SPF Equipment: Proportioners

An Spray Foam Insulation & Roofing Magazine eBook

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Introduction

The success of spray foam applications hinges on the proper functioning of SPF equipment–you literally can't install spray foam without it. And when a system is running smoothly, there are numerous parameters in which the equipment must be operated–all under the responsibility of the application crew. Spray Foam Equipment: Proportioners, the first feature from the equipment series of the Spray Foam Insulation and Roofing Magazine eBook Collection, highlights the multifaceted nature of the heart of every SPF equipment system, the proportioner. Sometimes referred to as spray foam machines, proportioners do much of the legwork in processing SPF chemicals: pumping, heating, and maintaining proper pressure. As you'll see, there is much that goes into these machines being able to sustain that all-important 1:1 A-B ratio.

A Perfect Entrance Point For Builders, Insulators and Weatherization Professionals to Apply Spray Foam Insulation

Touch 'n Seal's CPDS 1000 Constant Pressure Foam Dispensing System is a unique machine with several advantages through which to enter the spray foam market. The CPDS 1000's affordable price tag and easy to handle two-component material supply system makes it a great alternative to higher priced and more complex spray foam machines and full-blown trailer rigs.

The CPDS 1000 is a low-maintenance, portable, constant pressure spray foam dispensing system. It uses an internal air compressor to deliver higher foam yield at more than twice the speed of traditional foam kits.

A unique double-valved disposable canister ensures consistent foam flow and reduced chemical waste, making it ideal for use in residential and commercial sealing and insulating applications.

The system applies polyurethane spray foam to horizontal or vertical surfaces making it ideal for many of today's SPF insulation projects.

Hoses up to 150 feet long are available, allowing for job-site portability and versatility. No chemical calibration is required. With an empty weight of less than 155 pounds and a 24" by 33" footprint, the CPDS 1000 fits in the back of a standard truck and can easily be navigated through standard doorways and entrances.

The system comes complete with instructional DVDs. Touch 'n Seal's website also offers further support, how-to's and customer service.

Mobile Spray Foam Rigs and Trailers

Mobile all-in-one trailer rigs that contain the spray foam machine, tools, compressor and generator have fast become the standard for spray foam contractors.

Mobile Spray Rigs integrate all of the necessary tools and equipment needed for SPF application into a turnkey mobile trailer system. Most of these trailers are tag along style (towed behind a pick-up truck) however; you will also see them integrated into a box truck style as well.

The benefit with a mobile spray rig is that all equipment is always set-up and stored in one place. The power utilities can also be included in the rig so you always have electrical power and air. Mobile spray rigs with built-in generators allow you to arrive on the jobsite and get to work quickly.

One of the major benefits in having a spray rig is that all of your equipment remains connected and set-up. There is no lost time running around looking for power and wasting time hooking up the material hoses and utility connections every day.

Mobile spray rigs also allow you to keep all of your valuable tools, equipment and material supplies in one locked and secure place. Additionally, the rig protects all of your components from the harsh weather and jobsite environment.

Many spray foam rigs are set-up with work benches and other support tools so you can service the equipment and spray guns when in need.

Your mobile spray rig can be your best source of marketing and advertising. It is very common for the foam contractor and coatings applicator to install huge graphics on the sides of the rig, with company name, logo and billboard style advertising and branding.

Photo Courtesy of Spray Foam Systems

Evolution:

A Look at the History of Proportioners and Heated Hoses for Spray Foam

1960

1970

1980

1990

2000

2010

Generally speaking, an equipment package consists of a proportioning unit, spray gun, heated hoses and transfer pumps. In this article we'll focus on the transition of proportioners and heated hoses.

In the early 1960's, in response to the emerging opportunities created by the development of polyurethane foam formulations, Fred Gusmer adapted an epoxy machine to demonstrate the feasibility of spraying urethane foam directly onto a substrate. The initial tests were encouraging to the point that Gusmer developed the famed air operated FF Proportioning Unit complemented by the Model D-Gun and heated hose sections. Thus the Gusmer Corporation was born, with the advent of a reliable proportioning system and the first mechanically self-cleaned spray gun.

The Model FF featured a mass style single pre heater, two (Iso and Poly) double-acting, positive displacement piston pumps and a manually controlled high voltage (220 volts) heated hose. Because of safety concerns regarding the spray applicator holding 220 volts in his hands, the next innovation by Gusmer was the development of the low voltage heated hose. This system is powered by an isolation transformer with the advantage that the high voltage side of the transformer is physically isolated from the low voltage side connected to the hose element. The heating element is a copper ribbon wound around the hose and electrically coupled to the proportioning unit directly or by wire. This hose design sets the format for the modern equipment of today.

With the vertical alignment of the proportioning pumps, typical of air operated machines, the pressure fluctuates from the up (fill) stroke that is aided by the transfer pump pressure to the down (discharge) stroke that is isolated from the supply pressure. This is considered to be a disadvantage; therefore the next innovation in the evolutionary process was the development of the Gusmer Model H with the patented opposed piston pump design. The

opposed configuration neutralized the effect of transfer pump pressure and results in constant pressure development on either stroke. Further advantages of the Model H was two mass style pre-heaters, including some patented technology, that allowed for separate temperature control of each component and more importantly introduced a hydraulically driven pumping system that produced a more reliable drive system, increased the spray output as well as eliminating the need for a large air compressor. The Model H was the mainstay of the industry until the introduction of the Graco Foam Cat line of equipment.

The Foam Cat included an innovative spray gun that competed directly with the Gusmer Model AR Gun. Both guns were impingement mixing and mechanically cleaned; however the Foam Cat featured a plastic module with a metal valving rod. Suffice it to say that this gun offered many advantages and set the standard for several of the designs to follow.

The Foam Cat was an air operated design and raised the bar for operating parameters. The pressure available was 2000 psi, the heaters were a direct contact design and the hose heat control was automatic. These features, complemented by the Graco Spray Gun, tipped the competitive advantage from the Model H to the Foam Cat.

Before we measure the response to the Foam Cat, it is well to discuss the role of GlasCraft to the industry. As well as offering an alternative to Graco and Gusmer,

the mainstay of the product line was the Probler Air Purge Spray Gun. This design was a slow starter but has gained favor over the years and it is safe to say that air purge has since become a widely used standard of the industry.

In the early 80's, Gusmer introduced the Model H-2000 along with the GX-7 Spray Gun. The H-2000 raised the operating pressure and the spray output, but its redeeming value was the maintenance-friendly direct contact pre-heaters and the unique Temperature Sensing Unit. Automatic hose temperature control was sensed in the hose at the gun and this "set it and forget it" concept was a major step forward in producing a quality foam product.

At this time, equipment design was fairly mature and on hold for the next family of urethane systems. Along came the urethane and polyurea coatings. Equipment manufacturers had to adapt to meet the application criteria of these high performance coatings by ramping up the pressure available to 3500psi and the processing temperatures to 160 degrees F plus. These high- performance coatings also dictated many design changes in the spray guns, such as direct impingement mixing and shorter-length mixing chambers, to name a few.

The urethane industry then shifted some emphasis to residential insulation that required some adjustment to

design protocols. Enter the target engineered Graco E series proportioning units with the Fusion spray gun. The E series design replaced the air motor with a variable DC electric motor coupled to vertical piston pumps.

The economic advantages and smaller footprint lent itself nicely to entry-level equipment for the emerging urethane applications and ultimately captured a significant, if not major, market share. The E Series electric console and control system introduced a customized solid state, circuit board type of design with diagnostics and monitoring capability.

In 2007, the Polyurethane Machinery Corporation was founded and subsequently introduced the Classic series of hydraulically operated, high pressure, high output proportioning machines along with the AP-1 Air Purge Spray Gun. The design format of the Classic was a back-to-basics approach that eliminated the expensive and somewhat less durable circuit boards in favor of point-to-point wiring and relay logic. The hydraulic tank is sized to allow continuous operation at specific pressures and outputs without the need for supplemental hydraulic fluid cooling. An open construction configuration provides easy access to all of the components for ease of maintenance.

The Classic hose design maintains the low voltage operation but is significantly enhanced by the use of an innovative copper weave-heating element with a PVC over-mold to protect the element. Unlike a copper ribbon, this element design covers 100% of the surface area of the hose and claimed to provide a more homogeneous and efficient temperature control. The temperature sensing is in the hose at the gun and features a thermal couple that can be replaced without entering the hose.

More recently in just the last couple of years, we have seen Graco, Inc. introduce a non-heated machine that processes polyurethane foam systems that do not require heat. Major system houses like Burtin Polymer Labs, Gaco Western and Quadrant Technologies have introduced new foam systems, both open and closed cell formulations that do not require any heat. This chemical and equipment innovation now opens up entirely ne market segments fo residential spray fo insulation.

Graco's E-8p Reactor Non-Heated Spray Foam Machine

Another great innovation in machinery design is Touch N Seals' CPDS, or Constant Pressure Dispensing System that utilizes pressurized canisters typically found in foam kit systems, and integrates them into a great little machinery package.

As the market changes and competitive pressures dictate, it is certain that we will see more innovation in the design of plural component polyurethane equipment!

Polyurethane Machinery Corporation (PMC) Unveils New Hydraulic Spray Foam Machine

Polyurethane Machinery Corporation (PMC) is celebrating five (5) years as a manufacturer of spray foam and polyurea application equipment. PMC is a subsidiary of the well-known multinational corporation PMC Global Inc., in Sun Valley, California and is supported by over 100 years of industry experience on staff.

At the 2012 SPFA Convention and Expo, PMC will introduce the next generation of Classic Series machines that will offer the consumer a more rugged design to withstand the rigors of a contractor's operation.

To develop this product line, PMC consulted with distributors and veteran contractors and the consensus was to eliminate the delicate custom designed and fabricated parts such as circuit boards. The Classic console reverts back to the basic point to point wiring scheme controlled by NEMA 4 rated switches. This translates into an environmental proof with duty cycles in excess of 1 million. PMC tells us the new wiring scheme makes troubleshooting a snap. All design components are easily replaceable in the field and readily available.

Reversing systems have been frequently plagued by poor switch alignment and mechanical failures. The new Classic system is signaled by factory aligned proximity switches and solid state relays for a rapid response with no moving parts and virtually indefinite service life, claims PMC.

Included in the main control system is an operator selectable counter that can be preset by the operator to interrupt the pump circuit at the completion of a certain cycle count or throughput; for example, just prior to operation and potential failure from an empty supply drum.

The new Classic PH Series is offered in four models ranging from outputs of 25-40 lbs/min and pressures from 2000-3500 psi.

According to PMC, several very satisfied customers have already come forward in support of the product.

Hygrade Insulators in Phillipsburg, New Jersey is an award-winning commercial and industrial roofing contractor that uses PMC's Hydraulic Classic units.

"We purchased our Classic and used it every day on schools in Ocean County, New Jersey for 850,000 square feet of roofing. We did not have one problem and the unit did not require any service," said Sal Piccione, Vice President of Hygrade Insulators. "This summer Hygrade did over 1.6 million square feet of roofs. The Classic was used on every job and again there were no issues. The hose heat and primary heaters seem to be much more accurate than our units from other manufacturers. Hygrade did a large job in

Hunts Point, NY where the temperature dipped as much as 45 degrees and the heaters performed flawlessly. Hygrade used 460 ft. of PMC hose with the Classic units and the temperature was maintained throughout the entire length.

Spray foam machines on the production line

The service from PMC was top shelf. Anything we asked for, we got. PMC even helped to offer service information and guidance for repair on other manufacturer's equipment. Business looks good for 2012 with a large amount of roofing jobs already booked. If anyone is in doubt about the products and service from PMC, give me a call," said Piccione.

Stan Betz, President of BN Contracting LLC in Ocean, New Jersey, agreed.

"I purchased the PMC Air Driven unit mainly because of the low price for a high performance machine that I can use efficiently for applying residential insulation. We found that the horizontal pump line on this unit flows so smooth and consistent and there is no hesitation at the change of the stroke. My mix and yield using this unit was phenomenal, which gives a quality insulation job for the customer and more profits for my company. My crew was also amazed at how quietly the unit operated. We like the air system because it is a very simple and rugged machine with fewer parts than others. The PMC unit sprayed and performed perfectly for the entire job and subsequently dozens since. I'm sold on the PMC equipment, the quality and performance and the guys that stand behind their products," he said.

PMC tells us they are also introducing a new, more economical air operated proportioner with vertically aligned pumps built to the same standard as the Classic. Also, the service does not stop with the sale. Anchoring the support for technical service is Frank Sica (voted by the industry, Technician of the Year for 2011) and his experienced technical staff.

The next generation of the Classic Hydraulic Series proportioners, along with the all new PA-16 and PA-30 air driven proportioners will be introduced at SPFA 2012 Dallas, Texas in January 2012.

Visit PMC's website for more information: www.polymac-usa.com.

Captured

Co-generation technology brings a new level of efficiency to proportioning systems

By Ryan Spencer

An improvement in energy efficiency is perhaps the most effective selling point for spray foam contractors trying to communicate the benefits of SPF insulation and roofing to their customers. However, efficiency isn't relegated to just the final product of a spray foam application; the process itself can benefit from efficiency-improving initiatives. Graco had that notion in mind when designing a proportioning system with the hope that it would operate more efficiently than anything currently on the market.

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Fuel savings primarily comes from removing the large electrical load of the material heaters.

"It was 18 months of design time and field testing, and before that, a year of market research," said Nick Pagano, Worldwide Product Marketing Manager for Graco's Applied Fluid Technologies Division.

Success came in the form of producing a proportioning system that not only improved efficiency, but performance as well–all while lowering operating costs for end-users.

Wasteful Spending

In considering ways to more efficiently design proportioning systems, Graco turned its attention to the heart of the system: the generator (in this case, a generator powered by a diesel engine). Those who took high school physics may recall the most important fact about energy conversion or transformation is that no conversion is completely efficient; usable energy output is always lesser than the energy input.

This holds true for diesel engines, which output usable energy that's only a portion of the fuel energy input. Arthur Graf, Electrical Design Engineer for Graco's Applied Fluid Technologies Division, authored a white paper, entitled Co-Generation Technology: The Key to a More Fuel-Efficient Proportioning System, that was presented at the 2012 CPI Polyurethanes Technical Conference, with Pagano delivering the presentation. A notable statistic from the paper asserted that less than a quarter of the output from a typical diesel engine is energy–in this case, electricity–that's available to power the numerous components of a spray rig (proportioners, air compressors, heaters, etc.).

With fuel prices surpassing four dollars per gallon this year, the inefficiency of diesel generators translates to three out of every four dollars spent on fuel being wasted. Suffice to say, there was opportunity for improvement.

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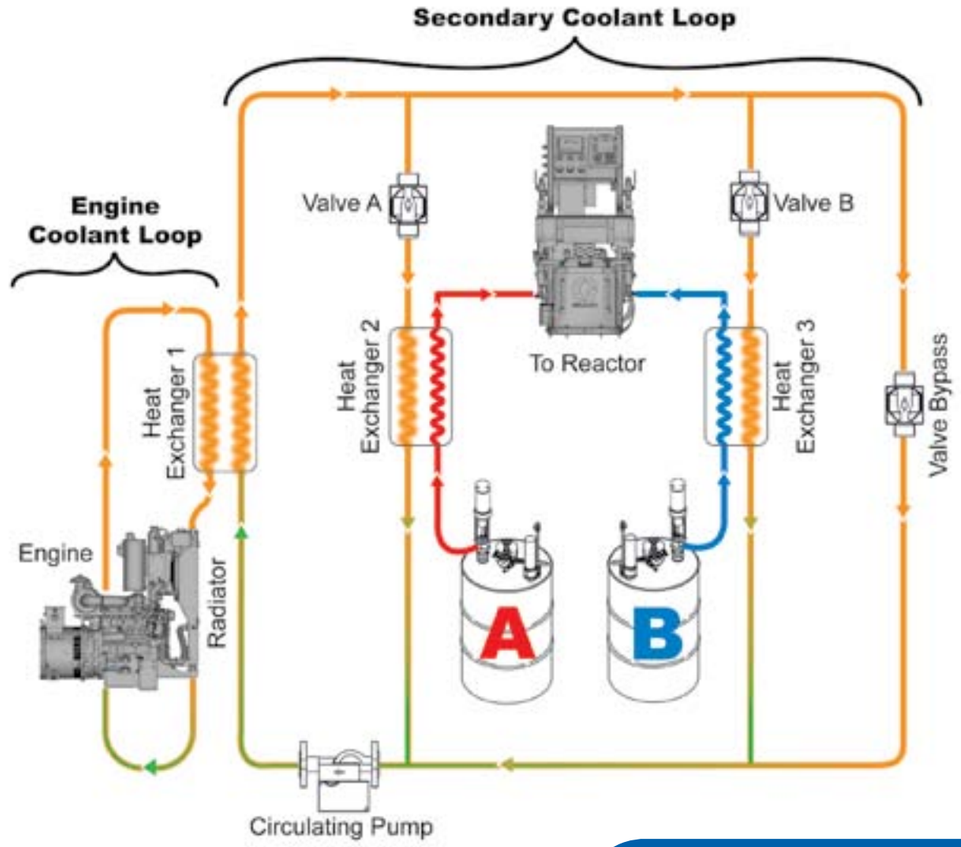
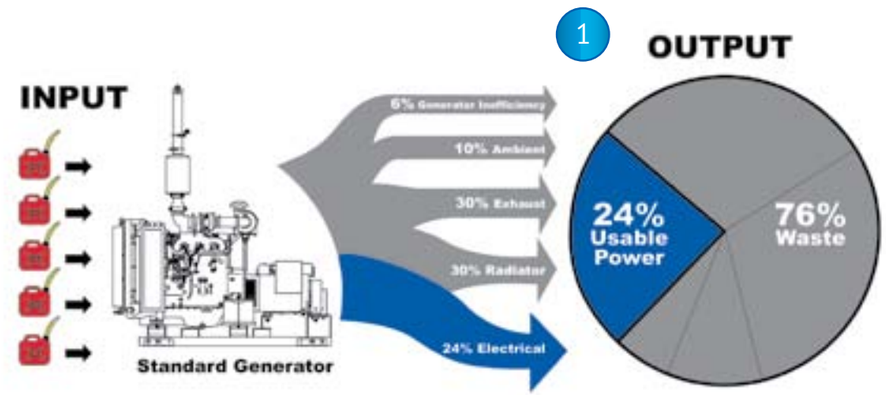
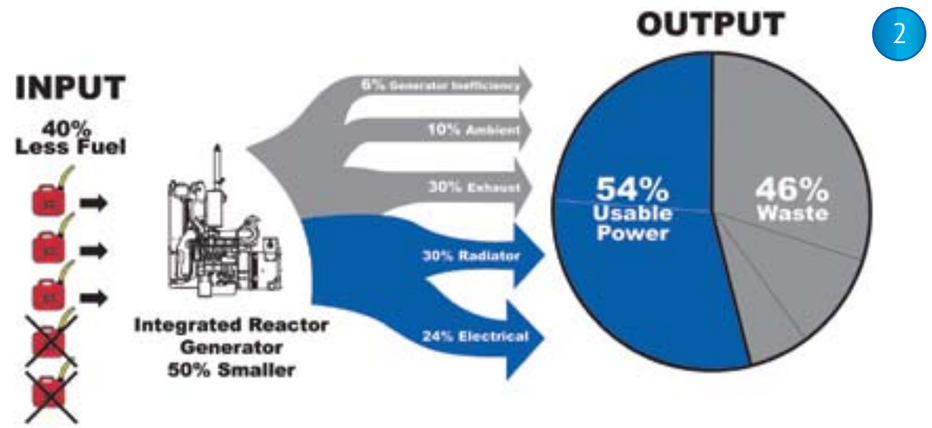


Co-Generation Heat Capture Diagram

Generator Efficiencies

1. Efficiencies of a standard generator
2. A generator using co-generation technology is 50% smaller and uses 40% less fuel





So, in addressing this glaring inefficiency, Graco focused on the fact that nearly one-third of the energy output of a diesel engine is waste heat expelled from the engine to the radiator. Since one of the functions of proportioner is heating A and B material, and that function is typically performed via an electric heater, Graco saw the opportunity: ditch the electric heater and make the "waste" heat usable.

Co-Generation as an Efficient Solution

Capturing the heat lost through a radiator so that a generator produces two usable forms of energy, heat and electricity, is a process known as co-generation. This technology makes usable the 30% of heat energy lost through the radiator, thereby increasing generator efficiency to 54%.

Naturally, eliminating a power-drawing component from a system results in a reduced overall power requirement, which means a smaller generator can be implemented, which in turn results in less fuel usage. The nuance of that relationship should be noted:

"Fuel savings primarily comes from removing the large electrical load of the material heaters," Graf writes. "Fuel usage is proportional to the engine's mechanical load, not engine size."

In other words, a smaller-than-average generator utilizing co-generation technology will not only use less fuel than its larger counterpart, but also use less fuel when compared to an equivalently sized generator powering the typical series of a spray rig's electrical loads. In fact, Graco asserts that a proportioning system utilizing co-generation technology uses 40% less fuel than a typical proportioning system.

Beyond fuel savings, an advantage of utilizing a smaller generator is that it can be more easily integrated with the proportioner into a single unit. Integration isn't just a means for saving space,

Reactor® E-30i

but also the most effective way to implement co-generation technology. The key for Graco was developing a way to capture waste heat and a method to precisely control it.

On designing a reliable means to capture waste heat, Graf writes, "heat that is usually lost through the radiator is captured from the engine's coolant and transferred to the material through a set of three heat exchangers and two coolant loops."

More specifically, heat is transferred from the main coolant loop (specifically, the section circulating the 200ºF coolant from the engine to the radiator) to the secondary coolant loop via the first heat exchanger. The secondary loop circulates coolant through a bypass path until valves independently allow the coolant to enter the second and third heat exchangers, which transfer heat to the A-side and B-side materials, respectively.

The process is controlled by proprietary software specifically developed for this application. Graco also designed an electronic user interface for the system, called the Advanced Display Module, that provides everything from simultaneous temperature readings and drum level estimation, to troubleshooting help and data logging capabilities.

When everything was put together, Graco had developed the first "heat-as-you-go" proportioning system using co-generation technology.

An Integrated Proportioning System Graco brought co-generation technology to market in early 2012 with the Reactor®

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Opposite: front profile of the E-30i (with air compressor); **Right**: back profile of the E-30i (without air compressor); **Above:** the Advanced Display Module

Mobile Spray Rig Trailers

1 A trailered spray rig layout with an integrated Reactor® E-30i

2 The layout of a typical trailered spray rig with a non-integrated proportioning system

E-30i integrated proportioning system. (Graco has also introduced the integrated Reactor® E-XP2i, for protective coatings). The system incorporates a Reactor proportioner with a 22kW, 29hp generator, which is roughly half the power output and one-third the horsepower of a generator found in a typical spray rig.

Despite the unit's reduced power requirements, the integrated Reactor® E-30i truly delivers when it comes to performance. The co-generation technology is capable of raising material temperature by 100ºF, which is a 25% over non-integrated Reactor models. Material can be heated to a maximum of 140ºF, or to 180ºF with a 4kW booster heater, which is recommended for spraying higher temperature foams and polyureas. Additionally, material is heated more quickly with the integrated units, relative to non-integrated units.

When incorporating the optional air compressor into the unit, Graco touts the integrated system as the complete turnkey mobile solution for spray foam applications.

"You're no longer tied to your trailer because the generator is on the same piece of equipment," Pagano said. "You can make it as mobile as you want now that everything is contained in a four-by-five-foot frame."

In fact, the E-30i is mobile enough to be loaded into the bed of pickup and taken to remote job sites that box trucks and trailered spray rigs would be hard-pressed to get to. Pagano even mentioned an instance of an integrated Reactor® E-30i being taken by boat to a spray foam application located on an island.

That being said, box truck and trailered spray rigs can also benefit from the compact design. Whereas typical spray rigs are often designed to have the power and air supply walled-off and separated from the proportioner and material, rigs that utilize the integrated proportioning system are afforded a more flexible trailer layout.

It's clear that an integrated proportioning system can positively impact the spray foam application process in numerous ways, but perhaps the most substantial advantage for spray foam contractors is the reduction in operating costs. To help in assessing exactly how much an integrated proportioning system can positively impact their bottom lines, Graco offers an online ROI tool wherein end-users can input various aspects of their operation and obtain a tangible estimate of savings.

For more information about Graco's integrated proportioning systems, visit www.graco.com.