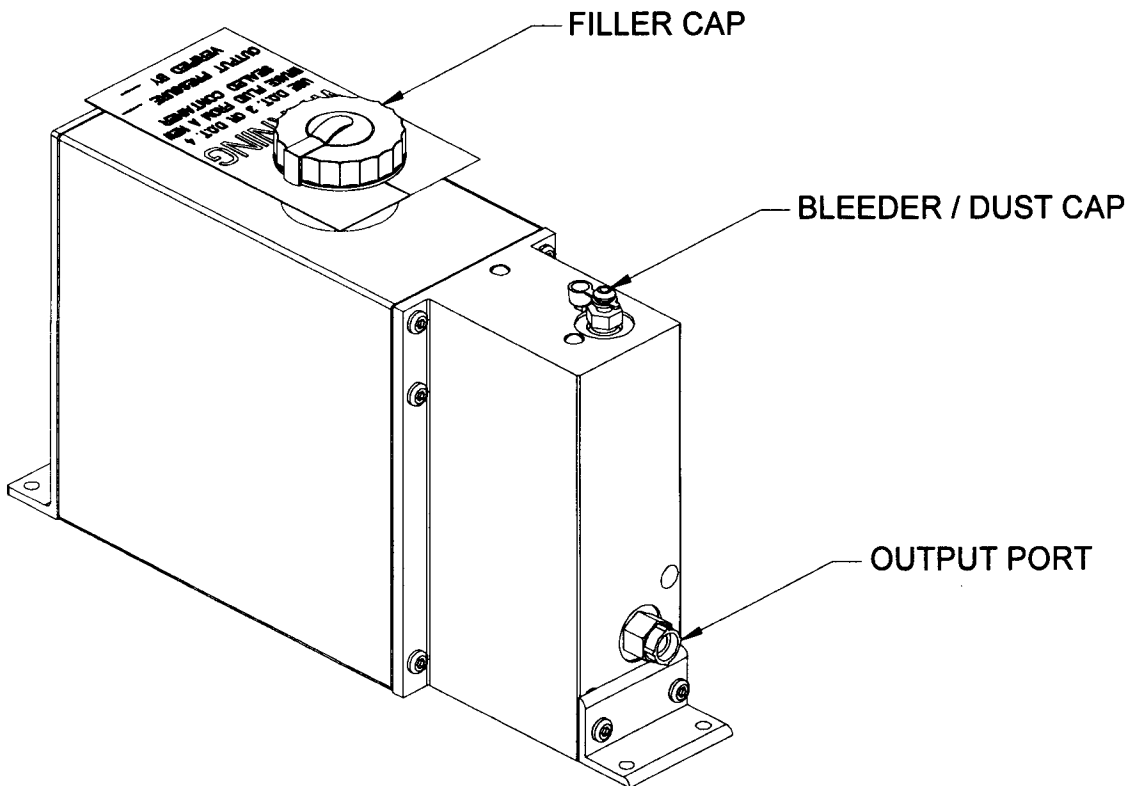




MANUAL 440-1008

CARLISLE SERVICE MANUAL FOR HYDRASTAR™ HYDRAULIC BRAKE ACTUATORS

THIS DOCUMENT TO BE USED FOR
HBA-10, HBA-12, and HBA-16
ACTUATORS



WIRE COLORS - FUNCTION

SOLID BLACK – 40 amp 12 volt Supply From Tow Vehicle

SOLID BLUE – Output From In-Cab Electronic Brake Controller

SOLID WHITE – Trailer and Tow Vehicle Ground

SOLID YELLOW – Cold Side Of Breakaway Switch

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A. WARNINGS

PROPER INSTALLATION REQUIRED - The Hydrastar™ actuator must be installed by a qualified individual. Failure to properly install, protect, operate, and maintain the system can cause malfunction resulting in possible serious or fatal injuries and or property damage.

MUST BE PROPERLY SIZED TO THE TOWED VEHICLE - The Hydrastar™ actuator is intended to provide flow and pressure to the brake system on the towed vehicle in accordance with applicable state and federal laws. It is the sole responsibility of the installer to see that the actuator is properly sized with the brake system on the towed vehicle so that the time required to build pressure in the towed vehicle brake system is not excessive.

SELECT THE CORRECT OUTPUT PRESSURE - Over pressurizing the brakes on the trailer can cause permanent damage to the trailer brake system. It is the sole responsibility of the installer to determine the appropriate model of Hydrastar™ to insure that over pressurization of the trailer brake system does not occur.

NOT INTENDED TO BE USED AS A PARKING BRAKE - The Hydrastar™ actuator and trailer brakes are intended only to supplement the service brake system on the towing vehicle. The Hydrastar™ actuator and trailer brakes are not designed to function as a park brake. At no time should the towed vehicle brake system be used as the primary source of braking for the towing vehicle.

REQUIRES AN IN-CAB ELECTRONIC BRAKE CONTROL – The Hydrastar™ actuator is intended to be used with an in-cab electronic brake controller. The unit will operate with a wide variety of controllers but provides optimum performance when used with a CARLISLE electronic brake controller.

DAMAGE FROM EXTENDED STOPS - When stopped for extended periods (i.e. more than 2 minutes - at railroad crossings, traffic jams, or very long stoplights), apply the park brake on the towing vehicle and release the service brake pedal so that the Hydrastar™ actuator does not run continuously. Failure to follow this guideline will cause Hydrastar™ unit to overheat and will damage the Hydrastar™ unit.

EMERGENCY BREAKAWAY BATTERY MUST BE CHARGED - Do not attempt to tow the towed vehicle unless the emergency breakaway battery is fully charged.

DO NOT POWER WASH THE HYDRASTAR™ UNIT - Although the Hydrastar™ unit is weather tight, it is not designed to withstand the direct spray from a power / car wash. Care should be taken to protect the Hydrastar™ unit from direct spray when washing the trailer.

A. WARNINGS CONTINUED...

LOW VOLTAGE CONDITION – Failure to follow these guidelines will damage the Hydrastar™ unit and void your warranty.

It is critical that the BLACK and WHITE power leads from the tow vehicle to the input of the Hydrastar™ actuator are sized and terminated in accordance with the recommendations detailed in the service manual that is provided with each unit (i.e. dedicated 40 amp circuit on the tow vehicle – 12 gauge wire minimum for installations where the Hydrastar™ is located less than 10 feet from the tow vehicle / 10 gauge wire for installations where the Hydrastar™ is located more than 10 feet from the tow vehicle). Units that have been damaged by the low voltage condition that occurs when these guidelines are ignored are evidenced by the motor in the Hydrastar™ unit running whenever the trailer is connected to the tow vehicle. In order for the Hydrastar™ to function as designed, the voltage as measured at the black and white wires directly adjacent to the Hydrastar™ unit must be at least 8.5 volts dc (when the Hydrastar™ unit is running and the in-cab brake controller is set at its maximum gain setting). Confirm that at least 8.5 volts dc is obtained.

It is critical that the solid blue wire from the in-cab electronic brake control is connected to the solid blue wire on the Hydrastar™ actuator. It is also critical that the yellow wire from the Hydrastar™ actuator is connected to the cold side of the trailer emergency breakaway switch. Under no circumstances should the solid blue wire and the yellow wire be connected together.

B. ACTUATOR INSTALLATION INSTRUCTIONS



CAUTION – Wheels must be properly blocked to prevent the trailer and tow vehicle from rolling.

GETTING STARTED:

1. The following materials are required to properly install the Hydrastar™ unit:
 - If your trailer is not already equipped with brake lines, you will need enough 3/16" diameter automotive brake line to connect the trailer brakes to the Hydrastar™ unit. (Note that 1/4" diameter brake line is recommended for 3 axle trailers or for trailers where the total brake line length exceeds 25 feet). Where possible, steel tubing is preferred.
 - 4 pieces of #10 mounting hardware to mount the Hydrastar™ unit to the trailer
 - (1) quart of DOT 3 or DOT 4 brake fluid (from a new, sealed container)
 - (1) emergency breakaway kit - must include a 12 volt, 5 amp hour (minimum) battery
 - wire (see ELECTRICAL INSTALLATION REQUIREMENTS section for proper wire size)

LOCATION of the Hydrastar™ actuator is at the discretion of the vehicle owner. When determining location, consideration should be given to the following:

1. The shorter the brake lines are between the Hydrastar™ unit and the trailer brakes, the faster the brakes on the trailer will respond.
2. The unit should be located so that the electrical wiring and brake lines can be neatly routed directly to the towing vehicle and trailer brakes. Special care should be taken to minimize the number of bends and fittings in the brake line circuits.
3. An emergency breakaway kit must be located on the trailer so that the trailer breakaway cable can be easily attached to the towing vehicle.
4. The Hydrastar™ actuator is powered from the electrical system on the tow vehicle. In order for the Hydrastar™ unit to function properly, it must have adequate electrical power (See ELECTRICAL INSTALLATION REQUIREMENTS section).
5. The Hydrastar™ unit should not be placed in an area where it is susceptible to damage from trailer loads, road debris, or from being stepped on. Failure to protect the Hydrastar™ unit from damage can cause the unit to malfunction and void the Hydrastar™ warranty.



CAUTION – In stop and go traffic, the unit can get quite warm to the touch. This is normal and should not be of concern. Care should be taken to locate the unit in an area where your skin will not come in direct contact with the unit.

MOUNTING: Consideration should be given to the following:

1. The Hydrastar™ unit must be level, with the filler neck up.
2. It is the responsibility of the customer to provide necessary fasteners for attachment of the Hydrastar™ actuator to the trailer. 4 pieces of #10 mounting hardware required.



CAUTION – The Hydrastar™ unit contains sensitive electronics that must be protected. Drilling additional holes in the Hydrastar™ housing or welding anywhere on the Hydrastar™ unit will damage the unit making it inoperable and will void the manufacturer's warranty. Always make sure to disconnect the Hydrastar™ from the trailer electrical system before doing any welding repair or modifications to the trailer structure.

CONNECT the brake line on the towed vehicle to the Hydrastar™ actuator.

1. Remove the red plastic plug from the brake port on the Hydrastar™ unit. This will expose a 3/16" inverted flare fitting.
2. Brake line must be compatible with DOT 3 & DOT 4 brake fluid.
3. Connect the brake line from the trailer brakes to the 3/16" inverted flare fitting on the Hydrastar™ actuator.

FILL the unit with DOT 3 or DOT 4 brake fluid to the bottom of the reservoir filler neck. When putting filler cap back on it should be turned clockwise until snug.



CAUTION - Always use new, DOT 3 or DOT 4 brake fluid, from a sealed container. Never attempt to reuse old or dirty fluid. Do not overfill the unit. Take care to protect painted surfaces from contact with the brake fluid. Wash off any spilled brake fluid.

MOUNT the emergency breakaway switch and emergency breakaway battery on the trailer as detailed in the instruction sheets provided with the emergency breakaway kit.



CAUTION – Do not attempt to tow the towed vehicle unit until the emergency breakaway battery is fully charged.

C. ELECTRICAL INSTALLATION REQUIREMENTS

WIRE SIZE IS CRITICAL - It is critical for the proper operation of the Hydrastar™ actuator that full system voltage is available at the input of the Hydrastar™ actuator. The unit should be powered via a dedicated 40 amp circuit on the tow vehicle. A minimum of 12 gauge wire is required for the power leads between the tow vehicle and trailer (i.e. black and white wires). All other leads should be 16 gauge minimum. On applications where the Hydrastar™ unit is located more than 10 feet from the tow vehicle, 10 gauge power leads are highly recommended. Failure to follow these guidelines will cause the unit to be less responsive and can potentially damage the unit.

REQUIRES AN ELECTRONIC IN-CAB CONTROL – The Hydrastar™ actuator is intended to be used with an in-cab electronic brake controller. The unit will operate with a wide variety of controllers but provides optimum performance when used with a CARLISLE electronic brake controller (CARLISLE model HSC). The in-cab controller must have an output capacity of at least 5 amps for proper operation of the Hydrastar™ actuator.

ELECTRICAL CONNECTIONS – Make sure all electrical connections are clean, dry, weather tight, and secure to prevent damage to the wiring from dragging or becoming entangled with foreign objects. CARLISLE highly recommends soldering all electrical connections. A dedicated ground connection between the tow vehicle and trailer is also required.



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E. BLEEDING AND ADJUSTING THE BRAKES

1. It typically is much easier to bleed the brakes with two people working together.
2. Special care must be taken to insure that the Hydrastar™ unit does not run out of brake fluid. Check the fluid level frequently during the bleeding process.
3. Block the wheels on the trailer and towing vehicle.
4. If the trailer is equipped with drum brakes, check that the brake running clearances are properly adjusted consistent with the trailer manufacturer's recommendations. Even the slightest amount of brake drag will generate heat and will damage the trailer brake system voiding the manufacturer's warranty.



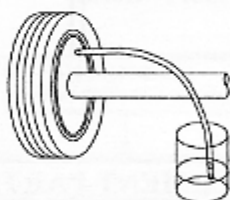
CAUTION — Failure to properly adjust the brakes on trailers equipped with drum brakes can result in sluggish operation of the Hydrastar™ unit. Eye protection should be worn at all times while bleeding the Hydrastar™ unit and trailer brake system.

5. Remove the dust cap from the bleed screw on the Hydrastar™ unit and install plastic tubing onto the bleeder
6. Immerse the free end of the plastic tubing in a clean container partially filled with brake fluid.
7. With eye protection on, open the bleeder screw one half turn on the Hydrastar™ unit. Take care to protect yourself and the trailer from brake fluid expelled from the bleeder.
8. Activate the Hydrastar™ unit by turning on the ignition switch and pressing on the brake pedal or the manual control on the in-cab controller.
9. Watch the free end of the bleeder hose for air bubbles escaping into the container.
10. Continue to bleed until the fluid becomes clear and free of bubbles.
11. Tighten the bleeder screw, turn off the Hydrastar™ unit, and remove the plastic tubing from the bleeder screw. Bleeding of the Hydrastar™ unit is now complete.
12. Install plastic tubing onto the bleeder screw of the wheel cylinder/caliper.
13. Immerse the free end of the plastic tube in a clean container partially filled with brake fluid.
14. With eye protection on, open the bleeder screw one half turn on the wheel cylinder/caliper farthest from the Hydrastar™ unit. *(If towed vehicle has multiple axles, always start with the rear axle first.)*
15. Activate the Hydrastar™ unit. *(Turn the ignition switch on and press on the brake pedal.)*
16. Watch the free end of the bleeder hose for air bubbles escaping into the clear container. Continue to bleed the wheel cylinder / caliper until the fluid becomes clear and free of bubbles.



CAUTION — Do not run the Hydrastar™ unit without adequate brake fluid in the reservoir as it will damage the unit and void the manufacturer's warranty. Check all bleeder screws to ensure that they are securely closed and do not leak.

17. Tighten the bleeder screw, turn off the Hydrastar™ unit, and remove plastic tubing from the bleeder screw. Bleeding of the wheel cylinder/caliper is now complete.
18. Refill the Hydrastar™ unit with brake fluid.
19. Continue the above process (steps 12 through 18) on the next farthest brake away from the Hydrastar™ unit. Repeat these steps until all the brakes have been bled.



WARNING — Failure to properly adjust the trailer brakes and to properly fill and bleed the Hydrastar™ unit and brakes may result in sluggish brake performance. This may result in serious or fatal injuries and / or property damage. As a precautionary measure, CARLISLE recommends bleeding the brakes a second time after the trailer has been in service for 7 – 10 days. CARLISLE also recommends checking the temperature of the hubs on a regular basis to insure that the trailer brakes are not dragging.

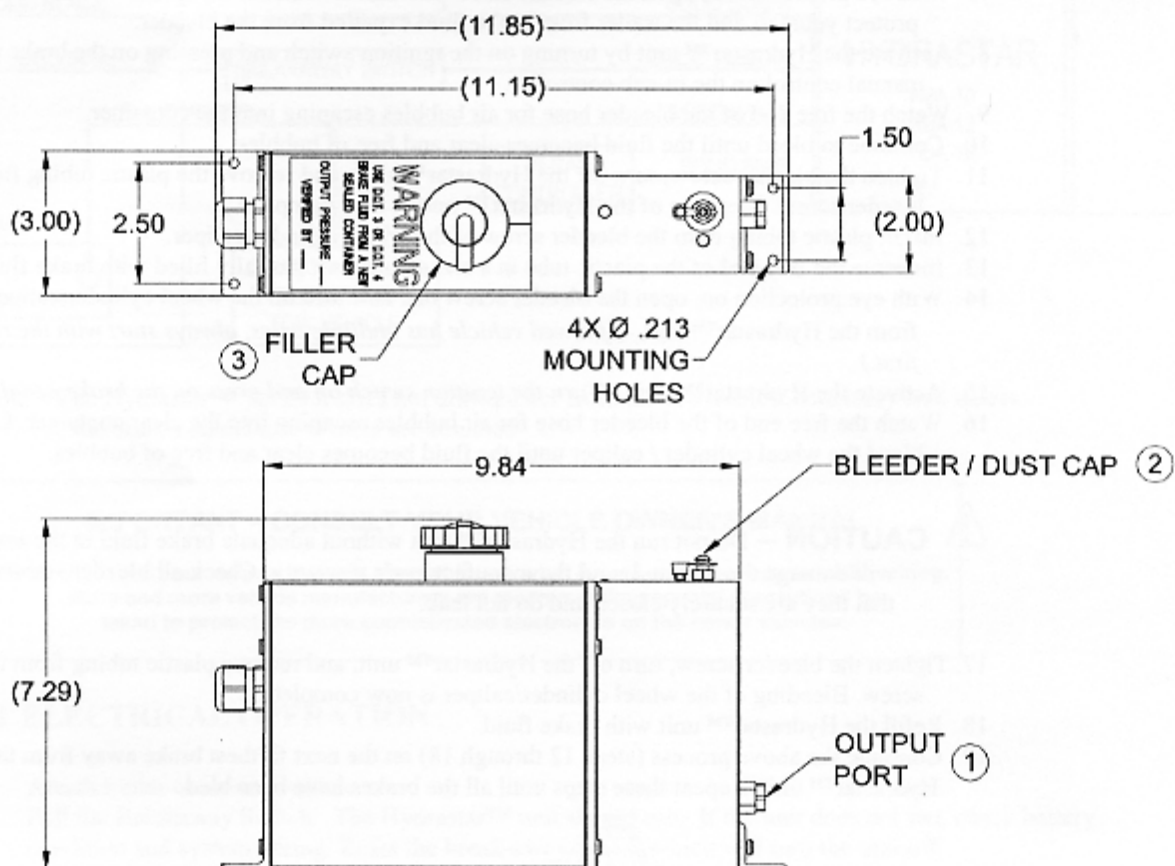
F. TESTING AND ADJUSTMENT OF ELECTRONIC CONTROLLER UNIT

1. Adjust the gain setting on the in-cab controller to a mid range setting and the sync setting to the maximum (most aggressive) setting.
2. Drive vehicle at 10 to 15 mph.
3. Apply the brakes. If braking is too severe, adjust the gain setting down to decrease pressure, and retest. If braking is inadequate, increase the gain setting on the in-cab electronic controller and retest.
4. Repeat this process until the brakes respond appropriately.



WARNING – The appropriate pressure setting will vary depending on the weight of the load being transported on the trailer, weather conditions, road conditions, brake lining wear, and brake displacement. The “TESTING AND ADJUSTMENT OF ELECTRONIC CONTROLLER UNIT” procedure should be repeated each time the trailer is used. Failure to properly adjust the Hydrastar™ unit may result in poor brake performance which could result in serious or fatal injuries and or property damage.

G. REPLACEMENT PARTS LIST / MOUNTING DIMENSIONS



REPLACEMENT PARTS LIST

| ITEM | PART NUMBER | DESCRIPTION |
|------|-------------|--|
| 1 | 192-7089 | OUTPUT PORT ADAPTER ASSEMBLY 3/16" INVERTED FLARE |
| 1 | 304-7107 | OUTPUT PORT ADAPTER ASSEMBLY 1/4" INVERTED FLARE KIT |
| 2 | 381-7037 | BLEEDER VALVE / TETHERED DUST CAP KIT |
| 3 | 32-7640 | FILLER CAP |

H. TROUBLESHOOTING GUIDE

Brakes are slow to respond

- re-bleed the trailer brakes and actuator
- if the trailer is equipped with drum brakes, re-adjust the drum brakes to the trailer manufacturer's recommended running clearance
- slow response can be caused by trailer wiring that is too small
 - + for trailers where the Hydrastar™ is located less than 10 feet from the tow vehicle, 12 gage wire is recommended for the black and white wires between the tow vehicle and the Hydrastar™ unit / all other wires should be a minimum of 16 gauge
 - + for trailers where the Hydrastar™ is located more than 10 feet from the tow vehicle, 10 gage wire is recommended for the black and white wires between the tow vehicle and the Hydrastar™ unit / all other wires should be a minimum of 16 gauge
- slow response can be caused by brake lines that are too restrictive on the trailer (i.e. small diameter / long length / restrictive fittings / routings)
 - + the trailer brake lines must be at least 3/16 inches in diameter / steel tubing is preferred over flexible hoses
 - + if it is not practical to locate the Hydrastar™ unit closer to the brakes, consider increasing the size of the trailer brake lines

Unit will not run when the ignition is on and the brake pedal is depressed

- verify that the trailer and tow vehicle are wired as detailed on page 5 of the manual
 - + with the ignition switch on and the brakes not applied, you should have 12 - 13 volts between the black and white wires on the Hydrastar™ unit
- clean / replace the ground between the trailer and the Hydrastar™ actuator
- test operation of the unit using the break-away test procedure

Breakaway test procedure (do not leave the breakaway switch pulled for more than 2 minutes during any of the steps outlined below)

- pull the breakaway switch on the trailer
 - + if the unit runs and builds pressure, the problem most likely is a defective in cab controller or defective wiring between the tow vehicle and Hydrastar™ unit
 - + if the unit runs but will not build pressure, the problem most likely is a defective solenoid valve in the Hydrastar™ unit and the actuator should be returned for repair
 - + if the unit still does not run after the breakaway battery is fully charged, verify that the voltage between the white wire and the yellow wire is at least 12 volts
 - if the voltage is less than 12 volts, either the breakaway switch or the break-away wiring is defective
 - if the voltage is greater than 12 volts, the Hydrastar™ actuator should be returned for repair

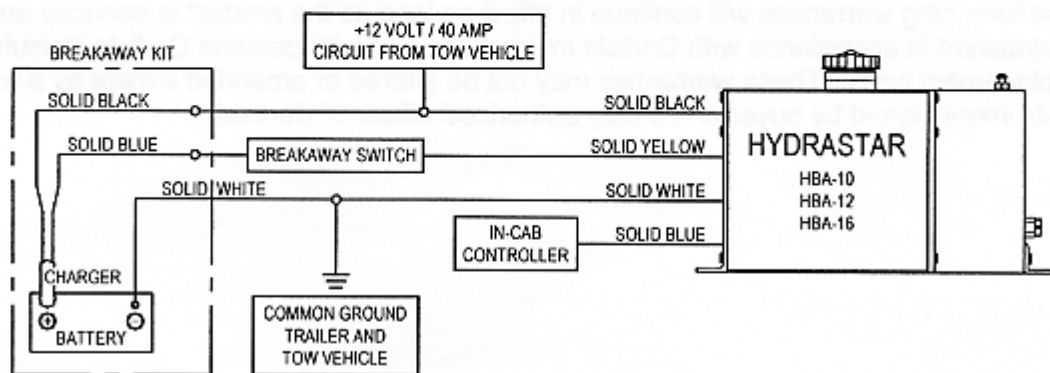
Trailer brakes too aggressive

- reduce the gain setting on the in-cab electronic brake controller

Trailer brakes not aggressive enough

- increase the gain setting on the in-cab electronic brake controller

ELECTRICAL SCHEMATIC





A. LIMITED WARRANTY AND LIMITATION OF LIABILITY

All products, excluding friction materials, manufactured and sold by Carlisle Industrial Brake, Subsidiary of Carlisle Corporation, are warranted to be free from defects in material and workmanship under normal and proper use for a period the shorter of: (1) one year from vehicle in-service date subsequent to installation of Carlisle product or (2) 18 months from date of shipment from Carlisle. No claim for breach of warranty will be allowed unless the material or workmanship defect is found within the warranty period, properly documented by buyer and Carlisle is notified in writing within 30 days from failure. This warranty shall not apply to products altered or utilized in a manner not approved by Carlisle or subjected to abuse, misuse, improper maintenance, negligence or accident.

THE FOREGOING WARRANTIES ARE EXCLUSIVE, AND ARE ACCEPTED BY BUYER IN LIEU OF ANY AND ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING WITHOUT LIMITATION THE IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR PARTICULAR PURPOSE. Buyer's sole remedy in the event of a breach of the foregoing warranties is the repair or replacement of the affected product by Carlisle. NO merchandise will be accepted for warranty credit consideration without a Returned Goods Authorization Number issued by the Customer Service Representative (812-334-8737). If, upon inspection by the Returned Goods Technician, the merchandise is found to be free from defects in material and workmanship, then the warranty claim shall be deemed invalid, and the merchandise shall be held for a period of (15) days pending disposition by the buyer and an inspection charge may be applied by Carlisle. BUYER AGREES THAT IN NO EVENT WILL CARLISLE'S LIABILITY FOR ALL LOSSES FROM ANY CAUSE, WHETHER BASED ON CONTRACT, NEGLIGENCE, STRICT LIABILITY, OTHER TORT OR OTHERWISE, EXCEED BUYER'S NET PURCHASE PRICE, NOR WILL CARLISLE BE LIABLE FOR ANY SPECIAL, INCIDENTAL, CONSEQUENTIAL OR EXEMPLARY DAMAGES.

The foregoing warranties will continue in effect so long as the product is serviced and maintained in accordance with Carlisle instructions and with genuine Carlisle manufactured replacement parts. These warranties may not be altered or amended except by a written instrument signed by buyer and a duly authorized officer of Carlisle.