SOUND TALK
FROM THE MAKERS OF "SCOTCH" BRAND MAGNETIC TAPE

SOUND TALK BULLETIN
NUMBER 39

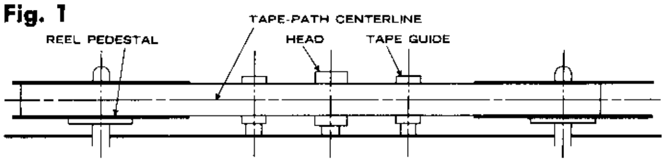
PEDESTAL HEIGHT ADJUSTMENT

For minimum tape wear, accurate response and smooth tape motion, magnetic tape ideally should move through a tape transport without deviation from the tape-path centerline.

Likewise, the centerlines of each equipment component linked directly with the tape—magnetic heads, guides, reels (reel flanges)—should be "in tram". That is, they should maintain the same unvarying reference. Clearance limits of such equipment parts are only a few thousandths of an inch wider than prescribed maximum tape widths; therefore, even slight variation of their centers from such a centerline reference can cause tape to bind at its edges, skewing on a tangent from the path, "foldover", azimuthal frequency response problems, edge damage, oxide ruboff, and excessive back tension.

Also important is the perpendicularity of each of these parts to that centerline reference to assure freedom from excessive edge wear and elongation, sporadic tape motion and other perhaps less obvious effects of this condition. Both precise centerline positioning and perpendicular alignment assure maximum clearance between tape edges and guide limits to provide the greatest margin of safety when encountering less controllable factors (warped reel flanges, thick flanges, tape dimensions, etc.).

Fig. 1

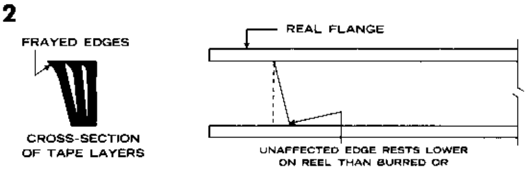


Idealized tape-path centerline.

Of the many recording inefficiencies resulting from out-of-tram situations, those dealing with rubbed-off coating are probably the most common. In addition to the obvious signal losses caused by oxide ruboff, further signal losses result when the oxide builds up at the head, preventing good head/tape contact. (Refer: Technical Talk Bulletin No. 7, "Surface Protected Magnetic Tapes".)

Also, the tape edge at which the abrasion occurs becomes burred or microscopically "frayed" so that its caliper is thicker than the opposite edge. In a single tape layer this minute difference is of no consequence, but when the affected tape is wound onto a reel the thickness error compounds, layer upon layer, to cause a visibly notable difference in circumferences between the two edges of the wound tape, subjecting the tape to excessive, uneven tensions. These tensions often exceed the yield point of the base material's strength causing permanent deformation of the tape and manifesting as another cause of tape skew and permanent distortion.

Fig. 2



In the slitting process of magnetic tape manufacture, strict quality control assures close tolerances of all tape widths, thus dependable reference to an unvarying tape centerline. Projects researching newer slitting and control techniques are constantly programmed to increase the efficiency of such slitting, to provide even greater assurance against tape misalignment from this cause.

And in the manufacture of recorder transports, close tolerances guarantee a precise tape-path centerline. But as equipment wears and as components are replaced, tape-path misalignment manifests as a consequence of such wear or replacement; especially on equipment parts not firmly supported by the base of the transport.

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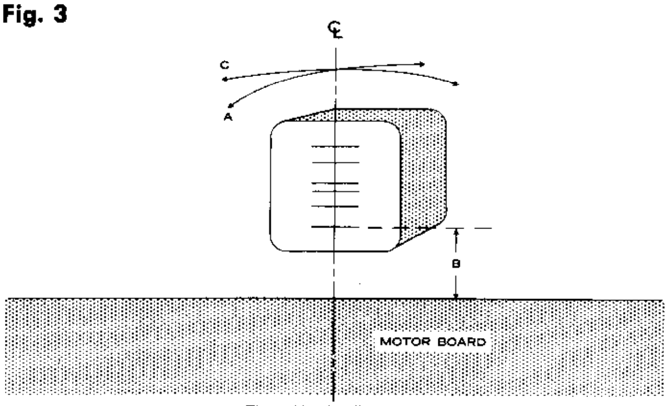
Most tape guides, for example, can be considered fixed in their installation; not apt to become misaligned to the tape-path even when the part is replaced. (Because of the usually positive, direct mounting involved.) But in some equipment, guides are mounted on tension compensator arms which are generally vulnerable to being bent into- or out-of-tram position. Normal maintenance on such equipment should include periodic checks to assure precise centerline guiding and perpendicular attitude of the guide through the entire operational arc of the arm's motion.

While there are three separate adjustments in aligning magnetic heads in the system, proper tramming (tape centerline) adjustment generally involves only two of these: The first is the arc of adjustment in which the face of the head tilts toward or away from contact with the tape (arc A).

Fig. 3



Three Head Adjustments.

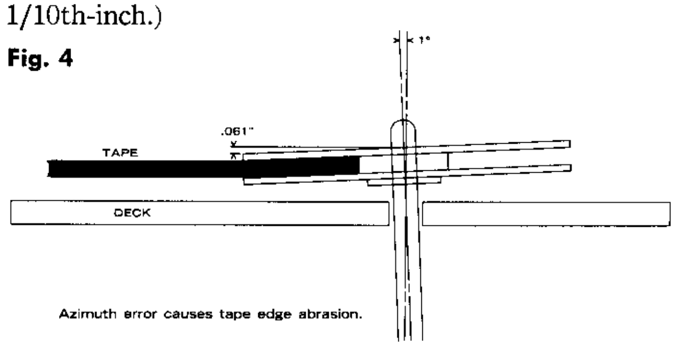
Establishing the correct vertical is important to maintaining uniform tension across the width of the tape in contact with the head. If tape is allowed to "pull" more at one edge than the other while in contact with the head, not only does physical distortion of that edge occur, but the difference in tension across the face of the head can cause tape to skew away from the exact centerline reference, manifesting later in the path as tape edge abrasion at a guide.

Head height adjustment (adjustment B), primarily important to correcting mistracking or crosstalk errors, is of little consequence to tramming adjustment unless the head surface is worn to where an indentation or "nest" exists on the head face. This condition is the rule rather than the exception. A severely worn area acts as a tape guide, and head height must be adjusted accordingly—matching the center of the indentation to the tape centerline. Head replacement or resurfacing is most advisable in these severe cases.

Head azimuth adjustment (arc C) has little significant affect on tape tramming. However, in order to produce maximum output (especially at short wave lengths) on machines with separate record and play heads, it is important that both heads be azimuthed to the same reference. To assure inter-system compatibility of tape, it is highly important that all heads involved, whether single or dual purpose, be adjusted so the gaps are exactly perpendicular to the tape-path centerline. This is best accomplished by using a professionally prepared pre-recorded test tape.

The greatest amount of tram error generally occurs from improperly positioned tape reel pedestals. This is perhaps because of the lack of an industry standard in correct reel pedestal adjustment, and because even slight variation of the pedestal axis from a right angle to the tape path creates an exaggerated error at the reel flange circumferences. (A seven-inch reel on a pedestal in which an azimuth error of just one degree exists will displace the reel flange by 61 mils from the correct position. If the tram error incurred through an improper pedestal *height* adjustment is only .030″, the cummulative error due to incorrect azimuth and height is .091″—nearly 1/10th-inch.)

Fig. 4



Azimuth error causes tape edge abrasion.

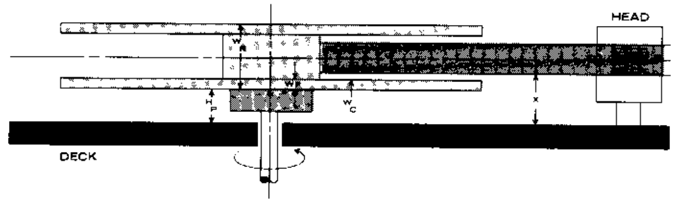
Also important to pedestal height adjustment is the thickness of the reel flanges. Plastic reel flanges are thicker than metal reel flanges to provide needed strength. If both metal and plastic reels are to be used, pedestal height should be determined by the plastic reel centerline. While this causes tape to wind slightly above center on the thinner-flanged metal reel (since its center will rest lower on the pedestal), the thinner flanges also provide greater clearance between flanges to compensate for the slight difference.

In adjusting pedestals to accept all reels, it is obviously necessary to know the dimensions of "all" reels; specifically, their *width* dimensions. While there are no universally accepted standard dimensions for all available reel types, there is a strong industry movement in this direction. The Electronic Industries Association (EIA), in its Standard RS 254, has achieved agreement among its members on several basic dimensions for all standard tape widths. This allows adjusting transports for correct tram using a Precision Reel as a "gauge" and automatically gaining compatibility with less critical (NAB or plastic) reel types. Or, where this procedure is impractical, adjusting for correct tram using the correctly derived dimensions from precision reels, gains the same end.

EIA Standard RS 254 specifies a standard nominal reel width of .462-inch for ¼-inch tape reels, which follows the rule: nominal tape width plus .212-inch. The other reel widths recommended by that standard follow the same rule. (For half-inch tape, reel width is .500-inch plus .212 . . . or .712-inch, etc.)

Because reels are symmetrical, it follows that a perfect wind on a perfectly trammed machine would center the tape between flanges. Thus the distance between tape-path centerline and the *outside* of the flange (i.e., the reel-to-pedestal contacting surface) is just one-half of the overall reel width. Since such a dimension has limited practical use inasmuch as the centerline of the tape is imaginary, it may become necessary to utilize the motor board or deck of the transport as an intermediate reference plane. When the distance from the transport deck to the nearest edge of the tape (correctly positioned) at the head, is established as, say, "X", this distance may then be used to correctly adjust all guides. And finally, it may be used to calculate the correct pedestal height by allowing for a minimum tape-edge-to-flange clearance (.005-inch), plus the distance between the pedestal's surface and the inner face of the flange adjacent to it. This distance is calculated for a precision reel below:

Fig. 5



Dimensions important to tape-path centerline and pedestal adjustments.

For ¼-inch Precision Reels:

$$W_F = \frac{W_R}{2} - \left(\frac{W_T}{2} + W_C\right)$$

$$W_F = \frac{.462}{2} - \left(\frac{.246}{2} + .005\right)$$

$$W_F = .103\text{-inch}^*$$

where . . .

W_F = distance between pedestal and nearest flange inner face

W_R = .462-inch average or nominal overall reel width within the lateral mounting area

W_T = average tape width

W_C = desired clearance between each tape edge and adjacent flange

To Then Determine Pedestal Height:

$$H_P = X - (W_C + W_F)$$

$$H_P = X - (.005 + .103)$$

$$H_P = X - .108\text{-inch}$$

where . . .

H_P = height of pedestal from reference plane

X = distance from reference plane (deck) to nearest tape edge correctly positioned with respect to guides and heads

*For other (½, ¾, 1, 1¼, 1½, 1¾, and 2") precision reels it can be easily shown that W_F = .102-inch. This is because average tape widths for these reels are .002 rather than .004 inch less than the appropriate multiple of ¼-inch. (e.g,. average width for ½-inch tape is .498, for 1-inch tape, .998, etc.).