

AUDI 5000

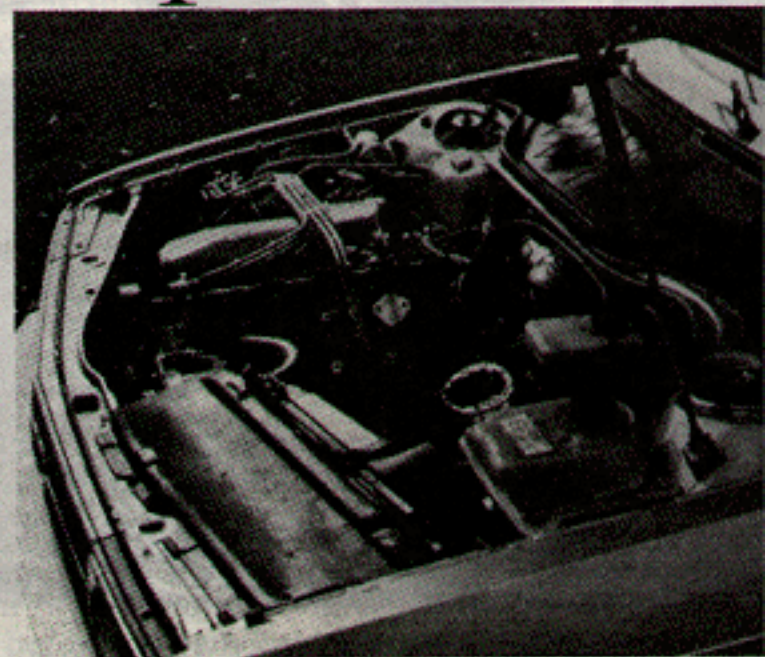
*A promising blend
of luxury, innovation
and logic*

BY DOROTHY CLENDENIN

PHOTOS BY THE AUTHOR



Driving Impressions



"THE BEST CARS in the world are built within 100 miles of the Alps," an R&T editor told me about 10 years ago. It is not a bad oversimplification today. Eight of the winners in our "10 Best Cars for a Changing World" (June 1975), are built within view of the Alps. Among them is the Audi 100LS, taking the honors for the Best Family Sedan, \$3500-\$6500.

The 100LS had been on our market five years and we had spent that time holding it up as one of the best examples of sensible use of space. It had one of the first 1-piece inertia-reel seatbelts and a number of other exemplary attributes: crisp and elegant styling (BMW and Mercedes-Benz influences), the trunk space of a fullsize American car, 20.0 mpg in our 1972 road test, excellent outward vision, plenty of interior space and comfort, rewarding handling via front-wheel drive and a certain refined, graceful air about it. A 1971 Audi 100LS calls my driveway home, although the car isn't mine. During the six years I've occasionally driven it, I've always been impressed with what a sensible sedan it is. With 110,000 miles on the odometer, it's a bit past its prime, but it's still a remarkable car. Later models are even better because brake and driveability problems have been solved. A total of 800,000 were sold in Europe and about 145,000 in the U.S.

Audi-NSU recently hosted a fly-drive for American automotive journalists to the Audi Ingolstadt factory in Bavaria and I was able to spend a few hours with the pre-production U.S.-version 5000, called the 100 in Europe. Because I'm fond of the 100LS, I expected the 5000 to be special.

I wasn't disappointed. It has the same virtues as the 100LS and some interesting innovations of its own. The Audi NSU company motto is *Vorsprung durch Technik*, Progress through Technology, and the 5000 has two major components never before seen on a production car: steel structural members designed to pro-

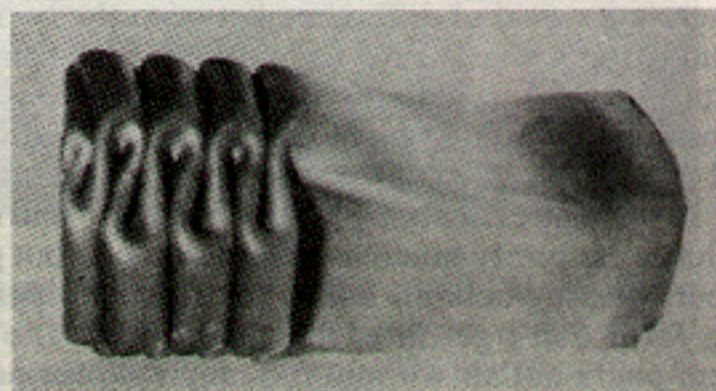
gressively fold on impact and the industry's only 5-cylinder gasoline engine.

Audi engineers have extended S.P. Timoshenko's theory of elasticity to the plastic mode and incorporated it into the longitudinal members integrated into the front and rear body structure. Timoshenko was a Russian professor living in America who wrote *Theory of Elasticity*, first published in 1934 and used as a text in engineering schools. Different manufacturers have tried various techniques to cause a frame member to progressively collapse on impact, but Audi's solution uses the fact that uniform folding or buckling of a thin-wall square tube will occur if the ratio of the wall thickness to the width of the cross section is greater than 0.018 ($\frac{t}{w} > 0.018$) and if the impact occurs above a so-called super-critical deformation speed. Audi engineers found that when the speed is less than 20 kph, the tube starts folding at its weakest point. For example, this could be a notch in the tube or a thinner section. However, when the impact speed is higher than 20 kph, the tube starts folding at the point of impact. This is ideal from an energy absorption standpoint: As the distance over which the impact energy is absorbed increases, the peak loads on the occupants decrease.

Intuitively, it might seem that the width of the tube's cross section would influence buckling. The deformation force is dependent on the square of the wall thickness, Audi found, but, surprisingly, it's relatively independent of the width of the tube. This results, Audi says, because with increasing pipe width, resistance to deformation increases but this is compensated by the increase in length of each of the folds; the longer the lever arm, the higher the force each fold produces on the unbuckled section of tube behind it. Seems there could be all sorts of applications for this theory, especially for metal sculptors, so if



A tach will probably be standard equipment on the U.S. 4-speed model.



Timoshenko's theory of progressive collapse or buckling is illustrated in the uniform folding of this thin-wall square tube. Buckling was initiated at the point of impact, meaning the impact speed was greater than 20 kph. Can you find the smile?



you see an artist running straight into an Armco barrier with a beam tucked under one arm, now you'll know why.

When the C-Modell (the 100's/5000's code name) was in the planning stages, the research team decided to retain front-wheel drive, but also wanted to provide an engine that gave brisk performance. They dismissed an inline six as too heavy and too long for fwd, while a V-6 design couldn't have been based on any existing Porsche-Audi engine design.

So it came to pass that the single-overhead-cam 1588-cc inline 4-cylinder used in all the new U.S. Volkswagens and the Audi Fox begat a 5-cylinder, displacing 2144 cc and producing 103 bhp in U.S. form. The 4- and 5-cylinder engines are machined on the same tooling line and share many of the same design features: cylinder spacing, bore, location of valves and sparkplugs, injectors and drilling for head bolts. However, the stroke is 86.4 mm, compared to 80.0 for the Fox engine.

Ferdinand Piech, Chief of Research and Development, is pleased with the five and thinks it is better than a V-6 because there is less noise (vibration) and better fuel economy. (For a complete explanation of the intricacies of the five, see SAE paper 770112, "A Five-cylinder Engine as an Economical, Smooth-running Power Plant" or *Automotive Engineering*, April 1977.)

All of Audi's production engines can be converted to diesel, but Piech says it is too early to talk about it. The five will eventually be fitted to other cars in the Porsche-Audi-Volkswagen family. A good guess might be the 924, but Piech just smiled when I suggested it.

The Audi family tree includes Wanderer, Horch, DKW, Auto Union, ties at one time with Fiat, and more recently NSU, Porsche and VW. In view of its sporting past, could it be possible the ultimate goal for the five is to produce an Auto Union-Audi V-10 for Formula 1? Possible, but not likely.

I took the prototype American-version 5000 out on narrow, 2-lane roadways that twist through storybook villages, wooded hills and hop-growing country and went for a couple of runs on the *Autobahn*. The speedometer needle happily pegged itself at what would be 115 mph if the numbers went up that far, probably an optimistic reading as the factory's conservative estimate is only 103 mph for top speed with the standard transmission. Free to go fast and not be forced into the adult game of cops and motorists is a wonderful experience. At speed the 5000 feels very stable and the engine is quiet—it doesn't feel overworked. The engine sound is distinctive, especially notable when I stood at the top of a hill and listened to the other cars descend a twisty 1-lane road.

There is quite a bit of roll in spirited cornering, but it doesn't detract from the exhilaration or control. Shifting is precise and the 5000 is really fun to drive; it has the benefits of fwd without it always being apparent. There is some front-end lift when accelerating from rest but we were told there could be no compensation for it because of the fwd.

The steering wheel is at exactly the right angle for control although the column is slightly offset and (hallelujah) the steering wheel is designed for people who like to drive with their

hands at the 9 and 3 position. The vital signs are right where they're supposed to be: directly in front of the driver, seen easily by glancing down and through the steering wheel. The dash photo shows a clock and while at the factory we made a strong plea for a tach; with a car this much fun to drive, it matters more what the rpm are than what time it is. Now I'm told the tach will probably be standard equipment on the U.S. 4-speed model. Good.

Following the precedent set by the 100LS, the interior of the 5000 is inviting and rich looking. The seats are very comfortable, fashioned in a wrap-around design, with support for the lower back and thighs. Seat and door panel fabric is similar to plushy no-wale corduroy and very handsome. The plastic, however, is the non-inspiring stuff we see all too frequently. The Audi folk told us the colors for the 5000s were chosen to blend with the environment and are "less aggressive." There will be 9 or 10 colors to choose from; the cars we drove had beautifully applied copper or pale limeade metallic paint.

The interior has an airy feel to it, thanks in part to the set-back curved dash. In fact, it is reminiscent of earlier BMWs and the imitation wood strip along the back augments the comparison. There is more than enough head, shoulder and leg room, front and back. There are plenty of places to stow things: a shelf under the dash on the driver's side, a drop-down lockable glovebox and door pockets. Outward vision is excellent, an Audi forte, and the only distraction to the driver is the adjustable headrest that must be looked around before making a lane change.

The trunk has a capacity of 22.6 cu ft and Piech showed us how the 5000 could accommodate a huge stack of luggage. Then he put the luggage into the trunk of his Cadillac Seville (14.9 cu ft) and had two large Rob Walker-size suitcases left over. Well, they are space wizards.

The factory people say the air conditioning unit is on a par with American A/C and uses parts from General Motors and Frigidaire. I tried it on my brief drive and it was impressive; there are seven air outlets. Without the A/C, ventilation is good, although I found the fan noise loud when set on high.

The 100 (5000) has been on sale in Europe since September 1976 and quite successfully, too. It has been the best seller in its category in the German market during the first part of 1977 and Audi sales increased 28 percent in 1976 over 1975, mainly because of the new car. The new sedan is called the 5000, by the way, because of the 5-cylinder engine and market studies indicated the thousand figure is appealing to quality car buyers. However, apparently there was some thought to using the handy Audi emblem of four interlocked zeros and making the logo look like this: 0000. How's that for finding a memorable name?

The 5000s are to go on sale in the U.S. this September at the 400 Porsche-Audi dealers. There are no plans for hatchback or wagon versions at this time, but the U.S. is scheduled for 25,000 sedans for the 1978 model year. The standard equipment list is long and among many other items includes tinted glass, 185/70HR-14 radial tires, chrome here and there, power-assisted brakes and steering, cruise control, carpeted trunk, remote-control outside mirror and fully reclining front seats. Although prices aren't firm at this time, the list price will probably be around \$8000. Options include automatic transmission, air conditioning, power windows, electric sunroof, heated front seats, vent windows, quadraphonic speakers, metallic paint and 14 x 6 light alloy wheels.

Fuel economy is expected to be 17-19 mpg for city driving and 24-27 mpg on the highway. Emission control is by engine modifications, K-Jetronic fuel injection and exhaust-gas recirculation. Only the California version will have a catalytic converter.

Which cars will this promising luxury sedan be competing with? Well, Cadillac Seville, Lincoln Versailles, Buick Electra, Oldsmobile 98, BMW 530i, Peugeot 604, Volvo 264 and Mercedes-Benz 230.

One of the best cars in the world? Certainly one of the most handsome and logical. We'll road test a production U.S. version soon.

