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FINAL DESIGN REVIEW
MULTI-PURPOSE SENIOR CENTER
SOLAR HEATING AND HOT WATER SYSTEM

MASTER

The final design review for the Solar Heating and Hot Water System for the Multi-purpose Senior Center was held on January 23, 1978, at Building 4201 on the Redstone Arsenal. The following personnel were present:

- Tom Davidson, NASA
- Robert Lewedag, NASA
- Robert Wessels, Solar Unlimited
- Steve Weinstein, PRL/The Ehrenkrantz Group
- Tom Lewis, PRC/EAC
- Jim Easterly, PRC/EAC
- Bruce Novell, Solar Unlimited
- W. R. Dickson, Dickson & Associates, Architects
- B. L. Wiesenmaier, NASA
- Glenn E. Wallace, City of Huntsville
- Sonya Salmon, City of Huntsville

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Mr. Davidson began the meeting by informing everyone that Mr. Weinstein, Mr. Lewis, and Mr. Easterly represented DOE. Mr. Dickson asked if it would be a good idea for him to give them a brief history of the Senior Center. Everyone agreed that this was a good idea; therefore, Mr. Dickson proceeded to detail the building's construction as a community center, renovation to a senior center considering the later possibilities of solar use, and the proposal submitted to DOE for the solar renovation now. He covered the changes that were made in the building when it was converted to a senior center, for example, the heating system. He then explained the model of the Senior Center and the solar renovation. He added that there was a possibility of adding a refrigeration system to the Center later. Mr. Novell stated that with the system being what it is it would be possible to use the solar storage in the summer for off-peak cooling storage. This is not part of the proposed project, but it can be done. Mr. Lewis asked if the utilities go along with that. Mr. Novell stated that they did not at this time. Mr. Dickson then continued to cover some other geographic facts about the building, such as the use of the Big Spring to heat and cool the Municipal Building. Mr. Novell then pointed out that the introduction of the solar collector panels on the south side insulate that portion of the building; and the insulation on the panels of the northeast and northwest side of the building and double glazing every other pane of window in the meeting room will decrease the heat load requirements and cooling load requirements.

Mr. Weinstein brought up a question concerning the location of the Center on the model in relation to the location of the Center on the plans. Mr. Dickson pointed out that the north arrow on the plans was for plan reference only. Mr. Weinstein then asked that we go through the mechanics of the system. Mr. Novell stated that the mechanical system of the building is a water circulation system with three zones - the office area, meeting room, and the crafts area. Every room in the building has an individual unit heater with the exception of the meeting room which has an air handler. Each one of these heaters has a thermostatic and far control; and the perimeter ones also have some electric heat in them so if the water is ever below 85° the electric heat will supplement the hydraulic. He continued that they had basically tried to have the pumps operating only when the building was calling for heat and give solar the priority in attempting to heat the building before the boiler would come on. There will be a time clock

to allow the solar system and the boiler time to heat the building before it is scheduled to be occupied. Mr. Lewis asked if all the controls were resettable. Mr. Novell stated that the time clock, the night set-back thermostat, and the heating and cooling thermostat measuring outside temperature were resettable. Mr. Lewis then asked if there was an economizing cycle. Mr. Novell stated that there was not because there is no outside air drawn into it anywhere except in the space above the roof and the ventilation system. Mr. Novell then proceeded to cover several schematics (Attachment A). He stated that there had been some minor changes - the addition of a circulation pump in the domestic water loop, and the reduction in the pump size in the collector loops. Mr. Weinstein asked if there would be any problem in overheating the domestic hot water on an extremely hot day since the silicone oil would be moving so slowly. Mr. Novell stated that they see stagnation temperatures reaching 275-300° however this would be reduced by taking the solar heat away, and there is a clamp-on pipe thermostat which will turn the system off when the pipe gets to be 180°. Mr. Lewis stated that he had seen those thermostats fail many times; he suggested a secondary measure, a temperature regulating valve, on the hot water supply valve. Mr. Novell felt that was a good suggestion. Mr. Weinstein asked if there was a dishwasher; bringing in the fact that it may need hotter water. Mr. Lewis stated that this problem could be solved by using two regulating valves, one being on the dishwasher. Mr. Lewis then asked if the City required that a back-flow preventer be installed. Mr. Novell stated that the City code does not specifically say that one has to be installed and the existing system does not have one. Mr. Weinstein asked if there was a way to tell if there was a leak in the silicone, such as an alarm. Mr. Novell stated that there was not because silicone fluid expands and contracts about 5 times faster than water. This causes a pressure problem. Also, silicone oil has a low surface tension and this causes it to leak easily; adding an alarm would just provide another place for leakage. He emphasized that the entire system will be pressure tested and vacuum tested for leakage upon installation.

There was some discussion concerning a time delay on the collection pump to allow the solar circuit to build up to a certain temperature so the thermal storage temperature will not be decreased when the system is operating. Mr. Novell stated that there would be no problem in placing a time delay on the pump.

Mr. Weinstein asked what the quality of maintenance would be on the system. Mr. Wallace stated that the City plans to contract the maintenance with Solar Unlimited. Mr. Weinstein asked how often the system would be checked. Mr. Novell replied that they would probably check the entire system once a month and the area around the pump seal, the place most likely to leak, more often at first.

Mr. Weinstein then asked if there were pans installed under the pumps. Mr. Novell stated that there was not but it would be relatively easy to install them. Mr. Lewis suggested that pans and drains to a container be installed to catch the silicone oil in case of a leak so the oil could be reused.

There was then some discussion as to the method used for filling the system with oil. Mr. Novell covered the procedure for filling the system and eliminating any air in the system. There were no questions on this procedure. Mr. Novell then covered the storage schematic. Mr. Lewis asked if the storage tanks were flooded. Mr. Novell stated that they were vented at the top but basically they were flooded tanks. There was some discussion as to the characteristics of silicone oil, for example, it does not deteriorate & it is non-toxic. Mr. Easterly asked if the pump seals were a problem. Mr. Novell stated that the pump they are using is the best pump they know of. Mr. Easterly asked if the pump had to be worked on, is

there a convenient holding tank. Mr. Novell said there was not; however he felt that was a good idea and would check into it. Mr. Lewis asked if the pumps in the lower array could be elevated to place a pan under them. Mr. Novell assured him that they could.

Mr. Novell then covered the heating from storage schematic. Mr. Easterly asked if there was enough piping above the storage tanks to cause a back-flow problem. Mr. Novell stated that he did not know that there was; but it is a possibility. Mr. Davidson then stated that in New Orleans it was suggested that we go from the one 3-way valve to two 2-way valves. Mr. Novell said he had looked into that possibility and he felt that the 3-way valve would work just as well if not better.

Mr. Novell then discussed the domestic water heating schematic. Mr. Easterly suggested placing a 5-minute delay on the two pumps in this cycle. Mr. Lewis asked what the back-up system for the water heating and the building heating is. Mr. Novell told him that both were gas. Mr. Lewis asked what the domestic hot water storage tank was sized for. Mr. Novell told him that it was a 120 gallon tank and that is about $\frac{1}{2}$ day's load. However, the building is occupied during the day when the solar panels are collecting so basically it will be an operating storage tank. Mr. Lewis suggested if the temperature is allowed to build up and a tempering valve is used, there could be maybe three days supply. Mr. Novell agreed that a tempering valve would be a good addition to the system.

Mr. Novell then discussed the direct solar heating schematic. Mr. Weinstein asked if the unit heaters were oversized. Mr. Novell stated that he did not think so; they are designed to use 120-140° water. Mr. Novell stressed the fact that each room was individually heated. Mr. Weinstein stated that as the system presently is, when a room is not occupied it is still being heated. He suggested that this problem be eliminated by wiring it so when the lights are turned off the room goes on a night set-back system. Mr. Lewis said that this could be done any time in the future. Mr. Lewis asked why we had electrical resistance heaters in the unit instead of just using the boiler when solar can not heat the room. Mr. Novell stated that these were only in the perimeter rooms. Mr. Lewis then asked if we were worried about our gas being turned off. Mr. Wallace told him we were not; the Senior Center is on permanent service. Mr. Wiesenmaier stated that it seemed this was going to be a fairly lengthy trial and error situation. He asked if there was a defined acceptance test that will be used. Mr. Davidson stated that the acceptance test of the solar system was supposed to be a separate item. However, a draft acceptance test was to be presented at the final review. Mr. Wessels stated that they felt it was their (the contractors and the City) responsibility to see that the system meets the acceptance test; however, he added that he needed a little guidance in drawing up an acceptance test. Mr. Davidson stated that he had a draft of what he thought should be in the test and he would be glad to give him a copy of it.

Mr. Davidson asked if there was a flow meter on the silicone side of the system. Mr. Novell stated that there was not because they felt it would not be feasible due to the change in viscosity of the oil. Mr. Weinstein asked if it would be possible to put a sensor on the collector that a temperature recorder could be tied to. Mr. Novell said that would be possible. Mr. Weinstein continued to say that by monitoring this recorder in respect to the useful energy, we could get some idea of how the system was operating.

Mr. Davidson then asked to go over the plans. Mr. Novell explained the fill procedure and the insulation of the storage tanks. There was some discussion concerning the possibility of fire and Mr. Novell stated that there was a fire wall between the tanks and the building and the tanks were going to be coated with a fire resistant resin. Mr. Weinstein asked if the area under the absorbers would be used as a storage room. Mr. Wallace and Mr. Novell explained that they did not think so. Mr. Davidson asked if there were any details on the procedure for mounting the heat exchangers on the platform. Mr. Novell said they would draw that up or note it on the plans. Mr. Davidson added that he did not see anything on the insulation of the heat exchangers and pumps. Mr. Novell said they would take care of this.

Mr. Weinstein then asked how the storage tanks would be supported. There was some discussion on this matter. Mr. Dickson concluded that he felt that a styrofoam base was the best idea. Mr. Davidson then stated that he could not find a code for the different controls. Mr. Wessels stated that the printer had left this out and gave Mr. Davidson a copy.

Mr. Easterly then covered some questions he had on the mechanical aspect of the project. He started by asking about the glass that was to be used. Mr. Novell explained that the glass was anti-reflective glass. Mr. Easterly brought up the possibility of a dust build-up. Mr. Novell said this could be eliminated by spraying it with a hose occasionally. Mr. Easterly also asked how the tanks were connected. Mr. Novell showed him the plans. He then asked how the pipes between the solar collectors are arranged. Mr. Novell said there was a parallel flow with a reverse control manifold. Mr. Easterly asked how the manifold is mounted. Mr. Novell showed him on the plans and stressed that the pipes are directly behind each other. Mr. Lewis asked how the pipes were supported. Mr. Novell said they were anchored according to standard procedure. Mr. Weinstein suggested that they detail the procedure for connecting the supports. Mr. Novell added that they also needed to detail the insulation of the absorbers. Mr. Easterly then suggested that when the pumps are tested, the storage tanks be isolated. Mr. Novell said they would add this to the specifications.

Mr. Lewis then pointed out that high speed pumps are generally avoided because of the noise; this noise can also be transmitted through the pipes. There was some discussion on this point and Mr. Wessels said they would certainly check on this.

Mr. Weinstein then covered some of the architectural questions. He began by asking if the collector piping had any expansion capability. Mr. Wessels stated that it met code requirements. Mr. Weinstein then asked how the glass was to be installed. Mr. Novell stated that the tape on the edges had a certain adhesive ability and then the silicone would be put on. Mr. Weinstein asked if there would be no mechanical installation. Mr. Novell told him there would not. Mr. Weinstein suggested that this installation also be detailed. Mr. Novell stated that they had considered putting a thenolic block between the absorber and the glass. Mr. Weinstein thought this was a good idea. Mr. Davidson suggested that they secure the block to the glass and the collector box. Mr. Weinstein continued to state that he thought chalking might be a better idea than the grout at the base of the absorber; he also pointed out that there might be a problem with the flashing leaking. These points were discussed briefly. He then stated that he did not know about the amount of stress that it was said could be placed on the absorber. Mr. Dickson therefore explained the amount of stress expected to be placed at certain stress points. Mr. Weinstein's final question concerned the straightness of the absorber panels. Mr. Wessels agreed

that they too were concerned in this area. That is the reason they ordered the test panel so early; maybe they could see if there was going to be a problem and if find a solution.

There were no further questions or comments; the meeting was adjourned.

ATTACHMENT "A"

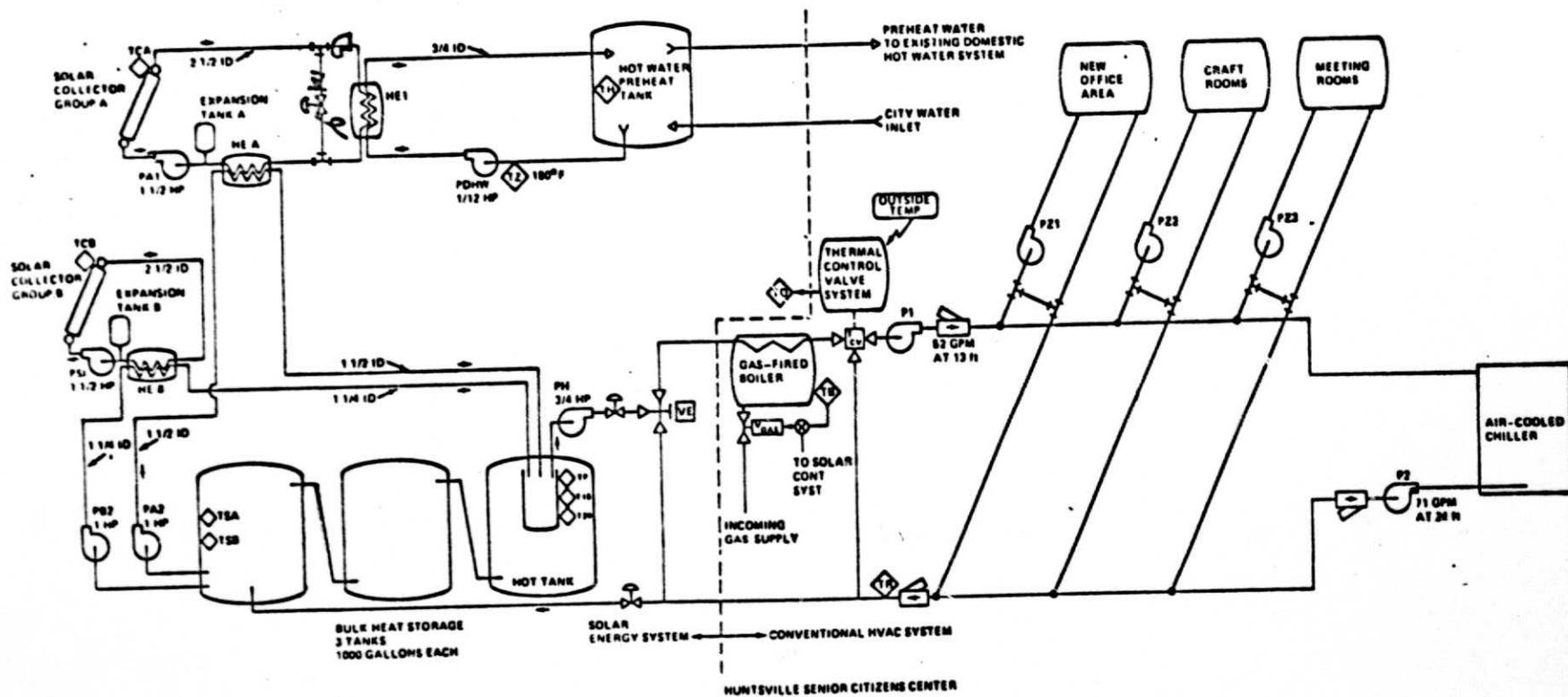


Figure S1. TOTAL SOLAR-HVAC SYSTEM SCHEMATIC

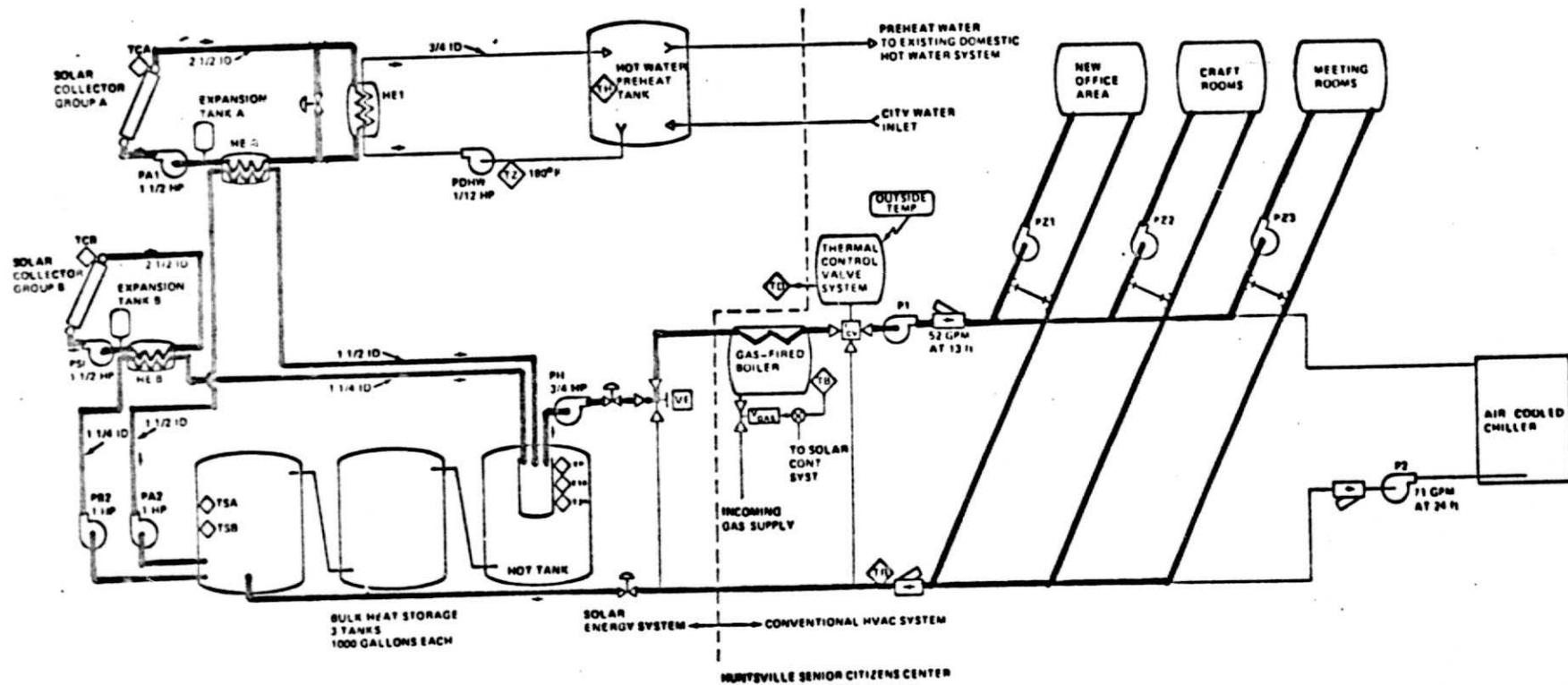


Figure S2. DIRECT SOLAR HEATING SCHEMATIC

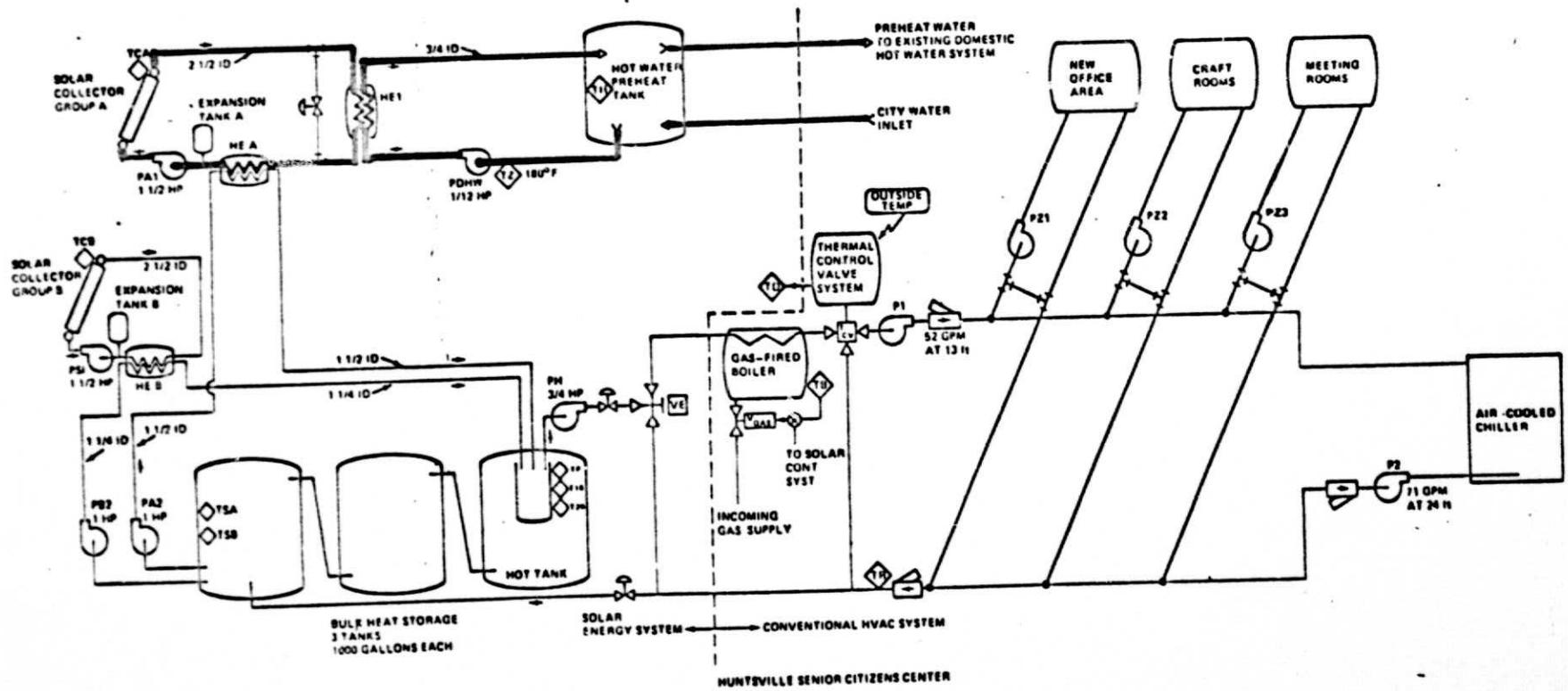


Figure S3. SOLAR DOMESTIC WATER HEATING SCHEMATIC

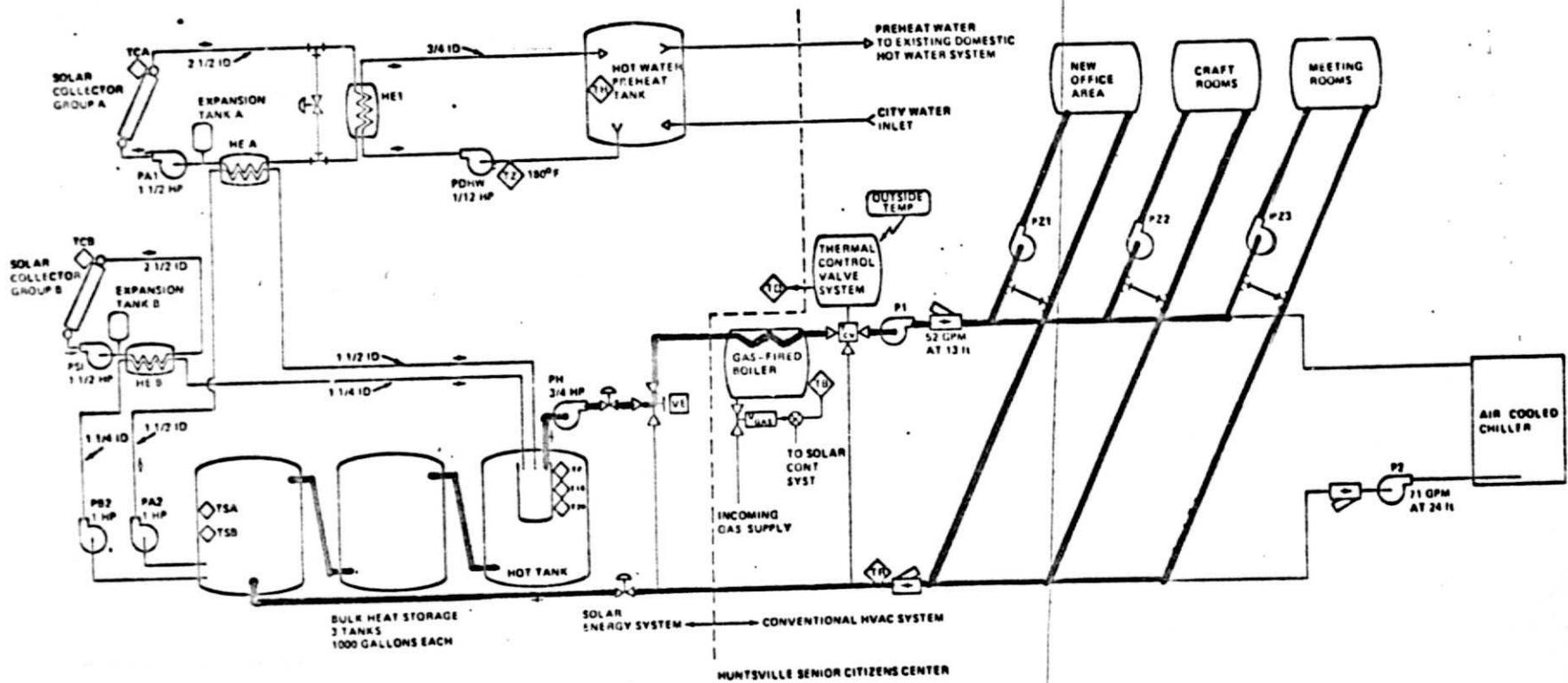


Figure S4. HEATING FROM STORAGE SCHEMATIC

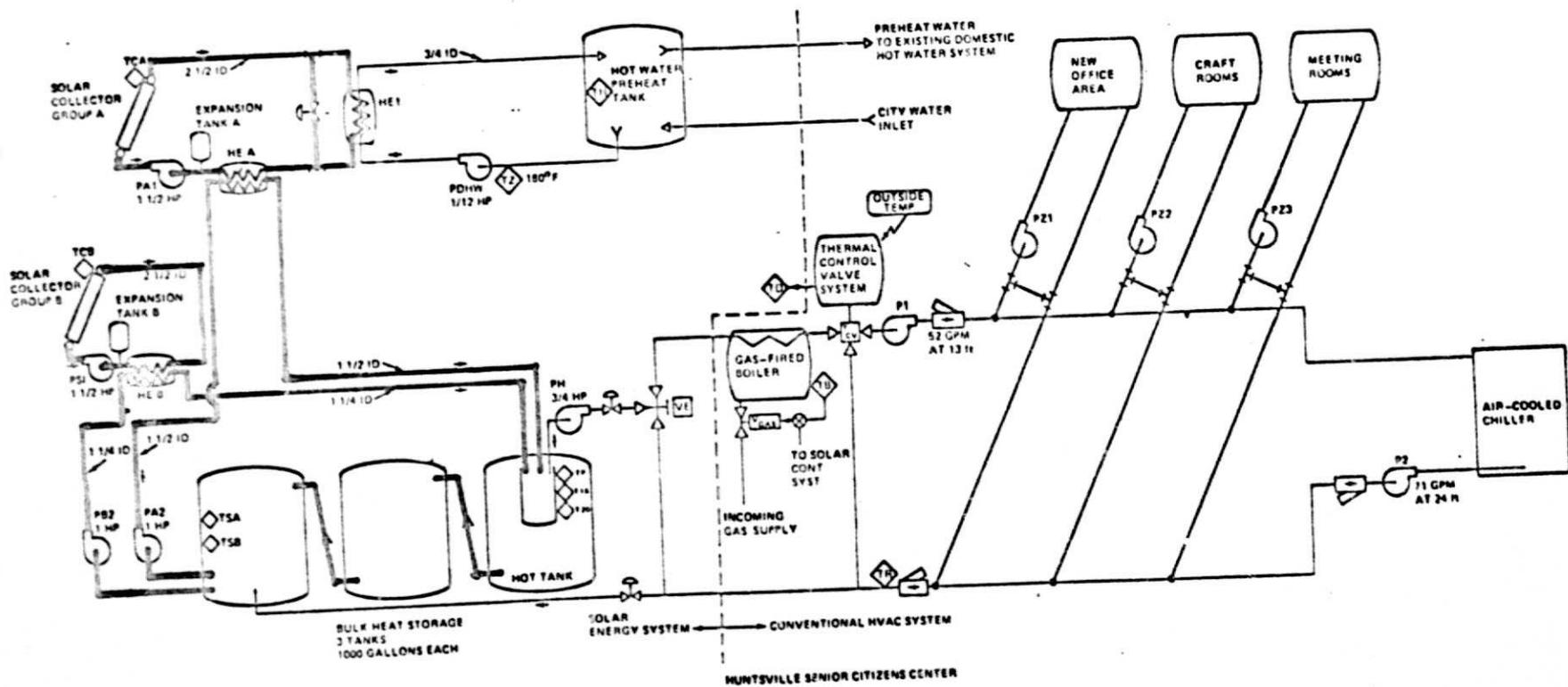


Figure S5. STORE SOLAR HEAT SCHEMATIC