

Drop Frame Timecode Explained

For an hour of video at 29.97 frames per second (NTSC/59.94i) an "hour of timecode" at a frame rate of 30 frame/s is longer than an hour of wall-clock time by 3.59 seconds, leading to an error of almost a minute and a half over a day.

To correct this, drop frame SMPTE timecode was invented. In spite of what the name implies, no video frames are dropped (skipped) using drop-frame timecode. What's actually being dropped are some of the timecode "labels". In order to make an hour of timecode match an hour on the clock, drop-frame timecode drops frame numbers 0 and 1 of the first second of every minute, except when the number of minutes is divisible by ten (i.e. when minutes mod 10 equals zero). This achieves an "easy-to-track" drop frame rate of 18 frames each ten minutes (18,000 frames @ 30frame/s) and almost perfectly compensates for the difference in rate. That is, drop frame TC drops 2 frames every minute, except every tenth minute, achieving $30 \times 0.999 = 29.97$ frame/s.

For example, the sequence when frames are dropped:

01:08:59:28

01:08:59:29

01:09:00:02

01:09:00:03

For each tenth minute

01:09:59:28

01:09:59:29

01:10:00:00

01:10:00:01

While non-drop time code is displayed with colons separating the digit pairs—"HH:MM:SS:FF"—drop frame is usually represented with a semi-colon (;) or period (.) as the divider between all the digit pairs—"HH;MM;SS;FF", "HH.MM.SS.FF"—or just between the seconds and frames—"HH:MM:SS;FF" or "HH:MM:SS.FF". The period is usually used on VTRs and other devices that don't have the ability to display a semi-colon.

Drop frame timecode is typically abbreviated as DF and non-drop as NDF.