commission
FROM: Joseph T. Madziar, Plumbing Division Chief 
SUBJECT: Approval of Custom Building Products, Inc., RedGard Fabric Membrane, BCCP-14-001

The applicant has requested product approval to provide product acceptance through approval clarification for a product that will be used as a waterproofing member for use in both horizontal and vertical tiling applications such as showers and other wet areas.

APPLICANT REPRESENTATIVE:

Ms. Karine Gulati

APPLICANT:

Custom Building Products, Inc.
13001 Seal Beach Blvd.
Seal Beach, CA 90740

AUTHORITY:

Section 21 of Act 230, 1972 being section 125.1521 of the Michigan Compiled Laws.

PRODUCT:

RedGard Fabric Membrane, Models RFM54 (1m x 5m rolls) and RFM323 (1m x 3m roll), 2 sided polyester fleece laminated polyethylene sheet membrane

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PRODUCT DESCRIPTION:

RedGard Fabric Membrane is a waterproof fabric sheet installed under tile used in showers and other high demand wet areas. The product creates a waterproof barrier between the tile installed over it and the substrate that the fabric is installed over.

APPLICATION:

This product will be used as the waterproofing material under tile installed in non-prefabricated shower stalls.

APPROVALS/TESTS:

ICC-ES Listing PMG-1188, Certified to ANSI A118.10-2008

APPLICABLE CODE SECTIONS:

Michigan Plumbing Code

Section 417.5.2 Shower lining states in part: Floors under shower compartments, except where prefabricated receptors have been provided, shall be lined and made water tight utilizing material complying with Sections 417.5.2.1 through 417.5.2.6.

Section 417.5.2.6 Liquid-type, trowel-applied, load-bearing, bonded waterproof materials. Liquid-type, trowel-applied, load-bearing, bonded waterproof materials shall meet the requirements of ANSI A118.10 and shall be applied in accordance with the manufacturer's instructions.

CONDITIONS OF USE AND INSTALLATION:

1. All requirements of the Michigan Plumbing Code shall be applicable.
2. Shall be installed in accordance with manufacturer's installation instructions.
3. This approval shall become void if and when the product no longer meets the requirements of the Michigan Plumbing Code or a change in design/designation occurs.

RECOMMENDATION:

The State Plumbing Board recommended the product to the commission for approval at the February 25, 2014 board meeting.

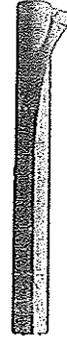
RedGard® Fabric Membrane

1 Product Name

RedGard® Fabric Membrane

2 Manufacturer

Custom Building Products
13001 Seal Beach Blvd.
Seal Beach, CA 90740-2757
Customer Support: 800-272-8786
Technical Services: 800-282-8786
Fax: 800-200-7765
Email: contactus@cbpmail.net
custombuildingproducts.com



3 Product Description

RedGard Fabric Membrane is a waterproof fabric sheet designed for use in both horizontal and vertical tiling applications such as showers and other high demand wet environments.

Suitable Tile Types

All types including impervious porcelain, ceramic tile, natural stone, and precast terrazzo tile. For glass tiles, check with the tile manufacturer to ensure compatibility.

Suitable Substrates

- Concrete, cement mortar, masonry
- Cement Backerboard
- Gypsum Wallboard
- Exterior Plywood and OSB (interior, dry areas only)
- Exterior Decks – Contact Technical Services
- Post Tension Concrete
- Concrete
- Lightweight Concrete (min. 2000 psi compressive strength)
- Gypsum-Based cement topping (min. 2000 psi compressive strength)
- Existing ceramic tile and resilient flooring

Composition of Product

2-sided polyester fleecy laminated polyethylene sheet membrane

Sizes

- 54 Sq. Ft. (5 Sq. M.) Roll
- 323 Sq. Ft. (30 Sq. M.) Roll

Benefits of Product in the Installation

Waterproof, easy to cut, hang and adjust. Installs over cement backerboard or gypsum wall board. Helps prepare showers and other wet areas for tiling. Suitable for all tile types. For information on steam showers, contact Custom's Technical Services department.

Limitations to the Product

RedGard Fabric Membrane will not accommodate deflection greater than specified in TCNA guidelines and should not be used as a wear surface or left otherwise exposed to construction traffic.

4 Technical Data

Applicable Standards

RedGard Fabric Membrane meets the American National Standard for Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone Installations (ANSI A118.10) and evaluated by ICC-ES (Report No. PMG-1188).

5 Instructions

Application of Product

All surfaces must be clean, smooth, and capable of supporting the finished tile installation. The thin-set mortar used for installing RedGard Fabric Membrane must be appropriate for the substrate, and should thoroughly embed in the RedGard Fabric Membrane. To minimize installation duration, pre-cut RedGard Fabric Membrane to size ahead of mixing thin-set for installation. Apply thin-set to the intended surface using a minimum 1/4" x 3/16" (6 mm x 5 mm) V-notched trowel. Rougher surfaces may require a larger notched trowel. Be sure to not let your thin-set mortar skin over. Only spread out as much as can be covered in about 5 minutes. Using the flat side of a trowel or a taping knife, embed the RedGard Fabric Membrane into the still wet thin-set. Work the trowel or taping knife at angles out and away from the center taking care to work out any air that may have been trapped when the sheet was placed.

Seams: Waterproof seams may be installed by overlapping edges of RedGard Fabric Membrane by at least 2" or by butting the joints and utilizing RedGard Fabric Membrane Strip over the top of the joint.

Corners: For inside and outside corners, used pre-formed RedGard Fabric Membrane corners. Connect these corners at change of plane with the RedGard Fabric Membrane Strip.

Pipe and Valve Flashing: RedGard Fabric Mixing and Pipe Seal can be used to flash around any wall protrusions. It comes with a pre-cut hole measuring 1/2" but can be enlarged in the field with scissors or a knife. Hole in mixer and pipe seal should be tight around any protrusions. Fill any gaps or openings with Custom Shower Installation Systems Sealant (Polyurethane) for a watertight seal.

Curing of Product

RedGard Fabric Membrane may be tiled as soon as it is installed. Flood testing should not occur sooner than 24 hours in moderate temperatures after installation of membrane to allow mortar to dry.



CUSTOM®

RedGard® Fabric Membrane

Cleaning of equipment

RedGard Fabric Membrane installation requires the use of thin-set mortar. Make sure to clean tools and hands with water before the material dries. Clean all spray equipment immediately after use.

Health Precautions

RedGard Fabric Membrane installation requires the use of thin-set mortar. When using thin-set, wear rubber gloves and eye protection. Avoid eye contact or prolonged contact with skin and wash thoroughly after handling. If eye contact occurs, flush with water for 15 minutes and consult a physician. Wash thoroughly after handling. Do not take internally. Keep out of the reach of children.

Conformance to Building Codes

Installation must comply with the requirements of all applicable local, state and federal code jurisdictions.

6 Availability & Cost

Location	Item Code	Size	Package
USA	RFM54	1m x 5m	6 rolls per case
USA	RFM323	1m x 30m	1 roll per case
Canada	CRFM54	1m x 5m	6 rolls per case
Canada	CRFM323	1m x 30m	1 roll per case

7 Product Warranty

Custom® Building Products warrants to the original consumer purchaser that its product shall be free from defects in material and workmanship under normal and proper usage for a period of one year following the date of original purchase. Custom's® sole liability under this warranty shall be limited to the replacement of the product. Some states, countries or territories do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you. This warranty will not extend to any product which has been modified in any way or which has not been used in accordance with Custom's® printed instructions. Custom® makes no other warranties either expressed or implied. This warranty gives you specific legal rights, and you may have other rights that vary from state to state or from one country/territory to another. Click for details and complete [warranty information](#).

8 Product Maintenance

Properly installed product requires no special maintenance. Do not use as a wear surface.

9 Technical Services Information

For technical assistance, contact Custom® Building Products.

10 Filing System

Additional product information is available from the manufacturer upon request.

VOC Content

RedGard Fabric Membrane has been independently tested and found to emit zero VOCs per California Specification 01350: "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers".

Zero VOC's qualify RedGard Fabric Membrane for:

- LEED, IEQ Credit 4.3: Low-Emitting Materials
- ICC 700-2008, 901.6: Pollutant Source Control
- CHPS, EQ2.2: Low-Emitting Materials

Expected Wear

If tile or stone will not be set immediately after curing, protect the application from rain, direct sunlight and inclement weather for 72 hours after application. If delays longer than 72 hours are expected, cover the area with felt paper. Care should be taken to prevent the application from becoming soiled or punctured during and after application.

Related Products

RedGard® Waterproofing and Crack Prevention Membrane





RICK SNYDER
GOVERNOR

STATE OF MICHIGAN
DEPARTMENT OF LICENSING AND REGULATORY AFFAIRS
BUREAU OF CONSTRUCTION CODES
IRVIN J. POKE
DIRECTOR

STEVE ARWOOD
DIRECTOR

DOCUMENT #14-22

March 7, 2014

TO: Members of the Construction Code Commission

FROM: Joseph T. Madziar, Plumbing Division Chief 

SUBJECT: Approval of Custom Building Products, Inc., RedGard Crack Prevention and Waterproofing Membrane, BCCP-14-002

The applicant has requested product approval to provide product acceptance through approval clarification for a product that is a liquid applied elastomeric waterproofing material that cures to form a monolithic membrane for tile and stone applications.

APPLICANT REPRESENTATIVE:

Ms. Karine Gulati

APPLICANT:

Custom Building Products, Inc.
13001 Seal Beach Blvd.
Seal Beach, CA 90740

AUTHORITY:

Section 21 of Act 230, 1972 being section 125.1521 of the Michigan Compiled Laws.

PRODUCT:

RedGard Crack Prevention and Waterproofing Membrane, Models LQWAF1 (1 gallon pail) and LQWAF3 (3.5 gallon pail)

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www.michigan.gov/bcc • Telephone (517) 241-9302 • Fax (517) 241-9570

PRODUCT DESCRIPTION:

RedGard Crack Prevention and Waterproofing Membrane is a liquid applied, ready to use, elastomeric waterproofing membrane for both commercial and residential tile and stone applications. The product creates a continuous waterproofing barrier with outstanding adhesion and reduces crack transmission in tile and stone floors. It bonds directly to clean metal drains, PVC, stainless steel, and ABS drain assemblies and can be used as a slab-on-grade vapor barrier under all types of floor coverings. Tile used in shower stall applications are adhered directly to this membrane.

APPLICATION:

This product will be used as the waterproofing material under the tile installed in non-prefabricated shower stalls. The product will be used for floors and walls in these shower installations.

APPROVALS/TESTS:

SGS U.S. Testing Company Inc., Tulsa, OK, Test Report No. 2119253-R1

Certified to ANSI A118.10-2008 by IAPMO File No. 4244

ICC Evaluation Service, ICC-ES Evaluation Report ESR-1413

APPLICABLE CODE SECTIONS:

Michigan Plumbing Code

Section 417.5.2 Shower lining states in part: Floors under shower compartments, except where prefabricated receptors have been provided, shall be lined and made water tight utilizing material complying with Sections 417.5.2.1 through 417.5.2.6.

Section 417.5.2.6 Liquid-type, trowel-applied, load-bearing, bonded waterproof materials. Liquid-type, trowel-applied, load-bearing, bonded waterproof materials shall meet the requirements of ANSI A118.10 and shall be applied in accordance with the manufacturer's instructions.

CONDITIONS OF USE AND INSTALLATION:

1. All requirements of the Michigan Plumbing Code shall be applicable.
2. Shall be installed in accordance with manufacturer's installation instructions.
3. This approval shall become void if and when the product no longer meets the requirements of the Michigan Plumbing Code or a change in design/designation occurs.

RECOMMENDATION:

The State Plumbing Board recommended the product to the commission for approval at the February 25, 2014 board meeting.

RedGard® Crack Prevention and Waterproofing Membrane

1 Product Name

RedGard® Crack Prevention and Waterproofing Membrane

2 Manufacturer

Custom Building Products
13001 Seal Beach Blvd.
Seal Beach, CA 90740-2757
Customer Support: 800-272-8786
Technical Services: 800-282-8786
Fax: 800-200-7765
Email: contactus@cbpmall.net
custombuildingproducts.com



3 Product Description

A ready-to-use elastomeric waterproofing membrane for both commercial and residential tile and stone application. Suiited for interior and exterior substrates, RedGard® creates a continuous waterproofing barrier with outstanding adhesion and reduces crack transmission in tile and stone floors. It bonds directly to clean metal drains, PVC, stainless steel and ABS drain assemblies and can be used as a slab-on-grade moisture vapor barrier under all types of floor coverings.

Suitable Substrates

- Concrete, cement mortar, masonry
- Cement Backerboard
- Exterior Plywood and OSB (interior, dry areas only)
- Exterior Decks - Contact Technical Services
- Post-Tension Concrete - Contact Technical Services
- Lightweight Concrete (min. 2000 psi compressive strength)
- Gypsum-Based cement topping (min. 2000 psi compressive strength)
- Existing ceramic tile and resilient flooring

Composition of Product

RedGard® is a liquid-applied elastomeric waterproofing material that cures to form a monolithic membrane.

Benefits of Product in the Installation

- Easy to use and can be applied by roller, trowel or airless sprayer
- Rated for extra heavy duty service
- Reduces curing time with quick-dry formula
- Isolates cracks to 1/8" (3 mm)
- Suitable for waterproofing pools, spas and water features
- Meets Uniform Plumbing Code specifications for use as a shower pan liner
- Obtained the Notice of Acceptance (NOA) for Miami-Dade County

Limitations to the Product

- Do not apply to surfaces that may drop below 40°F (4°C) within 72 hours of application.
- Do not apply over wet surfaces or surfaces subject to hydrostatic pressure.
- Do not use to bridge or cover over existing expansion, control, construction, cold or saw cut joints; use Crack Buster® Pro Membrane for control, cold or saw cut joints.
- Do not use as an adhesive.
- Do not use as a wear surface; the membrane must be covered with tile or other permanent flooring.
- Do not use solvents in conjunction with the membrane

Packaging

- 1 gallon (3.78 L) pail
- 3.5 gallon (13.2 L) pail

4 Technical Data

Applicable Standards

American National Standards Institute (ANSI) ANSI A108.01, A108.17, A108.13, A118.10 and A118.12 American National Standards for the Installation of Ceramic Tile ASTM International (ASTM)

- ASTM C627 Standard Test Method for Evaluating Ceramic Floor Tile Installation Systems Using the Robinson-Type Floor Tester
- ASTM D638 Standard Test Method for Tensile Properties of Plastics

Tile Council of North America (TCNA) TCNA Handbook for Ceramic Tile Installation, TCNA Method EJ171, F125 & F125A



RedGard® Crack Prevention and Waterproofing Membrane

Technical Chart

Property	Test Method	Requirement	Typical Results
Fungus Resistance	A118.10 Section 4.1	No Growth	Pass
Seam Strength	A118.10 Section 4.2	> 8 lbs/" width	16 lbs/2" (7.3 kg/5 cm) width
Breaking Strength	A118.10 Section 4.3	> 170 psi	484 psi (34 kg/cm ²)
Dimensional Stability	A118.10 Section 4.4	+/- 0.7%	0.05%
Waterproofness	A118.10 Section 4.5	No Water Penetration	Pass
Shear Bond Strength to Cement Mortar			
Four Week Shear Strength	A118.10 Section 5.5	> 50 psi	267 psi (18.8 kg/cm ²)
Shear Strength After Water Immersion	A118.10 Section 5.4	> 50 psi	89 psi (6.3 kg/cm ²)
System Crack Resistance			
Standard Performance	A118.12 Section 5.4	> 1/16" and < 1/8"	Pass
High Performance	A118.12 Section 5.4	> 1/8"	Pass
Point Load	A118.12 Section 5.2	> 1000 lbs	> 1000 psi
Robinson Test	A118.12 Section 5.3	As Specified	14 Cycles; Extra Heavy

Environmental Consideration

Custom® Building Products is committed to environmental responsibility in both products produced and in manufacturing practices. Use of this product may contribute to LEED® certification.

5 Instructions

General Surface Prep

Exterior and wet areas must have proper sloping to drains. All surfaces must be structurally sound, clean, dry and free from contaminants that would prevent a good bond. Newly prepared concrete must be troweled smooth and textured to a fine broom finish and cured for 28 days. Existing surfaces must be scarified and leveled, and all defects must be repaired. Cracks exceeding 1/8" (3 mm) should be treated in accordance with TCNA F125 or TCNA F125A.

Bonding to Lightweight Cement and Gypsum Surfaces

Lightweight or gypsum-based materials must obtain a minimum of 2000 psi (13.8 MPa) compressive strength at the recommended cure time. The underlayment must be sufficiently dry and properly cured to the manufacturer's specifications for permanent, non-moisture permeable coverings. Surfaces to be covered must be clean, structurally sound and subject to deflection not to exceed the current ANSI standards. Expansion joints must be installed in accordance with local building codes and ANSI/TCNA guidelines. Prime all surfaces to receive RedGard® with properly applied manufacturer's sealer or with a primer coat of RedGard®, consisting of 1 part RedGard®, diluted with 4 parts clean, cool water. In a clean pail, mix at low speed to obtain a lump-free solution. The primer can be brushed, rolled or sprayed to achieve an even coat. Apply the primer coat to the floor at a rate of 300 ft/gallon (7.5 M/L) of reduced material. When dry, apply at least one full coat of RedGard® to the primed area.

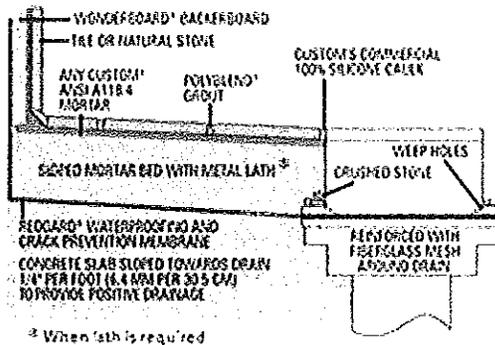
Vapor Barrier

When used as a vapor barrier, apply one full coat (20 to 25 mils wet) where vapor transmission is up to 8 lbs per 1000 sq. ft per day and two full coats (20 to 25 mils wet each coat) where vapor transmission is up to 12 lbs per 1000 sq. ft per day. Refer to ASTM F1869 for more information on Vapor Transmission Testing.

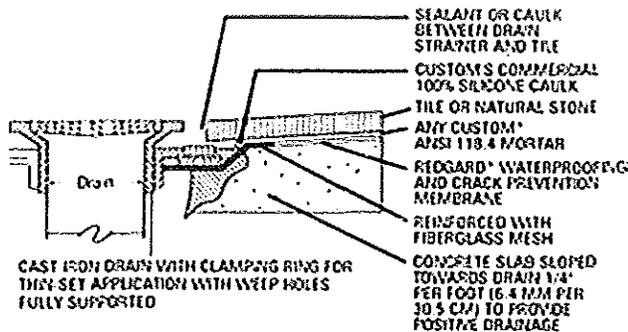
Expansion Joint placement

Do not bridge joints designed to experience movement. Carry these types of joints through the tile work. Clean the joint and install an open or closed cell-backer rod to the proper depth, as outlined in the Tile Council Handbook, E1171. Next compress sealant into the joint, coating the sides and leaving the sealant flush with the surface. When the sealant is dry, place bond-breaker tape over the joint. Apply a minimum 3/64" (1.2 mm) of RedGard® over the joint and the substrate, following the instructions provided previously. Install the tile work onto the membrane, but do not bridge the joint. After the tile work is properly set, follow the architect's and manufacturer's instructions to fill the joint with a specified color sealant.

Application of Product



RedGard® Crack Prevention and Waterproofing Membrane



RedGard at Drains

Drains should have a clamping ring with open weep holes for thin-set application. Apply the membrane to the bottom of the flange. The drain should be fully supported, without movement, and should be even with the plane of the substrate. Apply the RedGard membrane around drain. Embed a 12" x 12" (30 x 30 cm) fiberglass mesh into the membrane, making sure it does not obstruct the drainage weep holes. Then apply an additional coat of the membrane and smooth. After curing, clamp the upper flange onto the membrane and tighten. Use a silicone caulk around the flange where the membrane and the upper flange make contact. A toilet flange can be handled in much the same manner.

RedGard® as Crack Prevention Membrane

Force RedGard® into cracks with the flat side of the trowel, roller or brush. Using a 3/16"-1/4" (5-6 mm) V-notch trowel or 3/8" (9.5 mm) rough textured roller. Use the flat side of the trowel and flatten the ridges to form a continuous, even coat of material. The membrane should extend a minimum of the diagonal measurement of the tile beyond both sides of the crack. Gaps between plywood sheets and where floors meet walls must also be pre-filled. For continuous crack isolation, cover the entire substrate with RedGard® applied to a minimum 30 mils wet-film thickness.

RedGard® as General Waterproof Membrane (ANSI 118.10)

Cracks to 1/8" (3 mm) should be pre-filled before beginning the waterproofing application. Lightly dampen all porous surfaces. Use a 3/4" (19 mm) rough-textured synthetic roller or a 3/16"-1/4" (5-6 mm) V-notch trowel and heavily pre-coat the corners and the intersections where the floors and walls meet, extending 6" (15 cm) on either side.

RedGard® applied in the above manner meets requirements of ANSI A118.10 without fabric reinforcement. For extra protection, embed a 6" (15 cm) wide fiberglass mesh into the membrane for changes of plane and for gaps 1/8" (3 mm) or greater. If using a trowel, spread the material with the trowel held at a 45° angle, and then flattens the ridges. If using a roller, apply a continuous, even film with overlapping strokes. An airless sprayer may be used for the waterproofing application. The sprayer must produce between 1900-2300 psi, with a flow rate of 1.0-1.5 GPM and must have a tip orifice size of 0.025-0.029. Apply a continuous film with overlapping spray. The membrane appearance is pink when wet and dries to a dark red color. It typically takes 1-1.5 hours to turn completely red. After the first coat turns red, inspect the film for integrity and fill any voids or pinholes with additional material. Apply a second coat at right angles to the first coat. Periodically check the film thickness with a wet-film gauge. Combined dried coatings must be at least 30-35 mils thick. When wet, the combined coatings must be at least 60-70 mils and must not exceed 125 mils wet-film thickness.

Curing of Product

RedGard® is dry when it turns solid red, with no visible, pink color. Typically, drying time is 1-1.5 hours; depending on ambient conditions, drying time can be as much as 12 hours. After the second coat is applied and both coats are fully cured, the application area can be flood tested.

Protection

If tile or stone will not be set immediately after curing, protect the application from rain, direct sunlight and inclement weather for 72 hours after application. If delays longer than 72 hours are expected, cover the area with felt paper. Care should be taken to prevent the application from becoming soiled or punctured during and after application.

Tile and Stone Installation

Install tile or stone with a Custom® Building Products polymer-modified mortar that meets ANSI A118.4 or A118.15 standards.

Cleaning of equipment

Clean tools and hands with water before the material dries. Clean all spray equipment immediately after use.

Health Precautions

Wear rubber gloves and eye protection while using this product. Avoid eye contact or prolonged contact with skin and wash thoroughly after handling. If eye contact occurs, flush with water for 15 minutes and consult a physician. Wash thoroughly after handling. Do not take internally. Keep out of the reach of children.

Conformance to Building Codes

Installation must comply with the requirements of all applicable local, state and federal code jurisdictions.

6 Availability & Cost

Location	Item Code	Size	Color	Package
USA	LQWAF1	1 gallon (3.78 L)	Pink	Pail
USA	LQWAF3	3.5 gallon (13.2 L)	Pink	Pail
Canada	CLLQWAF1	1 gallon (3.78 L)	Pink	Pail
Canada	CLLQWAF3	3.5 gallon (13.2 L)	Pink	Pail



RedGard® Crack Prevention and Waterproofing Membrane

7 Product Warranty

Custom® Building Products warrants to the original consumer purchaser that its product shall be free from defects in material and workmanship under normal and proper usage for a period of one year following the date of original purchase. Custom's® sole liability under this warranty shall be limited to the replacement of the product. Some states, countries or territories do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you. This warranty will not extend to any product which has been modified in any way or which has not been used in accordance with Custom's® printed instructions. Custom® makes no other warranties either expressed or implied. This warranty gives you specific legal rights, and you may have other rights that vary from state to state or from one country/territory to another. Click for details and complete [warranty information](#).

8 Warranty Duration

When RedGard® Waterproofing and Crack Prevention Membrane is used as a part of a qualifying full installation system of CUSTOM products, the installation can qualify for up to a lifetime system warranty. CUSTOM will repair and/or replace, at its discretion, the affected area of the system. For more information, find details and limitations to this warranty at [custombuildingproducts.com](#).

9 Product Maintenance

Properly installed product requires no special maintenance. Do not use as a wear surface.

10 Technical Services Information

For technical assistance, contact Custom® Building Products.

Filing System

Additional product information is available from the manufacturer upon request.

Related Products

RedGard® Fabric Membrane



RedGard® Crack Prevention and Waterproofing Membrane

Coverage

Size	Thickness	Min Coverage	Max Coverage
RedGard as Crack Prevention Membrane:			
1 Gallon (3.78 L)	30 mil thickness when wet	110 sq. ft. (10.2 M ²)	
3.5 Gallon (13.2 L)	30 mil thickness when wet	385 sq. ft. (35.8 M ²)	
RedGard as Waterproof Membrane (ANSI A118.10):			
1 Gallon (3.78 L)	60 mil thickness when wet; 30 mil thickness when dry	35 sq. ft. (3.3 M ²)	40 sq. ft. (3.7 M ²)
3.5 Gallon (13.2 L)	60 mil thickness when wet; 30 mil thickness when dry	123 sq. ft. (11.4 M ²)	140 sq. ft. (13 M ²)
RedGard as IAPMO Pan Liner:			
1 Gallon (3.78 L)	60 mils when wet; 30 mils when dry	35 sq. ft. (3.3 M ²)	40 sq. ft. (3.7 M ²)
3.5 Gallon (13.2 L)	60 mils when wet; 30 mils when dry	123 sq. ft. (11.4 M ²)	140 sq. ft. (13 M ²)





RICK SNYDER
GOVERNOR

STATE OF MICHIGAN
DEPARTMENT OF LICENSING AND REGULATORY AFFAIRS
BUREAU OF CONSTRUCTION CODES
IRVIN J. POKE
DIRECTOR

STEVE ARWOOD
DIRECTOR

DOCUMENT #14-23

March 7, 2014

TO: Members of the Construction Code Commission
FROM: Joseph T. Madziar, Plumbing Division Chief *J Madziar*
SUBJECT: Approval of Custom Building Products, Inc., Custom 9240 Waterproofing and Anti-Fracture Membrane, BCCP-14-003

The applicant has requested product approval to provide product acceptance through approval clarification for a product that is a liquid applied flexible, seamless waterproofing membrane designed for waterproofing tile and stone installations.

APPLICANT REPRESENTATIVE:

Ms. Karine Gulati

APPLICANT:

Custom Building Products, Inc.
13001 Seal Beach Blvd.
Seal Beach, CA 90740

AUTHORITY:

Section 21 of Act 230, 1972 being section 125.1521 of the Michigan Compiled Laws.

PRODUCT:

Custom 9240 Waterproofing and Anti-Fracture Membrane, Models C9240K, C9240L, and C9240F. Model C9240K is a kit which contains a 6 gallon pail of Part 1 Liquid and Part 2 Fabric Carton containing 2 sizes of fabric used in the installation. Model C9240L is a 6 gallon pail of Part 1 Liquid. Model C9240F includes a 6 inch x 75 foot roll of fabric and a 36 inch x 100 foot roll of fabric.

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P.O. BOX 30254 • LANSING, MICHIGAN 48909
www.michigan.gov/bcc • Telephone (517) 241-9302 • Fax (517) 241-9570

PRODUCT DESCRIPTION:

Custom 9240 Waterproofing and Anti-Fracture Membrane is a flexible, seamless waterproofing membrane with a liquid-applied polymer and reinforcing fabric that bonds to a variety of substrates for heavy duty installations. The product is designed for waterproofing tile and stone installations.

APPLICATION:

This product will be used as the waterproofing membrane for tile and stone applications in non-prefabricated showers. The product will be used for floors and walls in these shower installations.

APPROVALS/TESTS:

Certified to ANSI A118.10-2008 by IAPMO File No. 4244

APPLICABLE CODE SECTIONS:

Michigan Plumbing Code

Section 417.5.2 Shower lining states in part: Floors under shower compartments, except where prefabricated receptors have been provided, shall be lined and made water tight utilizing material complying with Sections 417.5.2.1 through 417.5.2.6.

Section 417.5.2.6 Liquid-type, trowel-applied, load-bearing, bonded waterproof materials. Liquid-type, trowel-applied, load-bearing, bonded waterproof materials shall meet the requirements of ANSI A118.10 and shall be applied in accordance with the manufacturer's instructions.

CONDITIONS OF USE AND INSTALLATION:

1. All requirements of the Michigan Plumbing Code shall be applicable.
2. Shall be installed in accordance with manufacturer's installation instructions.
3. This approval shall become void if and when the product no longer meets the requirements of the Michigan Plumbing Code or a change in design/designation occurs.

RECOMMENDATION:

The State Plumbing Board recommended the product to the commission for approval at the February 25, 2014 board meeting.

Custom® 9240 Waterproofing and Anti-Fracture Membrane

1 Product Name

Custom® 9240 Waterproofing and Anti-Fracture Membrane

2 Manufacturer

Custom Building Products
13001 Seal Beach Blvd.
Seal Beach, CA 90740-2757
Customer Support: 800-272-8786
Technical Services: 800-282-8786
Fax: 800-200-7765
Email: contactus@cbpmail.net
custombuildingproducts.com



3 Product Description

A flexible, seamless waterproofing membrane with a liquid-applied polymer and reinforcing fabric that bonds to a variety of substrates and is ideal for heavy duty service installations. Designed for waterproofing tile and stone installations, Custom® 9240 also provides protection from fractures to 1/8" (3 mm) over shrinkage and other non-structural cracks.

Suitable Substrates

- Concrete, cement mortar, masonry
- Cement Backerboard
- Exterior Plywood and OSB (Interior, dry areas only)
- Exterior Decks – Contact Technical Services
- Post-Tension Concrete – Contact Technical Services
- Lightweight Concrete (min. 2000 psi compressive strength)
- Gypsum-Based cement topping (min. 2000 psi compressive strength)
- Existing ceramic tile and resilient flooring

Composition of Product

Custom® 9240 is a liquid-applied polymer with a reinforcing fabric.

Benefits of Product in the Installation

- Rated for extra heavy duty service
- Forms flexible, seamless waterproofing for varying substrates
- Provides anti-fracture protection to 1/8" (3 mm) for shrinkage and non-structural cracks
- Meets Uniform Plumbing Code specifications for use as a shower pan liner

Limitations to the Product

- Do not apply to surfaces that may drop below 40°F (4°C) within 72 hours of application.
- Do not apply over wet surfaces or surfaces subject to hydrostatic pressure.
- Do not use to bridge or cover over existing expansion, control, construction, cold or saw cut joints; use Crack Buster® Pro Membrane for control, cold or saw cut joints.
- Do not use as an adhesive.
- Do not use as a wear surface; the membrane must be covered with tile or other permanent flooring.
- Do not use solvents in conjunction with the membrane

Packaging

- 6 gallon (22.7 L) pail of liquid
- 6" x 75' (0.15 x 22.85 M) fabric roll
- 36" x 100' (0.91 x 30.5 M) fabric roll
- Kit 6 gallon (22.7 L) pail of liquid and either 6" x 75' (0.15 x 22.85 M) or 36" x 100' (0.91 x 30.5 M) fabric roll

4 Technical Data

Applicable Standards

American National Standards Institute (ANSI) ANSI A108.01, A108.13, A108.17, A118.10 and A118.12 American National Standards for the Installation of Ceramic Tile ASTM International (ASTM)

- ASTM C627 Standard Test Method for Evaluating Ceramic Floor Tile Installation Systems Using the Robinson-Type Floor Tester
- ASTM D638 Standard Test Method for Tensile Properties of Plastics

Tile Council of North America (TCNA) TCNA Handbook for Ceramic Tile Installation, TCNA Method EJ171, F125 & F125A

Approvals

Custom® 9240 has tested and complies with Uniform Plumbing Code and International Plumbing Code standards for use as a shower pan liner per IAPMO Research and Testing, Inc., File No. 4244. Custom® 9240 has tested and complies with International Building Code (IBC), International Residential Code (IRC) and International Plumbing Code (IPC) standards for water resistance per ICC Evaluation Service, ESR-1413.



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Custom® 9240 Waterproofing and Anti-Fracture Membrane

Technical Chart

Property	Test Method	Requirement	Typical Results
Fungus Resistance	A118.10 Section 4.1	No Growth	Pass
Seam Strength	A118.10 Section 4.2	> 8 lbs/" width	97 lb/" (6.8 kg/25 cm) width
Breaking Strength	A118.10 Section 4.3	> 170 psi	2550 psi (179.3 kg/cm ²)
Dimensional Stability	A118.10 Section 4.4	+/- 0.7%	No Change
Waterproofness	A118.10 Section 4.5	No Water Penetration	Pass
Shear Bond Strength to cement mortar			
Four Week Shear Strength	A118.10 Section 5.5	> 50 psi	305 psi (21.4 kg/cm ²)
Shear Strength After Water Immersion	A118.10 Section 5.4	> 50 psi	89 psi (6.3 kg/cm ²)
System Crack Resistance			
Standard Performance	A118.12 Section 5.4	> 1/16" and < 1/8"	
High Performance	A118.12 Section 5.4	> 1/8"	
Point Load	A118.12 Section 5.2	> 1000 lbs	
Robinson Test	A118.12 Section 5.3	As Specified	14 Cycles; Extra Heavy
Sound Transmission Reduction (IIC)	A118.13 Section 5.3	> 10	N/A

Environmental Consideration

Custom® Building Products is committed to environmental responsibility in both products produced and in manufacturing practices. Use of this product may contribute to LEED® certification.

5 Instructions

General Surface Prep

Exterior and wet areas must have proper sloping to drains. All surfaces must be structurally sound, clean, dry and free from contaminants that would prevent a good bond. Newly prepared concrete must be troweled smooth and textured to a fine broom finish and cured for 28 days. Existing surfaces must be scarified and leveled, and all defects must be repaired. Cracks exceeding 1/8" (3 mm) should be treated in accordance with TCNA F125 or TCNA F125A.

Bonding to Wonderboard Backerboards

Custom® 9240 reinforcing fabric and the third coat of liquid may be omitted from main applications over interior walls and other vertical surfaces made with cementitious backer units (CBU) or gypsum wallboard. Coves, corners, seams and board joints, however, must be pretreated as described previously.

Expansion Joint placement

Do not bridge joints designed to experience movement. Carry these types of joints through the tile work. Clean the joint and install an open or closed cell-backer rod to the proper depth, as outlined in the Tile Council Handbook, EJ171. Next compress sealant into the joint, coating the sides and leaving the sealant flush with the surface. When the sealant is dry, place bond-breaker tape over the joint. Apply a minimum 3/64" (1.2 mm) of Custom® 9240 liquid over the joint and the substrate, following the instructions provided previously. Install the tile work onto the membrane, but do not bridge the joint. After the tile work is properly set, follow the architect's and manufacturer's instructions to fill the joint with a specified color sealant.

Application of Product

Custom® 9240 for 2-Part System for heavy duty and commercial applications

Apply a liberal coat of liquid, approximately 8" (20 cm) wide, over cracks and joints. Embed the 6" (15 cm) wide reinforcing fabric into the first coat of liquid. Apply a second liberal coat of liquid to seal the fabric. To pretreat coves and corners, apply a liberal coat of liquid. Fold 6" (15 cm) wide fabric in half and embed it into the liquid, flashing the fabric 3" (7.5 cm) up walls. Apply a second liberal coat of liquid to seal the fabric. Wet-coat thickness should be 20-30 mils thick. Do not install over structural cracks, cracks with vertical movement or cracks with more than 1/8" (3 mm) horizontal movement.

To pretreat penetrations, pack any gaps around pipes, lights or other penetrations with a compressible backer rod and suitable waterproof sealant. Apply a liberal coat of liquid around the penetration opening and embed pieces of 6" (15 cm) wide fabric into the liquid. Cover with a second layer of liquid. After curing, seal the flashing with a waterproof sealant. For expansion joints and cracks in excess of 1/8" (3 mm), treat as expansion joints and follow the instructions provided previously for expansion joints.



Custom® 9240 Waterproofing and Anti-Fracture Membrane

To pretreat drains for a 2-part system, have a clamping ring with open-weep holes for thin-set application. The drain should be fully supported, without movement, and should be even with the substrate plane. Cut a square of reinforcing fabric approximately 38" x 38" (96 x 96 cm). In the center of the fabric, cut a hole that matches the diameter of the drain throat. Apply a liberal coat of liquid to the bottom flange. Center the circular cutout over the drain throat and embed the fabric into the liquid, making sure it does not obstruct the drainage hole. Apply an additional coat of liquid 20-30 mils thick. After curing, apply a waterproof sealant bead where the fabric cutout meets the drain throat. Clamp the upper flange onto the membrane and tighten. Caulk with 100% Commercial Silicone Caulk around the flange where the membrane and upper flange make contact. A toilet flange may be handled in much the same manner. Before beginning the 2-part Custom® 9240 application, allow all pretreated areas to dry to the touch. Using a brush or roller, apply a liberal coat (20-30 mils thick) of liquid over the substrate, including pretreated areas. Lay reinforcing fabric into the wet liquid and smooth out any wrinkles. Press the fabric with a brush or roller until liquid bleeds through to the surface. Lap seams approximately 2" (5 cm). Flash the membrane over pretreated coves and corners so that the areas will have two layers of fabric. Apply another liberal coat of liquid over the fabric to saturate it. Let the top coat dry to the touch, approximately 1-3 hours. Apply another liberal coat (20-30 mils thick) of liquid over the entire surface to the seal membrane. When the last coat has dried to the touch, inspect final surface for pinholes, voids, thin spots or other defects and use additional liquid to seal defects. Reinforcing fabric and the third coat of liquid can be omitted over interior, vertical cement backerboard or drywall surfaces; pretreatment is, however, still required.

Custom® 9240 for 1-Part System for Residential and Light Commercial Applications

Using the above instructions: reinforcing fabric and third coat of liquid can be omitted; however, pretreatment is required for coves, corners, seams, expansion joints and drains.

Curing of Product

Custom® 9240 is dry when it turns a solid dark orange, normally 1.5-2 hours; ambient conditions can, however, increase drying time to 12 hours. Installation can be flood tested 24 hours later. Swimming pools should not be filled for 7 days.

Protection

If tile or stone will not be set immediately after curing, protect the application from rain, direct sunlight and inclement weather for 72 hours after application. If delays longer than 72 hours are expected, cover the area with felt paper. Care should be taken to prevent the application from becoming soiled or punctured during and after application.

Tile and Stone Installation

Install tile or stone with a Custom® Building Products polymer-modified mortar that meets ANSI A118.4, A118.15 or A118.11 standards.

Cleaning of equipment

Clean tools and hands with water before the material dries. Clean all spray equipment immediately after use.

Health Precautions

Wear rubber gloves and eye protection while using this product. Avoid eye contact or prolonged contact with skin and wash thoroughly after handling. If eye contact occurs, flush with water for 15 minutes and consult a physician. Wash thoroughly after handling. Do not take internally. Keep out of the reach of children.

Conformance to Building Codes

Installation must comply with the requirements of all applicable local, state and federal code jurisdictions.

6 Availability & Cost

Item Code	Size
C9240K	Kit consists of: 6 gallon (22.7 L) pail of Part 1 Liquid Part 2 Fabric Carton containing: 1 - 6" x 75' (15 cm x 22.85 M) roll of fabric 1 - 36" x 100' (91.5 cm x 30.5 M) roll of fabric
C9240L	6 gallon (22.7 L) pail
C9240F	1 - 6" x 75' (15 cm x 22.85 M) roll of fabric 1 - 36" x 100' (91.5 cm x 30.5 M) roll of fabric

7 Product Warranty

Custom® Building Products warrants to the original consumer purchaser that its product shall be free from defects in material and workmanship under normal and proper usage for a period of one year following the date of original purchase. Custom's® sole liability under this warranty shall be limited to the replacement of the product. Some states, countries or territories do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you. This warranty will not extend to any product which has been modified in any way or which has not been used in accordance with Custom's® printed instructions. Custom® makes no other warranties either expressed or implied. This warranty gives you specific legal rights, and you may have other rights that vary from state to state or from one country/territory to another. Click for details and complete [warranty information](#).

8 Product Maintenance

Properly installed product requires no special maintenance. Do not use as a wear surface.

9 Technical Services Information

For technical assistance, contact Custom® Building Products.

10 Filing System

Additional product information is available from the manufacturer upon request.



Custom® 9240 Waterproofing and Anti-Fracture Membrane

Coverage

Size	Thickness	Min Coverage	Max Coverage
Custom 9240 as Crack Isolation Coverage:			
1 Gallon (3.78 L)	30 mil thickness when wet	54 sq. ft. (5 M ²)	
Custom 9240 as Waterproofing Membrane (ANSI A118.10):			
1 Gallon (3.78 L)	60 mil thickness when wet	27 sq. ft. (2.5 M ²)	
Custom 9240 as IAPMO Pan Liner:			
1 Gallon (3.78 L)	93 mil thickness when wet	17 sq. ft. (1.6 M ²)	



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