

# USE THOSE "JUNK BOX" CHOKES!

Salvage those unidentified parts by running tests to determine their electrical characteristics

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When designing or building a voltage-regulated power supply with a choke input filter, the average experimenter or ham usually casts a furtive eye at his "junk-box" when he reaches the stage for the selection of the proper choke. Usually he has a number of iron-core chokes that appear to be physically large enough to carry the current needed, but not enough data is known to identify them, in order to build a good ripple-free, voltage-regulated power supply.

As a result, unless the builder can identify the choke by manufacturer and part number, his only recourse is to go to a catalogue and buy a choke that will meet his requirements. However, by setting up a relatively simple circuit (see the schematic diagram) and following the procedures outlined, those "junk-box" chokes can be readily identified as to their electrical characteristics and, hence, can be salvaged.

To properly identify the electrical characteristics of an iron-core choke it is necessary that the basic characteristics of iron-core chokes and their effects upon power supplies be understood.

One of the most important characteristics needed to properly evaluate the suitability of a choke as an input filter for a voltage-regulated power supply is to know the relationship of inductance to the d.c. current flowing in the choke. This is important because as the d.c. current varies, so does the flux density of the core and, consequently, the inductance. This means that an iron core choke may have vastly different inductances under "load" and "no-load" conditions.

This characteristic may be utilized to good advantage in power supply filtering, because for most efficient filtering action the inductance should increase with a decrease in load current. It should be noted that a choke is called a swinging choke if the inductance is high at low values of direct current yet decreases markedly with increased direct currents. However, if the power supply has a bleeder resistor in parallel with the load, the importance of the ability of the choke to have its inductance increase with a decrease in load current diminishes, since there is always a minimum value of load current flowing through the choke.

At some point the choke will reach saturation as the current increases. This is due to the iron core becoming saturated, which decreases the permeability of the iron, and hence decreases the inductance of the choke. This, of course, determines the upper limit of usability of the choke under load conditions. In addition, it is important to know the maximum current the choke may carry without overheating.

It is also necessary to know the critical inductance of the choke, that minimum value of the input-choke inductance which prevents the d.c. output voltage from rising above the average of the rectified a.c. wave. This minimum value, the critical inductance, must be maintained at all currents, in order to prevent the filter from acting as a capacitor-input filter.

Therefore, it becomes evident that to properly use a "junk-box" choke it is necessary to have a plot of inductance *versus* load current. Then if the inductance range of the "junk-box" choke is proper for the design range of the filter needed, it may be readily used.

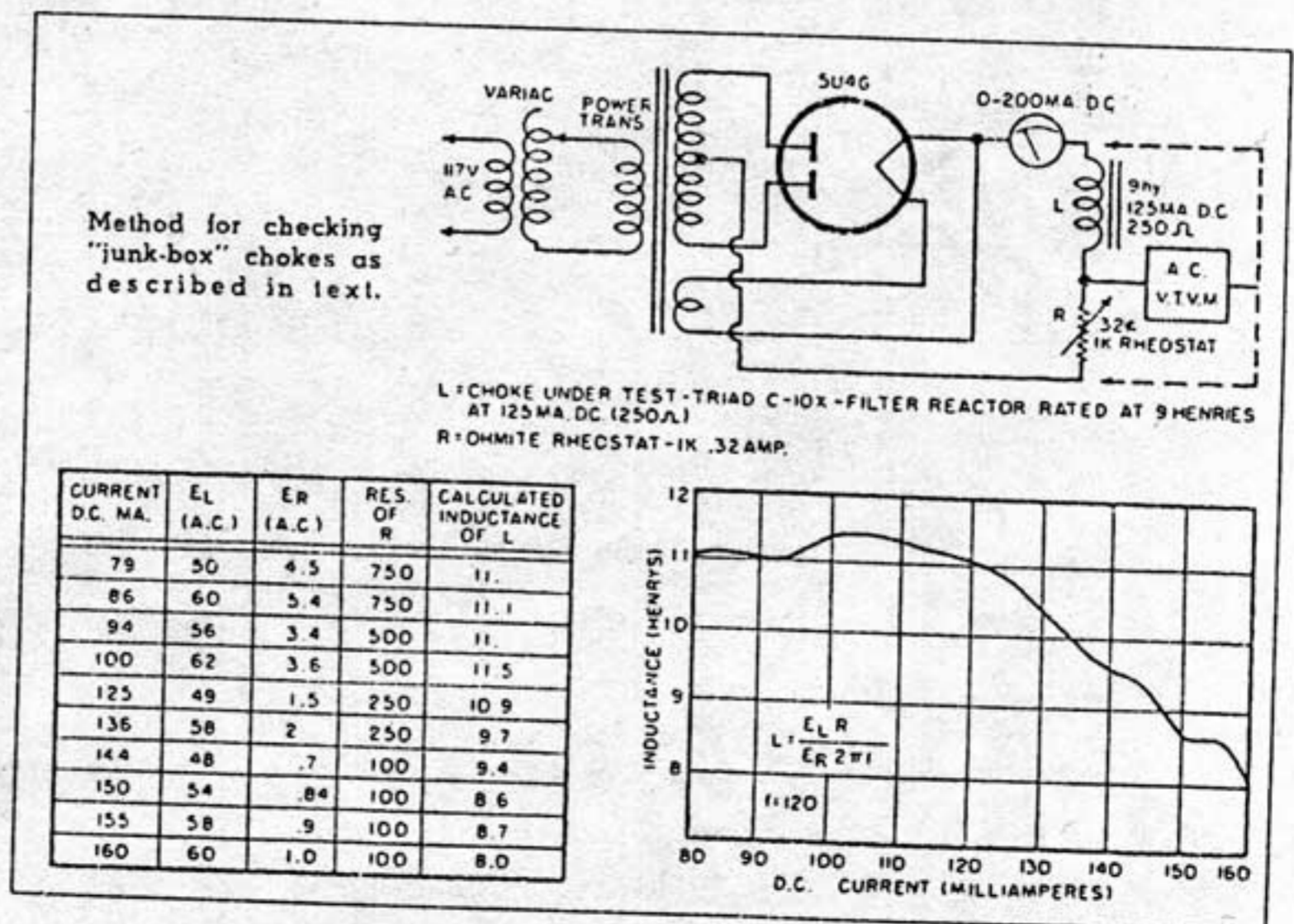
A relatively quick and comparatively simple procedure may be employed to plot this curve, using only a vacuum-tube voltmeter and an ammeter as test equipment. The test circuit should preferably be the full-wave rectifier of the power supply being built, with the choke and a high wattage rheostat in series across the output. (See schematic diagram).

The test procedure is based on the following theory. An assumption is made that the d.c. resistance of the choke is small in comparison to its inductive reactance.

Hence, the normal equation for impedance:  $Z = \sqrt{R^2 + X_L^2}$  becomes  $Z = X_L$ . The current flow through L and R is equal, consequently:

$$I = E/Z = E_L/X_L = E_R/R$$

Solving for  $X_L = E_L R / E_R = 2\pi f L$  Therefore  $L = E_L R / E_R 2\pi f$ .



In actual use, vary the rheostat until the ammeter reads a low value of current. Measure the voltages across the rheostat and the choke with the vacuum-tube voltmeter, then measure the resistance of the rheostat. Substitute these values in the formula  $L = E_L R / E_R 2\pi f$  and solve for  $L$ . The value of  $f$  in a full-wave rectifier circuit is 120.

Record this value of inductance and the current at which it was measured. Repeat this procedure until all the possible ranges of current that the power supply may require have been recorded.

When the curve has reached a point where the inductance starts to level as the current increases, the saturation point of the choke has been reached. Since this determines the upper limit of usability of the choke under load conditions, this is also the point at which the current rating of the choke should be checked. Leave the load connected for ten or fifteen minutes, carefully observing the case for signs of overheating. The choke may get warmer than body temperature, but should not burn the hand or get unduly hot. If the actual temperature of the choke is desired, fasten a thermometer to the case with putty. Be careful not to place the thermometer near the rectifier or any other heat producing tube. The temperature should be between 180° and 170° F.

The previously described plot will accurately show the point of saturation and how the inductance of the choke varies under different load conditions, and from this it can be readily determined if that "junk box" choke can be used in the power supply and whether it meet the design requirements.

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## The Search for Musical Ecstasy by Harvey "Gizmo" Rosenberg

### RE: TECHNO-SHAMANS

Since the late Paleolithic period, in every culture, a special group of men — those endowed with both courage and gifts — have been responsible for exploring the outer limits of knowledge: ecstasy. We are the modern incarnation of these shamans, and like our ancient brothers we use our music to open the door to higher states of being. Some anthropologists would argue that solder flux is hallucinogenic, the soldering iron is a magic wand, and our single-ended triodes are totems — all used to release a primal instinct for musical ecstasy.

My fellow techno-shamans, now is the time to cast off the mealy minded robe of mediocre audio orthodoxy and explore an expanded gizmological metacontext for the electromechanical arts that create an ecstatic aural metaphor. . . with me.



In other words dudes, read my new 350 page richly illustrated book which will stiffen your resolve, conviction, and whatever else you use to explore the audio arts. It is \$25, plus \$4 shipping, \$11 overseas airmail. Send checks, VISA, MC.

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Dear Friends:

During 1993 and 1994, my position as author and designer allowed me to travel and experience many exotic hi-fi systems in the States and abroad. As I traveled, I searched for persons with highly developed "internal references" for beauty and musical pleasure. These contacts taught me lessons about myself and the wide possibilities of the art of audio engineering.

I discovered that many music lovers have systems beyond what is available at *any* cost in normal high-end stores. These exceptional systems were always single-ended triode powered and they played ALL types of program with equal aplomb.

Every record, no matter how poorly recorded, was a joy and a revelation. Great performances which are unlistenable on most systems because of poor recording quality, became simply GREAT PERFORMANCES.

It wasn't that these components unnaturally embellished or beautified the recording. On the contrary, I never heard so much detail, texture and color provided for my listening pleasure, and I never heard hi-fi sound so right. I felt privileged to be listening to the music . . . like I was the first man on a new planet. I beheld what I was hearing with awe and amazement. There was a deep sea of information but it was human and completely unmechanical. When a system's tonal character is *truly* natural, the aesthetic worth of *all* recordings is elevated.

Believe me, this really happens — even on rip roaring rock and roll. I know this all sounds like hyperbole, but I am writing this letter to explain what I have heard, what is possible, and point out a rewarding approach to music reproduction in your home.

There are only a few systems of this quality in America, but there are hundreds in Europe and Asia. I don't know of any present-day US "high-end" manufacturer with the aesthetic sophistication, ethical values, or engineering open-mindedness to create this sort of *system*. I say *system* because it can't be done by six different component manufacturers. A system of the highest quality can only be made under a single, highly evolved, whole-system engineering aesthetic. Some of the great systems I heard were lovingly built by their owners. The rest were designed by Hiroyasu Kondo of Audio Note in Japan or the engineers at Audio Note UK.

After I heard systems built around the *Ongaku*, the *Kassai*, the *Neiro*, and the *Meishu*, I began to wonder: "How many more years would it take me to design a complete system on this level?" I wasn't sure if I could build anything more than a copy, hopefully something almost as good.

The answer is: I have assembled a complete silver wired, Kondo-designed Audio Note system at the Staten Island Firehouse. My Bliss system is now all Audio Note. I would like to invite you to audition an audio *system* that will raise your internal reference for authentic musical reproduction.

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