Why and how to maintain trunnion ball valves: Part 2

Norwegian consultant and valve instructor, Ingolf Fra Holmslet, continues his bi-monthly series of informative articles.

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In the first article we discussed the spindle seal and whether or not the spindle was equipped with a lubrication fitting making it possible to lubricate or seal the valve in case of an external leakage out past the stem seal. The next item on the list was lubrication fittings and connecting channels to the seat/ball seal. Looking back 30 years or more when all ball valves were soft seated and easily scratched and worn on the seat seal there were secondary seal injection ports on the valves where sealing component could be injected to seal a valve in case of an internal leak. Nowadays it is common to use hard metal or tungsten carbide seals on the seats making them much more resistant towards scratches and operational wear. In the minds of some, this makes the lubrication fittings and the connecting channels unnecessary and, in fact, a danger to the safety of the valves as they are regarded as possible leak-points and therefore taken away.
Let's look into the whys and hows for the use of lubrication fittings in connection with the seats on a trunnion valve. The lubrication fittings have three main functions.

1: To keep the seats loose in the seat pocket enabling them to maintain good contact with the ball to make the valve seal.
2: As mentioned earlier, to use sealing component to seal minor leaks or scratches.
3: Clean the seal surface of the ball and seats.

It´s not that placing a lubrication fitting and drilling some holes solves all the problems, far from it; it´s not that simple. There are valve manufacturers constructing good solutions that actually function very well but others do not work at all. Let's see what works and why. In Figure 7 you can see how the channel from the lubrication fitting connects to the channels in the seat and directs the lubricant to the ball/seat seal area. As discussed in earlier articles, the seat (blue) needs to be able to float in the seat-pocket to make a seal together with the ball. If the seat is stuck in the seat pocket making it impossible to form a seal with the ball, one can inject in valve cleaner to reduce the friction between the seat and the seat-pocket. When reducing the friction the coil springs in Figure 7 will

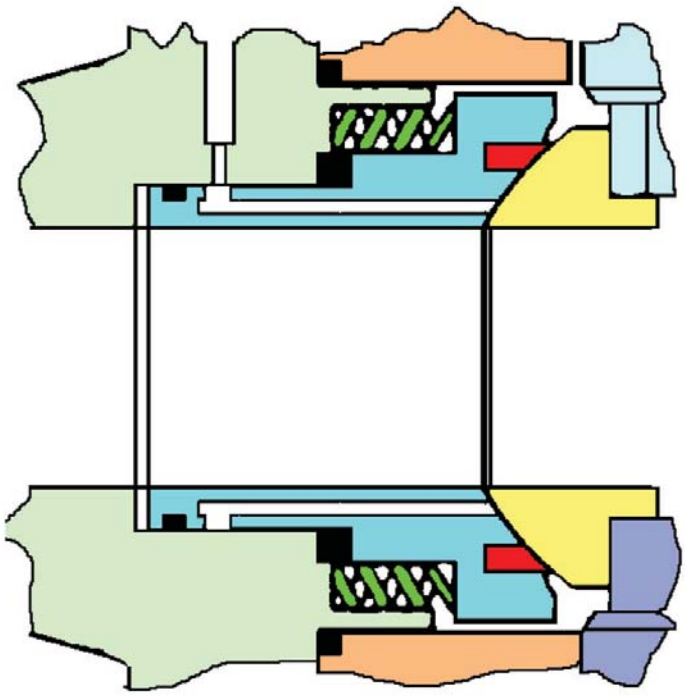

Figure 7.

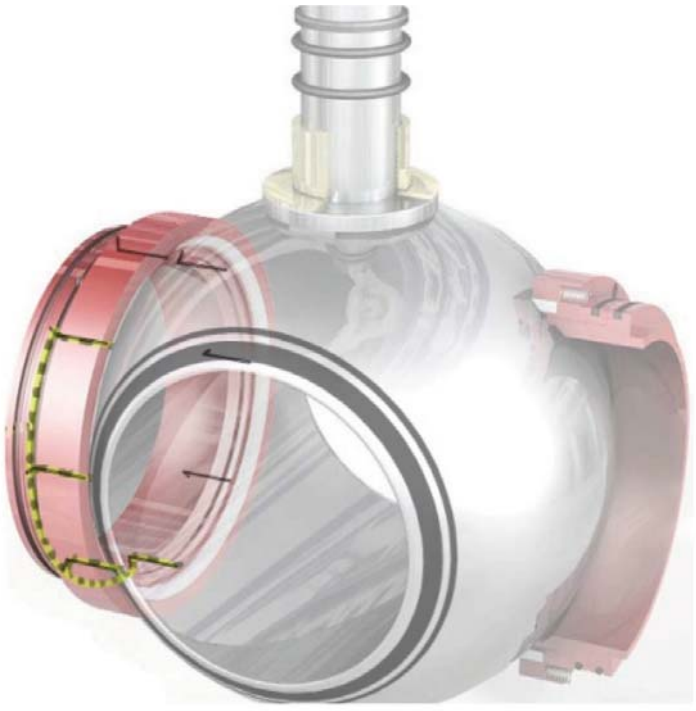

Figure 8.

Figure 9.

Figure 10.

overcome the friction in the seat-pocket and press the seat towards the ball. This has nothing to do with the seat having a metal or soft seat seal. Some months ago I was doing a valve maintenance job on an installation in the Norwegian sector. On the list were 8 leaky valves ready to be replaced with new valves, but in this time of economical crises and budget cuts the company was going to try my method of maintenance and try to save the valves. After injecting valve cleaner and performing some hocus pocus seven of the eight valves were 100 % sealed. The eighth valve did have a minor leak, due to damages on the seat seal.

The last valve was a 6" class 900 valve with only one lubrication fitting to each seat. We tried to seal the valve by injecting sealing component and managed to reduce the leak-rate by 60% but that was the best we got.

We now have to take a look at the way the channels are drilled in the valve body and the seats. Looking at Figure 8 you can see the horizontal channels drilled in the seat, the channel transporting the cleaner or sealing component towards the ball. Imagine there were only four of these channels in the seat, how much sealing component did you have to inject to ensure the sealing component from one hole meets the component coming from the hole next to it enabling a seal to be formed by the sealing component entering between the ball and seat. Then imagine there are eight or ten horizontal holes in the seat, you would then need a lesser amount of sealing component to fill the distance between the holes. So the first role is simple, you want as many holes as possible to get a good result when carrying out maintenance on the valve.

Then we have to think of how many lubrication fittings there are to each seat. In article 1 in this series I stated that every trunnion valve between 3" and 8" should be equipped with two lubrication fittings to each seat (one on each side), and all 10" and up should have four lubrication fittings to each seat (two on each side). Valve number eight on my offshore job had only one lubrication fitting. The second rule is that there must sufficient with injection points to get the cleaner and sealant transported around 100% of the seal area. Look at Figure 9 and imagine that the sealing component injected into the one channel should be transported into and around the seat to the opposite side of where the injection was made.

I would think it´s nearly impossible to be able to this without using a huge amount of sealing component. Then imagine there are two lubrication channels on each seat, one on each side; now it is feasible to seal off the valve by using sealing component.

I have never been able to seal off a valve with only one fitting to each seat. I have been able to reduce the leak rate but not to seal it completely.

I did a job on twelve valves in a metering-system. They were nearly 30 years old, soft seated 24" valves which all had some medium to small leaks but, as illustrated in Figure 10, the valves were equipped with four Injection fittings to each seat, two on each side. After injecting a normal amount of sealant component all twelve valves were sealed. There was no need for valve replacement and the valves were ready for at least ten more years.

As a comparison, I had another job on a 24" class 1500 trunnion soft seated ball valve that was equipped with only one lubrication fitting on each seat, placed diagonally opposite each other. The valve had a small internal leak but it was not possible to get the valve sealed. After injecting 100% more medium sealant component than calculated necessary, the leak rate was reduced by only 40%.

It was not possible to seal the valve with only one lubrication fitting, there were simply not enough channels and injection points.

If you are going to do maintenance on a ball valve that has been in service for 10 – 15 years you first of all need to clean the sealing surfaces and reduce the friction between the seats and the seat pockets. To be able to do that you need a valve cleaner in gel form.

The reason for that is that liquid substances like diesel or kerosene only flow downwards. Look at Figure 9 and imagine you are injecting diesel, the injected liquid will enter the seat pocket and float to the bottom of the valve. Absolutely nothing will go towards the top of the seat. With only one lubrication fitting you can only clean a quarter of the circle. With two fittings you can clean half of the circle but you will never be able to clean the whole circle unless the cleaning agent is a semi liquid substance in gel form that actually transports itself upwards and fills the whole seal area and all the channels with cleaning agent. Furthermore the gel form cleaner will stay on the metal surface for however long it takes, but the liquid diesel or kerosene will sink down and dry out, unless you are constantly injecting lots of it.

To be continued…