Maintenance on Christmas trees – Part 1

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

ingolf@valve.no
www.valve.no

Figure 1.

As the year 2015 comes to a close and we are getting close to Christmas it is natural, in this world of valves, to think of Christmas trees. Not the ones in the living room made of wood or plastic of course, but the X-mas trees on the well head or on the sea-bed providing us with the flow of oil or gas from the reservoirs in the ground or under the sea.

The X-mas tree is the first barrier and comprises the most important group of valves controlling the hydrocarbons after they pass from the seabed or the ground. To ensure this group of valves a long and well-functioning life they need to be treated and maintained in the proper way. This leads us to the all-important question; How are those valves to be maintained? There is no simple answer as it all depends on how the valves are equipped, how they are operated and how the media passes through the valves.

I have heard many times the statement that all X-mas trees must be greased, which is actually far from the truth. So how do we decide how the X-mas trees should be maintained?

First of all, let's look at the media going through the valve and at which way this media flows.

There is quite a difference if the media are clean gas or water to be injected compared to polluted crude oil coming up from the ground. In the the case of a clean media I don't think I would inject anything into the cavity, but maintain the valve by partly stroking (inching) the valve 15% in both open and closed position 3 or 4 times a year if possible to keep the seal area clean. A valve standing in the open position for a year or more can easily get a build-up of residues on the closed seal area. You only need a tenth of a millimetre to result in a leaky valve, as illustrated with the arrows in Figure 1.

Operating the valve regularly may prevent this build up and keep the seal area clean.

To be able to do maintenance on any valve, regardless of type or dimension, there is a need for lubrication of fittings and/or auxiliary valves installed on the valve body.

I won't hide the fact that there are differing opinions about those fittings/valves. Some regard them as a leak point which should be reduced as much as possible, others as a cost increasing item, yet others like me regard them as a tool for maintenance of the valves. It has to be said that those fittings/valves should only be installed on the valve when needed for maintenance. No one would dream of installing those fittings on a subsea valve.

So on which valves should those fittings/auxiliary valves be installed? Take gate valves. First let us have a look at Figure 2 and the placement of the fittings. Fitting no. 1: This is the drain point where the

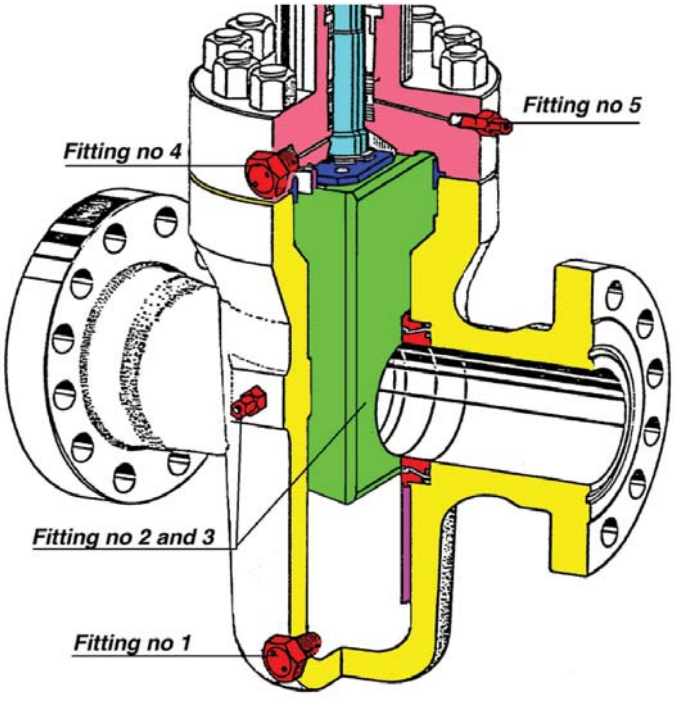

Figure 2.

fitting could be replaced by an auxiliary valve to increase the bleed area. The drain point should be on the **lowest** point when the valve is installed. This drain point is ideal for reducing the cavity pressure to test the seat integrity or to set the valve in a double block position. Fittings no. 2 and 3: These are injection points through which to inject valve cleaner to clean the seat/gate seal area, or to inject a sealing component to seal off the valve in case of small internal leaks. On valves larger than 8" there should be two fittings to each seat. Fitting no. 4: This fitting has two functions, one is to test the back seat in case of an external stem leak, and the other is to inject body filler or dissolvent into the cavity. Fitting no. 4 can also be used as a vent in case of liquid filling of the cavity. Fitting no. 5: This is a lubrication or sealing component injection point to be used if the stem seal needs lubrication or in case of an external leak passing the stem seal.

In addition, to reduce build up on the seal area of the gate, there are several other reasons why well head valves need maintenance. There are still companies using gate valve components and valves made from carbon steel, and as we know carbon steel corrodes. To prevent corrosion on internal parts the entire valve cavity should be filled with body filler (grease). Body filler will also act as a lubricant and reduce friction on all moving parts inside the valve.

To be able to fill the entire cavity it is important that Fitting no. 1 is at the lowest point of the body and Fitting no. 4 is at the highest point of the body as the valve is installed in the X-mas tree. If Fitting no. 1 is missing and the valve is only installed with Fitting no. 4 it would be impossible to fill the bottom of the cavity with body filler if the cavity is filled with water or any other unvented liquid that has to be drained in order to fill with body filler.

If the cavity is filled with body filler it is important that the seats are equipped with skirts, as illustrated in Figure 3. The skirts will hold the body filler inside the cavity and reduce the consumption of the body filler when the valve is operated, closed when flowing or opened with a differential pressure. Figure 4 illustrates what happens when operating a valve without skirts to hold the body filler inside the cavity. There is no point in filling the cavity with body filler and then sucking it out of the cavity at the first operation.

There is one other difference between Figures 3 and 4. In Figure 3 there are two injection points and in Figure 4 there is only one. In the valve illustrated in Figure 4 it would be impossible to fill the lower part of the cavity with body filler.

When maintaining a well head valve it is not unusual to refill with body filler to the same volume as in the cavity. This is fine if the valve is equipped with two fittings (Figure 3). In that case you can drain out the old body filler. But in the case of having only one fitting and having skirts the whole volume of body filler goes into the production line.

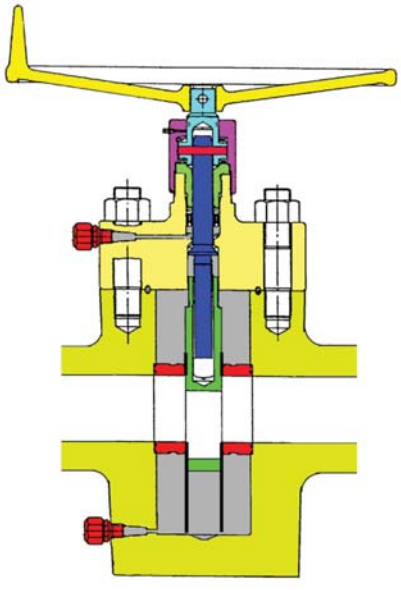

Figure 3.

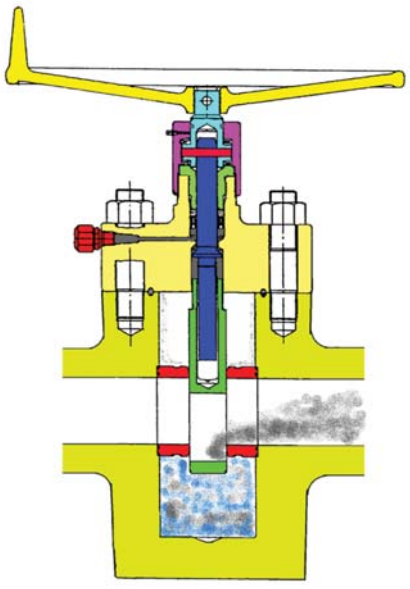

Figure 4.

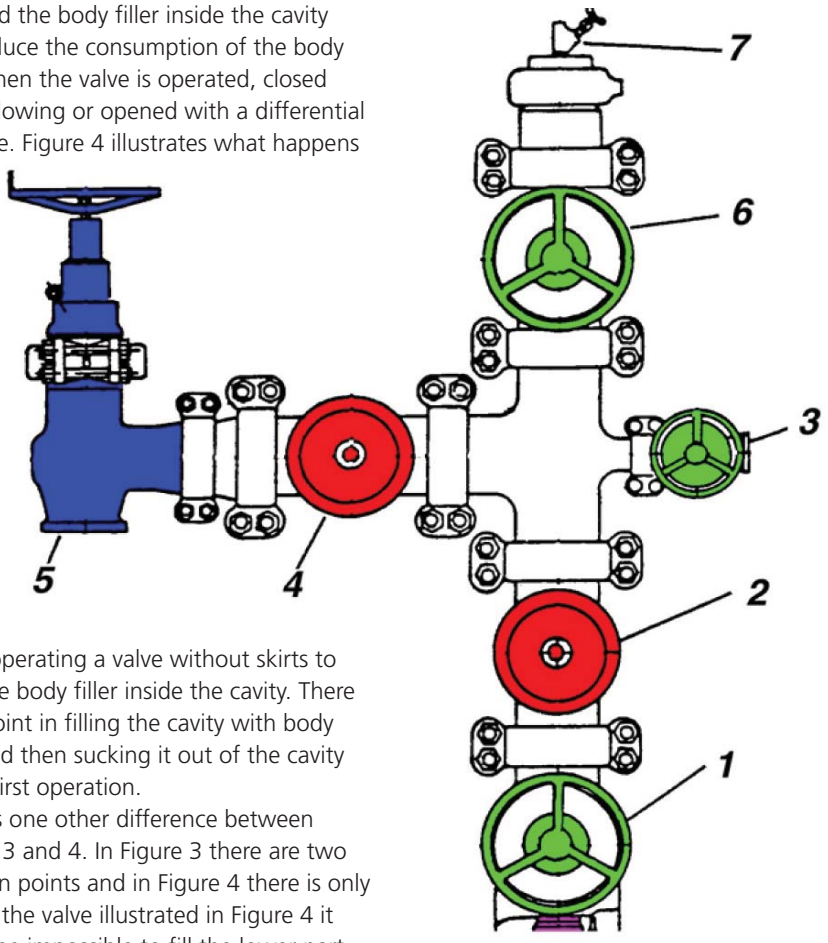

Figure 5.

There is another important aspect to consider. That is how often the valve is operated, and is it operated in a flowing condition? Let's look at the valves on the X-mas tree illustrated in Figure 5.

When looking at Figure 5 you will see that all the valves are orientated with the stem in a horizontal position where valve nos. 1, 2 and 6 are in a vertical flow and valves 3 and 4 are in a horizontal flow. This is important when it comes to lubricant fittings as the top and bottom points are different. When the valve manufacturer produces the valves they must install the fitting in a way that best suits the purpose, which is different when installing the valve with the stem vertical or horizontal and installing the valve in a horizontal or vertical flow direction. The top and bottom position will be different in all four cases.

To be continued....