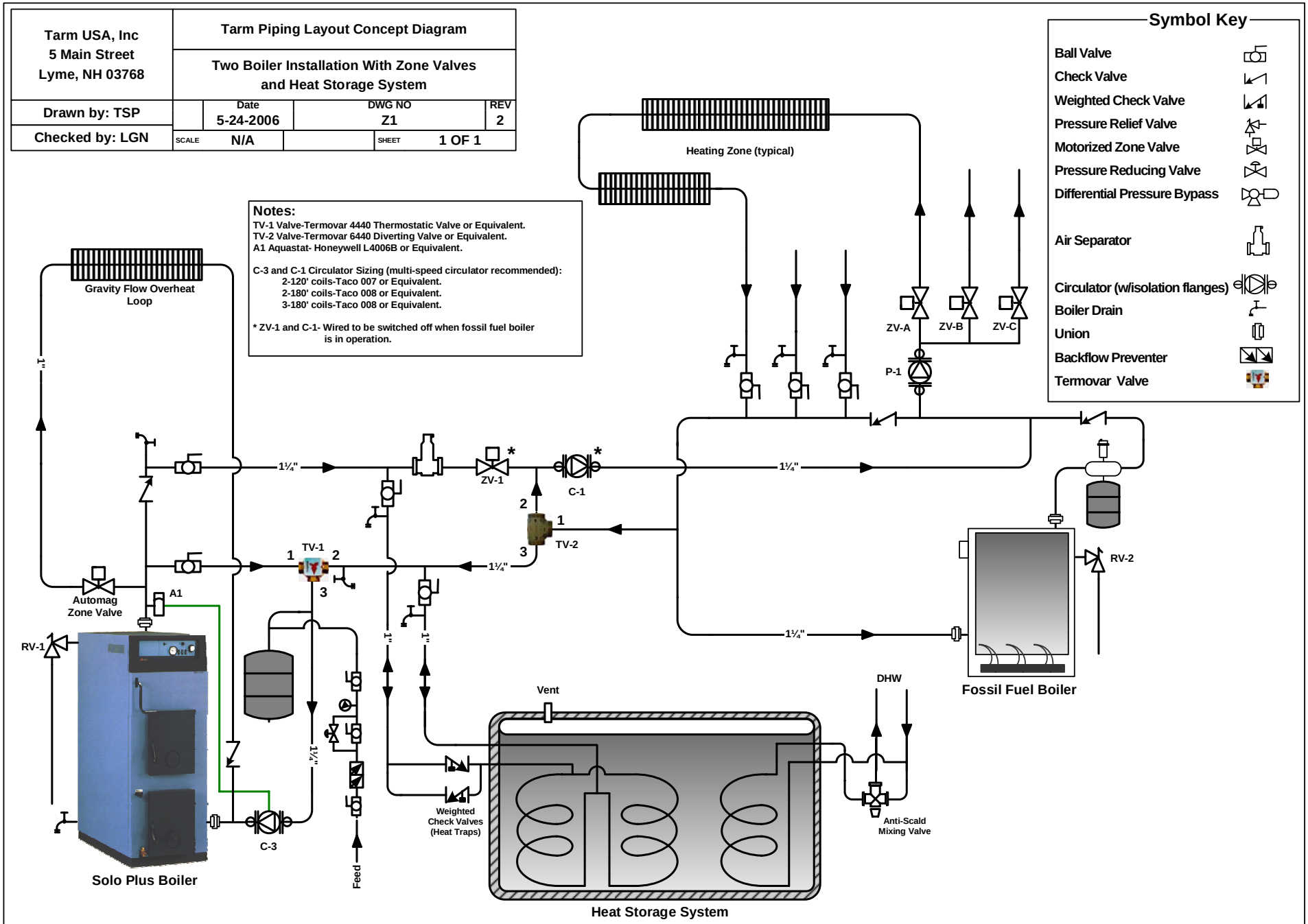
Tarm USA, Inc 5 Main Street Lyme, NH 03768	Tarm Piping Layout Concept Diagram			
	Two Boiler Installation With Zone Valves and Heat Storage System			
Drawn by: TSP		Date 5-24-2006	DWG NO Z1	REV 2
Checked by: LGN	SCALE N/A		SHEET 1 OF 1	



This is only a **concept** drawing. Final design, installation and code compliance details are the responsibility of the designer/installer of the system.

BASIC PLUMBING AND WIRING CONCEPTS FOR CONNECTING HS TARM BOILERS WITH STSS HEAT STORAGE TANKS

(FOR ZONE VALVE ZONE CONTROL ONLY)

Before you begin the boiler installation, please make sure that you have your field wiring and plumbing diagrams available. The boiler manual will provide little information regarding connection to a heat storage tank. The concepts that follow should clarify the field wiring and plumbing diagrams.

The process begins when a fire is lit in the boiler and the boiler's control is reset. Water within the boiler begins to warm. When the boiler reaches 165º F., circulator (C3) starts. C3 is controlled by a close on rise aquastat such as a Honeywell L4006B on the Solo Plus boilers. On Excel boilers C3 is controlled by the L6081 aquastat, which is pre-wired in the Excel boiler control. Hot water from the boiler will begin to circulate (generally at 165ºF) when the C3 circulator starts. Depending on the water temperature at the 4440 Termovar valve (TV1), water will either circulate right back into the return of the boiler or will continue on to the supply manifold.

TV1 is a three way thermostatic tempering valve. Port 3, which is the return to the boiler, always stays open. Port 1 remains open until it senses 165º F. water. At temperatures above 165º F., Port 1 begins to close while Port 2 begins to open. Port 2 is fully open at 180º.

The thermostatic element in the Termovar prevents return of cold return water to the boiler until the boiler reaches operating temperature. The Termovar then gradually opens, blending hot boiler supply water with the cold return water. Once system temperature equalizes, the Termovar opens fully to allow full flow to and from the heating load (the house and/or a heat storage system).

Assuming that TV1 is hot, the water being circulated by C3 is now heading for the supply manifold. If no zones are calling for heat then the Honeywell V80431079E zone valve (ZV1) will remain closed. All of the hot supply water being moved by C3 must travel through the heating coils in the tank moving from top to bottom and then back through Port 2 of the Termovar and back to the boiler.

If at any point while the boiler is in operation a zone calls for heat, 24 VAC[1*] is passed through the end switch of the zone relay control to ZV1. When ZV1 is fully open it closes contacts allowing 120 VAC[2] to pass through to the auxiliary circulator (C1). With the calling zone's zone valve open, ZV1 open, C3 running, and C1 running, all boiler supply water bypasses the heat storage tank and goes straight to the calling zone(s).

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[1] 24 VAC may be pulled from any available 24 VAC source. In most instances, a transformer will need to be added to supply this application.

[2] 120 VAC may be pulled from any available line voltage source. The end switch on the V80431079E Honeywell zone valve (ZV1) is rated for 120 VAC.

[*] Use the yellow wires on the Honeywell V80431079E for 24 VAC and the red wires for 120 VAC.

Water that cannot pass through the open zone(s) passes through a **D**ifferential **P**ressure **B**ypass **V**alve (DPBV).

Adjusted properly, this valve will only allow water to pass if it cannot be used by the zone(s). DPBVs solve problems associated with using one large single speed circulator to supply multiple zones. DPBVs reduce unwanted noise in zones that are open by reducing flow to a normal rate through the open zones. DPBVs also reduce the chance for erosion of plumbing components. Furthermore, a DPBV will also decrease the likelihood that closed zone valves will be forced open when other zones call for heat.

If the boiler has burned through its wood and has cooled, Port 2 of the TV1 valve will close and C3 will stop. Flow through the boiler will cease. Once the boiler is eliminated from the plumbing circuit, any zone that calls must pull heat through the heat storage tank. Return water passes into the bottom of the heating coils and exits the top of the coils re-heated and headed back to the supply manifold. Again, as when the boiler is hot, whenever a zone calls for heat, the end switch on the zone relay allows 24 VAC to pass to ZV1. When ZV1 is fully open, it closes end switch contacts allowing 120 VAC to pass through to C1.

TARM USA, INC. recommends the use of an additional Termovar valve model 6440AF (TV2) for many installations. Typically a house with many zones will have some zones that are very small. By using our plumbing diagram without TV2, it is possible that when a small zone is the only zone calling, a master bathroom zone for instance, all of the heat the boiler is producing will be sent to the small zone. The result is that a 100,000 – 198,000 Btu boiler is sending all of its output to a load that could be 2,500 Btu's or less. The boiler quickly reaches operating temperature and shuts off, which is what we are trying to avoid by using a heat storage tank. TV2 solves this problem. It operates much the same way that TV1 operates except that it is a diverting valve. Port 1 of TV2 receives water from the return manifold. Port 2 of TV2 is connected to the supply manifold. Port 3 of TV2 is connected to the return to the boiler and to the storage tank. When the TV2 senses water 165º and above, it shunts water from Port 1 to Port 2 (back to the supply manifold). Because flow returning to the boiler from the return manifold is diminished, the remaining supply flow from the boiler is forced through the heating coils in the tank. Both the zone and the tank get hot water and the boiler cruises along with a demand equal to or greater than its output. The end result is that the heating load is always prioritized over the heat storage tank, but heat not used will be stored in the storage tank for later use.

If you have reviewed our plumbing diagrams you have probably noticed a couple of uncommon valve applications. The first is the use of two opposing **weighted check valves** on the same pipe leading from the top of the heating coils in the heat storage tank. Their purpose is to act as a thermal trap preventing heated tank water from migrating out of the tank by convection. A simple 18" deep (or deeper) "U" shaped trap will provide the same benefit. If check valves are used, we recommend that they be cast iron bodied universal style flow checks. They must not be swing type check valves, as natural gravity flow of water will push swing check valves open.

The second valve application that could use some explanation is the "balancing valve" located between the boiler supply and Port 1 of the 4440 Termovar (TV1). This valve could be a true balancing valve, but for our purposes a ball valve is adequate. We are unconcerned with erosion that may prevent the valve from fully closing as years go by. This valve simply serves to reduce unwanted flow through Port 1 when the boiler is at temperature. Typically this valve is positioned ½ closed, and left in that position.