IMPERIAL CHEMICAL INDUSTRIES LIMITED
PETROCHEMICALS DIVISION

SAFETY NEWSLETTER No. 56

56/1 A MAN IS BURNT WHILE DEMOLISHING OLD PIPELINES

Earlier Newsletters [51/2, 24/6 and 18/7(e)] have described fires or explosions which occurred because deposits of heavy oil caught fire. Now another incident has occurred in the Division.

Some old pipelines were being demolished. They were cleaned as far as possible and then tested with a combustible gas detector. No flammable gas or vapour was detected and so a burner was given permission to cut them up. While he was doing so, sitting on the pipes 12 ft above the ground, a tarry substance seeped from one of the pipes and caught fire. The fire spread to the burner's clothing and he ended up in hospital with burns to his legs and face.

The tarry deposit in the pipe caught fire when it was heated by the burner's torch. The deposit was not flammable when it was cold so it could not be detected by the combustible gas detector.

Everyone who has to burn or weld, or give permission to burn or weld, on pipelines or other equipment which may contain heavy oils or deposits should be aware that oils which are safe when cold will burn or explode when hot. It is almost impossible to make pipes which have contained heavy oils or polymers perfectly clean and therefore fires may occur when the pipes are heated. The precautions to be taken when demolishing storage tanks were described in Newsletter 51/2 When demolishing pipelines there should be as many open ends as possible so that a pressure cannot build up. Good access must be provided so that the burner or welder can withdraw from the burning point without difficulty if a fire occurs.

56/2 "HOW STRONG IS A STORAGE TANK"

With this Newsletter we are re-issuing the series of cartoons by Brian Drummond which were originally issued with Newsletter 9 in April 1969 (They are not included in Newsletter 9 above but are reprinted at the end of this Newsletter.) Since then our circulation has increased ten-fold and many readers may not have seen them.

When the cartoons first appeared, many Works copied them and distributed copies widely. You may like to do the same.

The cartoons have been made into a set of 14 colour slides and copies are available on request.

56/3 A PUMP GETS TOO HOT

Newsletter 54, Item 1 described how a pump overheated and leaked because it was running against a gagged isolation valve. A reader points out that on certain sorts of pumps this can produce high axial forces and bearing failure.

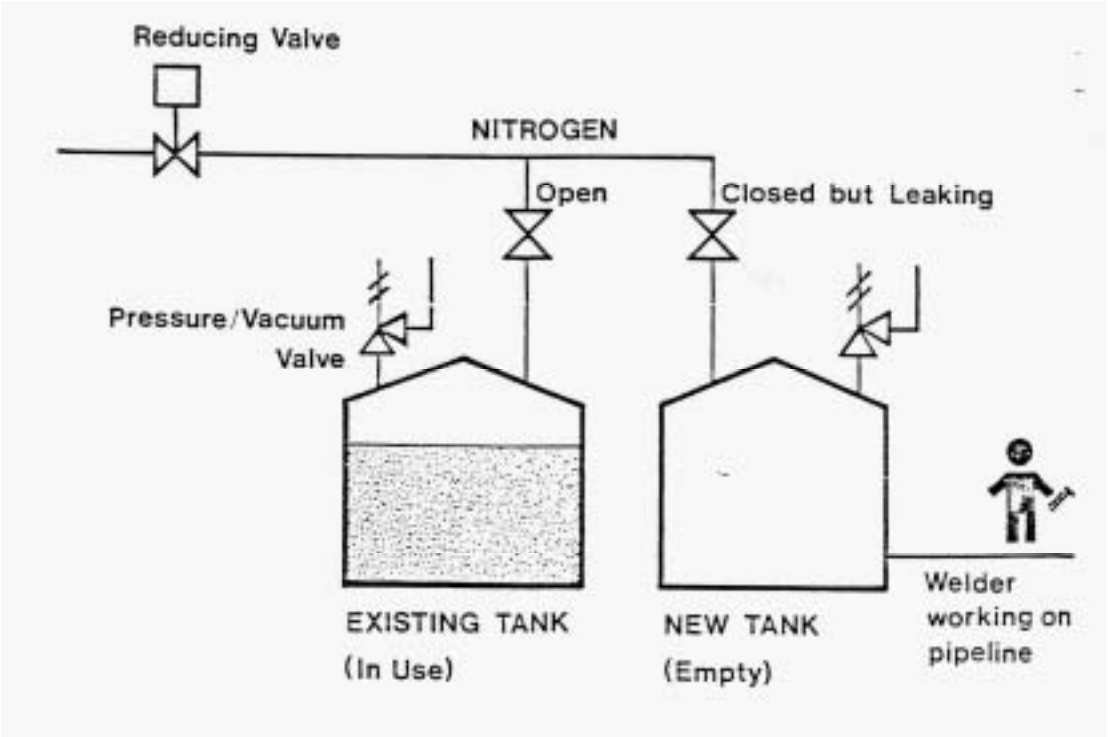
Another reader points out that a number of devices are available which will sound an alarm or trip a pump if it runs against a closed or gagged delivery valve. The devices make use of the drop in motor current which occurs. They also operate if a pump runs dry. These devices cost about £50 each installed and are described in Mond Division Note No. EDS 69. We can let you have a copy.

56/4 CONTRACTORS CONNECT UP LINES WITHOUT PERMISSION AND CAUSE TWO EXPLOSIONS

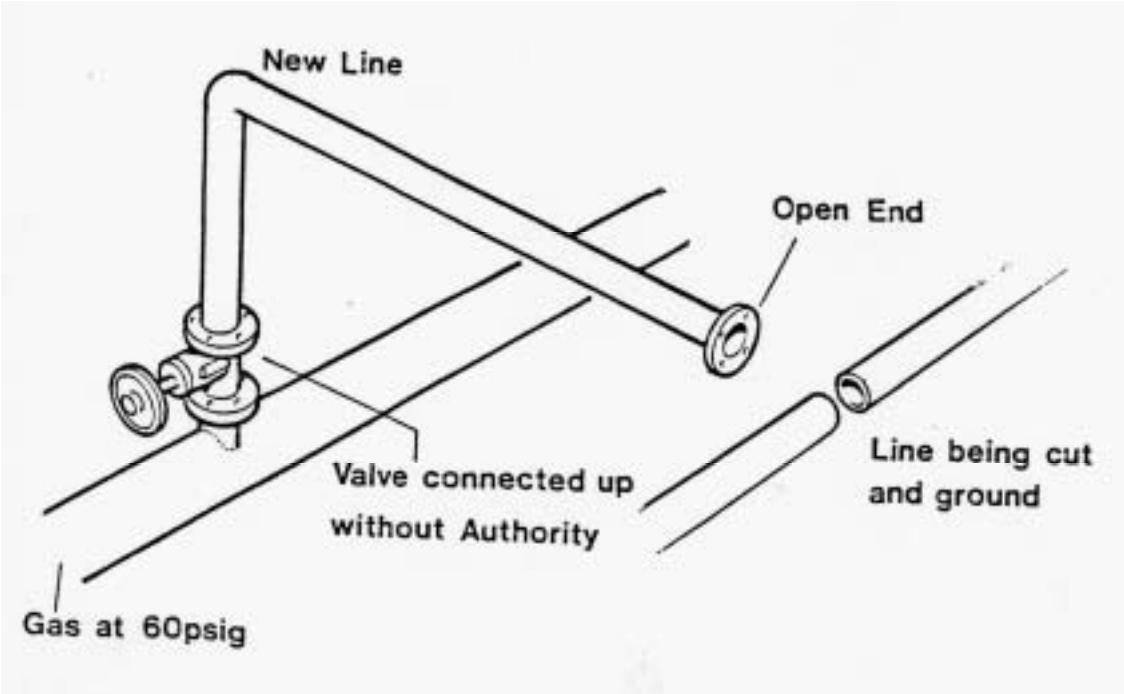
In 1965 an explosion occurred in a new storage tank and the roof was blown off. It landed, by great good fortune, on one of the few pieces of spare ground in the area and no one was hurt. The tank had not been handed over by construction. They had finished the tank itself but were still working on the connecting lines.

Without permission from the plant and without their knowledge, the construction team had connected up a nitrogen line to the tank. They would not, they said, have connected up a product line but they thought it would be quite safe to connect up the nitrogen line. The nitrogen valve was leaking and a mixture of nitrogen and vapour entered the tank and was ignited by one of the welders.

As the diagram shows, the vapour space of the new tank was designed to be on balance with the vapour space of an existing tank, so the nitrogen will always be mixed with vapour.



Now another similar incident has occurred. A grinder was being used near the open end of a new pipeline. Unknown to the plant people the contractors had connected up the other end of the pipeline to a live line. The connecting valve leaked, gas came out of the open end and exploded with a loud bang.



If a portable gas detector alarm (a 'Dalek') had been used it would probably have detected the leak.

It should be made clear to all contractors, including our own internal contractors, that new equipment must not be connected to existing plant without a special clearance certificate. One clearance certificate is needed to install the new equipment and a separate one is needed to connect it up to the existing plant. Whenever possible this connection should be done by plant fitters rather than the construction team.

If any further work has to be done on the new equipment after it has been connected up, then it must be slip-plated off from the existing plant and all work done under the normal plant clearance system.

A quick look through some Works instructions shows that on some Works these points are not fully covered. What about your Works?

Reminder: Newsletter 44, Item 1 described how a tank was burst because contractors pressure tested it with compressed air, without permission.

56/5 FOUR YEARS AGO

The following appeared in Safety Newsletter No. 13, September 1969:

"A maintenance supervisor was called to look at a faulty cooling water pump. He decided that to prevent damage to the machine, it was essential to reduce the machine's speed immediately. He did so, but did not tell Process straight away. The cooling water rate fell, the process was upset and a leak developed on a cooler".

56/6 DIFFERENT ENVIRONMENT — SAME PROBLEMS

During my holiday in North Wales I travelled on the cable tramway up the Great Orme at Llandudno. As the gradient in places is 1 in 4, the trams are drawn up by a cable which runs in a groove between the rails. (It is like the famous San Francisco cable cars except that the Llandudno cars are permanently attached to the cable). The souvenir booklet ("The Great Orme Railway" by R C Anderson) describes a fatal accident which occurred in 1932. It is worth describing as the causes were similar to those of many industrial accidents.

When the tramway was built in 1902 it was provided with an emergency brake held off by the tension in the cable. If the cable broke the tension was released and powerful springs gripped the slot in the metal cover over the cable groove. They held so tightly that it took several hours to free them.

Mishandling of the controls sometimes caused the cable to jerk. This caused the emergency brake to operate and the tramway was out of action for several hours. As a result, in 1905, without the knowledge of some of the directors of the company, the emergency brake was removed.

For 27 years nothing went wrong. Then in 1932 the steel drawbar on one of the tramcars suddenly broke. The car became detached from the cable and the ordinary brakes failed to stop it; it ran down the hill and left the rails, hitting a wall and killing the driver and a 12-year-old girl. Ten passengers were seriously injured.

The official enquiry brought out some other facts:

A similar drawbar had failed ten days earlier but on this occasion the car was stopped with the ordinary brakes and the incident was ignored.

The manufacturers had been given an incorrect specification for the steel drawbars and had not been told the purpose for which they were to be used.

After the accident the tramway was shut down, on the instructions of a Government inspector, for nearly two years while a new emergency brake was designed, tested and installed. The insurance company refused to pay any compensation to the injured passengers as the safety equipment had been removed. As the tramway was shutdown and not earning any money, the tramway company could not pay either and they went bankrupt.

The accident occurred because safety equipment which was giving rise to what we call spurious trips was removed and because the first fracture of the drawbar was ignored.

Is there a lesson for us?

56/7 UNUSUAL ACCIDENTS NO. 26

The managing director of a printing works in Huddersfield decided to have sprinklers installed in his warehouse. While they were being fitted a spark from the welding equipment being used landed on a bale of paper and set the whole warehouse alight, causing half a million pounds worth of damage.

Daily Express, 3 July 1973

56/8 WHAT THE LAW SAYS NO. 13

If there is any petroleum stored on your plant you have to have a licence to store it. The licence lays down 21 conditions. Do you know what they are?

If there are any boilers on your plant you are covered by the Boiler Explosion Acts 1882 and 1890. Do you know what they require you to do?

If there are any stacks or chimneys on your plant you are allowed to emit “dark smoke” for a certain length of time and “black smoke” for a shorter period. Do you know what these terms mean and for how long you are allowed to emit them?

For the answers to these questions and many more see Loss Prevention Guide No. 24, “A Guide to the Legal Responsibilities of Plant Managers and Engineers”.

56/9 ICI DIVISIONS FORM PROCESS SAFETY PANEL

Under the general direction of the Company Process Engineering Committee, a Process Safety Panel has been set up with the following remit:

1. To identify areas of common interest in process safety where further information is required and if necessary to sponsor work both inside and outside the Company.
2. To set up Working Parties to study specific problem areas.
3. To facilitate exchange of information between Division Engineering Departments and Hazard Specialists and, where appropriate, to make use of the communications network of Safety Departments.

The membership of the new Panel has been drawn from the various Divisions of the Company but at the same time covers a wide spectrum of technologies and professional responsibilities. This is necessary because process safety covers such a wide range of activities within the Company.

The present membership of the Panel is as follows:

Mr R H Bowers	Organics Divisions (Chairman)
Mr A Birkett	Pharmaceuticals Division
Mr G de Neef	ICI Europa Ltd
Mr C Elton	Agricultural Division
Mr T A Kletz	Petrochemicals Division
Mr G T Shepherd	Mond Division
Mr G Thomas	Plastics Division
Mr M G Jeeps	Organics Division
Mr C Putt	Corporate Laboratory, Bozedown
Dr A D Meads	Central Safety Department, Millbank(Secretary)

Initially the Panel will be dealing with those aspects of safety concerned mainly with fire and explosion hazards. As the work proceeds it may well be possible to extend the work into other aspects, for example, medical, toxicological and environmental problems.

The first task before the Panel has been to try and identify whether there are problems of common interest across the Company which would justify a combined approach by a number of Divisions and two meetings have been held with this as the main objective.

Five such areas have been identified as a first list and they are as follows:

1. Relief and venting systems.
2. Dust-in-air explosions.
3. Protection against excessive temperature.
4. Emergency isolation of plant.
5. Dispersion of heavy vapours.

A review of each of these topics is to be completed within 3/6 months so that the Panel can meet and consider whether future action in these areas is required by way of further experimental work or whether perhaps sufficient information already exists to enable a design brochure to be prepared. Your Divisional representative would welcome your comments on the selection of these topics and any information which you think should be included in the reviews.

56/10 RECENT PUBLICATIONS

(a) Report No. 0.21 542/C, available from Division Reports Centres describes the results of a hazard analysis on a nitric acid plant. All the circumstances that could lead to an air/ammonia explosion or an ammonium nitrate explosion were shown on a logic tree and the hazard rate estimated. Although additional trips and other changes were found to be necessary in certain parts of the plant, it was also found possible to remove some trips.

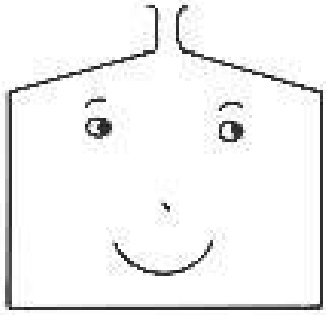
(b) The Institute of Petroleum is collaborating with similar organisations in other European countries to produce a “European Model Code of Safe Practice in the Storage and Handling of Petroleum Products”. Part 1 Operations, has been published by Applied Science Publishers, price £2.50. As would be expected, it is rather general and describes only the basic precautions that everyone accepts. On most of the subjects covered our own Codes are more stringent, but the European Code is useful as a sort of minimum standard that no-one should ever fall below.

(c) Safety Note 73/17 shows that it is not necessary to fit earthing brushes on the shafts of pumps handling flammable liquids.

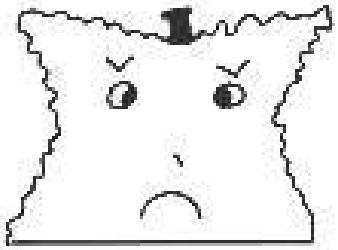
For a copy of (c) or for more information on any item in this Newsletter please write to Miss M N., Organic House, Billingham or ring B.3927. If you do not see this Newsletter regularly and would like your own copy please ask Miss N to and your name to the circulation list.

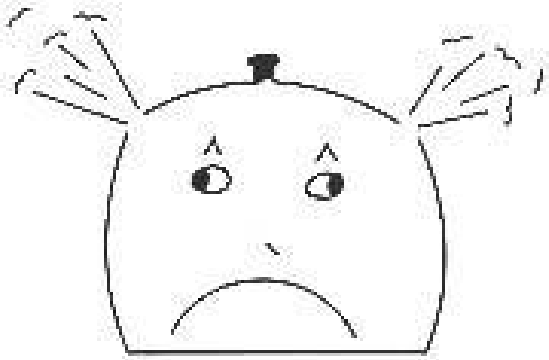
September 1973

There are many references in these Newsletters to other reports. Most of them are no longer available but I have copies of the Safety Notes and Loss Prevention Guides and can supply copies. Please remember that they are old and that current advice may be more stringent and/or more effective. – Trevor Kletz (T.Kletz@Lboro.ac.uk)

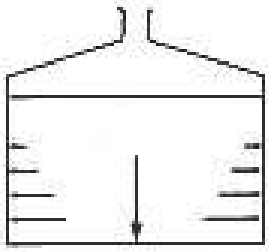


HOW STRONG IS A STORAGE TANK?





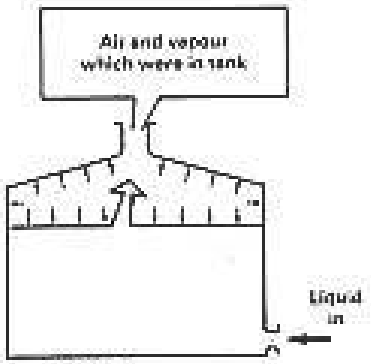
A STORAGE TANK IS DESIGNED:-



1 TO HOLD LIQUID

Liquid exerts pressure on the sides and base of the tank.

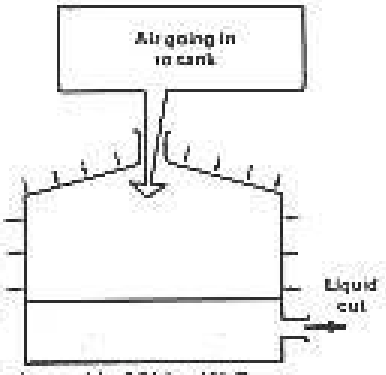
Pressure = head of liquid.



2 TO BE FILLED

For liquid to get in air and vapour must get out. If they can't the tank will be pressurised. For air and vapour to be pushed out the pressure in the tank must be slightly above atmospheric pressure.

The tank is designed for an internal pressure of 8 ins water gauge (W.G.)



3 TO BE EMPTIED

For liquid to get out air must get in. If it can't the tank will be under-pressured. For air to be sucked in the pressure in the tank must be slightly below atmospheric pressure.

The tank is designed for an external pressure (or vacuum in the tank) of 2½ ins W.G.

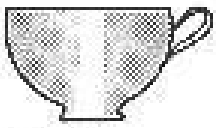
WHAT ARE INCHES WATER GAUGE?

They are a measurement of pressure, used for very low pressures:-

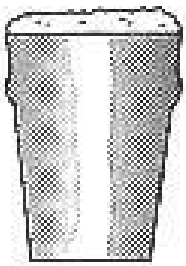
8 ins W.G. = ¼ pound/square inch

2½ ins W.G. = 1/10 pound/square inch

Or put another way:-

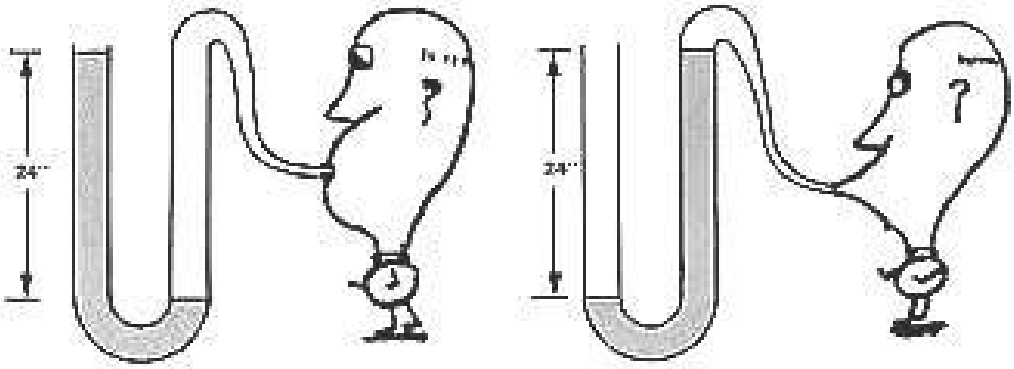


2½ ins W.G. is the pressure at the bottom of a cup of tea.



8 ins W.G. is the pressure at the bottom of a pint of beer.

YOU CAN BLOW OR SUCK ABOUT 24 INS W.G.



That means by just using your lungs you could over- or under-pressure a storage tank.
(Because of the volume of air it would take you a long time)

If you don't believe it, because storage tanks always look big and strong, just study the table below.

If a Heinz baked bean tin has a strength of 1, then:-

	SHELL	ROOF
Heinz Baked Bean tin (small)	1	1
40 Gallon drum	½	½
50 m³ tank	⅓	¼
100 m³ tank	¼	⅙
500 m³ tank	⅛	1/25
1000 m³ tank	1/10	1/15

Next time you eat baked beans just see how easy it is to push the sides or top in with your fingers – *and then look at the table again.* (Any small tin will do if you don't like baked beans).

Note too:- The bigger the tank the more fragile it is.
The roof is weaker than the shell.

Up to 1000 m³ the tank shell and roof are only as thick as the line under these words.

IF ALL THAT'S TRUE – IS A STORAGE TANK STRONG ENOUGH?

Yes. A 1000 m³ tank has a factor of safety of 2 against failure (smaller tanks have bigger safety factors) – provided it is operated within the very low pressures allowed.

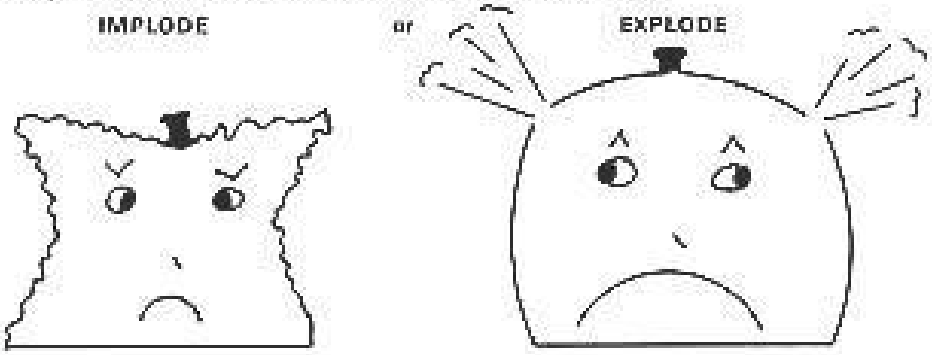
Most of the pressures we have available are *many times bigger* than the allowable pressures, that is, 8 ins W.G. inside, 2½ ins W.G. outside

FOR EXAMPLE

Full atmospheric pressure outside	= 150 times bigger
Transfer pump head inside	= 120 times bigger
40 p.s.i. Nitrogen inside	= 120 times bigger
100 p.s.i. Steam inside	= 300 times bigger

All of these pressures or even a small part of them will cause the tank

To IMPLODE or EXPLODE

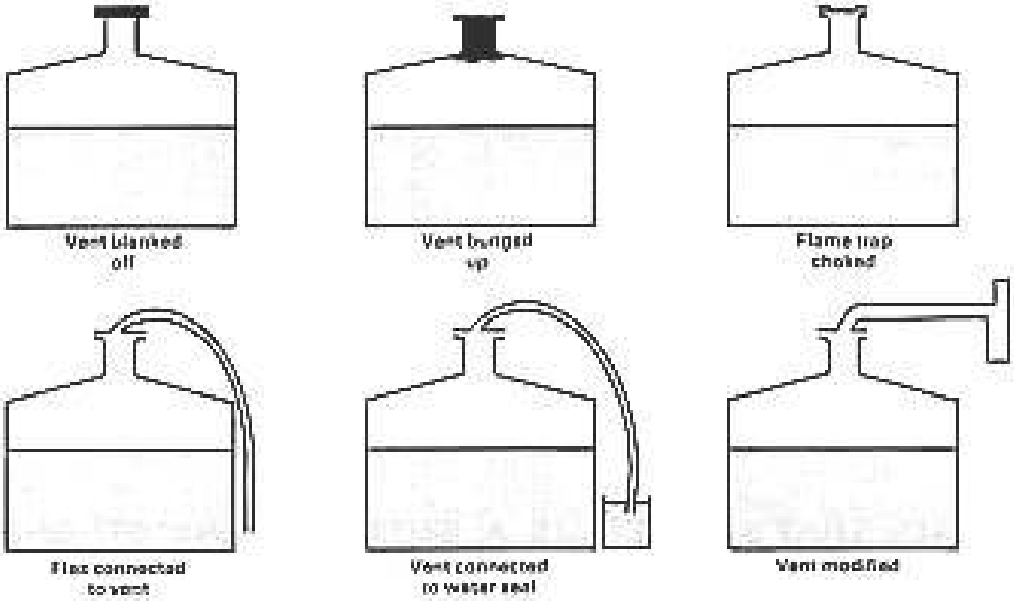


HOW DO WE STOP THIS HAPPENING?

By making sure that:-

1. The tank has a vent big enough to relieve all sources of pressure that might be applied to it.
2. The vent is always clear.
3. The vent is never modified without the authorisation of the plant or section engineer.

Here are some typical faults in vents which should never happen.



Don't look surprised — One (or more?) of these has almost certainly happened on your plant in the last year — it could have had serious consequences.

ONLY KNOWLEDGE AND VIGILANCE WILL STOP IT HAPPENING AGAIN