The Jersey Broadcaster

NEWSLETTER OF THE NEW JERSEY ANTIQUE RADIO CLUB

May 2013 Volume 19 Issue 5

MEETING NOTICE

NOTE: ONE WEEK EARLY AT INFOAGE!

The next NJARC meeting will take place on Friday, May 3rd at 7:30 PM at InfoAge. This is one week earlier than our normal meeting date to avoid a conflict with the Kutztown radio meet. Directions may be found at the club's we b-site (http://www.njarc.org). At this month's meeting we'll be judging the entries in our Homebrew Radio Contest and Basket Case Radio Restoration Contest so please don't forget to bring in your creations for display.

MEETING/ ACTIVITY NOTES

Reported by
Marv Beeferman

The ON-LINE Broadcaster

The New Jersey Broadcaster is now on-line. To date, 130 of your fellow NJARC members have subscribed, saving the club and your editor a significant amount of money and work. Interested? Send your e-mail address to mbeeferman@verizon.net. Be sure to include your full name.

When I was in the 7th grade, there was always one student who used non-conventional methods to solve algebra problems; the math teacher called him "Epstein the unique." At the April meeting, we had a wonderful presentation on FM alignment by our technical coordinator "Klase the unique." Al's method, using a spectrum analyzer (and an oscilloscope, VTVM and signal generator for those of us blessed with less high end test equipment), was both simple and very effective as opposed to the classic sweep generator alignment. Al based his presentation on an RCA 6-RF-9 and went through each aspect of the alignment - IF amplifiers, FM detector, front end, discriminator and RF stage - with a simplicity that was appreciated by all in attendance.

Although the turnout was somewhat less than normal, affected by other events running in parallel, our Spring swapmeet was still very successful. We again were able to realize a reasonable profit, buoyed by a brisk business at "Marv's Bagels, Muffins and More" canteen. All the action is captured in this month's *Broadcaster*, especially an "Aaah" moment of Aaron Hunter feeding his new arrival.

When you receive this issue, our InfoAge radio/electronics auction will be over but all the action will be captured in the June issue. We'll also cover the sold out Kutztown radio meet on the May 10th weekend; a flyer describing the meet's events can be found on page 8.

In a follow-up to the tree antenna story in the February *Broadcaster*, member Henry Sonntag W2HES wrote: "I worked at Ft. Monmouth from 1971-1981 and while there I had the pleasure of meeting Kurt Ikrath who worked mostly on antennas. It sounded to me that he may have been involved in this [tree antenna] effort. I also remembered that there was a test station located in Panama used by some of the personnel at the Fort. So I decided to Google "tree antenna work in Panama" and came up with a link to an ECOM R&D Technical Report by Kurt Ikrath, et. Al. describing this work done in Panama: www.dtic.mil/dtic/tr/fulltext/u2/742230.pdf. The title is "Performance of Trees as Radio Antennas in Tropical Jungle Forests - Panama Canal Zone Experiments. This report describes their effect on tree antennas and most likely these individuals were the authors of the IEEE paper."

What is so interesting about member John Dilks doing his wash? Find out in an upcoming *Broadcaster* article.

In a follow-up to Henry's posting, member Dr. Alex Magoun (now working at the IEEE History Center as an outreach historian) confirms that Kurt Ikrath, William Henneback and Robert T. Overtner were authors of the IEEE paper.

Upcoming Events

May 10/11: Kutztown PA radio swapmeet
June 14th: Monthly meeting at Princeton; Show & Tell and Estate Planning talk
June 22nd: Repair Clinic at InfoAge
July 12th: Monthly meeting at Princeton
July 27th: Tailgate Swapmeet at InfoAge

THE JERSEY BROADCASTER is the newsletter of the New Jersey Antique Radio Club (NJARC) which is dedicated to preserving the history and enhancing the knowledge of radio and related disciplines. Dues are $20 per year and meetings are held the second Friday of each month. The Editor or NJARC is not liable for any other use of the contents of this publication.

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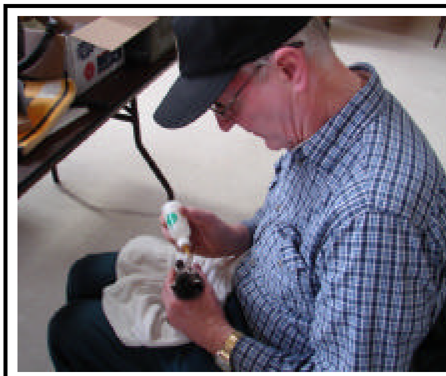
PAL SWAPMEET

APRIL 20th



Member Aaron Hunter rescued a three week old, abandoned kitten on his way to the meet. Well … we're always looking for new members.

Two rare offerings by Waves - the breadboard in front is a very early Model 12 identified by its unusually long base.

Radio-themed fans are difficult to find; the two on the left are very rare.

RE-USING SALVAGED TRANSFORMERS (PART II)

Edited by Marv Beeferman

In Part I of this article, we talked about identifying the windings of salvaged transformers that have no identifying markings. In Part II, we'll attack the topics of power ratings, long-term viability, impedance and replacement strategies.

Power Ratings

Without the manufacturer's specifications, you can select between some crude (but surprisingly effective) guesswork or more sophisticated tests to determine how much power you can draw from your replacement transformer. To start with, look through some old transformer catalogs (available from member Ray Chase at reasonable prices) or the transformer section in old electronics parts catalogs. Find the transformer that most closely resemble your replacement in terms of voltage ratings and number/type of windings. After you've narrowed it down to a few model numbers, compare physical dimensions and, if possible, the weight. The ampere values in the catalogs for a similar-size transformer will probably be close to your unknown unit.

A brute-force method based on the heat given off by an operating transformer may also be tried. Load the transformer to its estimated operating conditions and allow it to heat up for about an hour while closely monitoring it. Then, cautiously touch the case with your fingers; if you can say "Anaheim, Azusa and Cucamonga" before removing your hand, chances are that the transformer is within its desired rating. (If it sizzles or fumes during the heatup, you're not even close.)

A more sophisticated method is to measure actual transformer temperatures. A thermometer can be used but it is difficult to make good contact with the transformer case. A better choice would be one of today's sophisticated multimeters with a temperature function. Harbor Freight's CEN-TECH model P37772 is a typical example using a K thermocouple to take direct temperature measurements.

Secure the thermometer or thermocouple to the transformer case, energize the primary and let the transformer warm up (unloaded) for about an hour. Then record the temperature reading. Carefully connect the maximum load you expect the transformer to handle across the secondary winding(s). Check the temperature periodically and let it operate for about one more hour and take another reading at the end of this hour.

Compare the unloaded and loaded temperatures. You should not have a temperature change of more than 68º F (20º C) to 86º F (30º C) at any time during the test. For smaller transformers, use the 68º F temperature rise value, and on larger ones, the 86º F value. Any temperature increase below these values indicates that the transformer will run comparatively cool for your application.

A final method was suggested by Darwin H. Harris in an article entitled "Rating Power Transformers" in the December 1953 issue of *Radio Electronics*. Harris proposed a theory that the current rating of the high-voltage winding of a power transformer could be determined by a simple measurement of open-circuit voltage and resistance. He reasoned that the voltage output of the winding is proportional to the number of turns and that is directly related to the length of the wire in the winding. The resistance of the winding is related to both its length and the wire size (cross sectional area). So, if we divide the open-circuit voltage by the resistance, we will get a number proportional to the wire size. Knowing the wire size will permit an accurate estimation of current capacity.

Harris measured the voltage and resistance of a number of known-rated transformers and came up with the following relationship:

For a capacitor input filter: DC Current Rating = 25 X Vo/R
For a choke input filter: DC Current Rating = 35 X Vo/R

Where Vo is the open-circuit voltage from the center tap to one side of the high-voltage winding and R is the resistance between the center tap and one side. The DC current rating is given in mA.

In the experience of one user of this method (Reference 1) with dozens of transformers, it was found that these formulas seem to underestimate the capacity of small transformers while overestimating the capacity of the larger ones. But, overall, the formulas seem to work well and are useful when no other information about the transformer is available.

Determining the current ratings of transformer filament windings is difficult and, in most cases, unnecessary. Transformers designed for use in radios usually have a proportional relationship between the B+ current that can be supplied and the number of tubes that the filament windings can power. If a salvaged transformer can supply the proper B+ voltage and current for a given radio, it probably has sufficient filament current capacity to light up the tubes. Generally, a transformer that can supply up to 90 mA of B+ will have a 5-volt, 2-amp rectifier filament winding. Transformers rated for 100 mA or more will usually have a 5-volt, 3-amp rectifier winding. The 2.5-volt or 6.3-volt current capacity will be in proportion to the B+ current rating.

Long Term Viability: Take It Or Leave It

When I was "in the business," I conducted hundreds of insulation resistance tests on incoming and replacement components. In a few cases, higher than normal leakage currents predicted the possibility of impending failure in a short period of time.

There is no test to which a transformer is subjected which has such a shaky theoretical basis as the insulation test. Yet, this is the one test that the transformer should pass to ensure its long term viability. You might go through large quantities of transformers with little or no insulation trouble, but older examples that have been in service for many years and perhaps not built to the best specifications, may have poor insulation adequacy and ultimately fail (shorted turns) after only a few months in service.

It has been found over a period of years that, if insulation withstands the standard rule of twice normal voltage plus 1,000 volts rms at 60 cycles for 1 minute, reasonable insulation life is usually obtained. It is possible for a transformer to be extremely under-insulated and still pass this test; conversely, there are conditions under which the rule would be a handicap. Therefore, these values can only be considered a rough guide.

The equipment used to perform insulation tests consists of a high voltage, 60 cycle AC source and a meter that measures leakage currents below a few milliamps (preferably in microamps). Insulation testers, meggers, and capacitor leakage testers are typically used.

Power transformers should be tested to make sure they provide proper insulation from the AC line (primary), for leakage between primaries and secondaries and between all windings and their metal core and frame. Most new transformers used today have a 1500 volt break down rating and should have only a few microamps of leakage when tested at 1000 volts. Older transformers which have been in service many years in high temperature and high humidity environments may show significantly higher leakage values and consideration should be given to their acceptability in long term applications.

Note the "1500V HIPOT" (insulation) rating of this transformer.

Here's the caveat. If insulation tests are repeated one or more times, they may destroy insulation because insulation breakdown values decrease with time and the application environment. Therefore, you might want to reduce the insulation test voltages to say 500 volts for an older, well-used transformer. Or, in view of some who consider the value of insulation tests a little dubious, you might want to forgo this type of test.

Output Transformer Impedance

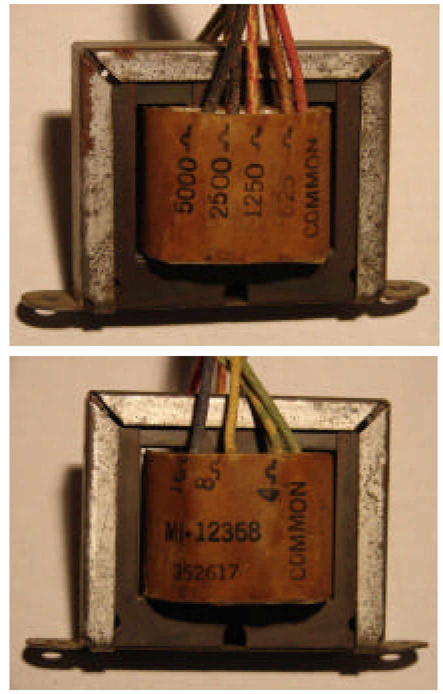
When replacing the audio output transformer on a radio, the replacement should match the impedance of the original as close as possible. If the wrong transformer is selected, the results can be low output and loss of tone quality. Universal output transformers are available which have multi-tapped primary and secondary windings to match a wide impedance range.

It is not uncommon for vintage radio collectors to have various output transformers laying about that have been pulled from parts sets, or have been obtained at swap meets. Often, the primary and secondary impedance information is not available for these units but with some simple test equipment and ohms law, we can calculate these values. All we need to do is to determine the turns ratio of the transformer and calculate what impedance will be reflected back to the primary with a given load on the secondary.

First, determine the primary and secondary of the transformer as explained in Part I. Then, connect a Variac monitored by an AC voltmeter to the primary. (An isolation transformer used in conjunction with the Variac is suggested for safety reasons.) Measure the transformer output voltage with an AC voltmeter. Increase the input voltage until the voltage on the secondary reads 1 volt; thus the voltage on the primary will be the turns ratio. For example, if the primary voltage measures 25 volts, the turns ratio is 25:1.

Since a transformer's impedance ratio is the square of its turns ratio, with a 25:1 turns ratio transformer, the impedance ratio is 25 X 25 = 625:1. So, if the transformer is working into an 8 ohm load, the impedance that will be reflected to the primary will be the impedance ratio (625) multiplied by the load impedance (8 ohms) or 5,000 ohms. Changing to a 4 ohm load will result in a reflected impedance of 2,500 ohms.

It should be noted that the load impedance seen by an output tube and output transformer is not constant. The frequency of an audio signal will vary over a wide range. The inductance in the transformer windings will have a different impedance at different frequencies. At a certain frequency, an 8-ohm voice coil may have an impedance of 10 ohms or at low frequencies it may have an impedance of 4 ohms. This varying load impedance is reflected back to the primary, so the tube and output transformer must work into a varying impedance range.



The primary and secondary impedance values of this output transformer are clearly marked...not always the case.

Tips and Techniques

Hopefully, the information presented in this two-part article will help in determining if a salvaged transformer is suitable for replacement in a given application. The voltage requirements for a specific radio can usually be found in Rider, Beitman or Sams references, but current requirements are not always given. However, this information can be computed by looking up the radio's tube compliment in a tube manual and adding up the currents. Both the filament and B+ current requirements can be estimated. If the ratings of one of the salvaged transformers you have tested matches the radio's requirements, you're in business.

A simple, although not very elegant approach in selecting a replacement is to use the fact that the power capacity of a transformer is directly related to the cross-sectional area of its core. Thus, the bigger the transformer, the greater its capacity. Thus, if the replacement transformer produces the correct voltages and is physically as large or larger than the one you are replacing, it should work OK. But this rule should only be used when the salvaged transformer was taken from another radio. Transformers taken from signal generators, oscilloscopes, or other test equipment may not have the proper relationships between the high-voltage and filament windings and may have other windings that are not required in a radio application.

A 5% difference in secondary voltage ratings will usually not affect circuit operation.

Where a special transformer having several secondary windings is required, and an exact duplicate is unobtainable, separate transformers can be used in place of the single multi-winding unit, provided that adequate mounting space is available. The transformer's primary windings are then connected in parallel.

If special filament or bias voltages are required, two (or more) windings can be connected in series to supply necessary voltages. Connect adjacent winding leads together temporarily and check the output voltage; if it is less than expected, the windings may be "bucking." In this case, interchange the connections to one winding.

It may be necessary to reduce a circuit's B+ voltage after installing a substitute. There are several ways to do this. A small resistor (5 to 25 ohms, 10 watts) can be connected in series with one of the primary leads, or the effective turns ratio of the transformer can be reduced by connecting one of the filament windings in series with the primary. The preferred method would be to substitute a rectifier tube with a larger internal voltage drop or lower the value of the input filter capacitor. If the hum level in the d.c. output goes up, raise the value of the second capacitor in the pi filter.

Often, a center-tapped filament winding may be needed that may not be available on a substitute. In such a case, an electrical "center-tap" can be obtained by connecting a 50-to-100-ohm adjustable wire-wound resistor across the filament winding. The adjustable tap is centered on the resistor.

Happy Hunting

Power transformers from audio power amps make great replacements for radio transformers, but tube-type audio gear is highly collectable now. However, you can still find transformers at radio club flea markets and hamfests. It is worthwhile to pick up an old cannibalized chassis if the power transformer is there and the price is right. It is not a bad idea to keep a good supply of transformers since new ones will not be getting any cheaper. Never pass up a chance to pick up another one; you or one of your buddies will probably need it someday.

References:

1. Peter J. Bertini, "Testing and Rating Salvaged Power Transformers," *Popular Communications*, October 2002
2. Eugene Richardson, "How to Make Power Transformer Substitutions," *Popular Electronics*, April 1959
3. Len Buckwalter, K10DH, "A Handy Guide to Unmarked Transformers," *Electronics Illustrate*, July 1968
4. Robert C. Genn, Jr., *Manual of Electronic Servicing Tests and Measurements*, Parker Publishing Co., 1980
5. http://www.radioremembered.org/outimp.htm
6. http://www.vias.org/eltransformers/lee_electronic_04_23.html

SYLVANIA'S CLIFTON NEW JERSEY TRANSMITTING TUBES

(PART 1)

By
Jim Cross

The following article was originally published in the April 2013 (Vol. 15, No. 2) edition of the "Tube Collector," the bulletin of the Tube Collectors Association. It is being reproduced here because of its New Jersey "flavor" and with the kind permission of Jim Cross and Ludwell Sibley.

Sylvania (1) is reasonably thought-of as a large-scale maker of consumer and military receiving tubes. But between May 1933 and December 1934, Sylvania produced their first line of transmitting tubes at a plant in Clifton, New Jersey. These Sylvania "classic" 1933-34 transmitting types are arguably some of the most handsome types of the era. They are of interest for their form, and for their ground breaking use of graphite anodes, which became the industry standard for glass transmitting types in about the 50– to 500-watt range.

Sylvania 205D

In late June 1932, the DeForest Radio Company of Passaic, NJ went into receivership, with an estimated $950,000 in assets (2). The best offer for the DeForest assets was $500,000 from RCA, and a judge ordered the RCA offer be accepted in March of 1933 (3). At this point RCA planned to operate the Passaic plant for a short time and then move the operations to Harrison and Camden.

Due to the bitter competition between the companies, many of the employees of DeForest viewed RCA as “the enemy,” and even in this Depression era, most of the senior engineers did not want to work there and turned down offers (4). It is likely that these senior DeForest engineers contacted Sylvania, and persuaded them to open the plant in Clifton. (Clifton is immediately adjacent to Passaic.) Sylvania saw an opportunity to jump into the transmitting-tube business with an experienced staff. They leased a 46,000 sq ft (5) building, formerly the Portable Machine factory, at 64 Lakeview Ave., near the corner of Clifton and Lakeview Avenues. They hired many of DeForest’s former employees, and formed a division they called the Hygrade Sylvania Electronics Department. Part of the April, 1933 announcement to the industry stated:

> “Now, with the formation of the Electronics Department, the Hygrade Sylvania Corporation expands to meet the newer demands of electron-

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ics. In addition to lamp bulbs and radio set tubes, this company now produces radio transmitters, transmitter tubes, special receivers, industrial tubes, and custom-built electronic devices of every specialized nature."

"A technical staff composed of William J Barkley, General Manager, D. E. Replogle, Chief Engineer, Victor O. Allen, Assistant Chief Engineer; and 22 other electronics engineers and executives, all former associated with the DeForest Radio Company . . . add to the Hygrade Sylvania resources the same skill and knowledge responsible for today's most critical commercial applications of electronics ." (6)

The same announcement appeared for the general public in the May, 1933 issue of *QST*. A 1934 Walter Ashe catalogue says it this way:

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"The Electronics Department of the Hygrade Sylvania Corporation is composed of the former DeForest engineering and sales organizations practically intact, and headed by Mr. W. J. Barkley, former DeForest vice-president, as General Manage. Mr. D. E. Replogle, also former DeForest Vice-President and Chief Engineer, is Chief Engineer of the new organization." (7)

Many well-known people were part of this venture. William Barkley is best known for his long tenure as a Vice President of Collins Radio Co.

Delbert Replogle worked for Raytheon, Arcturus, Jenkins Television, and DeForest before Sylvania, and is probably best known for the tubes of General Electronics, whose tubes' "DR" prefix reflects his name.

Victor Allen had worked for Edison before DeForest, and went on to have over a dozen patents in his name.

Charles Rice was the Sales Manager of the Clifton division. He was one of the founders and later became President of United Electronics (8).

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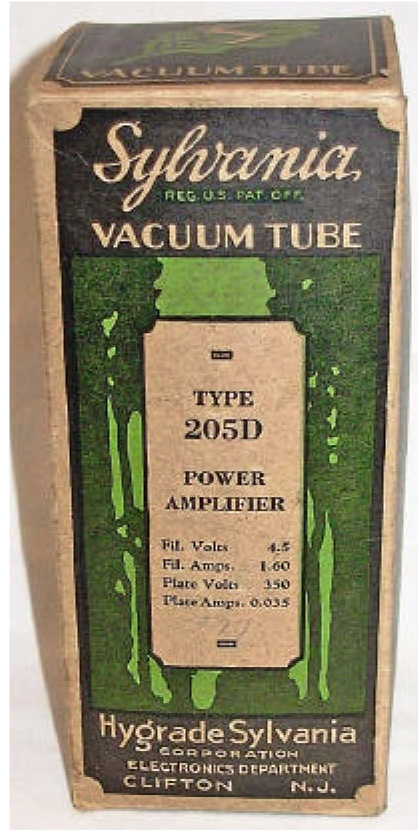
Charles P. Marsden spent the last 30 years of his career as the leader of the tube and transistor group at the National Bureau of Standards (now called the National Institute of Standards and Technology, NIST). One of his legacies is the small NIST tube museum.

With this instant well of experience, Sylvania was ready to produce a full line of transmitting tubes. But there was more. At the time the DeForest Company went bankrupt, DeForest engineers had been working on a process for making practical graphite anodes. Graphite has a great advantage as an anode material for medium-power transmitting types, since it is easy to machine and has a high melting point. Western Electric had experimented with graphite anodes in the early 1920s. But graphite was very hard to de-gas, and there was a problem with free amorphous (powdery) carbon on the surface that would contaminate other elements inside the tube.

At least one DeForest developmental sample of a graphite anode triode exists. Given the feelings of the DeForest employees for RCA, it is likely they purposely hid their work on the graphite anode from RCA, since the latter apparently either did not know of the work or recognize its importance. Sylvania was able to hire the two engineers responsible, Carson M. Wheeler and Charles P. Marsden, who applied for a patent on a way to make and process graphite anodes for tubes in early June 1933, and assigned it to Sylvania (9). The use of graphite anodes was a big innovation, and Sylvania became the first company to make transmitting tubes successfully with them. At least some of the tubes made at Clifton cite the graphite anode patent on the tubes.

The graphite anode types were announced in September 1933(10), and their full line was available by January 1934. Advertised prices were the same as for their non-graphite RCA counterparts. Sylvania took out full-page advertisements in *Electronics* magazine for their graphite-anode tubes every month between September 1933 and November 1934. It was at about this time that Sylvania stopped making tubes in Clifton.

(Continued next month…)



Carton Design

ENDNOTES

(1) At the time Sylvania owned the Clifton plant, the official name of the company was the Hygrade Sylvania Corporation. This is shortened to "Sylvania" throughout this article.
(2) "Receivers for Deforest", *The New York Times*, New York, NY, June 24, 1932, p. 31.
(3) "$500,000 Offer for DeForest's Plant Accepted", *The Herald-News*, Passaic, NJ, March 7, 1933, p. 1.
(4) Lorton Heusel, "Friends on the Front Line: The Story of Delbert and Ruth Replogle," North Carolina Friends Historical Society, 1985, p. 86.
(5) *Poor's Manual of Industrials*, 1937 edition.
(6) *Broadcasting*, Volume 4, Number 8, p 2, April 18, 1933.
(7) Walter Ashe Radio Co. catalog, 1934.
(8) Charles A. Rice biography, United Electronics catalog, mid-1950s.
(9) United States Patent 1,982,821 "Electrode and Method of Manufacture," applied-for June 2, 1933 and granted December 4, 1934.
(10) *Electronics*, September 1933, p. 7.

www.dvhrc.info

The Delaware Valley Historic Radio Club (DVHRC) and Renningers Antique and Farmers Market announce . . .

RENNINGERS.COM
www.renningers.com

Kutztown Radio Show XXVIII
May 10-11, 2013

Two full days of radio and radio-related activity

30,000+ sq. ft. outdoors and under roof • Auction of quality radios and related items 1pm Saturday in air-conditioned comfort • Buy-it-now starts 8am Saturday • No official starting time • Free admission • Free parking Free onsite camping • Food available next to pavilions plus nearby Farmer's Market with many vendors

Dealer spaces:
10' x 10' spaces are $30.00, (includes 1 table and electricity – bring your own extension cords). All spots under roof. Extra tables are $5. Overflow space available in 2nd pavilion once primary pavilion is full. To reserve a table contact Renninger's via their website (www.renningers.com); by email (kutz@renningers.com); or by phone: Mon-Thu (570) 385-0104, Fri-Sat (610) 683-6848; or by postal mail: 740 Noble St, Kutztown, PA 19530)

Saturday Auction:
10% commission for consignors, no buyer's premium, no sales tax. Consignments accepted Saturday morning. Consignors can set a reserve -- no more than 5 reserve items per consignor. At the discretion of the DVHRC, items can be excluded – consignor can donate item to Buy-it-Now or keep item. Seller/bidder cards are required to sell or buy. Cost is $3.00

Buy-it-Now:
The Buy-it-Now table is for the sale of donated items as is on a cash-and-carry basis. Buy-it-Now starts 8am Saturday. DVHRC reserves the right to refuse items for Buy-it-Now.

Raffle
Raffle tickets are available at the DVHRC table - $2 each, or 3 for $5. Drawing is noon Saturday. Winners do not have to be present.

Nearby Hotels:
Super 8 Motel (West Kutztown) 866-573-4235
Hawthorne Suites Limited, Fogelsville, PA 866-678-6350
Comfort Inn Allentown (Lehigh Valley West) 865-767-0278
Holiday Inn Conference Center, Allentown, PA 888-452-5664
Contact hotels directly for reservations and information.

DVHRC Information:
Contact Walt Peters, wpeters143@msn.com, 215-487-3602; or Tom Spiegle, adxymox@msn.com, 610-916-5133; or look for the DVHRC table in the center of the primary pavilion during the show. Table staffed 12noon-5pm Friday, 7am-Noon Saturday.