Startup and Tuning of a *Classic Static-Sparkgap TC*

(Guide for Newbies)

Safety Warning! Before performing any manipulations on the system:
Disconnect system from the mains power! Discharge capacitor!

TC presumed: EMI-Filt./ Variac/ NST/ Terry-Filter/ Stat.Maingap/ Primary L & C/ Secondary & Toroid

1.) Adjusting the Safetygap:

Disconnect the primary resonant circuit (=tank) from the HV powerfeed system (=NST+Terry Filter)
Set safetygap initial distance to a low initial value, i.e. 2 to 4mm.

Feed the NST with nominal primary voltage+10%. The gap should fire!
The NST should be powered for short time intervals only: 1 to 2 sec's max..,
(comparable to the time needed to ignite a neon sign;
longer operating periods of the NST with open circuit secondary can kill it).

Open the gap distance in small steps (i.e. 0.5mm) till it just ceases firing, when the NST is powered.:
Keep the safety warning in mind, when adjusting!

Record the last gap distance in the TUNING LOG: **gap dist. without ignition at HV+10% = …….mm**

Reduce gap distance in very small steps, till it just ignites again at HV+10%, when powering the NST:

This is the max. safety gap distance, which should not be altered again.

Record this safetygap distance in the TUNING LOG**: gap dist., just igniting at HV+10% = ……..mm**

2.) Conservatively setting the Maingap

Connect the maingap only, across the HV-outlet of the (Terry-) kickbackfilter.
(on the other hand the primary resonant circuit, must remain open / disconnected.)

Set maingap initial distance to a low net-total value, i.e. 2mm or even less;
if it's a multi copper tube, air blown gap (i.e. TCBOR style), tap only 3 or 4 tubes (= 2 or 3 gaps)

Feed the NST with nominal primary voltage. The gap should fire!
The NST should be powered for short time intervals only: 1 to 2 sec's max..,

Open the gap distance in small steps (i.e. 0.5mm) till it just ceases firing, when the NST is powered:
Keep the safety warning in mind, when adjusting!

Reduce gap distance again, till reliable ignition is attained.

This is the max. allowable maingap distance, which should rather not be exceeded.

Record this gap distance in the TUNING LOG: **maingap dist. with ignition at nominal HV = ……mm**
Bigger distance begins taking the risk of killing the NST !

Set gap distance now to about 50% of the max. allowable maingap distance**. Record distance = ……..mm**

3.) MMC-Cap: Verify the LTR capacitance value, and the total standoff voltage, by visual inspection and/or measurement, if capacitance meter available. Record Cprim = ……..nF

4.) Reconnect the primary resonant circuit, as needed to operate the TC.
Connect the primary coil tap at the precalculated position (as predicted by i.e. JAVATC)

---------- START OF INITIAL TUNING CYCLE ----------

5.) Attach a breakout-point on outer rim of the toroid.
Establish a grounded target face to face with the breakout-point, not too distant (i.e. 20cm).

6.) Turn the Variac down to zero. Power ON the mains feed! Slowly turn the Variac up, till you have the maingap reliably firing. From here, turn up for about 10% more input voltage to the NST. Watch the TC (preferably in a dimmed environment, with a mirror behind the TC, in order to watch the backside), if sparks develop (between toroid–breakout point and grounded target), without "racing sparks" along the secondary or sparkovers elsewhere. If corona develops at the upper end of the secondary winding: lower the toroid a little (some cm).

7.) Move the grounded target (away from the breakout point), till you get the sparks reaching the target every couple of seconds (i.e. every 5 or10 seconds).

8.) Optimizing the primary tap position systematically for longest sparks: Vary the tapping point, first by ± 1 turn, then by ± 0.5 turn, then by ± 0.25 turn etc., from the starting tap point. Move the grounded target away or closer, as in pt. 7.) above, in order to see, if the sparklength is better or worse. If no input mistakes to JAVATC were made, you will note, the optimum tap point will not deviate much from the calculated one; perhaps up to 0.5 turns higher.

9.) Watching common problems: Racing sparks? Primary – secondary sparkovers ? (check the RF ground connection of the secondary. Impedance to ground too high; line to ground too long? → consider a counterpoise instead).
If observing racing sparks, adjusting the prim. to sec. coupling is the way to go: The distance between the lower end of the secondary winding and the inner turn of the primary needs to be adjusted in small steps (i.e. 5mm), either by elevating the secondary or lowering the primary. (the coupling factor should be within about 0.08…0.15, calculated by JAVATC, if done right).

10.) If the optimum primary tap is found, and the coil is operating "clean", without any sparkovers and racing sparks, the optimum setup for the actual maingap adjustment is found (50% of the max. allowable maingap setting; see pt. 2.)).

Record the parameters in the TUNING LOG for 50% of allowable maingap distance:

Variac input = mains voltage: ……..(V)

Variac input current drawn: ……..(A)

@Variac position – NST primary voltage: ……..(Variac scale divisions) equivalent to ……(V)

@Variac position – NST primary current: ……..(Variac scale divisions) equivalent to ……(A)

Maingap total net-distance: ……(mm)

Primary-tap position: ……(turns)

Coupling (elevation distance of prim./sec.): ……(mm)

Optimum sec. spark length: ……(cm)

---------- END OF INITIAL TUNING CYCLE ----------

---------- FURTHER TUNING CYCLE(S) ----------

11.) Crank the Variac down to zero. Power ON the mains feed! Crank the Variac up for nominal NST voltage feed. (i.e. 120V in the US; 230V in Europe or elsewhere). Widen the distance between toroid – breakout point as in pt.7.) above. If corona develops at the upper end of the secondary winding: lower the toroid a little (some cm).

12.) Increase the maingap total net-distance in several test-steps, till the best spark length between breakout point and grounded target is achieved (adjust ground target distance accordingly). Don't widen the gap distance more, without need. The max. allowable maingap distance should rather not be exceeded, because the NST and primary cap are stressed / can be killed.

13.) Permanently watch again the TC, regarding "fires", respectively if it's working properly, without "racing sparks" along the secondary or sparkovers elsewhere. If problems show up: don't continue operating it, but first resolve the issue (coupling adjustment, grounding, toroid, etc.?).

14.) If the system is working properly, perhaps try again to adjust the primary tap for best sparks.

Record the parameters again in the TUNING LOG for nominal NST feed:

Variac input = mains voltage: ……..(V)

Variac input current drawn: ……..(A)

@Variac position – NST primary voltage: ……..(Variac scale divisions) equivalent to ……(V)

@Variac position – NST primary current: ……..(Variac scale divisions) equivalent to ……(A)

Maingap total net-distance: ……(mm)

Primary-tap position: ……(turns)

Coupling (elevation distance of prim./sec.): ……(mm)

Optimum sec. spark length: ……(cm)

---------- END OF THIS FURTHER TUNING CYCLE ----------

15.) Repeat one more tuning cycle with Variac adjusted for NST feed with nominal+10% Volts, (if taking the risk…!) meaning to repeat points 12.) to 14.) above. Step15.) is optional !

Record the parameters again in the TUNING LOG for nominal+10% NST feed:

Variac input = mains voltage: ……..(V)

Variac input current drawn: ……..(A)

@Variac position – NST primary voltage: ……..(Variac scale divisions) equivalent to ……(V)

@Variac position – NST primary current: ……..(Variac scale divisions) equivalent to ……(A)

Maingap total net-distance: ……(mm)

Primary-tap position: ……(turns)

Coupling (elevation distance of prim./sec.): ……(mm)

Optimum sec. spark length: ……(cm)