



Groove Tubes Process - 2012



GT Process – Acquisition

- There are very few tube factories in the world, GT sources only from the best
- GT only purchases raw tubes meet specs for low hum, noise and microphonics
- Tubes are shipped to GT global facilities for further selection and grading



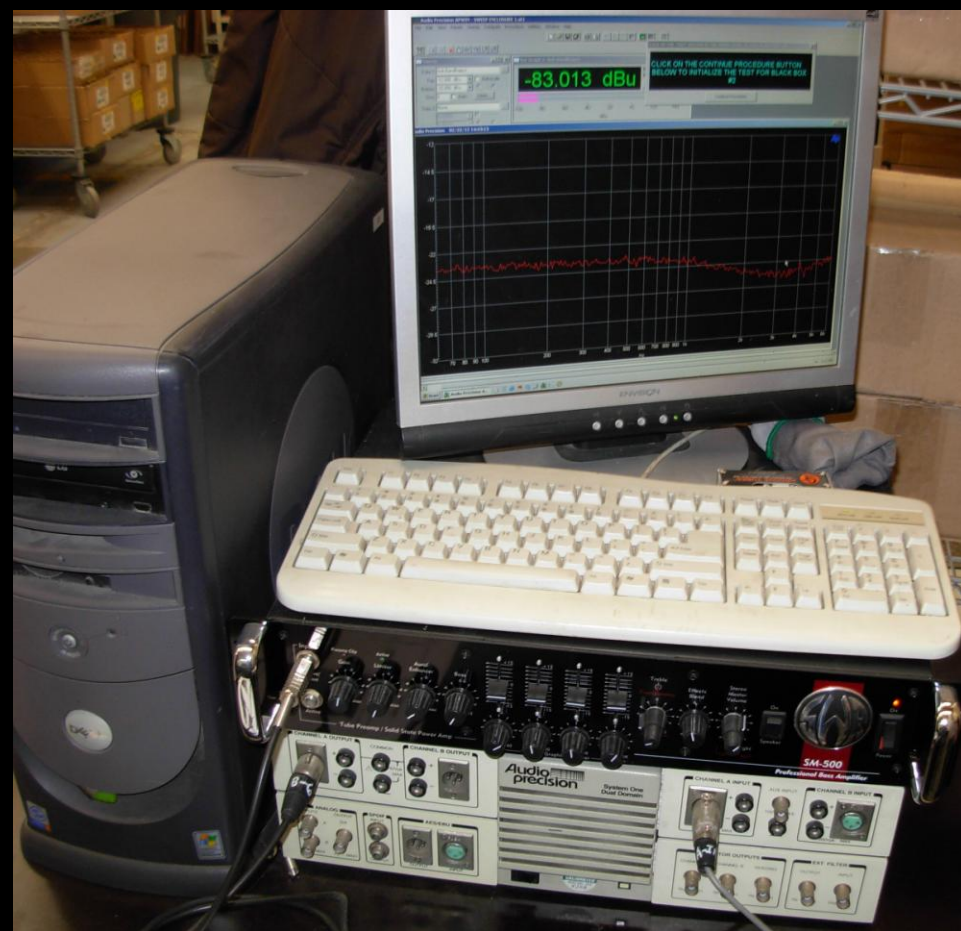
GT Process – Preamp Tubes

- The first step is a burn-in period which lasts approximately 2 hours
- This “settles the tubes”, burns off impurities and stabilizes components
- All processes and computer programs are proprietary to Groove Tubes



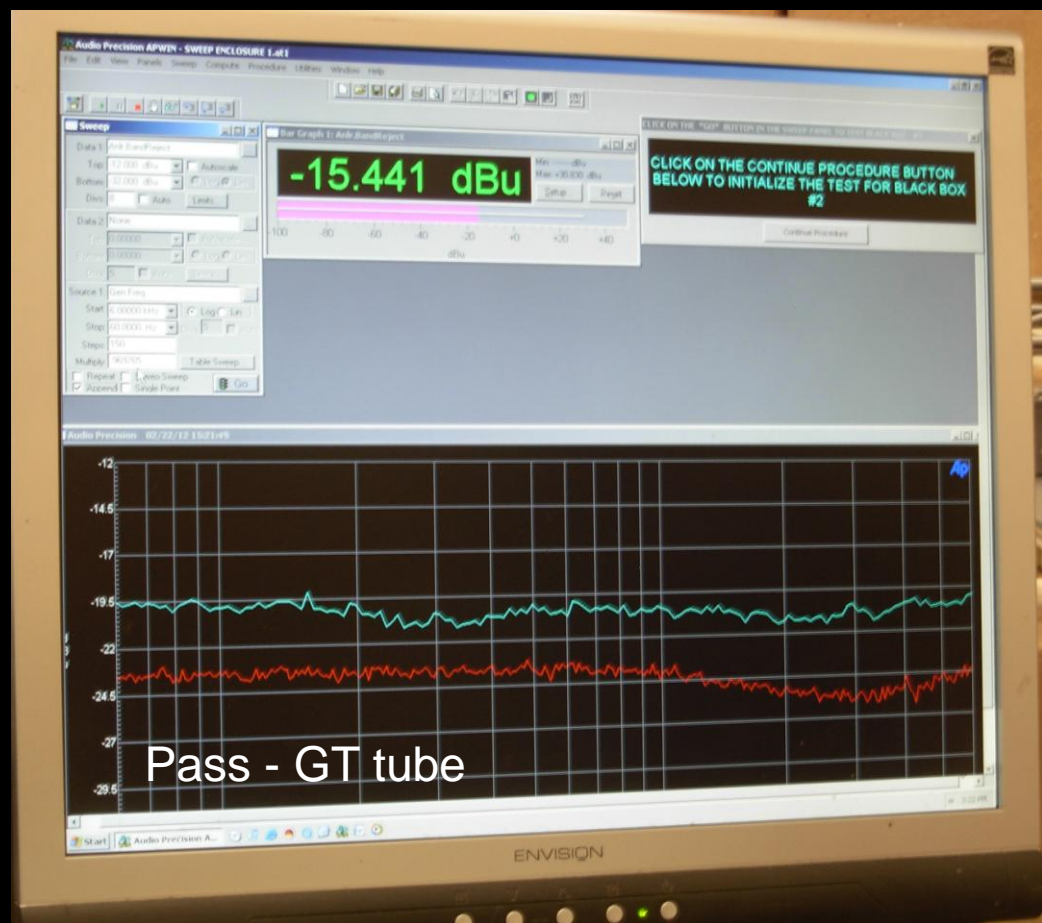
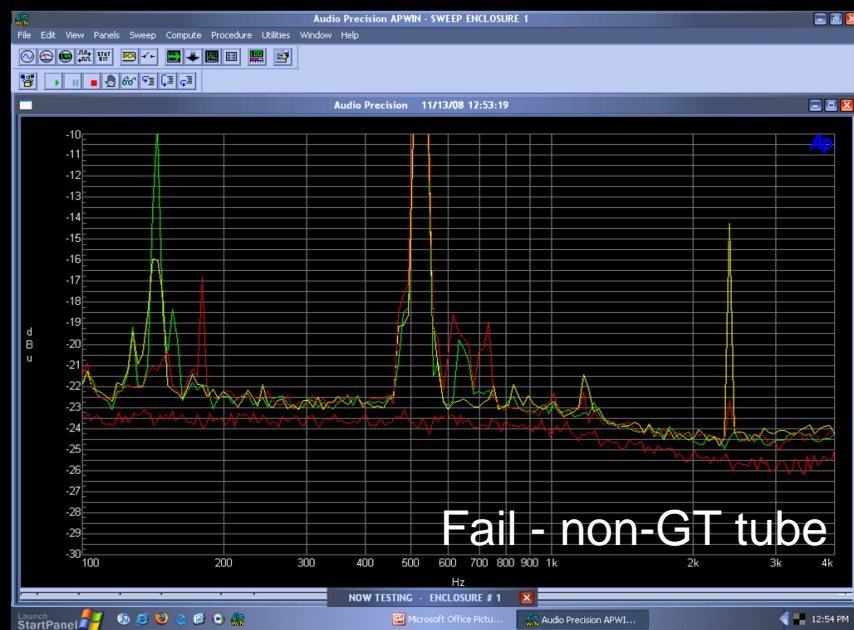
GT Process – Preamp Tubes

- House of Pain – The Human Element – Groove Tubes must make the first cut
- Tubes placed in amplifiers hooked to hum / volt meters and speakers
- Amps run at very high levels of Gain, EQ and “ping” tested for microphonics



GT Process – Preamp Tubes

- The Brain of the Black Box – Scientific evaluation of *overall* tube performance
- Tone Generator runs a frequency sweep through an amplifier into the Black Box
- Output from Black Box signal is connected to GT software and monitor



GT Process – Preamp Tubes

- The Brain and the Black Box – Scientific evaluation of *overall* tube performance
- GT proprietary program tests for smooth frequency response, gain and output
- Tubes are tested for hum and noise level, results are displayed in graphic form



GT Process – Preamp Tubes

- The Kennedy Amplitrex AT-1000— *Internal* tube function revealed
- GT proprietary program further dissects and measures tube performance
- Evaluates plate resistance, current, voltage, bias draw, transconductance



Amplitrex Tube Test V1.4

Test Results

Test Results Tube: ECC83

Test Method: Auto Bias

UPDATE PRINT

Item	Spec	Result 1	Result 2
Plate Volts	Ep vdc	250	250
DC Plate Current	Ip mAdc	1.2	1.2
AC Plate Current	Ip mAac	~	0.17
Screen Volts	G2 vdc	0	0
Screen Current	IG2 mA	0	0
Bias Volts	G1 vdc	2	1.7
Test Signal Volts	RMS	~	0.1
Mutual Conductance	uMhos	1600	1700
Grid #1 Leakage	uA	0	0
H/K Leakage	mA	0	0
Plate Resistance	RP ohms	~	58.8K
Tube Gain	Mu	~	99.9
Heater	aF vdc	12.6	12.6
Heater Run Time	Sec	1151	1171
Timestamp		2/22/2012	3:29:56 PM

Notes

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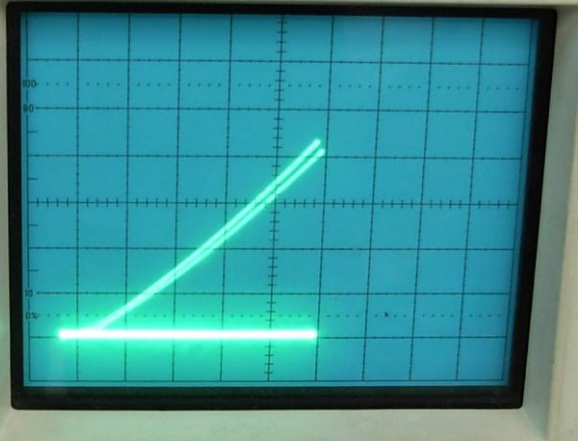
GT Process – Preamp Tubes

- The Kennedy Amplitrex AT-1000– *Internal* tube function revealed
- Provides numeric values for gain and voltage for each triode
- Based on results, tubes could be part of Special Applications Group kits

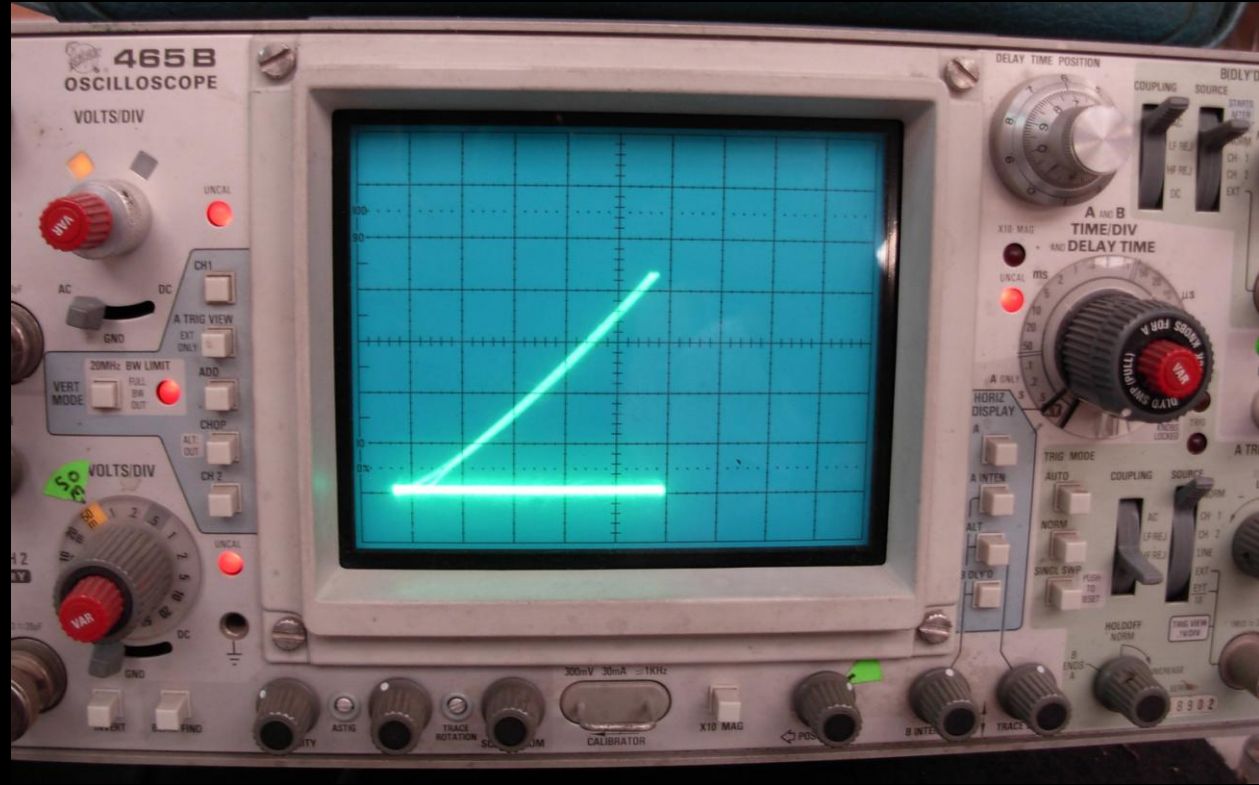


GT Process – Preamp Tubes

- The Hagerman Vacu-Trace and 465-B Oscilloscope - The final refinement
- Tubes are matched for Special Application Group kits during this phase
- Matched Phase Inverter (MPI) tubes must pass this test



Un-matched triodes



Matched triodes



GT Process – Preamp Tubes

- The Hagerman Vacu-Trace and 465-B Oscilloscope - The final refinement
- Provides visual reference matching for two sides of triode
- The two curves must visually lay on top of each other to be a perfect match



GT Process – Power Tubes

- Groove Tubes features proprietary matching and grading of power tubes
- Tubes must meet the same rigorous manufacturing specs as preamp tubes
- Tubes are placed in a fixture and “Dynamically Energized”



GT Process – Power Tubes

- Only Groove Tubes does “Dynamic Energized” testing of power tubes
- Measures cathode filament voltage, plate voltage, wide variety of other specs
- The GT “Mothership” contains all coding information on unique GT testing



GT Process – Power Tubes

- Tubes are graded according to distortion levels on a scale from 1 to 10
- Tubes with similar distortion levels are matched in pairs, quartets and sextets
- This creates opportunity to properly bias amp to maximize tube performance

Date Code / Power Rating
on the silver base label
Month / Date / Year



GT Process – Power Tubes

- High graded tubes have more headroom and less distortion - fine scale is 8 - 10
- Medium graded tubes most commonly used in stock amps – fine scale is 4 - 7
- Low graded tubes are softest and quickest into soft clipping – fine scale is 1 - 3



Groove Tubes Retail Display

- Overall display size is 6" deep x 12" tall x 16" wide - front is solid, back opens
- Clear front and back, internal shelving holds power amp and preamp tubes
- Works on a counter top or with standard 6" shelf brackets on a wall