ACERT diesels

A series of four- and six-cylinder diesel engines from **Perkins** uses elements of **Caterpillar** ACERT technology to achieve Tier 3/State IIIA emissions compliance in a common platform covering output ranges from 50 to 186 kW (67 to 249 hp). Designated the 1100D Series, and available with either mechanical or electronic fuel management systems, the engines are built around a common 1.1-L-per-cylinder platform that was proven

in the company's 1100A, 1100B, and 1100C engine series. Benefits of the 1100D engines for users of 1100C engines include identical hook-up points; minimum impact to engine bay installation; choice of aspiration (NA, T, or TA); improved noise levels; maintained maximum torque levels; and options including multi-vee belt, isolated sump, and **SAE** B drive.

For more information, circle 87

Bearing material

Brush Wellman's ToughMet bushings with solid-lubricant inserts can be used without external lubrication at higher pressures and speeds than possible with other material applications, such as oil-lubricated, leaded tin-bronze bushings. The company claims ToughMet, a copper-nickel-tin alloy, is a proven alternative to traditional transmission thrust bearing materials without increasing frictional power loss or endangering mating components. The material is used in excavators, haulage trucks, continuous miners, and tractors in areas such as transmission and drive-thrust washers, linkage bushings, undercarriage bearings, and guide bars.

For more information, circle 88

Commercial engines

Vanguard V-Twin Big Block air-cooled commercial engines from **Briggs & Stratton** Commercial Power feature 25, 27, 29, 31, 33, and 35 hp (19, 20, 22, 23, 25, and 26 kW) models. An advanced debris-management system—integrated with the engine's air-cooling system—allows the engine to run cooler and cleaner while enhancing durability and performance. The V-Twin Big Block liquid-cooled engines run in the same power ranges.

High-capacity liquid cooling allows the engines to run cooler, smoother, and longer, while giving high levels of performance and durability. Both engines are made by **DBS**, a Briggs & Stratton Commercial Power joint venture with **Daihatsu**, a member of the **Toyota Group**, and also contain V-Twin/Overhead Valve technology that reduces component and equipment wear while providing improved balance and low vibration. Steel-backed aluminum bearings contribute to increased load capacity and reduced engine noise, while an innovative intake and exhaust system and large-volume muffler are tuned to provide a quieter running engine.

For more information, circle 89

Common-rail engines

Cummins' QSB engines feature advanced electronics, new sculpted blocks, rear gear trains, and high-pressure common-rail fuel systems. The QSB engines are available in four- and six-cylinder platforms and meet **EPA** Tier 3 emissions requirements. Rated from 110 to 275 hp (82 to 205 kW), the engines meet the durability, reliability, and power density requirements of applications

such as excavators, materials-handling equipment, and cranes. The 6.7-L QSB, rated from 135 to 275 hp (101 to 205 kW), went in to limited production in June 2005; the 4.5-L QSB, rated from 110 to 170 hp (82 to 127 kW), will be in limited production in December. The 4.5-L QSB features an increase from 130 hp (97 kW) to 170 hp (127 kW) from the Tier 2 engine, while both versions contain an over 55% reduction in sound pressure.

For more information, circle 90

Water-cooled diesel

The 2009 series of water-cooled, compact diesel engines from **Deutz** 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 91

Excavator transmissions

ZF's transmissions for wheel excavators comprise three power classes that are designed for the same installation. The maximum tractive torque for the HL 250 transmission is 520 N·m (383 lb·ft), for the HL 270, 770 N·m (568 lb·ft), and for the HL 290, 950 N·m (701 lb·ft). The transmission can be mounted separately on the chassis as well as directly on the axle. Reduced installation size and standardized

mounting points simplify installation. Due to the internal lubricating oil intake, an external oil line is not needed. Integrated downshift protection is implemented hydraulically and also electrically as an option. Noise level is reduced by reducing hydraulic motor speed. A valve block for transmission control consists of a 4/3 directional control valve for the gear shift and a pressure protection valve with integral pressure reduction function.

For more information, circle 92

Planetary drives

The SLW-SCW winch drives for applications more than 12 ton (11 t) are based on the new **Brevini** S series gearboxes. The gearboxes feature an innovative epicyclic gear design that increases the power of

the unit without affecting overall weight. The design results in up to 60% more torque output than other gearbox designs of equivalent size and weight, claims the company. The SLW units employ this unique torque advantage in up to three rotating stages, with a fourth, a bevel unit (SCW), planned for the near future.

For more information, circle 93

32-L engine

Caterpillar's C32 engine, which replaces the 3508B, features a displacement of 32 L and ACERT technology to meet Tier 3/ Stage IIIa emissions standards. Ratings are 860 to 1300 hp (641 to 969 kW) at 2100 rpm. A 1500-hp (1119-kW) version can be used below 700-m (2297-ft) altitude. The block and crankshaft are robust to handle the higher loads this engine can produce. Improvements specific to ACERT technol-

ogy include an MEUI fuel system, cross-flow heads with high cam position, and ADEM A4 engine control module with increased memory and faster processor. Other enhancements include cross-bolted main bearing caps, 500-h oil change intervals, and a mass of 5368 lb (2435 kg) compared to 9101 lb (4128 kg) for the earlier version. The C32 will serve as the platform on which the company will build its Tier 4-compliant engine.

For more information, circle 94

Hydraulic ABS

Mico now offers HABS, a hydraulic brake system with ABS that it claims provides short stopping distances with improved vehicle stability and control during aggressive braking conditions. The system is designed to handle eight channels, or less, of HABS control for vehicles and equipment in the agriculture, construction, utility, and military markets. Starting with full power that uses brakes, a tandem modulating pedal valve, an accumulator charging system, and dual accumulators,

the system also uses speed sensors to monitor the speed of each wheel. Electrohydraulic ABS valves proportionally control the pressure at the brakes. An ABS electronic control unit sends current to the ABS valves when wheel slip occurs. Optional inputs and outputs can be added to the system, including keyed power or ABS on/off switch signals.

For more information, circle 95

Liquid-cooled diesel

Yanmar America's Tier 2-compliant TNV liquid-cooled diesel engines for construction and agricultural equipment include seven direct-injection models with rated outputs from 30.2 to 83.5 hp (23 to 63 kW) at 2500 to 3000 rpm and three indirect-injection models with rated outputs from 13.4 to 26.1 hp (10 to 19 kW) at 3600 rpm. The indirect-injection models feature improved combustion and fuel-injection systems for cleaner combustion. A new inline fuel-injection pump provides similar fuel-injection equipment performance to that of direct-injection engines. A load timer adjusts injection timing according to engine load. The direct-injection models in both three- and four-cylinder configurations have the injection nozzle

set at a larger angle to improve consistency of atomization and mixing. This feature improves combustion efficiency and startability while reducing noise and emissions.

For more information, circle 96

Ball bearings

SKF Explorer angular contact ball bearings are available in both single- and double-row configurations for electric motors, pumps, compressors, air-handling equipment, gearboxes, and other applications. The bearings can withstand high rotating speeds and combined axial and radial loads, while offering a high degree of stiffness and running accuracy. They are manufactured out of steel with low oxygen content using tech-

niques that serve to extend life and reduce fatigue failure by preventing the formation of oxide inclusions in the steel. The bearings' modified polyamide/brass cage geometry promotes higher speed ratings and acceleration, lower heat generation, and reduced vibration and noise. They have a maximum operating temperature of 150°C (302°F) and offer a constant predetermined clearance or preload after 10,000 h at 110°C (230°F).

For more information, circle 97

Transmission controls

Spicer transmission controls from **Dana**'s Off-Highway Systems Group provide com-

patibility with the CAN 2B communication protocol. The Spicer ECon essential controller and PCon powertrain controller are compatible with all Dana transmission designs that include an electric control valve. The controllers provide automatic shifting, system monitoring, data logging, safety shift inhibits, diagnostics, and single-pedal drive. In addition to new transmission applications, the units will be able to be engineered into existing machines that require added vehicle-control capability.

For more information, circle 98

Compact diesel

Deutz 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 in-line pumps designed on the monoblock principle. The engines were designed for heavy use with mobile working machines, agricultural machines, pumps, and gen-

erators. 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 99

Proportional solenoid

Thomas Magnete's proportional solenoid for the adjustment of intake and exhaust camshafts was designed to improve engine performance as well as reduce exhaust emissions and improve fuel efficiency. Mounted to a two-position, four-way hydraulic spool valve assembled axially to the camshafts in each cylinder head, the solenoids are controlled via a pulse width modulated signal and regulate the spool's valve position. Both intake and exhaust timing can be advanced or retarded independently to reduce the amount of design compromises between emissions and engine performance. The camshaft phasing solenoid was designed with few piece parts and was simplified for assembly.

For more information, circle 100

Heavy-duty gearbox

Carraro will be displaying its F1100 travel gearbox from its X-large range of final drives. The F1100 is designed for heavy-duty mining applications in hydraulic, rope-shovel, or dragline excavators. The gearbox consists of a robust design that includes main taper-roller bearings in the carrier unit, notchless ground teeth, high-quality floating seals, and long-life planetary bearings. High-quality machining enables the implementation of up to seven planetary gears in one planetary stage for improved load distribution. The company will also be displaying its new driveline with electronically controlled suspension and servo-synchro gearshift, which combines the features of a synchronized gearbox with automatic shifting capability. The gearshift uses electronically actuated, proportional pressure-reducing valves to replace hydraulic com-

ponents, which the company says improves clutch performance. The electronic control unit is informed in real time about the entire vehicle condition via sensors located throughout the machine.

For more information, circle 101

Medium-duty brake

Hayes Brake has designed the Lightning medium-duty hydraulics brake for the utility vehicle, electric vehicle, and ATV markets. The Lightning is a lightweight service brake for vehicles with either two- or four-wheel braking systems. The low-profile caliper is small enough to fit in most current tighter rim packages, with a one-piece

cast aluminum housing that is suitable for mounting inside the wheel. The brake features a square seal piston retraction for constant running clearance, a floating pin design for mounting ease, and quick-change pads with long-life friction material. Other features include 1850-lb (8230-N) clamp force and 1500-psi (103-bar) operating pressure.

For more information, circle 102

Diesel air cleaners

The FKB-Series air cleaners from **Donaldson** Filtration Solutions are for manufacturers of small- to medium-duty off-highway diesel engines. The cleaners are smaller than equivalent products but still deliver equal performance, claims the company. They effectively remove contaminants flowing through the air intake system, protecting the engine from harmful contaminants and increasing engine performance and fuel efficiency. The units' plastic housing and durable construction tolerates all types of off-highway operating

environments and are suitable for equipment operating in medium-dust conditions with engine airflow ranges between 35 and 400 ft^3/min (990 and 11,300 L/min). They come in four sizes: 4, 5, 6, and 8 in (102, 127, 152, and 203 mm).

For more information, circle 103

PowerTech engines

John Deere Power Systems' PowerTech family includes PowerTech Plus, PowerTech E, and PowerTech M engines, which meet Tier 3/Stage IIIa emissions requirements. PowerTech Plus models feature 4.5 L, 6.8 L, 9.0 L, and 13.5 L displacements. The 4.5-L models provide a power range of 111 to 138 kW (149 to 185 hp); the 6.8-L 134 to 205 kW (180 to 275 hp); the 9.0-L 168 to 298 kW (225 to 400 hp); and the 13.5-L 261 to 448 kW (350 to 600 hp). PowerTech

E engines feature a high-pressure common-rail fuel system and full authority electronic controls. The key difference between PowerTech Plus and PowerTech E engines is the level of emissions-control technologies employed. While both use a high-pressure common-rail fuel system and electronic controls, PowerTech Plus models are equipped with cooled exhaust gas recirculation and a variable geometry turbocharger. PowerTech E models range from 2.4 L through 6.8 L, and from 45 to 60 kW (60 to 80 hp) to 104 to 149 kW (140 to 200 hp). PowerTech M engines employ a new mechanical fuel system that generates higher injection pressures for more efficient combustion and are suited for lower-power applications.

For more information, circle 104

Industrial 1.6-L engine

The 1.6-L, four-cylinder TSG-416 industrial engine from **Ford Power Products** is for applications including material han-

dling and scrubbing/sweeping. The gasoline version provides 58 hp (43 kW) and 95 lb·ft (128 N·m) at 3200 rpm. The natural gas option achieves 48 hp (35 kW) at 3200 rpm and 80 lb·ft (109 N·m) at 2000 rpm. The LPG engine features 52 hp (39 kW) at 3200 rpm and 87 lb·ft (118 N·m) at 2000 rpm. Emissions-certified packages are available for the gasoline and LPG versions.

For more information, circle 105

Diesel engine

The **Iveco Motors**' Vector diesel engine is an eight-cylinder, V-configuration, four-valve diesel engine that can be configured to meet applications in the industrial, marine, and power-generation industries. This fully electronic engine, with a com-

mon-rail fuel injection system, has a range from 640 to 1174 hp (477 to 875 kW). The crankshaft includes a deep, hard-nitrided steel and a wider pin diameter than Iveco's previous V8 engines. It is a low-profile package with a high speed of 2100 rpm.

For more information, circle 106

Axle series

ZF has matched the MS/MT-E 3000 axle series to forthcoming vehicle classes. The offered flange dimensions enable full use of legally permissible vehicle widths. Due to modular construction and a refined component strategy, part number is re-

duced by 25% over previous models. The MS/MT-E 3050 axle covers vehicle class up to 15 t, the MS/MT-E 3060 up to 19.5 t, and the MS/MT-E 3070 up to 25 t. A standard brake design with encapsulated, wet multi-disc brakes is used on the front and rear axles. Brake operation directly on the wheel hub greatly minimizes undesirable vehicle swaying during on-site operation. The Multisteer steering axle integrates the steering cylinder into the axle body.

For more information, circle 107

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 108

Big-bore diesel

International Truck and Engine's in-line, six-cylinder, big-bore, 11- to 13-L diesel

engine is slated for release in late 2007. Some features include direct-injection high-pressure common-rail electronic fuel system capable of multiple injection events, durable single overhead cam actuated with four valves/cylinder and roller rocker arms, compacted graphite iron cylinder block for high strength and low weight, and a rugged gear-driven air compressor and power steering pump. The big-bore engine launch is part of a strategic agreement between International and **MAN Nutfahrzeuge** to collaborate on design, development, sourcing, and manufacturing of components and systems for commercial trucks and diesel engines.

For more information, circle 109

Industrial engine update

The gasoline version of **GM Powertrain**'s 2006 Vortec 3000 industrial engine will now be offered with factory-installed multi-port fuel injections (MPFI), the high-output gaseous fuel version of the engine will offer increased power and torque, and an engine with a 35-kW genset rating of 1800 rpm will be available. An adaptable, returnless-type fuel rail on the engines incorporates a pressure test port, allowing OEMs to customize the fuel system as needed. A version of the new, eight-port cast iron cylinder head used on the Vortec 3000 with MPFI is also used on the new high-output gaseous engine without MPFI. The new cylinder head design reduces

complexity and allows OEMs to design and tailor the intake manifold and exhaust system to fit their needs. GM claims all versions of the four-cycle, four-cylinder engine deliver the power and torque of many larger-displacement six-cylinder engines.

For more information, circle 110

Exhaust clamp

Norma's Normaconnect SEC, or swivel exhaust clamp, was designed for use with exhaust systems to compensate for misalignments and assure against leakage. Offered in standard diameters from 50 to 75 mm (2 to 3 in) in 5-mm (0.2-in) increments, the clamps compensate for misalignment of up to 8° and are guaranteed

not to leak more than 2 L/min (0.5 gal/min) when properly installed. Clamps are generally used in cold air applications, such as post-catalytic-converter in exhaust systems. A spherical design holds the pipes without slippage or damage, and the clamps can withstand high torsional and bending torque. Normaconnect SEC clamps are made of corrosion-resistant stainless steel, while the screw and trunnions are comprised of coated carbon steel.

For more information, circle 111

Small industrial engine

The air-cooled EH41 slant-cylinder, four-cycle engine was designed by **Robin Subaru** with a splash lubrication system and a large-capacity air cleaner with dual elements that protect the engine and provide enhanced reliability, it claims. The overhead valve design is said to contribute to combustion characteristics that improve power, fuel consumption, and emissions qualities. The engine provides a maximum power output of 13.5 hp (10 kW) at 3600 rpm and a "one-pull" start

by teaming a QuickStart starting system and a HotSpark electronic ignition system with an automatic decompression system. It has a bore and stroke of 89 x 65 mm (3.5 x 2.6 in), a compression ratio of 8.3:1, and is suitable for a variety of medium- to heavy-duty construction, agricultural, and recreational equipment such as air compressors, pumps, and pressure washers.

For more information, circle 112

Reducing emissions

An **AUTO21** research team, in collaboration with **Westport Innovations**, has been investigating the effects of injection pressure, injection timing, exhaust gas recirculation, and engine load on emissions from a heavy-duty diesel engine running with Westport Innovations' high-pressure direct-injection technology. The engine runs with natural gas as its primary fuel, with ignition provided by pilot diesel fuel; switching fuels from regular diesel to

natural gas results in significantly lower NOx and particulate emissions. With further tuning of the system, including relatively high rates of exhaust gas recirculation and carefully controlled timing of injection, researchers obtain a further significant reduction in emissions. The central finding of the research details that there is no globally optimal setting for the different parameters. However, with a well-designed engine map, very low engine emissions can be realized over a range of operating conditions.

For more information, circle 113

OPOC engine

FEV engineers have developed a concept diesel opposed-piston, opposed-cylinder (OPOC) engine that can use diesel fuel or JP8, a military jet fuel. The engine uses an electrically assisted turbocharger supplied by **Advanced Propulsion Technologies** and combines the features of an opposed-piston, two-crankshaft diesel aircraft engine and an opposed-cylinder boxer engine. Typical components such as the cyl-

inder head, valves, and camshafts are eliminated in the OPOC design for enhanced scalability. The engine is configured such that all forces act on the crankshaft and not on the main bearings of the crankcase. Because of fewer components, the 275-lb (125-kg) engine is likely to have a lower production cost than a conventional internal-combustion engine. Applications include unmanned aerial vehicles and unmanned ground vehicles.

For more information, circle 114

Industrial engine

A new optimized crank mechanism on **SisuDiesel**'s 74 ETA 7.4-L engine reduces internal stresses and vibrations, while a new fracture-split control rod design is smaller yet stronger, the company says. The six-cylinder engine, part of the company's Fortius series, now uses an electric fuel pump with its filtering ability improved to 5 microns. A second-generation electronic engine-management system controls the electric injection pump driver and, through it, all engine functions according to information received from the operator and data from the machine's control system. The engine can be integrated with a machine either via CAN bus or hard-wired applications. All Fortius engines feature an

electric inlet air heater as standard to enhance cold starts and improve cold-running properties.

For more information, circle 115

Nickel-plated zinc coupling

A nickel-plated zinc die cast coupling (ZLC) from **CPC** (Colder Products Company) is streamlined and lightweight in relation to comparable machined brass couplings. Applications for the unit include engine systems, analytical instrumentation, and pneumatic power tools. The durable device

is suited for high-volume requirements. It is interchangeable with many of CPC's existing coupling lines, including the acetal PLC Series, the polypropylene PLC-12 Series, and the chrome-plated brass LC Series.

For more information, circle 116

Compact engines

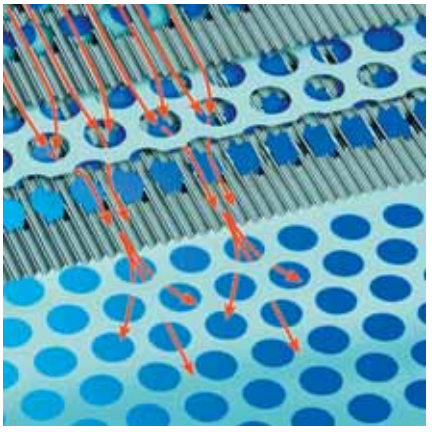
Perkins Engines' 400 Series naturally aspirated and turbocharged engines are offered in two-, three-, and four-cylinder configurations from 10 to 60 hp (7 to 45 kW). All seven of the 400 Series models provide an increase in power and torque of up to 8 and 10%, respectively, over previous models and reduced noise at low

idle speed of up to 5 dB(A). Manufactured by **Perkins Shibaura Engines** in Griffin, GA, the indirect-injection engines are suitable to a variety of off-highway applications including turf maintenance and compact construction equipment, light towers, generator sets, aerial lifts, and general industrial applications such as welders and pump sets.

For more information, circle 117

Substrate catalyst system

Stringent emissions limits, both in the European community and the U.S., require continuously increased conversion efficiency of exhaust aftertreatment systems. In addition to the obvious targets of fast light-off performance, overall conversion efficiency, and durability, catalytic converters for maximum-output engines require highly optimized flow properties to create minimum exhaust backpressure for low fuel consumption. A single-substrate catalyst system from **Emitec** uses perforated foil technology, which achieves all these goals. The tech-



nology incorporates stainless steel foil with perforations, which reduces mass and heat inertia and further improves cold-start performance. It also improves flow distribution within the catalyst, enabling the exhaust gas to travel from a cell with relatively high pressure and flow rates to a neighboring cell with relatively less pressure and flow. This enhanced flow distribution significantly increases efficiency and reduces backpressure. The improved flow properties of a perforated-foil metal substrate enable OEMs to install smaller volume catalysts, reducing total system costs and enabling it to fit into areas close to the engine where packaging space is at a premium.

For more information, circle 118

Portable inverter generators

The i-Pro and i-Deluxe portable inverter generators from **Honda** Power Equipment are 5000- and 6500-W devices that provide a clean, stable sine wave for sensitive electronics and feature a 33% reduction in size and weight. The EcoThrottle load-dependent throttle system enables reduced noise and emissions, with up to 30% increase in fuel economy. The systems offer 120/240 dual voltage. The standard i-Monitor system features an LCD readout capable of displaying generator run time,

output, engine speed, and battery voltage through a generator management system computer.

For more information, circle 119

Pivotal piston

The water-cooled pivotal piston from **Pivotal Engineering Limited** brings a new level of mechanical and thermal control, presenting opportunities in internal combustion (IC) engine design and application. The move to hydrogen fuel swings the balance further in favor of a two-cycle engine, but only if the piston can be thermally controlled and require minimal lubri-

cation. With the internal water-cooling of the pivotal piston, a hydrogen-fueled IC engine can deliver higher power density than the modern gasoline automotive engine. The independent water-cooling of the piston ensures uniform combustion chamber surface temperatures to control pre-ignition and excessive NOx emissions. The pivotal piston requires no surface lubrication and is mechanically quiet.

For more information, circle 120

Small engine

Caterpillar's C6.6 industrial engine is the smallest of the company's ACERT technology engines. The C6.6 has 10% more displacement in the same size envelope of its predecessor, the 3056E, and will be available in a broad power range. It provides 119 to 250 hp (89 to 186 kW) and 728 lb·ft (987 N·m) at 1400 rpm. It comes with an air-to-air charge cooled turbocharger. The engine is Tier 3/Stage IIIa compliant, and will later be Tier 4/Stage IIIb compliant with the addition of an

aftertreatment exhaust system. The engine boasts increased fuel tolerance, and will accept kerosene and JET A. Through a J1939 connector, the engine integrates with other machine systems via a CAN bus, enabling improved diagnostics, cruise control, and throttle override by the hydraulic system or transmission. Noise is reduced through sophisticated combustion control, a structural sump, and new engine block and gear train. Applications include lift equipment, chippers, tractors, transit tractors, and trenchers.

For more information, circle 121

High-friction coatings

EKagrip from **Ceradyne** is a friction-enhancing coating used at joints in powertrain, transmission, suspension, and drive applications. The coatings are unaffected by typical in-engine environments and can be reused, easing dismantling and reassembly. They consist of an electroless nickel matrix in which a specified quantity of diamond particles of defined size is co-deposited. These coatings can be applied either to the joint components directly or to thin foils or shims for installation in the joint. Applying the bolt preload on a crankshaft with a central bolt design causes the diamond particles to press into the opposing surface of the counterpart. This creates a micro-scale form fit between the base part and its counterpart. The coatings can transmit up to three times the load as conventional systems, and the joint design does not require modification. Various engine applications primarily focusing on crankshafts, camshafts, and balancer shaft

modules are in production. Several fastener applications are in test program status, with potential applications in suspension, transmission, and chassis environments.

For more information, circle 122

Water-pump seals

EKasic silicon carbide water pump seal faces from **ESK Ceramics**, which was recently acquired by **Ceradyne**, are a critical component in heavy-duty diesel engines. Damage to diesel engines is typically caused by cooling-system breakdown so the water pump and its components must operate properly. The seal ring is located where the

pump shaft passes through the pump casing. It must be resistant to coolant wear and corrosion, and be extremely rigid and able to withstand high temperatures. The material is a good thermal conductor and is resistant to corrosion by hot water. It improves hydrodynamics even under strong frictional stress.

For more information, circle 123

Single reduction axles

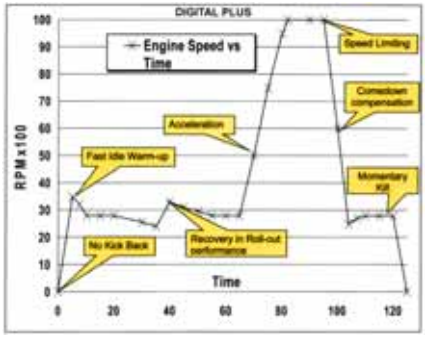
Dana's 44, 60, and 70 Spicer single reduction series of axles are developed for a variety of off-highway construction vehicles including small front-end loaders/wheel loaders, forklifts, ditchers, trenchers, and sweepers. The Spicer Model 44F steer drive axle has a nominal GAW rating of 3300 lb (1500 kg) and a 40 to 70 in (1016 to 1788 mm) typical track width. The Model 60F steer drive axle has a 4300-lb (1950-kg) nominal GAW rating and a 44.7-

in (1135-mm) to 74.0-in (1880-mm) typical track width. The Spicer Model 70BF steer drive axle has a 5700-lb (2580-kg) nominal GAW rating. Also available are the Model 44SF, 60SF, and 70B rigid drive axles, with nominal GAW ratings of 3300 lb (1500 kg), 4200 lb (1900 kg), and 7500 lb (3400 kg), respectively.

For more information, circle 124

Ignition system

Walbro Engine Management's Digital Plus ignition system monitors engine operating conditions and reacts by adjusting the ignition curve accordingly. Product benefits include improved operation and engine performance, the company claims. The Digital Plus system monitors engine rpm, time, temperature, and acceleration, then selects an appropriate sub-routine to



tailor ignition operation for optimum performance. A speed-limiting feature provides safety, warranty, and durability benefits, while the engine rpm is prevented from dropping too low during rapid deceleration to avoid stalling. A digital momentary-kill feature stops the engine with a push, then returns to the normal position for trouble-free starting.

For more information, circle 125

6.8-L engine

The **John Deere Power Systems**' PowerTech Plus 6.8-L engine is certified for compliance with Tier 3 emissions standards. Tier 3 regulations for 37 to 560-kW (50 to 750-hp) engines go into effect in January 2006 and are aimed at reducing NOx and particulate matter (PM) in off-highway emissions. A major challenge for engine manufacturers was the fact that reducing NOx tends to increase PM. This challenge was met by using cooled exhaust gas recirculation (EGR) and a variable geometry turbocharger (VGT). Cooled EGR

lowers the exhaust temperatures in the combustion process, thus reducing NOx levels. To offset the increase in PM, engineers used a high-pressure common-rail fuel system and electronic unit injectors for increased fuel injection pressure, improved power cylinder components for reduced oil consumption, a VGT to control transient smoke, and a redesigned combustion bowl to maximize air/fuel mixing and optimize the combustion process.

For more information, circle 126

Filtration solution

One Eye Industries' ADD-Vantage 9000 is an industrial filtration solution with magnetic technology that allows transport trucks 1000 h between oil changes. Maintenance intervals of large fixed engines, including generation sets and compressors, can be extended by 25 to 75%. The ADD-Vantage 9000 fuel and oil filters feature reusable, stainless steel filter ele-

ments and a choice of absolute micron-rated screens of 10, 25, and 40 µm (394, 984, and 1575 µin). A magnetic filter rod creates multiple magnetic fields that remove ferrous contaminants to sub-1-µm (sub-39-µin) levels and reduce engine component wear. Other benefits of the technology include improved fuel mileage, reduced emissions, and an improved environmental impact.

For more information, circle 127

V-10 industrial engine

The 6.8-L, V-10 WSG-1068 industrial engine from **Ford Power Products** can operate using natural gas, LPG, or a dual-fuel setup. It creates minimal vibration, making it durable and suited for generator sets and irrigation units. The natural gas option achieves 225 hp (168 kW) at 3600 rpm and 336 lb·ft (455 N·m) at 3400 rpm. The LPG engine features 226 hp (169 kW) at 3600 rpm and 343 lb·ft (465 N·m) at 3200 rpm. The company also has a turbocharged 6.8-L, V-10 hydrogen-fueled engine that is prototyped in a power gen-

eration unit and promises minimal vibration and wear on engine and generator set components.

For more information, circle 128

Racing sterndrive

Features of the HP600 SCi sterndrive from **Mercury** Racing that enhance its driveability include active torque management, sequential port fuel injection, individual coil ignition, roller camshaft, and dedicated powertrain control module control strategies. The CNC-machined 502-in³ cylinder block is the sole common component between the HP600 SCi and the 575 SCi. The HP600 has a custom intake manifold that houses an internal O-ring flange sealed intercooler. The intercooler is made of CuproNickel copper-nickel alloy for enhanced corrosion resistance. Boost bypass is achieved via an internal cast passage. The intake also features port fuel injection and a fuel crossover passage that eliminates tee fittings. An induction hardened, micro-alloy crankshaft features larger journal radii for enhanced strength and durability.

For more information, circle 129

Rail brake

Nexen Group's Profile Rail Brake is a spring-engaged, air-released linear motion control device designed for maximum dynamic braking. The compact brake is suitable for power-off safety conditions. It integrates into a profile rail system and allows frictionless movement of the carriage in disengaged mode until air is exhausted and the internal springs apply force on the brake mechanism that clamps the brake onto both sides of the rail. A normally closed, directional control valve is open to the air supply when energized. When powered-off, the valve blocks the air supply, the air escapes, and the springs apply the force to a clamping mechanism. The brake is able to hold large loads in all axes and performs dynamic stops within a short time and distance.

For more information, circle 130

High-speed transmissions

The Speed+ transmission from **Poclain Hydraulics** is based on the MW range of three- or four-speed multi-displacement motors, which are capable of rotational speeds up to 250 rpm and provide a large displacement ratio to minimize transmission pump displacement. It incorporates heavy-duty bearing supports for heavy

vehicles or vehicles with large tire diameters and a fully enclosed maintenance-free service brake that supplements the hydrostatic braking ability of the MW motor. The MW24 provides up to 174 in³ (2.86 L) of displacement at 6500 psi (450 bar). The transmissions are suited for vehicles that need higher speeds for travel between fields, including agricultural vehicles. They can be manual or fully automatic when combined with Smartdrive electronic transmission control systems.

For more information, circle 131

Oil cooler lines

Norma's transmission oil cooler lines combine NORMAFLEX plastic tubing and NORMAQUICK quick-connectors to achieve reduced warranty costs and shortened assembly times compared to traditional metal tubing with rubber jumpers. The plastic lines reduce the number of joints needed, which limits opportunities for leaks, and make recycling more practical. The lines have proven particularly effective in vehicles for which peak operating temperatures generally do not exceed 150°F (66°C). Applications include fuel

systems, oil fillers, coolant degassing, vapor lines, crankcase ventilation, and secondary air.

For more information, circle 132

Generator lines

Five lines of generators from **Honda Power Equipment** encompass 26 models that produce between 1000 and 10,500 W and are powered by four-stroke engines, which meet or exceed all **EPA** and **CARB** requirements. The Super Quiet series operates at noise levels as low as 49 dB. The generators feature an inverter technology

that passes the raw power from the generator through a microprocessor to provide ultra-clean power with a sine wave equal to or better than ac current from a standard household wall outlet. The inverters weigh 50% less and are one-third smaller than traditional generators.

For more information, circle 133

V-twin diesel

The Tier II compliant Vengeance 750 V-Twin Diesel engine from **Yanmar America** is a liquid-cooled V-twin diesel engine that is available in both vertical and horizontal shaft configurations. The four-cylinder, indirect-injection OHV-type engine has two valves per cylinder and displaces 749 cm³. It has a bore and stroke of 78 x 78.4 mm

(3.07 x 3.09 in). The 18.6-hp (13.8-kW) engine is naturally aspirated and includes pressure lubrication by a trochoid pump. The base engine measures 20.51 x 15.70 x 16.0 in (521 x 399 x 406 mm). It features a cast-iron cylinder head design and has a dry mass of 136 lb (62 kg). The four-cycle engine runs with minimal vibration and significant improvement in noise quality, according to Yanmar.

For more information, circle 134

Load-holding motor

The Char-Lynn T-Brake Series Motor from **Eaton** provides smooth load-holding performance in a compact design. System benefits include simplified ordering and inventory, design flexibility, dependable

brake performance, pre-set load-holding capacity, and integrated rear-mounted brake for 6:1 torque advantage. Applications include aerial work platforms, truck-mounted cranes, sweepers, and marine booms.

For more information, circle 135

Oil management

Cummins' CENTINEL engine oil-management system is offered as an aftermarket kit for the QSX, QSK19, QSK45, and QSK60 engines rated from 350 to 3000 hp (260 to 2240 kW). The system enables operators to extend oil change intervals to 4000 h by removing 15 to 20 oil changes. The CENTINEL integrates with full authority electronics, allowing the engine to

blend lube oil with fuel prior to engine combustion and adjusting the burn rate based on the equipment load factor. Offered with reserve tanks for continuous oil replenishment, the system's benefits include reduced maintenance time and subsequent expenses.

For more information, circle 136

Inverter generator

Silent series generators from **Robin Subaru** include the 1650-W R1700i, the 3200-W RG3200iS, and the 4300-W RG4300iS. To reduce running sound, the generators operate at a lower speed for low-power use and increase speed automatically as more electrical power is required. Further sound reduction is achieved

through a reverse cooling design that allows the generator to be enclosed in a sound-absorbing poly-resin enclosure for quiet operation. The use of inverter technology reduces size and mass, while a four-wheel rolling kit adds convenience. Other features include a microcomputer that controls the voltage and frequency of the power output and monitors the temperature of electronics as well as a one-touch control system.

For more information, circle 137

Diesel engines

Iveco Motors' 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 138

Fuel management

Low-evaporative products from **Walbro Engine Management** can enable outdoor equipment manufacturers to meet **CARB** (California Air Resources Board) evaporative emissions regulations that go into effect in 2006, according to the company. Complete fuel storage and delivery systems

as well as low permeation fuel line quick connectors are available. The Permblok PB 550 and PB 562 co-extruded, multi-layer fuel lines include an ethylene-vinyl-alcohol-copolymer (EVOH) vapor barrier layer and can be used in small off-highway engine evaporative systems. The lines allow users to avoid testing and are available in preformed or in a convoluted design. The EVOH layer is also used in the company's line of co-extruded, multi-layer fuel tanks, offered in various shapes and in sizes up to 5 gal (19 L).

For more information, circle 139

Drivetrain system

The Spicer heavy-duty drivetrain system for teleboom handlers from **Dana** Off-Highway Systems is a complete systems platform. Composed of Spicer Model 213 axles with an optional VDT13000 or T13000 transmission and Spicer driveshafts, the drivetrain system provides increased productivity, higher reach, and greater versatility to accommodate a variety of tools. Dana offers complete systems for medium- and heavy-duty front-end loaders, backhoe loaders, and compactors. The company's TE15 powershift transmission is designed for material handling and mobile crane applications. The transmission will replace the 32000 series and deliver a 15% increase in power ratings through the use of larger bearings and stronger shafting and gearing. It was due to be released in the middle of this year and provide the same silhouette as the 32000 series to facilitate compatibility with engine components.

For more information, circle 140

Torsional couplings

The LV torsional coupling line joins the existing LF, LK, and LM series from **Lovejoy**. The LV series features two styles—the LV-Torsional coupling for u-joint drive systems from 150 to 625 hp (112 to 466 kW) and the LV-C for direct-drive systems at 50 to 425 hp (37 to 317 kW)—and is suitable for agricultural and industrial applications. All couplings solve vibration problems common to internal-combustion engine-driven applications such as pumps, compressors, and gensets. The four designs offer alternatives for absorbing shock loads, accommodating misalignment, and/or shifting critical speeds above or below normal operating ranges. All are non-lubricated, maintenance-free designs that feature easy assembly and rugged construction.

For more information, circle 141

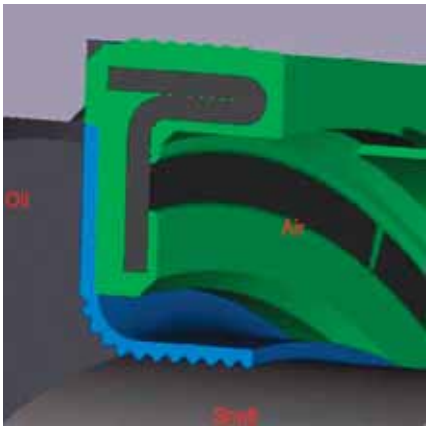
Leak-free radiator

Features of the Mesabi Boss radiator from **L&M Radiator** include brass finning brazed to individually replaceable brass tubes without soldering, a mild steel framework coated for offshore service, and the use of standard seals that are resistant to cooling system additives. Seals are warranted against leaking for 48 months. The Boss radiator can be custom designed for specific applications; a stainless steel framework is also available.

For more information, circle 142

Crankshaft seals

Three new diesel-engine crankshaft seal designs from **Simrit** enhance system durability and dependability. The first application is a second-generation polytetrafluoroethylene engine oil seal, which can be installed in a nonconventional direction, such as with the lip facing the air side of the system, providing installation, contaminant exclusion, and performance benefits. Integration of components such as speed sensors, seal carriers with molded-in gaskets, and multi-pole encoders into the seal design results in benefits including vibration reduction, simplified assembly, and choice between passive and active sensor. Lastly, the design, developed in collaboration with **Freudenberg NOK**, has a double spiral helix molded into the axial lip, and pumps on a surface perpendicular to the shaft, which helps reduce wear on the seal and increases product life.



For more information, circle 143

Diesel primer

When air becomes trapped in diesel fuel lines, it restricts fuel flow and can cause hard starts and other engine problems. The **Reverso** FP-301 Fuel Primer purges air from the entire fuel system. To restore full fuel flow, the system pumps diesel from the tank through the fuel lines, and in the process pushes air from the main feeding line, primary filters, and any secondary filters and the engine. Under extreme conditions, the primer can pump fuel through clogged filters to improve their operation. Integrated pressure relief valves protect fuel-system components.

For more information, circle 144