BENDIX ADVANCES COMMITMENT TO ENVIRONMENTAL LEADERSHIP

A focus on technology, facilities reduces the environmental impact of the company and its customers

Bendix Commercial Vehicle Systems LLC (BCVS) has been setting the industry standard for over 85 years in the development and manufacture of advanced active safety and braking system technologies. The company is equally committed to industry leadership in preserving and protecting our planet.

Together with its joint venture, Bendix Spicer Foundation Brake LLC (BSFB), BCVS continues to develop technology solutions that promote cleaner air, reduce fuel usage, and ensure progress toward a new generation of cleaner vehicles. The company also fully supports the intent of the final rule issued jointly by the National Highway Traffic Safety Administration (NHTSA) and the Environmental Protection Agency (EPA) establishing a comprehensive Heavy-Duty National Program. The HD National Program is intended to reduce greenhouse gas emissions and increase fuel efficiency in commercial medium- and heavy-duty vehicles manufactured between 2014 and 2018. Government agencies – NHTSA and the EPA – are nearing delivery of the second phase of the HD National Program for post model year 2018 vehicles, with the NPRM (Notice of Proposed Rulemaking) released in 2015, and a final rule planned for 2016. Bendix continues to provide insight regarding technologies that we feel can make an impact in helping our OEM customers meet the new, likely more stringent, requirements anticipated for this new phase. In addition to that proposed national program, Bendix stands ready to respond to legislation at the state level that reduces the amount of copper allowed in brake friction materials beginning in 2021. At the same time, Bendix continues to make green initiatives a priority in its facilities and operations.

HD National Program – Bendix Technology Solutions

Bendix is driven to deliver environmentally friendly solutions that optimize vehicle performance, energy efficiency, and emission reduction. Among the solutions are an air management system, advanced active safety technology, and a tire management system. When integrating all Bendix technology solutions, a total fuel reduction of as much as 20 percent can be achieved, versus traditional technologies, depending on vehicle configuration and fleet operations. These technologies support OEMs in their goals to meet the requirements of the HD National program.

- **Air management system**

  Bendix has developed a cost-effective air management package that offers significant environmental benefits to all engine types and OEMs. The package, consisting of the Bendix® Intelligent Air Control (IAC) Dryer and a lightweight, energy-efficient Bendix® compressor, enhances vehicle performance, reduces fuel consumption, and improves emissions. The technologies optimize the performance of all engine types, including those using Selective Catalytic Reduction (SCR) to meet the federal EPA emission standards implemented in 2007 and 2010.

  Bendix® IAC™ Intelligent Air Control is a compact, electronically controlled air treatment system that integrates the air dryer, Electronic Control Unit (ECU), unloader valve, and multi-circuit protection valve. Its four primary functions are brake system air quality assurance, pressure control, air distributions defined according to customer priorities, and information management. Internal sensors enable optimized air system control, plus on-board/off-board prognostics. The IAC replaces the traditional governor mechanism in the air brake system using software algorithms to manage air supply in the most energy-efficient manner. A commercial vehicle equipped with IAC technology can realize up to .5 percent in fuel savings.

  Our next-generation Bendix® single cylinder, fuel efficient compressor complements the IAC by utilizing a lighter housing and an efficient internal design that reduces required input horsepower across the charging cycle. The unique piston design provides industry-leading low levels of oil bypass, which can foul critical components in both charging and powertrain systems. The ultra-efficient unloader design is up to 30 percent more efficient than previous generations.

Both technologies, working together, can provide superior modulation and better control of air-operated functions in the vehicle and can yield up to a 1 percent overall fuel economy improvement, depending on vehicle configuration and fleet operations.

- **Advanced active safety technology**

  Bendix® Wingman® Advanced™ – A Collision Mitigation Technology, introduced in 2011, contributes to reduced fuel consumption. It is designed to deliver driver-friendly, forward collision warning and mitigation using full vehicle and braking system integration – whether or not the vehicle is in cruise control. In addition to the safety benefits, the active cruise with braking system portion can help drivers stay in fuel-efficient cruise control mode longer – while helping them maintain a safe following distance behind the vehicle ahead. This can result in fuel savings as high as 5 percent, depending on fleet operations.

  In 2015, Bendix introduced the **Bendix® Wingman® Fusion™** system – a groundbreaking combination of camera*, radar and braking technologies to deliver enhanced collision mitigation and other features to help drivers mitigate a variety of crash scenarios, including rear-end collisions, side-swipe crashes, rollover and loss-of-control situations. Fusion delivers similar fuel economy improvements as the Bendix® Wingman® Advanced™ collision mitigation system does.

- **Tire pressure monitoring system**

  The **SmarTire® Tire Pressure Monitoring System (TPMS) by Bendix CVS** monitors the pressure and temperature of each tire on a commercial vehicle or trailer to provide real-time, temperature-compensated tire pressure information to the driver or technician. Keeping commercial vehicle tires and trailer tires at proper inflation levels can deliver up to an additional 2 percent in fuel savings and maximize tire life. Tire pressure monitoring systems are one of the technologies the EPA and NHTSA note that OEMs and fleets can use on their tractor-trailers, trucks, and busses to help improve fuel economy and, in turn, help reduce greenhouse gas emissions.

- **Foundation brakes**

  To meet the phase one federal reduced stopping distance (RSD) mandate that took effect Aug. 1, 2011, trucks using foundation drum brakes require wider and heavier brakes. Because RSD phase two – which launched Aug. 1, 2013 – affects heavier vehicles and those with a wider variety of axle arrangements, Bendix has engineered friction materials that provide more brake torque to both tractor and trailer brakes. Trucks equipped with Bendix® ADB22X™ air disc brakes while exceeding RSD standards, can offer a significant weight savings over the wider drum brakes. Lower weight brake combinations could contribute towards improvements in fuel efficiency.

Bendix is committed to policies that enable the introduction of new technologies needed to support sustainable mobility. The company offers and will continue to develop product solutions to help OEMs, fleets, and owner-operators meet the HD National Program standards.

Meeting State Copper Limitations

Bendix has been proactively addressing the environmental concerns reflected in recent state laws passed in California and Washington that reduce the amount of copper allowed in brake friction materials beginning in 2021.

In March 2010, Washington became the first state to pass legislation in an effort to protect its waterways from the runoff of toxic copper brake dust to marine life. California's bill became law in September 2010. To help with implementation, in 2012, Washington issued the "Better Brakes Rule" requiring brakes manufactured after January 1, 2015, to comply with the rule. (California has not completed a rulemaking, but has provided guidance in alignment with Washington's rule.) Both states require that brakes contain no more than 5 percent copper beginning in 2021. By 2023 in Washington, and 2025 in California, the limit will be reduced to < 0.5 percent. Along with the copper and heavy metal reduction, Washington state is requiring that packaging identify the level of reduction being met. Bendix is also meeting this requirement.

The limit for cadmium and its compounds is < 0.01 percent by weight, while the limit for chromium (VI) salts, lead and its compounds, mercury and its compounds, and asbestiform fibers are < 0.1% in California for 2014 and in Washington for 2015. Bendix applauds and supports the efforts of our trade organization, the Motor & Equipment Manufacturers Association (MEMA), and other vehicle organizations in the successful completion of memorandum of understanding (MoU) with the U.S. Environmental Protection Agency (EPA) and the Environmental Council of the

States resulting in the Copper-Free Brake Initiative. As noted in the MoU, “the purpose of this agreement is to phase out copper and other constituents used in brake pads nationwide. The voluntary practices and approaches described in the Copper-Free Brake Initiative are modeled on laws and regulations currently in place in the states of Washington and California, which have taken the lead in establishing requirements to phase out the use of copper and other constituents used in brake pads.”. The MoU was signed on January 21, 2015.

BSFB’s lineup of Bendix® brand foundation drum brakes – available on a full range of OEM models today – currently meets the new state mandates. All Bendix foundation drum brake linings contain less than 5 percent copper, making them compliant to the 2021 requirement. The company’s drum brake lineup is also nearly 100 percent compliant with the more stringent 2025 copper restrictions. The majority of Bendix® air disc brake solutions contain less than 5 percent copper, making them 2021 compliant as well.

Bendix is working to reduce the copper content in the small percentage of its disc brake solutions that would not be compliant to the future 2021 regulation. Disc brakes are semi-metallic and pose a greater compliance challenge for all manufacturers.

A Corporate Commitment to Green

Along with technology development and support of national green policies, Bendix continues to advance environmental and sustainability initiatives throughout its organization. At present, all Bendix manufacturing sites and the corporate headquarters in Elyria, Ohio are ISO14001 certified and are already preparing updates to comply with the recently revised standard ISO14001:2015. Growing scrutiny toward industry's effects on the environment has made conformance with ISO14001 more important than ever. ISO14001 drives continual improvement in environmental performance and Year-over-Year reduction of each site’s operational impact. It specifies requirements for establishing an environmental policy, determining environmental aspects and impacts of products/activities/services, planning environmental objectives and measurable targets, implementation and operation of programs to meet objectives and targets, checking and corrective action, and management review.

In addition, through the Knorr-Bremse global initiative – ECCO2 – Bendix continues to drive improvements in our organization’s energy efficiency. Initially launched in 2010, it requires every Bendix location throughout North America to: 1) carry out a systematic assessment of their processes; 2) find suitable ways to improve energy and resource efficiency; and 3) define and implement appropriate measures that will benefit the environment, but also contribute to the group’s long-term competitive ability. The result has been a reduced environmental footprint, which benefits the communities Bendix calls home. The company surpassed its phase I goal of 20 percent reduction of energy consumption rate, and CO_2 emissions rate. Phase II goals (2015-2019), include a 10% reduction in energy consumption rate as well as implementation of an energy management system, such as ISO50001. Company-wide, Bendix saved more than 6.3 million kilowatt hours – translating to a savings of $383,700 – through implementation of energy-efficiency projects over the last 24 months. One site, the Bendix plant in Bowling Green, Kentucky, has already reached its 2019 goal.

The savings are due in large part to the company’s continued improvement of lighting efficiency, and a focus on the primary energy consumers – HVAC and compressed air. With efforts well underway, the company aims to be 100 percent lighting efficient by 2018. Bendix is also engaged in another important initiative by standardizing its energy submetering system and reports. Submetering is the installation of metering devices with the ability to measure and identify the energy usage of the major energy consumers within each facility. The company’s real-time data collection drives efficient management of energy demands, as well as peak and down times. Bendix has added energy submetering at its Elyria headquarters, as well as its Acuña, Mexico, and Huntington, Indiana, campuses. It plans to implement submetering at all manufacturing locations by 2019.

A leader in diverting waste from landfills, Bendix achieved a 96.4 percent diversion rate in 2016, continuing to focus on finding new ways to prevent plant waste from going into landfills by increasing recycling opportunities.

Bendix diverted more than 22 million pounds of waste, which included recycling more than 8,700 tons of material last year – waste that once would have gone into landfills. Bendix has an effective two-step plan to increase its waste diversion efforts Year over Year. Step one targets diversion of only industrial waste. Four Bendix facilities are already industrial waste landfill-free, and an additional four facilities are scheduled to follow and reach this milestone in 2017. The second step targets diversion from landfill of all remaining waste, including general trash and cafeteria waste. The company is well on track to reach this overall goal to be landfill-free by 2020.

Bendix also reduces its environmental impact through its remanufacturing efforts, dismantling parts such as compressors, air dryers, valves, and brake shoes after their initial use, salvaging key components and reassembling them with salvaged (when applicable) and new components to meet current specifications. This efficient form of recycling reduces the carbon footprint associated with the fabrication of new parts by 80 percent.

For Bendix, the "3 Rs" for environmental sustainability – Reduce, Reuse, and Recycle – is the key for success. Most of the current waste diversion by Bendix has been achieved through recycling, but the company is now focusing on reduction and reuse. At the Acuña manufacturing campus, discarded desiccant from recycled Bendix® air dryers is sent to a company that reclaims and reuses the waste material for use in producing cement. In 2015, Bendix is continuing its emphasis on reducing the use of packaging material – cardboard and wood – by working with its suppliers to institute returnable containers, where feasible and finding beneficial reuse for the largest waste streams at our manufacturing locations. This is an ideal sustainability project, as it will not only yield environmental benefits – reduced waste – but have a beneficial economic impact for the organization. For Bendix, the ultimate goal is to be a Zero Waste operation.

"From our facilities to our technologies, Bendix is committed to the environment," said Berend Bracht, Bendix president and CEO. "The company believes in innovations that can lead to a sustainable future for everyone."

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