JEDIC
Journal of Ethics and Diversity in International Communication
| e-ISSN: 2792-4017 | www.openaccessjournals.eu | Volume: 3 Issue: 12

Preventing Accidents in Heating Systems Using an Expansion Membrane Tank

Shairakhon Abdujalilova Saminjonovna, Abdullayev Bahrom Xaliljonovich
Ferghana Polytechnic Institute

Annotation: The use of water as a heat carrier in the heating system is considered the most effective method. The correct choice of equipment and devices for the water heating system has a great impact on the useful work of the system. An expansion tank is a part of a water heating system, which is designed to collect excess water that appears when it is heated and expands at the same time. Determining the expanded volume of water is a somewhat complicated process. In laboratory work, the expanded volume of water for the heating system is determined.

Keywords: heat carrier, water heating system, water temperature, water expansion volume, expansion tank, water glycol mixture.

Introduction.

The function of the expansion tank installed in hot water devices with natural circulation is to expel air from all heating devices, to contain the volume expansion caused by the heating of water, and to control the filling of the heating devices with water. Correct selection of the expansion tank ensures safe operation of the heating system. Determining the size of the expansion tank is a complicated process. There are several ways to determine the size of the expansion tank for the heating system. Methods of determining the size of the expansion tank for the heating system are considered. [1]

Methods: The expansion tank has two different functions, depending on whether it is installed on top or bottom spreading heat devices:

1. If overhead distribution heating devices are chosen, all heating devices must be vented, contain the volume expansion caused by the heating of the water, and control the filling of the heating devices with water.

2. If the heating devices have distribution main pipes from below, and the hot water is circulating with the help of pumps, the expansion tank will accept the volumetric expansion of the water from the heat and help to control the filling of the system with water. [2]

The expansion tank can be open, in contact with the atmosphere, or closed (membrane), under variable, but strictly limited overpressure.

Open expansion tank - located above the highest point of the systems - in the attic, stairs or on the roof of buildings and in some cases covered with thermal insulation. They are made of cylindrical or rectangular steel and equipped with a hatch at the top for inspection and painting. There are two or more pipes in the tank body: A closed expansion tank - there are two spaces separated by a flexible diaphragm. One is for air under pressure and the other is for water.

The water flowing from the overflow pipe connected to the expansion tank fills the system with water and expels the collected air through the faucet. Lack of circulation within the expansion tank can cause it to freeze. Therefore, in order to ensure that such an event does not occur in the tank, it is necessary to create a circular motion of the water in the tank. For this, it is necessary to connect a piece of connecting pipe to the tank through the distribution or return main pipe. The expansion tank is made of steel tunics and is fixed with sliding screws for easy removal from the system and reassembly. Also, just in case, the container is insulated with a heat-insulating material, and paint is applied inside and outside so that the metal does not rust. [5]

Method 1 for determining the size of the expansion tank

When determining the useful size of the expansion capacity, it is necessary to take into account the thermal expansion of water in the system.

Volumetric expansion of water is determined using the following formula:

$$\Delta V = \alpha \cdot V_w \cdot \Delta t \qquad (1)$$

Here: ΔV- volumetric expansion of water, m^3;

$\alpha = 0{,}0006$ - coefficient of volumetric expansion of water;

V_w – volume of water in all sections of the heating system;

Δt - the arithmetic difference between the temperature before starting the heating system and the calculated temperature in the system.

The volume of water in the heating system is determined using the following formula:

$$V_s = V_{q.q} + V_{i.a.} + V_q \qquad (2)$$

Here: $V_{q.q}$- the volume of water in the boiler unit or heat exchanger equipment, l/kvt; $V_{i.a.}$- volume of water in heating devices, l/kvt; V_q – the volume of water in the pipes in the system, l/kvt.

If water with a temperature of 20°C is heated to 95°C for heating public and residential buildings, formula 1 takes the following form:

$$\Delta V = 0{,}0006(95 - 20) \cdot V_w$$

Method 2 to determine the size of the expansion tank

To calculate the working capacity of the membrane expansion tank, it is necessary to determine the total volume of the heating system by adding the water volumes of the boiler, heaters and pipes. [5]

Knowing the size of the heat exchanger in the system, it is necessary to multiply it by 0.08 - 0.1, i.e. is about 8-10% of the volume of the heating system. Thus, for 100 liters of heat transfer water, an expansion tank of approximately 8-10 liters is required.

The size of the expansion tank

V = (VL x E) / D,

where: VL is the total volume of the system (boiler, radiators, pipes, heat exchangers, etc.).

E - the coefficient of expansion of the liquid %

D - efficiency of the membrane expansion tank

It is very difficult to calculate the volume of the heating system, so it is possible to get an approximate calculation by knowing the power of the heating system using the formula based on the ratio 1 kW = 15 liters.

RESULT AND DISCUSSION. Results obtained according to the 1st method of determining the volume of the expansion tank. In the above formula, the amount of water in all sections of the heating system is unknown. We can find the amount of water in each section. Water volume in radiators. For radiators with ribs:

- aluminum - for each part 0,45 - 0,5 l
- bimetallic - for each part 0,3 - 0,35 l
- cast iron - new 1 liter per section, old 1.8 -2 liters

The volume of water in the boiler

- 3-6 liters for wall-mounted gas boilers.
- For floor gas boilers and parapet gas boilers, depending on the power and, accordingly, the size of the boiler, the value is 10-30 liters.

Water volume in pipes:

- ø15 — 0,177 l
- ø20 — 0,310 l
- ø25 — 0,490 l
- ø32 — 0,800 l
- ø40 — 1,250 l
- ø50 — 1,960 l

A hydraulic calculation of the heating system is needed to perform calculations.

Hydraulic calculation of the heating system

Plot №	heat load Q	G=(3,6*Q)/(4,2*(tk-t2))	Plot length L	Diameter, D	Speed, V	Rubbing R*Pa/M	R*L Point in Lpa Geos	Plot resistance coefficient, ξ	Local resistances pressure loss Z=ξ*ρ	Total pressure loss
1	2	3	4	5	6	7	8	9	10	11
R-1	1316,43	45,1	4,7	20	0,034	1,4	6,58	10	5,56	12,14
1-2	2622,78	89,9	3	20	0,06	4	12,00	1	1,73	13,73
2-3	3929,13	134,7	3	20	0,097	10	30,00	2	9,04	39,04
3-4	5235,48	179,5	3	20	0,135	18	54,00	1,5	13,14	67,14
4-5	6541,83	224,3	3	20	0,171	28	84,00	2	28,11	112,11
5-6	7848,18	269,1	3	25	0,131	14	42,00	2	16,50	58,50
6-7	9154,53	313,9	3	25	0,15	18	54,00	2	21,63	75,63
7-8	10460,88	358,7	3	25	0,161	19	57,00	2	24,92	81,92
8-9	11767,23	403,4	3	25	0,19	26	78,00	2	34,70	112,70

9-10	13073,58	448,2	3	25	0,208	34	102,00	2	41,59	143,59

We determine the number of radiator ribs from the value of the heat load from the hydraulic calculation table of the heating system.

Q=71950/200=360 number of ribs

We determine the volume of water in the radiators.

360*0,45l=162 l

We determine the amount of water in the pipes.

16.7 pipe with a diameter of 20 mm.

ø20 — 0,310 l

16.7*0,310=5,18 l

16.7 pipe with a diameter of 20 mm

ø25 — 0,490 l

15*0,49=7,35

The volume of water in the boiler unit. 20 liters

We find the total amount of water in the heating system.

$V_s = V_{q.q} + V_{i.a.} + V_q = 162 + 5{,}18 + 7{,}35 + 20 = 194{,}55\ litr$

Volumetric expansion of water is determined

$\Delta V = 0{,}0006(95 - 20) \cdot V_s = 0{,}0006 \cdot 75 \cdot 194{,}55 = 8{,}75\ litr$

For the heating system, we choose Flamco Flexcon R expansion tank Flexcon R 12l/1.5 – 6 bar.

Results obtained according to the 2nd method of determining the volume of the expansion tank.

Heating power for a residential building is 45 kW, the total volume (power) of the heating system

$$VL = 15 \cdot 45 = 675\ l$$

The expansion of the liquid for the heating system is about 4%, the maximum temperature is 95 ° C. If ethylene glycol is used as a heat carrier in the system, then an approximate calculation of the coefficient of expansion can be made using the following formula:

$$10\% - 4\% \cdot 1{,}1 = 4{,}4\ \%$$

$$20\% - 4\% \cdot 1{,}2 = 4{,}8\ \%$$

Membrane Expansion Tank Efficiency:

$$d = \frac{PV - PS}{PV + 1}$$

where: PV is the maximum working pressure of the heating system (the design pressure of the safety valve is equal to the maximum working pressure), usually 2.5 bar is enough for cottages.

PS is the charging pressure of the diaphragm expansion tank (should be equal to the static pressure of the heating system; (0.5 bar = 5 meters)

An example of Buck's hypothetical choice. The heated area of a residential building is 400 m², the height of the system is 5 m, the required heating power is 45 kW, then the volume of the required expansion tank is as follows:

$$VL = 45 \cdot 15 = 675\ l$$

$$PV = 2{,}5\ bar; PS = 0{,}5\ bar$$

$$D = \frac{2{,}5 - 0{,}5}{2{,}5 + 1} = 0{,}57\ m$$

$$V = \frac{675 \cdot 0{,}04}{0{,}57} = 47{,}4$$

A UNIPUMP expansion tank of 50 liters, charging pressure of 0.5 bar brand expansion tank is designed for the heating system.

Results obtained in laboratory work.

Given: t_1=20ºC water temperature before turning on the heating core t_2=49ºC water temperature after turning on the heating core. Tube diameter:$d_k = 78\ mm = 0{,}78\ dm, \Delta h = h_1 - h_2$ difference in membrane height. It is required to find the volume of expanded water in the membrane expansion tank. [3]

ΔV_{mag}- expanded water in liters.

$$\Delta V_{mag} = \frac{\pi \cdot d_k^2}{4} \cdot \Delta h \qquad (2)$$

$\Delta h = 0{,}19\ dm$, in that case

$$\Delta V_{mag} = \frac{\pi \cdot d_k^2}{4} \cdot \Delta h = \frac{3{,}14 \cdot 0{,}78}{4} \cdot 0{,}19\ dm = 0{,}091\ dm^3$$

CONCLUSION. The size of the expansion tank for the heating system was determined using two different methods. In the first method, we determined the size of the expansion tank for the system using the heat load for the heated building, the volume of water and the coefficient of expansion of water. In the second method, we determined the size of the expansion tank for the heating system using the characteristics of the expansion tank. Using the first method, the volume of the expansion tank was calculated based on exact indicators. It turned out that the second method has several complications. The results of the hydraulic calculation were used to determine the size of the expansion tank suitable for the heating system. In the tank with an expanding membrane, the expanded part of the water in the system accumulates, and the emergency situation that occurs due to the excess pressure created in the system is prevented.

REFERENCES

1. Abdulkhaev, Z., Abdujalilova, S., & Abumalikov, R. (2023). CONTROL OF HEAT TRANSFER ABILITY OF RADIATORS USING THERMOVALVE. *Journal of Construction and Engineering Technology*, *1*(1).
2. Erkinjonovich, A. Z., Abdujalilova, S. S., Aminjonovna, A. I., Abdulazizovna, M. N., & Botyrjonovna, Y. A. (2023). Fire Prevention Using an Automatic Shut-of Valve. *CENTRAL ASIAN JOURNAL OF MATHEMATICAL THEORY AND COMPUTER SCIENCES*, *4*(8), 91-94.
3. Abdujalilova, S. S., & Zukhridinovna, R. S. (2023). MEASURING WATER CONSUMPTION IN FITTINGS. *CENTRAL ASIAN JOURNAL OF MATHEMATICAL THEORY AND COMPUTER SCIENCES*, *4*(5), 29-33.
4. Ибрагимова, З. К. К., Хамдамова, Н. С. К., Умуркулов, Ш. Х. У., & Сабиров, Д. Р. У. (2022). Подготовка питьевой воды из маломощных поверхностных водоисточников. Central Asian Research Journal for Interdisciplinary Studies (CARJIS), 2(Special Issue 4), 77-83.
5. OBIDOV J., UMURQULOV S. O ‘ZBEKISTON YASHIL IQTISODIYOT SOHASIDA ISLOHOTLARNI AMALGA OSHIRISHDA MUQOBIL ENERGIYA MANBALARINING O ‘RNI VA AHAMIYATI //Bulletin of Contemporary Studies. – 2023. – Т. 1. – №. 3. – С. 15-18.
6. Abdukarimov, B.A., Tillaboyeva F. Sh, va A.T.A’zamjonov. «QUYOSH SUV ISITISH KOLLEKTOR ISILIK QUVURLARIDAGI GIDRAVLIK JARAYONLARNI HISOBLASH». *Ekonomi va sotsium* 4-1 (107) (2023): 4-10.
7. qizi Tillaboyeva, F. S. (2023). QUYOSHLI SUV ISITGICH KOLLEKTORLARINING ISSIQLIK ALMASHINUVI HISOBI. GOLDEN BRAIN, 1(31), 156-162.
8. qizi Tillaboyeva, F. S. (2022). QUYOSH KOLLEKTORLARI. QUYOSH KOLLEKTORLARINING TURLARI VA KOMPONENTLARI. *INTERNATIONAL CONFERENCE ON LEARNING AND TEACHING*, *1*(6), 255-258.
9. Nurmuhammad, X. (2022). HYDRAULIC IMPACT IN HYDRO SYSTEMS AND ITS CAUSES. *CENTRAL ASIAN JOURNAL OF MATHEMATICAL THEORY AND COMPUTER SCIENCES*, *3*(12), 159-164.
10. Ishankulovich, K. S., & Akramovna, U. N. (2021). Simulation of the Lift of Two Sequential Gate Valves of the Karkidon Reservoir. *Middle European Scientific Bulletin*, *18*, 148-156.
11. Ishankulovich, K. S. (2022). Modeling The Rotation Of A Turbulent Flow With A Variable Radius. *International Journal of Progressive Sciences and Technologies*, *31*(2), 388-395.
12. O‘tbosarov, S. H., & Xusanov, N. (2022). ASSEMBLY OF STRUCTURES AND WATER DIVIDERS. *Science and innovation*, *1*(A7), 780-784.
13. Mo’minov, O. A., & O’tbosarov Sh, R. Type of heating radiators, principles of operation and theoretical analysis of their technical and economic characteristics. *JournalNX*, *7*(05), 299-303.

14. Bekzod, A. (2020). Relevance of use of solar energy and optimization of operating parameters of new solar heaters for effective use of solar energy. *IJAR*, *6*(6), 16-20.

15. Mo'minov, O. A., Abdukarimov, B. A., & O'tbosarov, S. R. (2021). Improving support for the process of the thermal convection process by installing reflective panels in existing radiators in places and theoretical analysis. In *Наука и инновации в строительстве* (pp. 47-50).

16. Abdukarimov, B., O'tbosarov, S., & Abdurazakov, A. (2021). Investigation of the use of new solar air heaters for drying agricultural products. In *E3S Web of Conferences* (Vol. 264). EDP Sciences.

17. Abdukarimov, B. A., O’tbosarov, S. R., & Tursunaliyev, M. M. (2014). Increasing Performance Efficiency by Investigating the Surface of the Solar Air Heater Collector. *NM Safarov and A. Alinazarov. Use of environmentally friendly energy sources*.

18. Худайкулов, С. И., Жовлиев, У. Т., Сайлиев, О. И., & Утбосаров, Ш. Р. (2022). МОДЕЛИРОВАНИЯ ЗАДАЧИ ТУРБУЛЕНТНОГО ТЕЧЕНИЯ СМЕСИ ВЯЗКИХ ЖИДКОСТЕЙ. *BARQARORLIK VA YETAKCHI TADQIQOTLAR ONLAYN ILMIY JURNALI*, *2*(1), 405-410.

19. Эгамбердиев, О. Ш., Хамдамов, А., Ўзбеков, Ж., Рахмонкулова, С., & Халилов, Н. (2022). НАСОС СТАНЦИЯСИНИНГ ИШЛАШ ЖАРАЁНИНИ ОПТИМАЛ БОШҚАРИШ АЛГОРИТМИ. *Евразийский журнал академических исследований*, *2*(11), 94-99.

20. Abdullayev, B. X., & Rahmankulov, S. A. (2021). Modeling Aeration in High Pressure Hydraulic Circulation. *Central Asian Journal of Theoretical and Applied Science*, *2*(12), 127-136.

21. Madaliev, M. E. U., Rakhmankulov, S. A., & Tursunaliev, M. M. U. (2021). Comparison of Finite-Difference Schemes for the Burgers Problem. *Middle European Scientific Bulletin*, *18*, 76-83.

22. Abdullayev, B. X., & Rahmankulov, S. A. (2021). Movement of Variable Flow Flux Along the Path in a Closed Inclined Pipeline. *Central Asian Journal of Theoretical and Applied Science*, *2*(12), 120-126..

23. Rakhmankulov, A. (2022). ГИДРАВЛИЧЕСКИЕ ПАРАМЕТРЫ ПОТОКА ВОДЫ В БОРОДЕ С НЕСТАЦИОНАРНЫМ ДНОМ. *Science and innovation*, *1*(A7), 820-826.

24. Rakhmankulov, A. (2022). ГИДРАВЛИЧЕСКИЕ ПАРАМЕТРЫ ПОТОКА ВОДЫ В БОРОДЕ С НЕСТАЦИОНАРНЫМ ДНОМ. *Science and innovation*, *1*(A7), 820-826.

25. Mo'minov, O. A., Abdukarimov, B. A., & O'tbosarov, S. R. (2021). Improving support for the process of the thermal convection process by installing reflective panels in existing radiators in places and theoretical analysis. In *Наука и инновации в строительстве* (pp. 47-50).

26. Абдукаримов, Б. А., Муминов, О. А., & Утбосаров, Ш. Р. (2020). Оптимизация рабочих параметров плоского солнечного воздушного обогревателя. In *Приоритетные направления инновационной деятельности в промышленности* (pp. 8-11).

27. Mo’minov, O. A., & O’tbosarov Sh, R. Type of heating radiators, principles of operation and theoretical analysis of their technical and economic characteristics. *JournalNX*, *7*(05), 299-303.

28. Muminov, O., & Maksudov, R. (2022). HIDROTECHNICS PREVENT VIBRATIONS THAT OCCUR IN CONSTRUCTIONS. *Science and innovation*, *1*(A7), 762-766.
29. Muminov, O. (2022). TYPES OF CAVITATION, CAUSING VIBRATION IN ENGINEERING AND WATER SUPPLY SYSTEMS. *Science and innovation*, *1*(A7), 732-737.
30. Umurzakova, M. A., Usmanov, M. A., & Rakhimov, M. N. (2021). ANALOGY REYNOLDS PRI TECHENIYAX AND DIFFUZORNO-CONFUZORNYX KANALAX. *Economics and society* , (3-2 (82)), 479-486.
31. Abbasov, Y., & Usmanov, M. (2022). CALCULATION OF THEIR POWER AND HEATING SURFACE IN IMPROVING THE EFFICIENCY OF AIR HEATING SYSTEMS. *Science and innovation* , *1* (A7), 738-743.
32. Abbasov, YS, Abdukarimov, BA, & Ugli Usmanov, MA (2022). Optimization of Working Parameters of Colorifiers used in Heat Supply Systems. *Central Asian Journal of Theoretical and Applied Science* , *3* (6), 399-406.
33. Maksudov, RI, Dehkanov, SS, & Usmanov, MA (2023). THERMAL INSULATION MATERIALS AND DETERMINATION OF THEIR OPTIMAL THICKNESS. *Economics and society* , (4-1 (107)), 151-157.
34. Abbasov , Y. _ S. , & ugli Usmanov , M. _ A. _ (2022). Design of an Effective Heating System for Residential and Public Buildings. *Central Asian Journal of Theoretical and Applied Science* , *3* (5), 341-346 .
35. Madaliyev , E. , Makhsitalayev , B. , & Rustamova , K. (2022). IMPROVEMENT OF SEWAGE FLATS. *Science and innovation* , *1* (A7), 796-801.
36. Madaliyev, E., & Maksitaliyev , B. (2022). A NEW WAY OF GETTING ELECTRICITY. *Science oath innovation* , *1* (A7), 790-795.
37. Solijonov, MV (2022). QUYOSH ENERGİYAsidan FOYDALANGAN YANGI QOYISH HAVO ISITISH PARAMETRLARINI ISHLAB CHIQISH PARAMETRLARINI OPTİMLAYTIRISh. *MATEMATİK NAZARIYA VA INFORMATYA FANLARI MARKAZIY ASIAN JURNALI* , *3* (12), 190-197.
38. Abdukarimov, BA, Solijonov, MV, & Abdumalikov, RR (2023). AN'VANSIY VA QAYTA OLiladigan ENERGIYA MANBALARI ASOSIDA ISHLAB CHIQISH ISILIK TA'MINLANISH TIZIMLARINI TADQIQOT. *OLTIN MIYA* , *1* (1), 253-255.
39. Abdukarimov, A., Solijonov, M., & Abduxamidov, A. (2022). QUYOSH ENERGIYASIDAN FOYDALANISHDA YANGI SOLAR HAVO ISITISHLARNING ISHLATILISH PARAMETRLARINI OPTİMLAYTIRISh. *Fan va innovatsiyalar* , *1* (A8), 815-823.