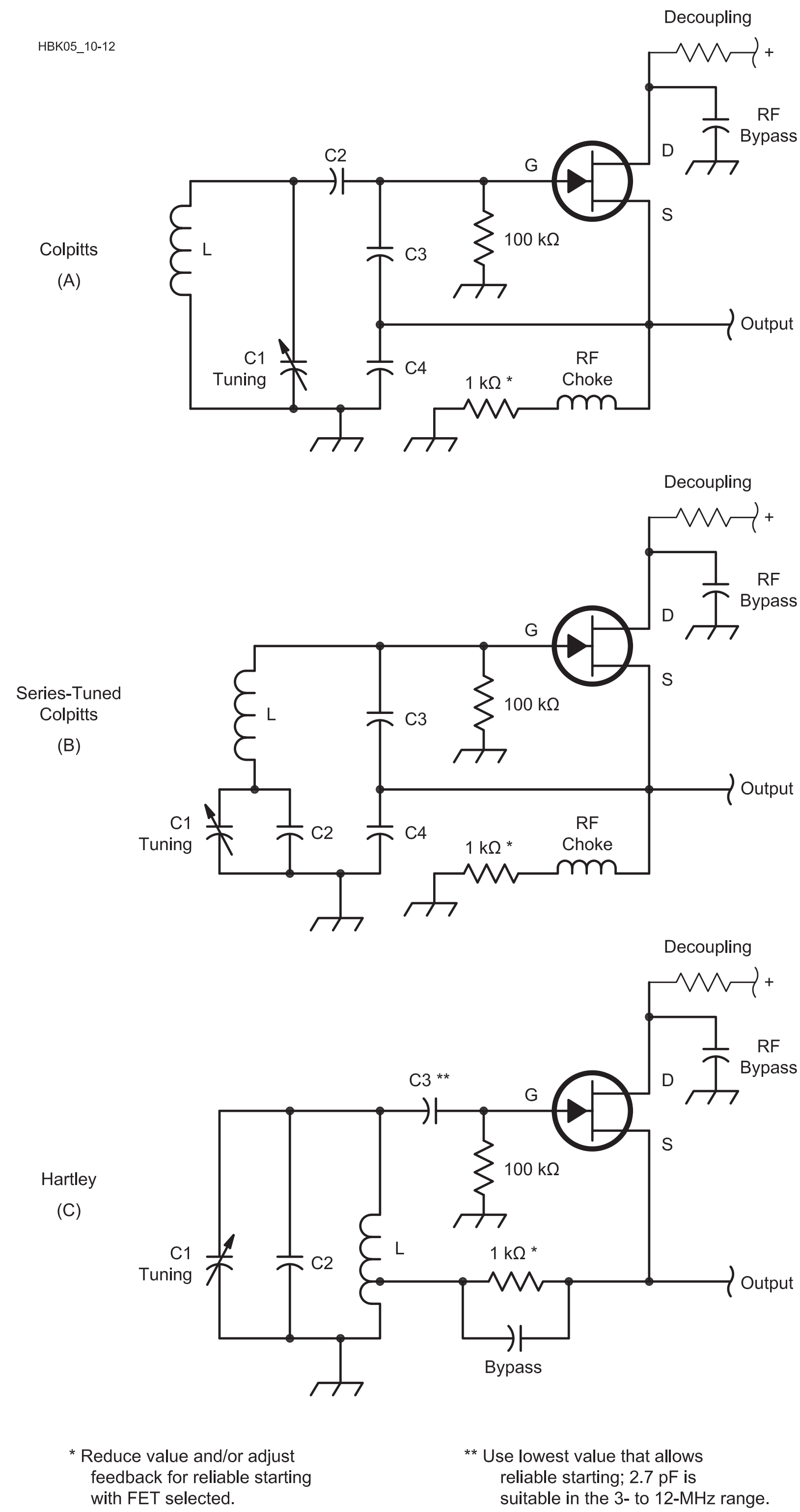

Fig 9.11 — The Colpitts (A), series-tuned Colpitts (B) and Hartley (C) oscillator circuits. Rules of thumb: C3 and C4 at A and B should be equal and valued such that their X_C = 45 Ω at the operating frequency; for C2 at A, X_C = 100 Ω. For best stability, use C0G or NP0 units for all capacitors associated with the FETs' gates and sources. Depending on the FET chosen, the 1-kΩ source-bias-resistor value shown may require adjustment for reliable starting.

Rohde, N1UL, available on the CD-ROM accompanying this book. The paper shows the design process by which both noise and power can be optimized in a simple oscillator.

SERIES-TUNED COLPITTS VFO

The series-tuned Colpitts circuit works in much the same way. The difference is that the variable capacitor, C1, is positioned so that it is well-protected from being swamped by the large values of C3 and C4. In fact, small values of C3, C4 would act to limit the tuning range. Fixed capacitance, C2, is often added across C1 to allow the tuning range to be reduced to that required without interfering with C3 and C4, which set the amplifier coupling. The series-tuned Colpitts has a reputation for better stability than the parallel-tuned original. Note how C3 and C4 swamp the capacitances of the amplifier in both versions.

HARTLEY VFO

The Hartley oscillator of Fig 9.11C is similar to the parallel-tuned Colpitts, but the JFET amplifier source is connected to a tap on the tank inductance instead of the tank capacitance. A typical tap placement is 10% to 20% of the total turns up from the cold end of the inductor. (It's usual to refer to the lowest-signal-voltage end of an inductor as "cold" and the other, with the highest signal voltage as "hot".) C2 limits the tuning range as required.

C3 is reduced to the minimum value that allows reliable starting. This is necessary because the Hartley's lack of the Colpitts' capacitive divider would otherwise couple the FET's internal capacitances to the tank more strongly than in the Colpitts, potentially affecting the circuit's frequency stability.

VFO DESIGN NOTES

Generally, VFOs can be adapted to work at other frequencies (within the limits of the active device). To do so, compute an adjustment factor: f_{old} / f_{new}. Multiply the value of each frequency determining or feedback L or C by that factor. As frequency increases and amplifier gain drops, it may be required to increase feedback more than indicated by the factor.

In all three circuits, there is a 1 kΩ resistor in series with the source bias circuit. This resistor does a number of desirable things. It spoils (lowers) the Q of the inevitable low-frequency resonance of the choke with the tank tap circuit. It reduces tuning drift due to choke impedance and winding capacitance variations. It also protects against spurious oscillation at undesired frequencies due to internal choke resonances. Less obviously, it acts to stabilize the loop gain of the built-in AGC action of this oscillator. Stable operating conditions act to reduce frequency drift.