1. **Aging:** The gradual change in frequency over time, assuming all other factors remain constant. This is primarily caused by mass transfer and stress relaxation within the crystal unit. These effects can be minimized by increasing the overtone number (which maximizes the ratio of quartz resonator mass to contamination mass) and through careful resonator design and processing. In a well-designed oscillator, the aging rate tends to decrease with time. Aging shifts occur whether the unit is powered on or not and can be significant if units are stored for long periods before being used.
2. **Current Consumption:** The total amount of current drawn by the oscillator during operation. Different output types have varying current requirements.
3. **Duty Cycle:** A measure of the output waveform's uniformity. It's the ratio of the time the signal is at logic 1 level to the time it's at logic 0 level, measured at 1.4V for TTL output and 50% of the peak-to-peak voltage for CMOS and other logics.
4. **Harmonics:** For sine wave outputs, harmonics represent the next highest-level frequency component that is an integer multiple of the output frequency. They are measured in dBc (decibels relative to the carrier).
5. **Frequency Accuracy:** The difference between the oscillator's actual frequency and its nominal frequency.
6. **Frequency Stability:** The change in frequency caused by all external factors over time. This includes both environmental and electrical influences outside the oscillator. While a crystal oscillator's stability is largely determined by the crystal itself, the oscillator circuitry also plays a role. Both aspects need to be optimized for the best performance.
7. **Linearity:** Linearity can be expressed in different ways. One method, according to MIL-O-55310, involves drawing a best-fit straight line and using the ratio of the worst point's deviation from that line to the maximum deviation as the specification. This is usually given as a percentage, with ±10% being common. Other measures are based on modulation distortion or slope variation.
8. **Nominal Frequency:** The intended or target frequency of the oscillator. For a given crystal cut, lower frequency crystals tend to have better stability. For a specific frequency, the highest possible overtone generally offers the best stability. This follows the principle that "the greater the mass of quartz, the greater the stability." The main limitation here is the crystal package and, ultimately, the oscillator package. Frequency ranges down to 10 MHz are suitable for dividers and CMOS outputs. Above 100 MHz, phase-locked loops and frequency multipliers are often used to leverage the stability of low-frequency crystals.

9. **Operating Temperature Range:** The temperature range within which the oscillator will meet its specified frequency stability. Outside this range, the frequency may change rapidly as the oscillator struggles to cope with the extremes. No functional damage should occur if the temperature stays within the storage temperature range. However, temperatures significantly higher than the maximum can lead to increased aging rates and potential internal component damage.

10. **Operating Voltage:** The voltage required to operate the oscillator.

11. **Output Load:**

    - For a sine wave, this is typically limited to +0dBm into a 50 Ohm load, with specifications for harmonic and spur levels.
    - For CMOS, typical 15pF, the load is limited to 50pF, and parameters like the number of gates, duty cycle, and rise and fall times are specified.
    - TTL levels are a subset of CMOS levels, as CMOS can drive TTL loads.

12. **Output Type:** Outputs can be either sine wave or logics (TTL, CMOS, LVDS, LVPECL, HCSL, Clipped sinewave, etc.). Load sensitivity depends on the output type.

13. **Phase Noise:** A measure of short-term frequency fluctuations in the oscillator. It's usually specified as the single sideband (SSB) power density in a 1Hz bandwidth at a certain offset frequency from the carrier, measured in dBc/Hz.

14. **Pullability:** The total range of frequency adjustment available. For TCXOs, this can be around ±20 ppm. For OCXOs, it's typically in the range of ±5ppm to ±15ppm. For CMOS, it is more than ±100ppm. This is meant to compensate for long-term drift.

15. **Reference Frequency:** The frequency used to calculate the maximum deviation. This can be the nominal frequency, or a frequency measured at a specific temperature, often 25°C.

16. **Room Temperature Offset:** This allows for optimal peak-to-peak temperature deviation. The oscillator frequency is sometimes intentionally offset at room temperature to minimize the largest deviation from the nominal frequency across the entire temperature range. This results in the maximum positive and negative frequency deviations being equally spaced around the nominal frequency.

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17. **Short Term Frequency Stability:** A measure of oscillator stability in the time domain, also known as Allan variance. It quantifies the RMS change in successive frequency measurements for short gate times (milliseconds to seconds) and is important for timing applications. It typically improves with longer gate times until it reflects the medium to long-term drift of the oscillator, which is caused by the oscillator's temperature coefficient and/or aging.

18. **Start-up Time:** The time it takes for an oscillator to reach its specified RF output amplitude. This is determined by the closed-loop time constant and the circuit's loading conditions.

19. **Storage Temperature Range:** The temperature range within which the oscillator can be safely stored. Exceeding these temperatures can lead to faster aging and potential internal component damage.

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