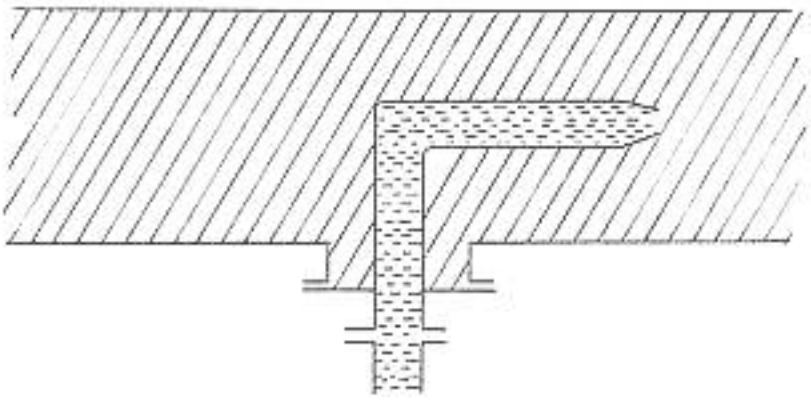
IMPERIAL CHEMICAL INDUSTRIES
HEAVY ORGANICS DIVISION

SAFETY NEWSLETTER NUMBER 30

By Trevor Kletz

30/1 HOW TO ADD WATER TO OIL

Newsletter 27, Item 1, pointed out that corrosion can occur when oil and water meet. This has caused a number of leaks some of which have fired and caused serious damage. If water has to be added to an oil stream, the water pipe should enter the centre of the oil pipe. Harland Frank suggests the following arrangement:



The dimensions of the branch and quill are chosen so that the injection pipe can be removed for inspection.

This arrangement is also suitable for the injection of Corrosion inhibitors, small quantities of additives etc.

The Bulletin, the Journal of the Association for Petroleum Acts Administration, April 1971 contained the following account of an explosion and fire which occurred at Shell's Teesport Refinery on 10.2.71 :-

> "The seat of the facture would appear to have been in the gasoline hydro-treator. At this point in the processing, water is injected into the system. The corrosion tolerance is accepted at 0.050 inch per year, but the corrosion and erosion at this point in the process were much higher than expected for reasons not yet fully understood, but which include the presence of corrosive contaminants and an unfavourable flow pattern inside the pipe. These circumstances contributed to the excessive thinning of the pipe wall and its ultimate failure."

30/2 COVER SUMPS AND DRAINS WHEN WELDING IS TAKING PLACE NEARBY

A pipeline had to be welded 20 ft. above the ground. Tests with a combustible gas detector near the pipeline and on the ground below were negative and so a fire permit was issued.

A piece of hot welding slag bounced off a pipeline and fell on a sump 20 ft. below and 8ft. away. The cover on the sump was loose and some oil inside caught fire.

Welding jobs should be boxed in with fire-resistant sheets.

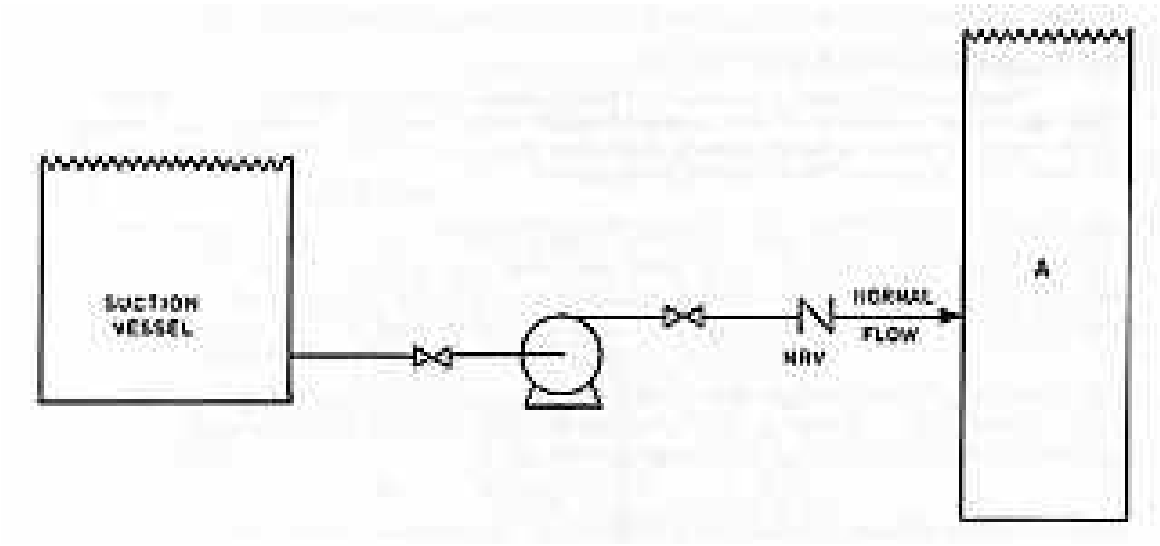
Nevertheless, some sparks may reach the ground so drains and sumps should be completely covered.

Even if the drain or sump is gas free at the start of the job it is possible for a back flow in the drains to bring oil into it.

30/3 NON-RETURN VALVES

As everyone knows, non-return valves are not 100% reliable and, as mentioned in Newsletter 19, Item 3, we can let you have some data on their reliability.

A reader has described what happened when a non-return valve failed on his plant :-



The pump tripped out. The non-return valve failed to work and the pump was driven backwards by the pressure and head of liquid in vessel A. The impellor disintegrated and the motor was damaged.

Whenever failure of a non-return valve could have serious consequences, the use of two in series should be considered. In many cases it will be possible to work out the probability of failure and see if duplication is worthwhile. The following example shows how to go about it.

Suppose the non-return valve develops faults which would cause it to fail at a rate of 0.003 faults/year (once in 330 years — a typical figure) and that it is inspected once/year. On average it will fail half-way between inspection periods and will be out of action for 6 months every 330 years.

We say that its fractional dead time is 0.5/330 = 0.0015. Suppose the *demand rate* on the NRV is 10 times/year. Then the *hazard rate*, the rate at which demands and dead time co-incide, is given by

Hazard rate = Demand rate x Fractional dead time

= 10 x 0.0015

= 0.015 per year or once in 67years

Suppose the cost of a failure (damage to equipment and lost production) is £10,000.

As this occurs on average every 67 years the average annual loss is £10,000/67 = £150/year.

If two non-return valves are installed in series and both are inspected at the same time, the system will fail once in 30,000 years. If the inspections are staggered, the rate is reduced to once in 50,000 years. The average annual cost of failure in these two cases is negligible.

Duplication of the NRV is, therefore, justified if it can be done for less than £150/year, or about £500 capital.

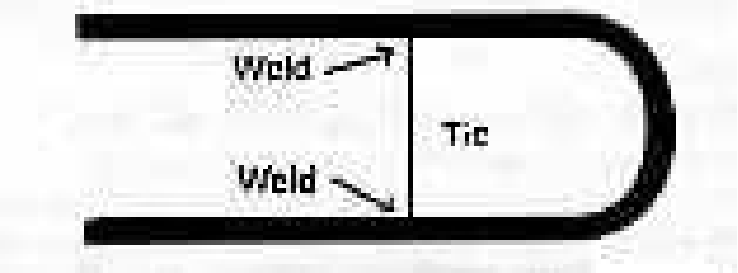
30/4 OVER-RIGID CLAMPING OF PIPELINES

Newsletter 10, Item 6, described a serious fire which occurred in another company because a pipeline was clamped so rigidly that it did not have any freedom to expand or vibrate. The pipeline was welded to two steel supports 6 ft. apart. A segment of the pipe was actually torn out by the force developed when the pipeline expanded.

The reaction in the Division to this incident was, “It couldn’t happen here. Our design procedures would prevent it happening”

But it did happen. On one of our Works a reflux line was assembled rigidly in brackets welded to the shell of a tall distillation column. At start up the differential expansion of the hot tower and the cold reflux line was sufficient to tear one of the brackets from the shell, releasing flammable vapour. Luckily this was noticed before it fired.

One engineer recalls an occasion when a similar incident nearly happened. A pipeline carrying very hot gas was designed in the shape of a ‘U’ so that it was free to expand. To make construction easier the plumbers welded a tie across the ‘U’ as shown below



When the pipeline was complete they forgot to remove the tie and the laggers covered up the ends of it.

Fortunately, while the plant was warming up for the first time, one of the start-up team noticed the tie and asked why it was there.

30/5 POLYTETRAFLUORETHYLENE

Recent incidents have drawn attention to the precautions necessary with polytetrafluorethylene or Fluon. It is pretty safe material but a few precautions are necessary :-

(a) If PTFE gets very hot (over 400°C) it gives off fumes which produce an illness rather like influenza. A few particles on the end of a cigarette can make you ill. Therefore, do not smoke if PTFE is being machined, filed, cut or handled in any other way which might transfer dust onto your fingers.

If PTFE has to be heated or if a lot of dust is produced, good ventilation is needed.

Do not braze objects with PTFE parts in the open workshop.

(b) Some forms of PTFE are softened by nitrogen at high pressure (see “Polymer”, Feb 1971). If you want to use PTFE gaskets with high-pressure nitrogen, check with the experts first.

30/6 THREE YEARS AGO

A plumber assistant foreman had been given a Permit-to-Work to modify a pipeline. At 4.30 p.m. the plumbers went home intending to complete the job on the following day. During the evening the process supervisor wished to use the line that the plumbers were working on. He checked that the line was safe to use and he asked the shift fitter to sign off the Permit-to-Work. The next morning the plumbers, not knowing that the shift fitter had signed off their Permit, started working on the line while it was in use.

How can we prevent this incident happening again?

1. We should make it quite clear in our Instructions that Permits-to-Work can only be signed off by the supervisor to whom they are issued (or another supervisor of the same trade and responsible for the same area who is doing the job of the original supervisor).

2. If maintenance supervisors remove the top copies of the Permits-to-Work from the books, then it is difficult for an unauthorised person to get hold of them and sign off.

From Safety Newsletter No. 2, June 1968

30/7 NOT SO FUNNY'

A woman had been cleaning paint brushes with petrol, which she then poured down the lavatory. When her husband came home from work, he went up to the little room and while sitting there dropped a cigarette end into the pan.

The blast threw him into the air. Two ambulance men picked him off the floor and carried him downstairs on a stretcher but when he told them what had happened, the rear stretcher bearer, overcome with laughter, dropped his end - and the casualty fell out, breaking his arm.

From The Bulletin, The Journal of the Association for Petroleum Acts Administration

30/8 RECENT PUBLICATIONS

(a) Agricultural Division Engineering Design Note No. EDN 1273, available from Division Reports Centres, describes some tests on Albiclad fire-resistant intumescent mastic. This material swells up in a fire and this protects the material beneath it. The charred residue is destroyed by water hoses and the Design Note does not, therefore, recommend its use.

(b) Safety Note 71/10 is a translation of a report on an explosion in a storage tank. The original report suggests that the explosion was ignited by a discharge of static electricity from a mist but it now seems that the explosion may have been the result of overpressuring with nitrogen.

(c) "Fire Hazards in the Home", an excellent little booklet published by the Home Office, contains many coloured illustrations of fire hazards.

For copies of (b) and (c) or 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 add your name to the circulation list.

June 1971