NORCOLD

subsidiary of the stolle corporation

DUAL VOLTAGE REFRIGERATORS

OWNER'S MANUAL

NORCOLD INC.
A Subsidiary of the Stolle Corporation
P. O. Box 180, 1501 Michigan St.
Sidney, Ohio 45365

PART NO. 613116

CONGRATULATIONS

You have purchased the best Dual Voltage Electric Compressor Refrigerator made in the world. The "Norcold", in the American tradition, utilizes only the finest materials and workmanship to build its refrigerator.

Yours sincerely,

NORCOLD INC.

READ THIS BOOK CAREFULLY TO GET THE BEST RESULTS AND SERVICE FROM YOUR REFRIGERATOR

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CAUTION

1. **OVER COOLING DRAINS YOUR BATTERY.**
   In order to avoid an excessive drain of your battery, it is advisable to keep the thermostat setting at the #3 setting position when ambient temperatures are in the 70° to 90° F. When frozen food is stored in the freezing compartment, advisable thermostat setting is the #5 setting at the same temperature conditions.
2. **MAINTENANCE OF BATTERY IS IMPORTANT.**
   If the charge of your battery is not sufficient a decline in the cooling performance of your refrigerator can be expected. If 115 V, 60 cycle, electric power supply is available, A.C. operation is recommended to keep your battery in good condition. A.C. power is AUTOMATICALLY applied, if your vehicle's 115 volt electric system is connected to the 115V. power supply.

3. NEVER EMPLOY QUICK CHARGE TO YOUR BATTERY UNLESS THERMOSTAT HAS BEEN TURNED TO "OFF".

I. LIMITED WARRANTY

The manufacturer warrants to the original purchaser the refrigerator to be sold free from defects in material or workmanship for which it is responsible. The manufacturer's obligation under this warranty shall be limited to furnishing without charge any part of the refrigerator (with the exception of the exterior finish) which the examination shall disclose to its satisfaction to be defective within one year from the date of original purchase.

The manufacturer will, for an additional period of one (1) year, provide the compressor free of charge to the original purchaser (with the exception of labor and transportation charges) from the nearest point of supply. The limited warranty does not apply to transit damage, improper adjustment, misuse, neglect, or accident.

We do not authorize any person or representative to make any other warranty or to assume for us any liability in connection with the sale of refrigerators, other than those contained herein.

Any agreement outside of, or which contradicts, the foregoing shall be void and to no effect.

The limited warranty covering your refrigerator is fully described on page 16 of this manual. Read it carefully so that you understand the provisions therein.

It is important that the warranty card located on the back cover of this manual be properly filled out and mailed to Norcold, Inc. within ten days, so that your assurance of warranty protection is in effect. This card is placed on file in our service department and is our only means of effecting the proper registration of your refrigerator for warranty purposes.

II. INTRODUCTION

Your Norcold dual-voltage refrigerator has been designed exclusively for the recreational vehicle and marine industry.

It is operable on either 12 volt, D.C. or 115 volt, A.C., and, if used properly, will offer many years of carefree operation.

Unlike the absorption-type refrigerator which requires a constant heat source for efficient operation, your dual-voltage refrigerator operates on the same principle as the standard domestic refrigerator - that is, it has an electrically-operated compressor and uses freon as its refrigerating medium.

This type of refrigeration system is much more efficient than the absorber system and offers many advantages for the recreational vehicle owner.

Therefore, it is important that you read this manual thoroughly before installing or operating your dual-voltage refrigerator for the first time so that you fully understand its operational features.

III. REFRIGERATION SYSTEM

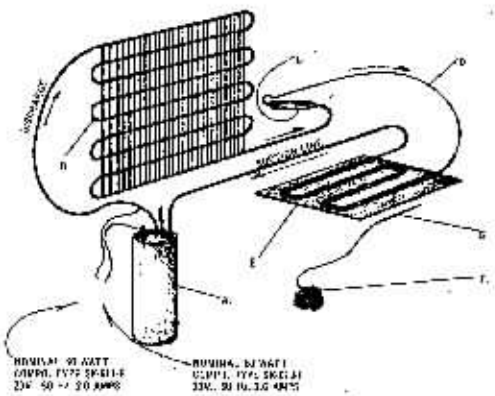

Figure 1

A. Compressor
B. Condanser
C. Dryer
D. Cap Tube
E. Evap. Plate
F. Cold Control
G. Sensing Element

Your Norcold refrigeration system consists of a swingmotor compressor, condenser, dryer, capillary tube, and evaporator plate joined to form a closed loop circulating system by means of aluminum and copper tubing, see Figure 1.

The compressor (A.), as its name implies, compresses the refrigerant gas (freon) into a high pressure gas. During this compression cycle, this gas is heated to a high temperature which must be cooled before efficient refrigeration may be expected. This cooling of the high temperature, high pressure gas is done by routing it through the condenser which is located at the back of the refrigerator.

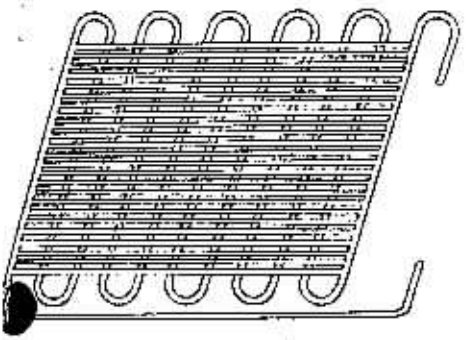

Figure 2 Condensor

This condenser (B.) is constructed of bundy steel tubing of a long length, usually formed in a continuous hair-pin loop effect to which lengths of thin wire have been welded. (See figure 2)

As the high temperature gas enters the condenser, the length of tube in the condenser and the number of wires welded to the tube join forces in dissipating the heat, allowing the gas to be cooled and converted into a liquid before entering the dryer.

The dryer (C.) performs two functions. Its primary purpose is to remove any moisture that may be in the system. This moisture, if not removed, may cause internal freezing of the capillary tube or may react with the freon to form hydrochloric acid which will cause internal corrosion, resulting in system failure.

The dryer also acts as a filter or strainer removing any particles that may cause stoppage within the small diameter of the capillary tube.

The capillary tube (D.) is a small tube having an inside diameter of .026 inches (less than 1/32 of an inch) and connects the outlet of the dryer to the inlet of the evaporator.

It has an approximate length of 8 feet and this length in conjunction with its small internal diameter combines to prevent the liquid freon from expanding and provides the resistance necessary to assure freon velocity as it enters the evaporator plate.

The evaporator (E.) is located inside the refrigerator cabinet and is the primary source of cooling the freezer and cabinet compartment.

As the liquid freon enters the larger tubes of the evaporator plate, it expands into a gaseous state. This gas then absorbs the heat within the cabinet and causes the cabinet temperature to drop or become cool.

The heat absorbed gas is then returned to the compressor where the refrigeration cycle or compression is initiated over again.

IV. THE NORCOLD SWINGMOTOR

The Norcold Swingmotor is a major step toward the simplification of mechanical refrigeration equipment. Invented by Mr. Heinrich Dölz of West Germany, the swingmotor is an electrodynamic reciprocating device that connects directly to the piston of a compressor.

In a rotating type compressor, the rotary motion of an induction motor must be converted mechanically to a reciprocating motion to compress the gas. This is done by means of a counterbalanced crankshaft, connecting rod, and a piston assembly and is similar in construction to the automobile engine.

This conversion of rotary motion to reciprocating motion involves friction at no less than four points between the contacting parts.

The swingmotor has only one point of contact - between the piston and the cylinder. Although it is a precision device, its mechanism is basically simple having few parts.

A sectional view is shown in figure 3. The coil (F) is suspended by two springs (D) in the ring gap formed between the yoke (A), pole piece (B), and the permanent magnet

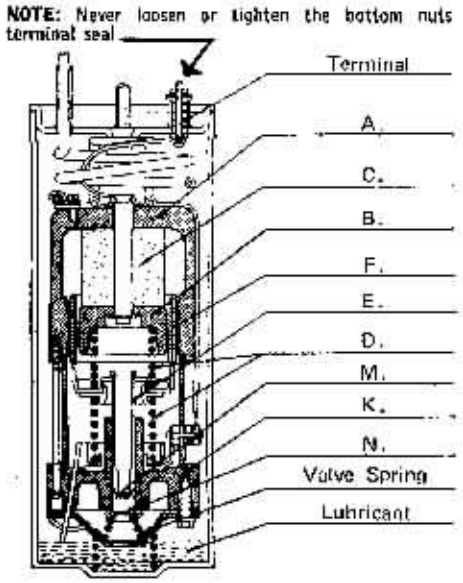

Figure 3 Compressor (Swing motor) Sectional view of compressor

(C). The piston (E) is connected to the coil (F). This piston is inserted in the cylinder (K) which allows the piston and coil to move back and forth (oscillate) without contacting the yoke and the pole piece. When the coil is connected to a 60 Hertz power supply, the coil and piston move back and forth at the rate of 60 strokes per second. An intake valve (M) and an exhaust valve (N) permit the cylinder and the piston to act as a simple pump compressing the gas in a refrigerating system. By utilizing the principle of resonance, it is possible to produce a vibration with a large amplitude at the given power frequency (in this case, 60 cycles per second).

The weight of the coil and the strength of the springs is carefully calculated to place the mechanical resonance of the system at the exact frequency of the power source, thus achieving the high efficiency. Because of this principle of operation, the swingmotor can only be used at its specified operating frequency.

The high efficiency of the electrodynamic principle and the low-friction losses provide a very low power consumption. It cannot be overloaded as can the rotary compressor, therefore, the need for a protective overload or circuit breaker is not necessary. It has a minimal starting torque and offers no interference to radio or television receivers. The low-power consumption of the swingmotor makes it ideally suitable for D.C. operation.

V. INSTALLATION

The proper installation of your refrigerator in the vehicle or marine counterpart is one of the most important steps to carefree operation. As with any appliance, there are certain installation requirements that, if followed, will eliminate service problems that could occur.

Your Norcold has been designed for installation in recreational vehicles. Unlike a domestic refrigerator, the R.V. refrigerator is subject to changing ambient temperatures, off-level and in-transit operation.

To compensate for the high ambient temperatures, both the cabinet and door of the refrigerator have been foamed in place with urethane - the ultimate in refrigeration insulation. The minimal thickness employed in the door and cabinet is two inches.

The vibration created by in-transit operation will not damage the swingmotor as its components are shock mounted. It will operate efficiently in an off-level condition as high as 30 degrees, therefore leveling of the vehicle is not required.

To assure proper operation even under the adverse conditions just described, the following steps in the installation of your unit should be followed:

1. **D.C. Supply**

   The size of the wire from your 12 volt, D.C. battery is dependent upon the distance between the refrigerator and the battery. Number 12 gauge wire should be used up to and including twenty feet and number 10 gauge wire should be used for distances in excess of twenty feet.

   It is important that the 12 volt, D.C. supply be connected directly to the positive and negative posts of the battery and that the wires are twisted or intertwined.

   If the D.C. terminal box is located at the bottom rear of the unit, then connect the D.C. supply to the terminal screws provided under the terminal cover. These

screws are marked (+) and (-) so that proper polarity may be assured.

Dependent upon the model, the D.C. supply connection may be located behind the perforated access panel at the bottom front of the unit.

Remove the 10/32 screw from the top center of the access panel and remove the panel. The D.C. terminal box is located in the invertor assembly. Remove the terminal box and connect the positive battery lead to the red wire and the negative battery lead to the black wire. These splices should be soldered or connected by means of an approved splice connector. Tape the splice connections generously before replacing the terminal cover box. This type of connection permits the battery to act as a capacitor or sponge absorbing any high voltage spikes that the vehicle alternator or generator may induce. These high voltage spikes, although not discernable on a standard voltmeter are nevertheless prevalent and will damage the transistors in the invertor. The twisting of the lead wire nullifies the induction created by high voltage surges which contribute to radio and T.V. interference.

A 30 amp fuse should be installed as close to the battery as possible in the ungrounded wire leading to the refrigerator. This fuse will protect the wiring from the battery to the refrigerator in the event of a short circuit.

115 Volt A.C. Supply

The 115 volt, A.C. supply outlet to which the refrigerator is connected should be routed through the fuse panel or circuit breaker that protects the vehicle when an outside power source is used. This will permit the automatic voltage selection relay in the refrigerator to operate properly placing the unit on 115 volt, A.C. whenever the external power cord is used, thus conserving the battery.

Installation Clearances

Your refrigerator should be located and secured on a solid surface within the vehicle.

Before installing the cabinet into the opening, check to see if the A.C. power supply cord of the unit is properly connected to the A.C. wall outlet and if the D.C. supply should be connected. In many cases, the D.C. supply can be connected from outside the vehicle by means of the baggage or access door.

4. Measure the opening to determine if you have the proper clearances for installation. Your refrigerator has been designed for recessed installation and the clearances should be: (See figure 4)
   (a) 0" on each side
   (b) 0" on the bottom
   (c) 4" minimum at the top
   (d) 2" minimum at the rear

   There is no need for allowing an area around the cabinet for additional insulation as the Norcold refrigerator is well insulated and requires no additional insulation.

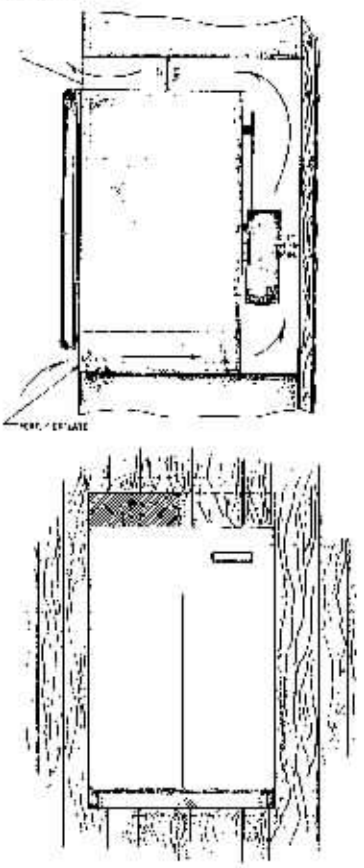

Figure 4 Installation

Place the refrigerator into the wall opening and secure it in place by fastening the mounting flange to the wall with the screws provided, or by the mounting holes located in each of the four corners of the bottom pan of the refrigerator.

VI. VENTING

Unlike the absorber refrigerator, venting is not as critical for efficient operation because the heat produced by the condenser at the rear of the refrigerator is minimal.

Please note, the perforated access panel or kick plate at the front base of the refrigerator. This panel allows air movement to flow under the cabinet and over the condenser area for cooling the refrigerant. If desired, the venting of the above air flow may be directed over the top and out the front of the refrigerator by utilizing the four-inch clearance provided during installation. This will permit venting of the unit without exterior air being required and limits the air flow to the interior of the vehicle. This is desirable during cold weather operation.

If preferred, a small louver-type vent or approximately 4" x 16" area may be installed at the top of the condenser and in the exterior wall of the vehicle for outside venting purposes.

A combination of both of the described venting installations permits the selection of interior or exterior venting dependent upon the outside ambient temperature.

VII. DUAL VOLTAGE OPERATION

The swingmotor compressor must have alternating current for its oscillating operation. At present, there are two sizes of compressors being used on Norcold units.

The 40-watt compressor is the smaller of the two and is used on Models 703-DE, and 704-DE. Its operational voltage requirement is 20 volts, A.C.

The 60-watt compressor is used on the Model 707-DE and requires 23 volts, A.C.

The low voltage used for these compressors is desirable because it provides non-hazardous electrical operation.

Please note that on either A.C. or D.C. operation the voltage to the compressor is always alternating current. This is accomplished by means of the invertor and dual-voltage transformer.

On 115 volt, AC operation, such as in the garage, on shoreline or motor generator set, the standard household, current is routed through the dual-voltage transformer and reduced to 20/23 volts, A.C.

On 12-volt operation, the D.C. is first inverted by the solid state invertor to 11 volts, A.C. (approximately 1 volt is lost in the inverting process) and then increased by the dual-voltage transformer to 20/23 volts, A.C.

Because the swingmotor cannot be overloaded, the protective fusing normally used to protect the standard rotary compressor is not required. However, to protect the electrical components such as the invertor or dual-voltage transformer, the following protective devices have been incorporated in the operating circuit.

A.C. Operation

During operation on 115 volt, A.C. current, the invertor and its immediate components are isolated from any electrical source by the automatic selection relay.

To prevent transformer failure due to short circuit of its secondary windings caused by a grounded condition, for instance, of the motor windings, the following protective device becomes effective.

Within the primary windings or high side (115V, A.C.) of the transformer is installed a bi-metallic current limiting device. Should an excessive overload occur on the secondary or low side (20/23 V, A.C.) of the transformer, this bi-metallic element will open and prevent any current flow. This protective

device works automatically to make and break the circuit. It is activated by heat and under normal load conditions of the transformer will not open. When a shorted secondary occurs, the heat created by this short causes the device to open and prevent transformer damage.

D.C. Operation

To protect the solid state components of the inverter necessitates the use of a ten-ampere in-line fuse or circuit breaker in the D.C. circuit.

This fuse is located behind the kickplate or access cover at the bottom front of the refrigerator and is mounted by means of a clip which is fastened to the right hand sway brace. This fuse will protect the invertor components such as diodes, transistors, and resistors when excessive current is drawn due to improper D.C. power supply or overload conditions. This fuse is inactive when the refrigerator is operated on 115 volts, A.C.

Battery

The battery power required for the operation of your refrigerator is dependent upon the number of D.C. appliances being used and the type of operation desired - whether remote from any power source for an extended period or overnight operation only.

A battery is a source of stored energy and is comparable to a checking account. Continuous withdrawal without sufficient deposit results in an overdrawn account.

A battery must also be sufficiently charged to prevent overdraw.

A battery is rated in ampere hours - that is, it is capable of sustaining its rated ampere capacity for a period of one hour.

If the total amperage load of the vehicle is high (25 amperes), then the installation of a 72-ampere-hour battery will not provide the required power for any length of time unless it is aided by a recharging source such

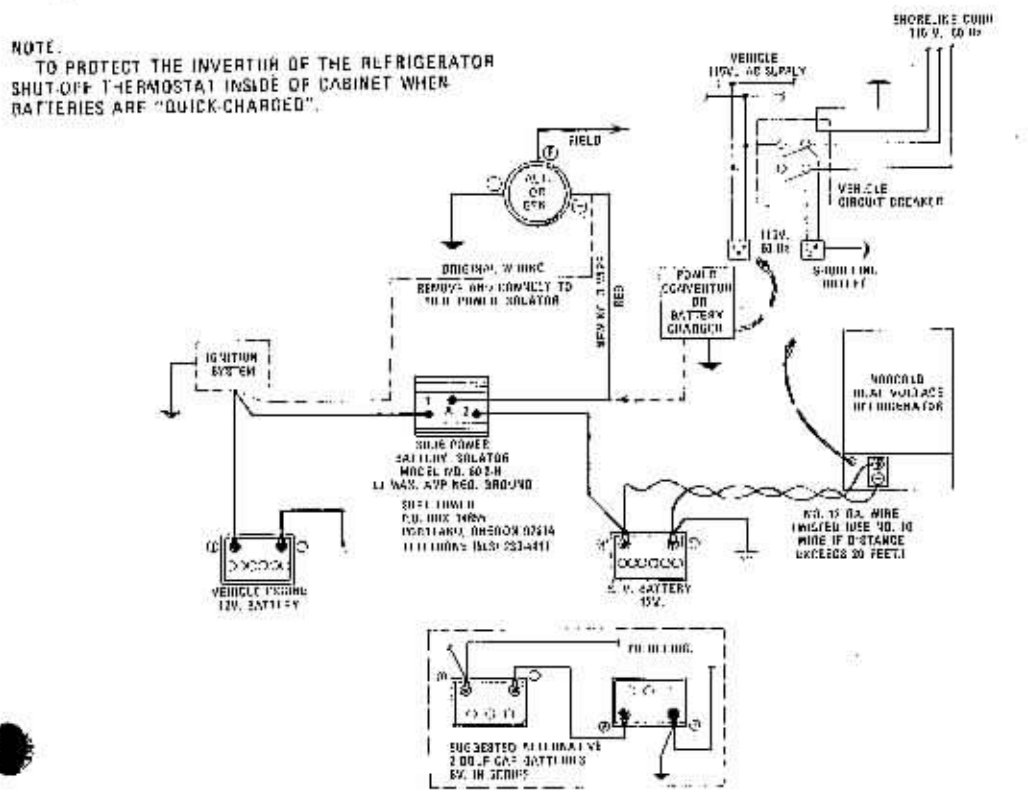

Figure 5 Dual Battery Hook-up

as an alternator or generator.

Various load requirements of the vehicle D.C. system dictate the ampere-hour capacity that should be installed.

Please refer to figure 5 for the suggested dual-battery wiring diagram. You will note that in this diagram there are two separate battery sources. One source is the vehicle or car battery used exclusively for the operation of the engine and accessory equipment such as head lights. The other source is for the operation of the D.C. appliances within the recreational vehicle. This battery source is referred to as the accessory battery and is used solely for that purpose.

Both of these battery sources are charged by one alternator or generator which is powered by the vehicle engine. This charging device should be of adequate amperage rating so that a short engine run will bring the batteries up to full charge. The standard alternator has a minimum rating of 60 amperes.

Check your voltage regulator or cut-out for correct charging level. Voltage should be 13 to 14.5 volts to the battery.

The dual battery switch or battery isolator is an important component as it permits the alternator or generator to charge both the accessory battery and the vehicle battery during operation of the vehicle engine, but limits the current draw of the D.C. appliances to the accessory battery source when the engine of the vehicle is idle or stopped, thus assuring that the vehicle battery is fully charged for starting the engine. The batteries referred to in figure 5 are two 6-volt golf cart batteries connected in series to provide 12 volts. Golf cart batteries are suggested for the following reasons:

(1) Larger plate construction
(2) Deep draw characteristics
(3) High ampere hour rating

The standard golf cart battery has a rating of approximately 185 ampere hours. When two of these batteries are connected in series, the result is 12 volt, D.C. at 185 ampere hour capacity.

The D.C. supply to the refrigerator is connected to the negative post of one battery and to the positive post of the other battery.

The power convertor or solid state battery charger shown in the diagram are essential items for battery operated systems.

The converter is operated on 115 volt, A.C. and has an output rating of 14.5 volts D.C. at approximately 50 ampere capacity. During 115 volt operation, the converter is used to charge the batteries and to operate the D.C. appliances conserving battery power. It has the capacity to operate items such as lighting, water pumps, exhaust fans, and sanitary facilities while maintaining or charging the batteries.

Your Norcold dual-voltage refrigerator automatically switches from A.C. to D.C. or from D.C. to A.C. When a power supply of 115 volts, A.C. is connected to the vehicle, the voltage selection relay is energized and disconnects the unit from D.C. operation. This unique feature assures 115-volt operation when available and permits the power converter to concentrate its charging facilities to the batteries and other D.C. appliances.

When the A.C. supply is disconnected, the refrigerator automatically reverts to D.C. operation. Turning the thermostat knob to the "off" position will prohibit operation on A.C. or D.C.

The following operating suggestions will serve as a guide in operating your unit efficiently during battery operation.

1. The thermostat dial is numbered from 1 through 5, with the number 5 setting the maximum or coldest position. In order to conserve battery power, it is advisable to set the thermostat dial at the lowest setting that will provide adequate refrigeration. This practice will reduce the running time of the refrigerator and draw less current from the battery. A setting of "3" is a normal position.
2. Always operate the refrigerator on 115 volt, A.C. when available, especially during initial start-up or pull-down cycle of the unit. Depending upon the ambient temperature, the initial start-up may require 1-2 hours of continuous operation before refrigeration temperatures are attained and unit cycling begins.
3. Never employ "quick chargers" to the bat-

tery unless the thermostat is set to "off" or the 12-volt, D.C. leads to the refrigerator are disconnected. Inverter damage will occur if the high voltage of "quick chargers" is permitted to energize the D.C. circuitry of the inverter.

4. The use of a commercial 12-volt, D.C. to 115-volt, A.C. output solid state inverter, convertor, gasoline, or belt-driven generator with 115-volt, A.C. output is not recommended for operating the refrigerator unless the manufacturer of the aforementioned devices guarantee the output voltage to be 120-volts, A.C. plus or minus 10 percent and the frequency to be 60 Hertz plus or minus 1 Hertz. Devices that cannot meet the specified tolerances do not hold the required frequency, provide poor performance of the refrigerator, and damage the resonance springs in the compressor.
5. When connecting the refrigerator to the D.C. supply, observe the correct polarity. If the polarity is reversed (positive connected to negative terminal), the in-line fuse will open or "blow" and the unit will fail to operate. Damage to the inverter may also occur.

VIII. THERMOSTAT

A single thermostat controls the operation of the refrigerator on A.C. or D.C. This thermostat is mounted at the rear of the cabinet with the control knob at the upper right and to the rear of the freezer compartment. The knob is marked "Off, 1, 2, 3, 4, and 5". The nearer the dial is set to "5", the colder the temperature becomes in the cabinet.

There is no need to readjust the setting of the thermostat for dual operation. Once the desired temperature is reached, the thermostat will control the cabinet temperature equally well on either voltage supply.

IX. INITIAL START-UP

Before operating the refrigerator for the first time, check to see that the A.C. and D.C. supply connections are correct and that the thermostat is turned to the "Off" position.

Connect the vehicle to the external power supply of 115 volts, A.C. Turn the thermostat knob to the number "3" setting. The unit should be operating. If the compressor motor cannot be heard, place your ear against the outside of the refrigerator door. This procedure will enable you to determine if the swingmotor is operating.

Allow approximately two minutes of operation and open the freezer compartment door. Place your hand at the right rear corner of the evaporator plate. This is the area of the evaporator that will begin cooling first. If you notice a cooling effect at this point, then the unit is functioning properly.

Close the refrigerator door and allow the refrigerator to operate on A.C. until it cycles or shuts itself off. This indicates the thermostat is operating and that the refrigerator is cooling on A.C. operation.

Now, disconnect the A.C. supply and open the refrigerator door so that the cabinet interior will warm up and allow the thermostat to demand cooling. As soon as the unit compressor begins to operate, close the refrigerator door allowing the unit to run. It should shut off or cycle within 10 to 20 minutes indicating the D.C. operation is correct.

X. TROUBLE SHOOTING YOUR REFRIGERATOR

There are basic steps in trouble shooting the Norcold dual-voltage refrigerator that, if followed, make problem pinpointing a simple process.

The three major component assemblies that will prevent operation are:

1. The compressor and system assembly
2. The inverter-transformer assembly
3. The thermostat

The description of these component assemblies follows. Please read this description carefully as it will be of valuable assist-

ance in pinpointing the type of failure incurred, should your unit fail to operate correctly.

1. **Compressor and System Assembly**
   This assembly consists of the swingmotor compressor, condenser, dryer, capillary tube, and evaporator plate. The individual function of each of these components is described in detail under "III Refrigeration". After these components have been connected to form a closed loop or circulatory system, this system is then put under high pressure testing by charging it with dry nitrogen gas and completely immersed in a water test tank to determine if any leaks are present.

   The system is then thoroughly dried and put under a rigid evacuation process through use of an efficient vacuum pump. This evacuation places the system under a negative pressure devoiding it of air, moisture, and to other contaminants.

   Once the required vacuum is attained, the system is then charged with a measured amount of refrigerating gas Freon — R-12 (Dichloro-Difluro-Methane) and sealed to form a non-contaminated, closed system through which the freon is recycled over and over again during the refrigeration process.

   Should a leak occur at any time in this system which allows the freon to escape, then the refrigerating capabilities of the system are terminated.

   A common symptom that the system has a leak is that the compressor runs continuously, but no cooling is obtained.

2. **The Inverter-Transformer Assembly**
   This assembly consists of a dual voltage transformer, an automatic voltage selection relay, and a solid state inverter.

   The inverter is in operation on D.C. only and its only function is to invert the 12 volt D.C. power supply to 11 volts A.C.

   The dual voltage transformer assures that the correct A.C. voltage (20/23 V., A.C.) is supplied to the swingmotor compressor.

   The automatic relay selects the voltage supply (A.C. or D.C.) and isolates one from the other so that the intermingling of the two different supply voltages is not possible.

3. **The Thermostat**
   This item is an adjustable temperature cold control that senses the temperature within the refrigerator and maintains it at the desired setting.

   Should this control fail, it may produce two different reactions.

   (a) The refrigerator will not operate and the unit will begin defrosting, or

   (b) The unit will not cycle, but will run continuously with the result that refrigeration temperatures are extremely cold, in some cases, causing foodstuffs such as milk, soft drinks, or other liquids to freeze.

Trouble shooting your refrigerator becomes much easier if the conditions of operation with relation to the malfunction are known.

An inoperative unit, dependent upon what component has caused the malfunction, has certain symptoms; that, if known, will facilitate repairs. These symptoms are:

1. **Compressor runs continuously on either voltage supply, but no cooling is obtained.** This indicates the system has a leak causing refrigerant loss, or the compressor is faulty. In either case, the system must be replaced.
2. **Compressor runs continuously on either voltage supply and cabinet temperature is extremely cold.** In this case, the thermostat is at fault. Check the capillary bulb of the thermostat. It is located under the evaporator and should be secured directly to the evaporator plate by means of a metal fastener. This tube should have a plastic sleeve and must contact the plate directly. If this capillary tube is intact and the plastic sleeve is in place, then the thermostat is faulty and should be replaced.
3. **Compressor does not operate on either voltage.** If this condition exists, perform the following checks:
   (a) Check the voltage supply (A.C. D.C.) to assure the correct voltage is being applied to the refrigerator.
   (b) Turn the thermostat knob to the

maximum position of "5".

(c) Remove the rubber protective cap from the terminal on top of the compressor. Make sure it is properly connected. At this time, also check the ground wire to see that is is securely fastened.

(d) Check the circuit breaker located at the right front and bottom of the refrigerator. This circuit breaker effects D.C. operation only.

If steps "A" through "D" are performed and the unit still does not operate, then the thermostat may be defective.

Remove the thermostat cover located at the rear or at the inside of the cabinet. Also, remove the gray thermostat lead and bridge the two ends of the lead with a suitable strip of metal; such as a paper clip or a hair pin. (Note: If the unit is plugged into 115 volt A.C. outlet, disconnect the supply cord before performing this step, because on A.C. operation, the thermostat lead is energized by 115 volts and could be hazardous, do not disconnect green ground wire.)

If the unit runs after the lead has been shorted, then the thermostat should be replaced.

4. **Compressor runs on A.C. but not D.C.** Before assuming that the inverter assembly is defective, check the following:

(a) D. C. connections at the rear of the cabinet to see if polarity is reversed.

(b) If connections and polarity are correct, take a voltage reading. It should read 12 volts, D.C., indicating the battery is fully charged.

(c) Short the thermostat leads. It may be that the thermostat contacts are dirty or pitted, permitting the high potential A.C. to flow but restricting the low potential D.C. Clean the contacts or replace the thermostat.

(d) If the above steps do not provide operation, then remove the transformer-inverter assembly from the bottom of the cabinet. Plug the power supply cord into a 115 volt A.C. outlet. Upon doing so, note the voltage selector relay. When A.C. is applied to the refrigerator you should hear a discernible "click" of the relay. If this "click" is not audible, check the relay movable contact section. When the A.C. supply is removed, the movable contact armature of the relay should relax, indicating that the D.C. circuit is closed.

(e) If the relay is operating normally, then the inverter or transformer is defective. This procedure for ascertaining the defective component should be referred to an authorized service center.

5. **The compressor runs on D.C. but not A.C.** Make the following checks for the malfunction.

(a) Check the A.C. voltage supply.

(b) Using an A.C. voltmeter, check the voltage at the compressor by placing one probe of the voltmeter at the compressor terminal and the other probe to the ground wire. Your voltmeter should read 20 volts A.C. if you have the Model 703-DE, 704-DE or 726-DE, and 23 volts if you have a Model 707-DE, 727-DE or 728-DE.

(c) If you don't get a voltage reading at this check, be sure the voltage selector relay is being energized.

(d) If the above steps do not provide operation, then the dual voltage transformer should be replaced.

6. **The compressor operates on A.C. but not on D.C. and unit cycles intermittently regardless of thermostat position.**

(a) This is an indication that one or both of the transistors in the inverter are shorted, creating an excessive load on the secondary of the dual voltage transformer. This load causes the bi-metallic element in the primary of the transformer to open and close causing intermittent operation of the unit. Both transistors should be removed if continued A.C. operation is desired to prevent transformer failure.

The following pages contain additional trouble shooting procedures not covered by the preceding paragraphs.

XI. TROUBLE SHOOTING

(A) INSUFFICIENT COOLING

To be Checked on AC Operation

SYSTEM	CAUSES OF FAILURE	METHOD OF FINDING	REMEDY
Compressor (Swing motor) does not run	Thermostat (cold control) Gas leaks	Pinched or broken capillary tube, leak in bellows. Turn the dial up and down (CW & CCW) At some point a click should be heard and the compressor should start. If no click is observed the cold control is defective.	Change the thermostat
	Defective contacts	Check continuity of circuit and contacts with tester.	Clean contacts or change thermostat
	Open or short circuit in swing motor	Measure the resistance (Ω OHMS) between the motor terminal and the ground, 0.9± 10% OHMS denotes normal function.	Exchange compressor
	Power cutoff	1.) Blown fuse in wall receptical outlet 2.) Broken wire in power supply cord 3.) Bad connections to transformer 4.) On DC: Circuit breaker is tripped or fuse is blown	Replace fuse Repair cord Repair Reset circuit breaker.
	Transformer burn-out	1.) Transformer shows burned spots at input or output lead wires. 2.) Transformer has typical "Burn-out smell". 3.) Output on secondary voltage is zero or "Dead Short" to ground. 4.) Transformer is cold, even when power is applied.	Exchange Transformer
Swing motor runs	Loss of refrigerant through pipe connections or welded parts. Broken refrigerator lines. Broken wires on condenser, the seal of the electric terminal on top of the compressor has been broken when the two bottom nuts were tightened up or loos-	If the customer reports: " it gradually ceases to cool the refrigerator or it takes longer to freeze ice cubes " Then the most common cause is a refrigerant leak **SIGNS OF REFRIGERATOR LEAK ARE:** 1.) The compressor runs too hot and constantly (no cycling on cold control). 2). Compressor draws more than 2.5 amps and less than 20 volts from transformer. (Voltage Drop) 3.) The condensor top half or the compressor discharge tube stays cold, same as room temp.	1.) If warranty is still in effect the refrigerator should be returned under the condition of the warranty to the factory. 2.) Authorized refrigerator

(A) INSUFFICIENT COOLING

SYSTEM	CAUSES OF FAILURE	METHOD OF FINDING	REMEDY
Swing motor runs (Cont.)	ened. (Never move these two nuts when removing or installing wire harness)	4.) Refrigerator compartment is too warm. 5.) Evaporator plate does not show frosting when unit is running for approximately 20 minutes with open door. 6.) No freezing of ice cubes. 7.) Oily spots tend to appear on tubing, condenser drier, etc. or on the table below the machine compartment.	service personnel could find the leak, repair, evacuate and recharge the system. 3.) Change refrigerator system.
	System "Freeze-up" or clogging	If there is app. no leak or loss of refrigerant, the compressor is running constantly and is very hot, and the refrigerator compartment is too warm and no freezing of ice cubes then a sudden freeze-up or clogging has occured. **SIGNS ARE:** 1.) The condenser is not warm or hot, stays at room temperature. 2.) The compresser draws less then 1.5 amps at 20 volt from transformer. 3.) Evaporator plate warm. **CAUSES:** 1.) Moisture freeze-up at the outlet of the capillary tube into the evaporator. 2.) Particles obstructing the inlet of the capillary tube in the drier. 3.) Capillary tube leading from the drier to the evaporator is pinched. 4.) Unclean system (gunk or residue blocking passage of refrigerant through the small capillary tube).	1.) Shut-off compressor, let system cool down, start up, let run for 5 minutes, shut off, start-up after 5 minutes. If the condenser does not become warm and the evaporator plate inlet does not become cold, then repeat cycling. 2.) Return refrigerator under warranty conditions. 3.) Authorized service personnel can flush, evac. change drier, and recharge system. 4.) Change refrigerator system.

TROUBLE SHOOTING

(A) INSUFFICIENT COOLING

SYSTEM	CAUSES OF FAILURE	METHOD OF FINDING	REMEDY
Swing motor runs (Cont.)	Insufficinet heat radiation of condenser	1.) Ambient temperature is over 110°F. 2.) Refrigerator is placed in direct sunlight. 3.) The back of the refrigerator is placed directly against a wall or other objects (leave 3" of space all around the refrigerator for air circulation. 4.) Refrigerator is placed too close to a heat source (Radiator, oven, warm air duct or outlet, etc.) 5.) Condenser is plugged-up with lint or dust particles.	1.) Change location of refrigerator. 2.) Brush or vacuum condenser.
(B) REFRIGERATOR TOO COLD			
Compressor runs constantly	Thermostat "sticking"	1.) Contact points of cold control are pitted. 2.) Contact points are welded together, could occure after a transformer burn-out, due to high current draw.	Clean points or replace control
	Short circuit	Short circuit across cold control terminals or bare wires in wiring harness touching each other or touching ground.	Check with tester & insulate parts.
	Sensitive element	Thermostat bulb loose on evaporator plate mounting.	Tighten screws
	Installation and maintenance	See "Adjustment of thermostat"	
(C) ABNORMAL LOUD NOISE			
Abnormally loud noise during operation.	Resonant floor	Table or floor boards loose or too thin.	Move to better location
	Loose parts in machine compartment due to transportation	Check installation of each part after receiving unit.	Tighten screws
	Touching of tubes and parts	Bend carefully tubes and wiring in different location.	
Transportation and lifting	Mounting springs of compressor	A metallic sound-clicking-may be heard when the refregerator is moved or tilted or pushed. This is not a defect.	Explain to customer

TROUBLE SHOOTING

(D) OTHER DEFECTS

SYSTEM	CAUSES OF FAILURE	METHOD OF FINDING	REMEDY
Electricity leaks	Electricity leaks or insulation break downs can occur through "aging" or using the refrigerator in extreme ambient temperature or heavy-duty continued use.	1.) Measure the insulation resistance (OHMS) between terminal post and ground. A possible leak or break down exists, if the reading is below 1 megohm. 2.) Accumulation of dust or dirt or grease or water spots on the insulated terminal post or rubber cap can invite electricity leaks.	Disconnect wiring harness from compressor and test resistants Clean parts
Excess frost built-up evaporator	Overloaded storage of refrigerator compartment	If too much food is stored in the cabinet the cooling air from the evaporator can be blocked, this preventing proper air circulation.	Adjust food storage, leave air passage or space.
	Frost and ice built-up on evaporator	1.) Ice and frost are bad heat conductor. Frost built-up of more than ¼ inch should be avoided. It decreases over all cooling capacity and increases power consumption. 2.) Never put hot or steaming food in the refrigerator.	Defrost refrigerator (set to "Defrost") remove water from evaporator and and drip pan.
No cooling after first initial installation and first start up	During shipment and storage of regriferators, compressor oil stays in evaporator	Handling, shipping and storage can cause uneven distribution of lubrication oil.	Run compress for 5 minutes, shut off for 3 minutes, start up for 5 minutes, shutdown for 3 minutes, start up again.

NORCOLD, INC.

1121 Weddington St.
North Hollywood, Calif.
91601

1501 Michigan St.
P. O. Box 180
Sidney, Ohio 45365

1620 West Bristol St.
Elkhart, Indiana
46514

COMPRESSOR SERIAL NO. .....

MODEL NO. ..... CABINET SERIAL NO. ..... PURCHASE DATE .....

LIMITED WARRANTY

This limited warranty is given by NORCOLD, INC., a California corporation (hereinafter referred to as "Norcold"), to the original purchaser of any new refrigerating equipment (hereinafter referred to as "the equipment") supplied by Norcold, and will be effective as from date of original purchase. Norcold warrents (provided that the equipment shall at all times have been in the possession of and used by the original purchaser) that:

Norcold will provide free service and replacement of any defective parts at no charge at its shop locations in North Hollywood, California; Elkhart, Indiana; and Sidney, Ohio, and all authorized Norcold service points for a period of one (1) year from date of original purchase, with the exception of transportation which will be limited to ninety (90) days after date of original purchase. Norcold will, for an additional period of one (1) year, provide the compressor free of charge to the original purchaser (with the exception of labor and transportation) from the nearest point of supply.

Norcold shall not be liable under this limited warranty for any of the following:

A. Defects which in the opinion of Norcold arise by reason of misuse, neglect, or accident.
B. Defects in glassware, electric light bulbs or any other such fittings.
C. Defects arising from improper installation or adjustment of the equipment.
D. Defects arising from the improper use of parts in the course of repairs and/or replacements to the equipment.
E. Labor to remove and reinstall the refrigerator.
F. Transit damage.

Norcold shall not be liable for consequential loss or damage arising from any cause whatsoever.

The employees and agents of Norcold have no authority to vary the terms of this limited warranty.

This limited warranty applies only to equipment installed in the United States of America and Canada.

Norcold reserves the right to make any improvements, changes in parts and models, or changes in price without notice.

Implied warranties of merchantability and fitness for any particular purpose shall not extend beyond the duration of the foregoing Express Limited Warranty.

ITEM NO.	DESCRIPTION	DE-726		DE-704		DE-707		DE-727		DE-728	
		Quan.	Part No.	Quan.	Part No.	Quan.	Part No.	Quan.	Part No.	Quan.	Part No.
1	Refrigeration Unit	1	613679	1	613679	1	613749	1	613749	1	613686
2	#8 x 3/8 Sht. Mtl. Scr.		611109		611109		611109		611109		611109
3	#8 x 1" Sht. Mtl. Scr.		611834		611834		611834		611834		611834
4	#8 - 32 x 3/8 Mach. Scr.	2	611617	2	611617	2	611617	2	611617	2	611617
5	Thermostat Bulb Holder	1	612569	1	612569	1	612569	1	612569	1	612569
6	#8 - 32 Hex Nut	2	611565	2	611565	2	611565	2	611565	2	611565
7	#8 x 1 1/2 Sht. Mtl. Scr.		611870		611870		611870		611870		611870
8	#10 Washer	3	613263	3	613263	3	613263	3	613263	6	613263
9	Rubber Bumper	3	612351	3	612351	3	612351	3	612351	6	612351
0	Back Cover Plate	1	612912	1	612912	1	611249	1	614078	1	614078
1	Blind Cover	1	613545	1	613545	1	613750	1	613750	1	613555
2	Snap Bushing	1	613468	1	613468	1	613468	1	613468	1	613468
3	Clamp — Electric Cable	1	613469	1	613469	1	613469	1	613469	1	613469
4	Inverter	1	613678	1	613678	1	613685	1	613685	1	613685
5	Bottom Trim Spacer	1	613677	1	613677	1	613672	1	613672	1	613672
6	Bottom Trim	1	613525	1	613525	1	613603	1	613603	1	613603
7	Mounting Clip	1	613404	1	613404	1	613404	1	613404	1	613404
8	Kick Plate	1	613499	1	613499	1	613500	1	613500	1	613500-21
9	6/16 Nylon Tube Clamp	1	613888	1	613888	1	613888	1	613888	1	613888
:0	Wiring Harness	1	251326	1	251326	1	251311	1	251311	1	614111
:1	Bottom Hinge Nut Plate	2	613535	2	613535	2	613535	2	613535	2	613535
:2	Shelf Clip	2	613882	2	613882	3	613882	3	613882	2	613882
:3	Hinge L.H.		613529		613529		613529		613529		613529
:4	Hinge Pin	2	611146	2	611146	2	611146	2	611146	2	611146
:5	1/4 Alum. Tube Clamp	1	613889	1	613889	1	613889	1	613889	1	613889
:6	#10 24 x 1/2 Thd. Cutting Screw		613805		613805		613805		613805		613806
:7	Thermostat Knob	1	613639	1	613639	1	613639	1	613639	1	614097
:8	Thermostat Mounting Plate	1	613637	1	613637	1	613637	1	613637	1	613637
:9	Hole Plug	1	613261	1	613261	1	613261	1	613261	1	613261
0	Thermostat	1	613640	1	613640	1	613640	1	613640	1	614082
1	Shelf Clip	2	613660			2	613660	2	613660	2	613660
2	Nylon Hole Plug	5	613092	5	613092	5	613092	5	613092	5	613092
3	Hinge R.H.		613528		613528		613528		613528		613528
4	#10-16 x 1" Tek Scr.		613879		613879		613879		613879		613879
5	Side Breaker Strip R.H.	1	613832	1	613843	1	613845	1	613847	1	613819-21
6	Foamed Cabinet Ass'y.	1	613616	1	613753	1	613745	1	613757	1	613621
7	Top Breaker Strip	1	613536	1	613536	1	613614	1	613614	1	613614-21
8	Side Breaker Strip L.H.	1	613833	1	613844	1	613846	1	613848	1	613820-21
9	Evap. Door Gasket	1	613309	1	613309	1	613309				
0	Handle	1	613215	1	613215	1	613215				
1	Complete Evaporator Door Ass'y.	1	613306	1	613306	1	613307			1	614127
2	Door Frame — Bottom Cap	1	613508	1	613508	1	613515	2	613515	2	613515-24
3	Hinge Cover & Rivnut Ass'y.	1	611557	1	611557	1	611557				

ARTS LIST
DE-707, DE-727, DE-728

ITEM NO.	DESCRIPTION	DE-726		DE-704		DE-707		DE-727		DE-728	
		Quan.	Part No.	Quan.	Part No.	Quan.	Part No.	Quan.	Part No.	Quan.	Part No.
44	Double Hinge Pin							1	613384	1	613384
45	Single Dr. Travel Latch Ass'y. L.H.	1	614089	1	614089	1	614089				
46	Double Dr. Travel Latch Ass'y. L.H.							1	614091		
47	Double Dr. Travel Latch Ass'y. R.H.							1	614090		
48	Single Dr. Travel Latch Ass'y. R.H.	1	614088	1	614088	1	614088				
49	#8 x 3/4 Sht. Mtl. Scr.		611682		611682		611682		611682		611682
50	Hinge Bushing	3	611592	3	611592	3	611592	7	611592	8	613127
51	#6 x 1/2 Sht. Mtl. Scr.		611686		611686		611686		611686		614136
52	Door Frame — Top & Sides	1	613509	1	613737	1	613708				
53	Complete Door Ass'y.	1	613510	1	613736	1	613710				
54	Door Rail	6	613131	5	613131	5	613132	7	613132	7	613132
55	Door Rail Trim	2	613447	2	613447	2	613448	3	613448	3	613448-2
56	Door Gasket	1	613507	1	613736	1	613700				
57	Foam Tape	2	613587	2	613584	2	613585				
58	Foam Tape (Breaker Strip)	120"		106"		130"		130"		146"	
			613480		613480		613480		613480		613480
59	Crisper	1	613497	1	611644	1	613377	1	613377	1	613377-2
60	Glass Shelf	1	613518			1	613376	1	613376	1	613376
61	Ice Cube Tray	2	612192	2	612192	2	612192	2	612192	4	612192
62	Drip Tray	1	613502	1	613502	1	613378	1	613378	1	613378-2
63	Wire Shelf	1	613082	1	613082	2	613089	2	613089	2	613089
64	Shelf Trim	1	613452	1	613452	2	613452	2	613452	3	613452-2
65	Plastic Rivet							2	613880		
66	Divider Foamed Ass'y.							1	613408	1	613495
67	Egg Shelf Door Rail					2	613133				
68	Complete Lower Door Ass'y.							1	613717	1	614107-2
69	Complete Upper Door Ass'y.							1	613766	1	614108-2
70	Lower Door Gasket							1	613720	1	613514-0
71	Upper Door Gasket							1	613773	1	613620-0
72	Lower Door Frame — Top & Sides							1	613722	1	613516-2
73	Upper Door Frame — Top & Sides							1	613772	1	613521-2
74	Foam Tape (Lower Door)							2	613584	2	613599
75	Foam Tape (Upper Door)							2	613585	2	613598
76	Decorative Door Trim (Lower Door)									1	614138
77	Decorative Door Trim (Upper Door)									1	614137
78	Hole Plug									1	614165
79	Rod Ass'y.									1	614159
80	Cam									1	614156
81	Screw									1	614155
82	Lock									1	614152
83	Clip									1	614154
84	Key									1	614153

LIMITED WARRANTY REGISTRATION CARD

Cabinet Serial No. 5623 G.E. Model .....
Customer's Name (Block Letters) .....
Address .....
.....
The appliance specified above was purchased:
..... day of .....19 .....
Dealer's Name .....
Address .....
Purchased As: ( ) Original Equipment ( ) Replacement
Type of Installation:

( ) Commercial .....
Type of Business
( ) Residential .....
Room
( ) R. V. .....
Length of Vehicle and Manufacturer's Name
( ) Marine .....
Length of Boat and Manufacturer's Name

TO INSURE THAT YOUR REFRIGERATOR IS REGISTERED FOR WARRANTY PURPOSES, THIS CARD MUST BE COMPLETED AND RETURNED TO US WITHIN TEN (10) DAYS OF PURCHASE.

LIMITED WARRANTY REGISTRATION CARD

Cabinet Serial No. 5623 G.E. Model .....
Customer's Name (Block Letters) .....
Address .....
.....
The appliance specified above was installed and left in good working order on:
.....day of..... 19 .....
Dealer's Name .....
Address .....

THIS PORTION TO BE RETAINED BY DEALER FOR RECORD PURPOSES.

NORCOLD

subsidiary of the stolle corporation

Printed in U.S.A.

7-75

PLACE
STAMP
HERE

NORCOLD INC.
REGRIGERATION WARRANTY DEPT.
P. O. BOX 180, 1501 MICHIGAN ST.
SIDNEY, OHIO 45365