Why Strainers Are Vital to Pump Efficiency

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It's as important to keep pump strainers clean as it is to install one on your pump. Here are the key facts on this important pump accessory.

AT FIRST thought, it may seem that a strainer is a simple fitting hardly worth taking time to study. However, strainers (or the lack of strainers) can be one of the greatest causes of pumping trouble. Having no strainer in the pump inlet line is harmful, as this lets abrasive foreign material that may be present in the fluid being handled, get into the pump. But is is just as harmful to have a strainer and neglect it, as then foreign matter may build up in the strainer screen and cause a serious pump inlet restriction, reducing the pump delivery rate and, in extreme cases, causing starvation and excessive pump wear. It will be the purpose of this article, therefore, to explain the need for a strainer in the inlet line to every pump, to describe the types best suited for LP-Gas service, to tell how to choose the proper size of strainer, and to show how this strainer should be installed so that it may be most easily cleaned and serviced.

Question: What are the kinds of foreign matter that may be present in LP-Gases?

Answer: Weld-shot, sand, gravel, rust, pipe scale, hardened pipe-joint sealing compound, and insoluble greases are all often present in liquid butane and propane. Weld-shot is particularly common when new storage tanks or pipe fittings with welded joints are first put into use. Weld-shot is composed of small round particles of hard steel, and is very damaging to any type of pump. New tanks may be thought to be thoroughly cleaned, but still they may have some weld-shot in them.

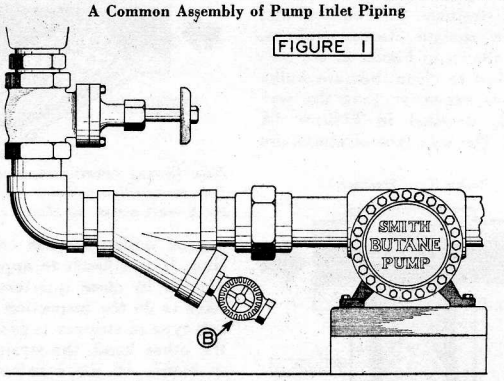
Sand and gravel often get into the system if unloading hoses are dropped or are coiled on the ground. Rust can be a serious problem if tanks or piping that have been out of service for some time are put back into use. Insoluble greases used for lubricating plug-type valves are often present. Your plant may not have plug valves; but if this type of valve is used in the refinery, the load of fuel you receive by tank-car or truck transport may be contaminated.

Question: Can insoluble greases be harmful to a pump? Why do we need a strainer for protection against this type of contamination?

Answer: These greases in small amounts are not harmful to a pump. However, a strainer must be installed for protection against other kinds of foreign material; and the greases pose a problem in that they clog up the small holes in the strainer screen, rendering them difficult to clean.

A Common Assembly of Pump Inlet Piping

FIGURE 1



Note blow-off valve (B) in the strainer cap. Opening this valve when pressure is in the lines will blow off some foreign matter, but will not clean out insoluble greases if they are present.

Question: Then why not use a screen with larger holes?

Answer: Dirt particles as small as 15/1000 of an inch in size will seriously damage any make of pump, through their abrasive action. Clearances between pump working parts are usually much smaller than this. It is therefore necessary to use a screen with very small holes, or one made of fine mesh wire cloth, so these fine dirt particles cannot get through.

Question: What type of strainer screen do you recommend?

Answer: For units of our manufacture, we recommend a strainer screen made of 40-mesh or finer wire cloth, or one having 1/64 in. perforations. The wire cloth screens are preferred, since they have more open spaces and cause less restriction-to-flow. Sometimes, if it is known that extremely fine particles of rust are present in the fuel, it is good practice to install screens made of up to 100-mesh wire cloth. This type causes a greater flow restriction, however, and should not be used except where it is absolutely necessary.

Question: When we installed our new storage tank and got a new pump, we put in a strainer, and for the first few months of operation took a half-cupful of weld-shot out of the strainer every week. The weld-shot is all washed out now. We have lubricated plug valves, and have a lot of trouble cleaning the strainer screen, because of the insoluble grease present in the lines. Since we are catching no more weld-shot, can we safely leave the screen out of the strainer now?

Answer: It would be much safer to leave the screen installed. An easy way to clean a screen, if you find this difficult, is to boil it for a half-hour in a strong solution of caustic soda (sodium hydroxide) and water. Small cans of caustic soda can be obtained in almost any grocery store. We feel that an hour spent each month inspecting the strainer screen and cleaning it if necessary is good and cheap insurance against pump wear.

Question: Our strainer is installed with a blow-off valve, as shown at B in Figure 1. We have been cleaning our screen by blowing it off every few weeks, and save a lot of time that way over having to take the thing apart. Is this procedure O.K.?

Answer: Blowing-off will usually get rid of weld-shot and other large pieces of foreign matter, but it does not clean out the insoluble grease, if this is present. This grease is very sticky after exposure to butane or propane, and adheres tightly to the screen. It is much better to take the time to remove the screen completely and boil it out if necessary. By doing this, you also have a chance to inspect the screen to see if it is damaged, and you will know if it is necessary to order a new one.

Question: I suppose a strainer blow-off valve connected to a blow-off stack, as shown in Figure 2, is even less efficient?

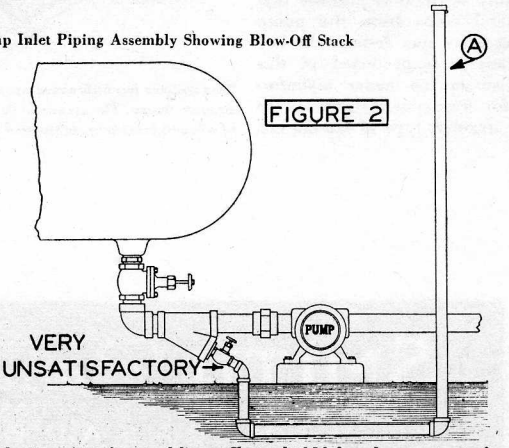
Answer: Right, because the heavy pieces of dirt cannot be lifted to the top of the stack, and will fill the pipe at its lowest point. A blow-off stack is a handy thing to have, but it should not be connected at the strainer cap.

Question: One morning we suddenly found we were unable to make fuel deliveries. It seemed like the pump was not working. We realized that the pump could not move fuel if the inlet strainer was clogged, so we checked this by opening the blow-off valve (B). Plenty of liquid came out of this valve, so we decided the pump was worn out and we took it down for repairs. Your factory men told us the pump appeared to be in good condition. We were at a loss to understand the cause of the trouble.

After checking everything else and spending a large amount of time on the job, we finally went back to the strainer and opened it up this time. When we pulled the screen out it was full of fine dirt mixed with insoluble grease. After the screen was cleaned, the pump

Pump Inlet Piping Assembly Showing Blow-Off Stack

FIGURE 2



Note that connection to blow off stack (A) has been at strainer cleanout opening. It is difficult to clean the strainer, as the piping must be removed before the strainer can be opened.

worked fine. Can you explain why we got liquid out of the strainer when we opened Valve B, and yet liquid could not get to the pump?

Answer: When you opened the blow-off valve, you had a direct open connection from tank to atmosphere. In order for liquid to come out of the valve, it did not first have to pass through the strainer screen. See Figures 4A and 4B, and read the description under 4A. Note that the strainer cap opening (shown plugged in these drawings) is connected to the inside of the tube screen, the same space to which the strainer inlet opens. Since the liquid did not have to pass through the wire cloth of the screen when the blow-off valve was opened, liquid came out of the strainer cap opening easily. In order for liquid to get to the pump, it must first pass through the wire cloth of the screen; and this cloth, when badly clogged, restricts flow enough so that deliveries cannot be made with any type of pump.

(Author's Note: The reason this condition came on so suddenly was that the storage tank had just been filled with a load of extremely dirty fuel. This unfortunate story, which may be difficult for some readers to believe, accurately describes events that have actually happened in several California plants during the past few years. Clearly, the only way to be sure a strainer is clean is to open the strainer. You may think you are blowing it clean when you open Valve B, but if insoluble grease is present this will not do the job.)

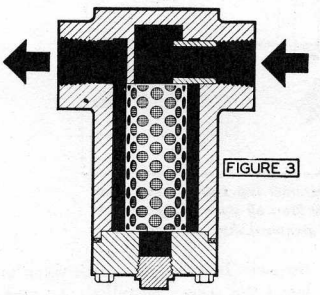
Question: On our delivery truck we use a liquid meter to measure deliveries. We already have a strainer between the storage tank and the pump. Do we need a second strainer to protect the meter?

Answer: The use of another strainer between pump and meter is good meter insurance. When the pump gets badly worn, it is possible that fine metal chips from the pump working parts may damage the meter unless it is protected in this way. Contact the meter manufacturer for recommendations as to size of strainer, type of screen, etc. Some meters have built-in strainers, and are thus already provided with the proper screen. Cleaning meter strainers is almost as important as cleaning pump strainers, and meter strainers should be checked as frequently.

Question: Getting back to pump strainers, what types are available, and which type is best for LP-Gas service?

Answer: There are two common types of strainers, the "basket" and the "wye" designs. Basket strainers, such as shown in Figure 3, are usually easiest to clean, but are bulky and more expensive than the wye strainers, detailed in Figures 4A and 4B. The wye type strainers are

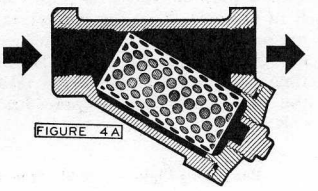
Basket Type Strainer



therefore the most widely used in normal service.

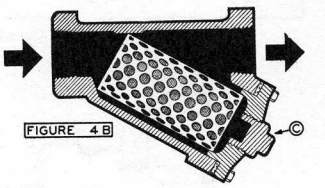
Since strainers must be opened frequently, always install the types that lend themselves to easy inspection. The strainer shown in Figure 4A has a threaded plug-type cap that requires the use of a large stillson wrench for removal. This is not

Wye Strainer A



This strainer has a threaded opening to the strainer screen. The screen is in the form of a round brass tube, perforated with many holes. Inside the brass tube is wrapped one or more layers of fine-mesh wire cloth. The tube is open at each end. Liquid enters the strainer as shown by the arrow, flows inside the brass tube screen, flows out through the wire cloth and the many perforations in the tube, then flows between the strainer body and the outside of the screen to the strainer discharge port. Flow in Wye Strainer B follows a similar course.

Wye Strainer B



Note flanged opening to strainer screen. This construction makes it easy to remove the strainer screen for cleaning.

a good design for use on a truck, since it is difficult to apply a large wrench in close quarters. No one likes to do the inspection job when this type of strainer is provided. On the other hand, the strainer shown in Figure 4B has a bolted cap fastened with six or eight small hexhead screws. This cap can be removed with an 8 in. crescent wrench, and makes what would otherwise be a difficult job an easy, simple one. Some strainer caps have a threaded hole centrally located. Plug this hole as shown in Figure 4B at C. Never install a blow-off or other long piping connection at this point, as this will make strainer inspection very difficult.

Question: How can I tell how large a pump inlet strainer to install?

Answer: Roughly, we usually figure that the strainer screen should have 13 sq in. of area for each 10 gal. per minute of pump capacity. The following table gives the proper area of screen for various sizes of pumps, figured on this basis:

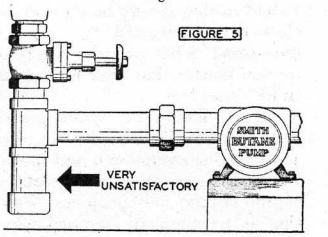
10 g.p.m.—	13 sq. in.
20 g.p.m.—	26 sq. in.
35 g.p.m.—	46 sq. in.
50 g.p.m.—	65 sq. in.
100 g.p.m.—	130 sq. in.
150 g.p.m.—	195 sq. in.

The above figures are based on use of a screen made from 40-mesh wire cloth, for pumps handling butane and propane. If finer-mesh screens are specified, use a strainer with a larger screen area, so as to keep resistance-to-flow at a minimum. As a general guide, plan on using a strainer of the next larger pipe size than the other fittings in the inlet line. Some makes of strainers have more screen area than other strainers of the same pipe size. Try to use the make of strainer with the largest area of screen. Ask the manufacturer's representative to give you the area of the screen for each size of strainer he handles.

Question: What is your opinion of a dirt-trap or settling-pot, such as shown in Figure 5? Will this accomplish the same result as a strainer?

Answer: In our opinion, a dirt trap is practically useless in an LP-Gas pumping system. We must remember that liquid velocities in the pipes are very fast, of the order of 5 ft. per second. The liquid passes the trap so quickly that there is

Settling-Pot



Arrow indicates dirt trap or settling-pot sometimes used in place of a strainer. This is an inefficient means of preventing the entrance of dirt into the pump. The fluid in the pipe flows so fast that most of the foreign material is carried past the trap before it has a chance to settle out.

very little time for any dirt to settle. Traps may remove large pieces of the heavier metals, but they will not help if fine weld-shot, rust, sand, or gravel is present. Installing a good make of strainer, and opening it for inspection and cleaning about once a month, is the only satisfactory answer to the dirt problem.