SAFETY NEWSLETTER

No. 107

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,SOME FAMILIAR INCIDENTS

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107/4 **Relief valves located in the wrong place caused a fire and a vessel failure.**

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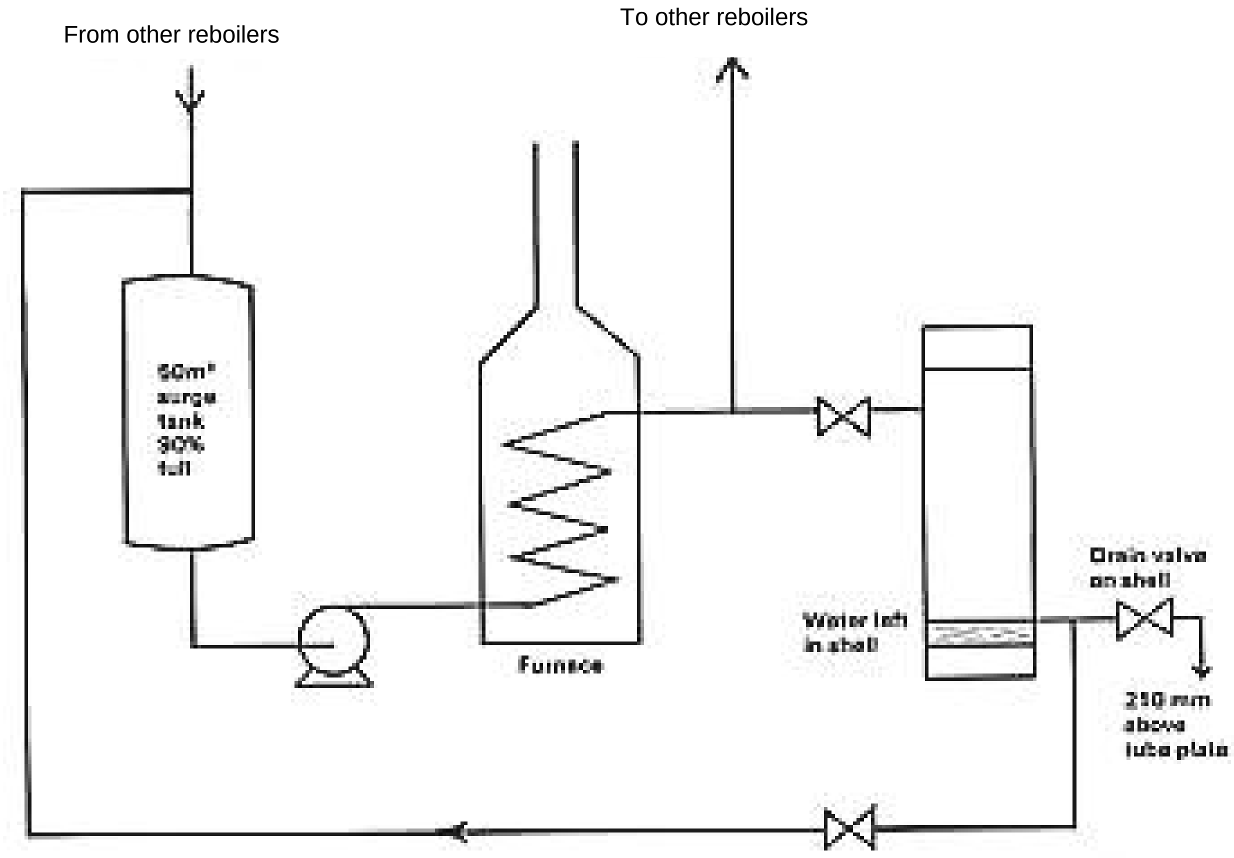
IMPERIAL CHEMICAL INDUSTRIES LIMITED

PETROCHEMICALS DIVISION

107/1 RAPID VAPOURISATION OF WATER RUPTURES A VESSEL

Earlier Newsletters (50/7c, 47/8, 42/8 and 9/8) have described how water came into contact with hot oil and vaporised with explosive violence. Low pressure storage tanks have often been ruptured in this way but it is unusual for a pressure vessel to be ruptured. However, this occurred last year in another Company.



A furnace supplied heat transfer oil to four reboilers. One was isolated for repair and then pressure tested with water. The water was drained out of the shell using a drain valve on the exit line located 210 mm above the level of the bottom tube plate. This left a layer of water in the reboiler. When it was brought back on line the water was swept into the heat transfer lines and vaporised instantly and this set up a liquid hammer.

The top of the surge tank, bursting pressure 450 psig, was blown off in one piece and the rest of the vessel was split into 20 pieces. The hot oil formed a fine mist-like cloud which ignited immediately forming a fireball 120 metres in diameter.

To prevent a recurrence the Company concerned recommends:

1 Adequate facilities must be provided for draining water from heat transfer and other hot oil systems.

2 If possible, oil should be used instead of water for pressure testing.

3 Surge vessels should have adequate ullage.

107/2 A LOW OIL PRESSURE GOES UNNOTICED FOR MONTHS

The governor assembly and guard on a steam engine disintegrated with a loud bang, scattering bits of metal over the floor. Fortunately, no-one was injured.

On investigation it was found that the lubricating oil pressure had been only 8 psig instead of 25 psig for “several months” — no-one was sure, as the oil pressure was not read regularly and was not recorded on the record sheet.

Several other machines on the same plant were found to have worn governors as the result of oil starvation.

Are the oil pressures on your machines read regularly?

However, taking readings is not sufficient. Newsletter 38/9 described how abnormal readings were entered on a record sheet for many hours without anyone realising that anything was wrong. Finally, a vessel overflowed. A similar incident was described in Chemical Engineering Progress, April 1974, page 83.

After the incident described above the machine speeded up and the operator started to shut it down using the normal procedure, thus exposing himself to an unnecessary risk. Another example of failure to use emergency equipment was described in Newsletter 60/1.

107/3 THREE MONTHS IN AN OIL COMPANY — FIRES, MEN OVERCOME IN VESSELS, TRIP FAILURE, WRONG MATERIAL OF CONSTRUCTION

An oil company has described some dangerous incidents that occurred during three months last year (1977). All are similar to incidents described in earlier Newsletters. The incidents are summarised below, to reinforce the earlier advice, and to remind us that old Newsletters are still relevant.

(a) Pump Seal Fires

Three serious fires were due to bad leaks from pump seals. One was soon out but two could not be stopped because the flow was too great and the isolation valves could not be reached.

If remotely operated emergency isolation valves had been installed in the pump suction lines then the fires could have been stopped in their early stages and damage would have been much less. (See Newsletters 103/1, 70/2, 62/2).

(b) **Fires while Repairing Tanks**

Two fires occurred while tanks were being repaired. One was due to sludge leaking out of one of the legs supporting the roof of a floating roof tank. (See Newsletter 40/1).

- Before welding is permitted in a floating roof tank the legs should be flushed with water. If the bottoms of the legs are sealed, holes should be drilled in them so that they can be flushed through.

The second fire was due to oil trapped between the plates of a lap-welded tank (see Newsletter 68/3).

If lap-welded tanks have to be repaired they should be filled with water and repaired from the outside. The water will keep the space between the plates cool and prevent any trapped petrol vaporising.

(c) **Wrong Material of Construction**

Some new pipes were found to be made of the wrong alloy. Further investigation showed that many of the pipes, clips and valves in store were made of the wrong alloys. The investigation was then extended to existing plant and the following are some examples of the findings:

The wrong electrodes had been used for 72 welds on the tubes of a fired heater.

Carbon steel vent and drain valves had been fitted on an alloy steel system.

An alloy steel heat exchanger shell had been fitted with two large carbon steel flanges. The flanges were stamped as alloy.

A similar situation in the Division was described in Newsletter 71/6 which also described the action we are now taking to prevent similar incidents in the future.

(d) **Entry to Vessels**

A welding inspector and another man went into a reactor to carry out a dye-penetrant test on a new weld, using trichlorethylene, a toxic but non-flammable solvent. As the weld was 8 metres long the solvent was soon used up and the inspector asked the man who was standing by at the entrance to the vessel to go and get some more.

He was away for 10 minutes. When he returned the two men inside the reactor had collapsed. Fortunately they were rescued and recovered. They had been overcome by trichiorethylene fumes.

Works instructions impose limits on the amount of solvent that can be taken into a vessel for dye-penetrant testing.

Stand-by men should not leave a vessel when other men are inside.

Other entry incidents were described in Newsletters 88/4 and 77/1.

(e) **A Compressor Trip Fails to Work**

A compressor was seriously damaged when the high level trip on the suction catchpot failed to work.

The recommendation was: *Test the trip regularly*!

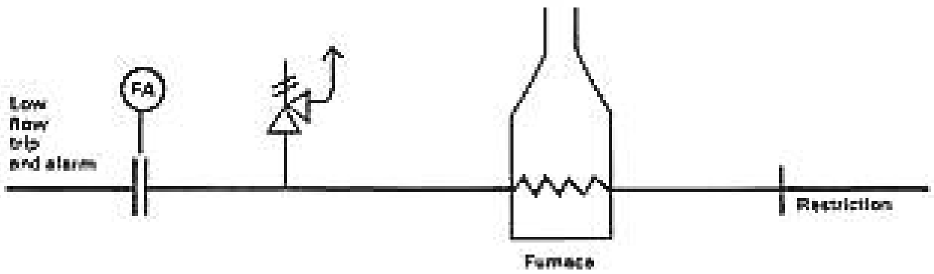
Reminder: The incidents that occurred in the same oil company in other three-month periods were described in Newsletters 18/7 and 12/4.

107/4 A LOOK BACK AT NEWSLETTER 7 (JANUARY 1969)

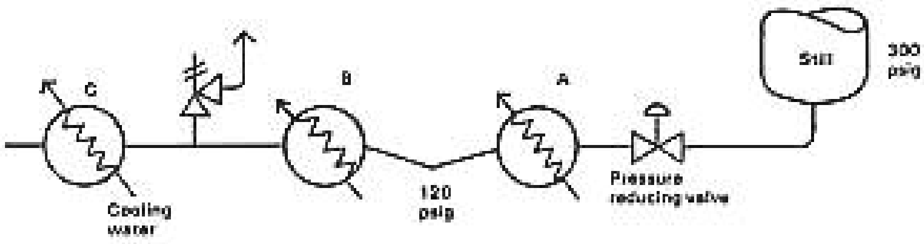
If a vessel is protected against overpressure by a relief valve, sometimes the valve is placed on the vessel itself, sometimes it is placed immediately before or after the vessel. Two incidents have drawn attention to the need to consider critically where the relief valve is placed — it can matter.

In the first incident, which happened a few years ago, a furnace was protected by a relief valve in the inlet line. A restriction developed after the furnace and the relief valve lifted and took most of the flow. The flow through the furnace tubes fell to a low level so that they overheated and burst.

The low flow trip and alarm did not operate as the flowmeter was placed upstream of the relief valve and the flow through it was normal.



The second incident occurred on the bottom line of a distillation column containing cold liquefied gas.



The two heat exchangers A and B are designed to withstand 150 psig and a relief valve is fitted in the position shown to protect them from the still pressure if the motor valve opens fully.

A leak in exchanger C, coinciding with a low pressure in the process line, caused a slug of water to enter the process line and form a plug of ice in a dip in the line between A and B. As a result, A was blocked in, isolated from its relief valve and overpressured.

Whenever a vessel may be isolated from its relief valve by ice, solidified process material, catalyst dust or any other cause, then a relief valve must be placed on the vessel itself, or alternatively, the vessel must be made capable of withstanding the full pressure to which it can be subjected.

In the present case the latter would probably have been the easiest course to adopt at the design stage. It would not have cost much more to make A and B capable of withstanding 300 psig.

107/5 OTHER MEN'S VIEWS No.6

"…… an increasing number of false prophets arose, of rather uncertain motivation, who declared a holy war against pollution of all kinds. At that point the situation got out of hand, like l'Apprentis Sorcier.

One of the essential items of equipment of a false prophet is a small scientific fact with which to bait his seductive hook. Another is a chair in some remote speciality. Yet another is an absence of any conscience and finally he has to have a sublime ignorance of the nature of industry. Thus armed he swings into action and the media, ever hungry for sensation, welcome him with open arms. An incident, a small fact, an orgy of unbridled speculation and a frisson of fear and alarm runs around whipping up ever more speculation and strident calls for urgent action on the part of whatever scapegoat is handiest. Avonmouth, Hebden Bridge, Flixborough, Seveso — the names are now household words. I believe that the situation is serious and that even the scientists are becoming the victims of emotion — not to mention the politicians, industry and the unfortunate public who forget that their life expectancy has been markedly improved when they are confronted with some hitherto hidden and preferably sinister risk."

R Murray, former Medical Adviser to the Trades Union Congress in "Health and Safety in the Oil Industry", Proceedings of the Institute of Petroleum 1976 Annual Conference, Heyden, 1977, p.27.

107/6 UNUSUAL ACCIDENTS— No.74

The Sieger Dalek, a large portable combustible gas detector alarm, makes a loud siren-like noise if combustible gas is detected. It is used when welding has to take place in an area where leaks of flammable gas may occur. If any gas is detected the siren can be heard above the background noise and the welder knows that he must switch off his welding gear and leave the area. (See Newsletter 51/1).

A Dalek had to be sent back to the makers for repair. It was packed in a wooden crate and while it was waiting on Darlington Railway Station the siren suddenly went off. Everyone rushed away and the Police were called. The crate was lassooed with a rope from a safe distance and dragged to the far end of the Station which was roped off until the arrival of an ICI representative.

The Dalek had been left switched on when it was placed in the crate. The alarm went off when the battery ran down — as it is supposed to do.

107/7 RECENT PUBLICATION

The microfiche Newsletter index described in Newsletter 88/6 has been extended to include all Newsletters from 1 to 104.

For a copy or for more information on any item in this Newsletter please ‘phone Eileen Turner (Ext. P.2845) or write to her at Wilton. If you do not see this Newsletter regularly and would like your own copy, please ask Mrs Turner to add your name to the circulation list.

Newsletter 105/1 stated that when liquid may settle at the bottom of a pipe, seam-welded pipe should not be installed with the welds at the bottom. This applies to pipes which may be alternately wetted and dried out (as the context made clear). It does not apply to all pipes.

January 1978

AN ENGINEER'S CASEBOOK No. 7—THROTTLE BUSHES

The Division's Specification MAC 0304 for centrifugal pumps and API Recommend Practice 610, 'Centrifugal Pumps for General Refinery Purposes', define the requirements for the majority of centrifugal pumps used in the Division's Works. Where pumps are fitted with a single mechanical seal, and most are, there is a requirement for a non-sparking throttle bush to be fitted into the seal end plate. The diametral clearance between the inside diameter of this bush and the shaft passing through it is specified to not exceed 0.025 ins. Bushes may be made of brass, sintered bronze, PTFE etc.

The purpose of the throttle bush is to restrict the amount of the pumped fluid which is discharged to atmosphere in an uncontrolled way should there be major leakage from, or total disruption of, the mechanical seal. In a way it acts as a crude auxiliary sealing device and limits the discharge of product to enable the pump to be shut down, prevents the production of a large flammable cloud of vapour if liquefied flammable gas (LFG) or hot flashing liquids are discharged and helps direct spillage along the drain connection from the space outboard of the seal. The throttle bush should not be confused with the throat bush (or neck bush) which is at the inboard end of the seal chamber and serves to limit the clearance between the shaft and pump casing near the back of the impeller.

Under normal circumstances the maximum diametral clearance of 0.025 ins between the throttle bush and shaft should more than cater for shaft displacements arising from impeller imbalance, bearing wear etc. One might suppose that there should be no contact, no wear and therefore no need to check or replace the throttle bush.

Last year a check was carried out on one Works in which the diametral throttle bush to shaft clearance was measured on eleven pumps on LFG duty. On only two was the clearance within the specified 0.025 ins, some exceeded 0.100 ins the greatest being 0.180 ins. It had not been this Works practice to check throttle bush clearances during pump overhauls. This is now being done and clearances brought into line with the design figure. The source of hazard approach to area classification assures that the clearance is not greater then 0.025 ins. The maintenance of this is a necessary part of continued safe operation where pumps handle LFG, flashing liquids and other materials which can give rise to significant clouds of flammable vapour.

E H Frank

WHO'S WHO IN SAFETY

No.22—T B WHITEFOOT

Yorkshire born, Lancashire bred, educated in London and first employed in Scotland, makes Barrie Whitefoot something of a mongrel. He took an honours degree in chemistry at University College, London and joined ICI Dyestuffs Division in 1939. In late 1940 he returned to University College for a year's Diploma Course in chemical engineering at the Ramsey Laboratory. Since then, he claims, he has been able to look both chemists and engineers in the eye.

After making dyestuffs intermediates at both Grangemouth and Blackley he moved, in 1950, to Wilton Council Technical Department, to plan supplies of services. Later he spent a few years in Services Works producing them.

In 1973 he was appointed Division Environmental Adviser, a job he loves. In 1976 he also took on the job of Division Toxicological Liaison Officer, which he finds equally fascinating and absorbing. It has, he says, involved him in learning a completely new vocabulary so that he can hold his own amongst his medical colleagues.

Barrie is married with two sons. One is an established dentist and the other a doctor in training. His hobbies are odd-jobbing, country walking, gardening, sketching and bee-keeping.