mastering.heyrec.org

Preparing Music for Vinyl Records – A Very Short Guide:

Basic Practical Recommendations

Too many engineers are forced to mix and master as if a vinyl record doesn't exist—focusing only on the digital version and leaving the record as an afterthought. Many expect records to sound exactly like digital, only "better" because they are analog, without realizing that it is a completely different technology altogether.

Engineers are not always to blame: decisions for record releases frequently come late in the production process, and sometimes mastering engineers don't even know a vinyl record release is planned. It's important to ask the client early whether a record is intended.

To get the best results, careful considerations of of side length, running order, dynamics, spectral balance, and stereo imaging ensure the music translates faithfully to disc while respecting the format's unique physical characteristics.

Key guidelines:

- **Communication with the disc mastering engineer:** Collaborate early on levels, side length, running order and sound rather than expecting them to "just slam it on disc." Early open discussion ensures the vinyl record reproduces the music faithfully.
- **Side length:** Keep sides short for more freedom in decision-making and headroom. Longer sides may require lower cutting volume, reduced stereo width and reduced spectrum and may risk distortion, especially toward the end of sides. For a good LP side aiming for **18–20 minutes per side is ideal**. For a 7-inch single at **45 RPM, 4–5 minutes per side** is typically recommended.
- **Low frequencies**: Use a gentle **high-pass filter around 20–30 Hz** to remove inaudible subsonics. Collapse extreme low-end stereo to mono.
- **High frequencies**: De-ess "s" sounds and tame cymbals radically. Apply a **low-pass filter around 16–18 kHz**.
- **Stereo**: Avoid excessive stereo content, and try to keep the **correlation of left and right channels in the positive.**
- Dynamics: Aim for a **crest factor of 6–10 dB**. This typically corresponds to tracks with integrated loudness around **-12 to -16 LUFS**, allowing healthy average levels and dynamic peaks. Gentle true peak limiting translates faithfully to the record. Avoid aggressive digital clipping or loudness maximising—these practices are harmful to the groove geometry regardless of the cutting level. Pushing digital levels higher will not make the record louder, as the overall volume on disc is chosen independently as part of the art of analog disc mastering.

Records are often surrounded by myths: that they have "infinite resolution," "full frequency range," or are inherently "warmer and more natural." In reality, records have clear physical limits, and much of their character comes from distortion, EQ curves, and playback artifacts. Their true value lies in their distinctive tonal fingerprint, the large physical format, and the way they influence the listening experience. Beyond sound, records have shaped how we engage with recorded music, leaving a lasting cultural legacy.

Records are not simply a "better digital" format. They are a different medium, and mastering must respect their characteristics. Side length, sequencing, level, dynamics, stereo, bass, and highs all interact and require careful balance, and each record deserves thoughtful individual care.

Never label files "vinyl master – ready for 1:1 cut." When in doubt, less processing is better—give the disc mastering engineer freedom, engage in conversation, and let them work their magic to optimize the record.

mastering.heyrec.org

Preparing Music for Vinyl Records – A Very Short Guide:

How Side Length Affects Groove Space

The length of each side of a record (how many minutes of music it contains) is a very important factor in disc mastering. Longer sides need more revolutions of the record to fit all the music, which leaves less space for the individual grooves.

For a standard **33 1/3 RPM record**, one full rotation takes **1.8 seconds**. This means:

- **12-minute side:** ~400 revolutions
- **20-minute side:** ~666 revolutions
- **28-minute side:** ~933 revolutions

Groove space:

The groove is cut in the area between the **outer edge** and the **center label**. No matter how long the side is, this space stays the same. So, the longer the music lasts, the **tighter the lines need to be packed together**.

This means that for very long sides, each individual line must take up very little space. In other words, the **stylus has less room** to cut the music into the disc.

Stylus motion and sound:

In analog vinyl records, the **movement of the stylus creates the sound**. Loud music, heavy bass, and wide stereo need more room and greater motion of the stylus.

However, if lines need to be packed tightly to fit many revolutions on long sides, the stylus cannot be allowed the full motion needed for optimum sound. There is not enough space for its free motion. The disc **mastering engineer then often has to reduce volume, bass, and stereo width to make it fit**.

Side length examples:

- **Short sides (12–16 min):** Lots of space per line. Volume can be loud, with plenty of bass, and stereo width.
- **Normal sides (18–20 min):** Space is tighter. Volume, bass and stereo width may need only slight reduction.
- **Long sides (24–26 min):** Very little space per line. Bass will need to be reduced, stereo may be narrowed, and overall volume needs to be low. Playback noise (rumble, clicks and hiss) becomes more noticeable.

Conclusion:

Shorter sides allow the stylus to use more space. They give the disc mastering engineer more freedom to keep the music loud, bass-rich, and spacious and require fewer compromises. They also allow for a much better signal-to-noise ratio.

mastering.heyrec.org

Preparing Music for Vinyl Records – A Very Short Guide:

How High Frequencies and Pickup affect Sound

High volume and high-frequency-content **cut a complex groove** into the disc. If the playback stylus **cannot track this groove accurately**, it is causing distortion. Parts of the music sound harsh, especially "s" or "t" sounds in singing and cymbals—this is often called "**sibilance**".

End-of-side distortion and diameter loss:

Near the center, the stylus travels a shorter distance per rotation and the groove is packed ~2.5× tighter than at the outer edge, making it increasingly hard for the stylus to track the groove accurately. The audible effect depends on the pickup and position on disc. From lack of high frequencies to increased distortion (and a nice mix of both) everything is possible.

Keeping the sound clean:

Engineers balance loudness and high frequencies with available space. Reducing cutting level or high frequencies—using de-essers, or careful EQ—helps the stylus track the groove accurately.

A typical consumer pickup with an elliptical stylus can track frequencies of ~ **14kHz - 16kHz at the outer diameter** cleanly. The same stylus can only track frequencies up to **8 - 10kHz at the inner diameter** properly. This is called "diameter loss". It becomes more audible the closer the stylus is to the center. This limitation can be surprising for people who expect “unlimited bandwidth” from analog playback.

Sometimes it is helpful to avoid the innermost recording area completely for a better sound.

Side length and distortion:

- **Short sides (12–16 min):** Can be cut at high level. High cutting levels may cause distortion, especially at the end of sides. **It is good to reduce high frequencies for loud cuts**. The disc mastering engineer has all the options and can avoid the innermost diameter where diameter loss is most significant - if necessary.
- **Normal sides (18–20 min):** Level needs to be quieter anyway, so less distortion will happen. However: It might be necessary to use the full available space of the record, so **diameter loss might be more significant**.
- **Long sides (24–26 min):** Diameter loss will be very significant. **The end of sides will suffer both from lack of high frequencies and from distortion**.

Conclusion:

How the high frequencies sound on a vinyl record **depends very much on the pickup and the position on the record.**

A track that sounds fine at the outer part of the record may sound not acceptable last on a side.

Managing running order, loudness, high frequencies, and recording diameter is important for a good sound.

Shorter sides give more freedom to keep the music loud, full, and clear, while longer sides might suffer from end-of-side-distortion and diameter loss.

Preparing Music for Vinyl Records – A Very Short Guide: How Wide Stereo, and Vertical Motion Affect Sound

---

How spacial sound works in vinyl records:

Mono information of the mid/center (left plus right channel) appears as motion in the horizontal plane only. This is simple to cut and easy to track.

Stereo information of the side/difference (left minus right channel) appears as additional up and down motion of the stylus. Stereo sound requires the stylus to move in two planes (horizontal and vertical) at once.

Why vertical motion matters:

- The additional vertical motion consumes additional space on the record. Wide stereo signals can consume ~30–40% more space than mono, allowing less time and level to be cut on the record.
- For example, a 20-minute mono side might shrink to about 15 minutes of playback time if cut in wide stereo at the same level. To keep the full 20 minutes, the cutting level would need to be lowered, increasing the percieved record noise significantly.
- Motion in the vertical plane is harder to track for the pickup. Especially cheaper consumer pickups or worn styli have difficulties with vertical tracking and may start to distort early.

Managing stereo in mastering:

- **To keep records acceptable over a wide range of pickups, mastering engineers often reduce stereo. They use an elliptical equalizer to collapse stereo bass into mono, ensuring a stable, centered bass.**
- **On very long or loud sides, stereo width can be narrowed further to reduce vertical pickup distortion, especially toward the end of sides. Overall, the correlation should never drop much below zero, preserving a balanced and stable stereo image of the full spectrum.**

Side length and spacial sound:

- **Short sides (12–16 min):** Lots of groove space. Stereo can be wide, with natural bass. Vertical pickup distortion can be an issue.
- **Normal sides (18–20 min):** Some narrowing of stereo in the bass may be needed to optimize space consumption.
- **Long sides (24–26 min):** Very limited groove space. Wide stereo, not only in low end, often must be reduced.

Conclusion:

Excessive stereo requires extra space, reducing the maximum cutting level and/or shortening the available playing time. It can sound spacious, but also increases the risk of distortion—especially at the end of very long or loud sides.

Techniques that work well in modern digital mixing and mastering, such as extreme widening, heavy mid/side enhancing, or very prominent stereo effects, can create problems on a record, since the physical limitations of groove geometry and stylus tracking make such treatments harder to reproduce faithfully.