

Saab Super Turbo

A better way to build boost.

BY DON SHERMAN

• That knocking you hear under your hood is the sound of efficiency. An occasional metallic rattle means your engine's probably squeezing all the energy it can from every drop of fuel, as it was designed to do. However, a louder, more persistent rap could mean trouble's at your door. If you're not driving a diesel, your engine's suffering from excessive detonation. In time, this heavy knocking will pound its way through a piston head and leave you with a very

expensive pile of smoking debris.

Treading that fine line between "just a little" and "not too much" detonation is a top-priority technical challenge in engine labs all over the world today. Saab has just jumped into the lead in this particular race with a clever breakthrough its engineers have labeled APC, for "Automatic Performance Control."

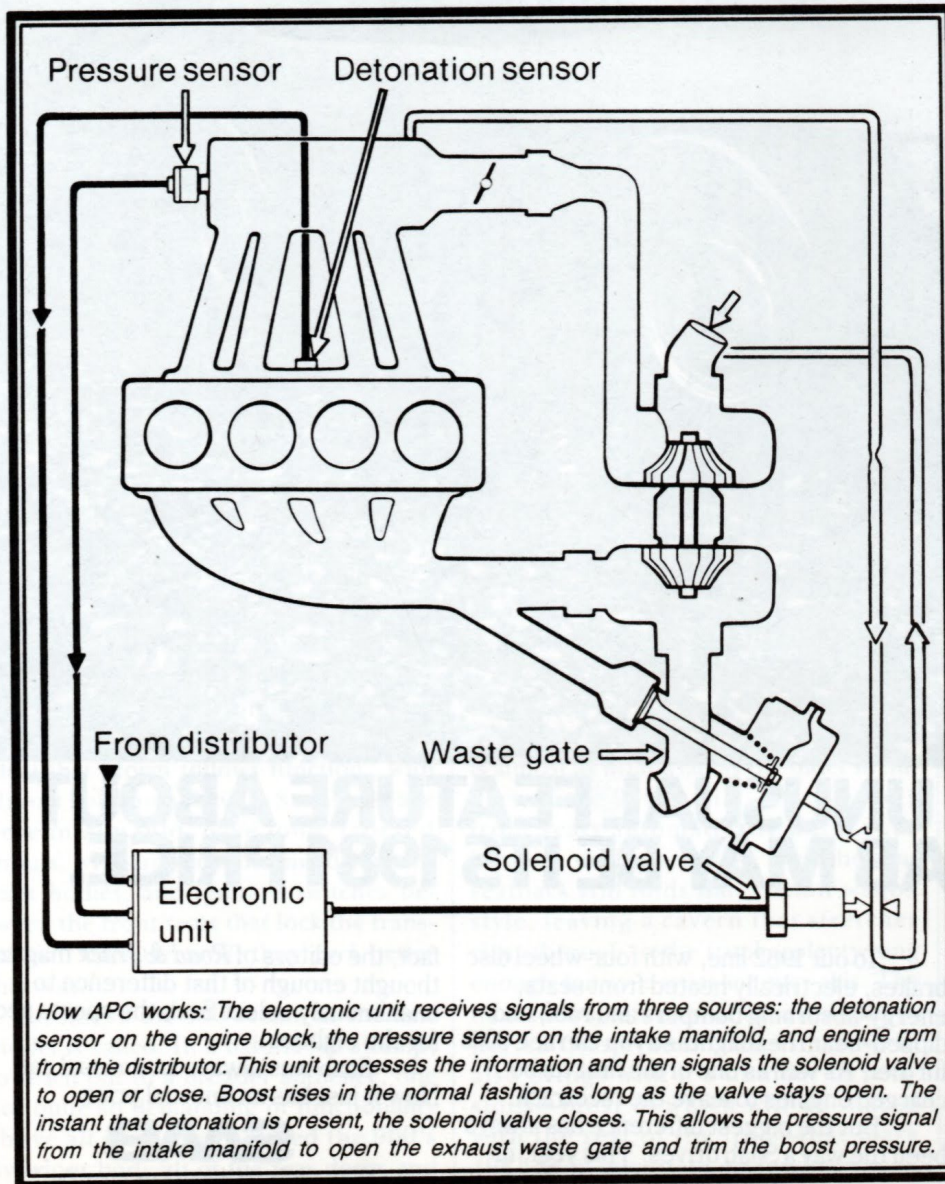
Necessity really did mother this invention. Saab made the shift to turbocharged engines for efficient perform-

ance two years ago, and promptly ran headlong into the grief that eventually confronts all who turbocharge: destructive detonation. At first, the engineers applied conventional controls—a lower compression ratio and moderate boost pressures—plus a carefully tailored boost curve that peaked early, then tapered off at the high end of the rev range. This killed detonation in most cases, but also sacrificed a great deal of power, fuel economy, and responsiveness. What's more, it wasn't foolproof. Fuel octane in America has deteriorated to the point that Saab's very conservative settings occasionally weren't conservative enough, resulting in owner complaints and service headaches.

So Saab engineers, headed by turbo ace Per Gillbrand, went back to the drawing board to design a solution. The APC they came up with is the most ingenious turbo-controller conceived since the waste gate. And it's so simple that engineers all over the globe should be kicking themselves for not inventing it sooner.

Saab's APC is built around a detonation sensor very much like the ones both Buick and Pontiac have on their turbo motors. But instead of using this transducer to trigger a spark retard, as GM does, the Saab APC stops detonation more directly, by trimming boost pressure. The small, accelerometerlike sensor is one element of a feedback loop, which also contains a compact electronic brain and a solenoid valve. This valve is in turn plumbed into the boost-pressure line to the waste gate.

The APC feedback system works as follows. As long as there is no detonation, the brain tells the solenoid valve to stay open. This vents the manifold-pressure signal to the waste gate, and in effect allows boost pressure to rise as high as 0.75 bar, or 10.9 psi. (Current Saab Turbos are limited to 0.50 bar, or 7.25 psi.) At the onset of detonation, the sensor fires an electrical signal to the con-

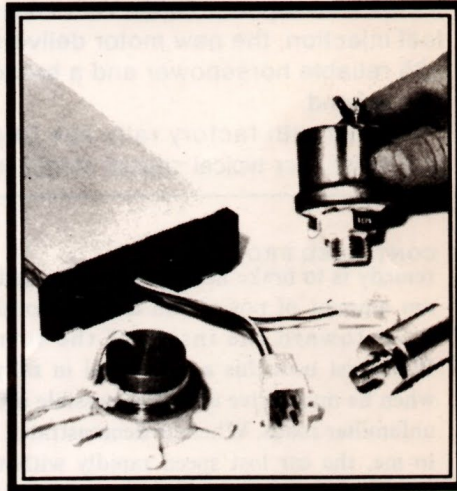


Per Gillbrand, Saab's chief testing engineer.
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troller brain, which in turn orders the solenoid valve to modulate the pressure signal (upward) fed to the waste gate. This trims the turbo's boost and damps out detonation long before it builds to destructive levels. The brain also reads rpm and boost-pressure signals so that, in the event some component malfunctions, maximum boost can be limited to 0.25 bar (3.6 psi).

As the name APC suggests, Saab's detonation deterrent is fully automatic. It constantly optimizes boost, and therefore engine performance over the entire range of operation, to use all the octane that's pumped into the tank. The system responds in fractions of a second and quite happily squeezes every last BTU out of either gasoline or gasohol.

The masterly APC has also paved the way to several other improvements in Saab's turbo motor. The compression ratio will be bumped from 7.2:1 to 8.5:1, which helps both off-boost responsiveness and fuel economy. Prelim-



inary tests show 8 percent better gas mileage with no change in exhaust emissions. APC also fattens up the torque curve, which in turn speeds up acceleration by roughly 20 percent. (Per Gillbrand calls the extra torque "a byproduct we couldn't avoid.") Even though APC Saabs are significantly more lively in response and quicker on their feet, peak power remains at 135 horsepower, the design capacity of the front-wheel-drive transaxle. APC may, however, be a less expensive approach to turbo power for Saab. Today's 900 Turbo uses discrete turbocharger and waste-gate components, while the APC system has them integrated into one unit (AiResearch T3).

Which leaves us with but one significant drawback to fret over with APC: these Super Turbos won't be in production before the 1981 model year. ●