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DEVELOPMENT OF CONSTRUCTION AND DETERMINATION OF GEOMETRICAL PARAMETERS OF THE NET CORRUGATED SHEATH PREVENTING DESTRUCTION OF THE FILTERING ELEMENT OF CYLINDRICAL GAS FILTERS

Background

Scientifically grounded methods of preventing destruction of the natural gas filtering elements are absent in current gas practice. Unsolved also is the problem of catching of big solid particles which are in the natural gas stream at the intake of a filter element. These drawbacks of existing protective constructions of filtering elements require that the actions on their elimination be developed.

Aims and Objectives

Development of construction and determination of geometrical parameters of the net corrugated sheath preventing destruction of the filter element of cylindrical gas filters.

Results

Authors offered a construction to prevent deformation and destruction of filtering element by forming on side surfaces of external and internal protective cylindrical sheaths parallel to the axis of one-type longitudinal corrugations uniformly distributed over their cylindrical surface. The external and internal net-type sheaths are located in relation to each other at the distance specified by the thickness of mesh of filter element, so that to form a three-layer structure. Moreover, external and internal cylindrical sheaths are made from a metallic net with the mesh size less than maximal size of solid particles in the natural gas.

The use of the offered construction allows to prevent deformation and destruction of the filtering element by the wreckages of metallic constructions and large solid particles, and, thereby, to improve safety of its operation and increase the extent of catching big solid factions. In this case it becomes possible to catch additionally large solid particles in the holes of external cylindrical sheath and narrow gap between the sheath and the filtering element.

To identify basic parameters of protective cylindrical sheath, formulas are obtained for determining the amount of corrugations in one sheath, the area of the sheath and the factor of its form, showing how many times the outer diameter of shell is more than the height of one of the corrugations. Knowing these parameters it is possible to determine the maximal size of surface of the protective sheaths and filter element for the set type of cylindrical filter, depending on the values of the form factor and the number of corrugations.

Key words: development, calculation, prevention, destruction, filter element, natural gas, cylindrical corrugated sheath, calculation of parameters

References

1. Gustov S.V., Shuraits A.L., Nedlin M.S., Usachev A.P., Doronin M.S., Demchuk V.Yu. Vysokotekhno-logichnye GRP – put' k povysheniyu nadezhnosti gazoraspredelitel'nykh setei [High-Tech GCP is a Way to Improve the Reliability of Gas Distribution Networks]. *Gaz Rossii - Gas of Russia*, 2010, No.41, pp. 56-60. (in Russ.).

2. *PB 12-529-03. Pravila bezopasnosti sistem gazoraspredeleniya i gazopotrebleniya (PB 03-576-03)* [PB 12-529-03. Safety Rules of Gas Distribution and Gas Consumption Systems (PB 03-576-03)] / B.A. Krasnykh, A.A. Sorokin, A.A. Feoktistov, A.L. Shuraits e.a. Moscow, GUP NTTs PB Gosgortekhnadzora Rossii, 2003, Ser. 12, Vyp. 4, 200 p. (in Russ.).

3. *STO 03321549-024-2013. Rekomendatsii po povysheniyu bezopasnosti ustanovok gruboi ochistki prirodnogo gaza ot tverdykh chastits* [STO 03321549-024-2013. Recommendations for Improving the Safety of Plants for Primary Natural Gas Cleaning from Solids] (A.P. Usachev, A.L. Shuraits, S.V. Gustov, P.V. Sherstyuk e.a.). Saratov, OAO «Giproniigaz», 2013. 74 p. (in Russ.).

4. Sherstyuk P.V., Gustov S.V., Zhelanov V.P. Aktual'nye zadachi povysheniya bezopasnosti i effektivnosti gazoregulyatornykh punktov [Actual Problems of Improving Safety and Efficiency of Gas Control Points]. *Sbornik nauchnykh trudov* SGTU «Nauchno-tekhnicheskie problemy sovershenstvovaniya i razvitiya sistem gazoenergosnabzheniya» [Collection of Scientific Works of SGTU «Scientific and Technical Problems of Improving and Developing Gas Supply Systems»]. Saratov, 2010, pp. 10-18. (in Russ.).

5. *GOST R 54960-2012. Sistemy gazoraspredelitel'nye. Punkty gazoregulyatornye blochnye i punkty redutsirovaniya shkafnye. Obshchie tekhnicheskie trebovaniya* [GOST R 54960-2012. Gas Distribution Systems. Modular Gas Control Points and Cabinet-Type Reduction Points. General Specifications]. Moscow, Rosstandart, 2012. 65 p. (in Russ.).

6. *STO Gazpromregiongaz 7.1-2011. Tekhnicheskie trebovaniya k materialam, oborudovaniyu i tekhnologicheskim skhemam blochnykh gazoregulya-tornykh punktov, shkafnykh punktov redutsirovaniya gaza (Sistema standartizatsii OAO «Gazpromregiongaz»)* [STO Gazpromregiongaz 7.1-2011. Specifications of Materials, Equipment and Lay-Out of Modular Gas Control Points and Cabinet-Type Gas Reduction Points (OAO «Gazpromregiongaz» Standard System)]. Saint-Petersburg, 2011. 33 p. (in Russ.).

7. *SP 62.13330.2011. Gazoraspredelitel'nye sistemy. Aktualizirovannaya redaktsiya SNiP 42-01-2002* [SP 62.13330.2011. Gas Distribution Systems. Update Edition of SNiP 42-01-2002]. Moscow, Minregion Rossii, 2010. 66 p. (in Russ.).

8. Usachev A.P., Zhmurov A.V., Sherstyuk P.V., Pisarev R.A. Analiz stsenariev razvitiya pri razrushenii fil'truyushchego elementa ustanovki ochistki prirodnogo gaza [Analysis of Development Scenarios of Events in Case of Destruction of the Filter Element of a Natural Gas Treatment Plant]. *Materialy XII Vserossiyskoy nauchno-prakticheskoy konferentsii «Energoeffektivnost'. Problemy i resheniya» 17 oktyabrya 2012 g.* [Proceedings of XII All-Russian Scientific and Practical Conference «Power Efficiency. Problems and Solutions» October, 17, 2012]. Ufa, 2012, pp. 169-170. (in Russ.).

9. Usachev A.P., Shuraits A.L., Gustov S.V. *Teoreticheskie i prikladnye osnovy povysheniya effektivnosti i bezopasnosti ekspluatatsii ustanovok gruboi ochistki prirodnogo gaza ot tverdykh chastits v sistemakh gazoraspredeleniya* [Theoretical and Applied Principles of Improving Operation Efficiency and Safety of the Plants for Primary Natural Gas Cleaning from Solids in Gas

Distribution Systems]. Saratov, Saratovsk. gos. tekhn. un-t, 2013. 172 p. (in Russ.).
10. Usachev A.P., Zhmurov A.V., Toporkov A.S. Analiz promyshlennoi bezopasnosti ustanovok ochistki prirodnogo gaza ot tverdykh chastits [Analysis of the Industrial Safety of the Plants for Natural Gas Cleaning from Solids]. *Sbornik nauchnykh trudov po materialam II* Vserossiiskoi *nauchno-prakticheskoi konferentsi «*Resursoenergoeffektivnye tekhnologii v stroitel'nom komplekse regiona*»* [Collection of Scientific Works of the Materials of II All-Russian Scientific-Practical Conference «Resource- and Power-Efficient Technologies in the Construction Industry of the Region»]. Saratov, SGTU, 2012, pp. 136-139. (in Russ.).
11. Shur I.A. *Gazoregulyatornye punkty i ustanovki* [Gas Control Points and Units]. Leningrad, Nedra, 1985. 288 p. (in Russ.).
12. Bakhtizin R.N., Urazakov K.R., Smol'nikov S.V., Politov M.E. Eksperimental'nye issledovaniya propusknoi sposobnosti fil'tra tonkoi ochistki [Experimental Studies of Fine Filter Bandwidth]. *Neftyanoe khozyaistvo - Oil Industry*, 2014, No. 9, pp. 122-124. (in Russ.).
13. Staskevich N.L., Severinets G. N., Vigdorchik D. Ya. *Spravochnik po gazosnabzheniyu i ispol'zovaniyu gaza* [Reference Book on Gas Supply and Usage]. Leningrad, Nedra, 1990. 762 p. (in Russ.).
14. *Promyshlennoe gazovoe oborudovanie: spravochnik* [Industrial Gas Equipment: Manual] / Pod red. E.A. Karyakina. 6-e izd., pererab. i dop. Saratov, Gazovik, 2013. 1280 p. (in Russ.).
15. *GOST R52857.2-2007. Normy i metody rascheta na prochnost'. Raschet tsilindricheskikh i konicheskikh obechaek, vypuklykh i ploskikh dnishch i kryshek* [GOST R52857.2-2007. Norms and Methods of Strength Calculation. Calculation of Cylindrical and Conical Shells, Convex and Flat Heads and Covers]. Moscow, Standartinform, 2009. 42 p. (in Russ.).
16. Gustov S.V., Usachev A.P., Shuraits A.L. e.a. *Ustroistvo dlya predotvrashcheniya rasprostraneniya oblomkov za predely fil'truyushchego elementa prirodnogo gaza* [A Device for Preventing Fragments from Leaving the Natural Gas Filter Element]. Patent RF, No. 126957, 2013. (in Russ.).
17. Usachev A.P., Shuraits A.L., Gustov S.V., Sherstyuk P.V. Razrabotka zashchitnoi obolochki fil'truyushchego elementa v ustanovke ochistki prirodnogo gaza [Development of Protecting Coating for Filtering Element In Natural Gas Purification Device]. *Problemy sbora, podgotovki i transporta nefti i nefteproduktov - Problems of Gathering, Treatment and Transportation of Oil and Oil Products,* 2012, Issue 3 (89), pp. 152-162. (in Russ.).
18. Straus V. *Promyshlennaya ochistka gazov*: Per. s angl. [Industrial Gas Treatment: Transl. from Engl.]. Moscow, Khimiya, 1981. 616 p. (in Russ.).
19. Birger M.I., Val'dberg A.Yu., Myagkov B.I. e.a. *Spravochnik po pyle- i zoloulavlivaniyu* [Handbook on Dust and Ash Trapping]. 2-e izd., pererab. i dop. Moscow, Energoatomizdat, 1983. 312 p. (in Russ.).
20. *GOST 6613-86. Setki provolochnye tkanye s kvadratnymi yacheikami* [GOST 6613-86. Square Mesh Wire Cloth]. Moscow, Izd-vo standartov, 1988. 12 p. (in Russ.).
21. *STO 03321549-047-2016. Rekomendatsii po povysheniyu effektivnosti i bezopasnosti gazovykh tsilindricheskikh fil'trov s vertikal'noi komponovkoi parallel'no ustanovlennykh fil'truyushchikh elementov* [STO 03321549-047-2016. Recommendations for Improving the Efficiency and Safety of Cylindrical Gas Filters with Vertical Layout of in Parallel Set Filter Elements] / A.P. Usachev, A.L. Shuraits, D.V. Salin, Z.M. Usuev e.a. Saratov, OAO «Giproniigaz», 2016. 52 p.

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