Our World Is Changing Fast!
Fluid Temperature Control and Thermal Efficient Equipment

The spray foam industry has been evolving for the past 50 years. Now, with ozone layer depletion and Covid-19, we need to change to meet new demands. Although the stoichiometry in our industry has been changing all along, our equipment is not ready for the next generation of changes.

ISO A is linear in viscosity, but the B resin changes because of changed chemicals that force reformulations. The B resin is also much more sensitive to temperature. Present equipment is not set up to closely handle, control, and monitor the temperatures and flow coefficients correctly. Backup equipment is too big and expensive to operate and current proportioners cannot control the heat when the lines are not even insulated.

Polymeric MDI Isocyanate, better known as ISO A, has a permissible exposure level (PEL) of 20 parts per billion. This component can cause asthmatic symptoms and breathing problems in humans.

Our best ISO A ratio is within 1 – 2% on the positive side. A negative ratio will cause shrinking in the sprayfoam. Our chemicals now average closer to 275 cps ambient down to 200 cps viscosity at 130° F. We used to be able to lower the B resin viscosity to match or cross the ISO A viscosity on a temperature/viscosity curve chart for optimum spray temperatures. This is no longer the case.

The resin B material is very thick at ambient with a large curve as we heat up the material, but this also lowers the viscosity or thickness substantially. *The resin B temperature also affects the flow coefficients by pressure and speed as the liquid flows through the lines.*

With today's ISO A component at 275 cps down to 200 cps at spray temperature, and the resin B component up in the 600 to 1200 cps range, we cannot get the resin B component below 350 cps to match our ISO A. Spraying within 1% and lower pressures could put us under the PEL level!

Installing a 400-watt heater at 4.16 amps at the foot valve of the B resin pump can change the flow ratio in the system. The B resin is sensitive to heat and cold and this affects spray ratios.

The thermal conductivity of aluminum is 136, mild steel is 26.0 – 37.5, and stainless steel is 8. This makes aluminum the best metal for transferring heat into liquids. All preheaters in the market currently use steel springs over fire rods, the poorest method to transmit heat into resins. Thick aluminum springs and aluminum cylinders for thermal mass greatly improved performance. Each steel spring can cause 100 #'s pressure loss!

HD aluminum spring for over fire rods.
Notice the large spacing with no pressure loss.

Future of Equipment in SPF Rigs?

Major changes will happen to our equipment soon. Backup equipment is huge, costing the contractor too much in operating costs and reducing profits.

Proportioners should be designed to operate with less wattage or amp draw. Rotary screw air compressors improve the startup amp draw compared to piston air compressors. Two spray guns will work on one independent drive meter without the trouble, expense, and maintenance of drum pumps.

Present proportioners are not insulated and lose heat from the preheaters to the heated hoses; aluminum manifolds mounted on a cold aluminum chassis lose 25% of the heat in this section.

An unheated resin hose in winter will lose all of your heat long before it gets to the meter if not spraying constantly. Summer heat could cause frothing and being unable to pump. Proper insulation of your supply hoses from the drums to the proportioner is vital to maintaining proper temperatures through your system. Strategically placed low wattage heaters can reduce the size of your generator, fuel consumption, and maintenance costs and still give ample heat to the spray gun.

Off-ratio foam is being tested and will adversely affect our common drive systems. Differential pressures and flow coefficients are not a problem in independent drive systems. Carlisle and Akurate are independent drive systems.

If you feel heat from your hose outside in the winter laying on the ground; you're lacking insulation on the spray Hose! Too many amps are being used to heat our present-day systems with a demand for huge generators with higher operating costs.

Equipment

Fire rods that heat the chemicals directly can cause damage to the chemicals as well as destroying the outside jackets of the fire rods. They cause 100 #'s pressure loss in every 18" of steel springs.

Massive preheaters draw huge amperage with no insulation to the tubes that control the flow of the products from the drum to the proportioner. Once the fluids leave the preheaters in small metal lines with no insulation, the fluids cool or heat back to ambient temperature quickly.

15,000-watt preheaters and 40 KVA generators that cost a lot per day for fuel are not efficient in our systems. We heat our 500 lb. drums with little 500-watt blankets that only draw 4.16 amps on 120 volts. This is useless with uninsulated supply hoses. We need to control the temperatures of both fluids from the drum to the gun with less amperage draw than we are presently using. **See SPFA TT – G10.** The contractor can do a great deal in controlling temperatures now. Heat tracing your supply line from the drum to the proportioner alone will control the beginning heat to the system. We need to gradually heat the materials and control temperatures all the way from the drums to the gun!

Pump lube systems

Most ISO A pump lube systems are a failure in design and fluids used. Any contractor can fix this problem by installing a small peristaltic pump and eliminating plasticizers that react and set up with ISO A.

Hydraulic pumps

Electrical directional control components are costly to troubleshoot and are not needed. Hydraulic reciprocating pumps have been available for over 40 years with fewer components, more reliability, and faster directional change. They can also eliminate air transfer pumps by using a driver pump technology, which can simplify your whole setup. For example, the paint industry uses simple hydraulic paint pumps.

Generators

Using a rotary screw type compressor eliminates current surges compared to piston compressors. This can reduce the size, KW, fuel consumption, and accessory components mounted to the generator. Using the hydraulics from the proportioner for a hydraulic drum mixer can reduce the CFM draw off your compressor allowing a smaller compressor.

With air meters the fluids can over pressure the air pumping system causing problems; running a larger air system also costs much more to operate.

If you switch between shore power and generators, keep a wired rotary screw compressor and hydraulics on the proportioner.

I propose to go Green with a generator that gets rid of all LP, gas, and diesel type generators that contaminate our air and cost too much to operate!

Unheated gun flex whips with mini-Y strainers

You can reduce maintenance time and costs by taking the screens out of the gun and installing separate mini-Y strainers just after the manifold valves. You can shut off the valves, clean the screens, and be back running in a few minutes without wasting time taking the gun off or apart. The gun without screens operates cleaner and better all day. When screens get full, they restrict flow and split and allow dirt to get into the rest of the gun.

Differences between common and independent drive proportioners

Common drive or mechanically linked proportioners have the ISO A and B resin pumps connected either with a shaft or a yoke so that both pumps stroke evenly at the same rate. Mechanically linked pumps are designed to dispense an equal amount of both A and B chemicals on each stroke. Mechanically linked pumps are the most used proportioners for spray foam materials. Many are failing in ratio control just because they are not insulating and controlling the heat and viscosity of the fluids that affect flow rate.

Independent or direct drive ISO A and B resin pumps are connected to separate pumps or drive power sources. Each pump or drive source may be separately controlled by downstream measurements of flow. Because the motor/driver for each pump is controlled independently, they are not restricted to pumping equal volumes of fluid. Independent drive systems can be set to minimize differences in pressure and may use flow meters to control ratio. Since the mixing ratio is adjustable, it may require a more qualified applicator to properly operate this type of system.

With a common drive the pressure in the A side affect the pressure of the B side when you have a restriction or starvation. This is not true with independent drive systems. Independent drive systems are designed for much better ratio control whether you spray 1:1 or any off ratio.

Troubleshooting an independent system is easier. For example, if you have plugging on the A side of the gun the pressure goes up a little and stops. This slight pressure increase does not affect the B side because there is no opposing force to push it up higher; the B resin stays right on your set spray pressure. At this point you need to identify which component you are lacking.

With an independent drive system, you can just shut off one side and then test spray the other side to make sure spray pressure is correct. Once you identify the problem side, you can determine whether you have a plugged gun or screens. If the problem is not in the gun or screens, you may have a cavitation problem. Work from the drum to the proportioner to find the problem. Independent drivers point you very quickly to the fluid's flow problem.

Independent drives also excel at dialing in and controlling ratios of less than even the 2% factor. We can change the cycle time of the ISO A component which flows easier than the B resin. We do this by slowing down the ISO A gear pump or by slowing down the cycling time of the ISO A pump in the hydraulic systems.

It does take more technical ability to operate and control the independent drive systems. But once you learn and understand the different way to control the ratio you can spray more correctly on the proper ratio. A Programmable Logic Controller (PLC) system controls the ratio by the cycle counts or flow meters, and by operating stepper motors to adjust the flows of the components.

Hydraulics is best at pressure compensating, including the drum mixer motor if needed to avoid component striation.

Summary / Conclusion

There are many benefits with independent driving systems and improved proportioner heat control. These benefits include:

- ✓ Excellent heat and ratio control
- ✓ Simpler, faster problem troubleshooting
- ✓ No transfer pumps used.
- ✓ Lower operating costs
- ✓ 2 gun capable
- ✓ Hydraulic drum mixer