Microirrigation Maintenance & Chemigation Uniformity

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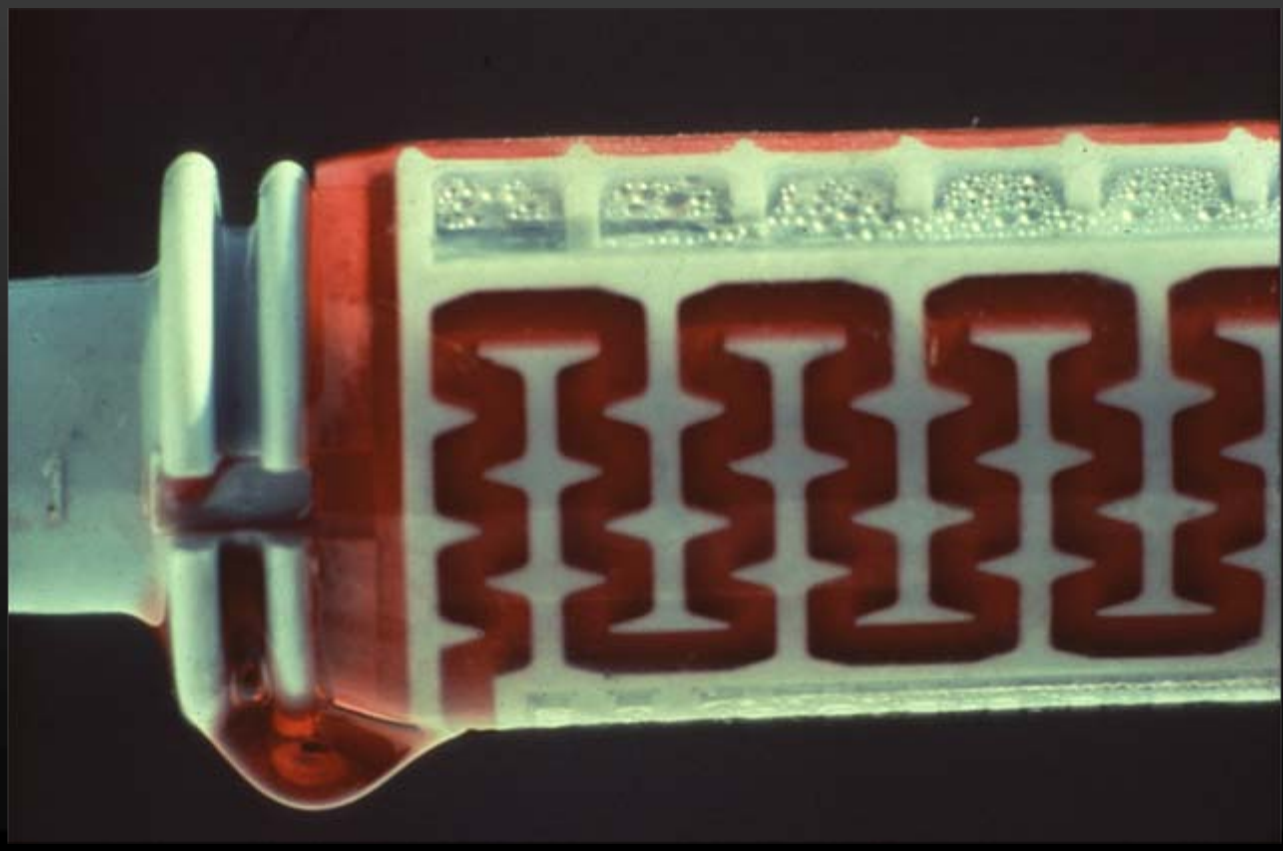
Maintenance of micro systems:

Emitters:

Clogging is the greatest “threat” to emitters.



Clogging of Microirrigation Systems

Source: Physical Clogging - Particulates

Clogging of Microirrigation Systems

Source: Physical Clogging - Particulates

Solution: Filtration

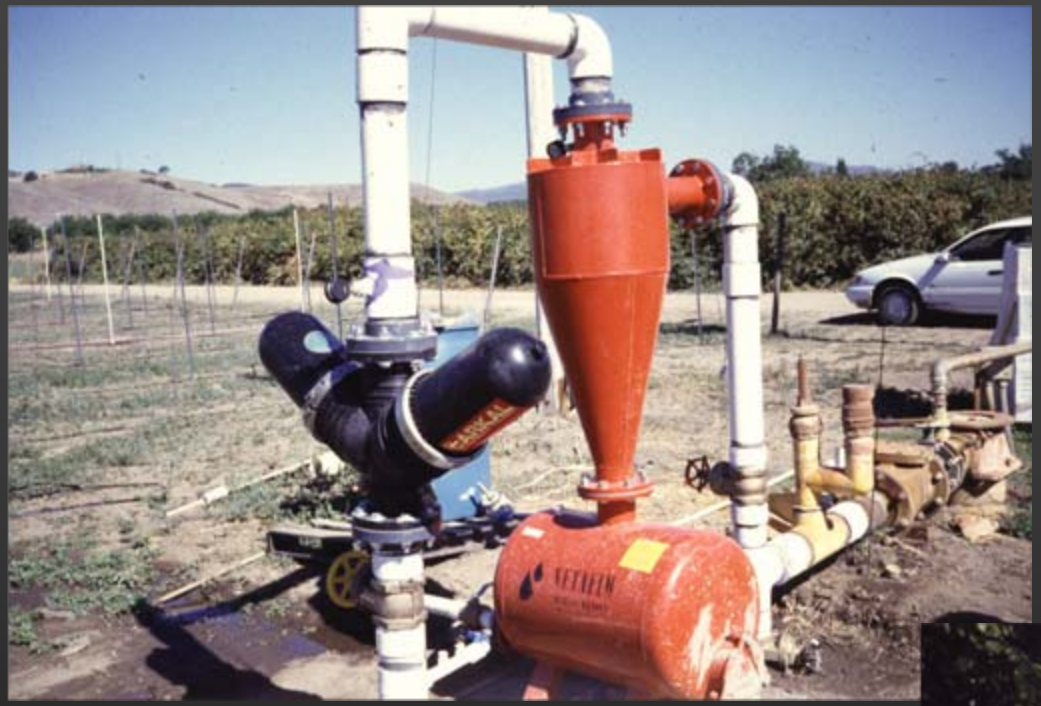
Filters:

- Screen, disk, and sand media filters are all available.

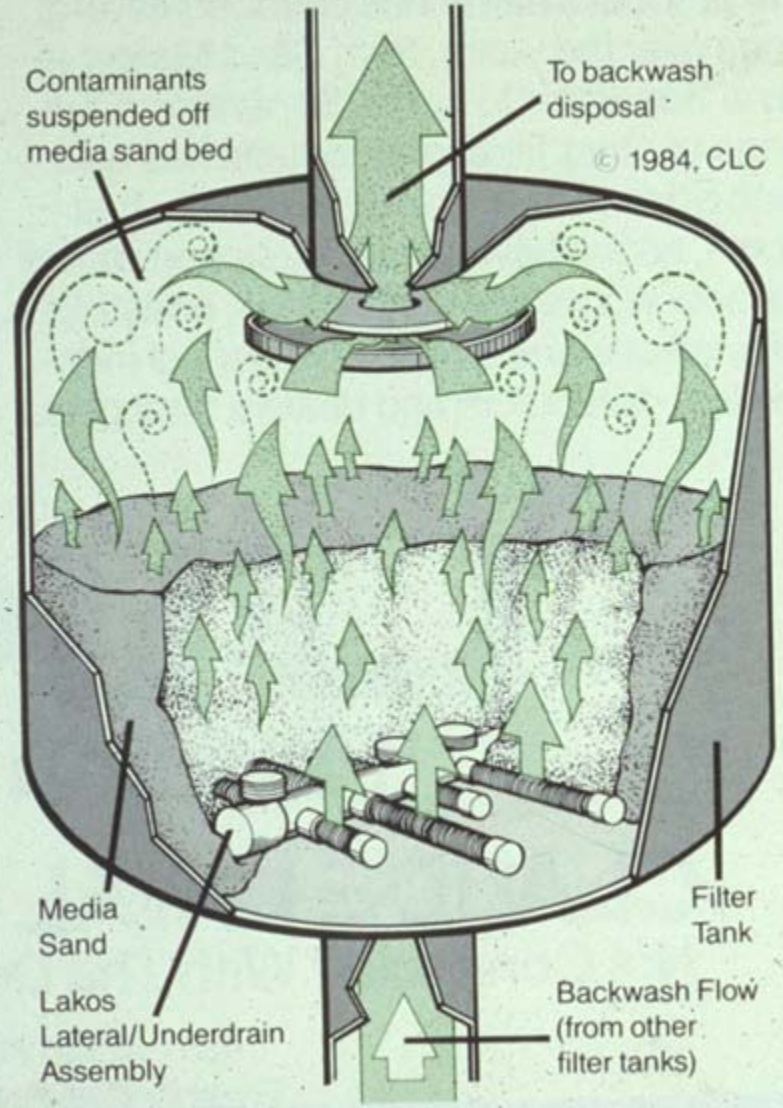
- They all filter to the same degree

BUT

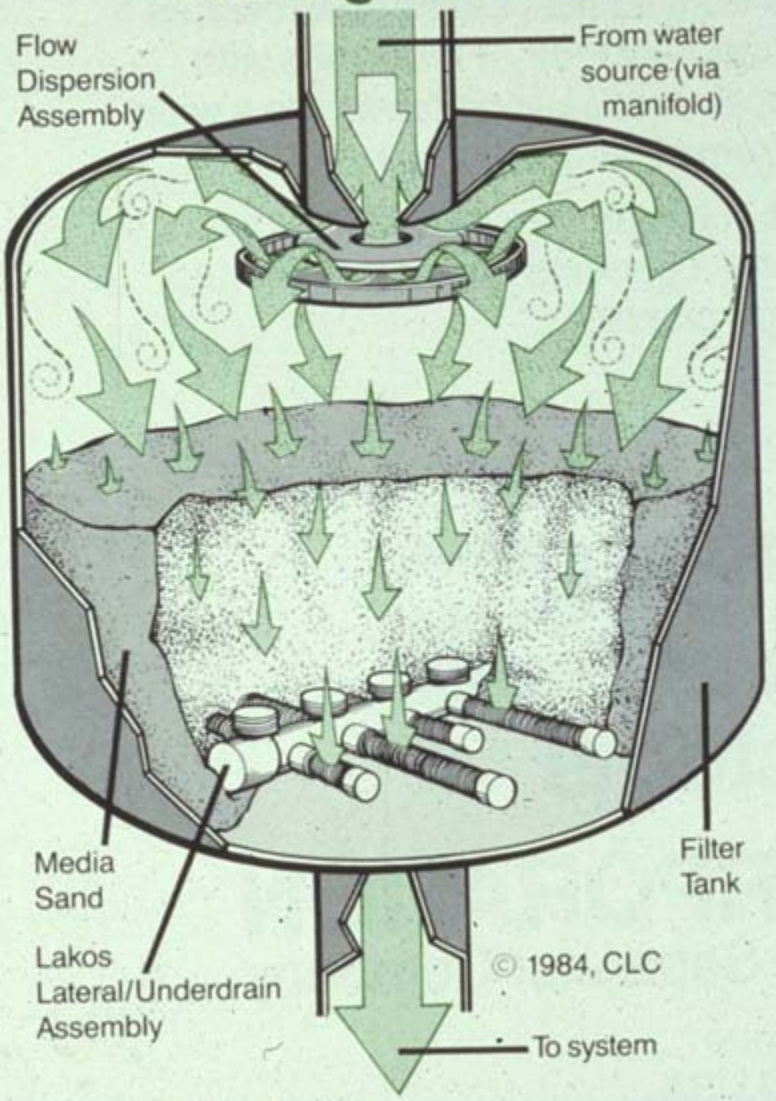
they req. different frequency of cleaning.



Backwash Process



Filtering Process

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Clogging of Microirrigation Systems

Source: Chemical Precipitates

- Lime (calcium carbonate) and iron are the most common problems.

Chemical Precipitate Clogging of Microirrigation Systems

Water quality levels of concern:

- Calcium: pH > 7.5 and 2.0 meq/l (120 ppm) of bicarbonate
- Iron: pH > 4.0 and 0.5 ppm iron

Clogging of Microirrigation Systems

Source: Lime

Solution: pH Control (Acidification)

+

filtration

Dealing with Iron Precipitation:

1. Precipitate iron in a pond / reservoir

Dealing with Iron Precipitation:

1. Precipitate iron in a pond / reservoir

2. Chemicals (e.g. phosphonic acid, phosphonate) may keep iron in solution

Clogging of Microirrigation Systems

Source: Biological Sources

Clogging of Microirrigation Systems

Source: Biological Sources

Solution: Filtration (usually media filters)

+

Biocide

Biolgical Clogging

Acid may deter
but not eliminate

biocide

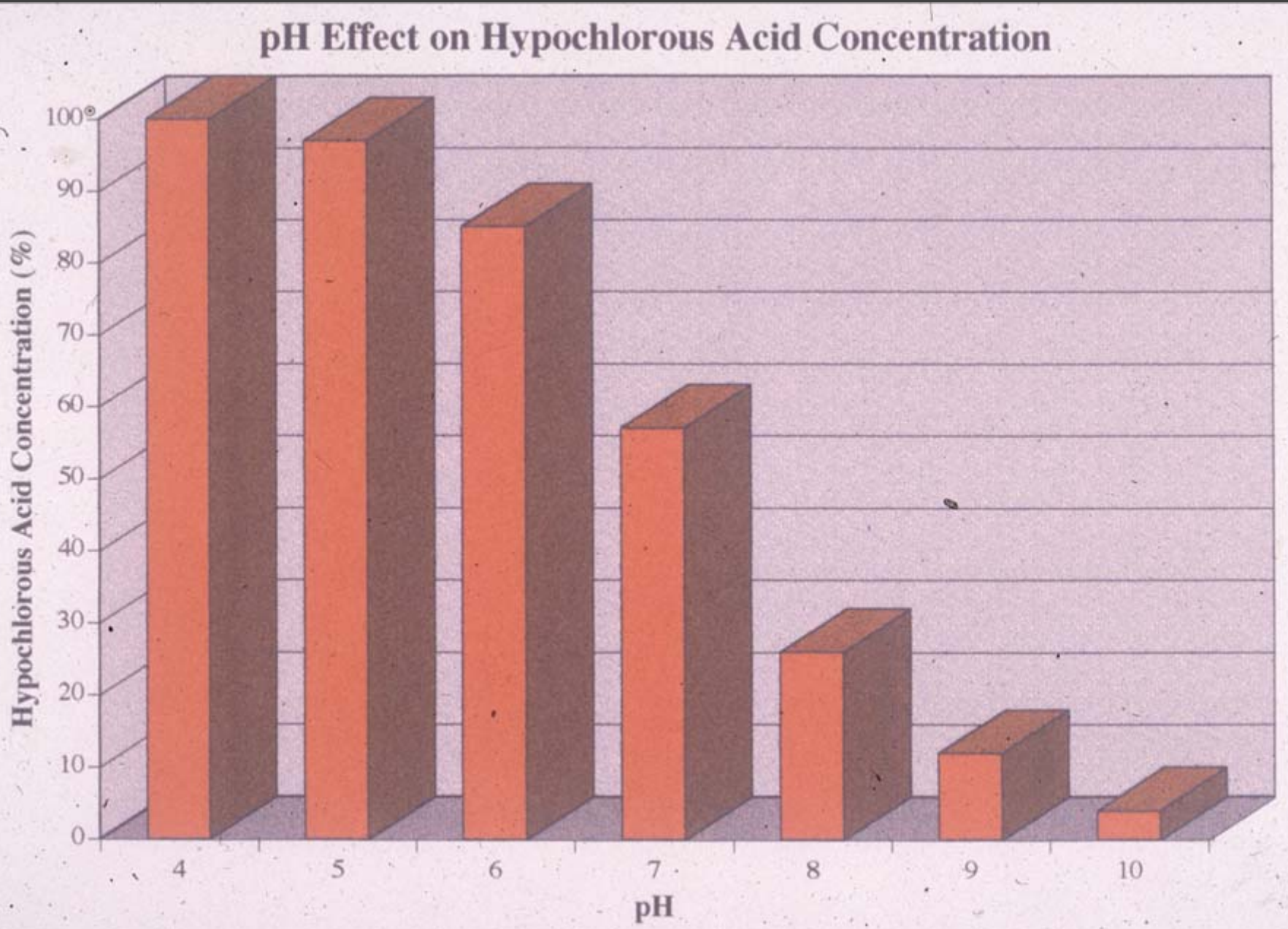
chlorine copper

Chlorine

- **Sources:**
  - **Liquid - sodium hypochlorite.**
  - **Solid - calcium hypochlorite.**
  - **Gas chlorine.**

Chlorine:

- Sources:
  - Liquid - sodium hypochlorite.
  - Solid - calcium hypochlorite.
  - Gas chlorine.
- When add chlorine source to water:
  - Forms hypochlorous acid + hypochlorite.
  - Hypochlorous acid is more powerful biocide.
  - If pH is lower (acidic), more hypochlorous acid is present - better biocide.


pH Effect on Hypochlorous Acid Concentration
Hypochlorous Acid Concentration (%)
100
90
80
70
60
50
40
30
20
10
0
4
5
6
7
8
9
10
pH

Chlorine as a Biocide

	Free Chlorine
prevent growth	1 - 2 ppm
periodic injection	10 - 20
super chlorination (reclamation)	500 - 1000

Test for chlorine using a pool / spa test kit

Chlorine: Injection Rates

- Sodium hypochlorite (liquid)
  - Example: household bleach w/ 5.25% active chorine.

Chlorine injection rate (gal/hr) = System flow rate (gpm) x Desired Cl Conc. (ppm) x 0.006 ÷ Strength of Cl soln (%)

- Calcium hypochlorite (solid)
  - 65-70% available chlorine.
  - 12.8 lbs. of calcium hypochlorite added to 100 gallons of water forms a 1% solution.
  - Use above formula.

Flushing of microirrigation systems:

- Silts and clay particles pass through even the best filters.

Flushing

- Silts and clay particles pass through even the best filters.

- Need to flush the system - mainlines, submains, and laterals (in that order).

Flushing

- **Silts and clay particles pass through even the best filters.**

- **Need to flush the system - mainlines, submains, and laterals (in that order).**
  - Flush laterals by hand or use automatic flushing end caps.

Chemigation Uniformity in Drip Irrigation Systems

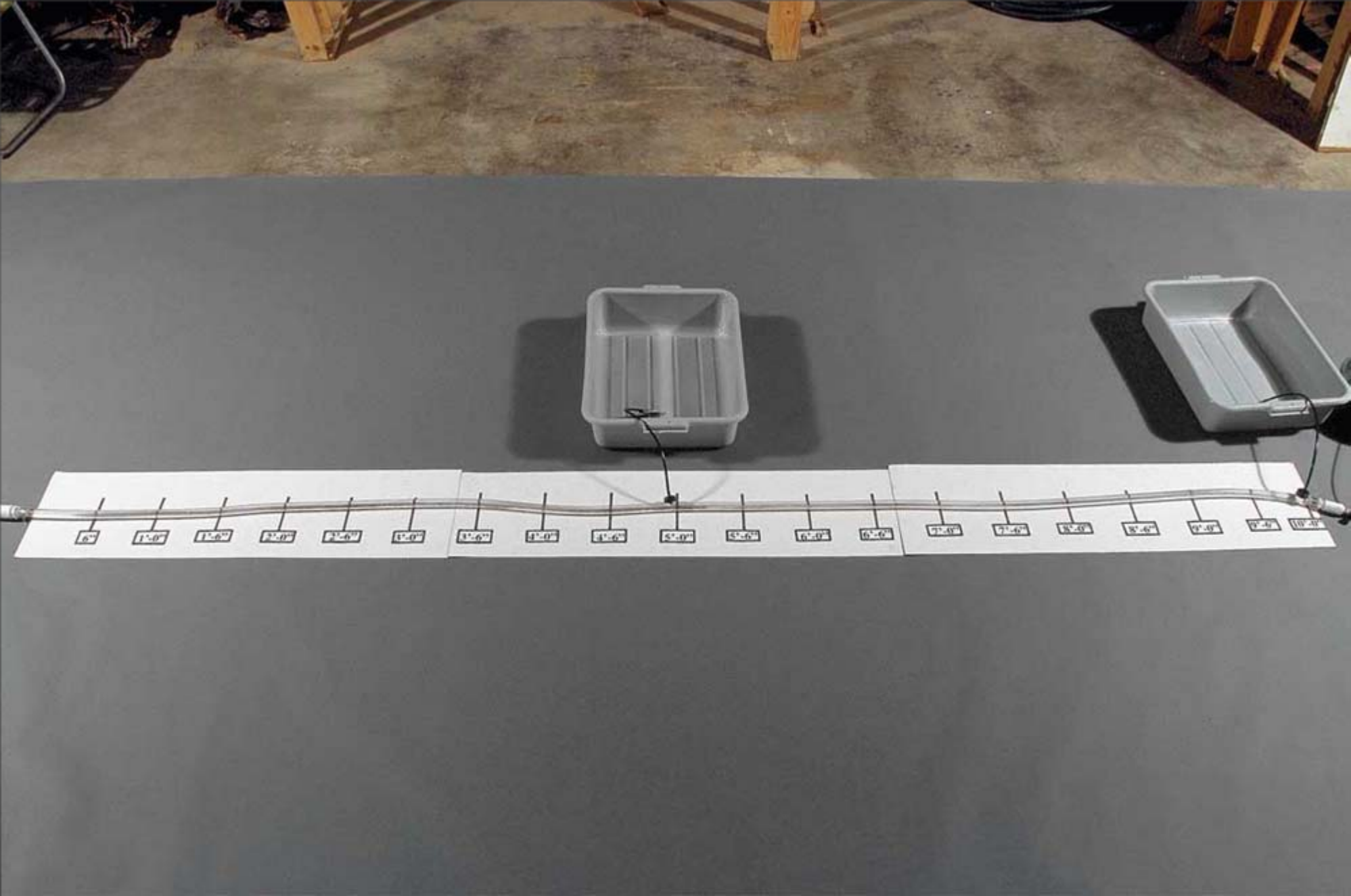
Uniform Chemigation

We want to have the material injected into the drip system to be applied as evenly (uniformly) as the water applied by the drip irrigation system.

Uniform Chemigation

First, it is important to remember that once you start injecting, the injected material doesn't immediately start coming out of all the drip emitters.

- It takes time for the injected material (and the water) to travel through the drip irrigation system.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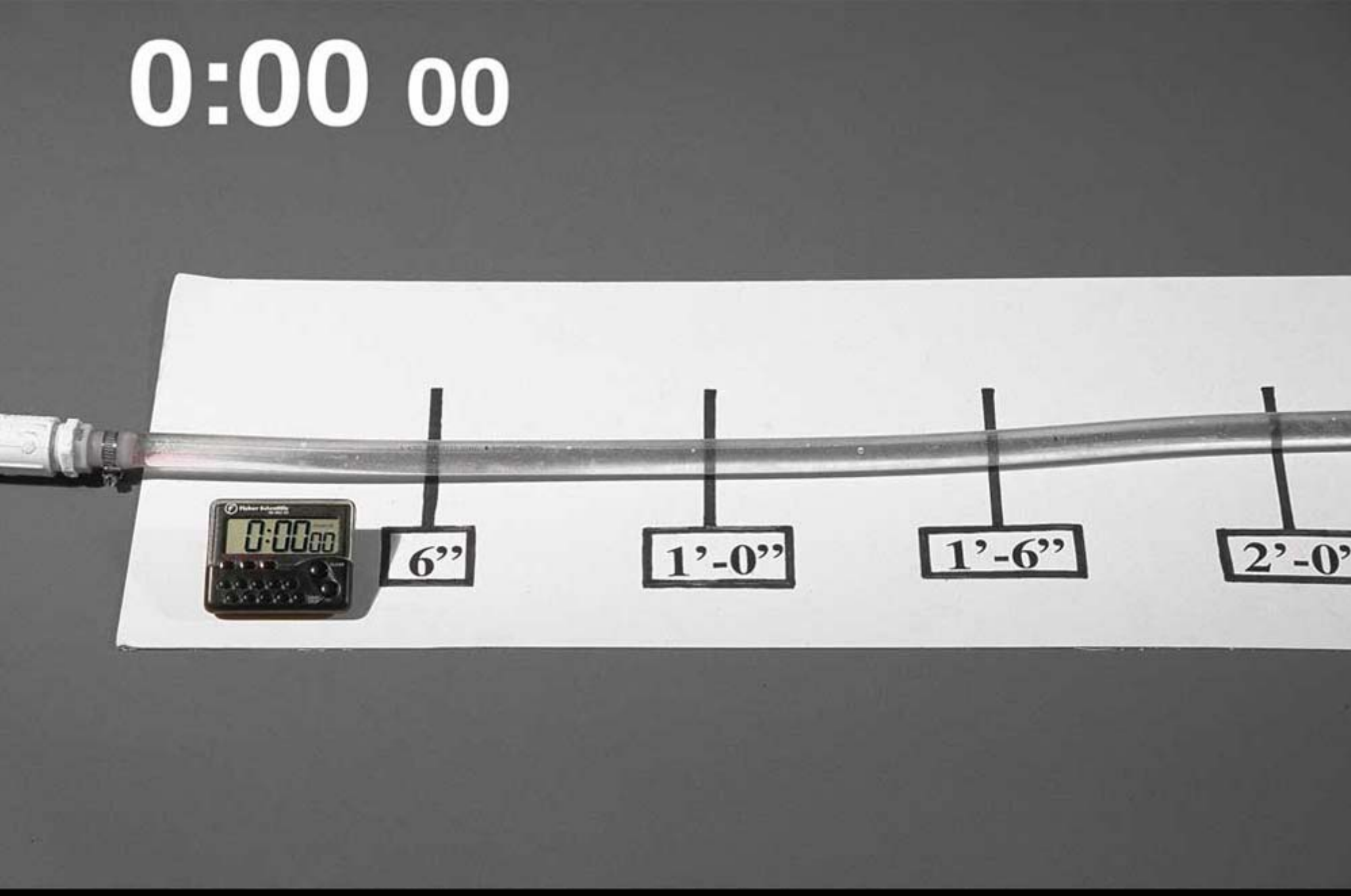
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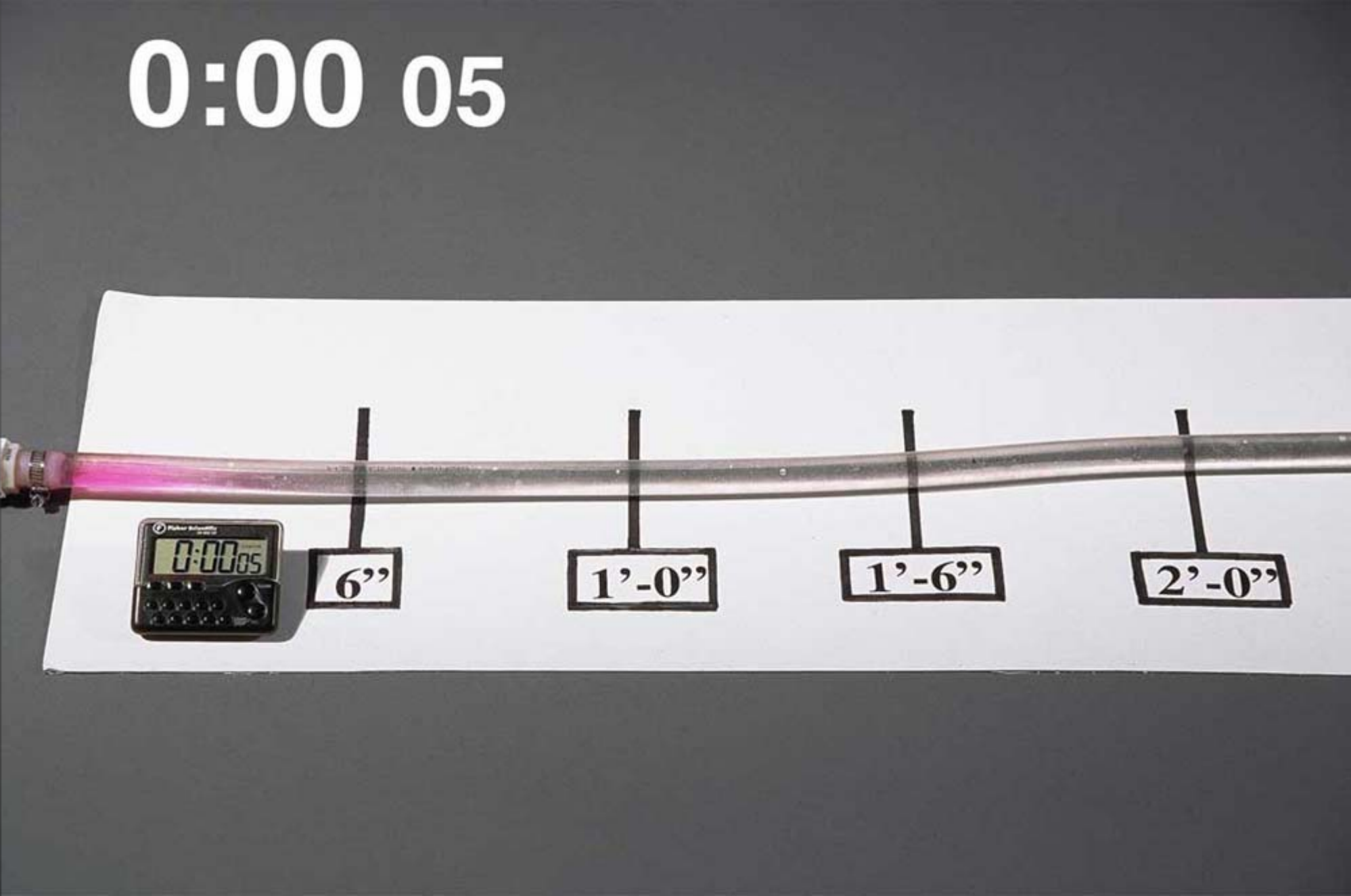
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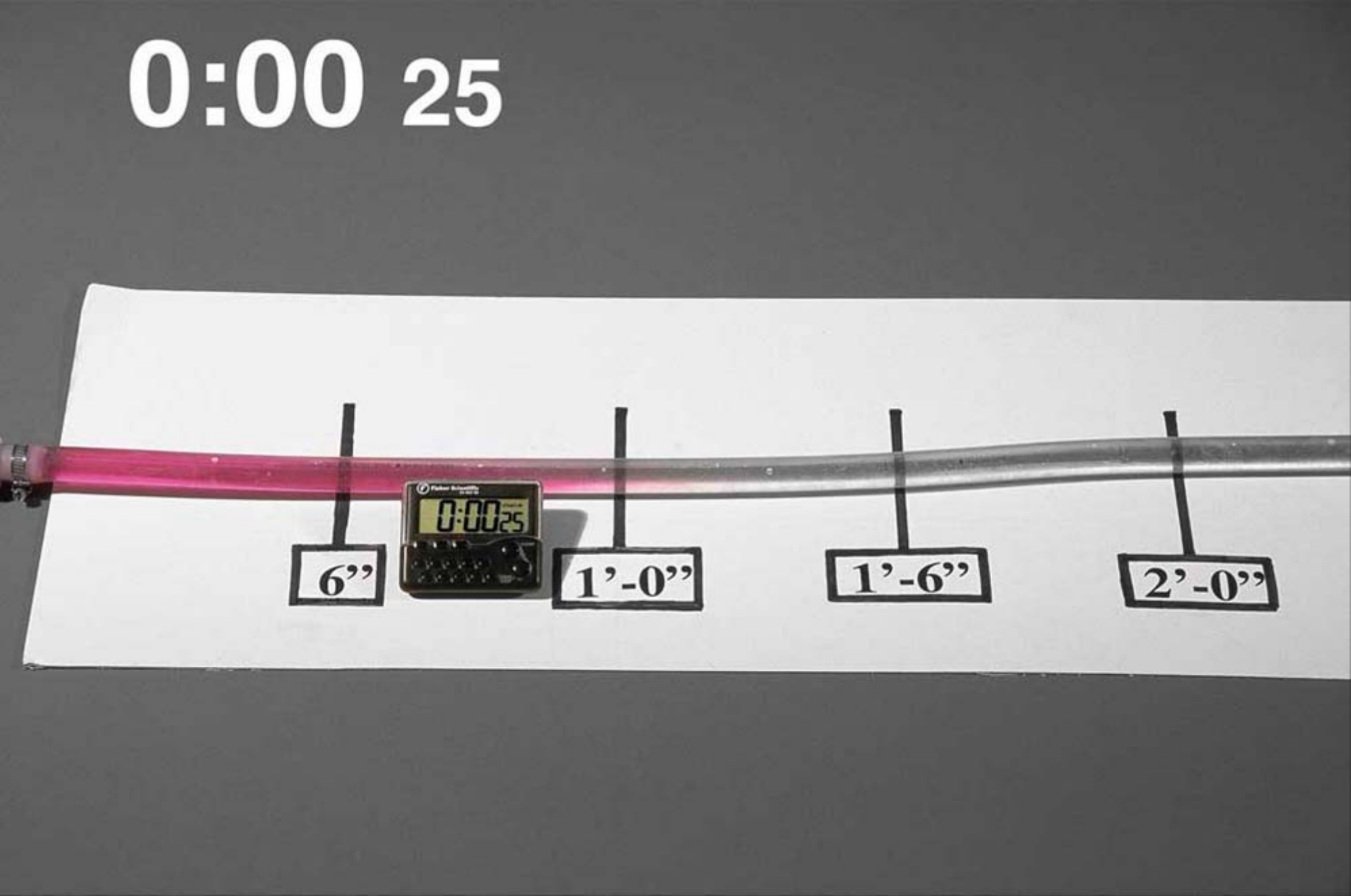
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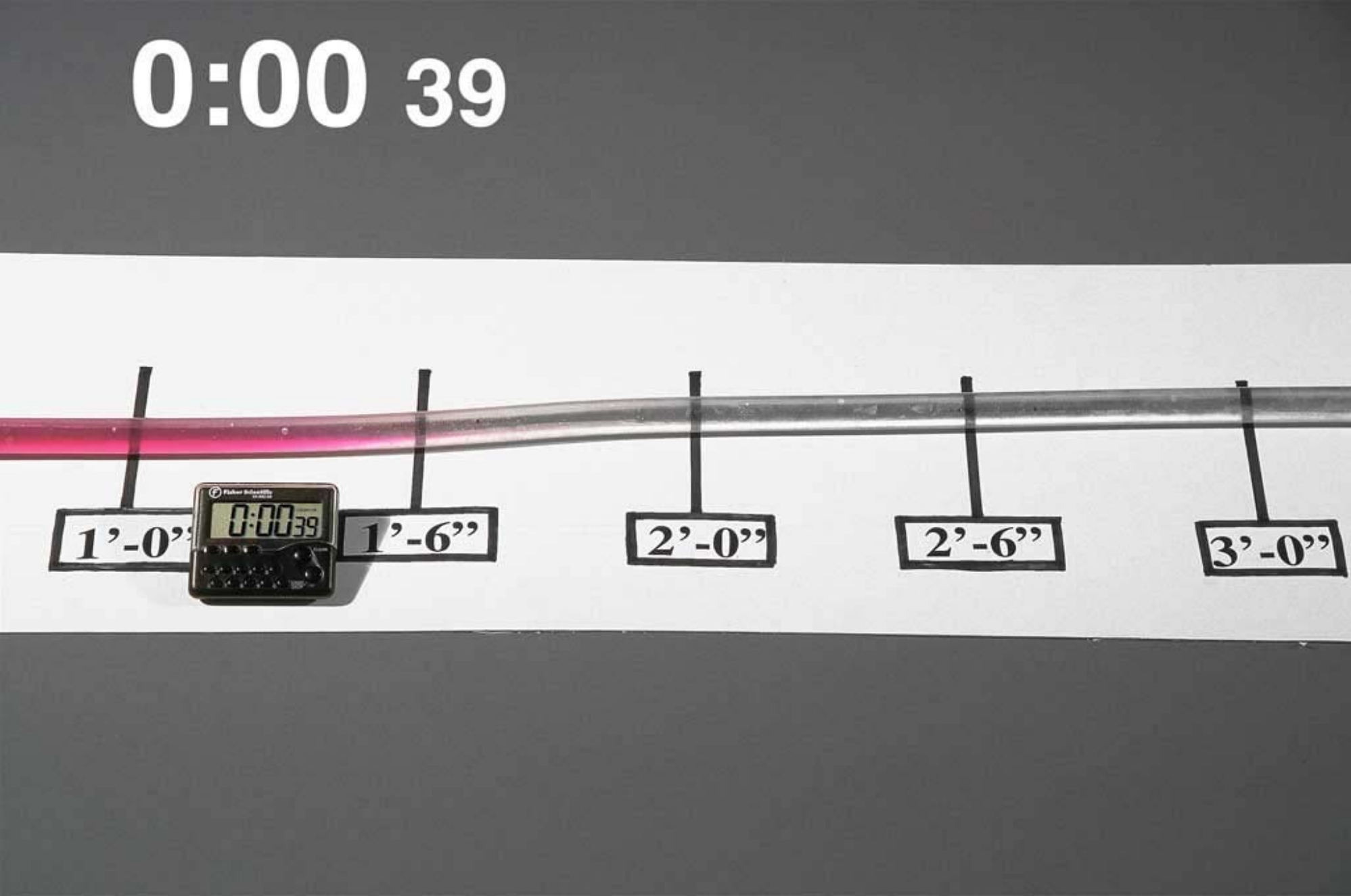
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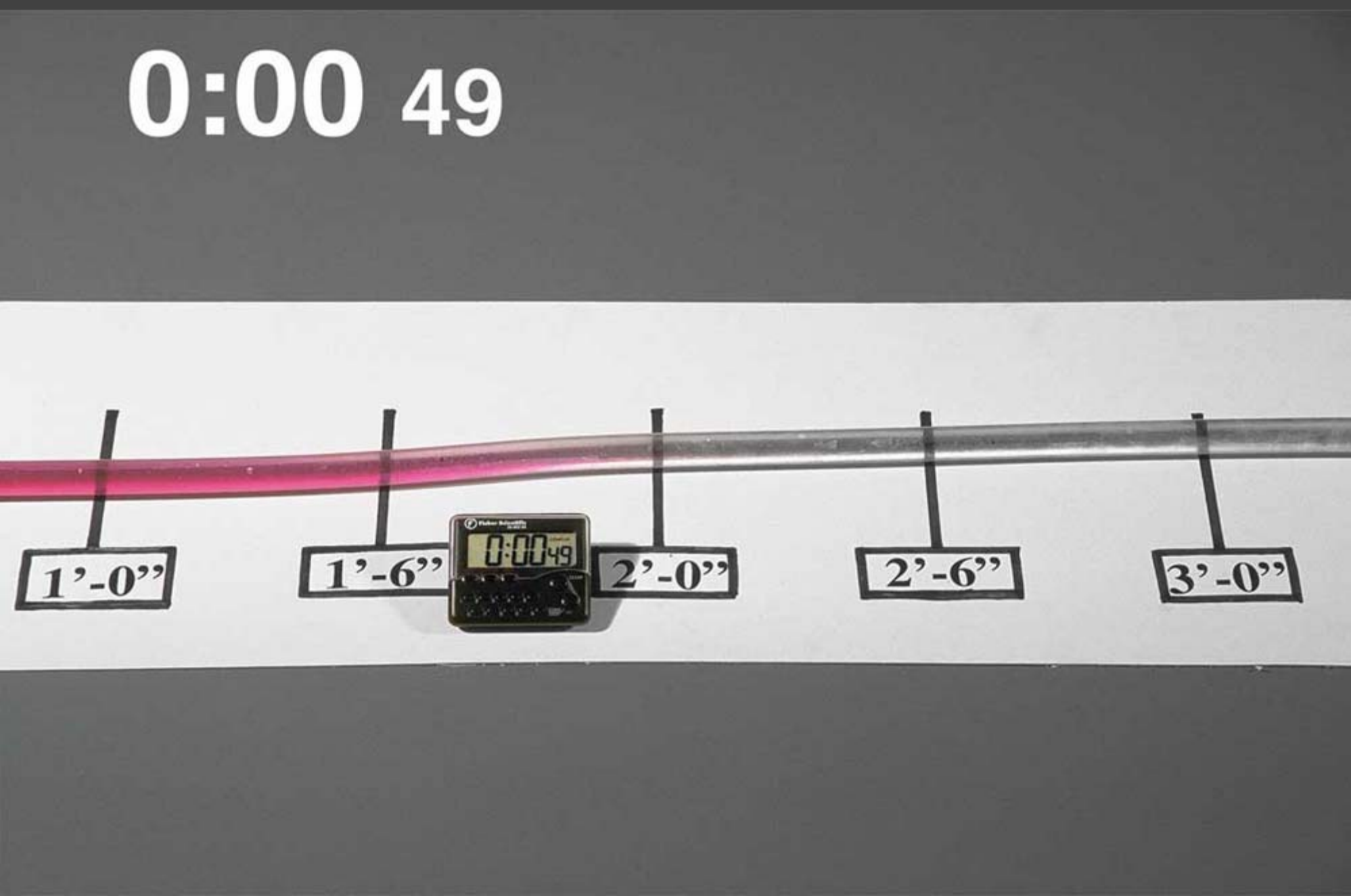
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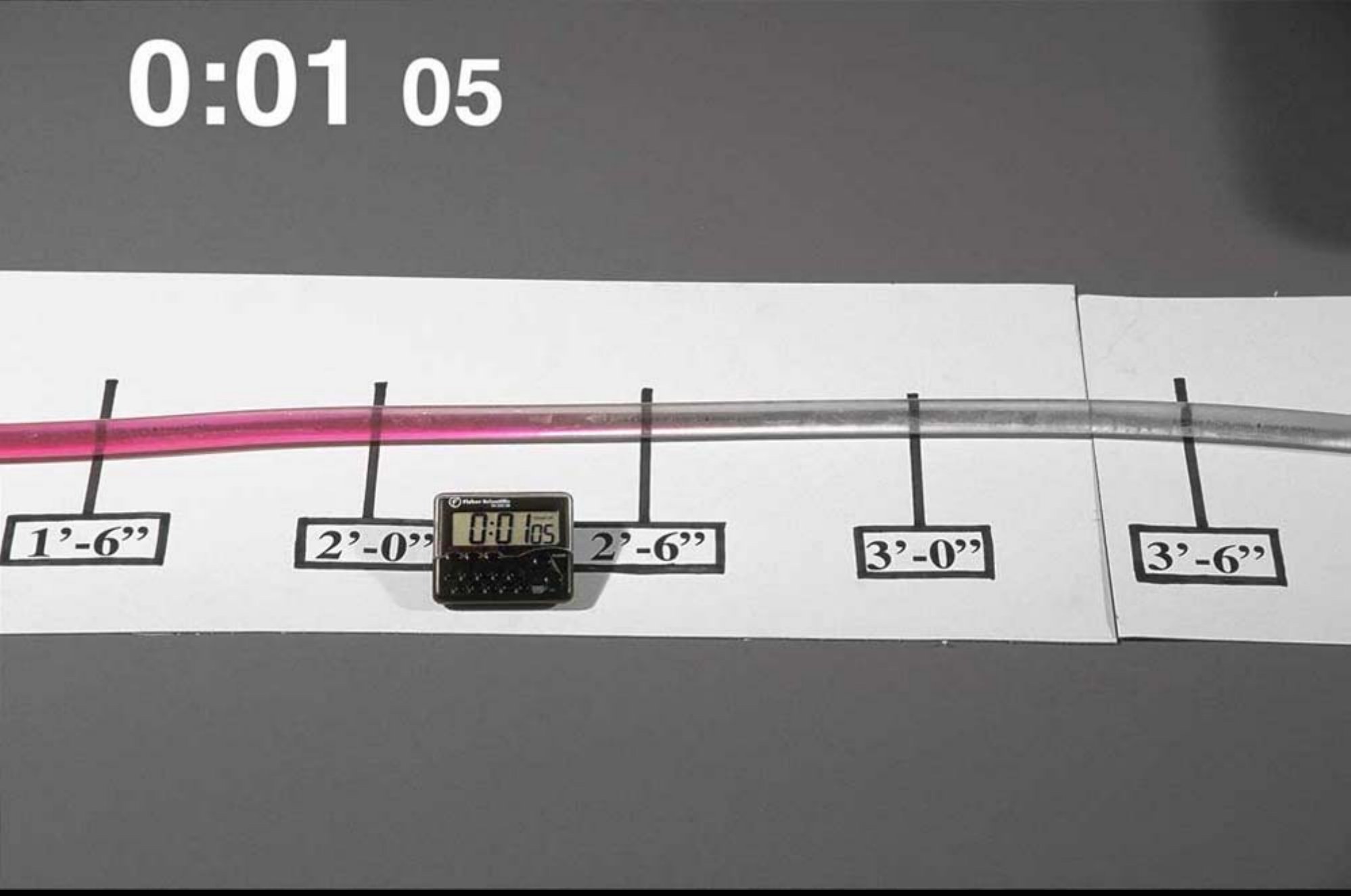
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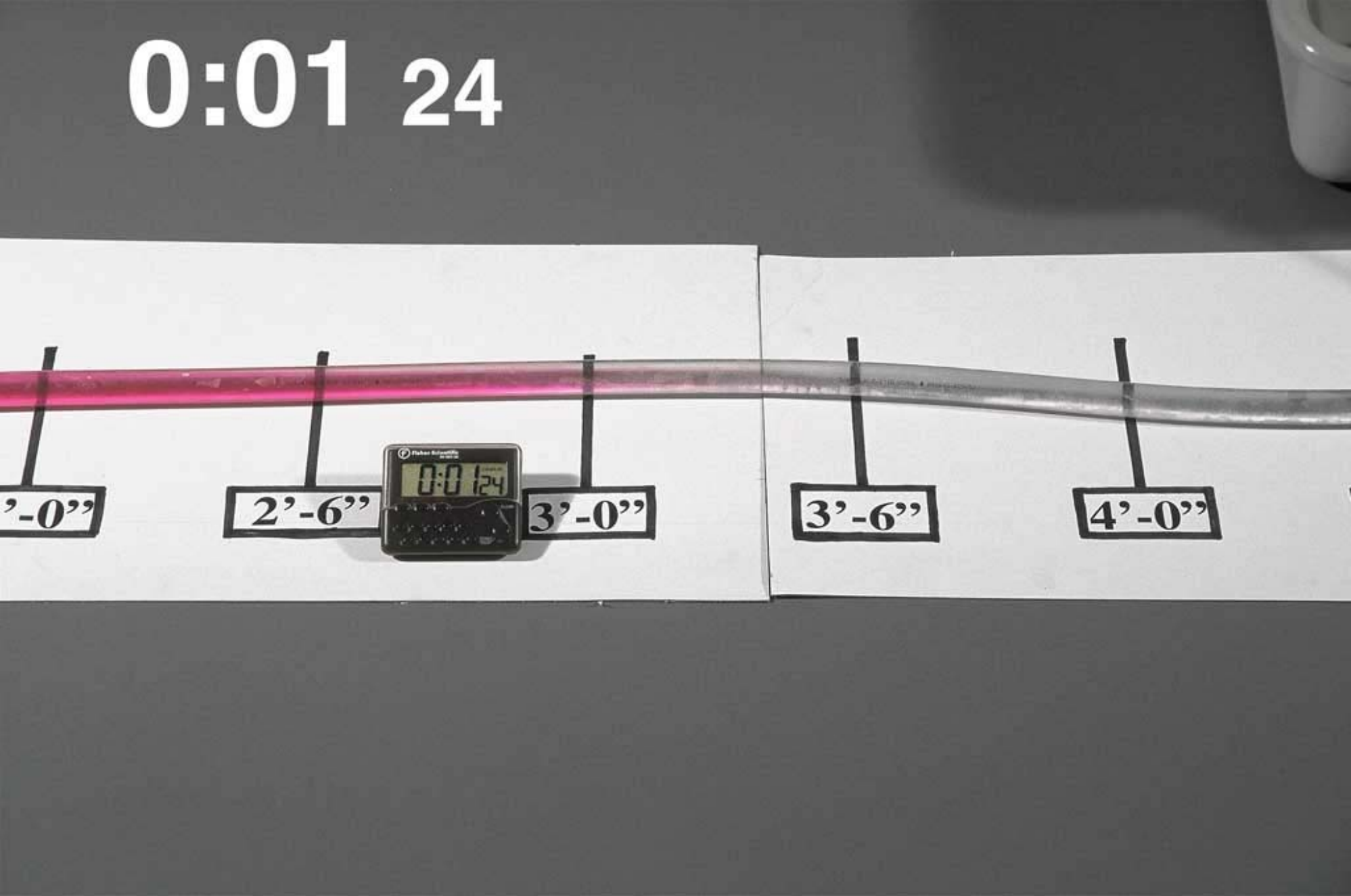
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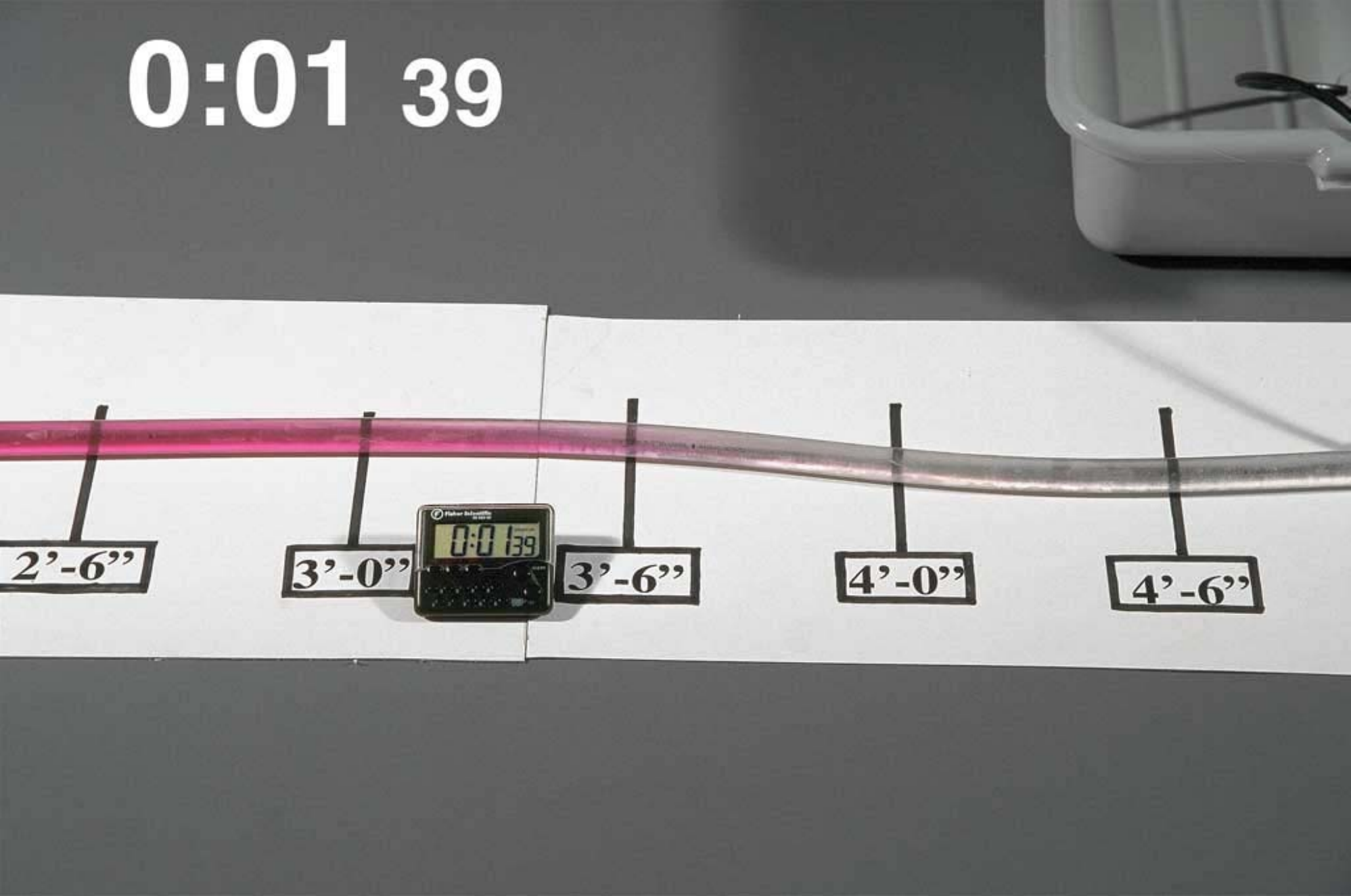
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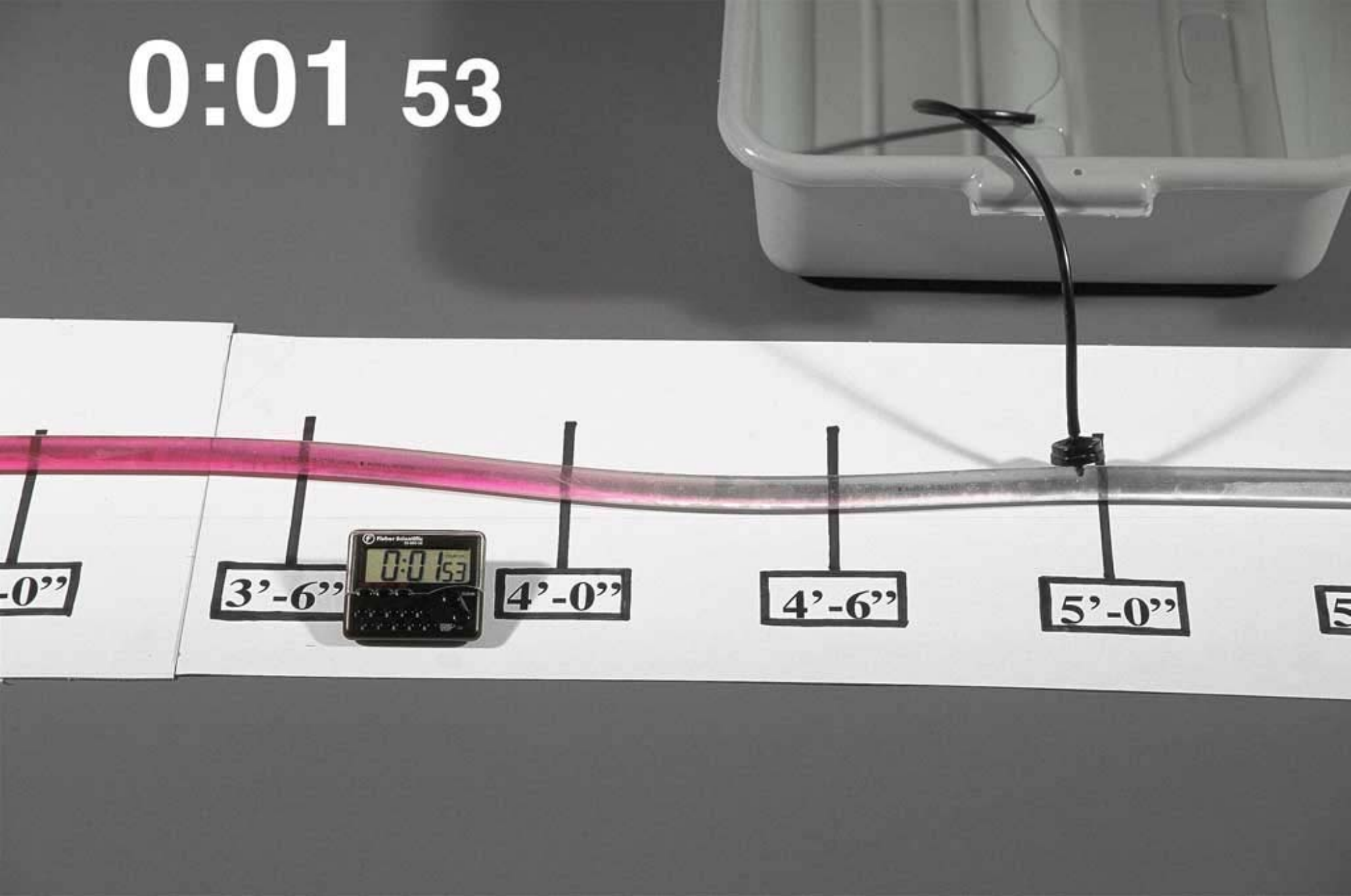
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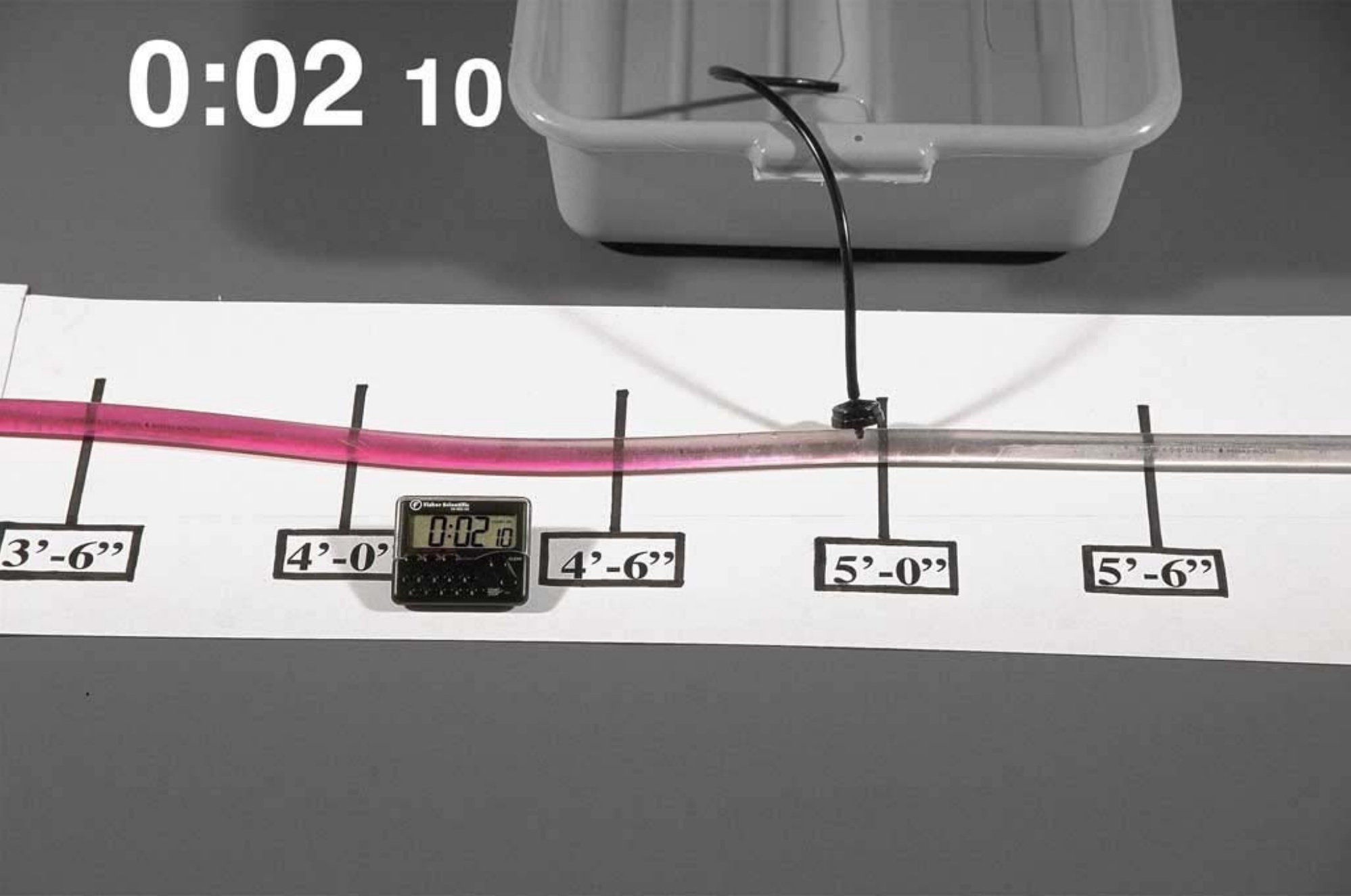
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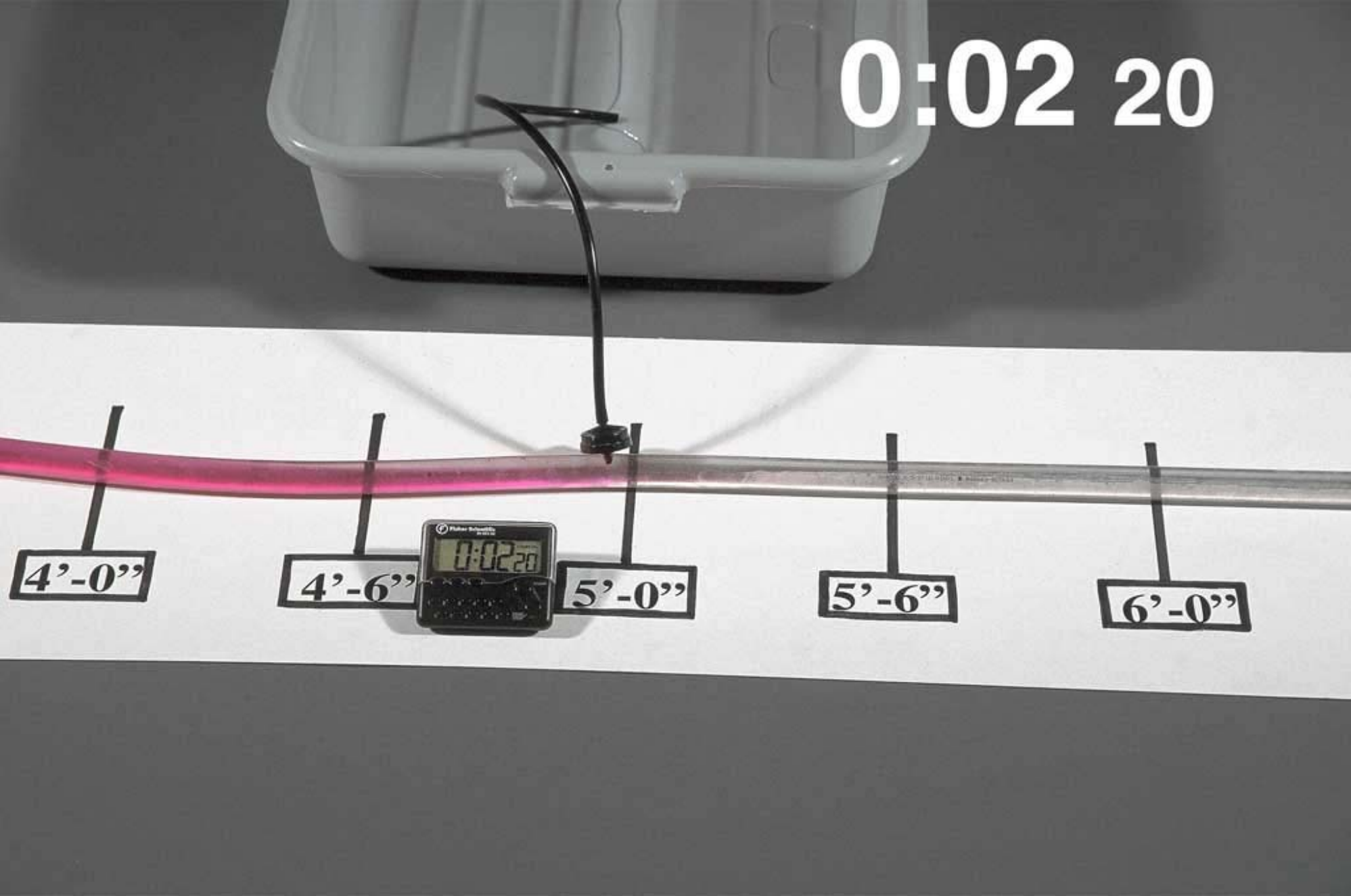
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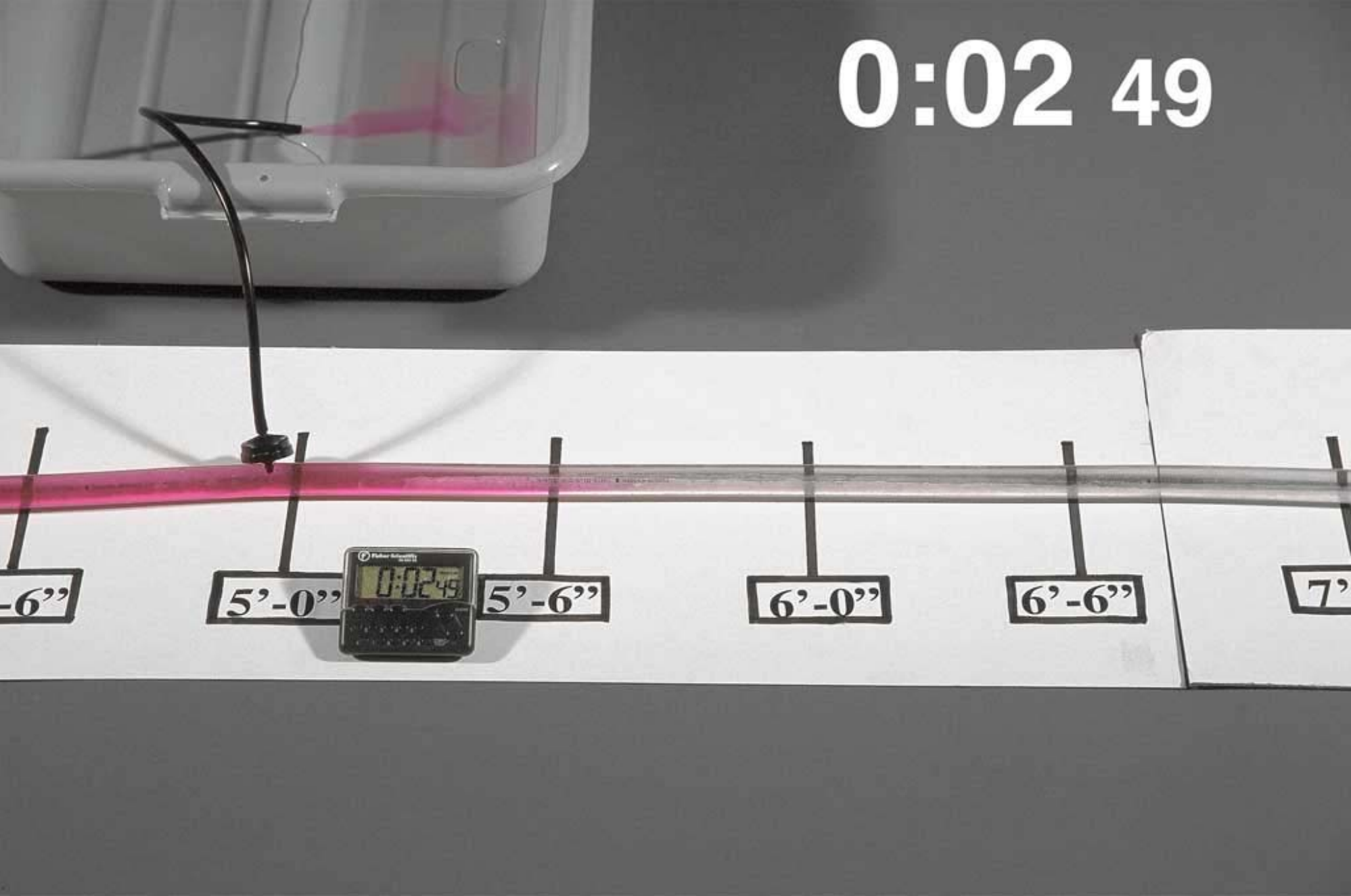
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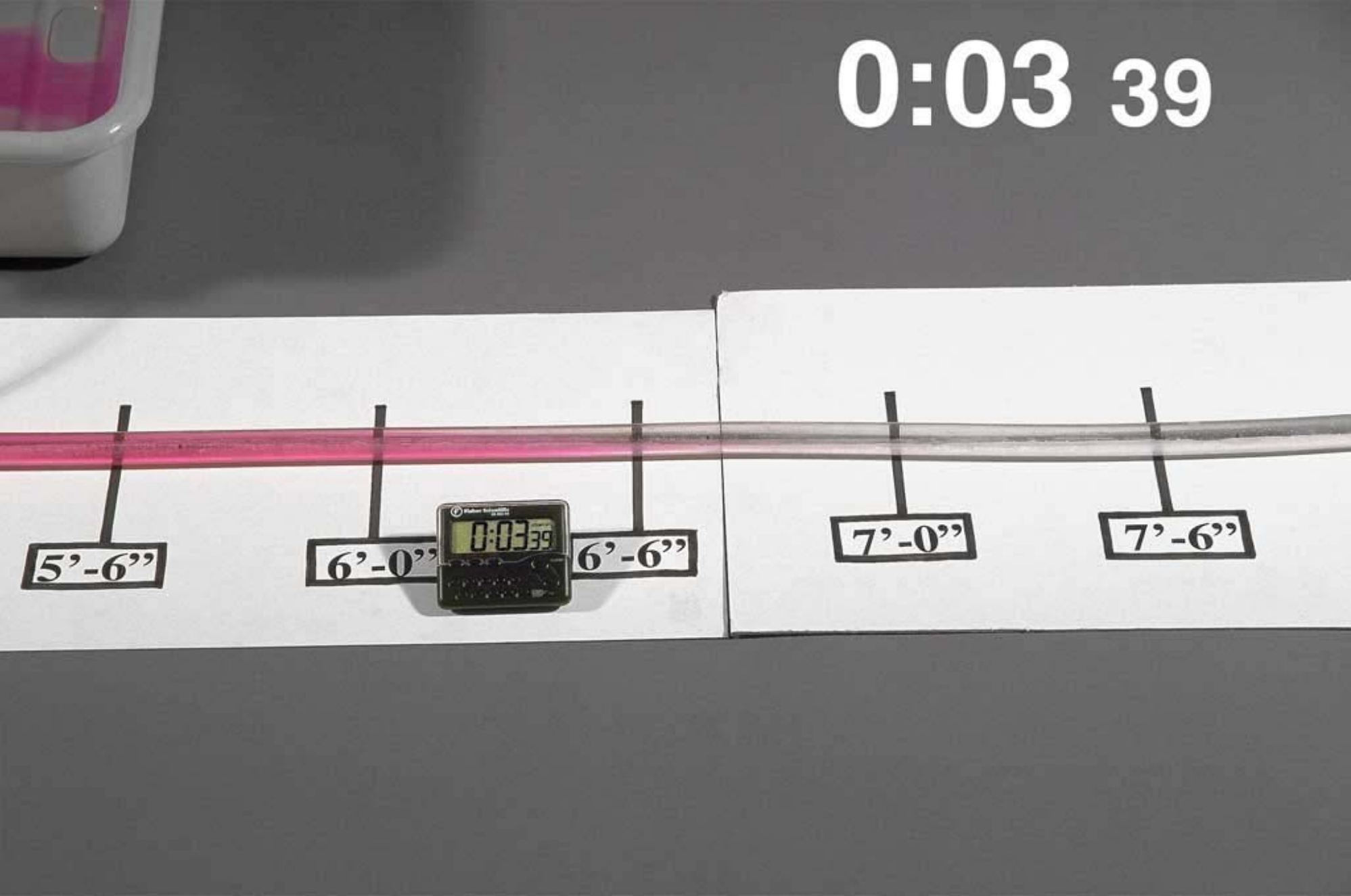
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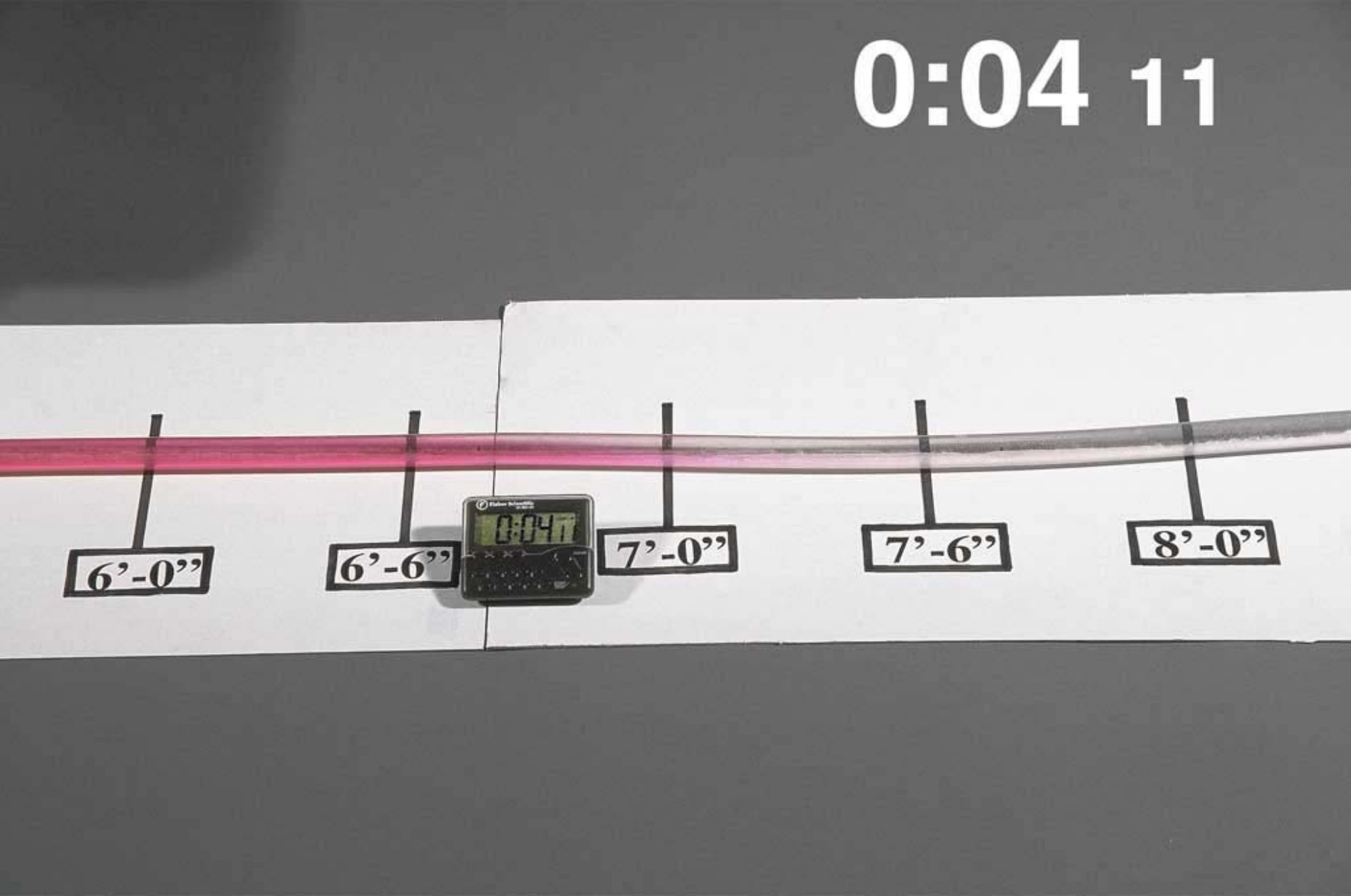
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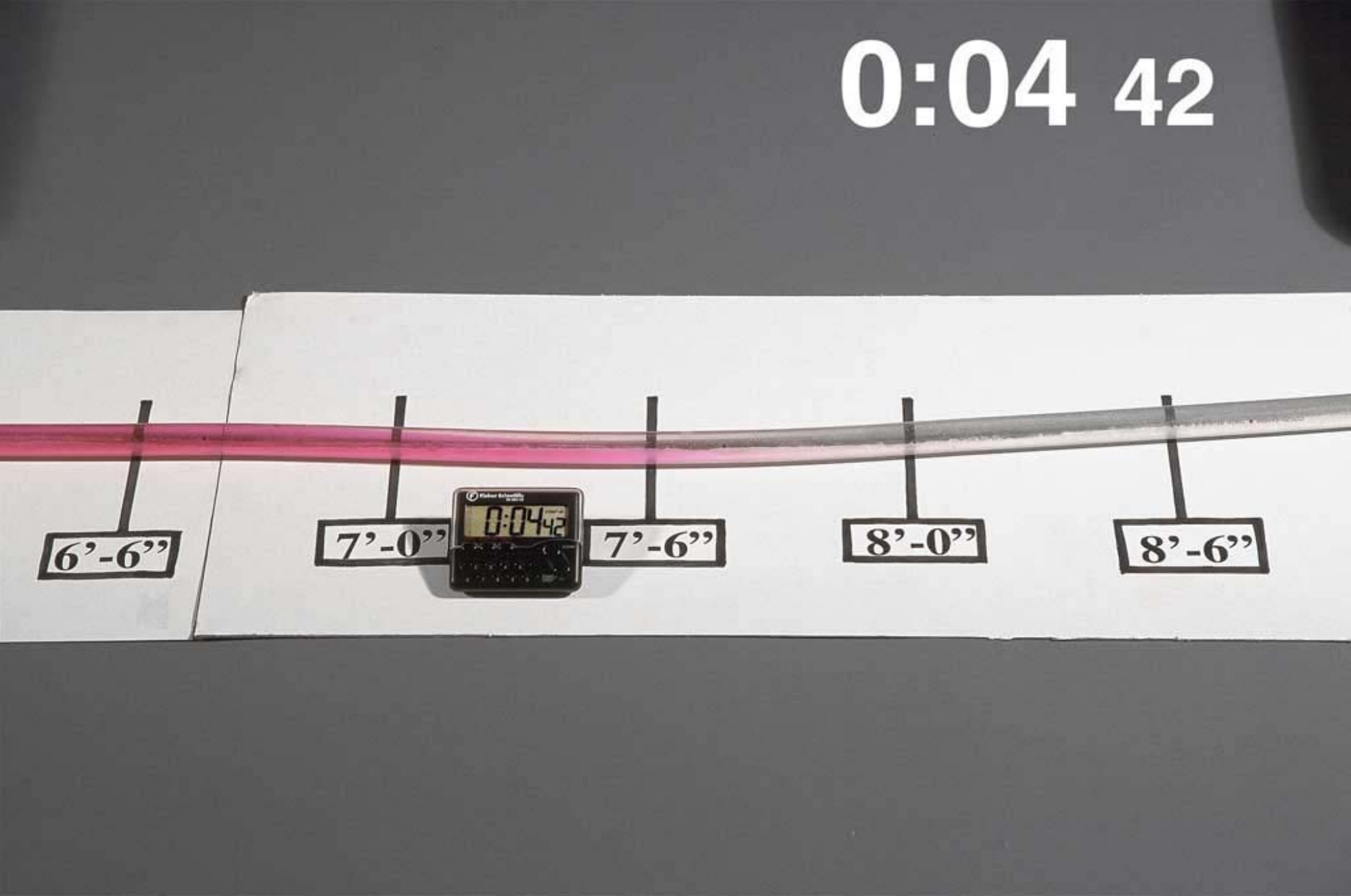
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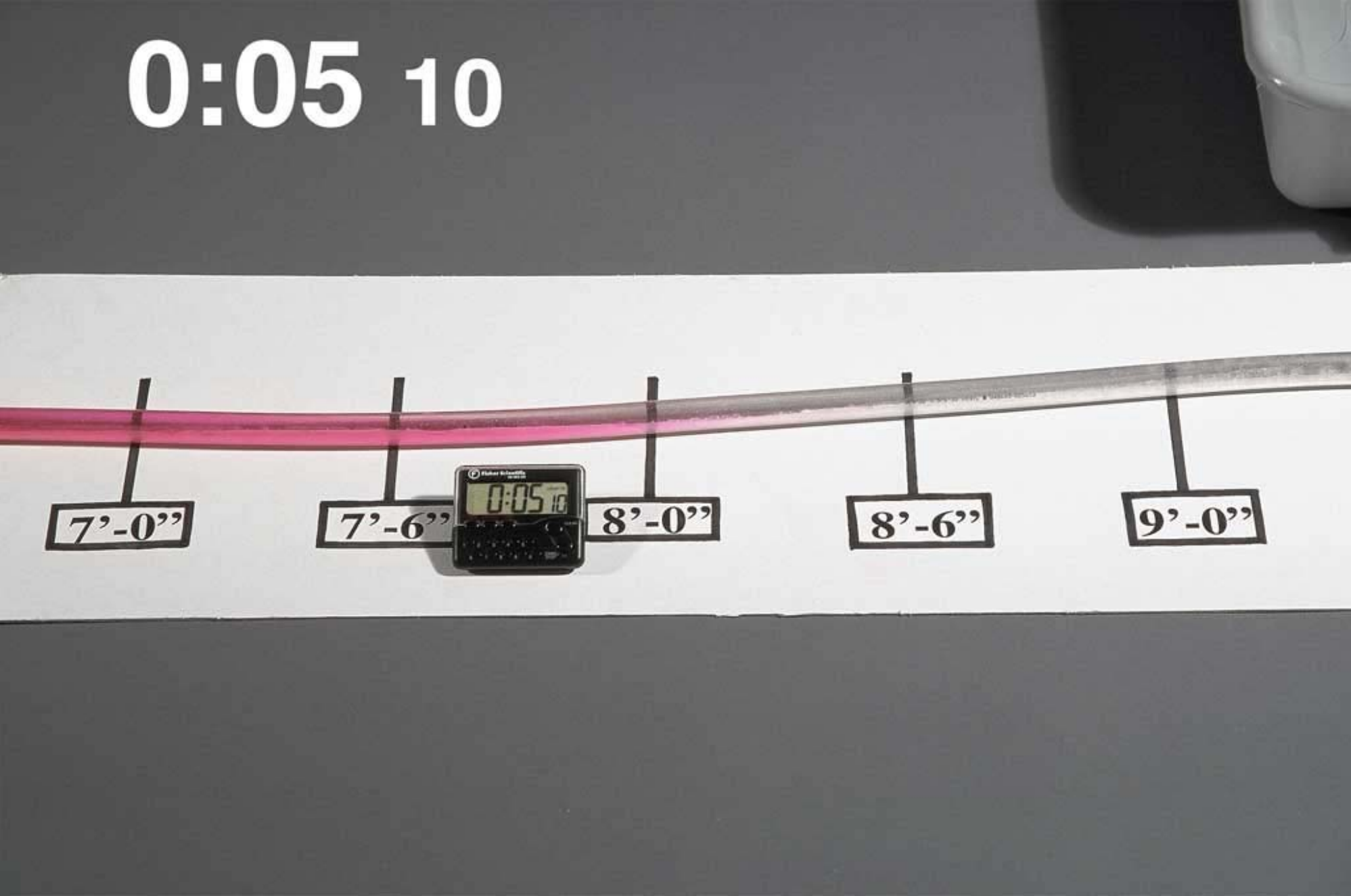
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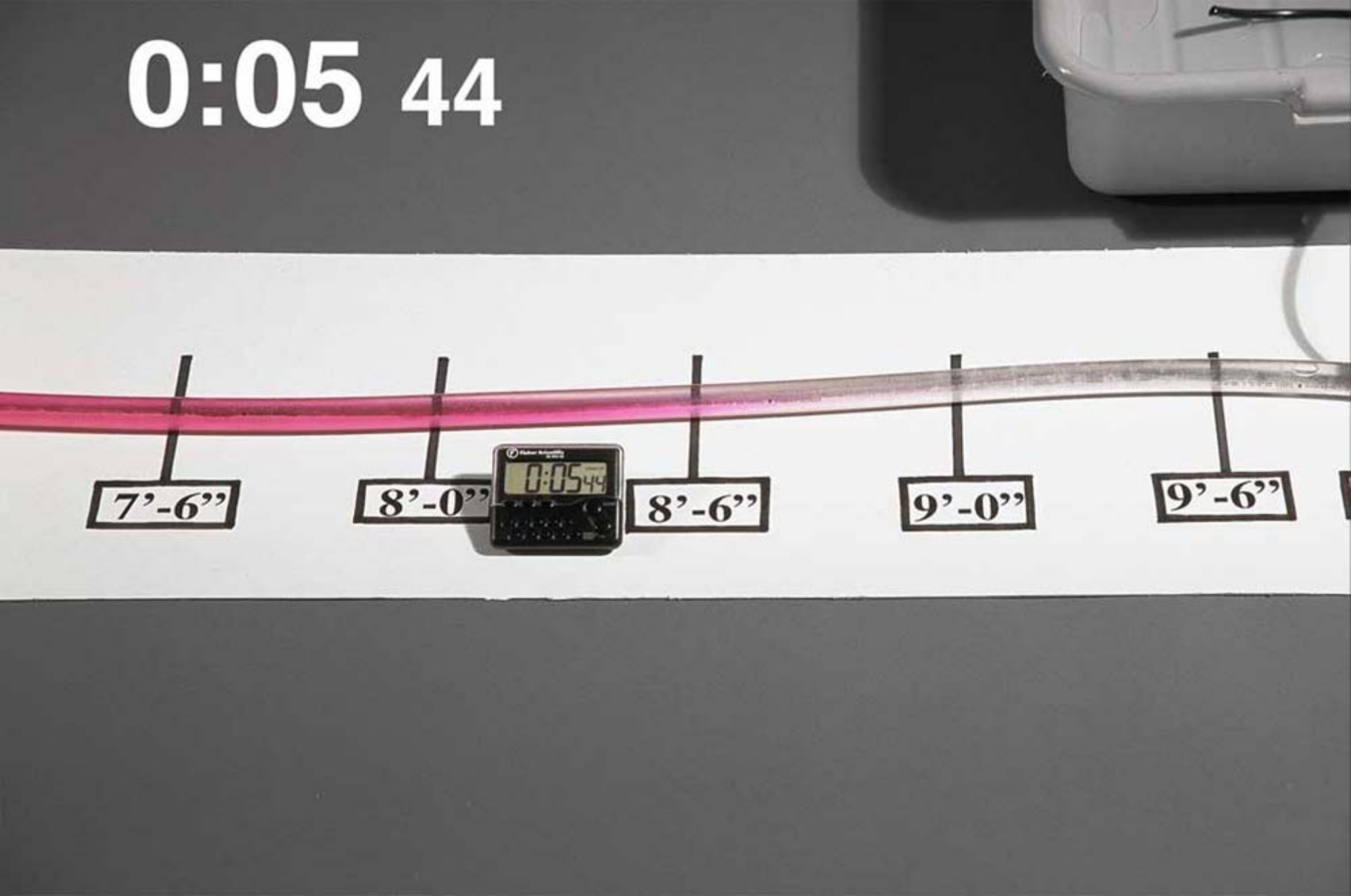
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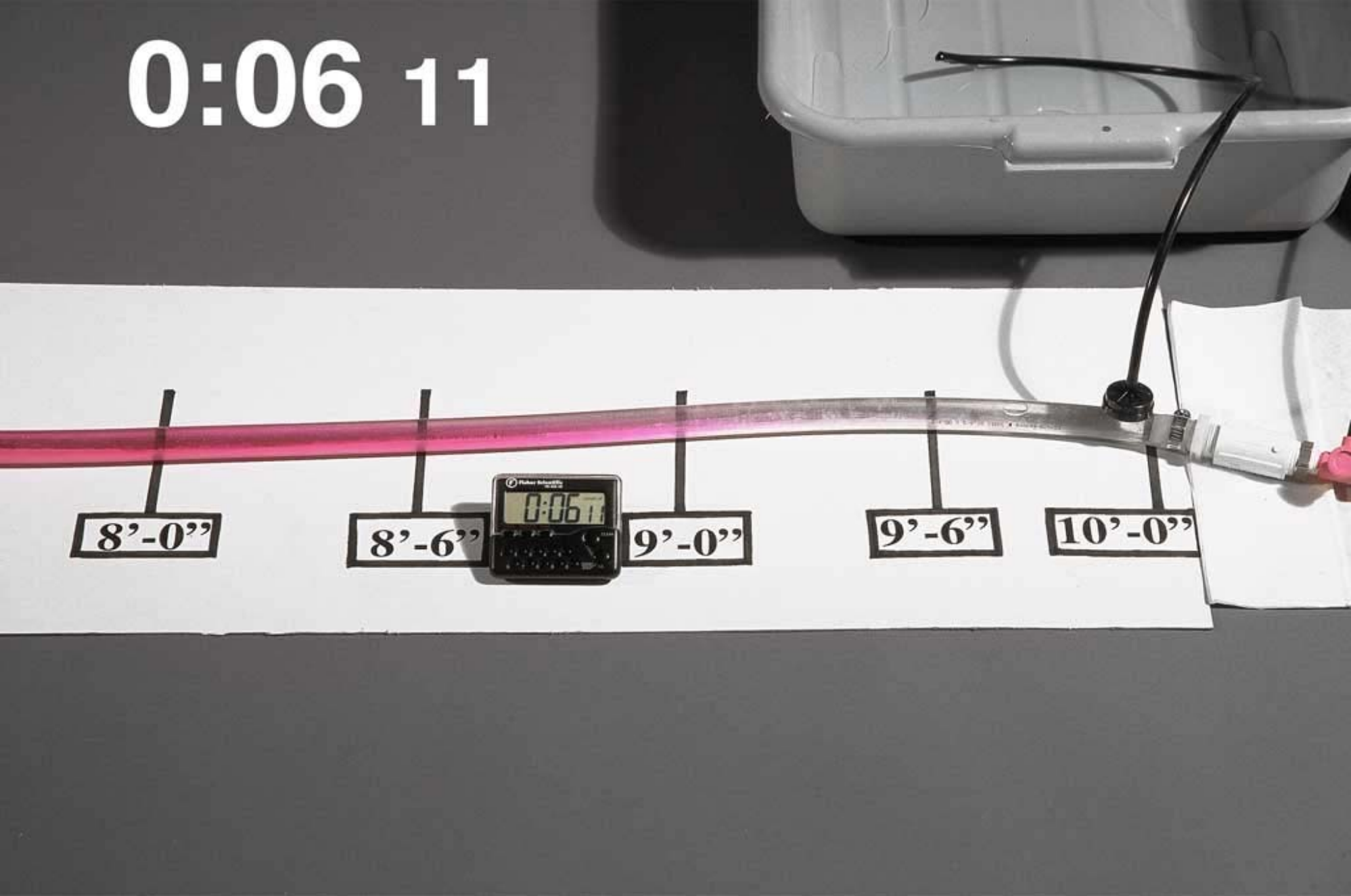
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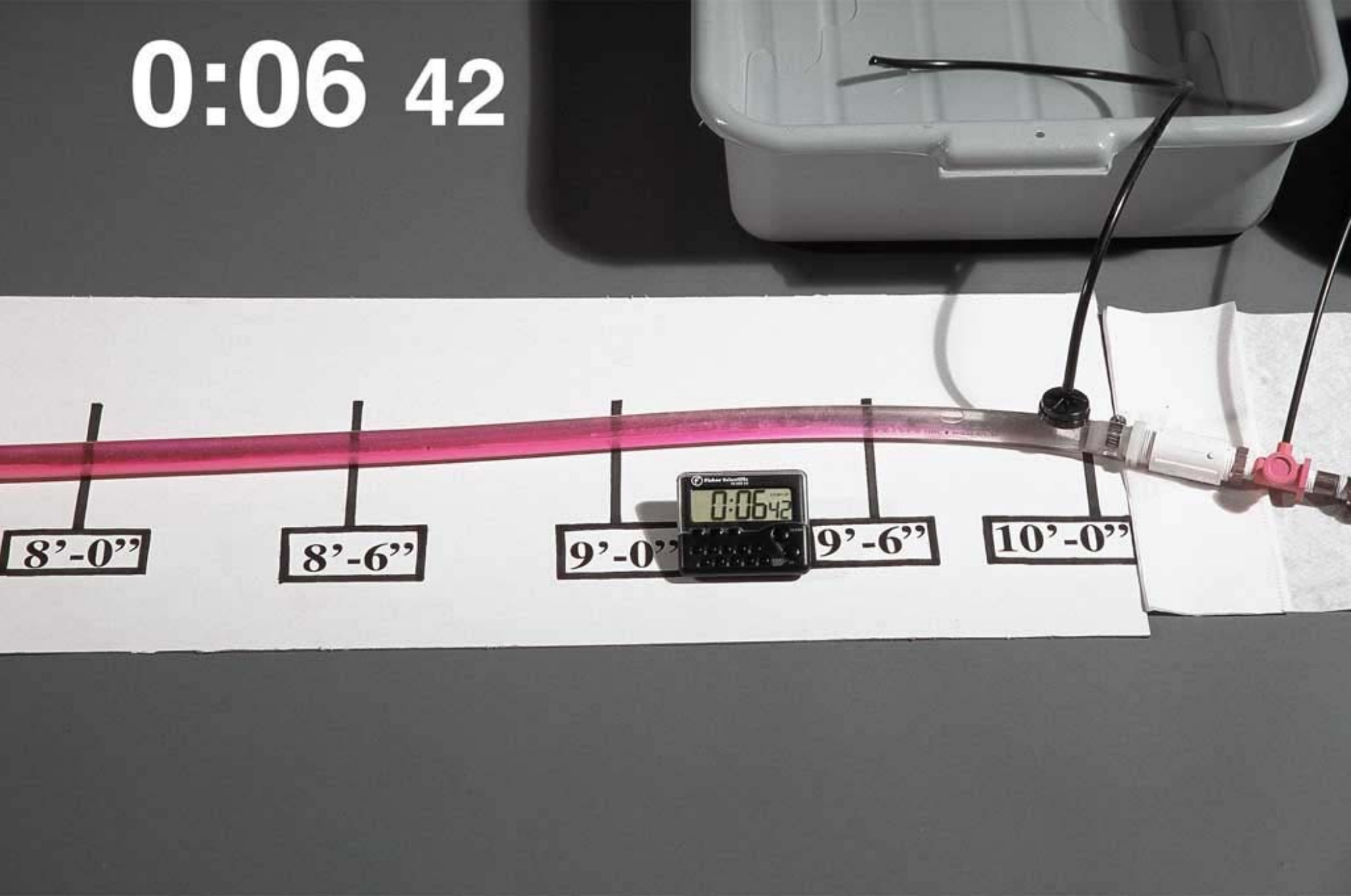
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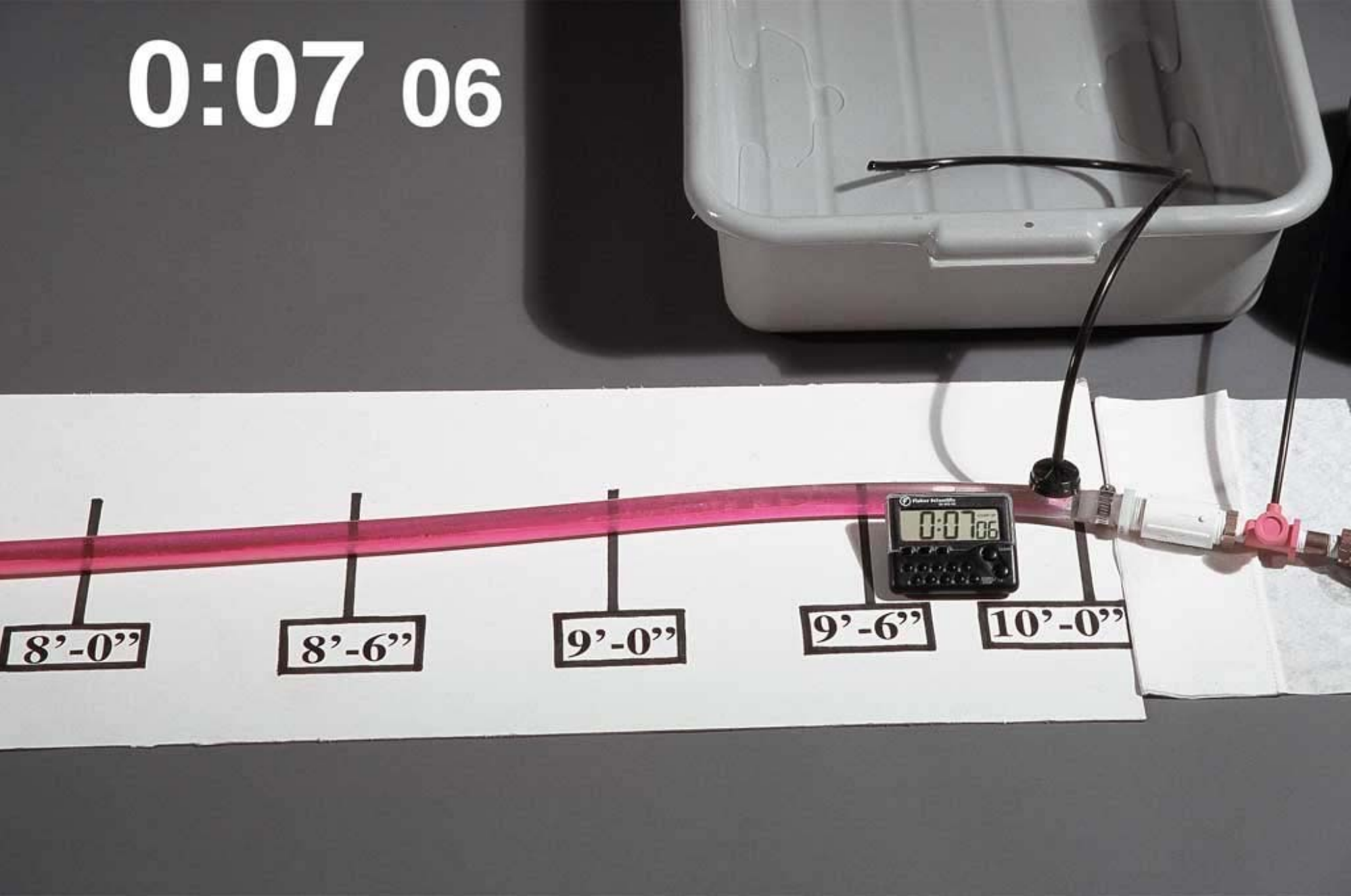
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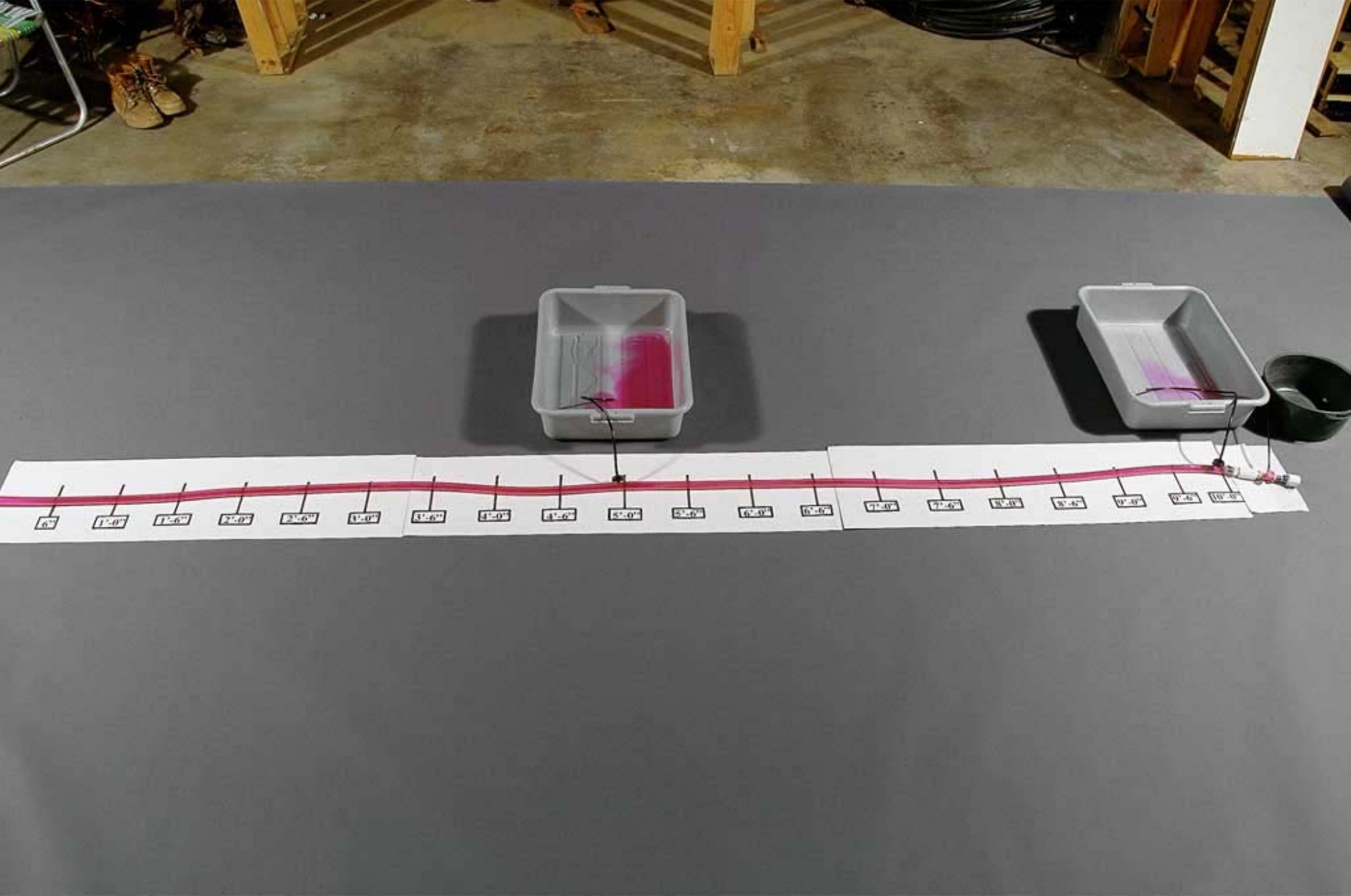
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Uniform Chemigation

What happens when we stop the injection?

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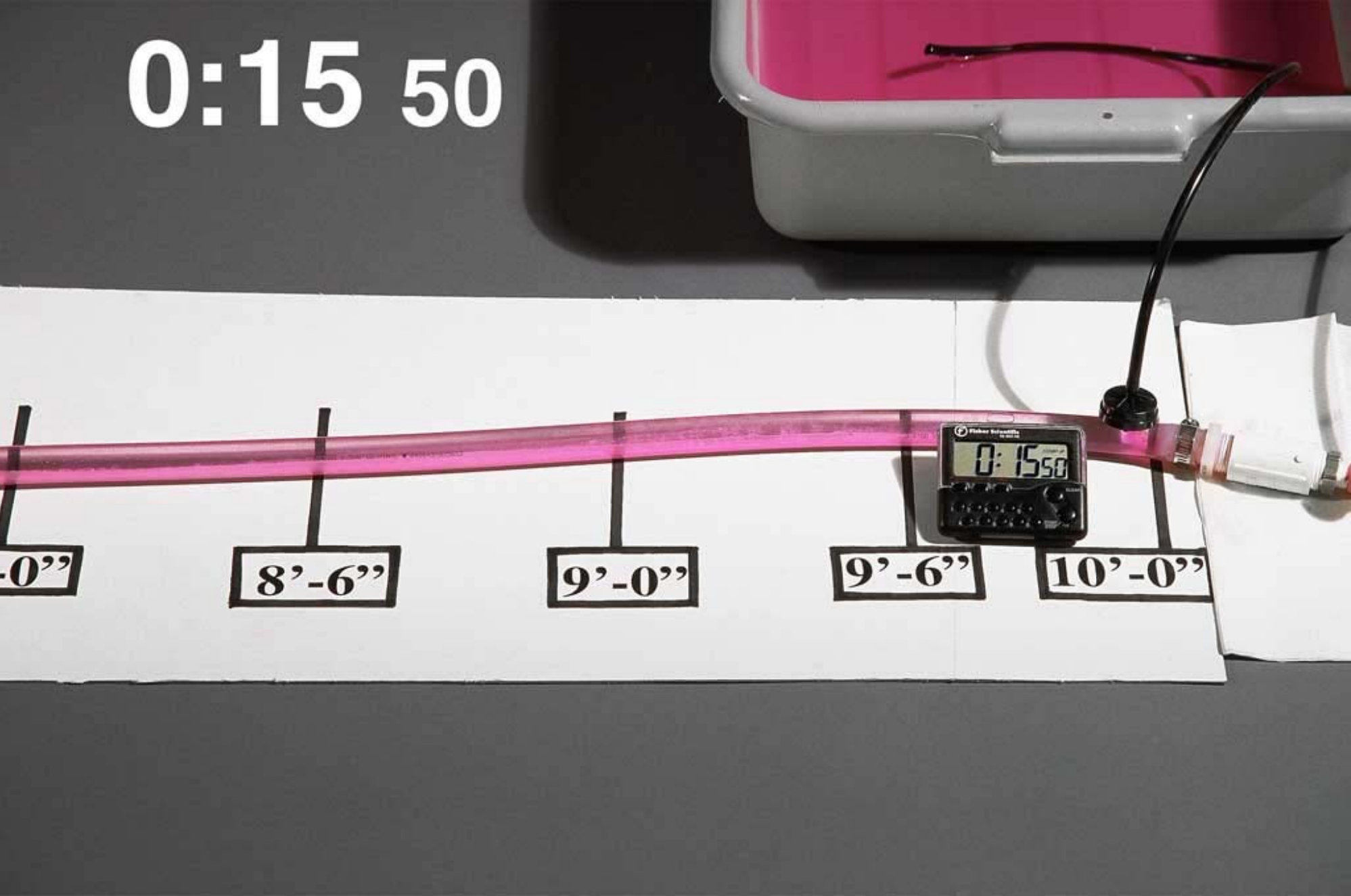
Uniform Chemigation

It takes at least as long for most of the chemical to clear from the drip lateral as it took it to initially move through the lateral.

To takes a long time for all the chemical to clear out of the drip lateral.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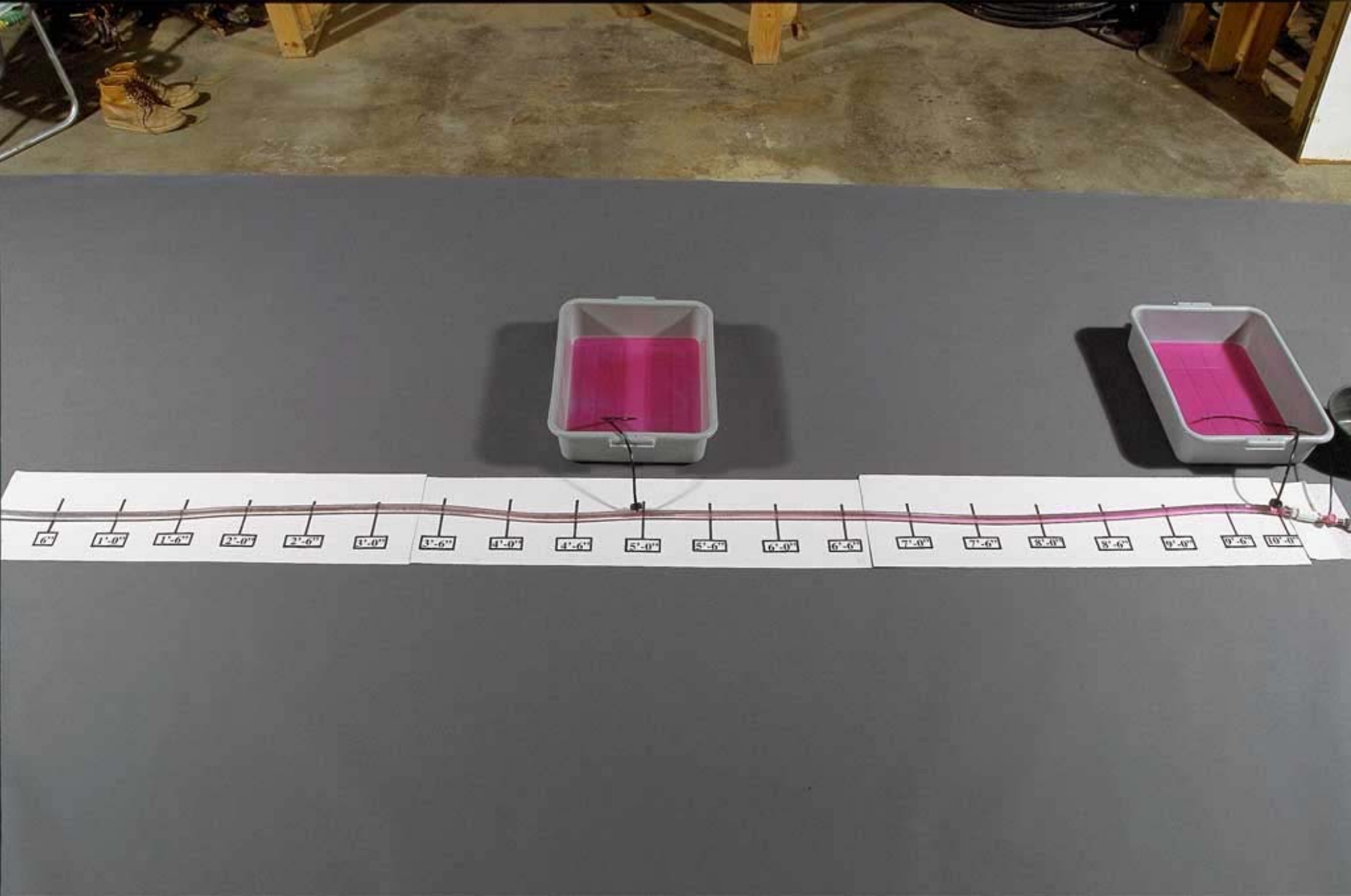
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Uniform Chemigation

We also need to account for the time it takes for the injected chemical to move through the underground pipelines.

How do we do this?

Uniform Chemigation

The easiest way to determine travel times of chemicals (and water) through a drip system:

- Inject chlorine (at about 10 - 20 ppm) into the drip system and follow its movement through the drip system.
- It is easy to spot when chlorine reaches any point by testing the water with a pool/spa test kit.

Uniform Chemigation

What if you don’t have the post-injection period of clean water irrigation?

Chemigation uniformity in a drip lateral (500-feet long with 1-gallon per hour drip emitters installed at 5-foot intervals) for various injection time periods and various post-injection clean water irrigations. The water / chemical travel time to reach the end of the drip lateral was 25 minutes.

Injection Time (min)	Post-Injection Irrigation Time (min)	Relative Uniformity
50	50	100
50	0	25
25	25	95
25	0	11

Uniform Chemigation

What happens during chemigation in a commercial scale vineyard or orchard?

The following table shows the characteristics (pipeline length and drip lateral lengths) and water/chemical travel times for 6 commercial systems.

Water / chemical travel times through the pipelines and drip lateral lines for the vineyard and orchard field sites evaluated.

Site	Mainline and Submain		Lateral Line		Total Travel
	Travel Time (min.)	Length (ft)	Travel Time (min.)	Length (ft)	Time (min)
1	22	1000	10	175	32
2	30	1500	10	340	40
3	65	5000	10	340	75
4	15	1400	30	630	45
5	8	700	25	625	33
6	17	800	28	600	45

Uniform Chemigation

In summary:

- There is no standard total travel time through a drip system. The travel times ranged from 30 to 75 minutes.

- You need to test (using the chlorine travel time test) the drip system you're concerned with. You only need to do this once - then you know the travel time through the drip system.

Chemigation Uniformity in Drip Irrigation Systems

- **Trees & vines -** injections should last at least 1 hour, and at least 1 hour (longer is better) of clean water irrigation should follow it.

- **Row crop drip -** injections should be at least 2 hours in length, and there should be at least 2 hours (longer is better) of clean water irrigation following injection.

Questions?

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For Powerpoint presentation, go to:

http://www.schwankl.uckac.edu