



Owner's Manual — Therma-Stor II

Heat Recovery System

Installation, Operation & Service Instructions

Read and Save These Instructions

Table Of Contents

1. Introduction	1
2. Specification information	2
2.1 Operation	2
2.2 Application Specification	2
3. Description.....	3
2.1 Refrigerant Capacities	3
2.2 Control Valves.....	3
2.3 Valve Selection	3
4. Location	3
5. Plumbing.....	4
5.1 Thermal-Siphoning.....	5
5.2 Recirculation.....	5
6. Refrigeration.....	5
6.1 Installation Layout	5
6.2 Hot Gas Bypass	5
6.3 Water Bleed Valve	5
6.4 Refrigerant lines.....	5
6.5 Line Connections	6
6.6 Discharge Muffler	6
6.7 Equalization Tube	6
7. Maintenance.....	6

Serial No. _____

Purchase Date _____

Customer Name _____

1. Introduction

The Therma-Stor II is an energy recovery unit that produces and stores hot water by simply transferring heat from the hot refrigerant gas to cold water. The Therma-Stor II is designed to supplement the existing air or water condensers and is not intended to completely replace the existing condenser.

The Table of Contents, which precedes this introduction, lists the sections of this instruction packet in the order in which they should be read and procedures should be carried out.

CAUTION

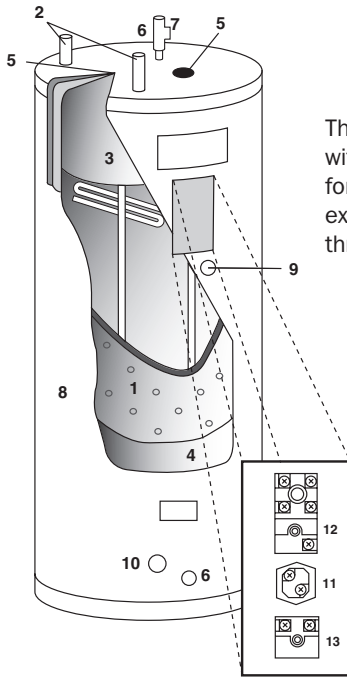
CAUTION: *Therma-Stor Heat Recovery Tanks are intended for indoor installation unless an adequate cover is installed to protect the unit from external moisture. Failure to adequately protect the unit from external moisture will result in premature condenser plate failure and void the warranty.*

The information within this packet is intended to aid in the installation of the Therma-Stor II heat recovery water heater. Read the instructions carefully before assembling and using the equipment to ensure proper installation. Proper installation and maintenance of all system parts are essential to obtain maximum benefit from Therma-Stor products.

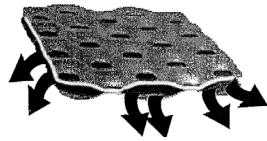
The owner is responsible for monitoring the equipment to ensure that it is functioning properly.



Specifications subject to change without notice.



Therma-Stor plate design, with rapid, free-flowing paths for refrigerant gas, promotes excellent waste heat transfer throughout the tank.



2. Specification Information

Construction Specifications

1. Single circuit heat exchanger plate is welded and expanded for internal refrigerant passage.
2. 1-5/8" O.D. refrigerant inlet and outlet.
3. Industrial glass lined hot water storage tank.
4. 2" foam-in-place urethane insulation.
5. Dual anode protection against corrosion for extended tank life.
6. 1-1/4" male NPT water inlet and high-temperature outlet.
7. 150 psi and 195°F pressure/temperature relief valve.
8. Attractive enameled galvanized external wrapper
9. Mid tank 3/4" NPT (female) opening for recirculating loop return or for aquastat.
10. Stub out for equalization tube (optional for use when two or more Therma-Stors are piped in parallel; see diagram D).

III-1 Only:

11. 6000 watt medium density electric heating element. 208/230 single phase is standard, also available with 480 volt element.
12. Thermostat to control element.
13. Thermostat to control 3-way reclaim valve or water bleed valve.

**UL requires the manufacturer to supply a control to avoid overheating the water. If utilizing a 3-way reclaim valve, ignore the water bleed solenoid that is included.*

Other Features and Specifications

- Diameter: 29", Height: 67", Weight: 427 lbs
- 119 gallon nominal water capacity
- Rated for 450 psi refrigerant operating pressure
- Max heat exchange rating 80,000 BTU/HR
- 150 psi maximum operating water pressure
- R-16 insulation
- UL Listed
- Meets ASHRAE 90 standards
- High refrigerant capacity
- Double wall protection between refrigerant and water
- Triple leak checked, shipped with N₂ holding charge
- Approved for Canada

Part No. 4020166 – II-1

Part No. 4021992 – II-1A with Ammonia connections (R-717)

Part No. 4021540 – III-1 208/230

Part No. 4021956 – III-1 480 volt

2.1 Operation

Therma-Stor II-1 and III-1 heat and store hot water by transferring refrigeration waste heat to cold water. This cost-efficient alternative for producing hot water fits any existing refrigeration system and improves the system's efficiency at the same time. Hot water production depends on the evaporator load and temperatures, compressor, water usage, condensing temperatures, etc. A water heating chart is found on the back page.

2.2 Application Specification

Therma-Stor II-1 and III-1 can accommodate evaporating loads of up to 85* tons total (R-22) on an open drive air conditioning system. Capacities for more typical systems such as supermarket racks are listed on back.

You can connect a II-1 or III-1 to an individual compressor or parallel units in multiples for larger tonnages. Therma-Stor's are not intended as a substitute for air or water cooled condensers.

**These ratings assume approximate 15 lb. pressure drop at maximum capacities. For complete pressure drop information, contact the factory.*

Specifications subject to change without notice.

3. Description

The Therma-Stor II heat recovery systems consist of a 120 gallon water tank with a integral heat exchanger in a single unit. There are 5 different models of the Therma-Stor II heat recovery systems, they are as follows:

Part No.	Model	Circuits	Capacity
4020166	TS-II-1	1	very high tonnage
4018910	TS-II-2	2	medium tonnage
4021577	TS-II-2HF*	1	high tonnage
4017825	TS-II-6	6	low tonnage
4021992	TS-II-1A	1	same as 4020166 with steel fittings for use with ammonia

* Do not install both circuits of the TS-II-2HF in parallel on a single system that experiences low load conditions since it may trap liquid at low load.

3.1 Refrigerant Capacities

Maximum Recommended Refrigerant Capacities In Tons*

Refrigerant	Temp.	Capacity			
		II-1	II-2 ()	II-2HF per circuit	II-6 ()
R-22	Low	60	8.5	25	3
R-22	Medium	64	10	27	3.5
R-134A	Low	47	7	20	2.5
R-134A	Medium	53	8	23	3
R-404A •	Low	42	6	18	2
R-404A •	Medium	51	7	20	2.5
R-502 •	Low	42	6	18	2
R-502 •	Medium	51	7	20	2.5
R-507	Low	42	6	18	2
R-507	Medium	51	7	20	2.5
R-717 (II-1A only)		100+ tons	—	—	—

- * Assumes a pressure drop of 15 psi at maximum condition. For complete pressure drop information, please contact the factory.
- The capacity of R-507 (AZ50) & R-404A (HP62) is assumed to be the same as the capacity of R-502 until further information is available.
- All Therma-Stor II tanks are glass lined with a nominal 120 gallon water capacity and are supplied with a pressure/temperature relief valve.

3.2 Control Valves

There are two types of valves available for controlling the water temperature with respect to the reclaimed heat energy. One type is a refrigerant bypass valve and the other is a water bleed valve. The refrigerant valve is a two-way valve that is installed to allow the refrigerant gas to bypass the Therma-Stor II when the valve is not energized.

The water valve is used to remove excess energy from the Therma-Stor II to limit the water temperature. The valve is normally open, so water will flow from the Therma-Stor II when the valve is not energized. When the water temperature rises to the thermostat set point, hot water will be bled through the valve to dissipate more energy than is being absorbed. The water temperature will drop to the thermostat cut-in temperature, and then the valve will be activated stopping the flow. Only the amount of hot water equal to the excess energy will be bled off. See the limitations for use before using the water bleed valve rather than the refrigerant bypass valve for control purposes.

3.3 Valve Selection

There are no limitations for the use of the refrigerant bypass valve. The water bleed valve is intended for limited applications where the reclaimed heat energy in relation to the energy used is such that the requirement to bleed off excess energy is infrequent. The following limitations apply to the use of the water bleed valve.

1. The total connected refrigeration system capacity must be less than 15 tons.
2. Provisions must be provided to safely dispose of the bleed water.

4. Location

The location for the Therma-Stor II should be chosen carefully. The following guidelines must be observed:

1. Locate the Therma-Stor II in a clean dry place, as close as possible to the compressor to minimize the refrigerant line lengths.
2. Locate the Therma-Stor II with adjacent clearance for ease of installation and service.
3. Locate the Therma-Stor II in an area that is protected from freezing.
4. Locate the Therma-Stor II in an area where water would not damage the surroundings or critical areas of the building if a fitting leaks. If a pitched floor to an open drain is not available, a catch pan should be constructed. See Figure 1.

5. Plumbing

Many localities have enacted regulations, codes, or ordinances governing the installation of water heaters and heat reclaimers. All local electric, refrigeration, and plumbing codes must be complied with and the installation must be accomplished only by qualified personnel.

1. After the location has been determined, the Therma-Stor II should be moved into position and leveled. At this time re-evaluate the working space allowed for making the refrigeration connections and checking for refrigeration leaks.
2. The cold water inlet is located at the bottom of the tank. Provide a union, shut-off valve, and drain valve for this connection. Refer to Figure 1 for typical arrangements.
3. The hot water outlet is at the top of the tank. A reducing tee and a combination pressure/temperature relief valve are furnished with the Therma-Stor II. These must be installed so the sensing element of the pressure/temperature valve extends inside the tank and the hot water discharge is horizontal, as shown in Figure 2. Connect the outlet of the relief valve to a suitable open drain. The drain pipe must pitch downward from the valve and must be no smaller than the size of the outlet of the valve. The end of the drain line should be close to the floor with a 6" air gap. It must not be concealed and should be protected from freezing. No valve of any type may be installed between the relief valve and the tank or in the drain line.
4. To fill the Therma-Stor II:
Close the drain valve and open a hot water tap to bleed the air from the tank as it fills. Open the inlet water valve. Allow sufficient time for the tank to fill, as indicated by a steady flow of water, then close the water tap and check for leaks.
5. The Therma-Stor II has dual magnesium anode protection. Under certain water conditions, an offensive odor may be noticed after the system is in operation. To eliminate this odor, remove the magnesium anodes and install aluminum anodes (Part Number 4016425).

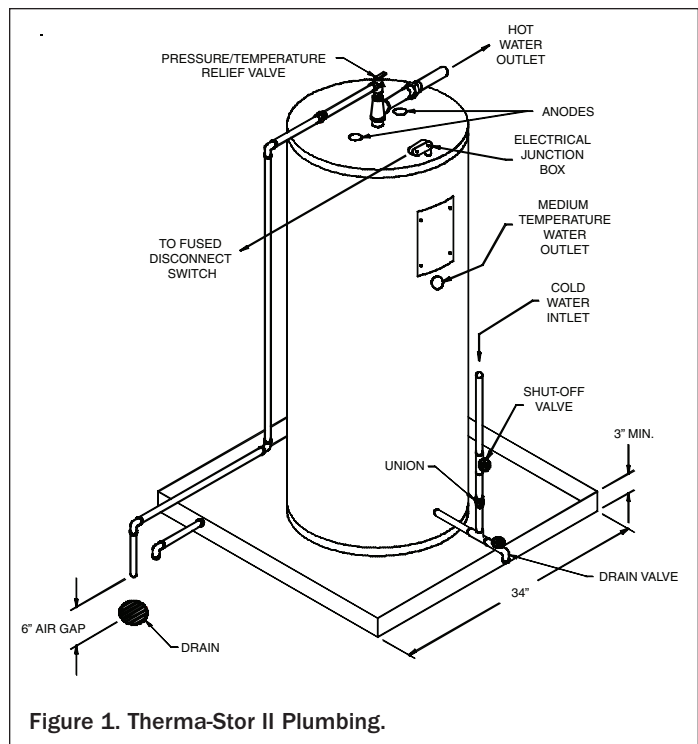


Figure 1. Therma-Stor II Plumbing.

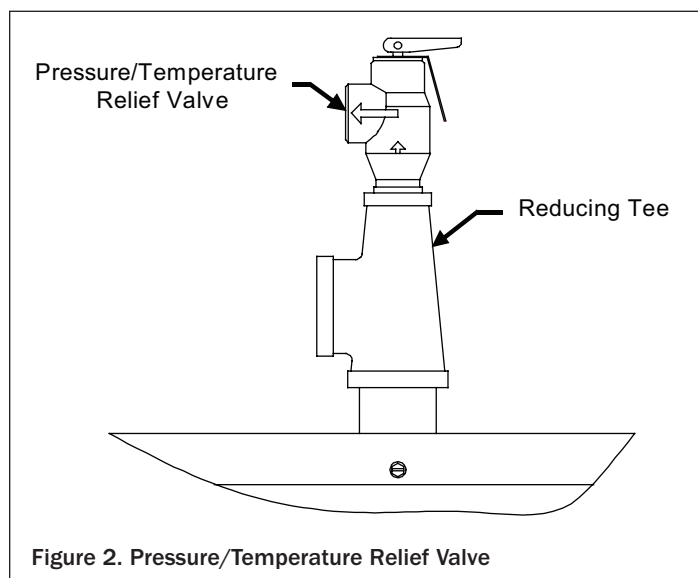


Figure 2. Pressure/Temperature Relief Valve

CAUTION

CAUTION: Failure to properly install the discharge line from the safety relief valve could result in hot water spraying on a person, causing burns.

CAUTION

CAUTION: To reduce the risk of excessive pressure and temperatures in this water heater, install temperature and pressure protective equipment required by local codes, but not less than a combination temperature and pressure relief valve certified by a nationally recognized testing laboratory that maintains periodic inspection of production of listed equipment of materials, as meeting the requirements for Relief Valves and Automatic Gas Shutoff Devices for Hot Water Supply Systems, ANSI Z21.22-1971. This valve must be marked with a maximum device pressure not to exceed the marked maximum working pressure of the water heater. Install the valve into an opening provided and marked for this purpose in the water heater. Orient it or provide tubing so that any discharge from the valve will exit only within 6 inches above, or any distance below the structural floor and can not contact any live electrical part. The discharge opening must not be blocked or reduced in size under any circumstances.

5.1 Thermal-Siphoning For Additional Storage

If additional hot water storage is required, a insulated storage tank can be used in conjunction with the Therma-Stor II heat recovery unit. This method of storage is a passive method based on the temperature stratification of the water and does not require a pump (See Figure 11).

To attach a passive storage tank to a Therma-Stor II heat recovery unit, remove one of the two anodes from the Therma-Stor II heat recovery unit. Then run piping from the 3/4" NPT (Anode opening) in the Therma-Stor II heat recovery unit to the hot water outlet on top of the storage tank. Next, the cold water inlets of the storage tank and the Therma-Stor II heat recovery unit must be connected in parallel. The cold water connections must not form a trap, or the thermal-siphoning system will not work.

5.2 Hot Water Recirculation

If hot water recirculation is used with a Therma-Stor II unit, the hot water should be taken out from the hot water outlet on top of the tank. The recirculated water should be returned to the 3/4" nipple located half way up the tank (See Figures 11 & 12). If recirculation is used on multiple tanks in parallel, the cold water inlets must not form a trap between units.

6. Refrigeration

6.1 Installation Layout

The Therma-Stor II is designed for use in refrigeration systems that have adequately sized air-cooled or water-cooled condensers. The Therma-Stor II should be installed between the compressor and condenser. A number of possible configurations are shown in Figures 6-13.

NOTE: Capillary tube systems are not normally recommended for use with the Therma-Stor II. For special considerations, please contact the factory.

6.2 Hot Gas Bypass

The temperature of the water in the tank should be limited to 180°F. If it is determined that the water may exceed this temperature, either additional storage or a hot gas bypass should be installed. The hot gas bypass may be accomplished by using a bypass valve in conjunction with an aquastat. A 3/4" NPT female coupling is provided for installation of an aquastat and well (see figure 10). If there is a recirculation loop that pumps through the Therma-Stor II, a strap on aquastat can be installed on the hot water line leaving the top of the Therma-Stor II (see figure 12).

6.3 Water Bleed Valve

For controlling water temperature on Therma-Stor II units that are connected to a total load of 15 tons or less, a water bleed valve may be used instead of the refrigerant bypass valve. The water bleed valve must be piped as in Figure 3 to safely dispose of the water that is bled off. A 3/4" NPT female coupling is provided for installation of an aquastat and well (see figure 10). If there is a recirculation loop that pumps through the Therma-Stor II, a strap on aquastat can be installed on the hot water line leaving the top of the Therma-Stor II (see figure 12).

6.4 Refrigerant Lines

The compressor discharge line size is usually adequate for normal installations. However, if lines are more than 20 feet long, they should be sized for a maximum of 15 psig pressure drop (See ASHRAE piping tables). Lines should be installed to pitch toward the Therma-Stor II and condenser, and to drop down from the compressor discharge to form a 6" trap to prevent oil and liquid from accumulating on the discharge valve plate.

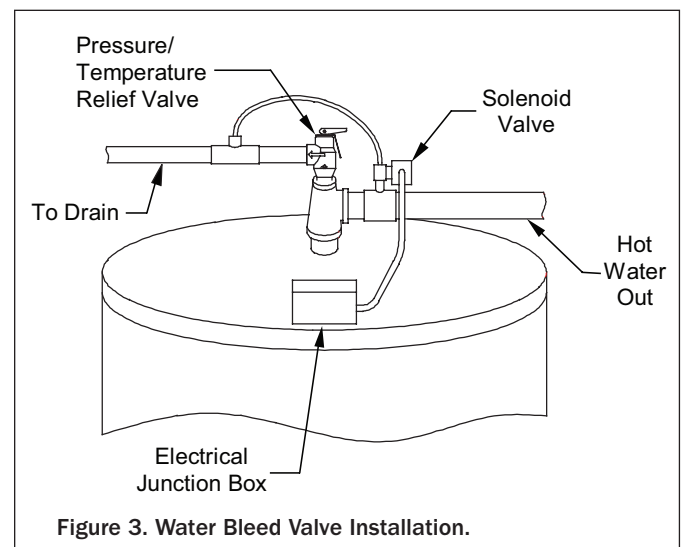


Figure 3. Water Bleed Valve Installation.

When installing a Therma-Stor II on an existing refrigeration system, extreme care must be used to prevent damage to the existing system. If the tubing must be routed through an existing cabinet, the following precautions must be taken. (See figure 3)

1. If cabinet openings or modifications have to be made, they must be accomplished in such a manner as not to be detrimental to the cabinet. Do not cut into electrical enclosures.
2. Do not route tubing through electrical enclosures or cabinet sections containing live metal parts. The tubing must be properly supported and protected from sharp edges and moving parts.
3. The tubing must be mechanically isolated from structural building members.

6.5 Line Connections

The Therma-Stor II line connections are made of steel tubing with copper fittings. A special model with steel threaded fittings must be used with R-717 (ammonia). Most installations will have the refrigeration lines connected to the copper fittings. These connections should be silver-brazed with alloy 505.

NOTE: Be careful not to burn the wrapper or the insulation when brazing the refrigeration lines. All joints should be checked for leaks and the lines evacuated according to standard refrigeration practices.

6.6 Discharge Line Muffler Installation

A discharge muffler may be used when a Therma-Stor II is installed on open-type or semi-hermetic compressor. A muffler would be installed on each circuit when two compressors are used, i.e., one muffler per circuit (on a Therma-Stor II-2).

Recommended placement of these mufflers is on the discharge line of the compressor just before the last vertical drop to the Therma-Stor II (See Figures 4 and 5). Discharge line mufflers are to be sized in accordance with the refrigeration tonnage being supplied to the Therma-Stor II and may be obtained from a refrigeration supply house.

The balance of the system should incorporate good piping practices and utilization of the common system components available, including vibration eliminators at the compressors as recommended by the various compressor manufacturers.

6.7 Equalization Tube Installation

The Therma-Stor II-1 is equipped with a port for connecting to other Therma-Stor II-1 heat recovery units when they are installed in parallel on a single system that experiences low load conditions. When installing Therma-Stor II-1 heat recovery units in parallel on large compressors or racks, the equalizing tubes of each unit

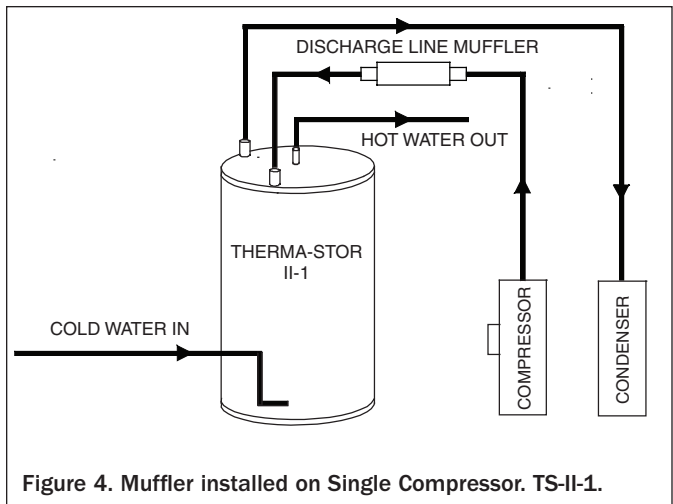


Figure 4. Muffler installed on Single Compressor. TS-II-1.

may be connected to equalize the pressure drop across each unit, thus ensuring even refrigerant flow through each of the units. The equalizing tubes of parallel units DO NOT need to be connected if the minimum tonnage per unit is 34 tons or greater. If the minimum tonnage per unit is less than this, the equalization tubes should be connected.

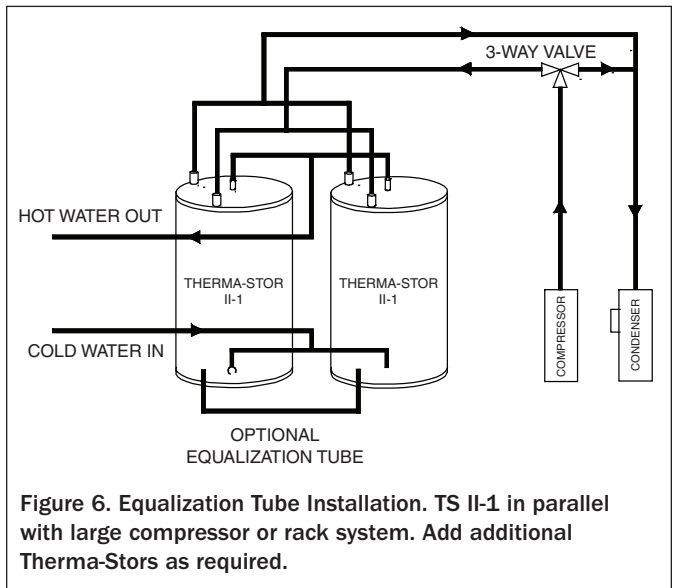


Figure 6. Equalization Tube Installation. TS II-1 in parallel with large compressor or rack system. Add additional Therma-Stors as required.

Carefully unbrazed the brass plug from inside the steel tube. The steel tube is sized so that 1/2" OD copper tubing will fit inside of it. For multiple Therma-Stor units in parallel, each equalization tube may be attached to a main header. (See fig. 6).

7. Maintenance

For maximum tank life the anodes should be inspected and/or changed every 3-5 years. The anodes will be consumed at different rates depending on the properties of the water. If the anodes are not replaced periodically, reduced tank life will result.

