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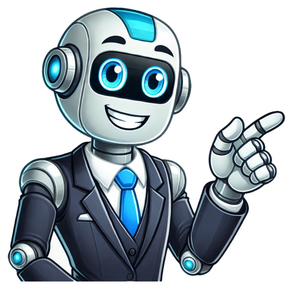

Dura-Lite offers hundreds of different Charge Air Coolers and Radiators for turbo-diesel powered equipment for the following applications; Agricultural, Bus, Cement Mixers, Classes 2, 3, 4, 5, 6, 7, and 8 Trucks, Coach, Construction, Fire Trucks, Generators and Power Units, Government, Marine, Military, Motorhome, Off-Highway Vehicles, Oil Field, On-Highway Vehicles, Recreational, Refuse, Stationary, Transit, Vocational, and many others.Charge air coolers, which some people also refer to as air cooler chargers, or intercoolers, are an important part of the combustion process for engines with turbochargers and superchargers. They cool air after it has been compressed by the turbocharger but before it enters the engine. This results in enhanced efficiency as well as both improved power output and longevity. Lets dive a little deeper.Whats The Purpose of a Charge Air Cooler?Charge air coolers, or intercoolers, cool down air for combustion. But why does the temperature of compressed air from the turbocharger need to be cooled down in the first place? Simply put, doing so provides denser cooler air that helps more air get in the cylinder in total and make the air/fuel charge less prone to the pre-ignition or detonation, so we can run more timing advance and get more power out.Charge Air Cooler vs Intercooler vs AftercoolerCharge air coolers and intercoolers are not one and the same, but theyre also not entirely different. Repair shop Kell Radiator Service does a great job of explaining why that is in their blog post 4 Facts About Charge-Air Coolers for Forced Induction Engines; they explain:Though charge air coolers are also sometimes referred to as aftercoolers, intercoolers, or turbo coolers, each of these is slightly different. The term charge air cooler and intercooler are often used interchangeably, but technically charge air cooler is an umbrella term for intercoolers and aftercoolers. Where the charge air cooler is placed in the car determines whether its technically an intercooler or aftercooler. ;Aftercoolers in particular cool compressed air after the entire compression cycle, whereas intercoolers cool it specifically before entering the engine.But realistically speaking, the term intercooler has come into common usage as an interchangeable term with charge air cooler and the term aftercooler has fallen out of favor with most people even experienced enthusiasts.Types of Charge Air CoolersThere are two main types of charge air coolers youll find available.Air to air cooling systems: Air to air coolers use ambient air to cool the compressed charge. Air to water cooling systems : Air to water coolers use a coolant liquid, and they are almost always used in applications where the vehicle space (packaging) requires it.Water is a much more efficient conductor of heat than air, so air to water charge coolers can be incredibly effective, but for their intended purpose, air to air coolers also work well.Radiator vs Charge Air CoolerWait a minute!, you might be thinkingDoesnt my engine have a radiator to cool down the engine? Yes. But while charge air coolers lower the temperature of compressed air specifically for the intake system, radiators cool engine coolant for the entire engine. Its also worth noting that air to water intercoolers in particular, which are a common upgrade for Audi vehicles with existing air to water setups, have a separate radiator often referred to as a heat exchanger.Learn About Your Charge Air Cooler & Intercooler OptionsCurious to see how you could improve your VW, Audi, or Porsches performance with an intercooler? Shop all our intercooler systems now. Weve got a wide range of options for you to explore. Whether you drive a VW MK7 or MK8, an Audi B8 A4, or a VW MK5 or MK6 GTI, well get you equipped with the right charge air cooling system for your vehicle. Diesel engines and turbos go together like cheese and crackers. The science is simple: if you can force more air into your engine, itll create a larger explosion and more power.It sounds simple enough, but there are two scientific principles that work against each other, causing inefficiency in the system:Compression creates heatHot air is less dense than cool airFor maximum power and efficiency, the air that enters an engine should be cool. Denser air means more oxygen molecules in a smaller space, allowing for a larger explosion. Unfortunately, when a turbo compresses the air, it also creates heat. Hot air entering an engine contains less oxygen, which will negatively affect power, torque, and emissions.Charge air coolersotherwise known as intercoolersact as the middleman between the turbo and the engine. They sit in front of the truck radiator and take the hot, compressed air from the turbo and cool it down before it reaches the engine. This increases engine efficiency and power.How Does a Charge Air Cooler Work?The function of a charge air cooler is to reduce the temperature of compressed air from the turbo before it enters the intake manifold.The compressed air from the turbo is piped to the cooler. The hot air passes through several small tubes in the core of the charge air cooler which cools the air while maintaining the pressure. A charge air cooler reduces the temperature from ~450F (from the turbo) to ~40F above the ambient air temperature as it enters the intake manifold.Your Truck Deserves a Dura-Lite Evolution Charge Air CoolerIf you want the best charge air cooler available, look no further than Dura-Lite. All charge air coolers are made of aluminum. Aluminum is a great material to remove the heat from the turbocharged air, but aluminum has one drawback. Aluminum expands and contracts a lot with temperature changes. Eventually, this expansion and contraction will cause all OE style coolers to start leaking and fail. Dura-Lite Evolution charge air coolers are unique, in that they are built using flexible seals on each tube. The seal allows the tubes to expand and contract freely. This means a Dura-Lite Evolution cooler that will last longer and stand up to heavy use. Thats why were the only company that can offer an unmatched 7-year, million-mile guarantee.To ensure your truck can stand up to the abuse of the job, trust Dura-Lite. To learn more about how a Dura-Lite Evolution charge air cooler can help you get the job done, contact us today. Were always happy to answer your questions! A working principle for charge air coolers: A charge air cooler manufactured by Vestas aircoil will feature within ita series of tube and fin elements. Fins are mechanically bonded to the outer surface of the tube. The principle is simple. By increasing the surface area, there is a consequent increase in the cooling surface, providing the bond between the tube and the fin is sufficiently strong to allow energy (heat) to pass. The same principle is used in reverse in a water heater (radiator). The materials of construction are important: its all too easy to cut corners here. Of course, the prudent engineer wishes to purchase at the best possible price, but consider the lifetime you expect from the replacement and how an air cooler company achieves your requirements. You should expect, first of all, that the construction materials are of suitable quality and that the supplier can prove the case. Copies of material certificates should be available for inspection by you if you wish. 90/10 copper nickel tubes are the optimum choice, but there are higher grades too if appropriate. As for the fins, copper is the correct material. If a company offers aluminium fins, you can expect a very short operational life. The replacement cooler should be constructed in a way, which accounts for all the physical stresses that it will encounter. Of course, the cooler has no moving parts and is therefore often considered of less importance, but what happens if the cooler begins to fall apart in your engine? Its design should allow for the stress of uneven expansion and contraction caused by a temperature difference in excess of 150C across it. It should also be rigid enough to withstandsometimessignificant vibration. A full tube support mechanism is therefore essential. Integral tube supports plates, positioned at intervals along the length of the air cooler are recommended. These plates are in effect intermediate tube plates and allow every tube to be mechanically bonded to every other tube, not just at either end of the cooler but throughout its entire length. If individual tubes or rows of tubes are allowed to float free or simply clamped with bars on the outside face of the cooler fins, then there is nothing to stop early mechanical failure caused by vibration. Our advice would be to question any potential supplier on this specific point in detail. How are the fins attached to the tubes? By expanding the diameter of the tube beyond its point of elasticity; thus gripping the fins to it. Both methods are effective but the coated versions have advantages in contaminated environments. There is a significant advantage if the number of separate components is kept to a minimum. A monoblock fin and tube element, encompassing as many tubes as possible, is preferable. The lifetime of the product will be longer where the possibility of separate components interacting against each other is removed. Vestas has extended its maximum fin width to 77 tubes wide, big enough for almost all sizes of coolers we call it a MonoBlock element. A MonoBlock combined with a full integral support plate means there is effectively a one-piece element. Fewer components means a more robust air cooler. Perfect where there is vibration. Hannu Jskelinen, Magdi K. KhairAbstract: Charge air cooling is an important feature of many modern boosted diesel engines that can be used to reduce emissions and fuel consumption and increase power density. Charge air can be cooled with engine coolant, ambient air or a separate low temperature liquid circuit.In modern engines, it is also important to ensure the temperature of the charge does not become excessive. In modern boosted engines, this is a real possibility. Excessive temperatures can lead to reduced charge density and higher combustion temperatures which can affect torque, power and emissions.While turbochargers and superchargers increase charge air density, they also increase the temperature of the air in the intake manifold. This arrangement with intake air compression with no subsequent cooling was suitable for applications such as North American heavy-duty diesel engines until the 1990s. As emission standards became increasingly stringent, additional increases in charge air density were needed. While this could be achieved through compression to higher pressures, this would require more expensive compression equipment and would further increase cycle temperatures. On the other hand, if intake manifold temperature could be reduced, the intake density could be further increased and more air could be supplied to the engine without necessarily increasing the intake manifold pressure. While this would require a compressor capable of higher flow, the cost would be considerably less than a compressor that was also capable of higher pressures. Cooling the air with a heat exchanger as it leaves the compressor is a common way to achieve this charge air cooling. Such a heat exchanger is referred to as a charge air cooler (CAC), intercooler or aftercooler (Figure 1). These terms are commonly used interchangeably. The term intercooler refers to the fact that this heat exchanger performs its task in between two stages of compression, i.e., between compression in the compressor and compression in the cylinder of the engine. The term aftercooler refers to the charge air being cooled after being compressed in the compressor. Increasing demand for improvements in fuel economy and exhaust emissions has made the charge air cooler an important component of most modern turbocharged engines.Figure 1. Schematic representation of turbocharger and charge air cooler ### Are you looking to take advantage of excellent charge air cooler solutions? As experts in charge of cooler technology, we at Dolphin Heat Exchanger USA are here to shed light on the intricate world of charge air cooler. Read on to learn more about charge coolers and find out how we can provide first-class solutions for this particular piece of kit.What Do You Need to Know About Charge Air Coolers?Charge air coolers, also known as intercoolers, are crucial in enhancing the efficiency and performance of various systems, particularly in engines and air compression applications. These coolers work by cooling the hot compressed air from the turbocharger before it enters the engine, ensuring a denser and more oxygen-rich air charge for combustion. Charge air coolers help prevent overheating by lowering the temperature of the intake air, reducing the risk of engine knocking. This ultimately leads to improved power output and fuel efficiency.In addition to enhancing performance, charge air coolers contribute to the engine's longevity by reducing thermal stress and minimizing the likelihood of premature wear. Properly maintaining and optimizing the performance of charge air coolers is essential for ensuring the overall effectiveness and reliability of heat transfer systems in various applications.Factors Influencing Charge Air Cooler PerformanceWith advancements in technology and engineering, charge air cooler performance is significantly impacted by various vital factors. The performance of a charge cooler is influenced by several factors, including:Design and SizeThe charge air cooler's design and size play a significant role in its performance. A well-designed cooler with sufficient surface area will effectively dissipate heat from the compressed air, resulting in lower intake temperatures.Type of CoolerThere are various charge air coolers, including air-to-air, air-to-water, and liquid-to-air coolers. Each type has advantages and disadvantages regarding cooling efficiency and packaging constraints.AirflowAdequate airflow through the charge air cooler is crucial for efficient heat exchange. Factors such as the cooling system's design, the cooler's placement (front-mounted, top-mounted, etc.), and the presence of ducting affect airflow.Benefits of Using Engine CoolersUtilizing engine coolers enhances overall vehicle performance by efficiently regulating temperature levels in critical components. These coolers are pivotal in maintaining optimal operating conditions for the engine, transmission, and other vital parts.Engine coolers offer several benefits that contribute to an engine's overall efficiency, performance, and longevity. Here are some of the key advantages: Temperature Regulation: Engine coolers help regulate the engine's operating temperature by dissipating excess heat. This prevents the engine from overheating, reducing performance, engine wear, and potential damage.Improved Performance: Engine coolers can enhance engine performance by maintaining optimal operating temperatures. Excellent air intake can improve combustion efficiency, increasing power output and torque.Increased Efficiency: Cooler engine temperatures can lead to improved fuel efficiency. When the engine operates within its optimal temperature range, fuel combustion is more efficient, reducing fuel consumption and emissions. Extended Engine Life: Overheating can accelerate engine wear and lead to premature component failure. Engine coolers help mitigate the risk of overheating, thereby extending the life of critical engine components such as piston rings, bearings, and seals. Enhanced Reliability: A properly cooled engine is more reliable and less prone to unexpected breakdowns or failures. Engine coolers contribute to overall system reliability by maintaining consistent operating temperatures, especially under high-load or extreme operating conditions. Optimized Turbocharger Performance: Many modern engines feature turbochargers to increase power output. Engine coolers help regulate the temperature of the compressed air entering the engine, improving turbocharger efficiency and longevity.How do Charge Air Coolers work? Charge air coolers enhance engine performance by cooling the compressed air before entering the combustion chamber. This cooling process increases the air density, allowing more oxygen to be packed into the cylinders, resulting in improved combustion and increased power output.Charge air coolers work by utilizing either air or liquid as the cooling medium. Air-to-air charge coolers use ambient air to dissipate heat from the compressed air, while liquid-to-air charge coolers circulate coolant through a series of tubes to cool the compressed air. In both cases, the goal is to lower the air intake temperature, improve engine efficiency, and reduce the risk of detonation.Learn more about the Maintaining Your Truck's Cooling System: Pro Tips for Keeping Your Vehicle Running SmoothlyWhat Makes Our Charge Air Coolers Unique?Crafting charge air coolers with cutting-edge technology sets us apart in heat transfer solutions. Our charge coolers stand out at Dolphin Heat Exchanger USA due to their innovative design and superior performance. What makes our charge air coolers unique is our unwavering commitment to excellence and a legacy of over three decades in the industry. Our state-of-the-art manufacturing facility in Ajman, UAE, is where each charge air cooler is meticulously crafted to ensure optimal cooling efficiency and durability.One key aspect that distinguishes our charge air coolers is the precision engineering that goes into their construction. We leverage the latest advancements in heat transfer technology to create products that not only meet but exceed industry standards.Additionally, our charge air coolers are designed to cater to a wide range of applications, from HD Truck/Bus to Off Road/Industrial sectors, providing versatile solutions to our clients. When you choose Dolphin Heat Exchanger USA, you aren't just investing in a charge air cooler but a legacy of quality, innovation, and unmatched performance.Contact UsOur commitment to excellence and innovation extends to ensuring easy access for any inquiries or assistance, so feel free to reach out to us at +1 (844) 536-5744. At Dolphin Heat Exchanger USA, we value direct communication and aim to provide prompt and efficient solutions to your queries. Whether you seek information about our charge coolers, radiators, condensers, or any other heat transfer products, our dedicated team is here to assist you.In this article we discuss the charge air cooler fitted between the turbocharger and the scavenge air manifold in all modern four stroke and two stroke engines. Readers will be able to understand the concept of charge air coolers, and their operation, construction, and maintenance. One can also find reasons for cooler fouling, its location on engine, and methods of cleaning the charge air cooler.Purpose of Charge Air CoolerThe exhaust gas from the engine is utilized in the turbocharger for compressing fresh air to charge the engine with a positive pressure greater than ambient conditions. This compression causes the temperature of the air to increase, which thus cannot be fed directly into the engine as it is out of operating limits. Thus a cooler that bring the air temperature back to near-ambient conditions is fitted on the engine. When the air is hot, its density is less and thus the mass of air charged into the engine is less when compared to the mass when the air is cold. Thus the charge air cooler improves the charge air density and its temperature.The compressed charged air at the outlet of charge air cooler will have a reduced temperature of about 40 to 50 degrees Celsius from a temperature of about 200 degrees Celsius. This reduced temperature of air will increase the density of the charge air at low temperature. Increased air density of the charge air will rise the scavenge efficiency and allow a greater mass of air to be compressed inside the engine cylinder so that more fuel can be burned inside the combustion chamber, giving an increase in power. Also the engine is maintained at a safe working temperature. The lower compression temperature reduces stress on the piston, piston rings, cylinder liner, and cylinder head. The charge air cooler has another advantage in that it reduces the exhaust gas temperature. It has been proven that every one degree Celsius drop in scavenge air temperature will reduce the exhaust temperature about five to ten degree Celsius. This does not mean that the air can be charged at cryogenic temperatures. If very cold air enters the cylinder liner, it would cause a sudden thermal shock, leading to cracking of liner.Thus charge air coolers also serve as heaters when a ship enters cold climate areas. Let us assume that the charge air cooler is cooled by fresh water (LT) circuit. If the ambient air temperature is very low, the fresh water, which is usually at 30 degrees Celsius, will heat the charged air and make it comfortable for the engine.Charge Air CoolerLocation of a Charge Air CoolerCharge air coolers are located between the turbocharger compressor side outlet and the engine inlet manifold or scavenge manifold. A clear view of the location of a charge air cooler is shown in the diagram below. The location of the charge air cooler between turbocharger and entry to engine should be such that the temperature of the charge air at the outlet of charge air cooler should not be increased before its entry to the engine cylinder due to the heated condition of the engine room. To avoid this, the air cooler should be located as close to the engine cylinder as possible. Also, the air duct between the charge air cooler and the engine inlet manifold should be insulated to avoid increase in the temperature of the air.Location of Cooler on Large Diesel EngineAir Cooler Fouling and its Effect on the EngineWhen the air cooler becomes fouled, less heat will be transferred from the air to the cooling water (usually fresh water). This is indicated by the changes in the air temperature and cooling water temperature and a pressure drop in the air passing through the air cooler. To measure this pressure drop, a manometer is connected between the charge air cooler inlet and outlet. The amount of pressure drop will depend upon the degree and nature of the fouling.Indications of Air Side Fouling:Increase of air pressure drop across the charge air cooler.Decrease of air temperature difference across air cooler.Rise in scavenge air temperature.Rise in exhaust gas temperature from all cylinders.Indications of cooling water side fouling:Rise in scavenge air temperature.Decrease in the difference of the air temperature across the air cooler.Decrease in the temperature of the cooling water across the cooler if fouling is on the tubes.Increase in exhaust gas temperature from all cylinders.Increase in the temperature of the cooling water due to fouling or chocking material in tubes that reduce the amount of cooling water flow.Methods of air side cleaning:Fins in the air side can be cleaned by using compressed air at Low pressure.The air side can be cleaned by dipping the air cooler in a chemical bath for a certain period of time. This will remove all deposits on the air side.Another method of cleaning the air side is by using the jet of water at Low pressure.Note: Usage of very high pressure may lead to bending of fins and thus causing permanent damage to the air cooler.Methods of Fresh water side cleaning:For soft deposits on the water side, dip the cooler in a chemical bath. After a certain period of time, take the cooler out and then clean with water at some temperature higher than ambient. It is always preferred to circulate water using wilden pump and drums.For hard deposits use a long drill bit to drill the hard deposits on the tubes. Note this requires a specialist to drill the hard deposits because small mistakes in drilling may damage the tubes.Image Credits:www.turbobygarrett.com/…/turbo_tech101.htmlwww.chevron.com.sg/prod_4_charged_aircoil.aspx //en.wikipedia.org/wiki/Charge_air_coolerReferencesAuthors experience and expertise A charge air cooler, also known as an intercooler, acts as the middleman between the engine and the turbo. It is situated in front of the vehicle's radiator to absorb the hot, compressed air from the turbo and cool it down before it reaches the engine. This accelerates the engine's power and efficiency. Therefore, the main idea is to produce optimum energy from the combustion process within the machine.Depending on the engine, charge air coolers differ in size. Typically, the smallest in length are attached to automobiles and are commonly referred to as intercoolers. In contrast, the largest ones weigh several tons and are used for huge marine diesel engines or in power plants.Damaged or leaking charge air coolers can lead to power loss, increased fuel consumption, increased emissions, and escalated exhaust temperatures leading to distressing engine damage.What are the features of a charge air cooler?Following are some of the top-known features of a charge air cooler:SafetyApart from enhancing the engine performance, the charge air coolers offer various other benefits. The lower air temperature reduces the capacity to knock. "Knocking" refers to the uncontrolled combustion or spontaneous ignition of fuel in power engines.Value retentionThe decreased level of combustion temperature ensures that the transformer is subjected to lower thermal stress. The engine's service life increases along with the alleviated propensity to knock.Environment protectionThe use of charge air coolers lowers the combustion temperature, reducing NOx emissions. Furthermore, the increased amount of oxygen in the combustion chamber leads to better engine efficiency.FunctionalityAt the same volume, cold air consists of more oxygen than warm air. Charge air coolers are either air or water-cooled. In water-cooled devices, the heat is discharged to a specific cooling circuit. However, the cooling effect of air-cooled charge coolers is increased by being sprinkled with water.How does a charge air cooler work?Turbos and diesel engines work together like crackers and cheese. The science is straightforward: exerting more air pressure into your engine will equip the machine to create more power. However, the inefficiency is caused majorly by the following two scientific principles that work against each other:Compression generates heatCool air is denser than the hot airTherefore, the turbo's compressed air is piped to a cooler. Here, the hot air passes through several small tubes in the center of the charge air cooler that cools the air while maintaining the pressure.The charge air cooler reduces the temperature from 450 degrees to 40 degrees Fahrenheit above the ambient air temperature as it enters the intake manifold. This is necessary because hot air contains less oxygen and, therefore, negatively affects the engine's torque, power, and emissions.About usIf you require all new top-quality exhaust systems for your vehicle, look no further than Project Gamma. We aim to provide best-in-class automobile protection products and materials for automobile enthusiasts and owners. We offer easy installation and lasting durability products and services. For more information, please write to us at our email info@shopprojectgamma.com. A charge air cooler takes hot air from the turbo and cools it. This lowered intake air temperature increases the engine horsepower and improves efficiency. Quite simply, less fuel for more power. A leak-free charge air cooler will maximize horsepower and fuel savings, but it can also prolong the life of your engine. Your semi-trucks cooling system is crucial in helping the truck's engine work as efficiently and smoothly as possible.The engine will lose power and waste fuel.Engine oil may contain elevated levels of soot.Damage to the engine may occur including premature piston, ring, and valve failures.The turbocharger and/or exhaust manifold may fail.An increase in coolant temperatures may lead to damage to other parts of the engine and cooling system.If your charge air cooler is defective, its time to replace it with the worlds best Evolution Charge Air Cooler. For more than 30-years Dura-Lite has been an industry leader and builds the best product in the market today! For more than 30-years, Dura-Lites Evolution Charge Air Cooler Patented High Temperature Silicone Leak-Free Grommet Tube-To-Header Seal System has led the industry. Other features and benefits of the most reliable charge air cooler in the world include:Tanks are reinforced to reduce premature failure.Engineered for performance, economy, and durability (longevity).Superior quality and warranty.Continuous, consistent fuel economy.Reduced downtime.Optimized power and emissions. The advanced features and durability of the Evolution allow us to offer a 7-Year, million-mile guarantee. Dura-Lite's Evolution Charge Air Coolers (CAC) have maintained a less than 1% warranty return rate for over 30-years. Our warranty is not prorated and warrants the original vehicle installation for a period of 7 (seven) years or 1,000,000 (one million) miles, or 1,609,000 (one million, six hundred and nine thousand) kilometres, whichever occurs first from the date of installation, that its Evolution Charge Air Coolers will remain within the allowable leak down rate specifications of the following applicable engine manufacturers under normal on-highway operating conditions: Caterpillar, Cummins, Detroit Diesel, International, Mack, Mercedes, Paccar, and Volvo ("Engine Manufacturers").Note: Most Dura-Lite Evolution Charge Air Coolers are backed by our industry-leading (non-prorated) 7 Year/ 1,000,000 Mile Warranty. Certain part numbers carry a limited warranty ranging from 1 to 3 years depending upon the design or application. The individual product page on our website indicates the specific warranty period covered for each product. If you need further information about product warranty or anything else, please contact our Customer Support team.In addition, Dura-Lite now covers Warranty Labor! Find out more Dura-Lite is a privately owned, Canadian based supplier of premium quality Charge Air Coolers, Radiators, and Charge Air Cooler Testing Equipment for all turbo-diesel powered equipment used in heavy-duty truck, transit bus, motorcoach, motorhome, industrial, agricultural, and construction markets. Dura-Lite is a world leader in the heat transfer industry since 1992. Dura-Lite's products are manufactured in North America, Australia, and Asia.Our customers are served by our network of dealers and our large inventory of products situated in our strategically located, multiple warehouses in Canada and the USA.Our e-Commerce websites allow our customers to browse the Dura-Lite Catalog, check product dimensions, availability and confirm vehicle fitments for both charge air coolers and radiators. Once the right product has been identified it can be added to a Cart and purchased with just a few clicks of a mouse. USA StoreGet in touchWhen Only The Best Will Do - Dura-Lite!

Charge air cooler. How charge air cooler works. How does charge air cooler work.