ALWAYS USE THE INSTALLATION INSTRUCTIONS SHIPPED WITH THE EQUIPMENT. BULLETINS WITH AN EARLIER DATE SHOULD BE DISCARDED.

BULLETIN
TTI-803
E
MAY 1984
SECTION "F"

INSTALLATION, START-UP AND MAINTENANCE INSTRUCTIONS

THERMOBANK-2®

KRAMER TRENTON CO. Trenton, N.J. 08605

Continuous Achievement in Heat Transfer Since 1914

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THERMOBANK - 2®

INSTALLATION AND SERVICE MANUAL

POWER SAVING THERMOBANK - 2. **This bulletin describes the first hot gas defrost system which can work year-round in all climates without any head pressure control during refrigeration. During refrigeration, the head pressure drops as the ambient drops, resulting in more capacity and reduced power requirements. There is no condenser flooding, no winterstat adjust - ment, no extra refrigerant charge for winter. No over-sized receiver and no lost capacity in winter.**

Read the "Sequence of Operation". Study the evaporator instructions, these instructions, and the applicable piping diagrams before starting work.

This equipment should only be installed by a competent refrigeration mechanic.

A. UNCRATING

Do not remove shipping skid until condensing unit is at actual point of installation.

B. RIGGING

Follow instructions in Drawings. Use spreader bars when rigging. Do not use shipping skid as a permanent base. Install condensing unit in a level position on a firm support.

C. UNIT LOCATION

Condensing units should be located where there is an ample supply of fresh, clean air. Units with horizontal condenser air flow should be positioned so that the direction of air flow through the condenser is the same as that of the prevailing winds. Caution against locating units in restricted spaces so that heat build-up with elevated air temperatures at the condenser can occur. Avoid locating units where the air discharge from one blows into the condenser air intake of another.

Units with horizontal air flow should be spaced at least one condenser height from the nearest wall. Units with vertical air flow should be spaced at least the width of one condenser from the nearest wall.

Means for convenient access to the units for service and regular inspection should be provided.

D. OPENING SEALED LEADS

Do not open sealed refrigeration leads until the unit has warmed up to surrounding air temperature. This will prevent moisture in the air from condensing inside the tubing. Never leave lines open over night. Solder caps on all open lines.

E. ROOF SYSTEMS/PAD SYSTEMS

Pad installations are those where the condensing unit is lower than the expansion valve.

Roof installations are those where the condensing unit is at the same level as or higher than the expansion valve.

Systems supplied for Pad installations are identified by the model designation CTTP. Systems supplied for Roof installations are identified by the model designation CTTR.

The difference between the two types of systems is in the selection of the expansion valve and the method of securing thermal contact between the bulb and the suction line.

Since Pad (CTTP) systems always have their evaporators and expansion valves higher than the condensing unit under coldest ambient conditions, it is likely that the static pressure reduction on the liquid refrigerant as it flows upward in the liquid line will offset the normal sub-cooling of the liquid as it leaves the receiver, and the supplementary sub-cooling imparted by the Thermolator.Under those conditions, liquid flashing will occur.

To feed sufficient liquid refrigerant under these conditions, the expansion valve is sized large enough to handle both liquid and flash gas. Under summer conditions, it is likely that sufficient sub-cooling will be available and pure, bubble-free liquid fed to the expansion valve. To ensure smooth expansion valve performance under both conditions, part of the bulb is actually immersed in the suction vapor through a suction line fitting equipped with a triple "O" ring seal in which the expansion valve bulb is installed so that the bulb protrudes directly into the suction line.

Roof (CTTR) systems feed pure sub-cooled liquid to the expansion valve in both summer and winter. Therefore, the valve need not be selected large enough to handle flash gas and the bulb is simply strapped on the suction line in the usual way.

F. PIPING

When piping components located in different ambients, always pipe from the warmer to the colder component.

When using high temperature solder, pass dry nitrogen through the lines to prevent scaling.

1. **Line Sizes**

   Using tubing sizes given on Pgs. 15 and 16. Refer to schematic piping diagrams for suggested piping arrangements.

2. **Recycling Pumpdown Mandatory**

   Recycling pumpdown (box thermostat controlling liquid solenoid valve) must be used and both are factory supplied.

   Pumpdown cycle is not complete until low pressure switch is set with gage in accordance with table supplied on the pressure switch. (Table 9A)

3. **Suction Line**

   a) Pitch all suction lines at least ¼" per foot in direction of flow. Use spirit level to check pitch.

   b) Install "P" trap at bottom of every suction riser at 15 ft. intervals for oil return.

   c) With multiple evaporators, suction lines from individual evaporators must "goose neck" into the suction main.

   d) For medium temperature systems (CTT-F), do not insulate the suction line except where necessary to prevent dripping damage to property or personal hazard (dripping and freezing on walkways in winter).

   Low temperature systems (CTT-L) should have suction lines insulated from the freezer wall to 15 feet from the connection on the unit. This last 15 feet should be left uninsulated.

4. **Liquid Line** (Functions as hot gas line during defrost.))

   a) Liquid runs should be kept as short as possible.

   b) Where long liquid runs are required, they should occur outdoors.

   c) Liquid lines must not be run through heated spaces.

   d) Liquid line must not be insulated.

5. **Thermolator (As required)**

   The Thermolator may be installed in any position. It should be installed outside the box near the hole where the suction and liquid lines traverse the wall.

   The tee in the liquid line leading to the hot gas solenoid must be on the liquid outlet side (evaporator side of the Thermolator.)

   Only one Thermolator is supplied with each system. (as required.)

6. **Liquid Solenoid**

   Install the liquid solenoid valve supplied with the unit near expansion valve inlet. If there are multiple evaporators, locate the liquid solenoid near the branch for the first evaporator.

7. **Liquid Sight Glass**

   The moisture indicating sight glass must be installed at the liquid outlet of the receiver, before the drier. The moisture indicating element should be deep green for maximum dryness.

8. **Drier**

   To assure lowest pressure drop, the drier has been amply sized. Do not replace with a drier of smaller rating or higher pressure drop.

9. **Hot Gas Lines and Hot Gas Solenoid Valve**

   a) The hot gas line must tee into the liquid line between the Thermolator outlet and the liquid solenoid valve.

   b) Install the hot gas solenoid in the hot gas line near the liquid line tee. Where more than one Thermobank - 2 System is being installed, check the parts list to be certain the correct solenoid valves are used for each system.

   c) Hot gas lines and drain lines must be soldered together for their entire run within the refrigerator and through the insulated walls.

   d) *Evaporators with heated drain pans* - connect hot gas line to hot gas lead provided at drain pan.

   e) *Evaporators without heated drain pans* - where there is no separate hot gas connection, a hot gas tee will be supplied for field installation at the expansion valve outlet.

   f) *Hot gas check valves* - on multiple evaporator systems, install hot gas check valves (supplied) in the branch lines to each evaporator hot gas inlet.

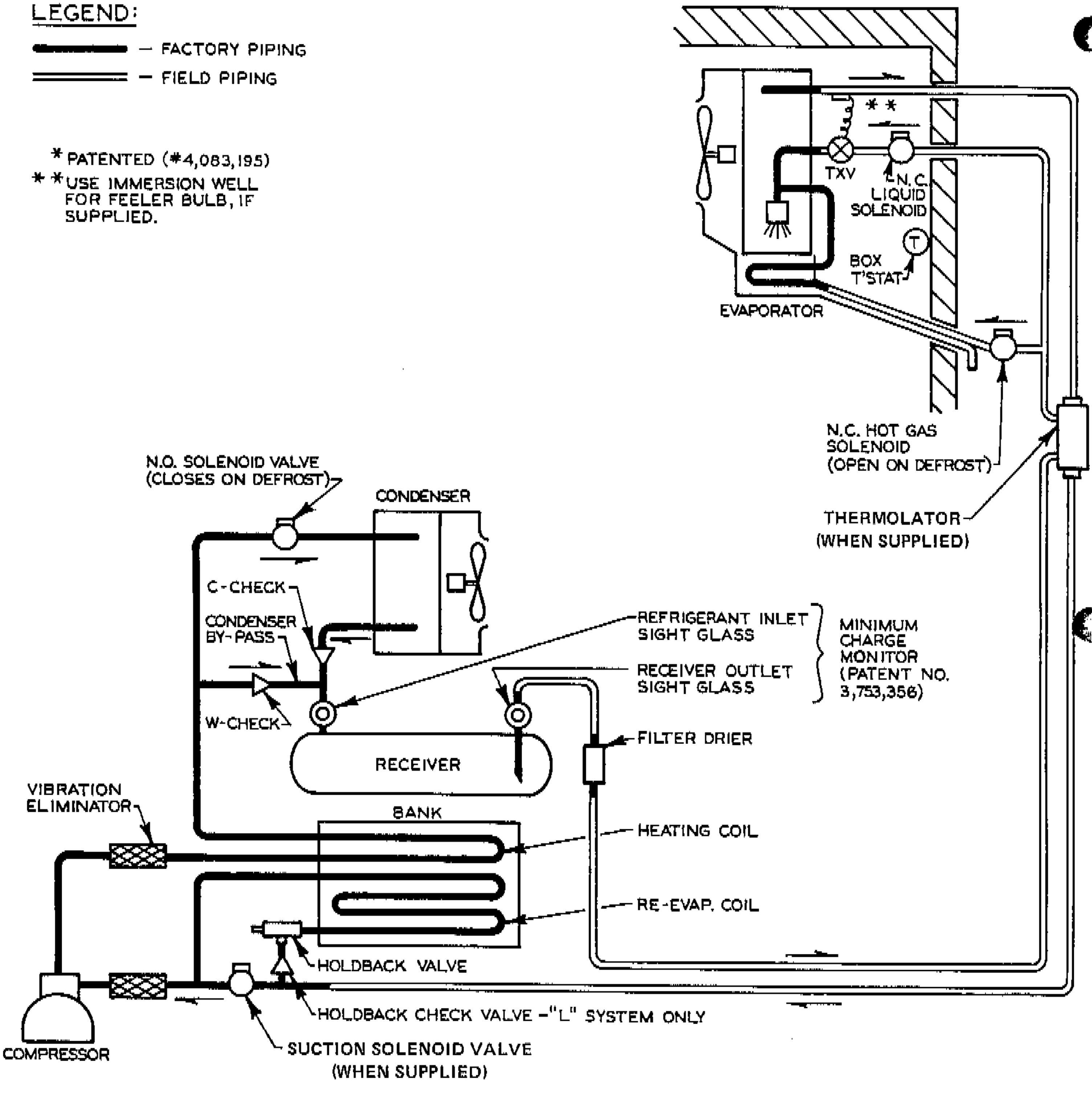
LEGEND:

— FACTORY PIPING

— FIELD PIPING

* PATENTED (#4,083,195)

** USE IMMERSION WELL FOR FEELER BULB, IF SUPPLIED.



SCHEMATIC PIPING DIAGRAM
FOR
THERMOBANK-2 *

SEQUENCE OF OPERATION

A. REFRIGERATION CYCLE

Hot discharge vapor flows from the compressor through the Bank heating coil, where normally wasted condenser heat is stored in the warm water. Then, cooler discharge gas enters the condenser through the normally open discharge solenoid valve. The condensed liquid from the condenser flows to the receiver, where it is collected. No flow can occur through the bypass so long as the condenser solenoid is open because the 15 PSI spring load keeps the W check valve closed.

Liquid from the receiver flows to the expansion valve through the drier, Thermolator and the liquid solenoid valve. The Thermolator is simply a very high efficiency heat exchanger for cooling warm liquid refrigerant flowing to the evaporator by using the residual cooling effect in the cold vapor leaving the evaporator. The liquid solenoid valve is controlled by the box thermostat, opening when cooling is required and closing when the operation of the system has reduced the box temperature enough to satisfy the thermostat.

In the evaporator, the liquid refrigerant fed by the expansion valve is evaporated to a vapor. The vapor flows into the suction line and through the open suction solenoid valve to the compressor, where it is recompressed.

B. DEFROST CYCLE

When the time clock initiates defrost, it does the following:

1. Energizes the discharge solenoid, causing it to close.
2. Stops the evaporator fans.
3. Energizes the hot gas solenoid at the evaporator, causing it to open.
4. Deenergizes the liquid solenoid, causing it to close.
5. Closes the suction solenoid. (where used)

The compressor continues to operate during defrost but the discharge vapor cannot flow to the condenser because the discharge solenoid is *energized* and *closed*. Therefore, the hot discharge vapor flows directly to the receiver through the condenser bypass. The normally closed W check in the bypass is pushed open against its closing spring when the discharge solenoid closes. All the liquid in the receiver and the liquid line flows into the evaporator through the now-open hot gas solenoid, clearing the liquid line. The hot gas flows to the evaporator by way of the liquid line through the drier and the liquid coil in the Thermolator. Part of the superheat of the hot gas is removed in the Thermolator. The *warm vapor* condenses in the evaporator, providing a defrost of unusual rapidity under all ambient conditions.

The liquid condensed in the evaporator flows through the suction line and is directed to the holdback valve by the now-closed suction solenoid. The holdback valve feeds the liquid into the Bank at a controlled rate and pressure. The refrigerant liquid evaporates in the Bank, cooling the water, freezing ice around the tubes, thereby abstracting the stored heat.

When the pressure in the defrosting evaporator rises to the setting of the defrost terminating pressure switch, the following events occur:

1. Discharge solenoid deenergizes and opens, allowing unrestricted flow to the condenser inlet.
2. Flow to the receiver through the condenser bypass is stopped by the spring load in the W check valve.
3. Hot gas solenoid closes.
4. Suction solenoid and liquid solenoid remain closed. These two valves are under the control of a "Post Defrost Pressure Switch" which senses evaporator pressure. When the evaporator pressure falls to about 20 PSI, this switch opens both the suction and liquid solenoid valves and starts the evaporator fans.

10. Expansion Valve

a) Selection

The expansion valves are supplied and no substitution should be made. Where more than one Thermobank - 2 System is being installed, check the parts list to be certain the correct expansion valves are used for each system.

b) Bulb Location

Roof Systems (CTTR -   )

Expansion valves for Roof Systems will be supplied with standard clamps for securing the bulb to the suction line. The bulb should be on the bottom of a horizontal run of suction line at the evaporator outlet. If necessary, the bulb may be located on an up or down flow riser at least two feet from the upstream ell.

The bulb must not bridge any fitting and must be on bright copper (polish with emery) and in uniform contact with the tube. Do not insulate the bulb.

Pad Systems (CTTP -   )

Pad Systems are supplied with an insert well soldered into a Tee whose fittings are the same size as the evaporator suction connection. The sequence for installing the insert well is as follows:

1. Unscrew the Packing Nut and remove the 3 "O" Rings from the well.
2. Solder the Tee at the evaporator suction connection as shown in Figure 14A. Both Tee fittings should be soldered before taking Step 3.
3. Lubricate the "O" rings with refrigeration oil and insert them one by one into the smooth part of the well, past the threads. (Fig. 13A)
4. Screw the packing nut into the well two turns only. At this point the packing nut should not contact or compress the "O" rings. (Fig. 13B)
5. Insert the expansion valve bulb into the packing nut and, using a firm pressure combined with a twisting motion, push the bulb all the way into the well so that the end of the bulb from which the capillary tube protrudes is recessed approximately 3/8" into the packing nut. (Fig. 13C)
6. Turn the Packing Nut by hand until it is as tight as possible and then tighten it exactly ½ turn more with a wrench.
7. Insert the cotter pin.
8. Fill the open end of the Packing Nut with Permagum and pack it in until it seals around the cotterpin.

c) Adjustment

Summer (Ambient over 50°F)

After box temperature has been brought down to normal, re-adjust expansion valve superheat to approximately 5°F. If frost becomes visible on the compressor body, turn superheat adjusting stem one-half turn in (clockwise) to increase superheat. Melt frost with external heat and repeat this procedure if frost reappears.

Winter

Block the condenser face with cardboard until head pressure increases to 200 - 250 PSI. Adjust the expansion valve as under Summer. In cold weather, frost may not form quickly on the compressor body. Look for uniform foam in the oil sight glass as evidence of floodback.

G. EVACUATION

Connect a rotary vacuum pump* to the gage port on the discharge and suction service valves of the compressor and to the receiver purge valve, with copper tubing or vacuum hose, not less than 3/8" inside diameter. Compressor suction and discharge service valves must be open, but not backseated.

Operate vacuum pump until a vacuum of 1500 microns absolute is obtained. Then break vacuum with refrigerant. Repeat evacuation and stop the pump at 1500 microns. Again break vacuum with refrigerant. Evacuate for a third time until a vacuum of 500 microns is reached. Break vacuum with refrigerant.

*Do not start the compressor while the system is under vacuum. *Do not attempt to use the compressor as a vacuum pump.* Use Cenco, Kinney, or Stokes vacuum pump and Stokes, McLeod or General Electric Type M vacuum gage. Ordinary service gages for evacuation are not satisfactory.

H. LEAK TESTING

After all refrigerant connections are made, add refrigerant vapor only until the system pressure is at least 30 PSI. Then pressurize with nitrogen up to 150 PSI. (Caution: always use pressure reducing regulator.) Carefully leak test all factory and field made joints including evaporator and condenser coils with electronic detector.

1. Gasketed and Flare Joints

Like all gaskets, refrigeration gaskets compress and sometimes require tightening. Therefore, it is essential to recheck the entire system for leaks after the first ten days to two weeks of operation, with particular attention to all gasketed and flare joints, and tighten as necessary.

I. FILL BANK WITH WATER

Fill Bank to overflowing with clean pure water. Do not add any glycol or anti-freeze.

Threaded Filler Plug

Through top filler opening screw plug in.

Expansion Type Rubber Filler Stopper

Insert stopper in filler opening. Rotate ears on stopper so they engage and lie under the lugs on Bank. Then, holding plug, to prevent ears turning from their position under the lugs, tighten the top screw until the stopper is snug in filler opening.

J. WIRING

1. **Disconnect Switch**

   Disconnect switches must be supplied by the installer and installed as required by the National Electric Code and all applicable local codes. Attach warning label 103 (included in instruction packet) to outside of fuse disconnect switch or circuit breaker.

2. **Checking Connections**

   Electrical connections have been securely tightened at the factory. These may have loosened during shipment and may loosen further during early periods of operation. Check all connections, before starting, for tightness. Then recheck for tightness after 10 days of operation. Be sure to disconnect all power before conducting these tightness checks.

3. **Hot Gas Solenoid**

   The hot gas solenoid coil is supplied with a ½" FPT conduit boss. Where the valve is located outdoors, appropriate water-tight electrical connection must be made.

4. **Bank Heaters**

   Use separate fused power supply to connect to bank heater and set thermostat for 120°F.

5. **Wire Evaporator Fan Motors**

   Wire evaporator fan motors, liquid solenoid, hot gas solenoid and box thermostat to terminals in control panel as shown.

6. **Fan Delay Thermostat (For blast freezers)**

   On blast freezing applications or where large evaporators are used in small rooms, install a fan delay thermostat (FD-1 or FD-2) (optional) settable to 15 to 25°F, 3-5° differential, with bulb clamped to bottom of suction line and wired in series with evaporator fans or evaporator fan contactor coil. Order FD-1 for 230 V. evaporators TV-550 and smaller; FD-2 for all 460 V. evaporators and 230 V evaporators TV-750 and larger.

K. CHARGING AND CHECKING CHARGE

Each Thermobank-2 System is equipped with a Minimum-Charge-Monitor. This is the application of two liquid sightglasses to the receiver. One is in the usual position at the receiver outlet (moisture indicating); a second is in the liquid line entering the receiver.

When the system is properly charged, the outlet sightglass should be clear, the inlet sightglass should bubble.

System Undercharged

Both sightglasses will bubble continuously: add refrigerant until outlet sightglass stops bubbling.

System Overcharged

Both sightglasses are clear: uncharge until inlet sightglass bubbles slightly.

L. VIBRATION

After starting, and on every inspection and service call, observe and secure all vibrating armored cable and refrigeration piping to prevent chafing which may lead to leaks.

M. PULLDOWN AFTER INITIAL START-UP

Pulldown after start-up may present one or more of the following problems.

1. Higher than normal suction pressure leading to compressor overload.
2. Higher than normal suction pressure causing high head pressure.
3. Higher than normal suction vapor temperature leading to nuisance trip-out on the compressor inherent protector.
4. Where pressure limiting expansion valves are used (L models) the evaporator may be starved during the pulldown period and oil loss from the compressor to the evaporator may be observed. This oil should return to the compressor when design

room temperature is reached and the expansion valve adjusted to flood the evaporator.

5. High moisture load in new boxes may cause rapid frost build up on the coil during the pulldown period.

6. Doors blowing open. See paragraph 6 on page 8, Fan Delay Thermostat.

In order to cope with the above problems, constant attention by the installer during the pull-down period is necessary. This may require him to adjust the expansion valve, throttle the compressor, manually trip the system into defrost or take other necessary steps to see the system pulls down safely.

N. PREVENTIVE MAINTENANCE

1. **Lubrication:**

When the compressor system is first installed, but before charging, raise the oil level to ½ sightglass. Thereafter, do not add oil even if oil level drops below oil sightglass unless unit trips on oil safety. The step of adding oil is diagnostic only. Excess oil is dangerous to the compressor and must be removed.

If unit trips on oil safety and oil level is visable or only ⅓ to ½ the full oil charge (see Tables 15A & 15B) is required to restore oil level, lost oil was not the cause of the oil safety trip; see Column B, Page 13; check for floodback, low back pressure, excessive time to pump down, etc. Correct cause of oil safety trip and then remove excess oil to ¼ glass maximum.

If ¾ or more of the full oil charge is required to restore oil level, the system has improperly robbed the oil from the compressor. See Column A, Page 13. Starved evaporator, long improperly pitched suction line, plugged suction accumulator, plugged oil separator will do this. When the problem is found and corrected, remove the excess oil, and reduce the oil level to ¼ glass maximum.

SEE ALSO PARA U-5 PAGE 11

2. **Detecting and Purging Non-Condensibles**

When the ambient is 80° or higher, non-condensibles can be detected when the compressor is running by feeling the receiver. If the head is higher than normal and the receiver is cool, there are non-condensibles or overcharge. If the head is high and the receiver is hot, non-condensibles are not the cause.

In winter, non-condensibles can be detected by blocking the condenser face until the head pressure rises to 95 PSI (R12); 180 PSI (R22/502). If the receiver does not warm up, there are non-condensibles.

To purge non-condensibles, open the purge valve wide for 4 to 8 seconds while the compressor is operating; close the valve and repeat again after 3 to 4 minutes. Repeat this procedure until the receiver warms up and the head pressure drops to normal.

3. **Cleaning Condenser**

The condensing unit should be located where a source of clean non-fouling air is available. If grease or dirt become present, clean the condenser as follows: Remove lint from the surface of the condenser with compressed air or a vacuum cleaner. Grease should be removed with a non-inflammable non-poisonous solvent which will not attack aluminum or copper.

4. **Regular Inspections**

A deliberate preventive maintenance program is strongly recommended for maximum system life and greatest customer satisfaction.

5. **Painting**

Where environmental conditions cause corrosion of aluminum or iron components, unit life and attractiveness can be extended by cleaning the metal and painting. Be careful not to paint over nameplates or part identifiers. Motors and switches (pressure and oil) should be covered before spraying.

TABLE 9-A
Pressure Switch Settings for Pumpdown Cycle

Lowest Winter Temp. or Lowest Box Temp. Expected	REFRIGERANT 12		REFRIGERANT 22		REFRIGERANT 502	
	Cut-In	Cut-Out	Cut-In	Cut-Out	Cut-In	Cut-Out
+30°	25	12	50	30	60	37
+20°	18	7	40	20	47	28
+10°	12	0	30	10	37	15
0°	7	5" Vac.	20	5	28	9
−10°	3	10" Vac.	13	0	20	5
−20°	2" Vac.	15" Vac.	8	5" Vac.	13	0
−30°	8" Vac.	16" Vac.	3	6" Vac.	7	0

DO NOT ATTEMPT TO SET THE CUT-OUT OF THE LOW PRESSURE SWITCH BELOW 20" VAC.

P. ADJUSTMENTS AND SETTINGS

1. High Pressure Switch

The high pressure cut-out switch is factory set at (220 PSI - R12) (360 PSI - R22, R502).

2. Low Pressure Switch

The low pressure switch is factory set as follows:
R12 (Cut-in-2″ Vac.) (Cut-out-18″ Vac.)
R22 (Cut-in-20 PSI) (Cut-out-5PSI)
R502 (Cut-in-12PSI) (Cut-out-0PSI)
Refer to Table 9A to determine if resetting is necessary for automatic recycling pumpdown.

3. Oil Safety Switch

The non-adjustable oil safety switch is factory set to trip when the oil pressure drops below 9 PSI for Copeland; 5 PSI for Carlyle Hermetic; 20 PSI for Carlyle Open.

4. Condenser Fan Thermostat

All CTTF Models are equipped with a thermostat which senses outside air temperature and turns off one (if 2) or two (if 3) condenser fan motors when the outdoor temperature falls below 35°. The thermostat restarts the stopped motors when the outside temperature rises to 40°.

5. Expansion Valve

See paragraph 10C, page 7.

Q. DEFROST CONTROLS (Time-Press.-Press.)

The timer initiates the defrost.

A pressure control, sensing evaporator pressure, terminates the defrost.

A second pressure control, also sensing evaporator pressure, terminates post defrost.

1. Timer Settings

a) Frequency. The frequency of defrost is determined by the number of pins in the timer disc. The factory setting is one every 4 hours.

b) Timer Over-ride. (Fail-Safe) The factory setting is 20 minutes for medium temp. (F) systems and 15 minutes for low temp. (L) systems. The timer will terminate the defrost in the event the pressure control does not.

c) Multiple Systems Cooling One Box: All timers *must* be synchronized so that all evaporators defrost simultaneously. To achieve synchronization, put pins in same timer hour holes on all timers and set all timers to clock time and override to same duration.

2. Defrost Termination Pressure Control

This pressure switch senses evaporator pressure and terminates defrost on rise. The factory termination setting is on a label near the Defrost Termination Pressure Switch. Typically these settings will be 180 PSI (R - 502), 160 PSI (R - 22).

Defrost duration should be increased, if necessary, by raising the termination setting by 10 PSI increments only.

CAUTION: **Under no circumstances should an iced coil be cleared or attempted to be cleared by increasing the defrost duration, since damage to the evaporator may result. Instead, the coils should be cleared of ice manually either with hot water or steam and then defrost duration increased by the above steps.**

3. Post-Defrost Control

The post-defrost pressure control is a non-adjustable pressure switch connected to sense pressure at the suction line at the inlet of the suction solenoid valve. Factory setting is approximately 25 PSI (post defrost terminates) and 40 PSI (automatic reset). On "L" Systems; 35 PSI (Post Defrost Terminates) and 75 PSI (Reset) on "F" Systems.

R. BANK HOLDBACK VALVE (HBV) SETTING

The Bank holdback valve is factory set to maintain a crankcase pressure of (5-10 PSI R-12) (10-20 PSI R-502 R22) during defrost. If Bank Suction outlet remains hot throughout defrost raise HBV setting. If floodback from Bank during defrost is observed, reduce holdback valve setting. Remove protective cap and turn adjusting stem in (clockwise) to raise pressure, or out (counter-clockwise) to lower pressure. Do not adjust holdback valve without gauge on suction service valve. Do not leave holdback valve with cap off.

S. SYSTEM SHUTDOWN

There are two toggle switches in the control panel.

One is labeled "Compressor Pilot." This switch is in the compressor starter pilot circuit and should be used by the serviceman only for emergencies since it disables the pumpdown cycle.

The second is labeled "Pumpdown." This switch stops the evaporator fans, closes the liquid solenoid and prevents defrost. The timer, however, continues to operate.

Use the "Pumpdown Switch" for shutting a normally operating system down for short or long periods.

The unit may safely stay off this way for long periods even though the box warms up.

IMPORTANT: If the compressor is turned off in any other manner, i.e., by the main disconnect switch or by the compressor switch in the control panel, be sure to follow step

(T) when restarting to minimize likelihood of compressor damage.

CAUTION: If unit should short cycle (turn on more than once each hour), one or more of the following components may be allowing refrigerant leakage into the low side:

1. Liquid Solenoid
2. Hot Gas Solenoid
3. KM Pilot Solenoid
4. Valve Plate (Discharge Reeds)
5. Oil Separator Float

Locate and correct the trouble.

T. PROCEDURE FOR RE-STARTING

How to re-start after long off-cycle pumpdown inoperative. Do not just turn machines on and walk away!

A compressor may be off for a long period of time with pumpdown inoperative for the following reasons:

1. Stoppage on overload, oil safety, high head or other lockout device.
2. Disconnect switch inadvertently pulled.
3. Power failure.
4. New Installation is charged, but start-up delayed without pumping down.

During an extended shutdown resulting from any of the above conditions, or on initial start-up, liquid refrigerant may flood the evaporator or compressor crankcase. It is necessary to carefully clear these components of liquid to prevent damage to the compressors. This can be accomplished by doing the following:

1. Close liquid solenoid and stop evaporator fans by placing pumpdown switch in the off position.
2. Re-set those controls which may have tripped.
3. Operate the compressor in very short bursts, starting with 1 or 2 seconds and gradually increasing these periods until the liquid is cleared out. *Use compressor on-off switch to accomplish this.* Stop the machine instantly if knocking is observed.
4. Watch the oil level and suction pressure carefully. Rapid boiling of refrigerant in the crankcase may lower the oil level dangerously. Add oil if necessary. Do not operate continuously at extra low vacuum.
5. After you are sure the liquid refrigerant is boiled off, re-start evaporator fans and re-open liquid solenoids. Attend the system just as you would during initial start-up. *Do not just turn machines on and walk away.*

U. SUCTION ACCUMULATOR (Standard on CTT36L, CTT42F and larger)

The accumulator is a safety device. During correct system operation it should contain no liquid refrigerant. If liquid refrigerant reaches the accumulator during normal operation or start-up, find the source of floodback and correct it.

If low oil level in compressor is caused by slow return of oil to compressor, take the following steps:

1. Make sure evaporators are fully flooded.
2. Make sure that the oil return tube is not plugged with dirt.
3. If a solenoid valve is installed in the metering tube, make sure it is energized and that the coil is operative and the interior parts work freely.
4. The solenoid valve in the metering tube is closed during compressor off cycles and during defrost. At other times it is controlled by a liquid detection system comprising a cartridge heater and a thermostat set to +20°F. When liquid refrigerant chills the thermostat bulb, the thermostat closes the solenoid and turns on the heater.
5. If persistant floodback keeps the accumulator partly full of liquid refrigerant, oil, normally returned to the compressor, will float on the liquid refrigerant in the accumulator and the compressor will run low on oil and trip on the oil safety.

V. SERVICING

1. **High Head Trip on Defrost**

   Nuisance trip on high head during defrost can be caused by one or more of the following:
   a) W hand valve closed
   b) W check valve stuck closed
   c) Receiver inlet valve closed
   d) Receiver outlet (king) valve closed
   e) Plugged drier
   f) Hot gas solenoid fails to open
   g) Defrost termination pressure switch fails to close
   h) Timer fails to terminate on impulse to X terminal

2. **Failure to Defrost**

   Defrost failure with Thermobank-2 without high head tripout can be caused by the following:
   a) Snow, not ice, plugging fins
      1. Timer not running
      2. Short in control circuit to timer X terminal causes timer to terminate instantly after initiation
      3. Fault in timer causes defrost to terminate instantly after initiation
      4. Timer switch broken
   b) Ice, not snow, on coil. Important: Immediately shut off System until the coil has been manually thawed with hot water. Any attempt to clear ice by increasing defrost time only will damage coil. See Caution Page 10, Item Q-2.
      1. Evaporator pitched away from drain
      2. Plugged or frozen drain
      3. Multiple evaporators with defrosts not simultaneous
      4. Defrost termination pressure switch set too low

c) Frost on fans
   1. Blow-through models (TV325 & smaller)
      a) Excessive infiltration
      b) High latent load from wet product
      c) Multiple systems with non-simultaneous defrosts
   2. Draw-through models (TV400 & larger)
      a) Multiple systems with non-simultaneous defrosts
      b) Excessively long defrost (reduce termination pressure) check terminator operation
      c) Defrosts too infrequently

3. Nuisance Trip on Oil-Safety

Refer to Page 9, Paragraph N-1 and the Columns on Page 13.

4. Trip on Discharge Line Thermostat

Use a recorder or clock to find out when the trip occurs, with respect to day, night, and with respect to defrost.
If day, especially afternoon, suspect high head or hot Bank.
If night, suspect low suction pressure.
If during defrost, suspect hot Bank.
If just before defrost, suspect frosted coil.
Look for one or more of the following:

a) Suction pressure too low.
   1) Coil frosted.
      Interval between defrosts too great. Defrost more frequently.
   2) Coil starved.
      Open TXV to reduce superheat. Do not allow floodback to compressor.
   3) Restriction in suction line.
      Suction solenoid not opening. External suction filter clogged. Suction strainer or filter inside compressor clogged.
   4) Evaporator fans off.
   5) Box too cold.
      Thermostat set too low.
      Thermostat located away from evaporator return air.
      Liquid solenoid stuck open.
      Air recirculation at evaporator.

b) Suction temperature too high.
   1) Long uninsulated suction run in hot environment.
   2) Starved evaporator.
   3) Bank too hot — trips during defrost.
      Caused by discharge temperature abnormally high but not hot enough to trip discharge line thermostat.
      Raise holdback valve setting.
      Lower thermostat setting on immersion heater to 100-120°F.
      Insulate suction line.
      Flood evaporator.
      Lower head pressure
      a) Purge overcharge and non-condensibles.
      b) Clean condenser.
      c) Correct air recirculation.
   4) Excessive oil return through oil separator.
      Remove oil from system.
   5) Excessive hot gas return through oil separator. Repair float mechanism.

c) Damaged Compressor
   1) Broken high-lowside head gasket.
   2) Broken discharge reed.
      Check for leak-back with compressor off and suction service valve closed.
      If multi-compressor, stop all compressors, close discharge service valves and check for rapid drop in pressure in head of each compressor.

d) High Head Pressure.
   1) Over charge.
   2) Fans off or short cycling.
   3) Non-condensibles.
   4) Clogged fins.
   5) Air recirculation or inadequate ventilation.

W. REPLACEMENT PARTS

Keep this instruction bulletin for later reference when performing regular preventive maintenance or corrective service.

When ordering replacement parts from the factory, be certain to state the model number and the serial number marked on the Kramer nameplate and clearly describe by number, function, description and size, the item required. This will facilitate prompt handling of your order.

Replacement compressors and compressor parts must be secured from a Copeland/Carlyle wholesaler (see Bulletin CW-599A).

X. WARRANTY

1. One Year Warranty

When installation is completed, fill out and have warranty card signed by authorized person, and mail to Kramer Trenton Company.

2. Four Year Additional Warranty

A four year additional warranty on the motor-compressor only may be purchased. The application forms and prices are in the warranty packet sent with each system. Follow instructions on the Application Form.

3. Cause for Warranty Withdrawal

Any deviation from correct installation and service practice, operation outside of recommended temperature range, and specifically that outlined in these instructions, will be sufficient cause for withdrawing all warranties.

TROUBLE SHOOTING NUISANCE TRIP ON OIL SAFETY

Column A

A. *LOW OIL LEVEL IN OIL SIGHT GLASS WHEN FOUND OFF.

1. SHORT OF OIL (NEW SYSTEM)
   Add oil once – do not add twice without checking the following.

2. POOR SUCTION PIPING HOLDS UP OIL
   a. Vertical risers must have "P" traps at bottom.
   b. Horizontal lines must be pitched towards compressor ¼" per foot.

3. STARVED EVAPORATORS HOLD UP OIL
   a. Poor TXV adjustment.
   b. Plugged or faulty TXV
   c. Shortage of refrigerant.
   d. Plugged drier.
   e. High liquid line risers cause flashing at expansion valve.
   f. Winterstat charge not added.

4. FLOOD BACK DILUTES OIL, MAKES IT FOAM SO PUMP CAN'T DEVELOP ENOUGH PRESSURE. ALSO CAUSES RAPID BEARING WEAR. (Check for rust on compressor suction service valve, end bell and motor compartment.)
   Causes:
   a. Plugged evaporator coil – ice, frost, dirt, air filter.
   b. Stoppage of evaporator fans – shut off by user, blown fuses, trip-out on overload, broken belts, door switch not interconnected with liquid solenoid. A stopped fan may appear to be operating but actually windmilling backwards.
   c. TXV adjustment – superheat too low, feeler bulb location should be on bottom of suction tube and not insulated.
   d. Liquid solenoid valve stuck open.
   e. Hot gas solenoid valve stuck open.
   f. Suction solenoid valve stuck open.
   g. Thermobank out of water or electric heater not working.
   h. Holdback valve setting at bank too high.
   i. Holdback valve bellows leaking. Causes valve to overfeed.
   j. Post defrost too short or post defrost pressure switch defective.
   k. Hot gas check valves stuck open.

5. INCORRECT OR NO RECYCLING PUMPDOWN
   Recycling pumpdown (thermostat controlling liquid solenoid valve) is mandatory and is not complete until low pressure switch is set with gauge in accordance with instructions.

6. OIL SEPARATOR OIL RETURN PORT PLUGGED OR FLOAT LEAKING
   a. While compressor is operating, sight glass in oil return line should show foam.
   b. While compressor is not operating, sight glass in oil return line should show no flow.

7. SUCTION ACCUMULATOR
   a. Metering tube plugged.
   b. Metering tube too small. First check that oil separator is returning oil and that the metering tube is not plugged before installing a larger metering tube.
   c. Oil return solenoid doesn't open.

SEE PARA U-4 AND U-5 PAGE 11

8. LOW PRESSURE SWITCH SET TOO LOW. DOESN'T SHUT OFF OR TAKES TOO LONG TO SHUT OFF WHILE COMPRESSOR IS ON PUMPDOWN

Column B

B. **OIL LEVEL OK WHEN FOUND OFF

*1. EXCESSIVELY LOW CRANKCASE PRESSURE
   A starved evaporator, see A-3, low pressure switch set too low or defective. (See A-8)

2. LOW OIL PRESURE OBSERVED EVEN WITH ADEQUATE OIL LEVEL
   a. Oil Pump not functioning, reversed compressor rotation.
   b. Compressor main or rod bearing loose or worn, most frequently caused by long term operation with liquid floodback.
   c. Plugged oil strainer.

*3. SHORT CYCLING

   Causes:
   a. Thermostat Calling for Cooling
      (1) Liquid solenoid energized
      (2) Incorrectly adjusted low pressure switch
      (3) Plugged drier
      (4) Defective TXV or TXV misadjusted and starving coil
      (5) Evaporator fans off
      (6) Coils iced
      (7) Low on refrigerant
   b. Thermostat Satisfied
      (1) Liquid solenoid de-energized
      (2) Broken discharge reed
      (3) Broken valve plate gasket
      (4) Leaking liquid solenoid (frost at valve outlet)
      (5) Leaking or stuck oil separator float
      (6) Leaking hot gas or modulator solenoid
      (7) Liquid solenoid located near condensing unit instead of near evaporator

*4. POST DEFROST TOO LONG

*5. OIL SEPARATOR FLOAT STUCK OPEN

*6. LIGHT FLOODBACK TO COMPRESSOR GENERATES FOAM

   Causes:
   a. TXV adjustment superheat too low
   b. Frost, ice or dirt plugged evaporator
   c. Holdback valve at Bank set too high
   d. Low water level in Bank
   e. Bank too cold; Bank heater not heating
      (1) Heater bad
      (2) Heater thermostat misadjusted
      (3) No power to heater

*May also cause loss of oil resulting in low oil level observed.

**CAUTION
Refrigerant may condense in oil after tripout and raise oil level.

ASSEMBLY DRAWING FOR TXV BULB INSERT WELL

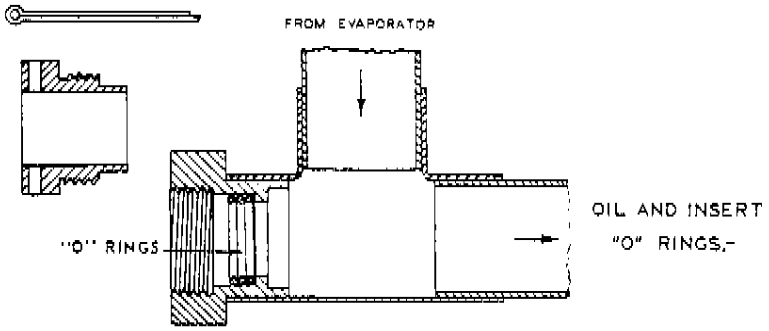


Figure 14A

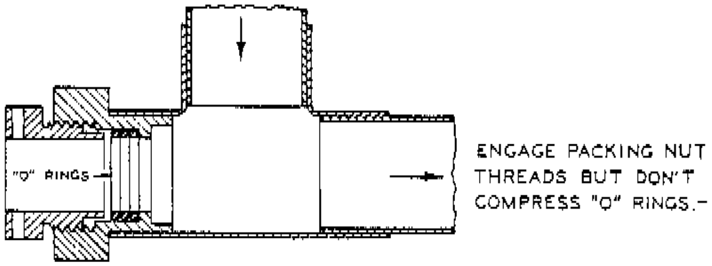


Figure 14B

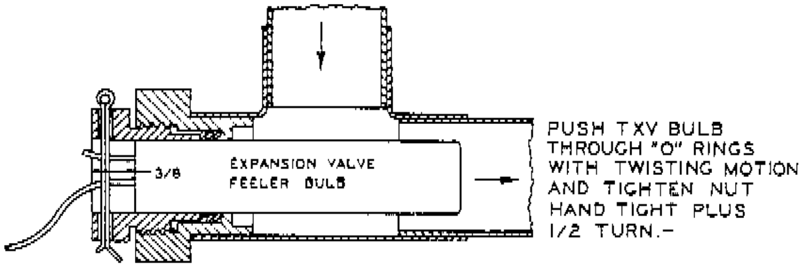
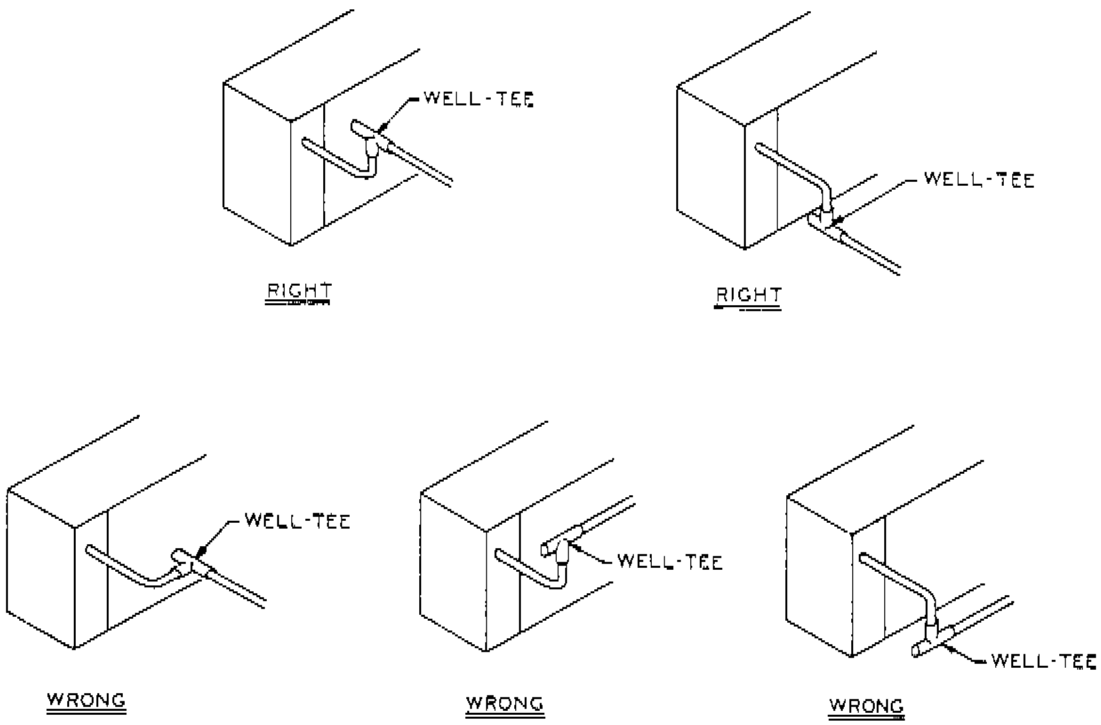


Figure 14C

Figure 14D
WELL-TEE INSTALLATION



Suggested Line Sizes (O.D) and Refrigerant Charges

TABLE 15A

Model Number	REFRIGERANT 502 Max. Equiv. Length in Ft. To	Sugg. Line Sizes (Type "L" Copper Tube) Liquid	Suction	Refrig. Chg. Lbs.	Oil Re-Charge Pints Suniso 3GS
CTT1L52	22	3/8	5/8	6	1.5
	100	3/8	7/8	9	
CTT1½L52	10	3/8	5/8	6	4.5
	57	3/8	7/8	8	
	100	1/2	1-1/8	13	
CTT2L52	37	3/8	7/8	9	4.5
	100	1/2	1-1/8	15	
CTT3L52	21	3/8	7/8	10	5.5
	74	1/2	1-1/8	15	
	100	5/8	1-3/8	21	
CTT6L52	31	1/2	1-1/8	15	6.0
	55	1/2	1-3/8	17	
	100	5/8	1-5/8	25	
CTT8L52	26	5/8	1-3/8	24	8.0
	52	5/8	1-5/8	27	
	100	7/8	2-1/8	46	
CTT12L52	19	5/8	1-3/8	34	7.5
	38	5/8	1-5/8	36	
	100	7/8	2-1/8	57	
CTT15L52	25	5/8	1-5/8	52	7.5
	104	7/8	2-1/8	75	
	125	7/8	2-5/8	80	
CTT18L52	18	5/8	1-5/8	53	9.0
	75	7/8	2-1/8	70	
	125	1-1/8	2-5/8	106	
CTT21L52	53	7/8	2-1/8	67	9.0
	125	1-1/8	2-5/8	108	
CTT31L52	30	7/8	2-1/8	74	19.0
	85	1-1/8	2-5/8	104	
	125	1-1/8	3-1/8	121	
CTT36L52	23	7/8	2-1/8	96	17.0
	65	1-1/8	2-5/8	118	
	125	1-3/8	3-1/8	173	
CTT42L52	44	1-1/8	2-5/8	119	18.0
	100	1-3/8	3-1/8	165	
	125	1-3/8	3-5/8	182	
CTT62L52	31	1-1/8	2-5/8	151	40.0
	72	1-3/8	3-1/8	185	
	145	1-3/8	3-5/8	233	

TABLE 15B

Model Number	REFRIGERANT 502 except * Max. Equiv. Length in Ft. To	Sugg. Line Sizes (Type "L" Copper Tube) Liquid	Suction	Refrig. Chg. Lbs.	Oil Re-Charge Pints Suniso 3GS
CTT3/4F12*	28	3/8	5/8	9	1.5
	100	3/8	7/8	12	
CTT1F12*	14	3/8	5/8	9	1.5
	74	3/8	7/8	11	
	100	3/8	1-1/8	13	
CTT1½F12*	50	3/8	7/8	12	4.5
	100	1/2	1-1/8	18	
CTT2F52	50	1/2	7/8	8	4.5
	100	1/2	1-1/8	15	
CTT3F52	35	1/2	7/8	10	4.5
	100	5/8	1-1/8	26	
CTT5F52	15	1/2	7/8	18	5.5
	50	5/8	1-1/8	23	
	100	7/8	1-3/8	42	
CTT7½F52	28	5/8	1-1/8	21	6.0
	65	7/8	1-3/8	35	
	100	7/8	1-5/8	44	
CTT10F52	15	5/8	1-1/8	30	8.0
	40	7/8	1-3/8	38	
	80	7/8	1-5/8	53	
CTT15F52	23	7/8	1-3/8	48	8.0
	50	7/8	1-5/8	57	
	100	1-1/8	2-1/8	88	
CTT16F52	16	7/8	1-3/8	55	7.5
	40	7/8	1-5/8	61	
	100	1-1/8	2-1/8	95	
CTT21F52	25	7/8	1-3/8	65	8.5
	84	1-1/8	1-5/8	95	
	100	1-1/8	2-1/8	102	
CTT24F52	20	7/8	1-5/8	82	9.0
	68	1-1/8	2-1/8	107	
	100	1-3/8	2-5/8	143	
CTT31F52	12	7/8	1-5/8	94	9.0
	50	1-1/8	2-1/8	113	
	125	1-3/8	2-5/8	174	
CTT42F52	28	1-1/8	2-1/8	146	17.0
	75	1-3/8	2-5/8	183	
	125	1-5/8	3-1/8	250	
CTT48F52	20	1-1/8	2-1/8	162	18.0
	60	1-3/8	2-5/8	193	
	125	1-5/8	3-1/8	269	
CTT62F52	35	1-3/8	2-5/8	190	18.0
	85	1-5/8	3-1/8	246	
	125	2-1/8	3-5/8	402	

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Suggested Line Sizes (O.D.) and Refrigerant Charges

TABLE 16A
SYSTEMS WITH T.V. LPG, C, LP & CM EVAPORATORS

Model Number	REFRIGERANT 22 except * Max. Equiv. Length in Ft. To	Sugg. Line Sizes (Type "L" Copper Tube) Liquid	Suction	Refrig. Chg. Lbs.	Oil Re-Charge Pints Suniso 3GS
CTT¾F12*	28	3/8	5/8	9	1.5
	100	3/8	7/8	12	
CTT1F12*	14	3/8	5/8	9	1.5
	74	3/8	7/8	11	
	100	3/8	1-1/8	13	
CTT1½F12*	50	3/8	7/8	12	4.5
	100	1/2	1-1/8	18	
CTT2F22	15	3/8	5/8	9	4.5
	50	3/8	7/8	10	
	100	1/2	1-1/8	16	
CTT3F22	50	1/2	7/8	14	4.5
	100	1/2	1-1/8	17	
CTT5F22	18	1/2	7/8	19	5.5
	50	5/8	1-1/8	23	
	100	5/8	1-3/8	29	
CTT7½F22	28	1/2	1-1/8	21	6.0
	83	5/8	1-3/8	29	
	100	7/8	1-3/8	44	
CTT10F22	18	5/8	1-1/8	35	8.0
	55	7/8	1-3/8	46	
	100	7/8	1-5/8	57	
CTT15F22	20	5/8	1-3/8	54	8.0
	75	7/8	1-5/8	69	
	100	7/8	2-1/8	76	
CTT16F22	15	5/8	1-3/8	63	7.5
	55	7/8	1-5/8	75	
	100	1-1/8	2-1/8	103	
CTT21F22	35	7/8	1-5/8	73	8.5
	55	7/8	2-1/8	78	
	125	1-1/8	2-1/8	116	
CTT24F22	28	7/8	1-5/8	90	9.0
	63	1-1/8	2-1/8	110	
	125	1-1/8	2-1/8	136	
CTT31F22	18	7/8	1-5/8	107	9.0
	67	1-1/8	2-1/8	131	
	125	1-1/8	2-5/8	155	
CTT42F22	38	1-1/8	2-1/8	162	17.0
	100	1-3/8	2-5/8	210	
	125	1-3/8	3-1/8	226	
CTT48F22	28	1-1/8	2-1/8	180	18.0
	76	1-3/8	2-5/8	200	
	125	1-5/8	3-1/8	248	
CTT62F22	20	1-1/8	2-1/8	229	18.0
	50	1-3/8	2-5/8	252	
	125	1-5/8	3-1/8	333	

* R-12

TABLE 16B
SYSTEMS WITH LV AND LVTV EVAPORATORS

Model Number	REFRIGERANT 22 except * Max. Equiv. Length in Ft. To	Sugg. Line Sizes (Type "L" Copper Tube) Liquid	Suction	Refrig. Chg. Lbs.	Oil Re-Charge Pints Suniso 3GS
CTT3/4F12*	28	3/8	5/8	12	1.5
	100	3/8	7/8	15	
CTT1F12*	14	3/8	5/8	11	1.5
	74	3/8	7/8	14	
	100	3/8	1-1/8	16	
CTT1½F12*	50	3/8	7/8	15	4.5
	100	1/2	1-1/8	23	
CTT2F22	15	3/8	5/8	12	4.5
	50	3/8	7/8	14	
	100	1/2	1-1/8	20	
CTT3F22	50	1/2	7/8	28	4.5
	100	1/2	1-1/8	32	
CTT5F22	18	1/2	7/8	48	5.5
	50	5/8	1-1/8	53	
	100	5/8	1-3/8	59	
CTT7½F22	28	1/2	1-1/8	61	6.0
	83	5/8	1-3/8	69	
	100	7/8	1-3/8	84	
CTT10F22	18	5/8	1-1/8	93	8.0
	55	7/8	1-3/8	105	
	100	7/8	1-5/8	117	
CTT15F22	20	5/8	1-3/8	126	8.0
	75	7/8	1-5/8	143	
	100	7/8	2-1/8	150	
CTT16F22	15	5/8	1-3/8	148	7.5
	55	7/8	1-5/8	160	
	100	1-1/8	2-1/8	190	
CTT21F22	35	7/8	1-5/8	157	8.5
	55	7/8	2-1/8	162	
	125	1-1/8	2-1/8	203	
CTT24F22	28	7/8	1-5/8	198	9.0
	63	1-1/8	2-1/8	219	
	125	1-1/8	2-1/8	246	
CTT31F22	18	7/8	1-5/8	250	9.0
	67	1-1/8	2-1/8	275	
	125	1-1/8	2-5/8	300	

*R-12

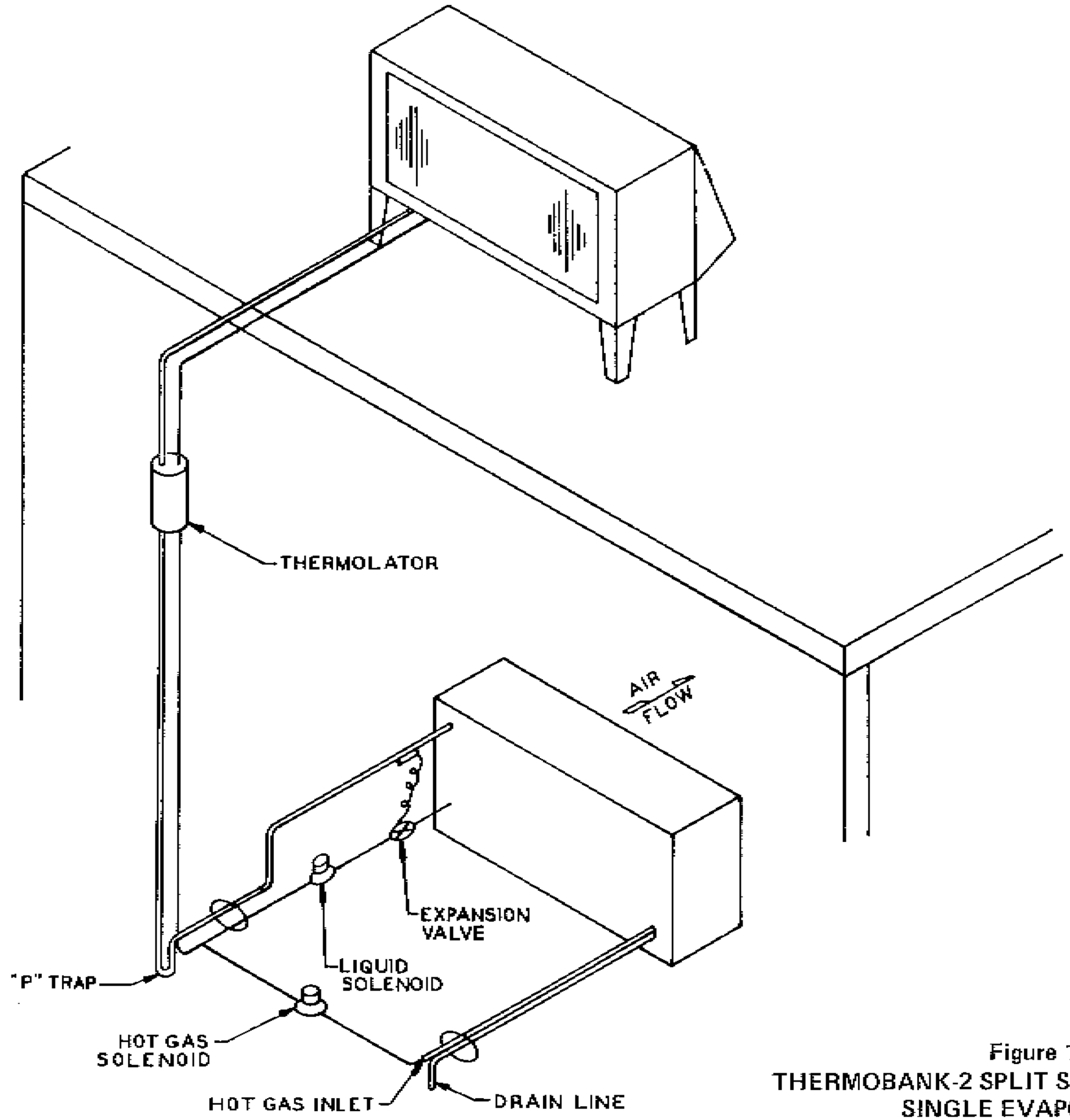
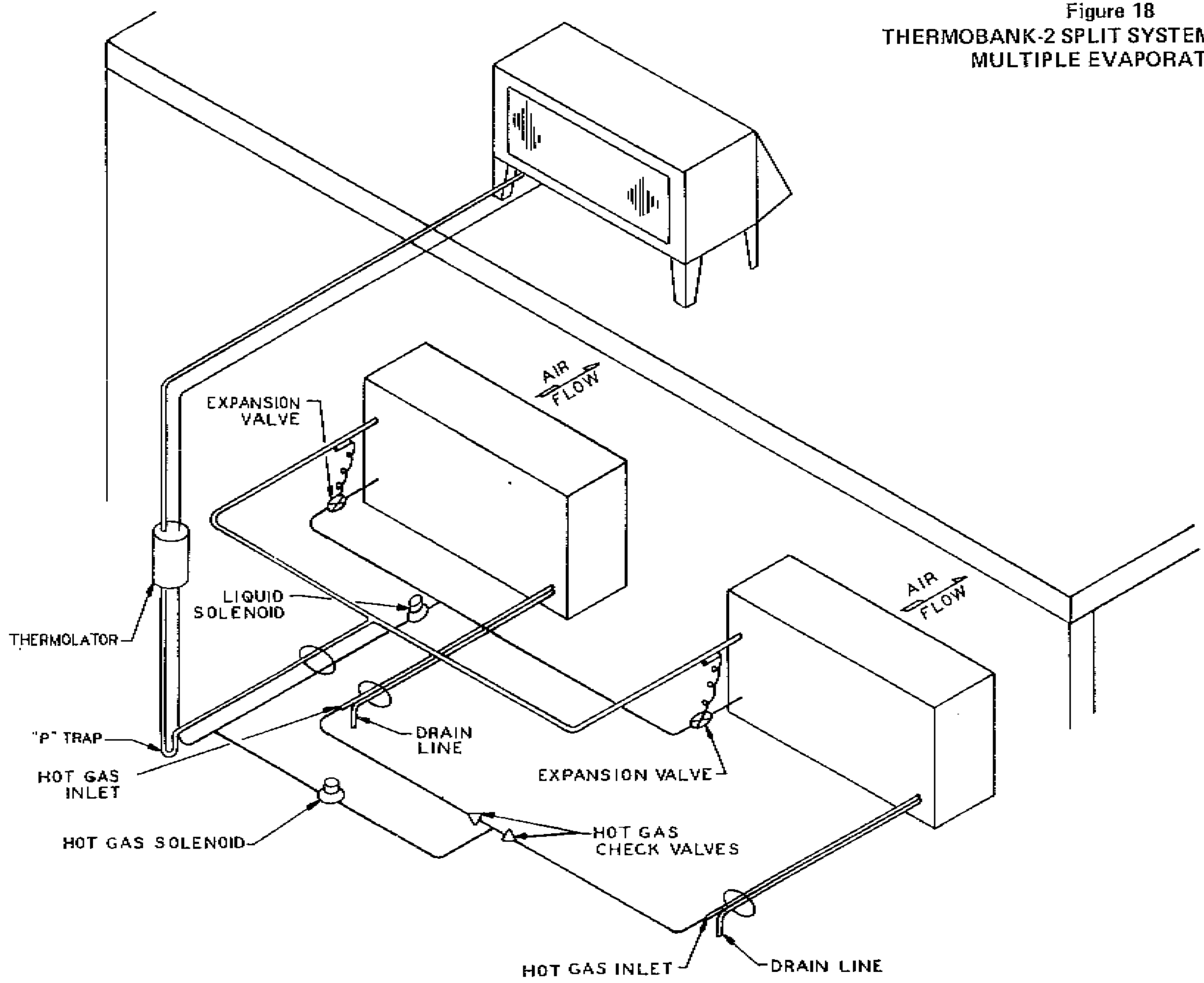


Figure 17
THERMOBANK-2 SPLIT SYSTEM ROOF TYPE
SINGLE EVAPORATOR

Figure 18
THERMOBANK-2 SPLIT SYSTEM ROOF TYPE
MULTIPLE EVAPORATORS



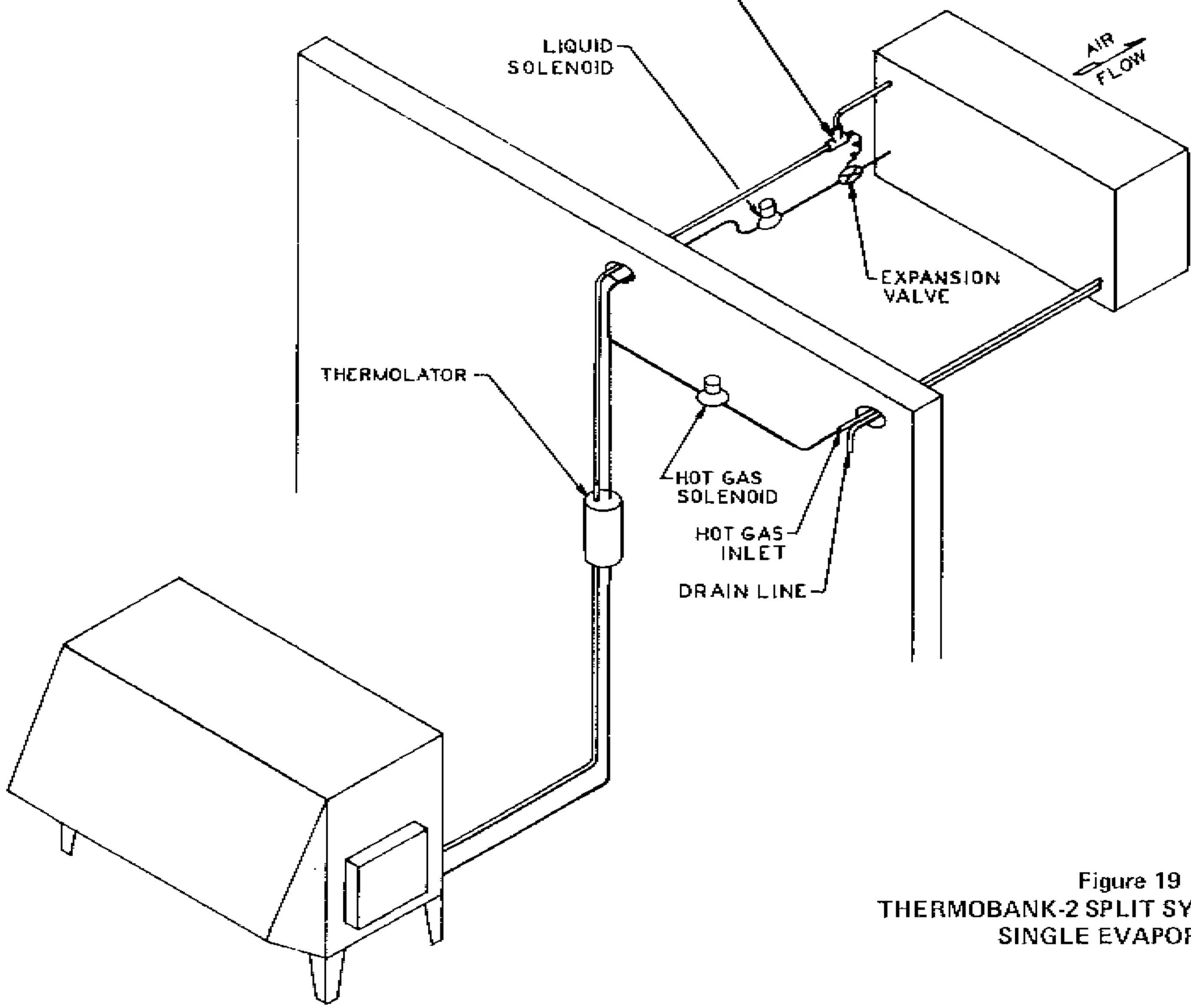


Figure 19
THERMOBANK-2 SPLIT SYSTEM PAD TYPE
SINGLE EVAPORATOR

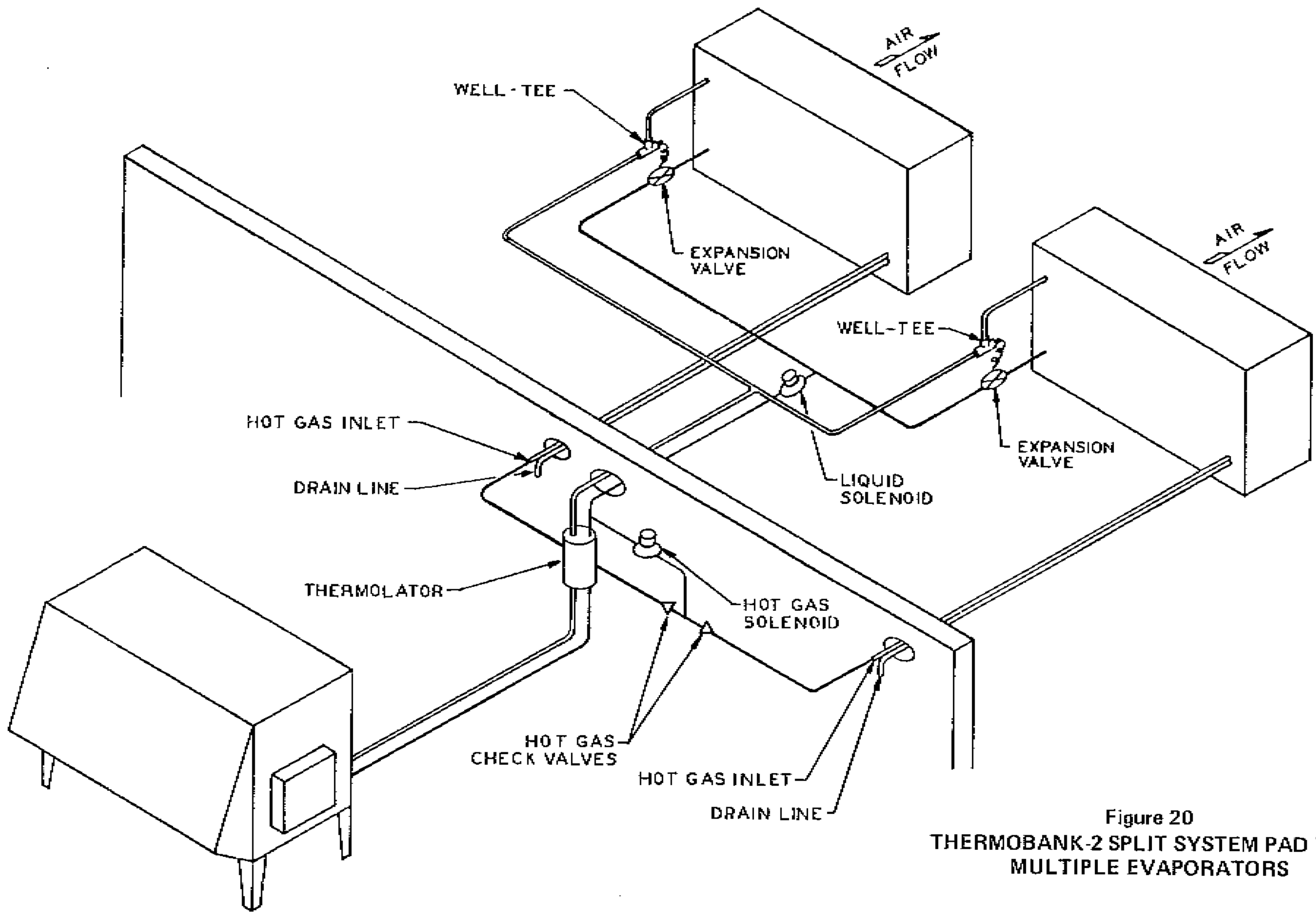


Figure 20
THERMOBANK-2 SPLIT SYSTEM PAD TYPE MULTIPLE EVAPORATORS