



# Filtering

*Filtration • Demisting • Humidification • Separation*

## General Description

Engineered high-performance, flexible polyurethane foams meet many design criteria for a variety of filtering functions. These include removing dust and contaminating particles from air, gases, and liquids (filtration), collecting vaporized oils from industrial equipment (de-misting), acting as an evaporative surface (humidification), and cleaning up oil spills (oil/water separation).

## Applications

- Air filters for small engines
- Air conditioners
- Data processing equipment
- Electronic air cleaners
- Humidifiers
- Furnaces
- Condenser coils
- Refrigerators, cold drink dispensers, and other appliances where moving air is required either by force or convection.

Table 1: Products

| Products          |      |           |                 |  |
|-------------------|------|-----------|-----------------|--|
| Functions         | SIF® | SIF® Felt | SIF® PVC-coated | Applications   |
| Filtering         | X    | X         | X               | air filters for engines<br>air conditioners,<br>furnaces, appliances |
| Demisting         | X    | X         | X               | fuels and oils   |
| Evaporative Media | X    |           | X               | humidifiers and<br>evaporative coolers                               |
| Coalescing        | X    | X         | X               | oil spill cleanup  |

*Matrix for Functional Applications of FXI Cellular Plastic Materials*

## Benefits

- Relatively low air resistance, low pressure drop
- Open-pore skeletal structure
- Large dust-holding
- Easy installation and space savings
- Ease by which it can be shaped, glued, sewn
- Since the flexible foams are washable
- Reusable
- Good depth loading capabilities
- Wide range of particle size filtration due to a range of pore sizes available
- Ability to separate oil-based materials in water environments because the foams are oleophilic



*\*information subject to change without notice*

## **FXI Filter Media**

Filter Foam (SIF®), PVC coated foam (SIF®-PVC), and SIF® Felt foam are reticulated flexible polyester polyurethane foams or specially engineered polyether foams. Unlike ordinary urethane foams, they have a completely open cell, three-dimensional structure of skeletal strands which give them special filtering properties. They are exceptionally porous and permeable; therefore, they are ideal for many filtration applications where other foams cannot be used.

SIF® PVC-coated foam is a flexible open-pore polyurethane foam coated with polyvinyl chloride. This coating preserves the foam strands without significantly increasing their resistance to air or liquid flow. SIF® PVC-coated foam resists chemical attack and has greater tear strength and compression deflection than uncoated polyurethane foam.

SIF® Felt is a compressed, reticulated flexible foam. It is made by compressing a 90 pores-per-linear-inch (ppi) foam under, heat and pressure.

## **Filtration**

SIF® and SIF® Felt foams filter air with relatively little air resistance or pressure drop because of the special

combination of dust-catching strands and dust-holding capacity in their voidspace. For example, these foams are used in engine air filters on lawn mowers, motorcycles, automobiles, and trucks. The high-performance foams filter air in air conditioning units, furnaces, computers, refrigerators, and many other products that require dust protection. SIF® and SIF® Felt foams can be fabricated in many ways such as hot wire cut to complex shapes for lawn mower engine air filters, metal or plastic framed sheets for a pre-filter and/or after-filter use in electronic air cleaners. In addition, the foams can be glued or sewn into bands for filter wraps on automobile carburetor air cleaners.

## **Stretchable Face Mask**

A comfortable mask of fine pore SIF® foam loops behind the ears and fits snugly against the nose and mouth to diffuse the wearer's breath and act as an oral spray screen. It is used, for example, by a dentist while working on a patient.

## **Gasoline Fuel Filters**

SIF® Felt foam is used in place of felt to filter gasoline fuel in chainsaws and other small engines.

## **Dust Removal Systems**

SIF® and SIF® Felt foams are used in this application because they can be manufactured in the optimum pore size for removing the specific contaminant. They have excellent depth loading and are long lasting. They can be oiled for greater particle impingement, are easily cleaned by vacuuming, hosing, or

washing, and are easy on fan motors because of their low air resistance.

## **Automobile Power Brake Unit**

SIF® Felt foam is used to both filter and diffuse air entering the power actuating cylinder where it helps protect the mechanism from dust and provides for quieter operation.

## **Electro-Magnetic Door Lock Actuator Wedge**

Thumbnail-size tabs of SIF® foam are used in the solenoid mechanism which must be vented and protected from dust. SIF® was the choice for this application because it is economical, easy to install, and stays in place by virtue of its own compression deflection. It is not affected by rain water in the event of window seal leakage and filters effectively for the normal life of the car.

## **Demisting**

SIF® effectively filters aerosols or droplets from air drawn through it. The moisture coalesces, or gathers, on the foam, trickles to the bottom, and is collected for reuse or disposal. SIF® foam is an excellent de-misting medium due to its large specific surface area—up to 2,300 ft<sup>2</sup>/ft<sup>3</sup> of foam.

## **Machine Tool Demisting**

Filters made of SIF® foam help inhibit the accumulation of oil on floors, walls, equipment and personnel.

*\*information subject to change without notice*

Table 2: SIF® Foam

| SIF® Foam - Typical Physical Properties <sup>1</sup> |                  |                              |                   |                             |                               |                                       |      |
|--|------------------|------------------------------|-------------------|-----------------------------|-------------------------------|---------------------------------------|------|
| Pore Size <sup>2</sup><br>(ppi)                      | Density<br>(pcf) | Tensile<br>Strength<br>(psi) | Elongation<br>(%) | Tear<br>Strength<br>(lb/in) | 50%<br>Compression<br>Set (%) | Compression Force<br>Deflection (psi) |      |
|  |                  |                              |                   |                             |                               | 25%                                   | 65%  |
| 10   | 1.9              | 20                           | 315               | 5.5                         | 8                             | 0.48                                  | 0.72 |
| 20   | 1.9              | 25                           | 320               | 5.5                         | 8                             | 0.42                                  | 0.67 |
| 30   | 1.9              | 25                           | 320               | 5.3                         | 8                             | 0.40                                  | 0.65 |
| 45   | 1.9              | 28                           | 340               | 4.7                         | 12                            | 0.40                                  | 0.65 |
| 60   | 1.9              | 33                           | 400               | 4.3                         | 12                            | 0.40                                  | 0.65 |
| 80   | 1.9              | 35                           | 415               | 3.9                         | 12                            | 0.40                                  | 0.65 |
| 100  | 1.9              | 35                           | 415               | 3.9                         | 12                            | 0.40                                  | 0.65 |

Table 3: PVC-Coated

| SIF® PVC-Coated - Typical Physical Properties <sup>1</sup> |                        |                              |                   |                             |                               |                                       |      |
|--|------------------------|------------------------------|-------------------|-----------------------------|-------------------------------|---------------------------------------|------|
| Pore Size <sup>2</sup><br>(ppi)                            | Thick-<br>ness<br>(in) | Tensile<br>Strength<br>(psi) | Elongation<br>(%) | Tear<br>Strength<br>(lb/in) | 50%<br>Compression<br>Set (%) | Compression Force<br>Deflection (psi) |      |
|  |                        |                              |                   |                             |                               | 25%                                   | 65%  |
| 10   | 0.375                  | 25                           | 270               | 6                           | 23                            | 0.60                                  | 1.20 |
| 20   | 0.250                  | 24                           | 300               | 6                           | 26                            | 0.50                                  | 1.10 |
| 45   | 0.250                  | 34                           | 320               | 8                           | 30                            | 0.60                                  | 1.20 |
| 60   | 0.250                  | 34                           | 250               | 8                           | 25                            | 0.50                                  | 1.40 |

Table 4: SIF® Felt

| SIF® Felt - Typical Physical Properties <sup>1</sup> |                  |                              |                   |                             |
|--|------------------|------------------------------|-------------------|-----------------------------|
| Firmness   | Density<br>(pcf) | Tensile<br>Strength<br>(psi) | Elongation<br>(%) | Tear<br>Strength<br>(lb/in) |
| 3-900Z   | 5.3              | 50-80                        | 250-350           | 5-10                        |
| 10-900Z  | 17.5             | 160-220                      | 200-300           | 20-30                       |
| 15-900Z  | 26.2             | 200-270                      | 200-300           | 25-35                       |

Table 5: Nominal Pore Size Ranges

| Nominal Pore Size Ranges          |         |         |  |
|-----------------------------------|---------|---------|--|
| Pore Size <sup>1,2</sup><br>(ppi) | Minimum | Maximum | Suggested<br>Minimum Sheet<br>Thickness (in) |
| 100                               | 80      | 110     | —  |
| 80                                | 70      | 90      | —  |
| 60                                | 55      | 65      | —  |
| 45                                | 40      | 50      | 1/8  |
| 30                                | 25      | 35      | 3/16   |
| 25                                | 20      | 30      | 7/32   |
| 20                                | 15      | 25      | 1/4  |
| 10                                | 5       | 15      | 1/2  |

<sup>1</sup> Not to be used as a specification<sup>2</sup> FXI Internal Test Method; all other properties tested in accordance to ASTM D3574

## Humidification

Because SIF® has a large surface area and low pressure drop, it makes an excellent humidifier evaporative medium.

## Domestic and Industrial Humidifiers

A band of coarse, open-pore SIF® foam lifts water from a reservoir pan across the path of a fan-fed airstream. The elasticity of the band of SIF® foam holds it firmly against the drive elements for months of service. Available in several different strand surface grades, its thickness and pore size can be varied to meet designer specifications.

## Oil/Water Separation

Being oleophilic, SIF® can be used to attract and separate oil based materials in a water environment, such as an oil spill clean-up.

## Other Applications

- Automotive air conditioner “split screens”
- Paint spray booths
- Volatile oil demisting (eg. coffee oil demisting)

\*information subject to change without notice

# Product Description

## Physical Properties

The homogeneous structure of SIF® helps minimize the possibility of open channels which could drastically affect filter efficiency. Each cell in the medium is completely interconnected with all surrounding cells. This allows for free passage of air and at the same time provides high surface-area contact for impingement of dust particles. The resilience and strength of the foam helps prevent strand displacement under normal operating conditions.

## Fabrication

The high tensile strength and tear resistance of SIF®, together with its ease of fabrication provides great flexibility in project design. It can be sewn, stapled, glued or grommeted. This foam can be framed as a more conventional filter medium, or it can be used simply as a filter pad with no additional fabrication. The material, however, is most practically and economically used as a filter pad alone where design of original equipment will accommodate this type of application.

## Pore Size

SIF® is produced in many standard pore grades. Expressed as the average number of pores-per-linear-inch, these grades range from 3 to 110 ppi. Two or three stage filters can be produced by combining several pore sizes. The range in pore size for each grade is controlled within specified limits.

Figure 1: Specific Surface Area vs Pore Size

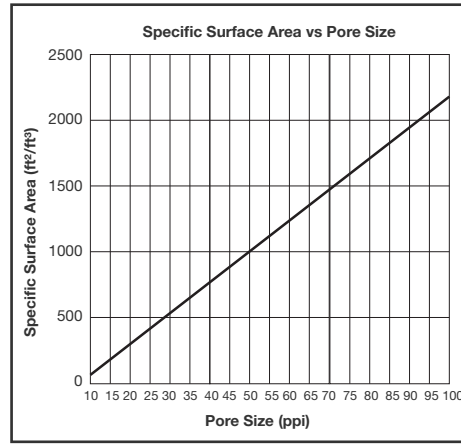
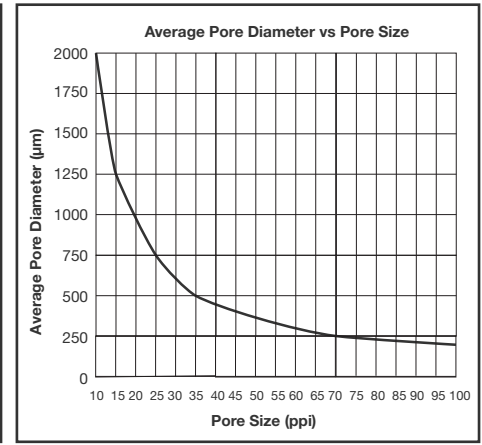


Figure 2: Average Pore Diameter vs Pore Size



## ASHRAE STD. 52-76 Air Filter Performance Report

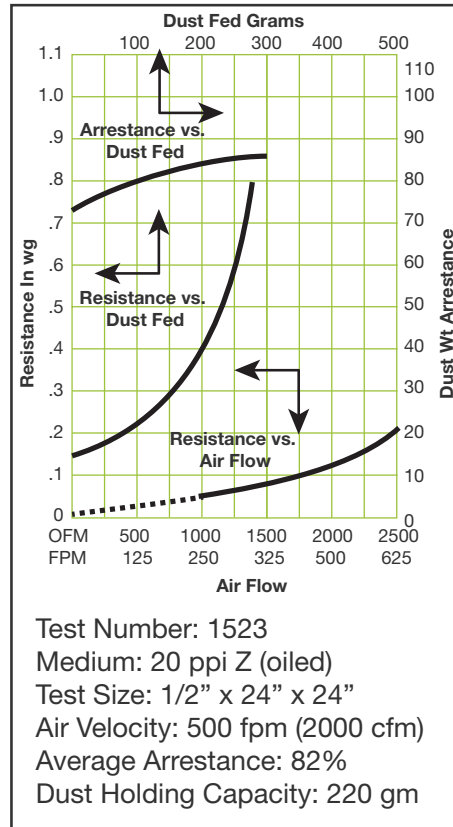


Figure 3: Test Number 1523

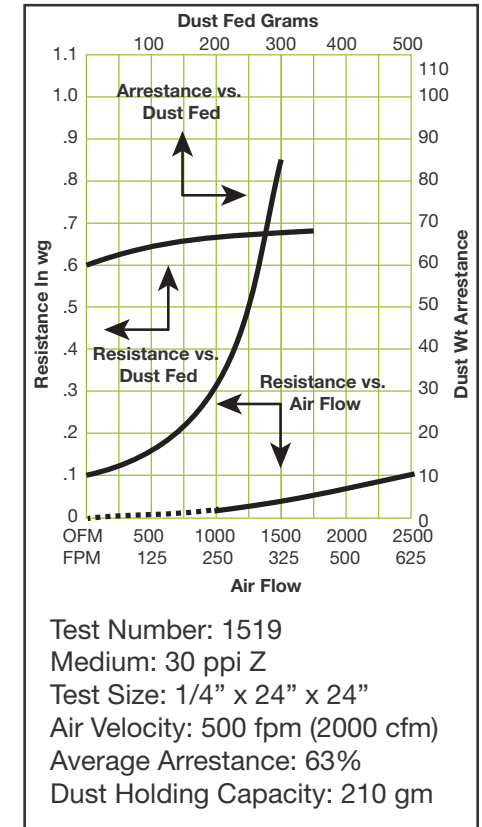


Figure 4: Test Number 1519

## SIF® Felt

Made from a reticulated polyester or polyether polyurethane foam, SIF® Felt has excellent permeability, high physical strength, outstanding filtration efficiency, abrasion resistance, and oil-wicking characteristics.

SIF® Felt Grade 900 is manufactured by compressing 90-ppi reticulated foam under time, heat and pressure to impart a permanent compression set. By varying machine conditions and the ratio of initial foam thickness to final felt thickness, the specific design properties of the end product can be controlled. This compression ratio is called the firmness of the material. A firmness as high as 20 is available.

As the particle size to be filtered decreases, the firmness increases and the resistance to fluid flow increases.

SIF® Felt is easy to work with and is easily cut, glued, or shaped into unusual or curved configurations. Because it is a homogeneous material, it does not fragment or fall apart.

## Temperature Features

SIF® and SIF® Felt foam have excellent high and low-temperature characteristics. They can withstand intermittent temperatures as high as 250 °F. At temperatures above 500 °F, these foams begin to melt with decomposition and vaporization. At -40 °F, they show no evidence of cracking or tearing when bent around a mandrel equal in diameter to the foam thickness.

## Chemical Properties

SIF® and SIF® Felt foams are not adversely affected by water, soap and most detergents, perspiration, oils, and on most cleaning solvents or greases at ambient temperatures. Aliphatic hydrocarbons cause slight swelling and aromatics cause considerable swelling. Removal of the hydrocarbons allows the foam to regain its original dimensions and strength. SIF® and SIF® Felt are attacked by strong acids, caustics and chlorine, and are not recommended unless protected by PVC coating.



*\*information subject to change without notice*

Figure 5: Pressure Drop vs Pore Size

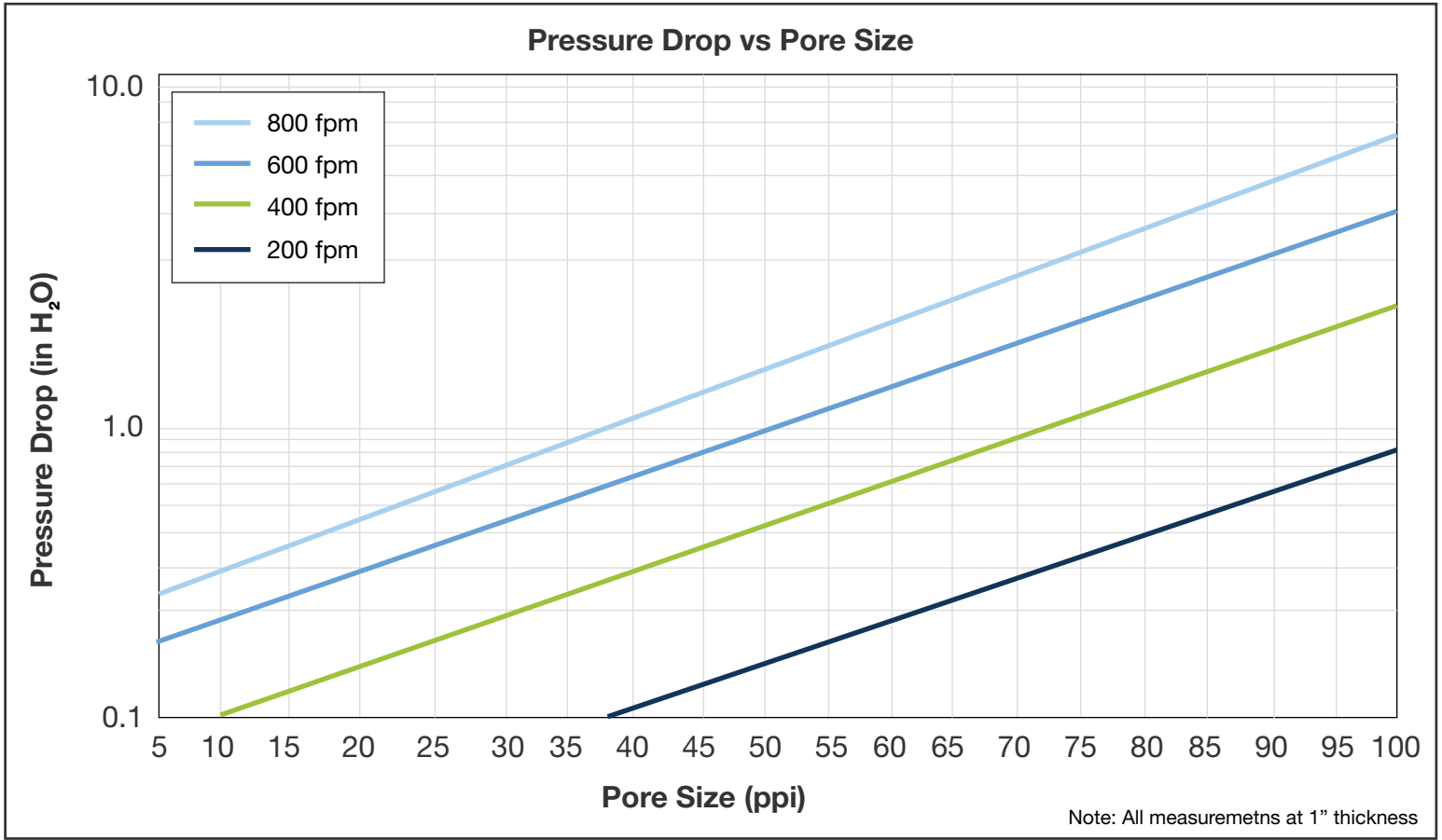


Figure 6: Velocity vs Pressure Drop @ 10 (ppi)

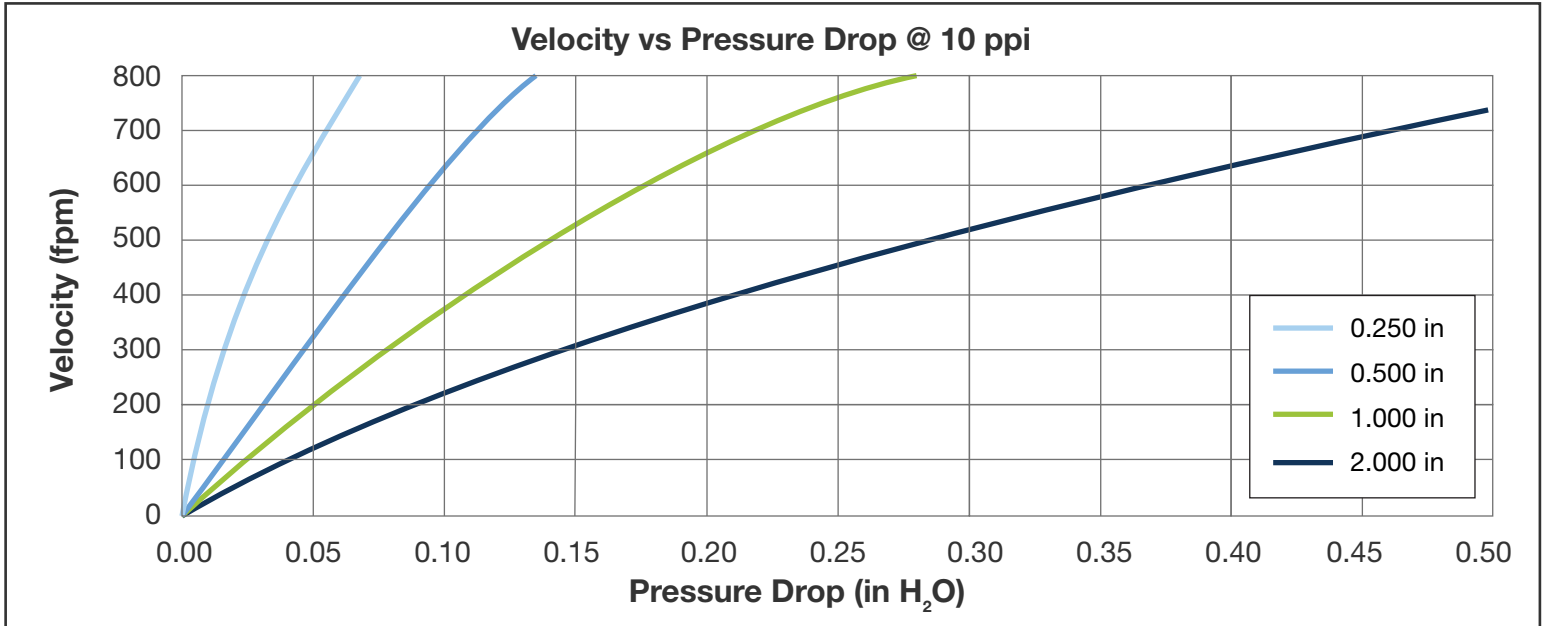


Figure 7: Velocity vs Pressure Drop @ 45 (ppi)

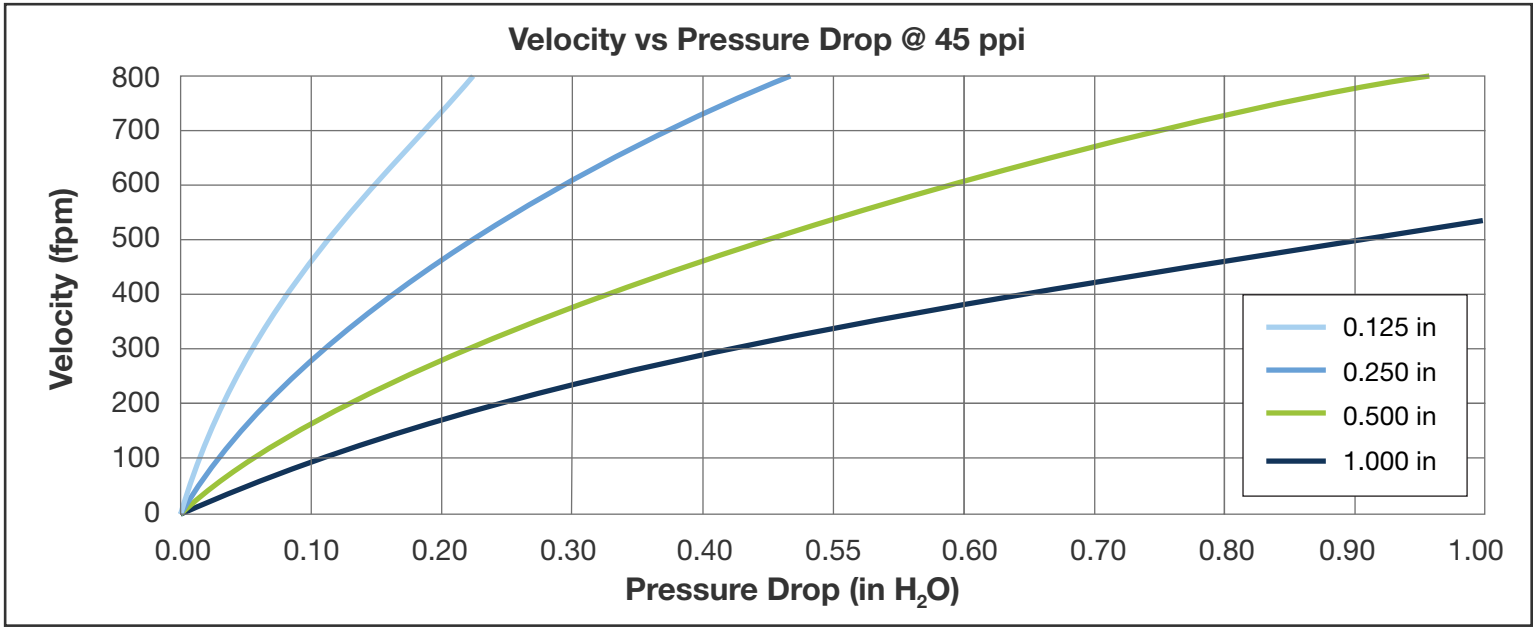


Figure 8: Velocity vs Pressure Drop @ 60 (ppi)

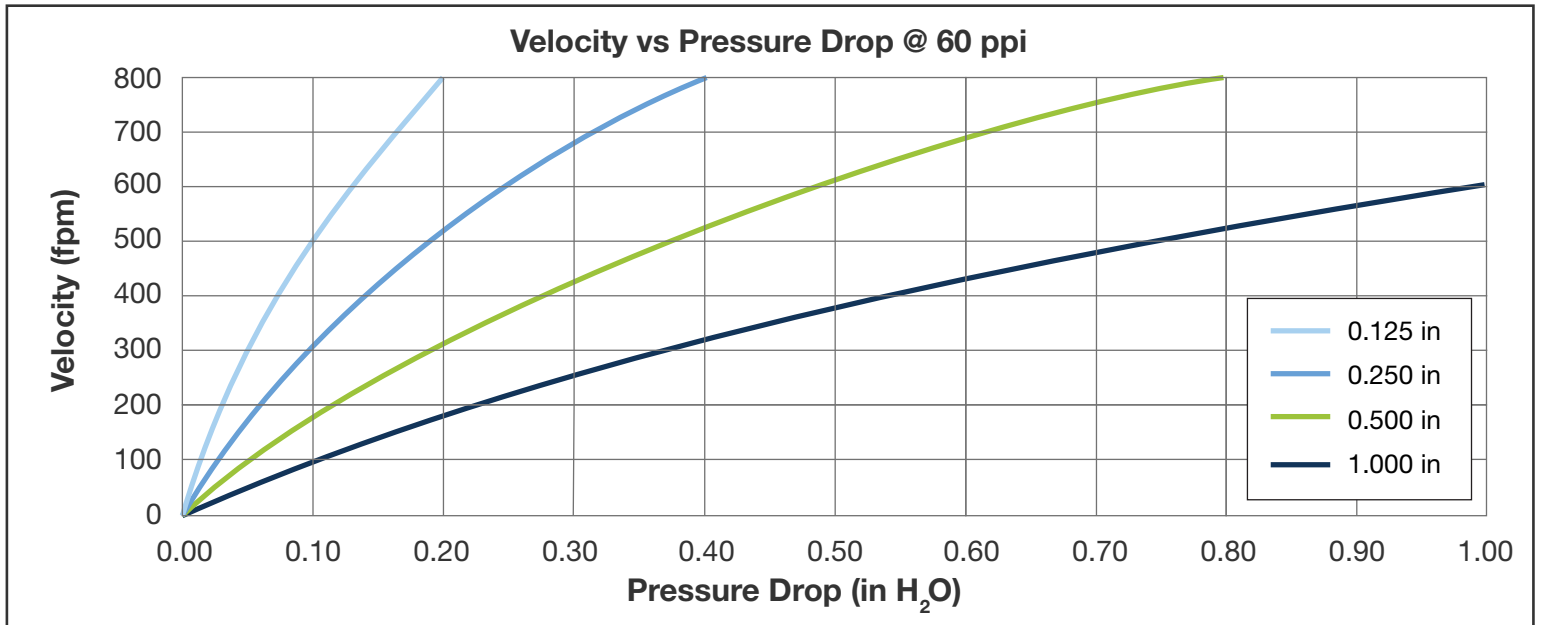
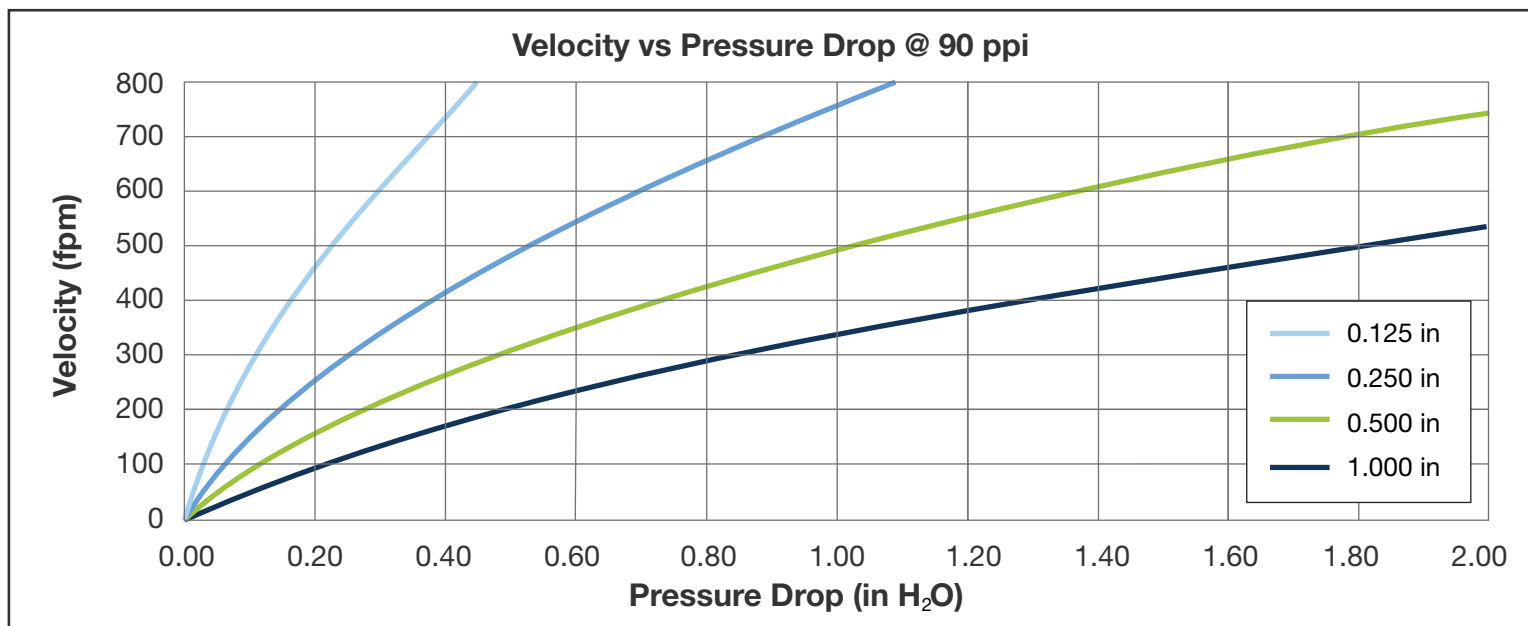


Figure 9: Velocity vs Pressure Drop @ 90 (ppi)



### FXI – Committed to Innovation, Service and Quality

For over 50 years FXI's technology has been leading the way to new and innovative applications for polyurethane foam solutions. We have one of the largest R&D centers and hold more patents than most companies in our industry. Across an increasing range of markets and applications, our team is ready to help you solve your most complex problems. With manufacturing facilities across the country, FXI is there when you need us – ready to deliver the highest quality products to help your business grow.

**IMPORTANT NOTICE REGARDING FLAMMABILITY**— All polyurethane foams including combustion modified foams will burn and generate smoke and gases. Performance conditions and corresponding data refer to typical performance in specific tests, such as UL-94 and MVSS-302, and should not be construed to imply the behavior of this or any other product under other fire conditions. All data regarding these products were obtained using specific test methods under controlled laboratory conditions intended to measure performance against specifications. Due to the great number and variety of applications for which FXI products are purchased, FXI does not recommend specific applications or assume any responsibility for use results obtained or suitability for specific applications. FXI warrants its products only to direct buyers. (See FXI's Standard Terms and Conditions of Sale for FXI's warranty.) IN NO EVENT SHALL FXI BE RESPONSIBLE FOR ANY CLAIM IN EXCESS OF FXI'S SALE PRICE OF THE PRODUCT TO WHICH THE CLAIM RELATES.

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