



Increasing productivity in mechanical insulation installation

An assessment of molded fiberglass pipe insulation and how flex core and rigid core insulation impact efficiency

Productivity Challenges

Construction productivity has been challenged with overruns in cost and time. A 2017 report by McKinsey Global Institute noted that labor-productivity growth in construction has failed to keep up with productivity growth in other industries, growing just one percent per year over the past two decades, compared with 3.6% in manufacturing.¹ Of course, construction faces numerous complexities and variables, and requires work in environments that aren't nearly as controllable as manufacturing. Still, this number, coupled with the fact that construction efficiency has lagged behind other industries for over fifty years,¹ deserves industry scrutiny.

Many contractors look for better ways to streamline operations and improve productivity through resource-tracking software, wearable tech and mobile technology. However, many manual — and labor-intensive processes — remain unchanged. What could be the impact on productivity if a simple, commonplace manual process were eliminated in a specific construction setting?

EXECUTIVE SUMMARY

- Construction faces continued challenges in improving productivity.
- In mechanical contracting, one area that may be a drain on productivity is the need to fillet insulation for small-bore pipes and fittings.
- A time study was conducted to determine whether using flex core insulation on small-bore pipes and fittings would result in a time-savings compared to rigid core insulation products.
- The study concluded that use of flex core insulation provided a time savings, and when extrapolated to a full-scale project, could save contractors up to 16% of labor-hours.²

Area of Focus

To uncover whether productivity could be improved by eliminating certain manual installation processes, an independent company specializing in gathering and analyzing construction cost data, conducted a time study of mechanical insulation installation for small-bore pipes and fittings. Typically, this process involves filleting insulation to fit around couplings, bends and fittings. Filleting is common and routine, and for expert installers, seems to be relatively quick and simple. What productivity improvements might be possible; however, if the need to fillet was eliminated?

The time study compared installation among three different types of small-bore pipe insulation—two that are traditional rigid core fiberglass products and one form-fitting insulation, flex core fiberglass insulation, which does not require filleting to fit over most* copper pipe and small-bore iron fittings.²

Methodology²

Products:

Three industry-leading fiberglass pipe insulations were selected for the study:

- Two products: Rigid core insulation
 - > Requires filleting to compress over copper pipe and some small-bore iron fittings
- One product: Flex core insulation
 - > Compresses over copper pipes and some small-bore iron pipes and fittings

Process:

Each product was tested via a time and motion study with consistent conditions used for each product. The study took place at NAHB Home Innovation Research Labs. The test space was configured to replicate the typical conditions of a commercial construction project requiring fiberglass pipe installation, including:

- Crew composition
- Materials used
- Configuration of piping
- Location of fittings
- Varying heights above the floor

The same configuration was used to study the installation of each product. Each product was installed on a separate day, for a total study length of three days.

Piping and fitting specifications:

- Type K copper piping
 - > 3/4-inch diameter: approx. 57 linear feet
 - > 1-inch diameter: approx. 134 linear feet
 - > 2-inch diameter: approx. 50 linear feet
- Horizontal runs were placed at heights of 2 ft., 6 ft., 8 ft. and 10 ft. off the floor.

Crew:

The crew consisted of two pipe insulators, each with five years of experience, who had worked together within the past 90 days on routine work assignments. They were given standard equipment to complete the installations.

Tasks:

For each insulation product, installation began at the same starting point on the piping run and with the same-sized pipe. Tasks performed and tracked included:

- Mobilization and demobilization
- Receiving and providing instruction to the crew
- Measuring and cutting pipe insulation to required size
- Cutting of angles and filleting when required
- Knife-sharpening
- Setting up and moving ladders, as needed
- Cleaning up debris after installation

Note: Non-productive time, such as instruction, cleanup, sharpening of tools and lunch break, was recorded, but removed from the study in order to measure actual gains and losses in productivity across the three products being tested.

Results²

The study concluded that use of flex core insulation provided a time savings, and when extrapolated to a full-scale project, could save contractors up to 16% of labor-hours.²

Installation time savings were realized across all pipe sizes tested (3/4 in., 1 in. and 2 in.) when insulated with flex core fiberglass pipe insulation in place of rigid core fiberglass insulation. Time savings were primarily credited to the elimination of filleting time for the elbows, couplings and tee sections. Installation time savings varied slightly across the three pipe diameters.

Insulating the 1-inch pipe was the most labor-intensive process for all of the products tested, consistent with this being the largest quantity of pipe used in the test. The greatest time savings for flex core insulation could be seen with the 3/4-inch pipe.

Additional Observations

During the study, several other advantages were observed with use of the flex core insulation that did not have a direct impact on installation time, but nonetheless would affect the process and experience of installation for a crew.

Simple learning curve

While flex core insulation was new to the study crew, they became comfortable using it by the second set of fittings.²

Easy to cut

The flex core insulation appeared to require less pressure and effort to cut, particularly compared to rigid core insulation. Over the course of a long working day, this is likely to result in less installer fatigue.²

Reliable adhesion

The flex core insulation product features a double-adhesion closure system that fastens and installs with no need for staples or mastic, removing another manual process, and remains closed after sealing.² During the study, one of the rigid core products, which featured a single adhesion closure, opened after sealing.² Multiple instances of a failed seal like this could likely add to rework and additional labor.

Durable protective surface

The flex core insulation also featured a polymer exterior surface which was easy to clean. Had the project been exposed to the elements, the polymer jacket would help protect the insulation in cases of short duration water exposure without supporting mold/mildew growth.

Installer Impressions

While this study focused on quantifiable time savings, crew impressions should not be overlooked. An easier, more pleasant installation experience reduces fatigue and frustration. The crew reported a number of positive impressions from working with flex core insulation versus the rigid core products, including:²

- Installation was easier and faster
- Fit was tighter at the elbows
- Cut pieces of insulation were less prone to move
- Less time was spent reworking or resetting elbow pieces prior to taping them or adding linear lengths on the run
- Double adhesion aided in keeping seams closed while cutting elbow pieces and regular lengths, and when scribing the “fish mouth” cut for a tee fitting

The fillet process is so automatic and ingrained in pipe insulation installers that one member of the crew accidentally filleted a piece of flex core insulation simply out of habit before realizing it wasn't necessary²—a mistake he didn't repeat once he got used to the ease-of-use of the flex core insulation product.

Conclusion

Labor- and cost-savings with use of flex core insulation

Extrapolated to a full-scale project, such as a multi-story office building, eliminating the need to fillet insulation for small-bore pipes, saves time and money. Considering that pipe insulation is often performed late in the project process, the improvement in efficiency from using a flex core insulation product could be even more meaningful in practice, allowing contractors to conserve valuable hours when deadlines are approaching. The simple learning curve for installing flex core insulation also eliminates the need to have installers that are more experienced and comfortable with filleting, potentially enabling a more flexible allocation of workers during a critical phase. When insulating small-bore pipes, contractors should consider the time- and cost-savings of utilizing a form-fitting, flex core insulation product.

Total project cost and savings calculator

Complete this form with project specifications to calculate potential savings with the use of flex core insulation.

Rigid core insulation							
MATERIALS				LABOR			
	A	B	C	D	E	F	G
Pipe size (diameter)	Linear feet	Cost per linear foot (average)	Material cost per pipe size	Labor per linear foot	Labor (hours)	National avg. rate	Labor cost per pipe size
¾-inch		x \$	\$	A x 0.0178		E x \$88.55*	\$
1-inch		x \$	\$	A x 0.0181		E x \$88.55*	\$
2-inch		x \$	\$	A x 0.0255		E x \$88.55*	\$
H Total materials cost:				I Total labor cost:			
				J Total rigid core project cost (H + I):			

Flex core insulation							
MATERIALS				LABOR			
	K	L	M	N	O	P	Q
Pipe size (diameter)	Linear feet	Cost per linear foot (average)	Material cost per pipe size	Labor per linear foot	Labor (hours)	National avg. rate	Labor cost per pipe size
¾-inch		x \$	\$	K x 0.0149		O x \$88.55*	\$
1-inch		x \$	\$	K x 0.0157		O x \$88.55*	\$
2-inch		x \$	\$	K x 0.0230		O x \$88.55*	\$
R Total materials cost:				S Total labor cost:			
				T Total flex core project cost (R + S):			
				U Potential project savings with flex core insulation (J - T):			

*2019 RSM means national average billing rate per labor-hour for a union pipe insulator. Fully burdened rate includes fixed payroll taxes, workers' compensation and general liability insurances, overhead and profit.

For more information about this study and how using flex core insulation can impact jobsite productivity, visit:
[OwensCorning.com/Mechanical](https://www.owenscorning.com/Mechanical)

Sources

- ¹ McKinsey Global Institute. 2017. "Reinventing Construction: A route to higher productivity." <https://www.mckinsey.com/industries/capital-projects-and-infrastructure/our-insights/reinventing-construction-through-a-productivity-revolution>.
- ² Del Pico, W., Gomes, J. et al. March 2019. Installation Comparison of Fiberglass Pipe Insulation.



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