MANUAL 2100-056

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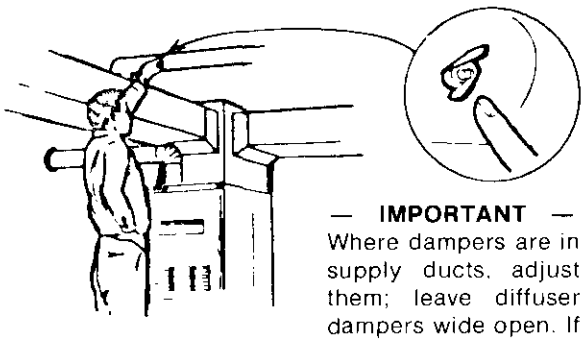
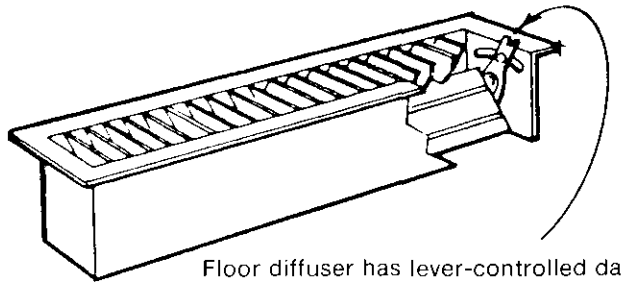


Adjusting damper in supply air duct.

— IMPORTANT —
Where dampers are in supply ducts, adjust them; leave diffuser dampers wide open. If there are no dampers in the ducts, adjust the dampers in the diffusers.



Floor diffuser has lever-controlled damper.

air balancing

INTRODUCTION

Air balancing is the essential final step in providing total comfort and it can be an important part of troubleshooting a system. A balanced air distribution system delivers the proper volume of air, expressed in cubic feet per minute (cfm), to each room in a building to maintain the desired temperature in each room. It is extremely difficult and normally impractical to design a system which is so perfect that it requires no air balancing. An air volume control damper should be installed in each branch duct leading to a supply outlet. These are the dampers used to balance the system. They should be installed as close to the supply trunk as possible for best control. Generally, there is also a damper in each supply air outlet diffuser. The diffuser damper is useful to stop the air supply to a room that is not in use, such as a spare bedroom. However, if system balancing is done with the diffuser dampers, irritating air noise may occur at some of the diffusers.

Balancing is achieved when air volume is reduced (the velocity at the outlet is lowered) in areas where there is too much heat or too much cooling. As the volume is cut down from one outlet, more air will automatically be pushed through other runs in the building that have dampers in the open position.

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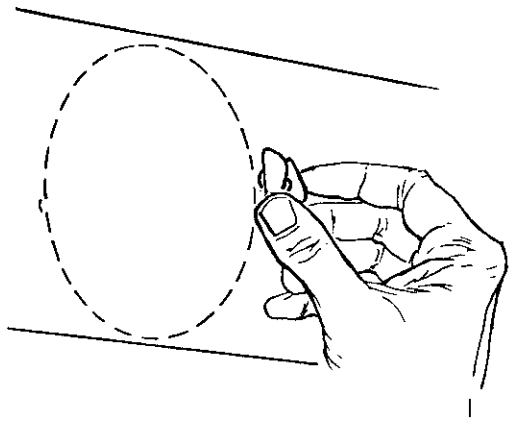
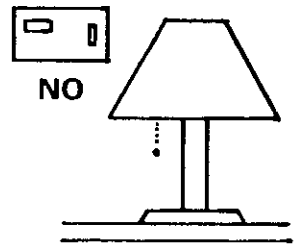
Before attempting to balance the system of air distribution, consider the following:

Damper Adjustment. A damper may have to be almost closed before it cuts off enough air to affect the rest of the system.



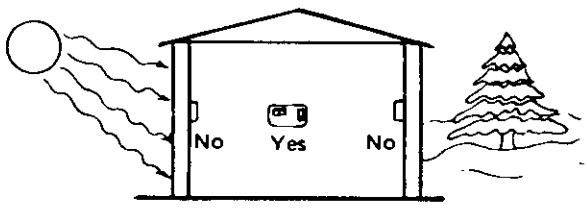
Air Movement. With the same blower speed, more air will move through a short, straight duct than through a longer duct with an elbow or two.

Thermostat Location. First of all, remember that the thermostat is boss of the system. If the thermostat in a particular location is satisfied with the temperature at that particular location, it will stop the heating or the cooling unit. Other rooms in the building may not be equally as comfortable. Proper balance and blower speed adjustment may be a simple solution, or the answer may be to pick a better thermostat location.



Choose a location that will not have false heat applied to it, such as lights, TV, radio, or other sources of heat. Do not locate the thermostat so that radiation from the sun can strike it. Do not mount the thermostat on a wall that has a chimney or flue running through it or behind it, as it will not allow the thermostat to control properly.

As a general rule, locate the thermostat in a room or area that has the fastest rate of heat loss and/or heat gain. Most frequently in the residential job this means the better location is in the living or dining area. The best possible control should be applied to the rooms which are most critical or the most used.



CAUTION: A small central hall is not a good location unless it includes a central return air grille, so that an average temperature is obtained. Many times a central hall with no return has little or no heat loss or gain and, therefore, becomes a poor location.

Be sure to plug the hole in the wall where wires come into the thermostat's subbase.

When a number of rooms are heated and cooled by one thermostat, locate the thermostat in a return duct fairly close to the unit to better control temperature. As the return air travels back to the unit, it is thoroughly mixed and the thermostat will then operate on the basis of this mixed air temperature instead of only the temperature of one room. This procedure may not always be practical, but it may be considered in some cases.

The thermostat should normally be mounted at a seated person's breathing level. This is usually around 42" to 48" above the floor. If the thermostat is mounted too low, small children may tamper with it.

BALANCING AIR DISTRIBUTION

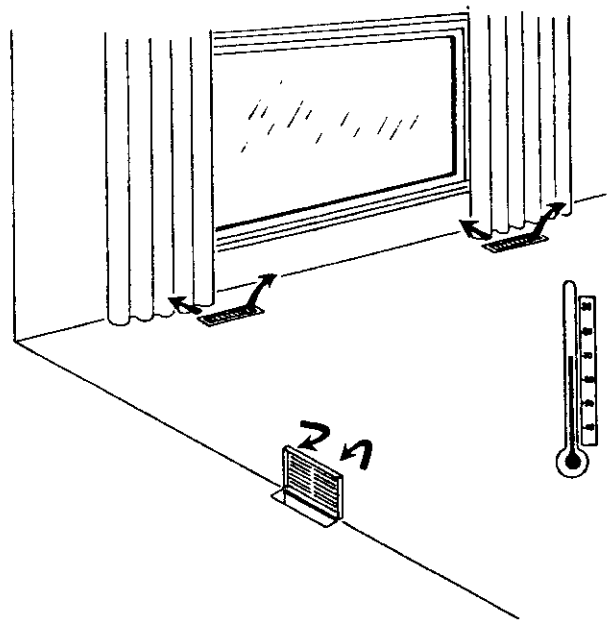
When a system is balanced, the blower should be running continuously. It is impossible to do a proper balancing job with the blower running intermittently. Place the fan switch in continuous operation. If there is no fan switch on the thermostat or the furnace, then adjust the "fan control" on the furnace down to its minimum setting. This will cause the blower to run constantly. Reset the summer switch or fan control to its original setting after completing the balancing job.

Various methods are used to balance a system; however, two methods are commonly used for the average residential job. They are the thermometer method and the thermometer and velocity meter method.

THERMOMETER METHOD

To balance the system using thermometers only, open all diffusers or volume dampers to their wide open position. Common sense dictates that certain outlets should be partially closed to begin with, such as extremely small bathrooms, etc. The next step is to lay all of the thermometers that are to be used for balancing purposes in one location. They should be left long enough so that the thermometers have all equalized or their readings have become stable. Check the readings on each thermometer to have some assurance that they will all read the same. If there are several thermometers that have different readings, make a notation of these readings then make adjustments to even out the readings as you proceed to balance the system.

NOTE: If doors to certain rooms are normally kept closed, they should also be in the closed position during this balancing period. If they are normally in the open position, they should be left in the open position during the balancing process.



The next step is to locate a thermometer somewhere near the center of the room at approximately 30" to 36" above the floor. Pick neutral locations (away from lamps, TV, etc.). With the building in normal use, and with the thermostat properly adjusted, allow the system to operate normally for thirty minutes or more.

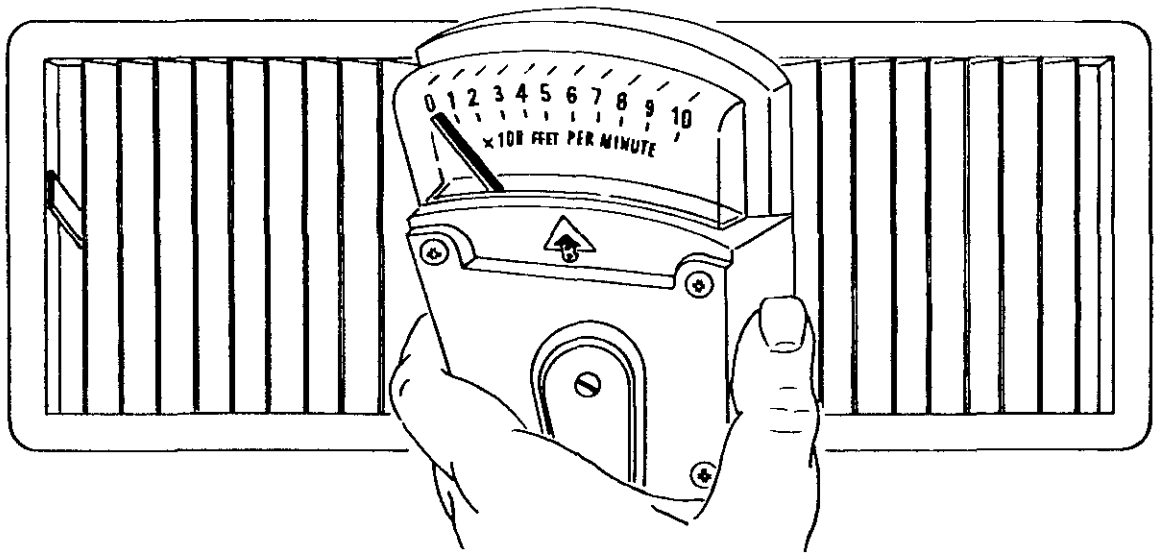
After the system has operated for about twenty minutes, check the temperature at each thermometer. Make notations of these readings. After reading the temperatures in all rooms and finding that some rooms are overheated or temperatures are higher than desired for that particular room, proceed to close the volume damper in the branch duct feeding that diffuser, or at the diffuser. (Normally, a volume control must be turned toward the closed position about 70% to 80% of its total range before it actually begins to reduce the amount of air volume through that run.)

As the air volume is slightly reduced to that room which is overheating, air will be delivered to other rooms which may have been underheated. After making an attempt at rebalancing the system by cutting down air volumes to most of the rooms that were overheating, allow the system to operate normally. This waiting period should be long enough so that all temperatures again stabilize within the building . If certain rooms are still underheated, cut down the air volume to the rooms that are being overheated until a balance has been achieved.

Remember that air follows the path of least resistance. Even though air volume is cut down in a room that is seriously overheating, this doesn't mean that additional air will necessarily go to the room that is underheating. The air might go to some other room that is of proper temperature or also overheating. Therefore, continuous checks of temperature must be made in all rooms of the building to be certain that the air is actually pushed to the areas where it is most required.

THERMOMETER AND AIR VELOCITY METER

When balancing the system with a velocity meter, start out in the same manner as outlined earlier; completely open dampers in branch ducts and diffusers, calibrate thermometers and locate them in each room. While waiting for the temperatures to level off or stabilize in the building take several readings of the air velocity from each supply outlet in the building. Make a rough sketch of the



Using the Velocity Meter

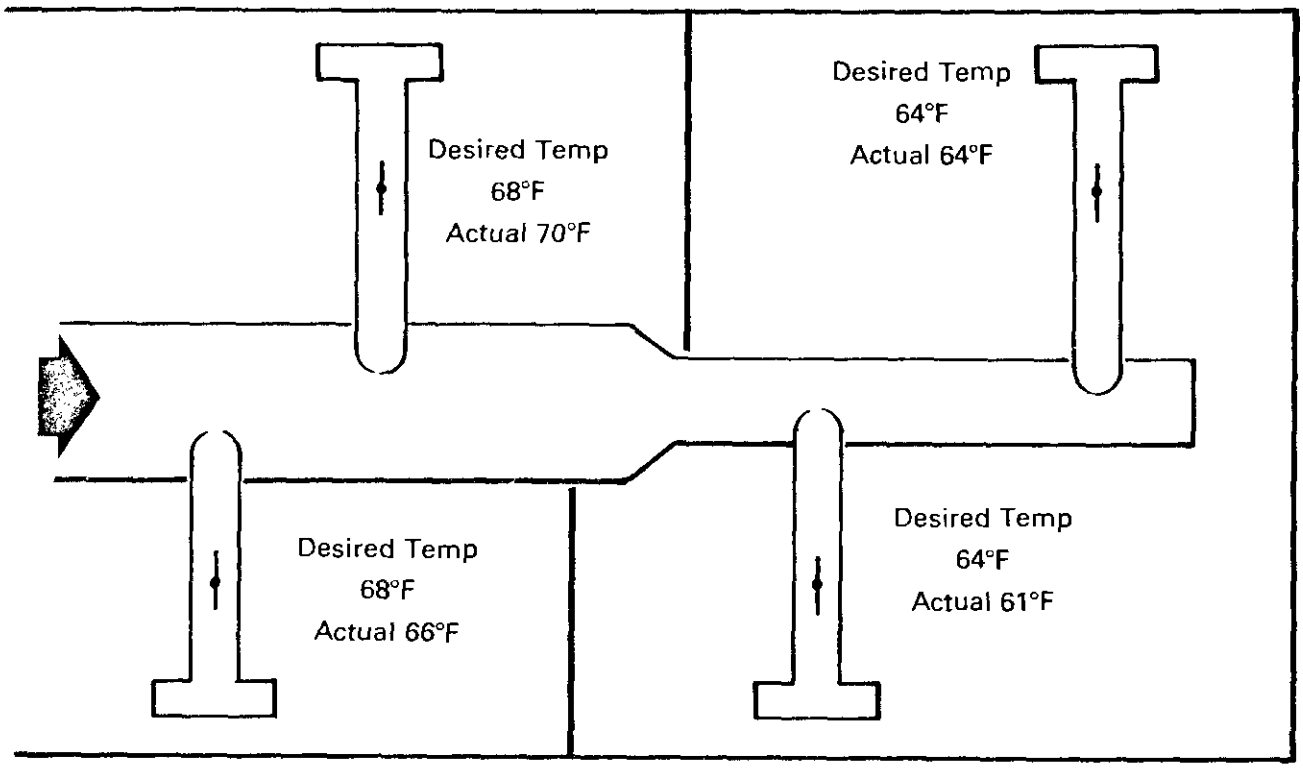
building and locate each supply outlet on the sketch. As readings are taken, write them down on the sketch. Indicate the velocity readings at each diffuser and the section of the diffuser that gave this reading. Each time thereafter when taking readings, be sure to take the readings in the same location.

After the temperatures have stabilized within the building, take a check again to see which rooms may be overheating and which rooms are underheating. Again proceed in the same manner as outlined earlier in the "thermostat method" by reducing the volume of air at the outlets which are overheating.

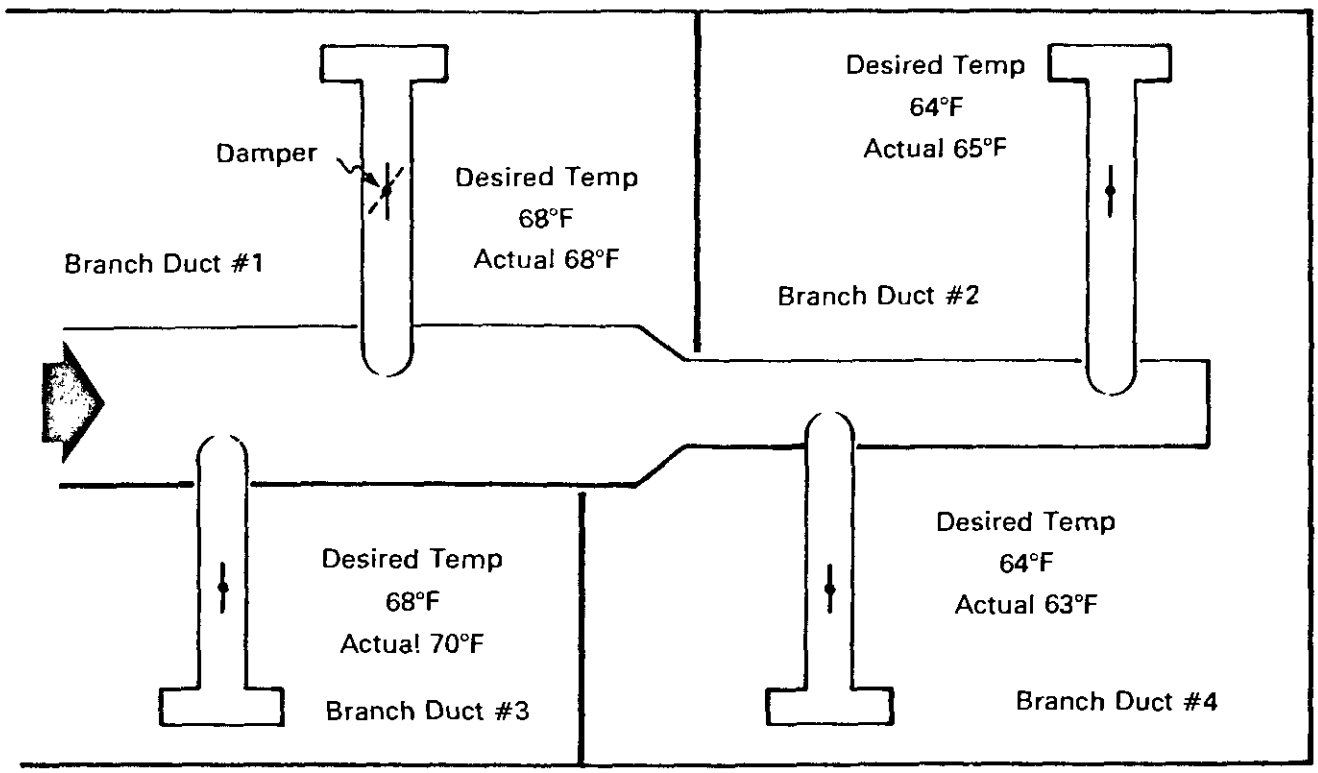
Using the velocity meter makes it much easier to know exactly how much the air volume has been reduced from that particular outlet. Refer to the sketch for the reading at the beginning of the operation. Reduce the air velocity and, therefore, reduce the volume at the supply outlet for the rooms that are overheating. Close the volume dampers about 70% to 80% in ducts to all of the overheated rooms.

A check of each supply outlet velocity determines just where the air is going. The velocity meter only gives an indication as to what is happening at each outlet. Normally, little attention is paid to the actual velocity readings.

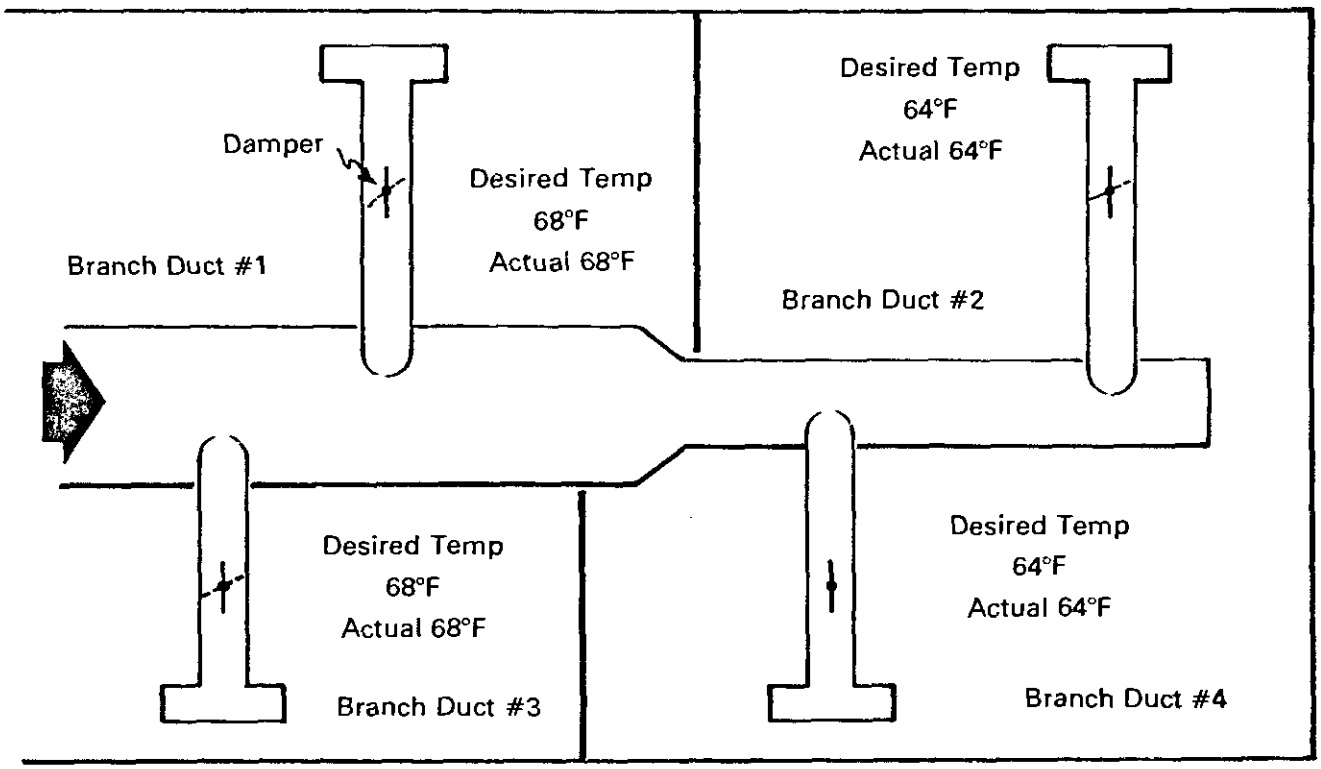
EXAMPLE OF AIR BALANCING HEATING SYSTEM



1. Take initial temperature readings with all dampers open.



2. Adjust dampers toward closed position in ducts leading to overheated rooms. See duct #1 above. Take second reading after about twenty minutes.



3. After a second temperature reading has been taken, "fine tuning" may be necessary for desired balance. See damper adjustment in ducts #2 and #3 above.

WORKSHEET

for Adjusting Air Conditioning Systems for COMFORT AIR CIRCULATION

Winter Operation

A. General Information

Homeowner's Name_____

Address_____

Date_____ Time_____

Outdoor Temperature_____

Wind: Velocity_____; Direction_____

Sky: Clear_____; Partly Cloudy_____; Overcast_____

Design Heat Loss of House_____ Btuh

Fuel Input Rate Required to Heat House_____ Btuh

Furnace Make_____

Furnace Model_____; Fuel_____

Fuel Input Rating_____ Btuh

Blower Model_____

Pulley Diameter: Blower_____; Motor_____

Motor Name Plate Data_____ hp

Volts_____; Amps: Full Load_____; Locked Rotor_____

Filters: Number_____; Size_____; Condition_____

Permanent_____; Replacable_____;

Form Completed_____

B. Furnace Adjustments	Before Adjustment	After Adjustments		
1. Limit Control Setting, F				
2. Fan Switch Setting—Cut-in, F				
Cut-out, F				
3. Furnace Blower:				
a. Blower pulley diameter, in.				
b. Motor pulley setting, in.				
4. Fuel Input Rate, Btuh				
5. Supply Duct Air Temperature, F				
6. Return Duct Air Temperature, F				
7. Air Temperature Rise, F				
8. Thermostat				

C. Room-Air Temperature Balance	Before Adjustment	After Adjustments		
9. Living Room				
10. Dining Room				
11.				
12.				
13. Kitchen				
14. Bedroom No. 1				
15. Bedroom No. 2				
16. Bedroom No. 3				
17. Bedroom No. 4				
18. Bathroom				
19.				
20. Basement				

D. Re-Check on Furnace Adjustments

(To be completed after balancing system)

21. Supply Duct Air Temperature, F_____

22. Return Duct Air Temperature, F_____

23. Air Temperature Rise, F_____

By:_____

A. General Information

Homeowner's Name_____

Address_____

Date_____ Time_____

Outdoor Temperature_____

Wind: Velocity_____; Direction_____

Sky: Clear_____; Partly cloudy_____; Overcast_____

Design Heat Gain of Structure_____ Btuh

Conditioner Data

Conditioner Make_____; Model_____

Serial No._____; Rating_____ Btuh

Blower Data	Evaporator	Condenser
Model		
Blower Pulley Diameter, in.		
Motor Pulley Diameter, in.		
Motor Pulley Bore, in.		
Belt Size		

Motor Nameplate Data	Evaporator	Condenser
Horsepower		
Volts		
Amps: Full Load		
Phase		

Compressor or Cycle Nameplate Data

Model_____; Serial No._____

KW_____; Volts_____; Phase_____

Amps: Full Load_____; Locked Rotor_____

Refrigerant: ☐ 12 ☐ 22 Amount_____ lb.

Filters: Number_____; Size_____; Condition_____

Type_____

B. System Adjustments	Before Adjustment	After Adjustments		
1. High Pressure Control Setting, psi				
2. Low Pressure Control Setting, psi				
3. Evaporator Blower:				
a. Blower pulley diameter, in.				
b. Motor pulley setting, in.				
4. Condenser Blower:				
a. Blower pulley diameter, in.				
b. Motor pulley setting, in.				
5. Return-duct Air Temperature, F				
6. Supply-duct Air Temperature, F				
7. Air Temperature Drop, F				
8. Thermostat Setting				

C. Room-Air Temperature Balance	Before Adjustment			After Adjustments								
	Dry Bulb* F	Wet Bulb† F	R H‡	Dry Bulb F	Wet Bulb F	R H	Dry Bulb F	Wet Bulb F	R H	Dry Bulb F	Wet Bulb F	R H
9. Living Room												
10. Dining Room												
11.												
12.												
13. Kitchen												
14. Bedroom No. 1												
15. Bedroom No. 2												
16. Bedroom No. 3												
17. Bedroom No. 4												
18. Bathroom												
19.												
20. Basement												

* Dry Bulb Temperature, F † Wet Bulb Temperature, F ‡ Relative Humidity

D. Re-Check on Conditioner Adjustments. (To be completed after balancing system).				
21. Return Duct Air Temperature, F				
22. Supply Duct Air Temperature, F				
23. Air Temperature Drop, F				

_____ By:_____