



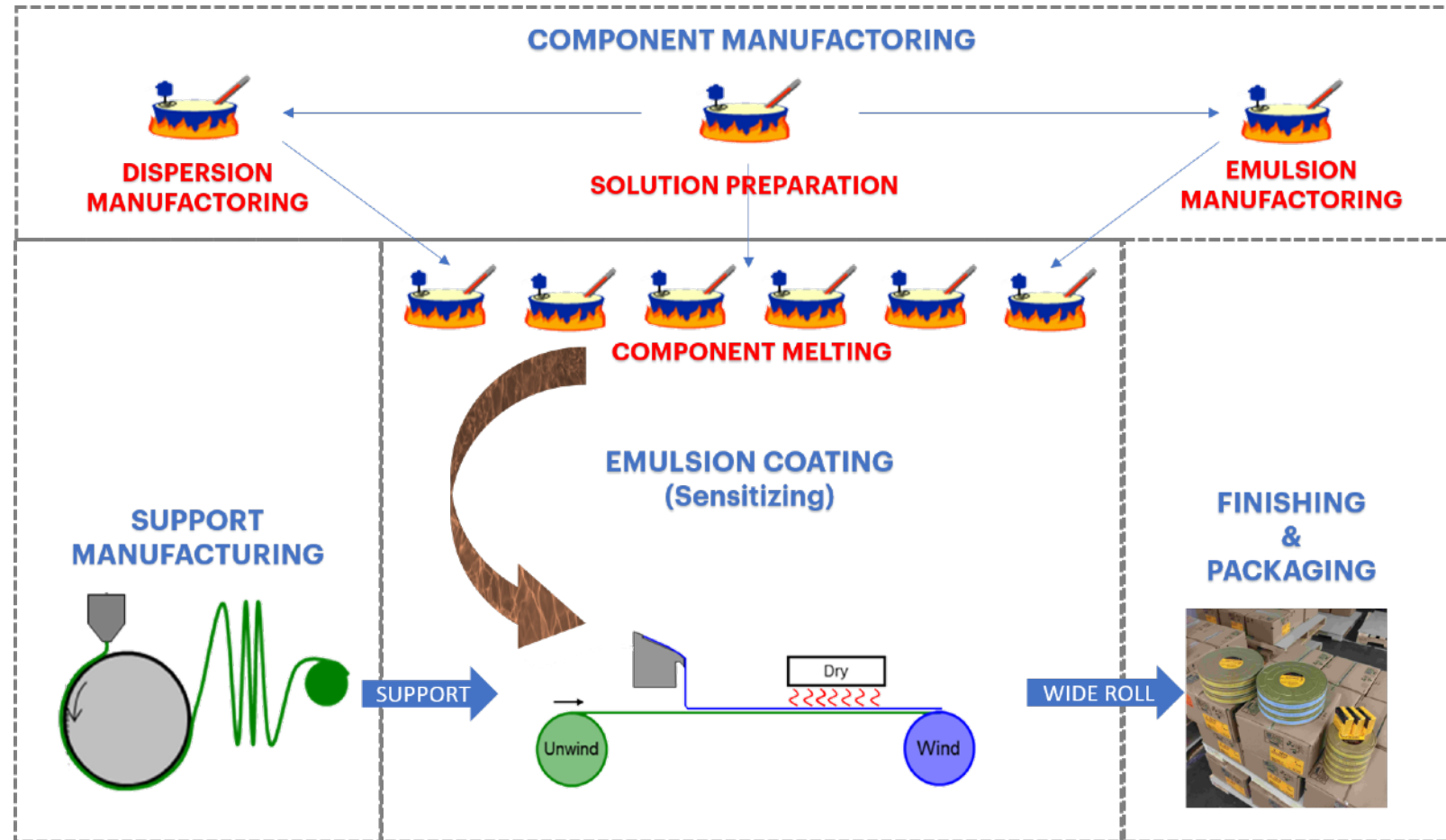
Anatomy of a Film Roll

AMIA 2021



There are 4 primary steps involved in the manufacture of film:

- Support or Base Manufacturing
- Component Manufacturing
 - (making the ingredients)
- Component Melting and Coating
 - (making the "recipe")
- Finishing and Packaging
 - (preparing for sale)



ESTAR Base manufacturing



At BASE MANUFACTURING (WHITE light):

All film requires a support medium for the photosensitive emulsions to be coated onto. Those supports can be made from nitrocellulose ("Nitrate"), cellulose triacetate ("CTA or Acetate") or polyethylene terephthalate ("PET" or Kodak trade-named ESTAR).

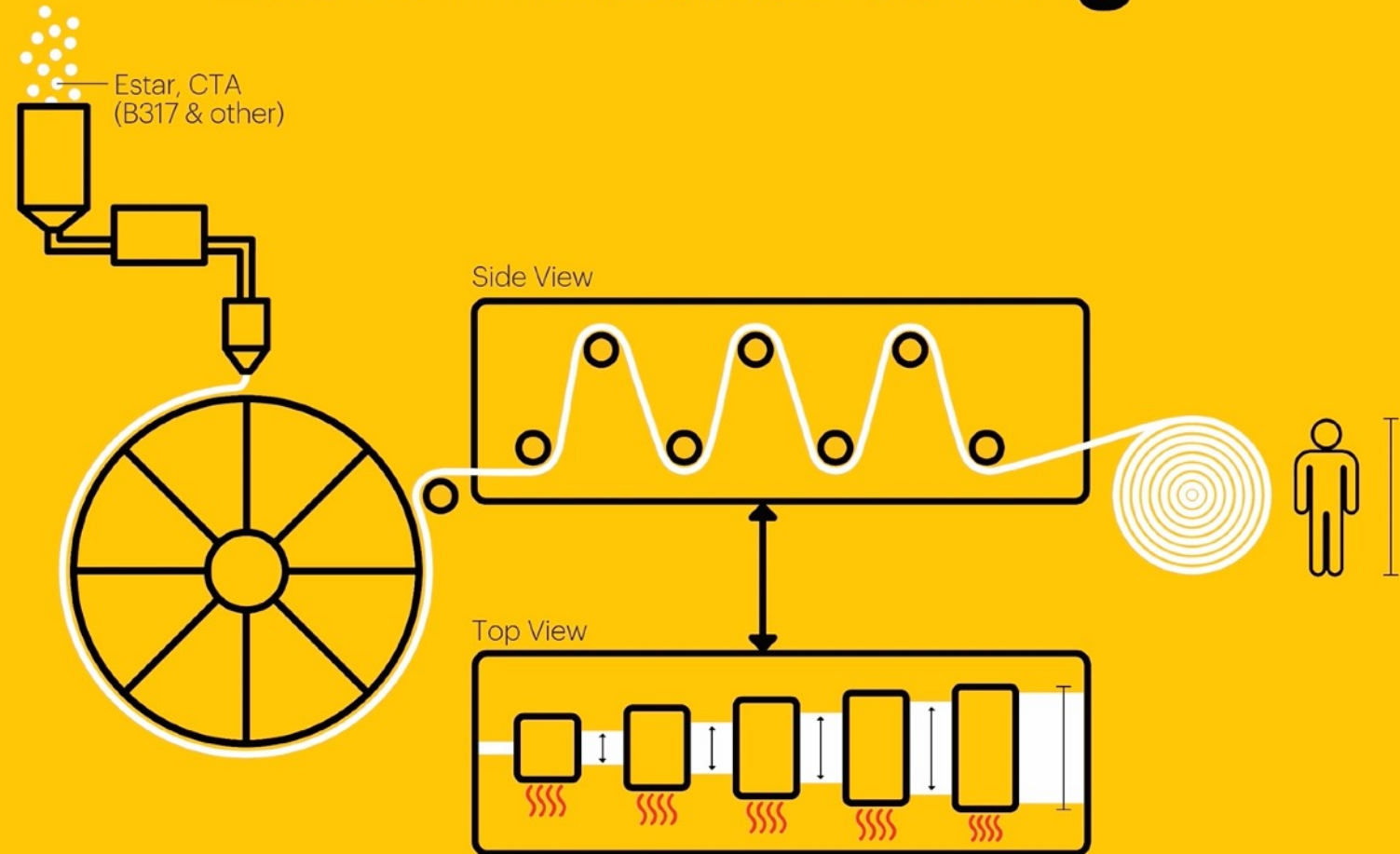
Nitrate (no longer manufactured) and Acetate support is cast onto a drum.

This image displays manufacturing of ESTAR support.

Molten polyethylene terephthalate (PET) polymer is extruded onto a roll drum to form film. Subbing layers can also be coated on the support.

The film is then stretched both biaxially (machine direction) and transversely (width direction).

Then the roll is shipped to the Sensitizing area, and is coated in DARK conditions





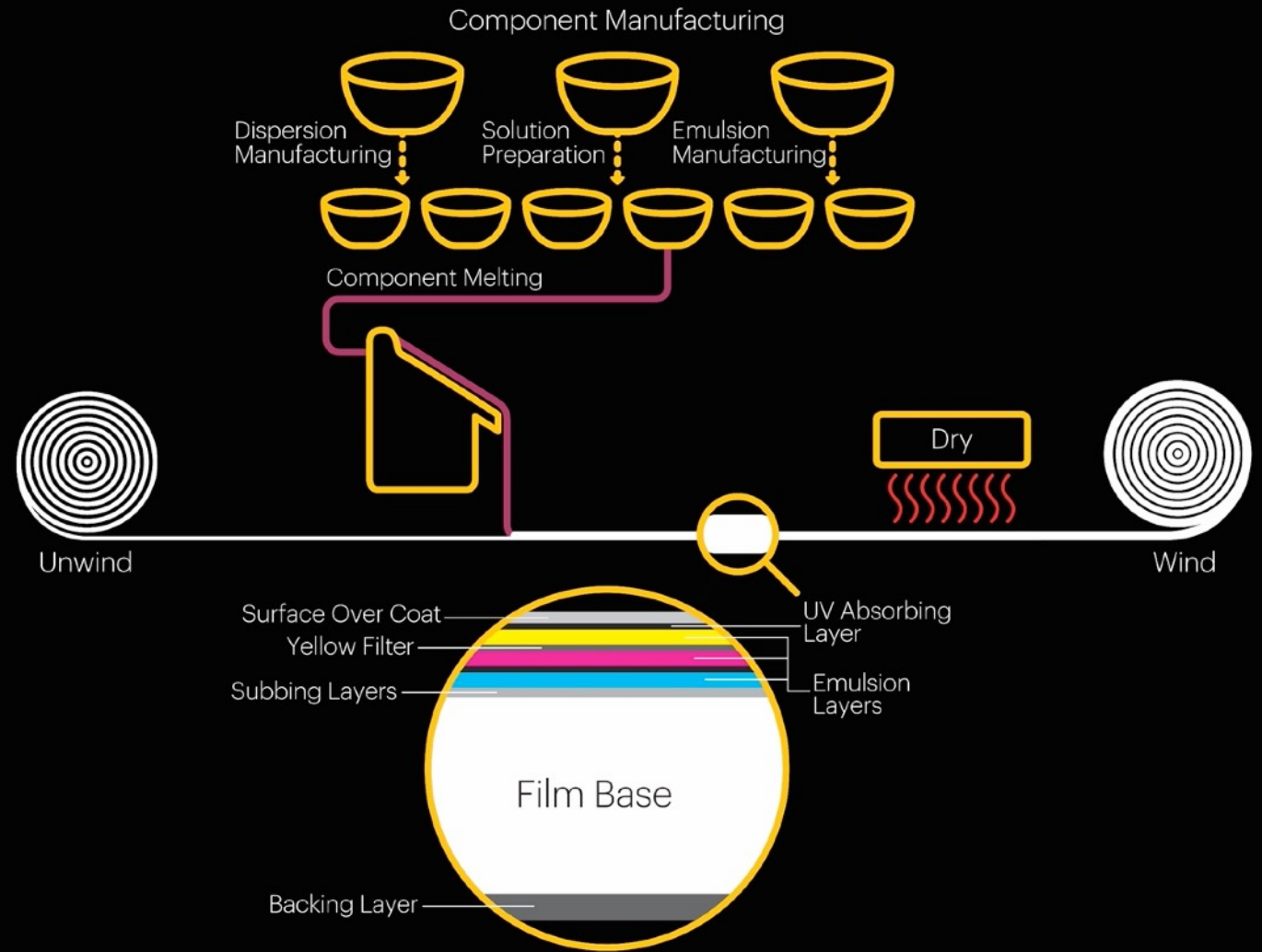
Hundreds of components need to be manufactured for most films:

- Emulsions (AgX)
- Dispersions (couplers)
- Binders (gelatin)
- Antifoggants
- Sequestrants
- Thickeners
- Hardeners
- Lubricants
- Matte beads
- Acids/Bases (pH control)
- Dyes

Some of these can take as long as 6 to 9 months to synthesize!

An exact recipe is followed for each coating layer - then precisely delivered in liquid form to the moving web of support. A key component of all films is gelatin, so the layers must be gently chilled before they are dried in the coating machine. Many products can have over a dozen layers.

Sensitizing



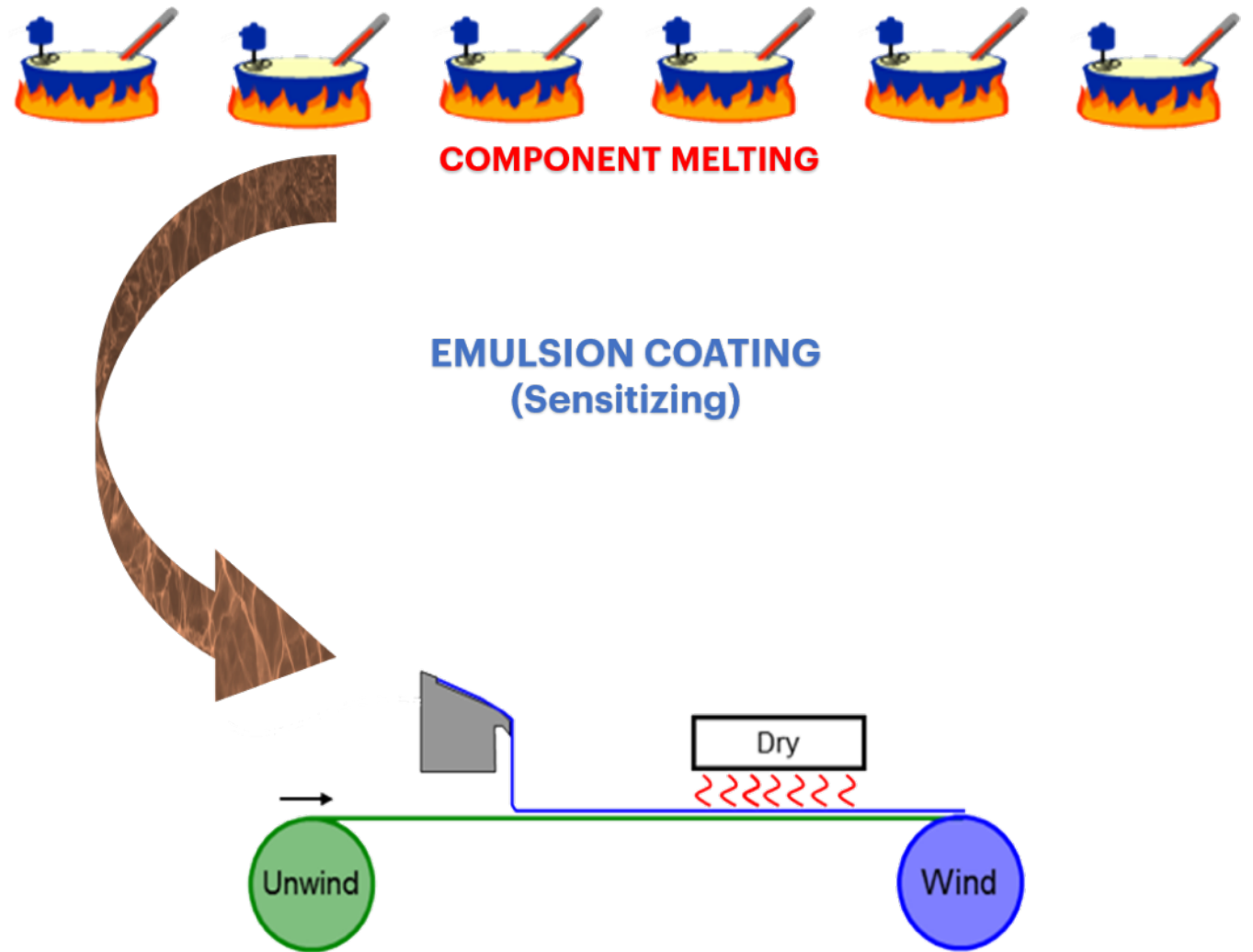
The coating machine has two coating stations (hoppers), each with multiple slots, one slot for each layer. The layers flow down on top of each other like a controlled waterfall as the support moves underneath. The layers do not intermix but stay separate in this process. The total emulsion layer thickness once dried is less than that of a human hair!

The coated film then transports on a web of air having minimal contact with any rollers into a dryer. All of this done in total darkness - there are over 100,000 sensors in the process, each looking at multiple parameters.

The coated "Master Roll" is wound-up, testing samples are taken, then placed in a light-tight carrier called a casket and transported to the Film Finishing operation.

Rolls are identified by film code (5219), sequential emulsion batch number (-381), and sequential roll number of the coating event (-016).

E.g.: 5219-381-016



The coated Master Roll of film can be finished in several ways depending on the final use. Industrial X-ray films and Printed Circuit Board films along with some still Professional films normally get slit and chopped into sheets.

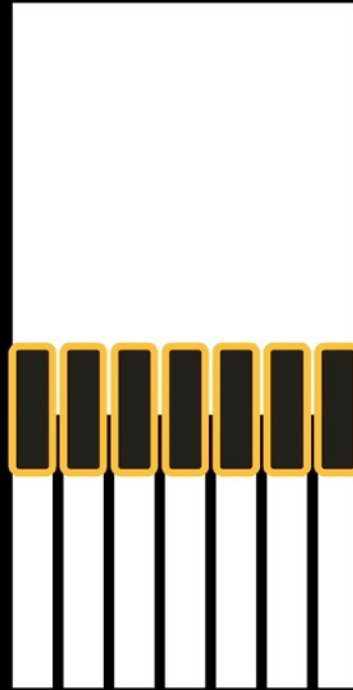
Motion Picture films and other still films are slit, perforated and wound into rolls for various formats.



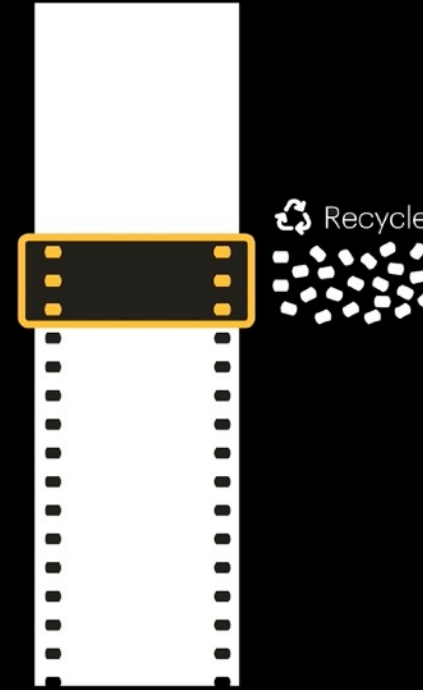
Finishing



1- Slitting



2- Perforations



3- Packaging



Common Film Sizes



120 format



70mm



65mm



35mm



16mm



8mm



For Motion Picture film, the master roll is slit down to the appropriate width.

35 mm formats:

- 45-inch-wide roll yields 31 strips.
- 54-inch-wide roll yields 38 strips.

16 mm formats:

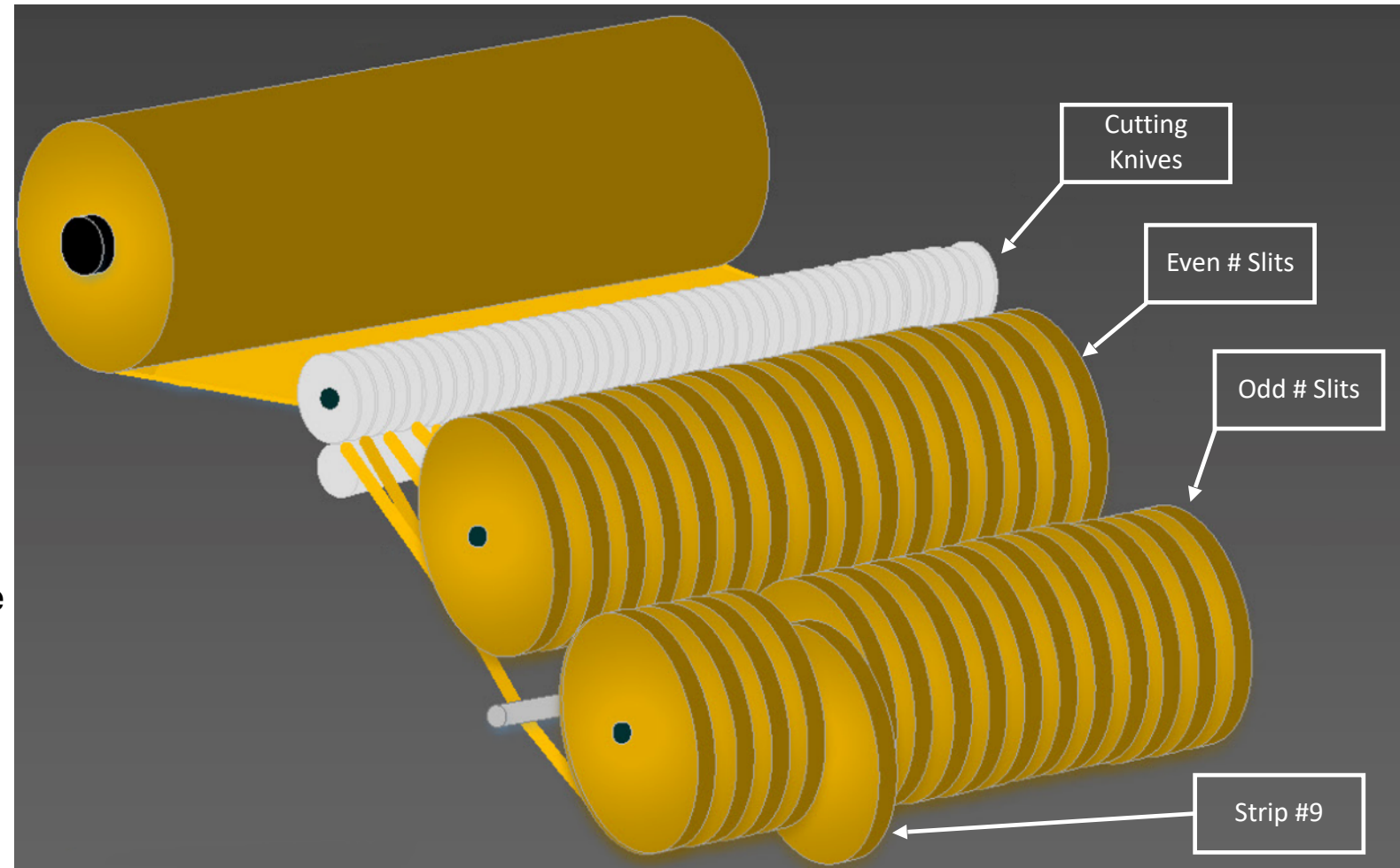
- 45-inch-wide roll yields 60 strips.
- 54-inch-wide roll yields 83 strips.

Each roll is up to 6000 ft long depending on scheduled demand.

If the roll is slit to its entirety, it would be called part 1. If slit into multiple parts, part 1, part 2, etc.

Here each strip number is printed on the film edge.

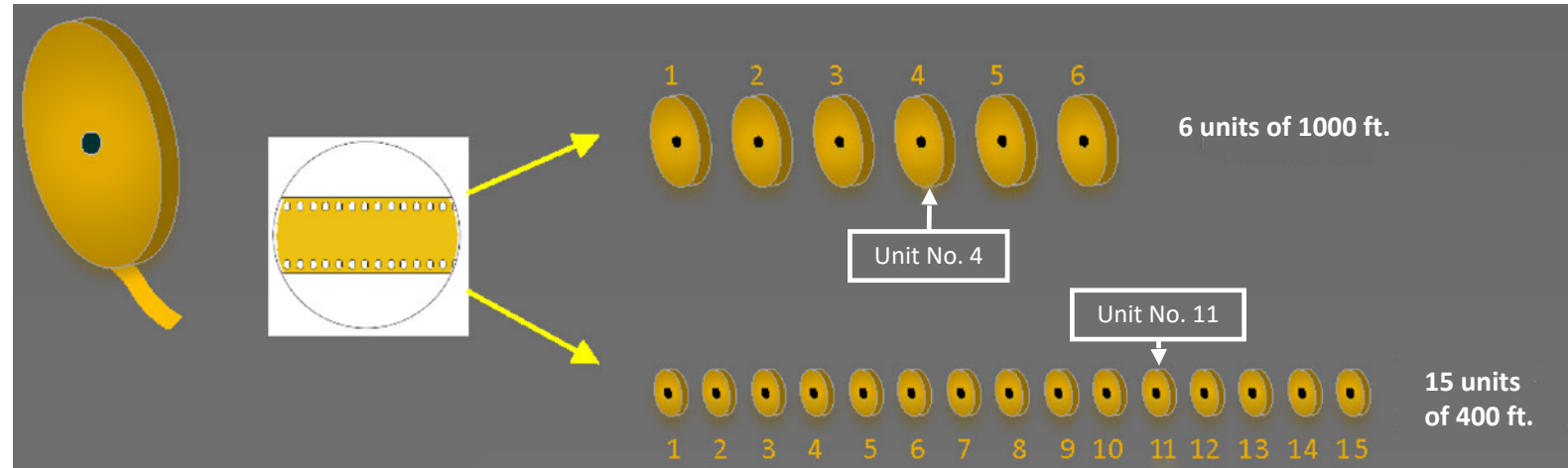
E.g.: 5219-381-01601.09



The 35 mm 6000ft long strips are then perforated and cut down to 1000ft or 400ft.

Identification Edgecode is applied during perforating (machine readable KeyKode is applied to camera films).

Each roll is then wrapped and placed in a can.



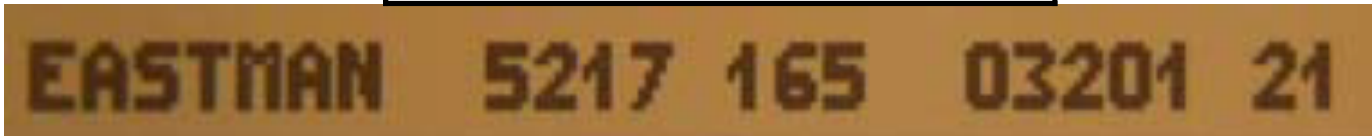
Batch Identity:

<u>Roll Length</u>	<u>Product Code</u>	<u>Batch / Emulsion</u>	<u>Wide Roll</u>	<u>Roll Part</u>	<u>Strip</u>	<u>Unit</u>
1000 ft.	5219	381	16	01	09	04
400 ft.	5219	381	16	01	09	11
5219 - 381 - 01601.09.04						
5219 - 381 - 01601.09.11						



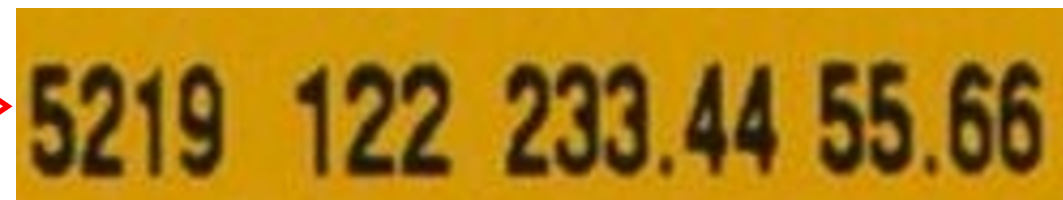
Edge Code:

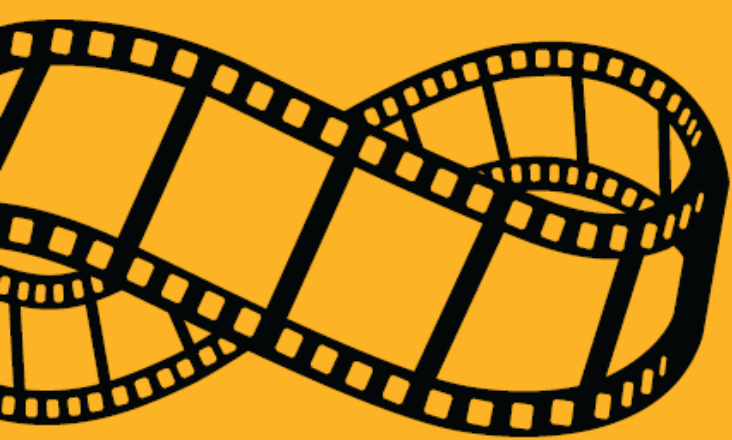
<u>Product Code</u>	<u>Batch / Emulsion</u>	<u>Wide Roll</u>	<u>Roll Part</u>	<u>Strip</u>
5217	165	032	01	21



Can Label:

<u>Product Code</u>	<u>Batch / Emulsion</u>	<u>Wide Roll</u>	<u>Roll Part</u>	<u>Strip</u>	<u>Unit</u>
5219	122	233	44	55	66





Film Forever.

With film, there is no compression, no format obscurity,
no corruption of media, no third party server, no hacking.
There it is, as it was and as it will be.

Analog is archival. Use film.



Thank you!