Process Isolation Using Stopples

Here's a discussion on the use of stopple plugging machines as temporary block valves in the inlet line to a relief valve.

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Cooperative Farm Chemicals Association operates a 1,000 ton/day Kellogg ammonia plant of typical design. Reformed gas flows from the primary reformer through the secondary reformer, through the primary and secondary waste heat boilers, and into the high temperature shift converter. A relief valve, to protect the shift converter in case of tube rupture of the waste heat boilers, is located between the secondary waste heat boiler and the high temperature shift converter. This relief valve has a 6 in. inlet, an 8 in. outlet, relieves at 471 lb./sq. in. gauge @ 700°F, and is located approximately 10 ft. above the process line.

A system upset resulted in this valve relieving and subsequent failure to reseat properly. Normal flow at this point is approximately 340,000 lb./hr., and we were venting about 9% or 30,6000 lb./hr. This is equivalent to a loss of 100,000 std. cu.ft./hr. of natural gas being vented. Process gas at this point was 638°F. and 430 lb./sq. in. gauge.

The exhaust from this relief valve is manifolded into a common vent which takes care of relief valve exhaust on inlet to low temperature shift, relief valve exhaust on zinc oxide chamber, the process gas vents, and terminates in a silencer and stack on top of the steam drum structure.

Solution to Problem

In order to find a method for removing the relief valve safety for repairs while plant continued in operation, TDW Services, Inc. of Tulsa, Okla. was contacted to explore the possibilities of using stopple plugging machines to serve as temporary block valves in the inlet line to the relief valve. The proposed solution, illustrated by Figure 1, is described below:

1. Weld two spherical fittings approximately 8 ft. apart on inlet line to relief valve. These fittings are designed to be stronger than original pipe after hot tap is made. Flange end of fitting is 600 lb. RF drilling and of Lock O Ring design. Lock O Ring design will be explained later.

2. Install sandwich valve on spherical fittings. Sandwich

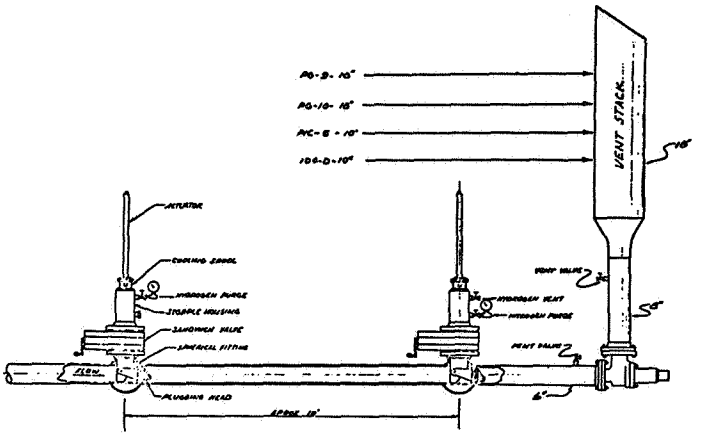


Figure 1. Six inch process gas stopple job (638°F at 410 lb./sq. in. gauge.) Illustration courtesy TDW Services, Inc.

valves are equipped to withstand temperatures of 650°F and pressures of 1,200 lb./sq. in. The sandwich valve is used instead of the regular gate valve to insure full opening for hot tap and to conserve space.

3. Mount hot tapping machine and make hot tap. Tapping time for 6 in. Schedule 40 pipe was 45 min. Power for driving the tapping machine was hydraulic using a gasoline driven oil pump. Air operated units are also available for use in hazardous areas.

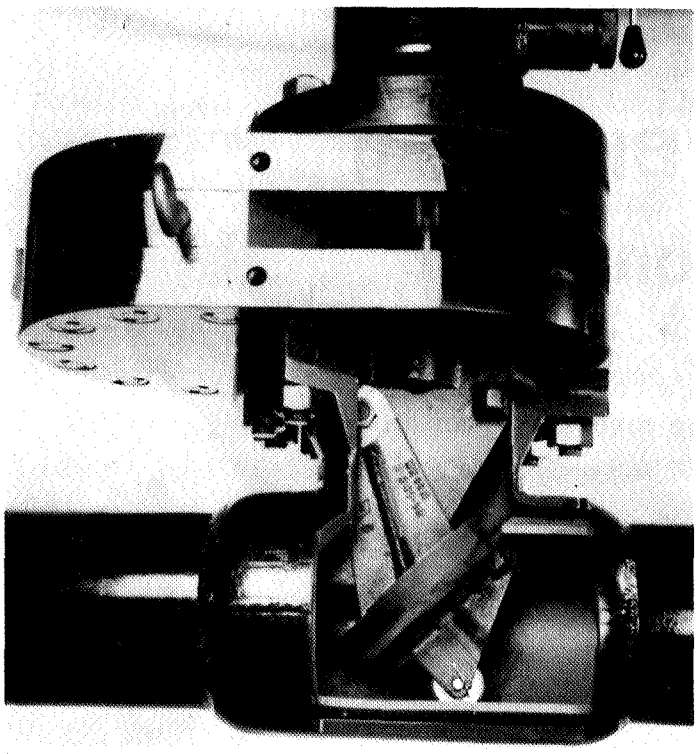
4. Retract cutter and coupon, close sandwich valve, and check for leakage. If no leakage, remove tapping machine.

5. Mount stopple plugging machine.

6. After plugging machine had been mounted on both installations, the stopplets were set. Previous measurement from sandwich valve to bottom of pipe determined number of turns necessary for setting stopples.

7. When the bottom stopple was set, flow stopped and the flare went out. The second or insurance stopple was then set. Nitrogen was introduced through the upper sandwich valve to purge between the stopples and then a pressure of 640 lb./sq. in. gauge, or 2 lb. higher than process pressure, was maintained between the stopples.

8. The vent piping above and below the relief valve was



Typical stopple installation with the stopple in the process of being set.

purged with nitrogen through previously installed hot tap connections.

9. The flange on the outlet side of the relief valve was broken and a blind installed. Care was taken to insure the purge was sufficiently strong to prevent air from entering the vent line while installing this blind.

10. The relief valve was removed and both flanges blinded securely.

11. Relief valve was repaired which, in this case, took 18 hr. and was in excess of 12 hr. elapsed time requested by TDW Services to insure tight shut off by the stopples. The high temperature units had been tested for 12 hr., however, longer service life was unknown. We were not worried by this delay as the nitrogen purge between the stopples, as well as a water spray on the lower sandwich valve, lowered the actual temperature of the apparatus considerably.

12. The relief valve was reinstalled with care exercised in preventing air from entering the vent stack. Purges were cut off after the relief valve was installed and the upper stopple retracted. The sandwich valves were closed. After testing for leakage, the stopples plugging machines were removed.

13. The Lock O Ring plugs were mounted on the tapping machines and the tapping machines mounted on the sandwich valves. The Lock O Ring plug is a device which fits inside a special flange, in this case, the flange of the spherical fitting, and utilizes an O ring seal. The plug is held in place by ring segments, a part of the Lock O Ring lfange, which fit into grooves of the plug. The ring segments are positioned by tightening retainer ring screws in the sides of the flanges. These screws are pressure sealed by O rings.

14. The Lock O Ring plugs were set in the flanges of the spherical fittings, tested for leakage, and the sandwich valves removed.

15. After sandwich valves were removed, permanent blinds were installed on the flanges and plugs installed in the tapped holes for the segmenting tightening screws.

The work is now complete. The relief valve has been repaired and the unit is still in operation. #

DISCUSSION

ED JOHNSON, Allied Chemical): How do you locate these people (TDW Services) if you should be interested?
ACREE: TDW Services is a subsidiary of T.B. Williamson, Inc. in Tulsa, Oklahoma and I will be happy to leave you my card and will appreciate any contacts.
JOHNSON: Do you make these stopples for corrosive and high pressure service such as in a nitric acid or urea plant?
ACREE: Yes sir, we have, to my knowledge right now anyway. In fact, in the past we have worked in just about every type media. Right now we do have a "hold" on working in ethylene because there are so many unknowns in ethylene. We are working on this problem and hope to have this resolved very shortly.
JOHNSON: What is the highest temperature and pressure you have gone to with these devices?
ACREE: We have what we call our normal stopples and then we have what Jack has just shown you here, the high temperature stopple. Now the maximum rating on this is 600 lb./sq. in. 650°F. We do have others; as long as we stay down around the 300° range, we can go up to 900 lb./sq. in.
ANON: What guarantees did you give that you won't lose the coupon on removing the cutter and what is the largest pipeline that you are capable of handling in this line?
ACREE: The largest stopple that we have made to-date is a 42-inch. That's a pretty good-sized stopple. The smallest one we've made in our high pressure equipment is a 2-inch stopple. As far as the guarantees of retaining these coupons, we can't actually give a gurantee. We have kept records over the past number of years and I think the rate of losing these coupons is about one in a thousand, and usually we've been able to retract these coupons. In other words, we've been able to find them and get them out of the line so they don't do damage to some components in your system.
ANON: Well, the effects of losing a coupon I think would be quite drastic in any operating plant, and I was just wondering if there was any special methods of retaining that coupon.
ACREE: Oh yes, very much so. And, in fact, we have retaining rods in there and we always make certain that we get at least two of these through our pilot hole before the cutter ever breaks the coupon loose.
BILL CHAVES, T.D. Williamson: We have just completed statistics on the coupon losses and since 1969 we have made about 2500 cust of all sizes. We have dropped four and none of these have been left in the line.

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