

Engine evolution

The Perkins 400 series engines, from **Perkins Shibaura Engines**, are the company's EPA Tier 2/Euro stage II-compliant successors to its 100 series diesel engines. The 400 series is a range of three- and four-cylinder, water-cooled, naturally aspirated, and turbocharged indirect-injection engines offering 10 to 60 hp (7 to 45 kW). Power



and torque have been increased by 8 and 10%, respectively, and the engines run clean and quiet, according to the company, with a reduction in noise level at low-idle speed of up to 5 dB(A). Applications include construction machinery, turf- or general-industrial equipment, or electric power generation.

For more information, circle 1

Mining engine

DaimlerChrysler Off-Highway offers an upgraded 16V 4000 engine with 3000-hp (2240-kW) output for use in heavy-duty mining vehicles and 300-ton (272-t) dump



trucks. The new engine offers a 3K turbocharger system from **BorgWarner Turbo Systems GmbH** that features four K365 turbochargers and is equipped with a **Detroit Diesel** electronic controls system to monitor turbocharger speeds. By re-engineering the main and big-end bearings, 16,000 h maintenance intervals are expected for a load factor of up to 30%. The thickness of the sputtered bearing surface was adjusted to the hard operating conditions of mining vehicles.

For more information, circle 2

Flexible driveline

ZF Passau GmbH offers the specialized axle range ZF-Multisteer MS-T 3000, ZF-Multitrac MT-T 3000 tailored specifically for telescopic handlers. Benefits of the flexible steering concept include steering axles for rigid or oscillating suspension, high



ground clearance from compact inserts, and a large planetary stage in the wheel heads. An integrated multi-disc functions as a service and parking brake with a fail-safe function, with various options for suspension, ratios, and differentials. The steering cylinder integrated into the steering axles offers a steering angle up to 55°. The shuttle transmission WG 98 offers conditions for quick reversing and for high on-road speeds. Other features include a compact design with reduced parts, low initial speeds, engine-dependent power take-off, and a

low mass. For vehicles with a low-boom design, the transmission is available in a side-mounting version, particularly suitable for short and narrow telehandlers.

For more information, circle 3

Performance engine

Volkswagen's TDI, maximum power density 2.5-L Euro III industrial engine features a combination of variable-geometry turbocharger, intercooler, and electronic injection to improve throttle response and high torque over a wide speed range. Exhaust



gas recirculation combined with overall engine design offers low emissions, while a fully electronic management system improves reliability. The TDI engine is service friendly, according to the company, due in part to valve actuation via a single overhead camshaft, a maintenance-free valve train, and a vertical oil filter with replaceable cartridges. With a mass of 200 kg (536 lb), the compact engine features a displacement of 2460 cm³, 80 kW (107 hp) of power, a 17.5:1 compression ratio, charge air pressure of 1.1 bar (16 psi), and a cold start temperature of -24°C (-11°F).

For more information, circle 4

Heating and cooling system

Espar has introduced its new Total Comfort System for heating and cooling in the truck, bus, automotive, and marine markets. Complementing its line of auxiliary independent heating systems are the Bergstrom NITE System air-conditioner (pictured), which is an under-the-bunk-mounted system with a 3000 BTU/h output, and the DC Airco A/C system, which is rooftop-mounted



and has a 9000 BTU/h output. Both systems are electrically driven, so they do not use any of the onboard fuel and do not need any outside engines for power. Each A/C unit is paired with Espar's Airtronic 2 bunk heater, which has a mass of 6 lb (2.7 kg) and can be installed nearly anywhere within a vehicle. The Hydronic 5 engine preheater is also part of the comfort system.

For more information, circle 5

Industrial engine

The Series 60 Tier-3 off-highway engine from DaimlerChrysler's Detroit Diesel division meets new emissions standards and offers the same basic configuration as the Tier-2 Series 60 with no need for EGR (exhaust gas recirculation) or aftertreatment. The 14-L model offers common engine hardware from 300 to 665 hp (224 to 496 kW). Improvements



have been made to the combustion, air-handling, and electronic systems. An electronic control system features increased capacity, memory, and capability, and additional inputs and outputs.

For more information, circle 6

Forestry axles

The new Spicer Hercules 37R and 43R axles for forestry and other heavy-duty off-highway applications from Dana Corp. feature a rigid three-piece load-supporting design with differential carrier, housing arm, and planetary wheel-end. The axle structure uses "extra-high" capacity wheel-end bearings and modular structural components to allow for a wide range of



vehicle weights, tracks, tires, and chain combinations. Inboard multi-disc brakes on the 37R116 and 43R175 take advantage of oil-sump cooling within the differential and housing arm areas for optimum braking performance and durability for skidder and feller buncher applications. Free-floating sun gear, internal gear, and axle shaft components optimize contact ratio and load-sharing for reduced stress.

For more information, circle 7

Travel drive

The 706CK-MAG 50VP drive from Bonfiglioli Riduttori is designed specifically for mini excavators but is also suitable for small crawler loaders, tractors,



and similar machines in the 3- to 6-t (3.3- to 6.6-ton) class. The compact, two-stage planetary gear unit has a standard reduction ratio of 1:26.8 to 1:43.8 and a maximum torque of 12,500 N•m (9200 lb•ft). It features a two-speed Kayaba hydraulic motor fitted with a reverse valve for circulating and cooling the hydraulic fluid, contributing to reliability in both continuous operation and at peak capacity in a closed-loop circuit. A hydraulically released multi-disc, fail-safe parking brake is integrated into the hydraulic motor.

For more information, circle 8

Backhoe driveline

CNH Power Components has introduced a mini backhoe loader driveline based on its D15 drive axles. The D15 driveline features a rigid rear axle and drive/steer front axle as well as a new two-speed hydrostatic drive box that allows the selection of either two- or four-wheel drive. When coupled with a two-speed hydraulic motor, this feature provides a machine with both traction and transport speed plus selectable four-wheel drive. The rear axle has oil-immersed brake discs, hydraulically applied braking, and a differential lock. According to CNH, an advantage of the driveline is its strength in relation to its overall envelope. With a drive/steer axle width under 1.3 m (4.3 ft), the axles offer dynamic loading up to 3700 kg (8160 lb).

For more information, circle 9

Fan drive

Horton's VMaster viscous air-sensing fan drive is a pulley-mounted fan drive designed for use in heavy-, medium-, and light-duty trucks, buses, and other off-highway equipment. A large flat-plate bimetal sensor sheds debris and reduces the likelihood of the engine overheating



from fan-drive failure. The fan drive offers automatic transitions to optimum speed and cools only when needed, resulting in improved engine performance and reduced noise and fuel consumption, according to the company. The VMaster is lightweight and features a fully-sealed design. The line, which includes first-fit and aftermarket applications, is compatible with fans from other manufacturers.

For more information, circle 10

Data controller

The controller/gateway from **ifm efector** extracts and displays engine performance data such as oil and fuel pressure, coolant and fuel temperature, battery voltage level, rpm, and exhaust gas temperature. Operating as a controller, the unit controls applications such as moving and lifting mechanisms, remote hydraulics, timing/sequence control, load sensing/



limiting, analog output monitoring, and proportional control of outputs. As a gateway, information is exchanged between a CAN-based system used in the application and the vehicle's powertrain controls, including the engine and transmission. The gateway uses the standardized application layer protocols CANopen and SAE J1939 to control the functions of special-purpose applications on a vehicle, and to enable the exchange of data between applications and the vehicle's powertrain. The unit simplifies dashboards and wiring and gives operators feedback from one location. It resists varied temperature levels, as well as extreme shock and vibration. A high ingress protection rating withstands direct exposure to dirt and water.

For more information, circle 11

High-speed transmission

The Speed+ transmission from **Poclair Hydraulics, Inc.** is a hydrostatic transmission suitable for agricultural vehicles that need large transmission ratios, high gradeability performance in the field, and high-speed on-road. It is based on the company's MW range of three- or four-speed multi-displacement motors, which are capable of rotational speeds up to 250 rpm. The Speed+ transmission provides up to 174 in³ (2857 cm³) of displacement at 6500 psi (450 bar) and incorporates heavy-duty bearing supports for larger, faster loads. Poclair's Dyna brakes are positioned around the bearing support and combine the parking, emergency, and service brake into one. The transmissions allow crop sprayers to achieve speeds over 40 mph (65 km/h), and can be manual or fully automatic



when combined with SMARTDRIVE electronic-transmission-control systems. SMARTDRIVE system features include automatic shift speed for continuously variable vehicle speed, cruise control, engine power limitation, engine anti-stall, vehicle traction control management, and transmission safety features.

For more information, circle 12

Compact transmission

HL series transmission types 250, 270, and 290 from **ZF Passau GmbH** can be used in wheeled excavators from 550 to 950 N•m (406 to 700 lb•ft). Combined with three-axle types, the systems cover vehicle masses up to 25 t (27.5 ton). Other features include a compact installation size with standard mounting points, improved gearshift quality, fewer standardized components, a standard



brake design for the front and rear axles, and an increase in tractive power. Transmission noise levels were reduced by decreasing the speed of the hydraulic motor. The transmissions are available in two variants of transmission ratio, matched to the transmission ratios of the axles and resulting in improved shift-spacing and efficiency for enhanced driving performance of mobile construction machines. The transmission can be mounted separately on the chassis or directly on the axle. An external oil line is not needed, and optional integrated downshift protection is implemented hydraulically and electrically. The axles feature a 25% part reduction over previous models and an integrated steering cylinder is protected behind it.

For more information, circle 13

Rugged generators

Rugged EB/EM series generators from **Honda** Power Equipment offer a heavy-duty, 27-mm (1.1-in) frame tubing and a 6.6-gal (25-L) fuel tank. Both series are available in 3800-, 5000-, and 6500-W. The EB features ground-fault circuit-interrupter protection to meet **OSHA** jobsite regulations, while the EM deluxe model (shown) offers home standby use.



Other model additions include a fuel gauge, a redesigned outlet panel with improved service access, an extra duplex outlet, redesigned handles for transport, increased bumper protection to minimize transport damage, and reinforced standing legs for durability. The GX series commercial-grade overhead-valve engines power all three generators and improve noise efficiency. The series includes a standard wheel kit, automatic voltage regulator, auto throttle, and a 120/240-V selector switch.

For more information, circle 14

Powershuttle transmission

Designed for compact vehicles including backhoe loaders, telescopic handlers, and tow tractors up to 120-hp (94-kW), the Spicer powershuttle transmission model PSR08 from **Dana Corp.**'s Heavy Vehicle Technologies and Systems Group features improved shift-quality and driver comfort provided by pre-filled forward and reverse clutches. A lubrication system minimizes clutch drag to make shifting in the speed



ranges easier and more efficient. A 12-in (305-mm) torque converter with a freewheel provides lower engine speeds, while a spring-applied, oil-immersed park brake improves brake life. All helical gears have been designed to reduce noise levels, and the transmission is offered in two- and four-wheel designs.

For more information, circle 15

Check valve

Minnesota Rubber QMR Plastics offers improved oil flow control in marine and industrial engines with a two-piece, glass-reinforced nylon check valve. Its two molded components incorporate rubber seals that are chemically and mechanically bonded to each end of the valve to prevent oil flow to one filter during regular engine operation while allowing oil flow to the second filter. The two-piece design also simplifies the rubber molding process.



The glass-reinforced nylon offers improved stability at elevated oil temperatures and less mass and improved assembly. The valve's hollow design structure provides relief from thermal expansion during operation.

For more information, circle 16

Engine exhaust

A disposable exhaust filter from **Donaldson Co. Inc.** designed for mining equipment allows operators to meet the latest emissions standards for diesel particulate matter. The filter can operate in temperatures as high as 650°F (343°C) and for uncooled, non-permissible applications with normal operating temperatures below 600°F (315°C). The water-resistant media performs in water-cooled permissible applications, eliminating the need for water de-misters that can contaminate cellulose media and reduce filter life to 8 h. The filter meets



U.S. Mine Safety and Health Administration testing requirements for filter efficiency and suitability for mining applications.

For more information, circle 17

Multi-purpose engine

John Deere Power Systems offers a complete line of PowerTech diesel engines ranging from 36 to 448 kW (48 to 600 hp), with displacements from 2.4 to 12.5 L, for use in a variety of off-highway applications, including construction, agriculture, and forestry. The Tier 2/Stage II engines meet emissions regulations and offer improved engine cooling, control,



and fuel systems. A front geartrain of two high-contact ratio gears mounted to the block simplifies design and reduces noise by 50 to 90%, or 3 to 8 dB(A). Other features include automatic adjusting hydraulic lifters; an independent, cast-iron water pump that resists corrosion; heavy-duty crankshaft and bearings; and a compact four- and five-cylinder block that includes front and rear flanges. Standard glow plugs provide cold weather starting as low as -15°F (-26°C), and an independent fan drive is offered in two heights to adapt to confined enclosures.

For more information, circle 18

Sensor assembly

Providing powertrain design engineers with a noncontact means of detecting the position of a rotating shaft, the **OPTEK Technology** division of **TT electronics** developed a Hall-effect filter assembly designed for high temperature and dust and dirt environments. The device uses hallogic technology, which combines a Hall-effect sensor element, linear amplifier, and Schmitt trigger on a silicon chip to provide noncontact sensing for



rotary shafts or gear-tooth position applications. Packaged in a thermoplastic housing, the assembly includes an earth magnet to produce flux at the Hall-effect sensor location. "True-power-on" feature helps determine absolute position upon power-up. Other applications include camshaft and crankshaft position sensing, drivetrain and transmission speed sensing, and a wide air gap of 0.125 to 3.18 mm (0.005 to 0.125 in) that allows the Hall-effect sensor to read the changes in the magnetic field around a toothed gear and a slotted wheel attached to the shaft. The sensor has an operating temperature range of -40 to +165°C (-40 to +329°F) with a supply voltage of 25 V. Output characteristics are constant at switching speeds from dc to more than 200 kHz.

For more information, circle 19

Steering unit

Bosch Rexroth AG offers solutions for improved steering systems and emergency steering functions that are now required by more stringent legal requirements associated with faster speed. The compact LAGU steering system features an integral chamber shut-off to halve steering forces in the event of a supply failure. Another separate emergency supply option is based on the EHP (electro-hydro pump) currently used in wheel loaders, while a



third, the A10VVO emergency steering pump, is unpressurized and turns with one of the axles during normal operation. If the supply fails, it automatically swivels out and builds up emergency steering pressure.

For more information, circle 20

Engine variety

The PowerTech and PowerTech Plus Tier 3/Stage IIIA heavy-duty engines from **John Deere Power Systems** feature a 40% reduction in NOx, achieved by reducing peak combustion temperatures without compromising engine and installation parameters. The PowerTech engines are designed for cost-sensitive markets and PowerTech Plus engines for performance markets. Both offer a variable geometry turbocharger to help drive the EGR (exhaust gas recirculation) and adjust the amount of recirculated gas that mixes with fresh air. PowerTech Plus lines are available in 4.5-, 6.8-, 9.0-, and 13.5-L models, offering 104 to 448 kW (140 to 600 hp). A 32-bit, PC-based engine control unit (ECU) controls air-to-fuel ratio, multiple fuel injections, and the amount of EGR. The ECU features snapshot diagnostics to record and store



up to seven sets of data. The PowerTech engine, available in 4.5- and 6.8-L models, offers 60 to 129 kW (80 to 173 hp) and uses two-valve cylinder heads, a high-pressure common-rail fuel system, full authority electronic engine controls, standard or wastegate turbocharger, and air-to-air intercooling.

For more information, circle 21

Elastomeric couplings

The JIS six-pin, jaw in-shear elastomeric couplings from **Lovejoy Inc.** add six sizes extending the maximum bore up to 9 in (229 mm), and introduce a non-lubricated drop-in replacement for grid spacer couplings. The JIS six-pin element, molded as a wrap-around strip, positions elastomeric cushions to span the shear-plane between the jaws of driving and



driven hubs. The radially removable design shortens element-replacement downtime by eliminating the need to disassemble hubs. Converting to in-shear service doubles the coupling's angular misalignment capability to 2° and its parallel misalignment capability to 0.030 to 0.094 in (0.76 to 2.39 mm) while adding torsional wind-up of 5° at full load for added vibration-damping action. Spacer designs fill between shaft end gaps of 3.5, 5, 7, and 9 in (89, 127, 178, and 229 mm), with maximum bores up to 5.5 in (140 mm). The JIS six-pin ring is comprised of type 347-cast stainless steel, while the six-pin element is made of 50D shore urethane and has a maximum operating temperature rating of 200°F (93°C). A total of 16 hub/ring/element sizes serve maximum torque requirements up to 366,666 lb•ft (41,428 N•m).

For more information, circle 22

Power transmission

The ZF-Ergopower series of countershaft-type transmissions from ZF Passau GmbH feature wide, helical, high-contact gearing through the use of short, torsion-free shafts and bearing technology. The control unit, ZF-Ergocontrol, provides optimum shift management, while driving up a steep gradient with a full shovel. The high-static dynamic forces involved during breakout and when loading, and the corresponding levels of tractive power, are transferred by the ZF-Multitrack axles. The transmission system's modular concept and optimized design lead to increased lifetime, reduced transmission mass, and decreased maintenance costs, according to the company. The axles feature compact inserts to increase ground clearance and are available with locking systems and internal brake systems to improve performance. Ergocontrol software synchronizes the components of the drivetrain to optimal driveline management.

For more information, circle 23



Diesel engines

Iveco Motors of North America, Inc.'s NEF Series of diesel engines offers a range of three-, four-, and six-cylinders that can be specified to meet applications in the industrial, agricultural, marine, and power-generation industries. Access is provided to every part of the engine, reducing maintenance time, and the engines feature 40% fewer components than engines of equal performance, low lubrication oil consumption, and a noise level below 91 dB(A). The combustion process enables the engines to contain



minimum hydrocarbon and NOx emissions. The engines are constructed with traditional or structural engine blocks for load-bearing purposes, and custom configurations are available to match any power need. Design solutions include two- and four-valves-per-cylinder, mechanical and electronic injection systems, coupling flywheel housings, oil sump configuration, intake and exhaust manifolds, and fan axis position.

For more information, circle 24

Wheel drive

The Rexroth HYDROTRAC GFT wheel drive with integral dynamic service brake or shiftable gear-stage from Bosch Rexroth AG increases the safety of self-propelled mobile machines that travel on roadways. The standard multiple-disc holding brake for the gearbox may be used as an additional service brake by using brake pistons in the planetary gearbox, eliminating the need for a conventional



external service brake. The compact GFT T2/3 drive features dirt-proof construction as well as a back-up planetary gear preliminary stage that allows the vehicle to be driven faster, reducing point-to-point travel times. When actuated, the gear ratio increases from four to six, producing different engine and travelling speeds.

For more information, circle 25

Gear drives

Funk Manufacturing, a subsidiary of John Deere Power Systems, offers eight basic models of planetary gear drives in speed reducer, swing, and track drive types. Each series provides benefits including improved durability, performance, and engineering. The P25 Series planetary drive is rated at a maximum input of 48 hp (34 kW). Input options include straight-in



for an on-centerline adaptation, giving a symmetrical clearance around the hydraulic motor input; offset-straight to allow the hydraulic motor to be mounted off center; or right angle input, which moves the hydraulic motor perpendicular to the centerline of the drive for added clearance between components on track drives. Keyed, flanged, or splined options are available to meet various required output connections. Applications include conveyors, cranes, crawlers, excavators, road rollers, track vehicles, and winches in the agricultural, construction, industrial, marine, mining, and petroleum industries.

For more information, circle 26

Hydraulic brake

Hayes Brake LLC's Lightning medium-duty hydraulic brake features 1850 lb (8.2 kN) of clamp force and a 1500-psi (103-bar) operating pressure. The compact, one-piece cast aluminum housing is suitable for mounting inside the wheel, while a square seal piston



retraction offers constant running clearance. Other benefits of the brake include 375 lb•ft (508 N•m) with an 8-in (203-mm) disc diameter, a floating pin design for improved mounting and flexibility, and quick-change pads that offer long-life friction material.

For more information, circle 27

Integrated driveline

The Carraro Group's driveline for backhoe loaders features a suspended front axle and servo-synchro gearshift. Suspension of the front axle ensures stability and constant vehicle trim under some operating conditions, allowing the



driver to safely perform necessary operations. Both the suspended front axle and the standard axle can use the same platform and are interchangeable in installation. The servo-assisted gearshift combines features of the synchronized gearbox and the automatic gearbox, improving reliability as well as versatility.

For more information, circle 28

Engine control

Ford Power Products adds components to its advanced engine control product line, including the MegaFactor, an electronic pressure regulator designed to boost engine performance. It meters dry fuels at precise pressures and high volumes, and delivers gaseous fuels consistently over varying temperatures and pressures. Other features include plug-and-play installation and a large fuel control range. The engine performance module (EPM) and the ignition performance module (IPM) are closely related electronic control systems that maximize performance of industrial engines. The EPM is for engines using dry fuel or fuel-injected gasoline, while the IPM is for dry fuels only. The EPM engine control package also incorporates a catalyst monitor sensor to control exhaust and make adjustments that will increase efficiency and catalyst life. The models



offer improved diagnostic capabilities, allowing technicians to troubleshoot the engines using a PC, laptop, or handheld device. Included software provides a snapshot of critical engine data whenever a fault occurs.

For more information circle 29

Brake system

The M30 WM from Hayes Brake LLC is suitable for hydraulic wheel motors with 8- and 10-in wheels. It is available as an integrated system with aluminum caliper, nodular iron bracket, and hub/disc and



offers 420 lb•ft (565 N•m) with a 6-in (152-mm) disc and 2900 lb (13 kN) clamp force. The M30 WM can accommodate standard- to medium-sized vehicles and equipment up to 50 hp (37 kW) without modifying existing brake systems and wheel motor designs. Other features include clockwise or counter-clockwise lever actuation and a single-piece caliper bridge design.

For more information, circle 30

High-capacity transmission

Dana Corp.'s Off-Highway Systems will replace the 32000 series with a Spicer TE15 transmission, designed for material-handling, underground-mining, rough-terrain cranes, and construction applications. The TE15 is said to deliver a 15% rating increase to 190 kW (250 hp) using larger bearings and stronger shafting and gearing. Both cast aluminum and stamped-steel torque converters are offered to provide a range of capacities to match Tier-3 engines. The capacity of the quieter PTO drive system has been increased by 35% to provide the flow needed to improve vehicle productivity. With many components common to the 32000 series and compatibility with the engine compartments, engineering effort is minimized. High-contact-ratio spur gears and helical gearing improve noise, while



full-flow solenoids and pre-charged clutches improve automatic shifting. Other features include an electronic control system with CAN 2B protocol, electronic clutch modulation, electronic-controlled inching, and diagnostic and troubleshooting elements designed in the software.

For more information, circle 31

Industrial engine

Volvo Penta offers a 9-L engine for processing machines, special vehicles, and electrical power generation. The engine is offered in four versions: TAD940VE (shown), TAD941VE, TAD942VE, and TAD943VE, with power outputs between 190 and 280 kW (255 and 375 hp). The new engines deliver 22% more



torque and 20% more power than their predecessor, with 1700 N•m (1254 lb•ft) between 1150 and 1550 rpm, and feature an injection pressure of up to 2000 bar (29,000 psi) for improved fuel combustion. The latest variation is also more compact, with an external height dimension reduced by 195 mm (7.7 in). Features include the EMS 2, an electronic control system for diesel engines that monitors and regulates a large number of components within the engine. Fuel needs are analyzed up to 100 times/s so the engine always receives the amount of fuel demanded by operating conditions, resulting in improved fuel consumption and cleaner exhaust emissions.

For more information, circle 32

Water pumps

Honda Power Equipment introduces the WB series of water pumps for commercial applications, including the WB20 (shown) and the WB30. The series replaces the outgoing WN, WP, and WD general-purpose pumps to consolidate the model lineup, according to the company. The 5.5-hp (4.1-kW) GX160 and 4.5-hp (3.4-kW) GX120 overhead-valve engines power the WB30 and WB20 pumps, respectively, and both feature oil alert



technology to prevent damage from oil starvation. The WB30 delivers a maximum discharge capacity of 275 gal/min (1041 L/min) and a maximum head of 83 ft (25 m), while the WB20 discharges up to 153 gal/min (580 L/min) with a maximum head of 94 ft (29 m). Other features include heavy-duty, full-frame protection, a rigid-mounted cast iron pump volute, and an abrasive-resistant silicone-carbide mechanical seal. High-performance mounts minimize vibration between the engine/pump unit and the frame.

For more information, circle 33

Filter systems

Johnson Matthey offers a range of diesel-particulate-filter (DPF) systems specifically designed to minimize operator demands and increase productivity for construction and mining machinery. A range of CRT (continuously regenerating trap) and other systems were developed to reduce particulate matter (PM), hydrocarbon, and carbon monoxide pollutants by as much as 99%, claims the company. The DPFs contain one or more filters to remove PM from the exhaust gasses, a regeneration system that cleans the filter by oxidizing the PM and producing carbon dioxide as a byproduct, and an electronic-monitoring system to ensure that the engine and filter are



functioning correctly. The electronic-monitoring system also can be used to control the regeneration system. Designed specially for off-highway machinery using stainless steel housings and vibration-reduced mountings, the DPFs also feature a modular design to improve servicing.

For more information, circle 34

Off-highway driveshaft

An improved Spicer Life Series 55 service-free driveshaft from **Dana Corp.**'s Off-Highway Systems features Glidecote slip splines for reduced friction and replaces **DuPont Corp.**'s Hytrel thermoplastic boot with a hard seal option to protect the slip member. The series 55 is available with long-length compensation for improved installation and a range of application



capability. Triple-lip sealing prevents dirt and contamination for improved service life. The driveshaft was engineered for such off-highway applications as backhoe and front-end loaders and is available with a variety of end fittings.

For more information, circle 35

High-torque gear units

Brevini USA, a division of **Brevini Riduttori Italy**, offers a series of high-torque planetary gear units for a range of industrial fixed and mobile applications. The S-series increases torque by 25% with a reduction of 40 to 60% in space and mass compared to the current series. The units are available in eight sizes with ratings from 25,000 to 275,000 lb•ft (34,000 to



372,850 N•m) and with transmission ratios from 3:1 to 3150:1. Features include four gears vs. the typical three, improved bearing life and durability, a rugged sealing arrangement, larger oil ports, and a robust adaptation system for large electric motors. S-series units are suitable for a range of applications including mixers, extruders, winches, cranes, and conveyors in the material handling, construction, and off-shore industries.

For more information, circle 36

Power units

NEF power units from **Iveco Motors** offer a complete package including a base engine, cooling package, and air filter that can be specified for stationary or mobile applications. The compact units arrive pre-engineered and feature 40% fewer components than previous models.



Additional components such as puller- or pusher-fans, balancers, engine mounts, and oil pans can be added. Naturally aspirated, turbocharged, and charge-air cooled versions are offered, with a power range of 80 to 277 hp (60 to 207 kW). The units meet EPA Tier-2 and EC 97/68 Stage-II requirements and are Tier-3 capable. Electronic control provides reduced fuel consumption, and offers onboard diagnostics, improved performance, and noise levels below 91 dB(A). The engines are constructed with traditional or structural engine blocks for load-bearing purposes, and custom configurations are available for any power need. Lubrication oil and filters need replacement every 600 h.

For more information, circle 37

Air-cooled diesel engines

The L48V, L70V, and L100V single-cylinder diesel engines from **Yanmar** are rated at 4.5, 6.7, and 9.3 hp (3.4, 5.0, and 6.9 kW) at 3600 rpm. Sized like gasoline engines, the L series engines are suitable for use in generator sets and pumps.



Designed to meet current emissions regulations, the L70V and L100V incorporate gas recirculation technology typically found in larger engines to recirculate a small amount of exhaust gas and mix it with intake air during the exhaust stroke. The fuel-injection system features a higher injection pressure, and a reconfigured cylinder block allows for a 3-mm (0.1-in) piston stroke. The engines include crankshaft, connecting rods, and redesigned balancer shafts.

For more information, circle 38

Brushless motor

The Etek brushless motor system from **Briggs & Stratton** Commercial Power features a pancake-style axial gap design with a programmable electronic motor system to improve flexibility for a broad range of application requirements, including utility vehicles. The motor is



capable of producing from 8 to 20 hp (6 to 15 kW), and is offered in 8- and 10-in (203- and 254-mm) versions. According to the company, the brushless system minimizes maintenance and improves reliability and productivity by using a programmable electronic motor controller (EMC) to perform the function of brushes. High-strength neodymium iron boron magnets are used in a disc-rotor arrangement to offer higher torque at lower speeds in a compact package; the motor is also available without the EMC for added versatility.

For more information, circle 39

16-L engine

A 16-L engine from **Volvo Penta** is available in several configurations for generator sets and as stationary industrial applications. The 16-L offers increased power and torque vs. the previous model, at 3150 N•m (2320 lb•ft) between 1200 and 1500 rpm and up to 605 kW (810 hp). An injection pressure of up to 2000

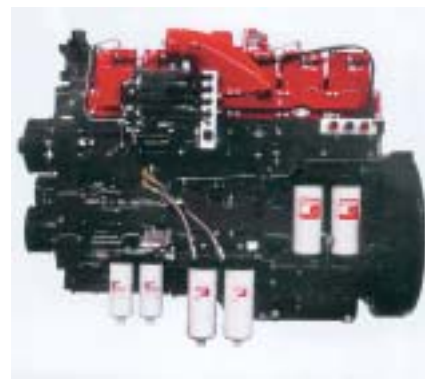


bar (29,000 psi) results in improved fuel combustion and consumption as well as lower NOx and particle emissions. The company's electronic EMS 2 monitors and regulates a large number of engine components to improve operational reliability and engine protection by creating a more responsive engine at increased loads. The EMS 2 also integrates all electronics into one unified system. Multiple configurations are available, and the straight-six composition results in fewer components and service and maintenance similar to the 9- and 12-L models.

For more information, circle 40

Mining application

Cummins' QSK19 engine incorporates combustion and fuel-system technology to deliver a 19-L platform with ratings of 373 to 522 kW (500 to 700 hp) for a range of mining, quarrying, and underground equipment. Designed for high-hour/high-load applications, the Tier-3 QSK19 offers a 10% durability increase and 20% lower oil consumption over previous models. An inline six-cylinder configuration and engine envelope of 2.42 m³ (8 ft³) provide a compact installation package. A high-efficiency turbocharger and low-temperature charge-air-cooling system contribute to a peak torque of 3000 N•m (2213 lb•ft) at 1300 rpm. Lower



piston temperatures and cylinder pressures result in reduced mechanical stress to improve engine life and efficiency, while the use of a high-pressure common-rail (HPCR) system designed for high loads and arduous conditions offers peak fuel injection pressures of up to 1600 bar (23,000 psi). With the HPCR system, maintaining pressure is not dependent on engine speed, load conditions, or fuelling capability. Other improvements to the 19-L include an upgraded electronic control module, fail-safe sensor designs, and double-wall protected fuel lines.

For more information, circle 41

Tier-3 engine

The C13 industrial engine from **Caterpillar** features ACERT technology, a displacement of 12.8 L, and five ratings from 385 to 520 hp (287 to 388 kW) at 1800 to 2100 rpm. ACERT technology controls the combustion cycle to reduce emissions and improve overall operating characteristics. Mechanically actuated, electronically controlled unit injectors (MEUI) provide multiple injections for rate-shaping, reducing NVH, and have 30,000-psi (2068-bar) peak-injection pressure. The next-generation ADEM 4 engine control module has increased speed and memory and a 120-pin engine connector, while cross-flow cylinder heads improve combustion. A high-capacity sump extends oil drains to 500 h. The engine was designed using an improved block-to-head joint, stronger connecting rods, and steel pistons for a higher compression ratio to improve power density and startability. Applications include compressors, chippers, harvesters, snow blowers, and other off-highway and construction machines.

For more information, circle 42

Electronically controlled diesel engines

Two 7-L diesel engines for electrical power generation from **Volvo Penta**, the TAD721GE and TAD722GE (shown), combine high output, low fuel consumption, and minimal exhaust emissions with long service intervals, according to the company. The EDC4, a comprehensive electronic control system, controls rpm and torque, monitors the



engine system, and sounds an alarm when operational problems arise. With EDC4, a switch can be installed that allows the operator to change the engine's operating frequency between 50 Hz (1500 rpm) and 60 Hz (1800 rpm). The engine can be operated using a potentiometer or using CAN bus technology for improved integration into larger systems. An advanced fuel system with turbocharged, air-to-air charge-air cooler, unit pumps, and electronic controls offers improved fuel efficiency and reduced exhaust emissions. Other features include an operating life of 500 h between oil changes, limited servicing needs, operating temperature range of up to 60°C (140°F), and cold start ability as low as -15°C (+5°F) without assistance or -30°C (-22°F) with assistance.

For more information, circle 43

Industrial engines

Cummins' QSB industrial engine platform for high-volume 80 to 250 kW (107 to 335 hp) power includes a four- and six-cylinder engine duo with high-pressure common rail (HPCR). The revamped engine's rear gear drive platform was designed to meet Tier-3/Stage-IIIa emissions. The four-cylinder, 16-valve, 4.5-L version offers 127 kW (170 hp) at 2500 rpm and 634 N•m (467 lb•ft) at 1500 rpm, while the six-cylinder, 24-valve, 6.7-L peaks at 205 kW (275 hp) at 2500 rpm and 990 N•m (730 lb•ft) at 1500 rpm. Driving the QSB engine-management system is an upgraded electronic control module with twice the processing speed and memory capacity as its predecessor. The electronics enable the HPCR system



to control fuel timing, quantity, pressure, delivery rate shape, and the number of injection events. At low engine speed or under low load, the high pressures can be maintained to produce more efficient combustion, with a maximum operating pressure of 1600 bar (23,000 psi). An improved rear gear drive configuration reduces noise at both idle and rated speed, and self-monitoring and -protection checks decrease maintenance intervention.

For more information, circle 44

Three-cylinder multi-fuel technology

Briggs & Stratton Commercial Power offers a line of compact diesel, petrol, and gaseous fuel Vanguard three-cylinder, liquid-cooled engines that range from 13.4 to 25.4 kW (18 to 34 hp). The



interchangeable engines feature the same envelope and identical PTO and mounting dimensions to minimize development costs. Features include a single-ply, thin-metal head gasket, improved combustion chamber function and engine performance, and low vibration from precision balancing.

For more information, circle 45

Compact technology

Caterpillar's C6.6 industrial engine is the smallest of the company's ACERT technology engines and offers 10% more displacement and a broad power range in the same size envelope vs. its predecessor, the 3056. The C6.6 is rated from 119 to 250 hp (89 to 186 kW) and 728 lb•ft (987 N•m) at 1400 rpm. Available with an air-to-air charge-cooled turbocharger, the C6.6 is Tier-3/Stage-IIIA compliant.



Other features include no increase in heat rejection to the coolant, a 500-h recommended service interval (1000-h interval as an option), convenient service access, improved fuel tolerance, cross-flow heads with four valves per cylinder, full authority electronics, integration with other systems through a CAN bus, improved diagnostics, cruise control, and throttle override by the hydraulic system or transmission. The engine will accept kerosene and jet A fuel. Hydraulically actuated, electronically controlled unit injectors improve combustion characteristics and reduce exhaust emissions and engine noise. Several configurations are available for the back end of the engine, and applications include lift equipment, chippers, tractors, transit tractors, and trenchers.

For more information, circle 46

Air- and liquid-cooled engines

Vanguard 18.65- to 26.1-kW (25- to 35-hp) V-Twin engines from **Briggs & Stratton** Commercial Power are available in two displacements with six different power options. The application-engineered engines are offered as both air- and liquid-cooled models; the air-cooled model is developed with cooler-cleaner technology that includes a debris-



management system to extend machine life, reduce maintenance costs, and to comply with European noise and emissions regulations. Other features include improved horsepower-to-weight ratio, a cast iron sleeve, large oil capacity, and reduced oil and fuel consumption. The liquid-cooled versions feature a lightweight aluminum block as well as a 360° cooling water jacket to cut oil and engine temperatures, while a volume muffler helps provide a quieter engine. The engines are manufactured through a joint venture with **Daihatsu**.

For more information, circle 47

Compact diesel

Deutz AG offers the 2008 series of water-cooled, compact diesel engines, featuring three- and four-cylinder naturally aspirated engines that cover the output range from 9 to 27 kW (12 to 36 hp) at a maximum speed of 3000 rpm. With a bore and stroke of 76 and 86 mm (3 and 3.5 in), the swept volume-per-cylinder is 0.39 L. A maximum torque of 72 N•m (53 lb•ft) from the three-cylinder engine and 97 N•m (72 lb•ft) from the four-cylinder is available at 2000 rpm. Both types work with the pre-chamber combustion process and inline pumps designed on the monoblock principle.



The engines were designed for heavy use with mobile working machines, agricultural machines, pumps, and generators. Other features include two additional toothed-gear driven power-off takes from the front gear train and noise emissions of 85 to 87 dB(A) acoustic pressure.

For more information, circle 48

Collar lock

Hayes Manufacturing designed a collar-lock system to prevent couplings from walking on driven shafts. No screw sets are necessary; the collar lock grips the diameter of the shaft and is fastened to the specific tightness, providing improved



contact strength between coupling and shaft. The three-piece, flexible unit connects an electric motor to a hydraulic pump or mechanical drive on such applications as blowers, fans, conveyors, elevators, mixers, crushers, presses, and winches. Custom orders are available.

For more information, circle 49

Small engines

Perkins offers three additions to the 400 Series small-engine market with the 404C-15, a four-cylinder with total displacement of 1.5 L producing 26.5 kW (35.5 hp); the 403C-07, a three-cylinder of 0.7 L with an output of 15.3 kW (20.5 hp); and the 402C-05, a two-cylinder of 0.5 L producing 10.2 kW (13.7 hp). All models offer increased power and torque of up to 8 and 10%, respectively, while reducing overall dimensions and noise at low idle speed up to 5 dB(A). Together these elements lower installation costs, particularly with sound attenuation, and improve operator comfort, according to the company.

For more information, circle 50

Water-cooled diesel

The 2009 series of water-cooled, compact diesel engines from **Deutz AG** was acquired from **Lister-Petter UK Ltd.** The series consists of a three- and a four-cylinder natural aspirated engine and a four-cylinder turbocharged engine, covering 15 to 50 kW (20 to 67 hp) at a maximum speed of 3000 rpm. The bore/stroke ratio is the same for all three types



of engines, and the swept volume is 0.57 L/cylinder. Maximum torque ranges from 104 to 200 N•m (77 to 148 lb•ft) at 2000 rpm for the engines. A direct-injection process with a distributor-injection pump ensures low fuel consumption. Power can be taken from the engine's main PTO side, the flywheel, or at the crankshaft front-end. Noise emissions of 91 to 93 dB(A) minimizes the amount of insulation needed on equipment surrounding the installed engine.

For more information, circle 51

Filter system

The high-performance PicoFlex air cleaner with CompacPlus filter from **MANN+HUMMEL** offers an improvement of up to 40% for the critical characteristics of installation-space and filter-service life when compared to conventional two-stage filters. A special multi-cyclone pre-separator developed for the PicoFlex achieves an efficiency of more than 95% and separates three times more dust than conventional construction machine filters, claims the company. As a result, the filter element is subject to



less strain and can achieve up to 40% increased dirt-holding capacity and service life. The CompacPlus filter element features a linear airflow to reduce the installation space with less pressure drop. Other features include a longer service life, a metal-free and fully incinerable filter medium, and an oval cross section and axial tensioning design to allow sealing of the filter. The first series application for the compact filter system is the D-series backhoe loader from **Caterpillar**.

For more information, circle 52

Industrial engine

The C9 industrial engine from **Caterpillar** offers an 8.8-L displacement and five ratings from 275 to 375 hp (205 to 280 kW) at 1800 to 2200 rpm. The engine, primarily for off-highway applications, features ACERT technology to meet Tier-3/Stage-IIIa standards.



ACERT technology offers control of the combustion cycle to reduce emissions and improve performance. Cylinder heads have been re-engineered with a four-valve cross-flow design, smoother intake ports, and larger valve faces; reshaped seats

improve flow. Rocker arms and valve bridges are lighter and stiffer, allowing the valves to closely follow the cam profile and to improve flow. The next-generation ADEM 4 control module offers increased memory and a faster processor, and mid-supported wet liners with crosshatching minimize oil consumption and blow-by. Service intervals are at 500 h. Applications include agricultural tractors and harvesters, rock drills, pumps, crushers, and other off-highway machines.

For more information, circle 53

Common-rail engine

Cummins' 9-L QSL in-cylinder advanced combustion and high-pressure common-rail fuel system feature 283 kW (380 hp) peak power. Heavy-duty features were added to the block, cylinder head, and valve train, and NOx emissions were reduced by 40% without the use of exhaust gas recirculation. High-pressure common rail (HPCR) technology improves cold starts and power delivery. The system offers up to



2000 bar (29,000 psi) peak fuel-injection pressure, and, using HPCR, maintains high-injection pressure at low speed or under low load to produce more efficient combustion. Rated power for the QSL extends from 209 to 276 kW (280 to 370 hp) at 2100 rpm with a peak power boost of 283 kW (380 hp). Torque output is 1627 N•m (1200 lb•ft) at 1500 rpm. Other features include a compact size, a 3-dB(A) reduction in noise, reduced maintenance costs, and improved efficiency to meet stage IIIa/Tier-3 emissions regulations.

For more information, circle 54