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# Dynaco ST-70 Series 3 Tube Power Amplifier

REVIEW

by Dick Olsher | Feb 04th, 2019



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Back to the future. When Radial Engineering announced its plans to market a modern version of the Dynaco Stereo 70, the news struck me as a valiant time shift, aimed squarely at resurrecting the soul of one of the most influential amps of all time, and the component that enshrined Dynaco in audio's Hall of Fame. Over a span of nearly 20 years in the 1960s and 70s, more than 400,000 ST-70s were sold both in kit and assembled forms, total sales by some estimates approaching half a million by 1977. That would make the ST-70 the most popular tube amplifier of all time. It sold well not only in the U.S. but also in Europe and Japan. I would venture to say that nearly every serious audiophile owned an ST-70 at some point in his lifetime.

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anyone at Radial Engineering expected. The design team approached the project with the reverence due a classic and embarked on a challenging but ultimately rewarding 18-month journey. The Series 3 may well be technically and sonically the finest ST-70 ever produced, and that should be exciting news for audiophiles and music lovers alike. Note that there will be no kit version available. This was debated in-house, but in the end, the legal risk of sending out a product with high voltages that could be worked on by customers without proper training was judged to be too great. And as far as looks, the new ST-70 has come a long way from its humble 1950s utilitarian kit persona. The finish is improved and the curvy white tube cage on black base gives the amp a sexy noir look.

By his own admission, David Hafler considered the ST-70 his favorite by virtue of its unbeatable combination of sound quality, cost, and a power delivery sufficient to meet the needs of, as he put it, "about three quarters of the market." To fully understand its appeal, please buckle up for a fast trip down memory lane. The year was 1955. Monophonic sound ruled the day. Fisher and H. H. Scott were major consumer audio brands, while Marantz and McIntosh were still years away from their heydays. The build-it-yourself movement was in full swing. Heathkit and EICO were busy selling various consumer kits, including hi-fi amps and preamps. You could purchase a Heathkit W3-M amplifier kit, a Williamson-type Ultralinear design, complete with an Acrosound output transformer, for \$49.75. It was also the year that Dynaco came into being. David Hafler and his boyhood friend, Herb Keroes, had founded Acrosound transformer company in 1949 and successfully promoted and popularized the Ultralinear output stage. But when it came to business plans the two friends were rather incompatible. For example, Keroes was resistant to the idea of interleaving output transformers because of the added complexity during production; he wanted to keep things simple for the highest volume. Eventually, for Hafler it was not just about selling more transformers. Interacting with numerous customers he realized a clear need for offering complete amplifier kits on a cost-effective basis. His timing couldn't have been more flawless at what turned out to be in hindsight the dawn of tube audio's golden age.

Dynaco's first viable amplifier design, the Mark II, quickly reached sales volumes of 1000 units per month. This was followed by the Mark III which offered 4, 8, and 16 ohm taps and the KT88 beam power tube for a mere \$10 more. With the advent of stereo in 1959, Dynaco launched its first stereo amp, the ST-70, available as a kit for \$99.95 (cover included). A review in the December 1959 issue of *High Fidelity* magazine concluded that its performance was only matched by manufactured amplifiers costing far more. It consisted, in essence, of two Mark II circuits on one chassis, and closely emulated Hafler's U.S. patents for a high-fidelity amplifier and output transformer design. Hafler understood that a low distortion spec along with flat frequency response over the audible bandwidth did not necessarily correlate with audible performance benefits. major design concerns were transient response and stability under feedback conditions, especially

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Hafler addressed these goals with a design paradigm that combined three distinct elements. First, use of a pentode-triode combination tube input stage providing a pentode gain stage directly coupled to the triode section configured as a cathodyne phase-splitter. However, Hafler confided many years later that he selected the 7199 and 6AN8 combination tubes for cost and space-saving reasons, so there's no reason to think that Hafler was wedded to such tubes for their technical advantages. Second, use of two feedback loops, one being a standard global loop from the output transformer's secondary to the input stage, and a second taken from the screen of one EL34, to linearize the phase-splitter's output impedance at high frequencies. Finally, use of an interleaved output transformer of unique design that offered excellent high-end bandwidth, and that remains 60 years later competitive with modern designs.

This is a good place to emphasize that the new ST-70 was not intended to be an exact copy of the original. The longer the contemporary design team listened to and measured the original, the clearer it became that there was no room for nostalgia—the Series 3 version would have to raise the sonic bar significantly over what had been expected in the early days of stereophonic sound to meet current audiophile expectations. Development was driven by the notion of what David Hafler would do today given modern components and available tube production. It seemed fairly obvious that he would opt for the very best parts and aim to deliver exceptional value. Every design aspect was examined under this conceptual lens with an effort to improve the performance of the original where possible. That this was accomplished with passionate attention to detail is evident from the time invested in the process.

The first challenge involved the obsolete 7199 pentode-triode. There have literally been dozens of DIY-inspired upgrades attempted over the years aimed at replacing the original front end. Radial Engineering selected three input/phase-splitter circuits for extensive testing using various tube configurations. The first recreated the original design using a pair of EF86 small-signal pentodes and a 12AU7 dual triode as the phase-splitter, even though there was concern over the limited availability of the EF86. The two other circuits evaluated were all triode, based on circuits designed by Hafler over his long career. The first of these used a 12AX7 voltage amplifier and a pair of 12AU7 as long-tailed-pair phase-splitters. The practical issue with the long-tail-pair phase-splitter was the need for a trimmer adjustment for proper balance. The third circuit was derived from a Williamson design by Hafler that was not sold commercially for cost reasons. It uses a 12AU7 dual triode as a voltage amplifier and cathodyne phase-splitter, and another 12AU7 as an additional voltage amplifier and output tube driver. That's a total of four 12AU7 triodes for both channels, so not surprisingly this version was dubbed the Quad Triode by the design team.