ESCO NEWS

OCCASIONAL NEWS AND INFORMATION FROM ESCO ENGINEERING

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CONGRATULATIONS TO PAUL

After several years of study, concurrent with his work for Esco, Paul Stone, our computer and Website guru, field technician, and part-time drafter has completed his degree at the University of Western Ontario, and has been awarded a B. E. Sc. in Chemical Engineering. Besides adding to the qualifications and skills that Esco can offer, it also puts Paul on the path to registration as a Professional Engineer.

PIPE FLOW, #1

One of the most common tasks that we do for our customers is to size piping, or, conversely, to advise what maximum flow an existing pipe can handle. These jobs require us to estimate the pressure drop in a piping system for various flow rates, and this is the first in a series of articles on the subject of piping pressure drop. In this part, we will describe the basic principles.

The pressure required to drive a given flow of fluid through a piping system depends on a number of system characteristics. These include:

- The pipe diameter and length
- The number and type of pipe fittings
- The roughness of the pipe inner surface
- Devices in the line that create pressure loss – orifice plates, control valves, strainers etc.
- Fluid properties (density, viscosity)
- Static lift - how far does the liquid have to be raised from its incoming level to its final delivery level.
- The pressure in the receiving vessel.

The last two factors can reduce the pressure needed if the static lift is actually a static drop, or the receiving vessel is at a lower pressure than the supply vessel.

A good rule of thumb for preliminary pipe sizing is to design for a flow velocity of 6-10 fps. This leaves some room for modest flow rate increases, without grossly oversizing the pipe.

Next time: the effect of piping characteristics.

FREE INFORMATION

The latest publication offered by Esco is a paper on Fume Control in Pickle Houses, which was presented by our chief engineer, Neil Stone, at the Wire Association meeting in Chicago last June. You can obtain a free copy of this paper by download from our Website (see below), or by requesting it by phone, fax or mail.

Other publications available from Esco are listed on our Website:

www.esco-engineering.ca

Which also contains instructions for downloading or requesting them.

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PARTICULATE REMOVAL – WHEN SHOULD YOU USE A WET SCRUBBER?

Wet scrubbers are the best devices for removing soluble gas contaminants from air streams, but are not always the best choice for particulate removal. Frequently, a dry removal device like a cyclone or baghouse is a better choice.

Generally, wet scrubbers are preferred in the following situations:

- The solids are sticky, or hygroscopic
- The gas stream is very humid
- The solids are flammable, combustible or potentially explosive.
- The gas stream is corrosive
- The particulate is not needed as dry material.

Particle size is also a factor. For particles over 25-30 µm, a cyclone is efficient enough. Below this size, down to about 2 µm, baghouses and wet scrubbers both give good efficiency with moderate pressure drop (4-6” w.c.)

For particles below 2 µm, wet scrubbing requires a venturi-type high energy scrubber, with a pressure drop in the 15-50” w.c. range. Baghouses are also efficient in this range, but need higher pressure drop and extra surface area to accommodate the fine particles which may blind the medium.

ESCO FIRSTS

Did you know that the Esco staff designed and built the first ever all-plastic plate scrubber for pickle line service, in 1973? We also developed design methods for plate scrubbers using very low, once-through, water flows. Currently, plate scrubbers are standard equipment on many pickle lines.

Did you know that Esco also developed a technically sound model for estimating vapor losses from open surface tanks? This was done, originally, as a tool to help in the rational design of fume scrubbers, and has now become our widely-used **emissions spreadsheet** (available for free download from our Website). This spreadsheet was used by the USEPA in developing the new NESHAP rules for HCl emissions, and has recently been used by Australian environmental authorities.

ABOUT VISCOSITY

Viscosity is a key property of fluids when calculating flow rates, or troubleshooting problems. Most people understand viscosity as what makes glycerine 'thick', and gasoline or water 'thin'.

In fact, viscosity is a measure of the friction of the fluid on itself. How it affects flow depends on the flow regime. There are two flow regimes - laminar (sometimes called 'streamline') and turbulent. Laminar flow occurs in fluids that are: moving slowly; moving in very small pipes; or with high viscosity fluids. In this regime, the fluid is moving in sheets in the direction of flow, and there is very little lateral mixing between one sheet and the next. The main resistance to flow is the friction between sheets of fluid – in other words, viscosity – so viscosity is a major factor in this mode of flow. A viscosity over 100 cP (centiPoise, the most common unit of viscosity) will result in laminar flow under most normal circumstances.

Turbulent flow is the more common flow regime for most industrial flows. In this mode, the fluid is a mass of eddies and vortices, with flow taking place locally in all directions, within the bulk of the fluid which moves in the direction of flow. In this mode of flow, the main resistance to flow is friction at the wall of the pipe or channel, and viscosity is a lesser factor.

For many fluids, like water or oil, viscosity is constant for a given temperature and pressure. Such fluids are called 'Newtonian fluids'. Other fluids are non-Newtonian, because their viscosity varies with flow conditions. One of the commonest types of non-Newtonian fluid, especially in the food industry, is the shear-thinning fluid - tomato paste and ketchup are two typical examples of this class of fluid.

In shear-thinning fluids, the faster they move, the lower the viscosity - for this reason, it is usually called 'apparent viscosity'. This is why, after you shake the ketchup bottle, it will flow out more easily. A viscosity value for this type of fluid is only useful if the shear rate is also given.

KEEPING RECORDS

As was mentioned a couple of newsletters ago, we have all our old job records, dating back to the '70s, saved for reference, all in hard copy format, including field sketches and handwritten notes. It is noticeable how thin the older (pre-computer) files are compared to the present-day files.

Yes, computers have substantially increased the amount of paper we have to store, instead of decreasing it, as was expected. The main reason for this is that, no matter what changes occur in our software, we can still retrieve the information from paper. We still have many 5-1/4" floppy disks, but I think we have only one workable 5-1/4" drive, in a very old computer, and, even then, much of the software used to write those disks can no longer be used on present-day computers. Our old drawings files, that were stored on floppies, are now on CD, but how long will that be good for? Will we still be able to read CDs in 10 years (never mind in 30 years)? Will we have workable copies of AutoCAD then?

We are already grappling with what to do about printing from DOS-based programs and records now that printers have done away with parallel ports and can't handle ASCII print characters.

For the moment, our answer is to hard copy everything important, and put it in the archive files. Unless people lose the ability to read, (which, with the current educations system, is not inconceivable), we should be good for 100 years.

GOOD FOR A LAUGH

A North American couple, on vacation, enter a shop in Austria. As they pass through the door, the man sneezes, and the shopkeeper says "Gesundheit!" At which, the lady says 'We're in luck, Wilbur, they speak English."