52 Questions and their Answers, Relating To Hot Water Safety

Prepared by
Watts Regulator Company
World Leader in the manufacture of
Temperature and Pressure Relief Valves

Typical Questions and Answers about Hot Water Safety!

1 **What causes a water heater or hot water storage tank to explode?**

Explosions result primarily from overheating or excessive temperature. Contributing physical causes are corrosion and service weaknesses. The resultant heat rupture exposes its pressurized contents to the atmosphere. This causes the superheated water to immediately flash into steam. This combination of factors creates the explosion.
To illustrate what "heat rupture" means, let us suppose that a heater operating at a normal temperature of 120°F can satisfactorily withstand water pressure of 75psi. However, the same tank when overheated may only be able to safely handle a pressure of 50psi.

2 **Why is it temperature and not pressure that causes a hot water explosion?**

Water does store energy when heated. Explosions resulting from the release of this latent energy can occur at normal operating pressures. The force and energy of the explosion derives from steam pressure resulting from the superheated water flashing into steam under the atmospheric pressure condition.
As shown in the Watts video, "Danger, Explosion Lurks", it is not water pressure that causes an explosion. Tank pressure was built up to over 500psi in an unheated tank when a rupture was caused, nothing happened except a squirt of high pressure water.

3 **If excessive pressure is relieved, why doesn't this give adequate protection against explosion?**

During the explosion demonstrations in the video, a pressure only relief valve was connected. It discharged the water under pressure from thermal expansion continuously above its pressure setting. The relief valve will only open far enough to reduce the excess pressure. But this amount of discharge was not sufficient to reduce temperature or to prevent the overheating.
The reason the volume of pressure discharged is not enough to overcome the BTU heat input is because thermal expansion pressure equals approximately 2½% of volume for every 100°F rise. Fluid heat discharge is necessary to relieve the extra BTU heat input for every 1,000 heat units which is about 20 times greater in volume. Also see Q&A 9 on p.4 for further discussion.

4 Is a pressure relief valve necessary on the cold water line when a Temperature and Pressure (T&P) valve is installed on the tank or heater?

No. The pressure is virtually the same in all parts of the immediate system. Since the combination T&P valve gives protection against both excessive temperature and excessive pressure, there is no need for a separate pressure relief valve on the cold water line.

5 Does the water pressure increase with temperature on open main systems?

In an open main system, nothing is closed between the house system and the street main. Heating water will cause thermal expansion to increase pressure allowing the system pressure to create backflow into the city supply main. The increased pressure will then be absorbed in the main.

6 Is it safe to install a check valve or backflow preventer in the cold water supply?

Remember that the purpose of a check valve is to prevent the backflow of contaminated water as well as protect the meter by preventing superheated water from backing up into the cold supply main from boilers and heaters. However, the very condition that can cause this, can also cause explosions in a potentially explosive condition. The temperature and pressure safety relief valve protects against both excessive temperature and pressure. Everyday thermal expansion should be absorbed by an expansion tank, or other pressure relief device, as per the local plumbing codes.

7 Should a check valve be used on the cold water line to protect the meter when a T&P relief valve is installed on a tank or heater?

No. A check valve has no value to the system when a T&P relief valve is installed on a tank or heater. Only when the tank heater temperature is allowed to rise beyond 212°F is there danger of meter damage. This has been proven by several tests, even with the meter within 6 feet of the tank.

The condition which causes meter damage is the greater hazard of superheated water that can cause an explosion should the tank or heater rupture. Using a check valve causes a pressure rise in the system each time water temperature is raised. Without the check, water pressure increases only in case of accidental stoppage in the supply line as the water is heated. (Subject refers to municipal water systems.)

8 Will a straight pressure relief valve prevent overheating when a check valve is used?

Definitely not. Overheating is wholly dependent on the BTU heat input from the heating element and a plain pressure only relief valve, regardless of its size, cannot prevent this overheating or reduce temperature.

9 Since a pressure relief valve will open in a closed system with a check valve, why doesn't this thermal expansion discharge eliminate overheating?

To prevent overheating, a relief valve must discharge heated water at the rate the heater supplies it. In a system with a check and pressure relief valve, the relief valve opening by pressure increase due to expanding water will discharge approximately ⅓ lbs. of water for each 1,000 heat units put into the water because that is the rate at which water expands. To release 1,000 heat units when the temperature is at 210°F to 212°F, there must be approximately 6⅔ lbs. of water released from the system.

In other words, to prevent overheating when there is a check valve in the supply line or an accidental stoppage that makes the system a closed one, a means must be provided to release about 20 times as much water from the system as a pressure relief valve can discharge from thermal expansion. To be safe, the system must be protected by a temperature relieving device which should be capable of releasing heat at a greater rate than the heater input rate.

10 What is the proper pressure setting for the pressure side of a T&P valve or for a separate pressure relief valve?

The correct setting for the pressure part of any relief valve is at least 20 to 30psi above the maximum working pressure in the system. If a setting is too close to the actual working pressure, it causes unnecessary and annoying drippage due to water pressure fluctuations and water hammer conditions. A standard pressure setting of 150psi, for example, is suitable for use on today's water heaters, most of which have a standard working pressure of 150psi. If the working pressures exceed 125psi, a pressure reducing valve is recommended to reduce the system pressure to around 45 to 50psi. Then a standard set valve can be used.

11 What effect does water hammer have on the setting of a pressure relief valve?

If a pressure relief valve is set 20 to 30psi higher than the maximum service pressure, it avoids unnecessary momentary discharges resulting from water hammer and minor pressure surges when faucets are closed quickly. Since water hammer shocks increase in intensity as the service pressure rises, it is recommended practice to use shock arrestors to prevent banging pipes and pressure reducing valves to lower the working pressure to a normal operating range thus protecting and prolonging the life of equipment.

12 What should the homeowner do if steam or scalding hot water comes out of a faucet?

If a storage tank has become seriously overheated, it could be dangerous to go near the tank to shut off the source of heat. **Do not shut off the water supply.** Open a hot water outlet moderately, and get away from the tank and out of the house. A plumber should then be called to have the heater serviced and a temperature and pressure relief valve correctly installed.

13 Would opening the hot water faucet connected to an overheated storage tank cause the tank to explode?

Opening the hot water faucet would allow cold water to enter as the hot water was being discharged. Depending on the extent of the overheating, the water would flash into steam as it reached the faucet outlet, thus releasing excess heat until the water temperature was reduced to its atmospheric boiling point.

The resultant cooler temperatures at the bottom of the tank may cause metal stress and a pressure-heat rupture. A plumber should be called to have the heater serviced and a new T&P relief valve correctly installed.

14 Where is the proper location for a pressure relief valve on a hot water storage system?

For pressure relief only, you can install a plain pressure relief valve anywhere in the system simply because pressure is common to all parts of a system. However, we recommend that you install it as close as possible to the equipment which it is to protect. We recommend simple pressure relief valves only for unfired storage vessels not subject to possible overheating. **Note: never install a shutoff valve between a relief valve and the tank!**

15 If a water tank has 60psi pressure and the water happens to be overheated to about 240°F, what happens if you shut off the water supply for system repairs or any other purpose?

Should a faucet be opened to bleed the 60psi, it would immediately drop down to about 10psi. The water will flash into steam creating a steam pressure of about 10psi until the escaping steam reduces the temperature. As the temperature drops, the pressure reduces accordingly. When the pressure drops to zero, the temperature is then at the boiling point of water according to the atmospheric pressure (212°F at sea level). Therefore, such a condition is “controlled steam pressure energy” being dissipated. Explosions occur when an uncontrolled rupture of the tank suddenly exposes the superheated contents to the atmosphere.

16 How can a plumber be sure the T&P valve is of ample capacity to properly protect the tank from excessive temperature and pressure?

All Watts Temperature and Pressure relief valves are marked with their BTU discharge capacity. Our Catalogue reference material provides information regarding BTU discharge capacity for various sizes and types. To be sure of ample capacity, it is equally important for you to know the BTU heat output capacity of the heater so that a valve can be selected to equal or exceed its BTU discharge rating.

17 What could cause an automatic T&P valve to open and close repeatedly when there is very little hot water in the tank?

With an automatic water heater installation, either the heater thermostat would have to be acting abnormally and not shutting off or stacking temperature conditions could contribute to this situation. Sidearm gas heaters commonly experience this condition. In such cases, an overheated condition exists at the point of the valve, but most of the overheated water is concentrated at the top of the tank. This can result from installing circulation piping with too small a diameter between heater and tank and return. This restricts the circulation area. Thus with the BTU input greater than that area can carry, it cannot enable proper circulation in the tank, as well as through the coils of the heater itself. Due to this inadequate circulation, the water overheats in the coils and slowly circulates to the top of the tank. This concentration of overheated water does not circulate to heat the tank from top to bottom. Consequently, a T&P valve is called upon to open, and after discharging for just a short time, (because there is so little hot water to discharge) it resets again.

The cure for this is to use a minimum of ¾" size circulation piping, preferably nonferrous. Unless it is nonferrous, piping can clog up with rust even if it is of large size. Clogging reduces the area of circulation in the pipe so that it functions no better than a small diameter pipe. For example, liming conditions are very common. Such conditions can literally plug up heater coils with lime scale, thus restricting the circulation flow.

18 What should be the correct size of circulating pipe connections to ensure balanced temperature in storage tanks and to prevent the T&P relief valve from opening up unnecessarily?

Circulation piping should be at least equal to the full size of the circulation connection on the heater, and never less than ¾".

19 Will the T&P relief valve protect the tank against rupturing from excessive water hammer?

Excessive water hammer is an abnormal momentary condition. Consequently, the pressure part of the T&P relief valve would only be able to relieve a limited amount of the excess pressure during the

water shock. The temperature mechanism could not assist in any way. However, it should be noted that without it, should this water hammer condition occur when a tank is overheated above atmospheric boiling point, there could be an explosion.

20 Should a T&P relief valve be installed in an elbow or coupling at the end of a 4" nipple or any size nipple?

A T&P relief valve must not be installed in an elbow. Because of the possibility of creating an air pocket in the dead end of a coupling, only extension type valves should be used. T&P valves should always be installed in the tapping provided on the water heater. If no tapping is provided, consult the water heater manufacturer.

21 What would cause a pressure relief valve to open periodically?

If a pressure relief valve opens periodically, it can be one of four things:

1. Fluctuating pressures in the area
2. Water hammer condition in the building
3. The two above conditions, combined with a pressure setting that is too low to a working pressure (see Q&A 10)
4. Thermal expansion pressure in a closed system

22 What is Thermal Expansion?

The use of a water pressure reducing valve, check valve or backflow preventer normally creates a closed system. When water is heated in a closed system, it expands causing an increase in pressure. This pressure may increase to the set pressure of the relief valve (on the water heater) causing it to drip, thus releasing the expanding water to protect the system against excessive pressure. This increase in the system pressure is called “thermal expansion pressure”. A solution to the drippage is to utilize a bypass model water pressure regulator which, under certain conditions, allows the water supply to escape back into the supply main before it can affect the relief valve; however, such regulators can only be effective when the street main pressure is less than the pressure relief valve setting.

23 Can air pockets form on the top of tanks?

As long as the hot outlet is taken from the top of the tank there can't be any air pockets. Any old style heaters with the outlet taken from the side directly could cause an air pocket at the top of the tank, but have been discontinued to our knowledge.

24 What advantages has a fully automatic T&P relief valve over the ordinary fuse type of valve?

The advantages of a fully automatic T&P valve over the ordinary fuse plug type of valve are several. For one, a fuse plug type of valve can have a fuse plug replaced with an incorrect melting material which would defeat the temperature safety factor of the valve. In the fully automatic type, there are no fuses to replace and the valve resets

automatically. Because of the replacement detail of fuse plugs, the fully automatic is cheaper in the long run since only one service call prevented will more than save the difference in cost to the home owner, or the contractor, if within the guarantee period. Also, fusible plugs can be affected by certain water conditions which may affect the melting point of the fusible material, and a lime coating can block water flow through the thermo tube. A self-closing T&P valve can break any lime condition through movement, and latest developed thermostats are unaffected by corrosive water conditions. Also, fuse plug type valves do not comply with current national standards.

25 Should the drain pipe from relief valves be reduced in size less than drain opening size in valve?

No. The relieving capacity of relief valves is based on a full size discharge line. Furthermore, there should be no shutoff valves in this line and it is essential that the drain line be piped to a safe place of disposal. The drain line must pitch downward. The function of a T&P valve is to operate by discharging water and, therefore, means must be provided to eliminate possible scalding and water damage during periods of relief.

26 Is it necessary to install T&P valves on a hot water space heating system?

We do not recommend T&P protection on hot water space heating systems because the operating factors differ considerably from that of domestic hot water supply systems.

27 What is considered proper and sufficient protection of hot water (space) heating boilers?

Only valves tested to and listed by ASME for BTU steam discharge capacity are allowed by code on boiler applications. The principle of hot water space heating boiler protection is diametrically different from that of protecting domestic hot water supply systems. This is because water is confined in the system which is more or less pure from heating and therefore less corrosive.

Chance of pressure-heat rupture is unlikely, by preventing any further rise in pressure above 30 to 33 lbs. regardless of runaway firing condition. ASME BTU steam rated pressure protection can, thus, maintain boiler conditions within safe pressure limits.

28 When a self-closing T&P valve opens, how can you tell whether it is opening on temperature or pressure?

If a fully automatic T&P valve is relieving at full flow, it generally indicates temperature relief. If it is relieving just a few drops or in dribbles, it indicates pressure relief. Under certain conditions, a minor temperature dribble might be caused due to a low heat input combined with a large capacity of the temperature thermostat part of the T&P valve.

29 What is meant by thermal lag on the hot water supply line?

A thermal (temperature) lag on the hot water outlet line is simply the difference in temperature between a given point in a nipple some distance away from the heater and the temperature in the top of the tank itself. Water in the hot water outlet lines doesn't have the same free circulation as within the larger area of the tank itself. Consequently, there is a continuous differential of temperature at a point 10" away, compared to the temperature in the tank itself. See Q&A 39 and 41 for further comments.

30 What can be done to prevent a T&P relief valve from liming up?

Removal of minerals from the water by treatment is the only method of preventing the liming up of valves in the system. In districts where liming conditions are common, a safety relief valve should be periodically checked to assure its being in a safe operating condition. Valves with test levers are required whereby it can be manually opened to check clearance of waterways.

31 What type of relief valve should be used on tankless heaters attached to low pressure hot water and steam heating boilers?

We do not recommend T&P valves for tankless heaters. This is because the nature of a tankless heater installation is different than that of a storage vessel in which water is heated for domestic hot water supply. Therefore, we recommend plain pressure relief, because it is difficult, and in some cases impossible, to locate a T&P valve correctly enough to serve a practical purpose of temperature protection.

32 Why isn't temperature and pressure protection applicable to tankless heater installations?

In the average tankless heater, the water in the tubes will reach the temperature of the water in the boiler during periods when there is no demand for domestic use. In cold weather when boiler water temperature may be in excess of 212°F, the domestic water would be above the temperature relief valve set temperature and there would be frequent, though short, periods of relief valve operation. There is no means of cooling the temperature of the water in the heater tubes, particularly with a built-in heater. Periodic high temperature entering the tubes is not particularly hazardous because of the small amount of excess heat energy. The danger of high temperature in tankless heaters is from the high temperature water flowing from the fixtures. It is most advisable to install a water tempering valve which will limit the water temperature at the fixture and prevent scalding of persons using hot water.

33 What type T&P valve should be used on a Booster type water heater?

A reliable T&P valve having a temperature relieving capacity equal to or preferably higher than the rated heater input. A booster heater is merely a high recovery heater. Therefore, the selection of a T&P valve is no different than for any other water heater, except to consider the BTU capacity rating of the T&P valve.

34 Should two T&P valves be installed when a tempering tank is used in conjunction with a water heater?

It is not necessary to use a T&P valve with a tempering tank used in conjunction with a water heater. A correctly sized T&P valve in the water heater itself is sufficient.

35 At what temperature do the fusible plugs melt?

There is a basic fusible plug mixture which we use and refer to as a eutectic mixture which melts very accurately at 212°F. This basic mixture is considered as accurate as a thermometer and pre-softening and melting takes place within one degree plus or minus 212°F.

36 Do lime or scale deposits have any effect on the melting point of a fusible plug?

Lime affects the melting point of a fusible plug only because it provides an insulating fibre over it, thereby keeping its temperature below that of the surrounding water. Further, the lime may build a hard bridge over it so that when tank temperatures rise sufficiently to melt the plug, water release is prevented by the cap of lime over the end of the small area waterway.

37 How should a T&P valve be sized?

T&P valves should be sized according to their BTU fluid discharge capacity and so that the rating will be in excess of the maximum BTU heat output of all connected heaters. The valve should be selected not on the basis of inlet or outlet connection size, but on its actual measured discharge capacity. However, the inlet connection size of a T&P relief valve should be minimum ¾" to allow for proper area for circulation of the heated water to contact the thermostatic element of the valve. All reliable T&P valves are rated for BTU discharge at 30 lbs. water pressure. Normal ratings will be increased at higher working pressures. Thermal expansion pressure relieving capacities by the pressure element of T&P valves are always well in excess of that required by the system if it is a closed system or accidentally closed.

38 Will ASME requirements on relief valves affect any present codes which require the use of T&P valves?

ASME boiler safety relief valves are designed primarily for low pressure space heating boilers. The ASME Low Pressure Heating

Boiler Code covers relieving devices for heating boilers and details requirements only for the prevention of excess pressures. The code specifies an emergency BTU pressure rating which must not be confused with the BTU temperature rating of a T&P valve.

The ASME BTU rating for safety valves is the expression of the amount of steam a safety valve will discharge under specified pressures at corresponding boiling points. It has no relation to the established rating practices and terminology of T&P valves. However, where ASME pressure requirements exist as well as temperature relief requirements, combined construction or separate valves can be furnished. If the correct intentions and purpose of the ASME Code recommendations were interpreted and applied, the vast majority of heaters and tanks less than 120 gal. or 100,000 BTU capacity would not be affected by any adopted ASME requirements. ASME pressure requirements cannot prevent overheating which is the fundamental cause of explosion potential, and is therefore the job for established T&P relief protection.

39 What is the advantage or necessity of extension thermostat type valves?

Extension thermostats are always recommended where valves cannot be installed directly in the tank by virtue of a separate tapping provided or available for this purpose. Serious thermal lag conditions can be caused and even at the top end of a ¾" x 5" nipple when the temperature reaches 210°F, temperature in the tank can exceed 250°F. When temperature reaches 210°F in the top of a ¾" x 10" nipple, temperatures in a tank can exceed 275°F. Violent explosions have occurred under these same temperature conditions. Therefore, safe tank temperatures are assured, providing that the end of the thermo-tube is within and below the top of the heater so that there would be no possible thermal lag.

40 What else should be considered in selecting the extension length of a thermostat in a T&P valve?

The internal flue location of the heater should be considered such as in multiple flue heaters or floater tanks because the temperature sensing element could be exposed to excessive flue temperature. Example: External flue heaters should always be protected by a valve with an extra length extension thermostat which would allow the temperature sensing portion to pass through the flue area and eventually locate itself in the tank water.

41 How should a T&P valve be installed on a system and what size fittings should be used?

T&P valves should be installed so that the temperature actuating means is in contact with the hot water at the top of the tank or heater. For valves without thermostat extensions, the fitting in which it is installed should be separated from tank or heater by not longer

than a shoulder or close nipple, and, no less than ¾" size. A valve having ½" inlet connection and an extension thermostat can be installed where a ½" nipple separates tank and fitting, but the length must allow the thermostatic element to extend into the tank. Temperatures drop rapidly in the hot water line leading from the tank as the distance from the tank increases, and is proportional to the pipe size – the smaller pipes showing the greatest difference. For example, with a ½" close or shoulder nipple, the temperature lag is 23°F, and with a ¾" x 2" nipple, difference as high as 18°F have been indicated, and with a ¾" x 6" it has reached 42°F. Therefore, the shortest possible nipple is recommended, and where possible a 1" close nipple or shoulder type should be used for safe performance.

42 What is meant by stacking temperature in water heaters?

The stacking temperature is the higher water temperature found at the top of the heater that is higher than the normal temperature maintained by the heaters thermostat. This condition is brought about principally by frequent small demands for hot water which keep the thermostat cool enough to maintain longer than normal operation of the heater. Entering cold water cannot absorb the total heat output, hence the water surrounding the heating surfaces picks up more heat clear to the top of the tank with consequent rise in temperature. This is not true with all heaters. Where a temperature relief valve on a thermostatically controlled heater operates, the thermostat should be checked.

43 Can lime accumulation on the bottom of a heater affect the performance of the water and/or the T&P valve?

Yes. The accumulation can cause an excessive amount of heat to pass up through the flue and contribute to a “stacking” condition in the heater.

44 Will a T&P valve prevent overheating if installed on the cold water line?

No. When a tank is heated, the water, as it expands, backs into the cold water line. Naturally this water gradually increases in temperature as the tank heats. Eventually, this temperature will reach a level at which the relief valve will open. Tests have shown that the tank water will be heated several degrees higher before the relief valve operating temperature is reached. Once the valve opens, water will be delayed, but it will run hot only until the heated water that backed into the cold line has run out. This will take just a short time and then the water will run cold. A tank is supplied only through the cold supply line. Water cannot flow in both directions in a pipe at the same time; i.e. hot cannot flow out of the tank and cold into it at the same time. Consequently, when the relief valve opens, the water flows in from its source, the cold water supply, to the valve and then out the drain it does not get to the tank – the tank temperature continues to rise – it has no protection.

45 Why must a T&P valve be installed on the hot water line as close to the tank or heater as possible?

Thermal lag is one of the biggest enemies of correct T&P relief valve location. Basically, the hot water in the heater itself is to be protected against excessive temperature and not the water in the lines leading to or from it. In some cases, installing a T&P valve in the hot water outlet line as close to the tank as possible is not close enough for adequate thermal circulation. If a T&P valve is installed within 2" from the tank tapping by means of a close nipple, satisfactory thermal circulation conditions exist. However, any further distance beyond this enables unsafe tank temperatures. Our film “Danger, Explosion Lurks”, shows very clearly what dangerous high temperatures can exist in a tank before 210°F is reached at the location of a valve 5" or 10" away from the tank. Therefore, to overcome the location and distance problem, an extension type thermostat is recommended.

46 What type T&P valve should be installed on an electric water heater?

Whether a heater is an electric, oil fired, or gas type, the basis of selecting a valve is essentially the same. Aside from proper BTU capacity sizing; correctly maintained, and inspected T&P valves, whether self-closing type or fusible plug design, are satisfactory. Most electric heaters now have a center connection in the top of the tank which is especially designed to accommodate the direct installation of a T&P valve. However, because electric heaters are insulated, an extension type valve must be used to get the thermostat or fusible plug directly in the tank water of the heater.

47 What formula do you use to correctly size T&P relief valves on Electric Water Heaters?

Basically the BTU relieving capacity of the valve should be greater than the electric capacity rating of the heater. For Electric Water Heaters the formula is: Kilowatts x 3.413 BTU/HR.

48 On open main systems, what value are pressure relief valves? Why not just temperature relief?

There is no essential difference between open or closed systems on the protection principles. It is true that on open systems pressure cannot increase above the city main pressure and therefore a pressure relief valve cannot operate. If, however, the system becomes accidentally closed or a reducing valve or check valve is installed, basic pressure protection is needed.

Overheating is common to both open and closed systems and therefore, temperature protection is vital. The combination T&P construction offers two in one service as the most practical and economical safety valve for adequate protection against both hot water supply heating hazards.

49 What are the advantages of spillage over non-spillage method of protection?

Emergency pressure relief is a physical fundamental that can only be attained by spillage method. However, temperature protection can be achieved by either spillage or non-spillage methods. As in everything, there are advantages and disadvantages, but the spillage method has proven to be the more practical, positive and economical solution. Because pressure relief is a basic necessity (even though of far less importance than temperature relief) the additional temperature sensing capability included in a combination T&P relief valve is much cheaper than a separate temperature non-spillage safety device. Also, installing the basic pressure relief valve would include the plumbing costs of drain piping necessary for either pressure or temperature function. Furthermore, the melting of a fuse plug, or the positive physical expansion of a fluid filled thermostat, unaffected by any water conditions, would allow harmful scalding overheated water to be discharged.

50 Does water pressure itself have any latent energy or explosive power?

No, it doesn't except when superheated. The phenomenon of water pressure, no matter how high, is somewhat misunderstood and no doubt is the background of why some feel that by releasing excessive pressure you relieve explosion danger. While more detailed accounts of water pressure can be referred to, let us establish that water is practically an incompressible solid. As a result, you cannot make its volume smaller by squeezing it, thus, there is nothing to give or expand if released.

No matter how high the water pressure is caused to be by thermal expansion or otherwise, it is only the equivalent of the weight of water per square inch. It possesses no other physical power when exposed to atmospheric pressure. However, when water is superheated above 212°F, it does possess latent heat energy which when exposed to atmospheric pressure flashes into steam pressure energy which is the power behind an explosion.

51 What is a so-called “pressure heat rupture”?

“Pressure heat rupture” is a phrase that describes a pressure rupture caused by superheated water (above 212°F) under normal pressure conditions. Heat weakening effects combined with corrosion weaknesses are the most common causes of a pressure heat rupture. Tests and studies have shown that metal stress is a very pertinent factor in causing a rupture. Recorded temperature changes develop severe stresses at certain points of construction in a tank.

It is sometimes argued that if excess pressures are prevented, the tank cannot rupture. This is unrealistic when applied to an open system where pressure relief cannot operate, although temperature may reach pressure boiling point. Even where pressure relief can operate,

the point is, if the tank is seriously overheated, it is a potential bomb whose explosion force may be liberated by an unpredictable rupture before a set pressure relief is reached. No one can guarantee the life and strength of a tank at any pressure when corroded by water conditions or weakened by heat.

52 Give the correct location for the installation of a T&P valve on a tank or heater.

First, it must not be installed on the cold water line. There is one preferred, and desired, standard location for all T&P valves, and that is directly in the tank shell of heaters themselves. Such a location however, requires special separate tappings. Where provided, it eliminates thermal lag conditions and better all-around valve performance due to constant temperature conditions on the thermostat and disc of the valve.

However, if the hot water line has to be used on tanks not provided with a separate tapping, such as for older installations, then it is important to be careful to use a valve with a long enough extension thermo-tube that extends into the tank to contact the hottest water in the top of the tank.

Watts Regulator
the Leader

- First to make public demonstrations of hot water tank explosions recorded on film, proving that overheated water can explode under normal pressure.
- First to establish by research and laboratory tests, the facts concerning the fundamental difference between pressure and temperature protection.
- First to develop combination temperature and pressure Auto-ther-matic Relief Valves for two in one valve protection.
- First to recommend reinspection of T&P relief valves and stress the importance for a reinspection program.

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