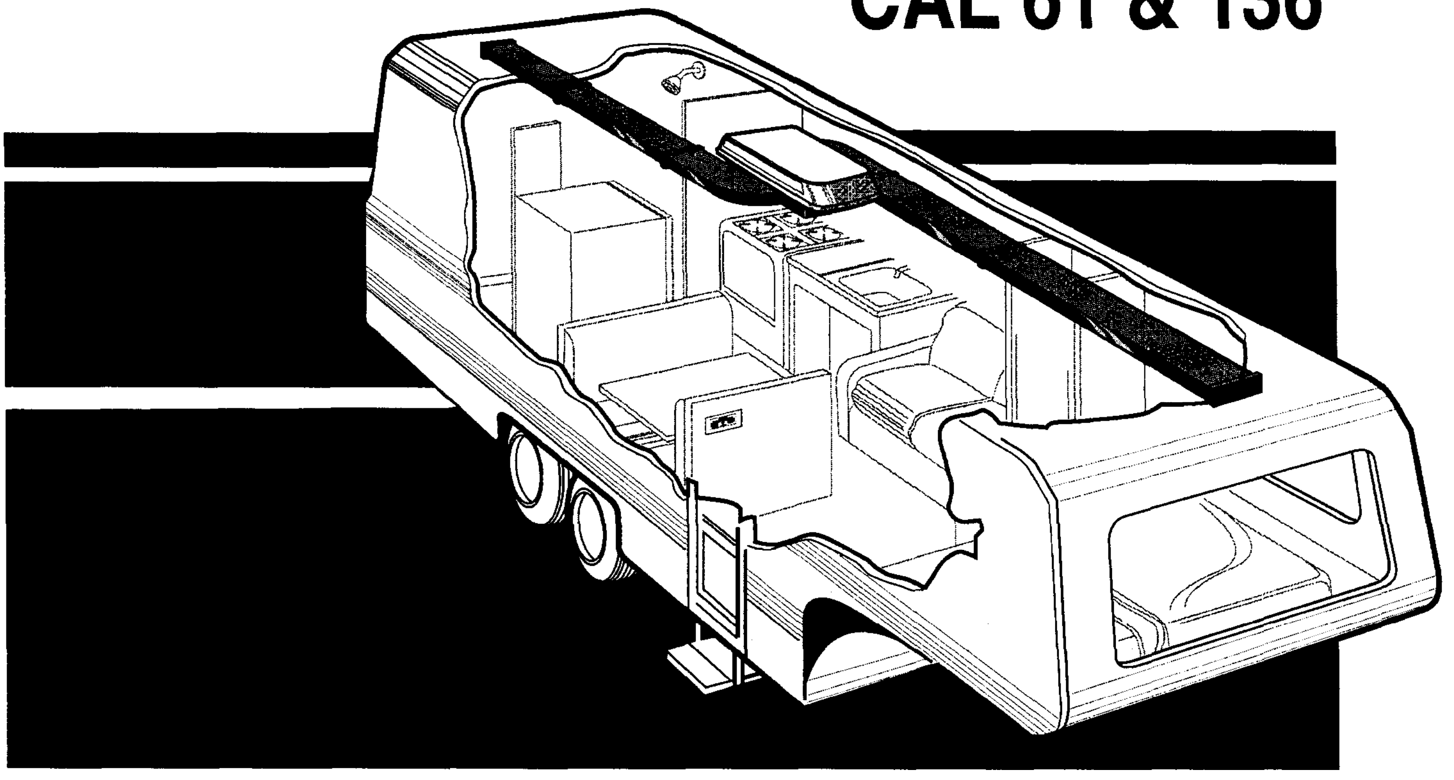
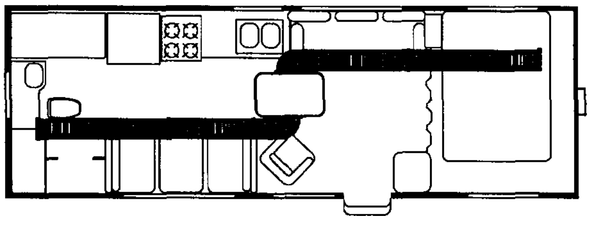
# Application Manual

Electrolux

## CAL 61 & 136





# *Ducted Air Conditioning Systems*

Form No 3105865.004 3194

LaGrange, IN 46761

# APPLICATION MANUAL

## DUCTED AIR CONDITIONING

# 1 .O AIR DISTRIBUTION

## ■1.1 GENERAL INFORMATION

The purpose of an air conditioning system is to provide environmental conditions in a space to keep its occupants comfortable.

The basic elements of a simple forced circulation air system consists of a cooling unit, a centrifugal blower, a temperature sensing device controlling operation of the compressor and blower, suitable air filters, and a duct system.

Air is filtered, cooled, and distributed to various areas of the vehicle. Duct work should deliver this conditioned air as directly, quietly, and economically as possible. If the distribution is not properly sized and balanced, flow of air will not be as calculated and the system will not function properly or efficiently.

## ■1.2 THE BASIC AIR CONDITIONING CYCLE

The components which are basic to air conditioning systems are illustrated by figure 1. Air is treated at the conditioning unit, transferred to the conditioned space through the supply duct system and returned to the conditioning unit through the return system. The duct systems are also referred to as the distribution system.

## ■1.3 FUNCTION OF A DUCT SYSTEM

A duct is a tube, or pipe, that carries air between two points. Strictly speaking, in air conditioning terms, a duct system is the arrangement of ducts between air conditioning equipment and rooms to be cooled, not including such items as filters, cooling coils, etc. However, we shall include in our use of the term "duct system", every item in the air-passage network that offers resistance to air flow. From the standpoint of the blower it makes no difference whether a resistance is caused by filters or by the use of a small duct; effect will be the same. Resistance tends to restrict flow of air through the entire system.

A forced air system is only as good as its air delivery system. Comfort levels are affected by the quantity and velocity of air movement within the space and the proper mixing of the supply air with the space air. Supply air should be furnished in a manner that will direct the air to the sources of the greatest heat loss and/or heat gain. The effects of the gain or loss can then be offset by the supply air. It is important that the selection of the diffusers and grills for the supply and return systems receive careful attention to enable them to accomplish their purpose.

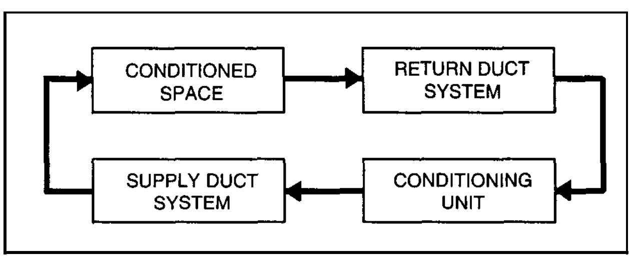
Consideration must be given to all aspects of the supply air distribution patterns: throw, spread, drop, etc. Also, the outlet and return grille velocities must be held within reasonable limits. Any noise generated at the grille is equal to or greater in importance than duct noise.

A window air conditioner (figure 2) is essentially a device with a minimum duct system, since the only items that offer resistance to air flow are built into the cabinet.

## ■ 1.4 FACTORS AFFECTING RESISTANCE TO AIR FLOW

Common observations of daily events tell us something about factors affecting resistance to air flow. We know, for example, that more pressure is required to force a given rate of air flow through a small duct than through a large duct. We also know that streamlining of ducts means less resistance to air flow, and that sharp angled turns must be avoided.

As air passes through ducts, cooling coils, grilles, diffusers, and dampers, the static pressure is reduced by friction and turbulence losses. Good duct design minimizes the need to balance the duct system by sizing the ducts such that the designed pressure drop allows the desired airflow rate to be delivered to each room. An improperly sized duct system will require extensive balancing. Balancing is a procedure by which the air flow allotment is adjusted to supply the correct quantity of conditioned air to each room.




**Block diagram of comfort air conditioning cycle.**
**Arrows indicate direction of air flow.**
FIG. 1

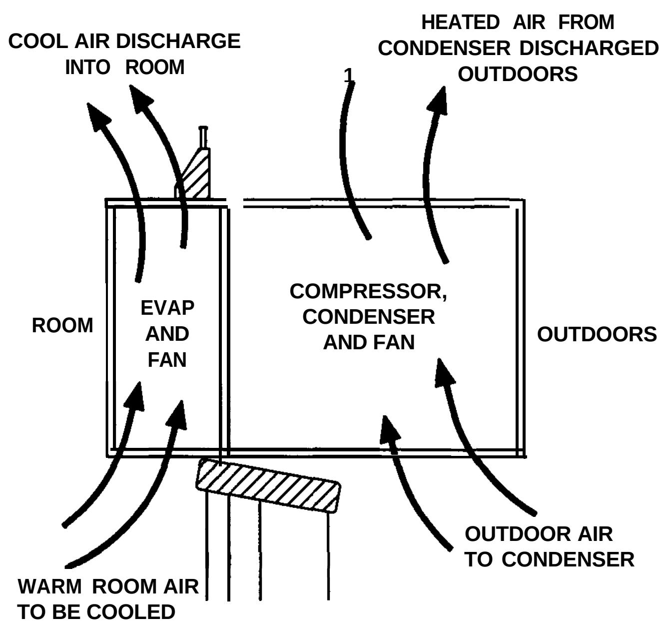



**FIG. 2**

**The Window Air Conditioner represents a minimum duct system, since air to and from the cooler is handled without external ducts.**

## ■1.5 AIR FLOW AND FRICTION

Air flows in a duct system from a region of high pressure to a region of lower pressure. The blower creates the pressure differential which causes the air flow through the duct system. The point of highest pressure in the system is at the outlet of the blower. The point of lowest pressure in the system is at the return opening of the blower. The air pressure constantly decreases as the air flows through the system. The pressure ultimately diminishes to zero as it passes through the register and is diffused into the conditioned space. As air moves through a duct, a pressure drop occurs due to the friction between the air and the walls of the duct. Another factor in pressure drop is the turbulence within the air stream itself. Air moving within a duct does not flow in a placid stream. Rather it moves in a churning and mixing path, or "turbulent flow." The cumulative effect of rubbing friction and turbulence friction is friction loss. Air turbulence in a duct system becomes substantial whenever there is a change in the direction of air flow.

## ■1.6 ECONOMICS OF DUCT DESIGN

In order to match to the system air delivery capacity, elbows for turning the air must be kept as large as allowed by the roof construction. Duct depth for Electrolux air conditioners may vary with each model series. Confirm the series of air conditioner to be installed and refer to Page 6, Figure 10, for specific duct configurations required. High loss elbows must have their resistance lowered by the use of splitters or turning vanes. Refer to figure 3.

By proper application of these splitters, the friction loss of the elbow will approach that of a standard elbow. From the construction standpoint, if throat radius (Ra) is less than 64 m, it is better to use a square turn elbow with appropriate turning vanes. Refer to figures 4-6.

Another factor in duct losses is air leakage. Although leakage is not considered in duct design it should be an installation consideration. Cold air leaking into the roof cavity will cause condensation to form on the ceiling under high humidity conditions. Sealing all joints will assure moisture free ceilings and maximum distribution of air to the outlets.

In most cases of high resistance encountered in duct systems, one or more of the following points have been overlooked by the installer:

A. **Small** Diameter

Pressure losses increase as diameter of a duct is reduced. Good design practice is that which enables the installer to put in the smallest size duct that will do the job of delivering required airflow rate with pressure available. No single size of duct will prove to be ideal for all jobs.

B. Length of Duct

Pressure loss increases as duct length is increased. This is almost obvious; a duct which is 6 m long has twice the pressure loss of one that is 3 m long, provided that both ducts are the same size and both are carrying the same airflow rate.

C. **Changes in Direction Figure 7)**

Pressure losses increase when direction of air flow is changed. When air is forced to make a 90" turn in a duct system, pressure loss is much greater than for a straight run of the same length.

**Item 1.** This sharp-angled bend causes a large pressure loss. A simple way of visualizing such pressure loss is to imagine that these diagrams represent highways on which you are driving a car. As you approach a bend you are forced to slow the car speed to 25 km/h. In so doing, a considerable part of energy of the fast-moving car has had to be absorbed by the brakes. The analogy holds for air particles flowing around a sharp bend.

**Item 2.** This sharp-angled bend on the inside corner causes great pressure loss. The rounded corner on the outside does not help as much as might be anticipated.

**item 3.** This is a common form of 90" bend that has relatively low resistance.

**Item 4.**

If minimum resistance is desired, this extreme example of a smooth, streamlined fitting can be used, although space requirements will be prohibitive in many installations.

**Item 5.** Occasionally, a beam or rafter prevents the use of a smooth bend and a rightangle bend is necessary. In such cases the use of turning vanes (splitters) will be effective in reducing resistance.

**Item 6.** Another way to reduce resistance is to change type (3) to a modified version of type (4) by inserting splitters in the sharper bend.

**D. Sudden Contraction**

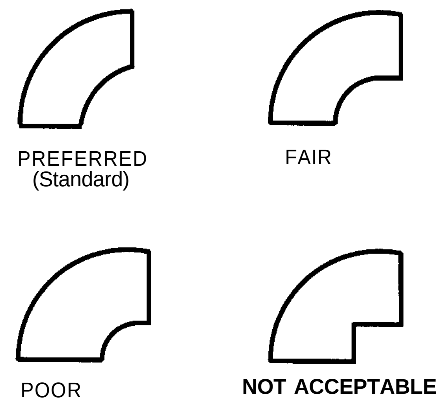
When air is suddenly contracted from a large duct to a small duct, a pressure loss occurs (Figure 8 ).

**E. Sudden Expansions**

The pressure loss resulting from the sudden expansion of air from a small duct to a large duct, are much larger than losses due to sudden contraction. As with sudden contraction, much can be done by making air expansion gradual, rather than abrupt. (Figure 9).

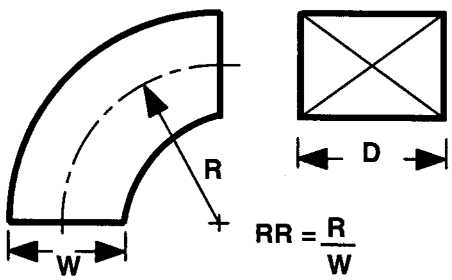
To summarize Section 1.6, the following items contribute to higher pressure losses in a duct system:

1. Smaller diameter ducts
2. Longer duct lengths
3. Changes in direction of air flow
4. Sudden contractions in air stream
5. Sudden expansions in air stream



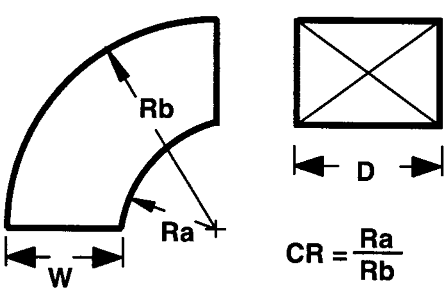

Various Elbows Showing Radius Ratios

**FIG. 3**



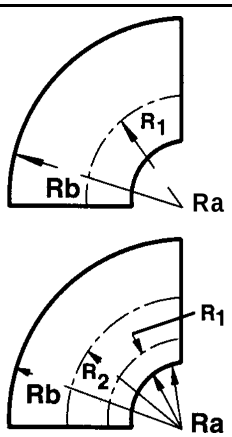

Radius Ratio (RR)
orRR=1.5

**FIG. 4**




Curve Ration (CR)
Optimum Reading CR = **.05**

**FIG. 5**




$CR = \frac{Ra}{Rb}$

R1 =2Ra

CR = .25

$CR = \frac{Ra}{Rb}$

R1 = 2 Ra

$R2 = \frac{(Rb - R1)}{2} + Ra$

CR = .15

**FIG. 6** Using Splitters to reduce resistance.

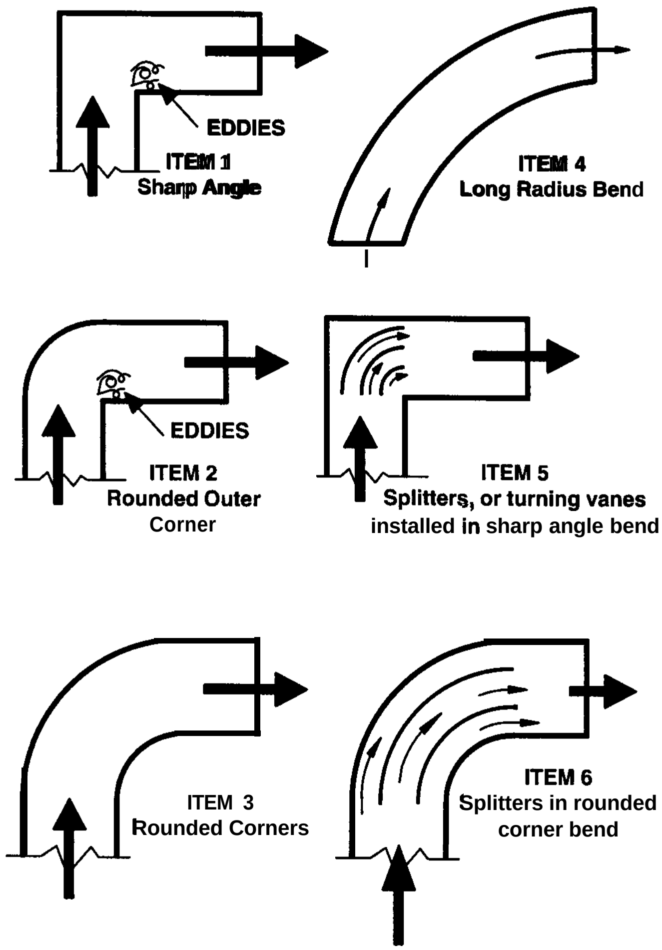



**FIG. 7**

Different ways of making a 90 degree bend. Some involve greater pressure losses than others.

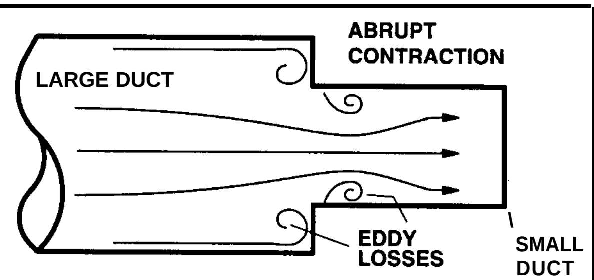



**FIG. 8**

Pressure losses occur with abrupt reducing fittings.

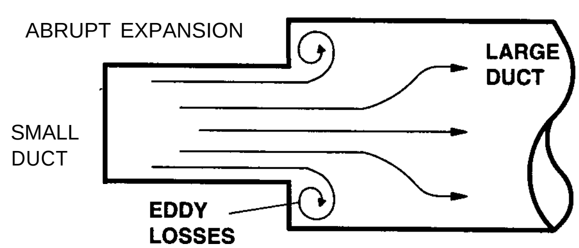



**FIG. 9**

Abrupt expansion results in excessive pressure losses.

## ■1.7 REGISTERS, DIFFUSERS, AND GRILLE SELECTION

One of the most important considerations in designing a conditioning system is the selection of the registers, diffusers and grills. Even though a system delivers the required amount of conditioned air to the room, discomfort results if the air is not satisfactorily distributed. Achieving good air distribution is as much an art as it is a science. Careful consideration must be given to the design of the air distribution system. A forced air system is only as efficient as its air delivery components.

Whenever a jet of conditioned air is admitted into a room it affects all the air within that room. Movement of the supply air induces adjacent room air to move along with it. This process of the supply air dragging along the room air and setting it in motion is called “entrainment” of the room air. As the room air mixes with the supply air, the temperature difference between them is reduced. This effect is even more pronounced with a spreading jet than with a non-spreading jet because of the greater surface area.

## ■1.8 ROOM AIR DISTRIBUTION

The final evaluation of air distribution in a space is determined by the occupants’ comfort. In general, a person is thermally comfortable when their body heat loss just equals their heat production.

During cooling, currents carry warm air up the wall to ceiling level, and stratification forms from the ceiling down, The solution is to project cool air into this region near the ceiling.

Performance of any supply outlet is related to initial velocity and area. As it leaves the outlet, an air jet becomes a mixture of supply and room air, expanding due to the induction of room air.

The buoyant forces with non-isothermal jets cause the jet to rise during heating and drop during cooling. If the jet is projected parallel to and within a few inches of a surface, the jet performance will be affected by the surface, which limits the induction on the surface side of the jet. This creates a low pressure region between the jet and the surface, which draws the jet toward the surface. In fact, this effect will prevail if the angle of discharge between the jet and surface is less than $40^{o}$. The surface effect will draw the jet from a ceiling outlet to the ceiling. Surface effect increases the throw for all types of outlets and decreases the drop for horizontally projected air streams. The air stream from the outlet tends to “hug” the surface. As a matter of fact, this characteristic is almost essential for good comfort air conditioning. Therefore, rather than trying to direct the air away from surfaces, the surfaces should be used intentionally. Note that where the surfaces are used most effectively, the high velocity portions of the air stream have less tendency to enter the occupied zone of the space.

## ■ 2.0 HOW ROOM AIR MOTION IS RELATED TO OUTLET PERFORMANCE

The room air near the supply air stream is entrained by the air stream and, in turn, is replaced by other room air. The room air always moves toward the supply air. The only general statement that can be made regarding room air motion and the number of air changes is that 8 to 10 air changes per hour are required to prevent formation of stagnant regions.

For most applications, a better approach is to supply air in such a way that the high velocity air stream from the outlet does not enter the occupied zone. It is practical to consider the region within 30 cm of the walls as outside the occupied zone as well as the region above the heads of the occupants.

Supply air should be spread in a thin layer over the surfaces, to surround the occupied zone with conditioned air. Air within the occupied zone will then move toward the total air stream, the mixture of primary and room air. The room air carries the load with it into the air stream and room conditions are maintained by constant mixing of room and supply air.

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# 3.0 SPECIFICATIONS & REQUIREMENTS

## ■ 3.1 GENERAL INFORMATION

**Following are precautions that should be taken into account before installation of this equipment.**

**! WARNING**

**Improper installation may damage equipment, could endanger life, cause serious injury and/or property damage.**

A. Read all installations and operating instructions carefully before starting installation.

B. Electrolux will not be liable for any damages or injury incurred due to failure in following these instructions.

C. Installation MUST comply with the National Electrical Code and any State or Local codes or regulations.

D. DO NOT add any devices or accessories to this air conditioner except those specifically authorized in writing by Electrolux.

E. This equipment must be serviced by qualified personnel and some countries require these people to be licensed.

F. It is the responsibility of the Manufacturer to insure the installed duct work complies with their national or appropriate agency standards.

This guide is for the installation of Electrolux ducted air conditioning systems and should be used when the recreational vehicle is constructed by the original manufacturer. The purpose for a ducted air conditioner is that the original manufacturer has the flexibility of installing this component to an air distribution system integrally installed within the ceiling/roof cavity of the recreational vehicle. For air conditioning installation after the vehicle is complete, contact your local Electrolux Distributor or Dealerforceiling mounted air distribution systems.

Since it is necessary to install all or part of the duct work in the ceiling, **it is the resoonsibility of the R.V. manufacturer to assure the structural integrity of the roof and any reinforcement that mav be required.** Additionally, they are responsible that the duct material meets or exceeds any vehicle listing agency standard or R.V.I.A. standard that may be in existence at the time that the vehicle is produced.

The R.V. manufacturer should review each floor plan to determine proper duct layout, register and thermostat placement. Each coach floor plan will require its own placement and layout for duct work, registers, and thermostat to insure that they do not hinder the performance of the air conditioner system.

**The minimum roof cavity thickness for proper installation measured between the roof and ceiling structure is 45 mm. This does not include space required for insulation of the duct work.**

The air conditioner was designed to allow flexibility for layout of duct work and the types of registers employed. To insure air conditioner maximum performance, certain parameters must be adhered to. Refer to figure 10 for duct sizing and grill placement.

### ■ 3.1.1 UNIT SPECIFICATIONS

Refer to the installation instructions provided with your air conditioner.

### ■ 3.1.2 COOLING REQUIREMENTS

When determining the cooling requirements of each vehicle, the following should be considered:

A. The size of the vehicle will determine the number of air conditioning units that are required or the need to pre-wire for additional air conditioners depending on the geographical location of use.

B. Amount of insulation in walls and roof of the R.V.

C. Identify possible heat sources and plan accordingly:

1. Skylights - location should not be within 1.2 m of the air conditioner return system.
2. Skylights - should be tinted and double pane.
3. Roof vents (355 x 355 mm) should be a tinted type, and quantity kept to minimum.
4. Increased use of slide-outs and/or glass square footage will require tinting with additional insulation in wall and ceiling structures.
5. Calculation of heat producing appliances.

### ■ 3.1.3 LOCATING AIR CONDITIONER ON ROOF

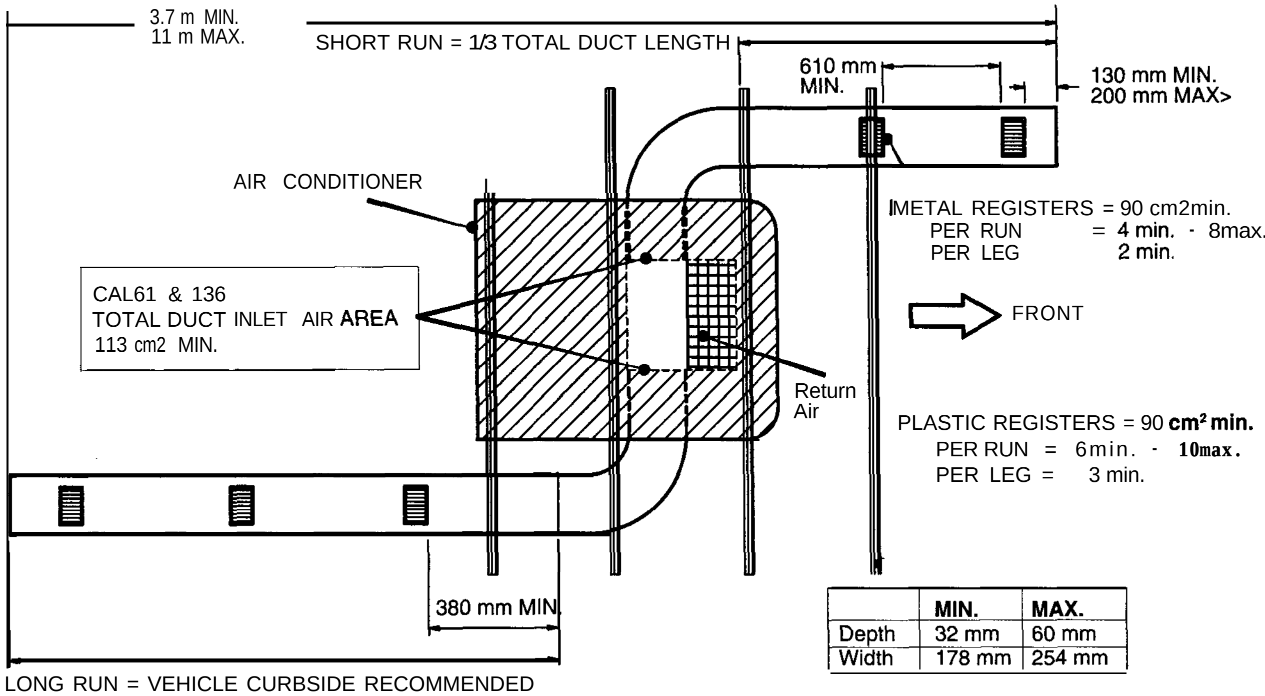
The air conditioner is designed to fit over a roof opening that is 355 x 355 mm. This opening must be located between roof reinforcing members. In some applications where the roof does not provide adequate support 6.5 mm plywood should be placed around the outer edges of the opening under the roof material.

This opening is part of the return air system and must be finished with metal flashing in accordance with your national fire protection agency standards and standards for Recreational Vehicles.

For those vehicles that require only one air conditioner, mounting should be slightly forward of center so that duct lengths may remain equal. Since most vehicles will be utilized in extreme climate conditions (above 38°C), it is highly recommended that all vehicles over 10 m feet have at least two (2) air conditioners installed. This will insure balanced cooling of the vehicle.

For those vehicles requiring two systems install one air conditioner in the rear 1/3 and the other in the front 1/3. If the air conditioners are to be mounted on a pitched roof, verify permissible mounting angle allowed for the air conditioner model selected.

**FIG. 10**




| | MIN. | MAX. |
|---|---|---|
| Depth | 32 mm | 60 mm |
| Width | 178 mm | 254 mm |

**FIG. 11**

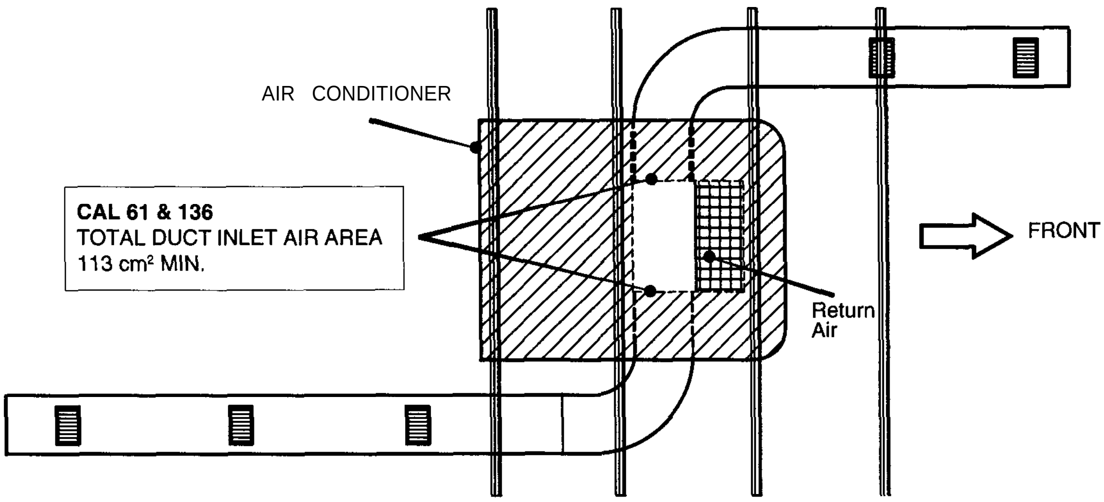
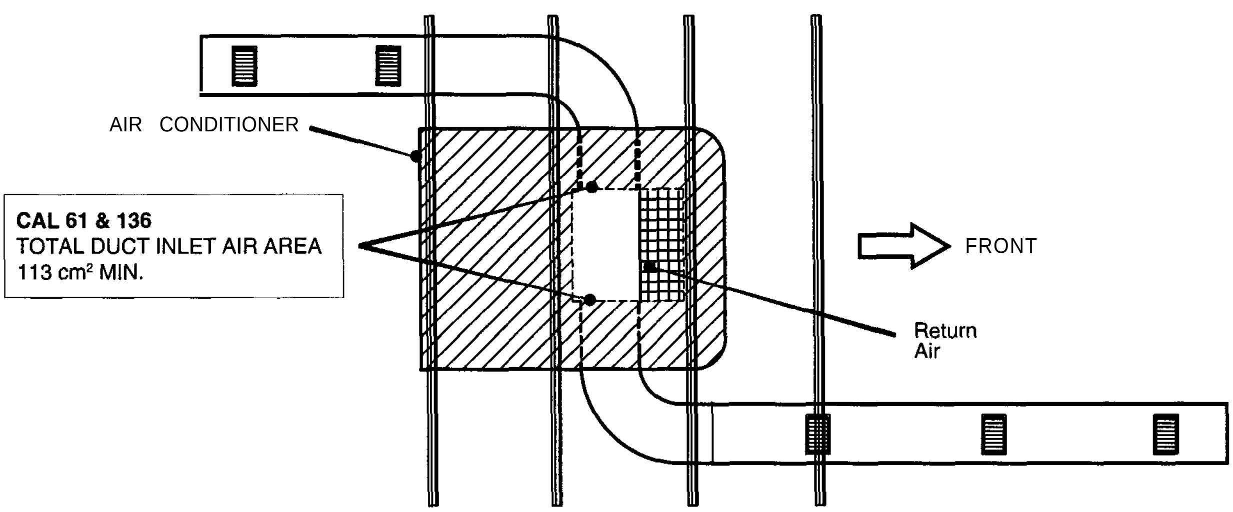



**FIG. 12**



## ■ 3.2 AIR DISTRIBUTION SYSTEM SIZING

The installer of this air conditioner must design the air distribution system for his particular application by following the guidelines specified within this application manual and unit installation instructions. Several specific requirements MUST BE met for the air conditioner to operate correctly:

1. Unit Total Static Pressure (in. W.C.)

   **CAL 61 & 136:**

   **0.12 – 0.65**

2. Total Minimum Duct Inlet Required. •

   CAL61 & 136

   32 x 178 mm each side

   113 cm2 total

* See Page 6, Fig. 10, for Maximum allowed.

3. Return air to the air conditioner must be filtered to prevent dirt accumulation on the evaporator cooling surface.

4. Return air opening must have 260 cm2 minimum free area. This figure must include the filter material selected.

5. Since a portion of the duct work is located within the roof structure it is necessary that all duct work must be wrapped with a minimum R7 insulating blanket with a vapor barrier. This will help prevent heat gain within the duct and possible condensation in the roof cavity.

NOTE. **ELECTROLUX WILL NOT BE HELD LIABLE FOR ROOF STRUCTURAL OR CEILING DAMAGE IF THE DUCT WORK IS NOT ADEQUATELY WRAPPED IN AN INSULATION BLANKET.**

## ■ 3.3 AIR DISTRIBUTION DUCT PREPARATION

Depending on the distribution configuration, ensure that the air entry points have the minimum cm2 required for the series of system installed. See figures 11 and 12 for permissible duct layouts. Duct elbows and/or restrictions must be kept to a minimum. The arrangement of the distribution system will determine the proper location for the openings within the 355 mm x 355 mm mounting hole. The duct must be pre-built within the roof structure and sealed along its entire length. If joints or bends leak conditioned air within the roof cavity, condensation will form on the ceiling.

When the duct is installed within the roof structure, measures must be taken to insure that the duct will not collapse or bend during or after installation of the air conditioner to the vehicle. Weight limitations must be calculated for any accessories that may be added to the roof by the end user (storage pods, satellite dishes, etc.) as well as proposed attachment methods. In addition, consider personnel that may walk on the roof structure during construction or follow up product service.

If the vehicle is a fifth wheel, the changing of the roof line must allow for the conditioned air to alter direction without adding restriction to the duct. A small plenum may be required at each turning point to allow the air to move freely.

## ■ 3.3.1 LOCATION OF DISTRIBUTION DUCT

The location of the duct will be dictated by the vehicle itself and the placement of interior components. One must be sure that the registers will not fall near the thermostat or the return filter. The placement must be such that the air distribution from the registers will provide the best possible movement within the living space area. Calculations should be made as to the strength of the roof, to insure rafter and roof integrity when notched for location of the duct runs.

Since the application of this system can fit multiple roof configurations the installer may be required to modify or provide an air diverter to separate the supply air from the return air. With the duct and air conditioner installed measure from the interior ceiling surface to the base pan of the air conditioner. This is the required height of the diverter and sealing gasket. Material used for the diverter must be insulated to prevent condensation in the return area. Care must be taken in the design and assembly of this air diverting device so that interference with the return filter and decorative component is not possible.

## ■ 3.4 RETURN AIR REQUIREMENTS

The return air system of the air conditioner is located within the 355 mm x 355 mm opening, and should be taken into account during the preparation of the duct configuration. The Electrolux Cover Kit No. 3104765.007 fulfills the required 260 cm2 of area specified in section 3.2. The return filter is included within the plastic arrangement.

## ■ 4.0 THERMOSTAT REQUIREMENTS

Refer to the installation instructions provided with your specific model.

## ■ 4.1 THERMOSTAT LOCATION

The proper location of the thermostat is very important to insure that the air conditioner will perform satisfactory for the consumer. If mislocated the comfort level desired will not be obtained. Observe the following general rules when selecting the proper location:

1. Locate it approximately 1-1/2 m from the floor.

2. Install on an inside partition, not on an outside wall. Do not locate near doors that lead outside, windows, or adjoining outside walls.

3. Never expose it to direct sunlight or from any heat source (example: cook stove, microwave oven, sun, above furnace cabinet or duct work, etc.).

4. Never locate in a room that will be warmer or cooler than the rest of the coach.

5. Avoid locations near the supply grilles or within the direct flow of their discharge air.

6. Do not locate on refrigerator cabinet wall.

## ■ 4.2 THERMOSTAT CABLE, REMOTE SWITCH, AND THERMOSTAT INSTALLATION

See installation instructions included with your unit for proper method and requirements for your specific air conditioner.

## ■ 5.0 ELECTRICAL INSTALLATION

See installation instructions included with your unit for proper method and requirements for your specific air conditioner.

## ■ 5.1 HI-POT REQUIREMENTS

Each air conditioner that is built by Electrolux is completely checked electrically and hi-pot tested on our production line. Additional hi-pot testing of the air conditioner must not be done. Disconnect the air conditioners from the power circuit prior to any vehicle high potential test operations.

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(6.0 Application Final Check List continued on next page . . .)

# 6.0 APPLICATION FINAL CHECK LIST

COMPANY NAME: ______________________________ DATE: ______________

COMPANY ADDRESS: ______________________________

CITY: ________________ COUNTRY: ________ ZIP: ______________

ATTN: ____________________ TITLE: ________________________

It is recommended that the Application Manual be used prior to installation of an Electrolux ducted air conditioning system. The Application Manual may be obtained by contacting your Electrolux Sales Representative or Electrolux Sales Department. This inspection sheet does not cover or warranty the final installation of the duct work that carries conditioned air within the ceiling cavity. The installer is responsible for the integrity of the insulated duct within the ceiling structure. If proper practices are not adhered to, condensation will collect on ceiling panels during high ambient conditions. **DAMAGE CAUSED BY CONDENSATION WILL NOT BE COVERED BY ELECTROLUX WARRANTIES.**

**Model** ______________ **S/N** _____________ Complete form per each A/C system checked

## ROOF CAVITY PREPARATION

Yes No
[ ] [ ] Cold air side of plenum totally sealed.
[ ] [ ] Duct inlets into roof cavity are sealed.
[ ] [ ] Roof area is sealed from conditioned air.
[ ] [ ] 113 cm2 minimum total area from plenum into ducts per a/c model.
[ ] [ ] Roof opening- _______ **W x** ______ L x ________ H (**4.4** cm minimum)
[ ] [ ] Power supply line is routed to proper area of roof opening.
[ ] [ ] Bi-Metal Thermostat wire routed properly and using adequate wire size (**22** Ga. Min.)
[ ] [ ] All wiring routed correctly and protected from damage.
[ ] [ ] Roof design will support minimum weight per unit instructions.

## DUCT CONFIGURATION INFORMATION

[ ] [ ] Duct maintains minimum dimension through total run.
Actual duct size (I.D.) ________H x _________W
[ ] [ ] Duct wrapped (or pre-insulated) with minimum insulation - R7 all sides with vapor barrier.
[ ] [ ] Rounded corners in duct at supply outlet. If no, explain.
[ ] [ ] Manufactured duct design and layout. (Please sketch)
[ ] [ ] Recommended duct configuration per Application Manual.
[ ] [ ] Minimum leg length in either direction - 1/3 total duct length.
[ ] [ ] Longest leg of duct run to curbside of vehicle.
[ ] [ ] Duct length - _________m roadside ________m
(Min. total duct length 3.7 m - Max. total duct length 11 m)

## UNIT PREPARATION

**Yes No**

[ ] [ ] A/C inspected when unpacked to ensure no damage in shipping.
[ ] [ ] A/C is handled properly from carton to the roof of the vehicle.
[ ] [ ] When placed on roof, unit is lifted in place ensuring a proper seal.
[ ] [ ] Unit location is minimum distance allowed from objects.
[ ] [ ] Any adjustments made from inside coach are done without damaging drain pan.
[ ] [ ] Air conditioner electrical conduit plugged in correctly.
[ ] [ ] Junction Box cover installed.
[ ] [ ] Installation operating instructions and warranty data are placed within the vehicle.
[ ] [ ] Unit disconnected prior to vehicle hi pot operation.

## POWER REQUIREMENTS

[ ] [ ] 220/240V wiring circuit is of adequate wire size per the installation instructions (1.5 mm2)
Size used _______Gauge wire length_____________
[ ] [ ] Circuit provided with proper time delay fuse or circuit breaker per installation
[ ] [ ] Bi-Metal Thermostat -wiring is of proper size (22 Ga. min.)
[ ] [ ] Generator is of adequate size ________KW
[ ] [ ] System checked in all modes of operation to verify performance.

## REGISTER INSTALLATION INFORMATION

[ ] [ ] Locations within requirements of Application Manual.
[ ] [ ] Each register measured open area 91 cm2 or greater.
- - - - - Metal registers -Total________ used. Plastic-________used.
[ ] [ ] Registers do not impede duct air flow.
[ ] [ ] Registers do not close off more than 80%.
[ ] [ ] Each register location is sealed properly.
[ ] [ ] Register mounting screws installed correctly.

## AIR CONDITIONER INSTALLATION

[ ] [ ] Electrolux return plenum. No, describe below. (260 cm2 min.)
[ ] [ ] Return plenum installed per instructions.
[ ] [ ] Supply diverter installed per instructions.
[ ] [ ] Supply diverter is sealed at edges per instructions.
[ ] [ ] Relay box installed per instructions.
[ ] [ ] Unit rating plate is visible after return plenum installed.
[ ] [ ] Bolts torqued to 4050 In. Lb. compressing the A/C gasket to approximately 13 mm.

## THERMOSTAT AND COMPONENTS

[ ] [ ] Thermostat cable routed so that it is not pinched, stapled or nailed during paneling installation.
[ ] [ ] Properly located approximately l-112 m from floor.
[ ] [ ] Installed on an inside partition.
[ ] [ ] Not exposed to direct sunlight or heat source (example: cook stove, microwave oven, above furnace cabinet or duct-work, etc.)
[ ] [ ] Located on refrigerator cabinet wall.

## ADDITIONAL REQUIREMENTS

Yes **No**

[ ] [ ] Skylight located more than 1.2 m from the return air plenum.

[ ] [ ] Air conditioner on sloped roof. Roof slope of ______°.

Side-to-Side_____ °, Front-to-Back____°.

## AIRFLOW MEASUREMENTS (high speed, fan only)

[ ] [ ] Total CFM__________ (if taken) measuring device-________________________

Sketch of duct and register arrangement:

Vehicle Front (please indicate)

**Installation observations not Per Application Manual or comments:**

______________________________________________________________________

______________________________________________________________________

______________________________________________________________________

______________________________________________________________________

______________________________________________________________________

______________________________________________________________________

______________________________________________________________________

Completed by: ____________________________________ Date: ______________

Review By: ____________________________________ Date: ______________

03/94

# 7.0 APPENDIX

1. ACTUAL LENGTH: refers to the measured length, in feet from the conditioning equipment to the outlet.

2. AIR, AMBIENT: generally, the air surrounding an object.

3. AIR, OUTDOOR: air taken from outdoors, not previously circulated through the system.

4. AIR, RECIRCULATED: air returned to the conditioned unit where it is reconditioned and again supplied to the conditioned space.

5. AIR, RETURN: air returned to the conditioner from the conditioned space.

6. AIR CHANGES (per unit time): the number of room volumes of air replaced or exchanged (usually per hour).

7. AIR CONDITIONING: the process of treating air so as to control simultaneously its temperature, humidity, cleanliness, and motion or distribution to the requirements of a conditioned space.

8. BRITISH THERMAL UNIT (Btu): approximately, the heat required to raise the temperature of 1 lb. of water -17.2%.

9. CONDENSATION: the process by which a vapor is changed to a liquid by the removal of heat.

10. DIFFUSER, AIR: a supply air outlet composed of deflecting elements discharging air in various directions and patterns to accomplish mixing of supply and room air.

11. DRAFT: the withdrawal of more heat from a person's skin than normally withdrawn as the result of one or more of the factors high air velocity, low air temperature, and direction of airflow.

12. ENVELOPE: refers to the surfaces of a structure which are exposed to ambient (outdoor) conditions.

13. EVAPORATION: the process by which a liquid is changed to a vapor by the addition of heat.

14. FREE AREA: the total area of the opening in an air inlet or outlet through which air can pass.

15. GRILLE: a louvered or perforated covering of an inlet or outlet opening through which air flows.

16. INCH OF WATER (in. W.C.): a unit of pressure equal to the pressure of a column of water 1 inch high at 2.54 cm at 4°C.

17. PRESSURE DROP: static pressure loss, as from one end of a duct to the other, due to friction, etc.

18. REGISTER: a combination grille and damper covering an air inlet or outlet opening.

19. RELATIVE HUMIDITY: approximately, the ratio of the density of the water vapor in the air to the saturation density of water vapor at the same temperature, expressed as a percentage.

20. STATIC PRESSURE: the force per unit area, perpendicular to the direction of flow in a duct.

21. STRATIFIED ZONE: a region in which room air velocity is less than 4.6 m min. Smoke will "hang" in this region for a relatively long time.

22. THROW: the distance an airstream travels after leaving a supply outlet before the velocity is reduced to the terminal velocity.

23. VELOCITY PRESSURE: the pressure in an airstream capable of producing the same velocity if applied to move the air through an orifice in such a manner that all pressure energy applied is converted to kinetic energy.