UDC 622.276

THE METHOD OF WELLHEAD THERMAL INSULATION IN INJECTION WELLS

I.G. Fattakhov
Oktyabrsky Branch of Ufa State Petroleum Technological University, Oktyabrsky, Russia e-mail: i-fattakhov@rambler.ru

R.R. Kadyrov
Tatar Oil Research and Design Institute (TatNIPIneft), Bugulma, Russia

L.S. Kuleshova
Oktyabrsky Branch of Ufa State Petroleum Technological University, Oktyabrsky, Russia

Abstract. *The problem of wellhead freezing in winter exploitation session is discussed in the article. We discussed the different constructions of wellhead setup and marked their disadvantages because of their construction feature. Construction of wellhead equipment is suggested in article. We discussed different types of thermal isolation, which are used in heating up of injection wells. Their classification by seven characteristic is given the article. We described thermal isolation, which has liquid consistency, that serve to its easy application to a surface of any shape. Setting-up of cylinders from rock-wool on flange coupling and shut-off valves are given as an example.*

Keywords: *injection well, winter session, freezing, construction, thermal isolation, hole mouth, wellhead*

Various system of formation pressure maintenance is used in order to increase formation oil recovery. Formation pressure maintenance is reached by different means, in particular, by injection of oil-bearing formations with salt and fresh water. During operation in winter session surface equipment and water pipes are exposed to freezeup and, beyond that, hole mouth of injection wells can freeze at a temperature of 25 °C or lower even if saltwater has been injected. Freezeup appears because of injectivity decrease, at emergency shut down of water injection, caused by water pipe leak or power shut down, at cyclic flooding, injection of minute volume of water injection by choke restriction, and also at particular water injection on horizonts. Cross-over bends of water pipes from Water injection system to pipe header, placed at hollows are also freezing.

According to expert appraisal of specialists in nine oil-and-gas production departments of OJSC “Tatneft” the number of injection wells, which are exposed to annual freezup composes more than 500 well in a year. To develop methods of freeze up prevention in injection well hole mouth became really necessary.

One of the methods, which are making for problem solution, is structural change in existing wellhead setup of injection wells. Nowadays ANK 1-65x210 [1] wellhead

setup for injection wells and ANK65x210K1M [2, 3] small-sized injection wellhead setup are used in oil industry. The disadvantages of the known constructions are low reliability because of the big number of connections, operating under pressure, inconvenience in servicing and difficulties in thermal isolation at low outside temperatures in consequence of high metal consumption and dimensions, including height. Also the presence of stagnant zones, making for fast freezing. Constructions of wellhead setup, described in [4], includes tubing head, adapter and T-shape bend in one body frame, in which technological channels are made, where downstream line is connected to the central channel through mechanically regulated outlet, and stagnant zones of fitting pipes are supplied by plugs on the collars in order to remove water and substitute it on antifreeze. The collar of central channel is supplied with coupling with an opportunity to connect retrievable fitting pipe.

The suggested construction leads to its simplification, decrease of metal consumption and dimensions, that results in material and financial expenses decrease on production, servicing and repair, and also increases reliability of operation by means of reducing the number of connections, operating under pressure. Thermal isolation construction is also simplificated and supposes development of such consistent construction, which will be applicable to the whole wellhead setup of injection wells.

Thermal isolation materials are classified by seven main features: form, structure, density, rigidity, appearance of initial material, flammability and thermal conductivity. All types of thermal isolation can be divided on two groups:

– mechanically insecure insulating coverages, which has been made on the base of porous polymer. Usually such coverages are made from foamed plastics (poly urethane foam, polyvinylchloride foams, subereous foams), which are hydrophilous, their cancellated structure is exposed to destruction under influence of outside pressure. Such isolation is necessary to contain in cover;

– insulating covers on the base of solid polymers, which can resist the influence of environment without additional compact external cover and have low thermal conductivity and thermal stability. There is the list of polymers, which can be used as a heat-insulating substance: foam (of low density, high density, synthetic, compositional), caoutchouc, polyolefine, polystyrol, chemical cotton, ethylvynilacetate, polycarbonates, polyvynilchlorid, polyamides, phenolic resin, polyester, silicones, urethanes, natural rubber.

Modern industry suggests new kinds of pipeline heating-up, the example of it can be heat-insulating staining agents, which represents thermal insulation. The material has liquid consistency, by reason of what it can be applied to a surface of any form. The discussed cover consists of ceramic and silicone microsphere, staying in suspended state in liquid phase from water, acrylic coupling and purposeful additive. Thickness of cover layer is 1 mm, it substitutes the layer of mineral wool heat insulator 5 cm in thickness

on warm keeping efficiency. The cover has wide range of operating temperatures from -40 till +250 °C.

The following constructions with heat-insulating materials are used nowadays:

– dresspolyurethane divisible panel;

– elasticdresspolyethylene ribbon of isolon type;

– flame-resistant glass-fibre material of URSA type;

– mineral-cotton on synthetic binder cylinder with protective cover of "ROCK-WOOL" type.

Mineral cotton cylinders of "ROCKWOOL" type [5] has hygienic and fire certificates and suggested for use in Russia without limitation. Initial derivative of this material is rock volcanic meltingwith addition of synthetic binding. The advantages of this ma-terial is that thermal isolation represents the set of cylinders, which correspond to pipeline diameter. Thermal isolation of wellhead setup is also represents the set of cylinders of big size. The cylinders are fixed by means of bandaging. Of hydrophobizated cylinders and cylinders, which have cover by protectively-mantled materials (backed).

The example of cylinder assembling, which are made of mineral wool on flange coupling and shut-off valves is given on Fig. 1, 2.

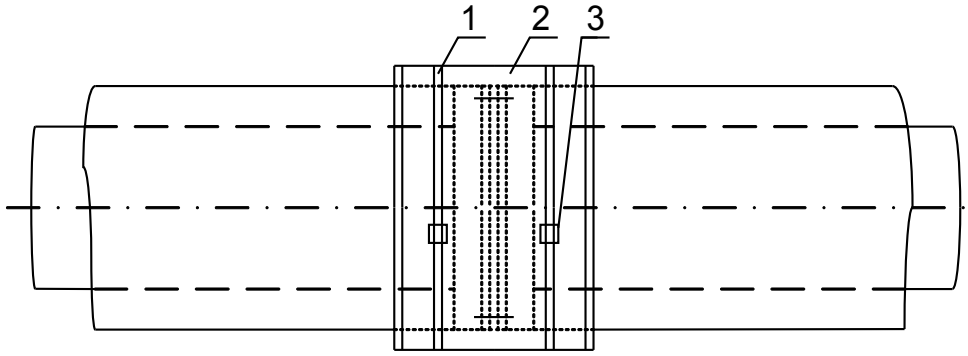

Fig. 1. Thermal isolation of flange coupling by heat-insulating cylinders:
1 – bandaging; 2 – movable guard; 3 – clamp

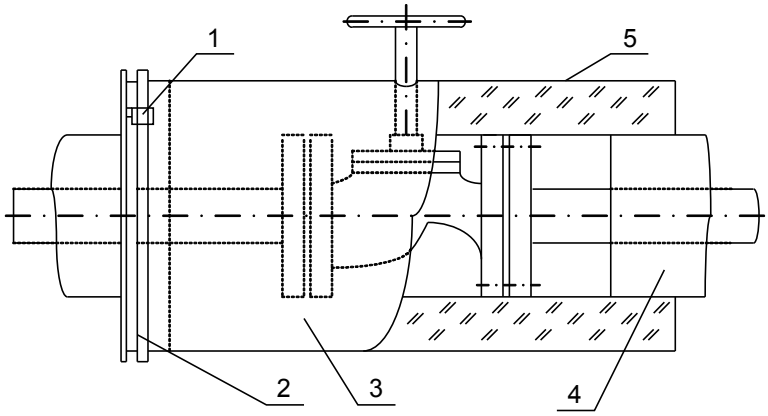

Fig. 1. Thermal isolation of reinforcement flange by insulating cylinder:
1 – clamp; 2 – bandaging; 3 – protective cover (movable guard); 4 – insulation; 5 – cylinder

The technology of “ROCKWOOL” heat-insulating cylinders assembling is given in recommendations [5] for use in more detail.

Dresspolyurethane is good heat-insulating material, but constructions, which were made of it is rough and delicate. And also it is hygroscopic if the protective cover is not used. That results in loss of heat-insulating properties of the material.

Elastic dresspolyethylene ribbon of isolon type is a good heat-insulating material, but it is applied by curling “along the body” of wellhead setup or pipeline, that in its turn, complicates dismantling of heat-insulation and performance of schedule and emergency operations on well. Moreover, dresspolyurethane and dresspolyethylene are flammable materials, that limits the area of their use.

Mineral wool of “URSA” type is flame-retardant material and corresponds to norms of fire code, hygienic certification, but the material is hyroscopic, that requires additional protective cover and also the use of additional devices for fixation of mineral wool of “URSA” type to wellhead setup or pipeline.

The essential disadvantage of enumerated heating-ups is their single application. As practice shows, in spring-summer session, at positioning on heat-insulated or other equipment of WO (workover) repair crew, heat-insulation is destroyed partially or fully and by the next season it should be restored again or apply another one. Quick-disconnected, segmented, heat-isolating construction should be developed.

It is known that any type of heat-isolating material does not prevent freezup of wellhead setup and water pipes on term more than 1 - 3 days, depending on decreasing of atmospheric temperature. In order to provide operability it is necessary to use heating elements of various constructions.

References

1. Neftepromyslovoe oborudovanie. Spravochnik (Oilfield equipment. Handbook). Ed. E.I. Bukhalenko. Moscow, Nedra, 1990. 559 p.

2. TU 3660-003-49652808-2001. Armatura ust'evaya nagnetatel'naya malogabaritnaya (Small-size wellhead equipment) ANK 65kh210K1M.

3. Utility model certificate №.29088 of the Russian Federation. IPC E21V 33/03. Armatura ust’evaya dlya nagnetatel’nyh skvajin (Wellhead equipment for injection wells). Valovskiiy V.M. et .al. Publ. 27.04.2003.

4. Utility model patent №48606 of Russia Federation. IPC E21V 33/03. Armatura ust’evaya dlya nagnetatel’nyh skvajin (Wellhead equipment for injection wells). Gabdrahmanov R.A. et.al. Publ. 27.07.2005.

5. Mineralovatnye tsilindry ZAO «Mineral'naya vata» v konstruktsiyakh teplovoi izolyatsii truboprovodov. Rekomendatsii po primeneniyu (Mineral-wool cylinders of JSC "Mineral'naya vata" in the construction of the thermal insulation of pipelines. Guidelines for the use). Moscow, AOOT “Teploproekt”, 1999. 78 p.