

Drip Irrigation – Application Rate and Injection Practices

**Larry Schwankl
UC Cooperative Extension**

**schwankl@uckac.edu 559-646-6569
website: <http://ucanr.org/schwankl>**

Drip Tape Application Rate



Drip Tape Application Rate

- Crop water use (ET) information is provided as *inches (e.g. in/day)*.



Drip Tape Application Rate

- Crop water use (ET) information is provided as *inches/day*.
- Drip tape discharges are often given in *gpm/100 ft* or *gph per emitter*.



Drip Tape Application Rate

- Crop water use (ET) information is provided as *inches/day*.
- Drip tape discharges are often given in *gpm/100 ft* or *gph per emitter*.

How do you work those two together?

Drip Tape Application Rate

Must know the kind of drip tape (tape diameter, emission point flow, & emitter spacing) and the operating pressure:

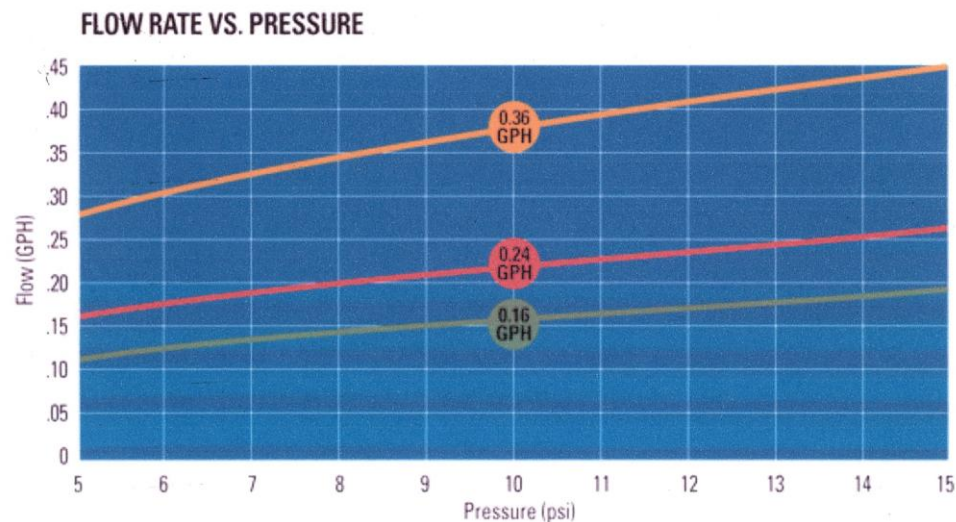
5/8"

16 mm

Available Wall Thickness:

4 mil, 6 mil, 8 mil, 10 mil, 12 mil, & 15 mil

	<i>Q-100 GPM @ 8 PSI</i>			
Outlet Spacing	0.13 GPH Emitter	0.20 GPH Emitter	0.27 GPH Emitter	0.34 GPH Emitter
4"	-	-	1.34	-
8"	0.34	0.50	0.67	0.84
12"	0.22	0.34	0.45	0.56
16"	0.17	0.25	0.34	0.42
24"	0.11	0.17	0.22	0.28



Drip Tape Application Rate

gpm/100 ft. to in/hr

$$\left[\begin{array}{c} \text{Application Rate} \\ \text{(in/hr)} \end{array} \right] = \left[\begin{array}{c} \text{Drip tape discharge} \\ \text{rate (gpm/100 ft.)} \end{array} \right] \div \left[\begin{array}{c} \text{Spacing between drip} \\ \text{tape laterals (ft)} \end{array} \right] \times 0.963$$

Application Rate (in/hr) of Drip Tapes

		Drip Tape Discharge Rate (gpm/100 ft)								
		0.1	0.15	0.2	0.25	0.3	0.35	0.4	0.45	0.5
Row Spacing (in)	12	0.10	0.14	0.19	0.24	0.29	0.34	0.39	0.43	0.48
	14	0.08	0.12	0.17	0.21	0.25	0.29	0.33	0.37	0.41
	16	0.07	0.11	0.14	0.18	0.22	0.25	0.29	0.33	0.36
	18	0.06	0.10	0.13	0.16	0.19	0.22	0.26	0.29	0.32
	20	0.06	0.09	0.12	0.14	0.17	0.20	0.23	0.26	0.29
	22	0.05	0.08	0.11	0.13	0.16	0.18	0.21	0.24	0.26
	24	0.05	0.07	0.10	0.12	0.14	0.17	0.19	0.22	0.24
	26	0.04	0.07	0.09	0.11	0.13	0.16	0.18	0.20	0.22
	28	0.04	0.06	0.08	0.10	0.12	0.14	0.17	0.19	0.21
	30	0.04	0.06	0.08	0.10	0.12	0.13	0.15	0.17	0.19
	32	0.04	0.05	0.07	0.09	0.11	0.13	0.14	0.16	0.18
	34	0.03	0.05	0.07	0.08	0.10	0.12	0.14	0.15	0.17
	36	0.03	0.05	0.06	0.08	0.10	0.11	0.13	0.14	0.16
	38	0.03	0.05	0.06	0.08	0.09	0.11	0.12	0.14	0.15
	40	0.03	0.04	0.06	0.07	0.09	0.10	0.12	0.13	0.14
	42	0.03	0.04	0.06	0.07	0.08	0.10	0.11	0.12	0.14
	44	0.03	0.04	0.05	0.07	0.08	0.09	0.11	0.12	0.13
	46	0.03	0.04	0.05	0.06	0.08	0.09	0.10	0.11	0.13
	48	0.02	0.04	0.05	0.06	0.07	0.08	0.10	0.11	0.12
	50	0.02	0.03	0.05	0.06	0.07	0.08	0.09	0.10	0.12
52	0.02	0.03	0.04	0.06	0.07	0.08	0.09	0.10	0.11	
54	0.02	0.03	0.04	0.05	0.06	0.07	0.09	0.10	0.11	
56	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09	0.10	
58	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09	0.10	
60	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09	0.10	

Drip Tape Application Rate

gpm/100 ft. to in/hr

$$\left[\begin{array}{c} \text{Application Rate} \\ \text{(in/hr)} \end{array} \right] = \left[\begin{array}{c} \text{Drip tape discharge} \\ \text{rate (gpm/100 ft.)} \end{array} \right] \div \left[\begin{array}{c} \text{Spacing between drip} \\ \text{tape laterals (ft)} \end{array} \right] \times 0.963$$

Application Rate (in/hr) of Drip Tapes

Row Spacing (in)	Drip Tape Discharge Rate (gpm/100 ft.)								
	0.1	0.15	0.2	0.25	0.3	0.35	0.4	0.45	0.5
12	0.10	0.14	0.19	0.24	0.29	0.34	0.39	0.43	0.48
14	0.08	0.12	0.17	0.21	0.25	0.29	0.33	0.37	0.41
16	0.07	0.11	0.14	0.18	0.22	0.25	0.29	0.33	0.36
18	0.06	0.10	0.13	0.16	0.19	0.22	0.26	0.29	0.32
20	0.06	0.09	0.12	0.14	0.17	0.20	0.23	0.26	0.29
22	0.05	0.08	0.11	0.13	0.16	0.18	0.21	0.24	0.26
24	0.05	0.07	0.10	0.12	0.14	0.17	0.19	0.22	0.24
26	0.04	0.07	0.09	0.11	0.13	0.16	0.18	0.20	0.22
28	0.04	0.06	0.08	0.10	0.12	0.14	0.17	0.19	0.21
30	0.04	0.06	0.08	0.10	0.12	0.13	0.15	0.17	0.19
32	0.04	0.05	0.07	0.09	0.11	0.13	0.14	0.16	0.18
34	0.03	0.05	0.07	0.08	0.10	0.12	0.14	0.15	0.17
36	0.03	0.05	0.06	0.08	0.10	0.11	0.13	0.14	0.16
38	0.03	0.05	0.06	0.08	0.09	0.11	0.12	0.14	0.15
40	0.03	0.04	0.06	0.07	0.09	0.10	0.12	0.13	0.14
42	0.03	0.04	0.06	0.07	0.08	0.10	0.11	0.12	0.14
44	0.03	0.04	0.05	0.07	0.08	0.09	0.11	0.12	0.13
46	0.03	0.04	0.05	0.06	0.08	0.09	0.10	0.11	0.13
48	0.02	0.04	0.05	0.06	0.07	0.08	0.10	0.11	0.12
50	0.02	0.03	0.05	0.06	0.07	0.08	0.09	0.10	0.12
52	0.02	0.03	0.04	0.06	0.07	0.08	0.09	0.10	0.11
54	0.02	0.03	0.04	0.05	0.06	0.07	0.09	0.10	0.11
56	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09	0.10
58	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09	0.10
60	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09	0.10

As long as pressure stays constant, application rate will stay the same.

Injection Through Drip Irrigation Systems



Injection Through Drip Irrigation Systems

What do you need to know?

1. Flow rate of irrigation system (often in gal/min).



Injection Through Drip Irrigation Systems

What do you need to know?

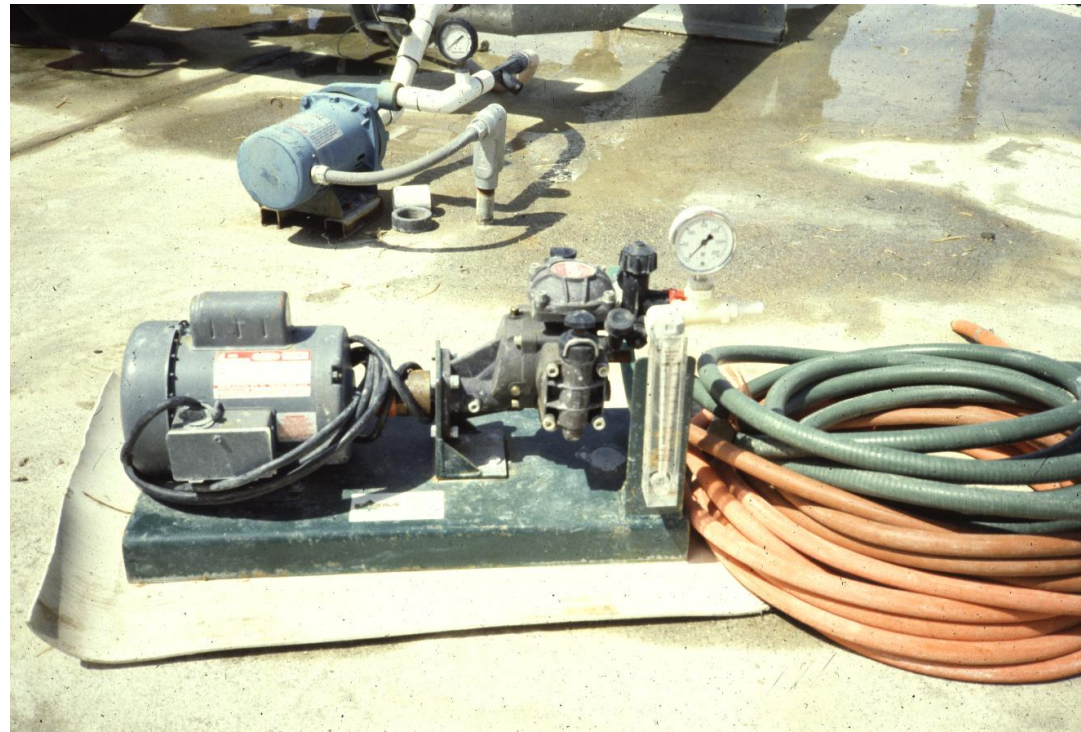
1. Flow rate of irrigation system (often in gal/min).
 - Especially important when concerned about concentration (ppm).



Injection Through Drip Irrigation Systems

What do you need to know?

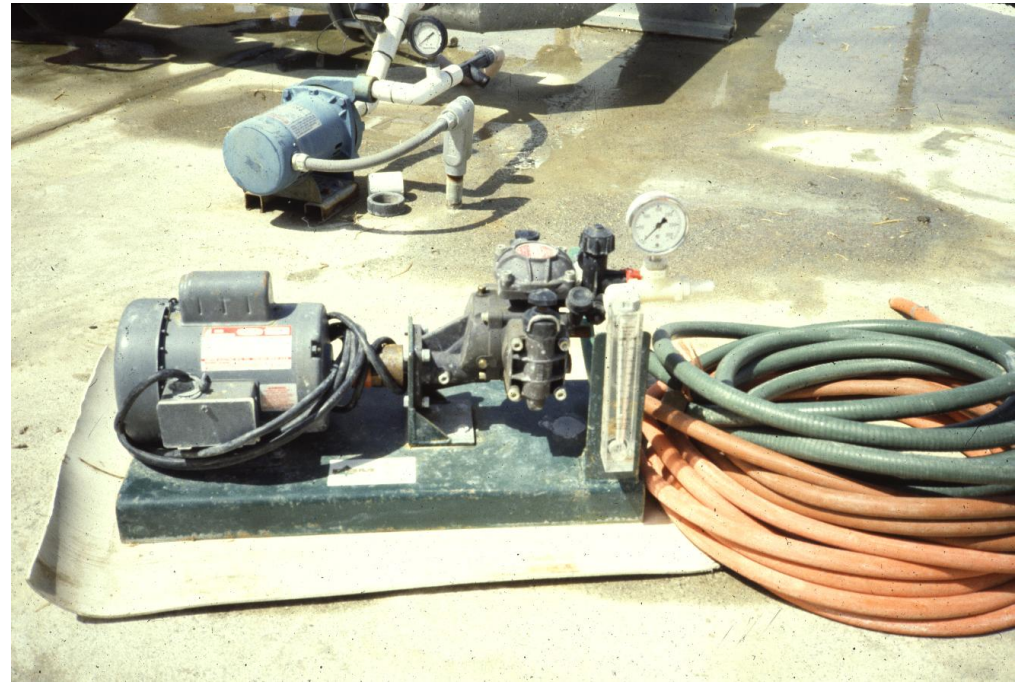
1. Flow rate of irrigation system (often in gal/min).
2. Injection rate (often in gal/hr).



Injection Through Drip Irrigation Systems

What do you need to know?

1. Flow rate of irrigation system (often in gal/min).
2. Injection rate (often in gal/hr).
 - Always important, but especially when concerned about concentration.

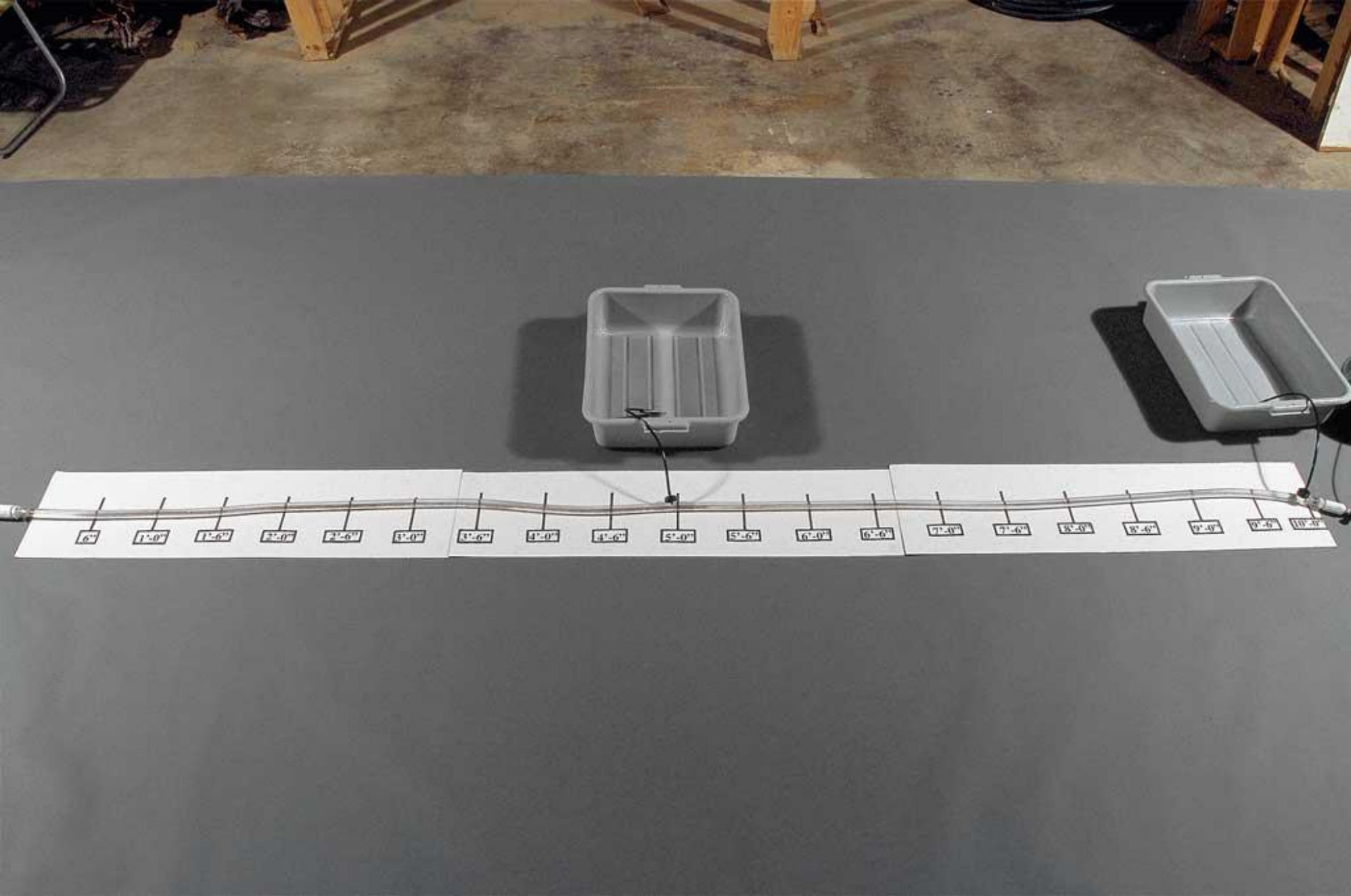


Injection Through Drip Irrigation Systems

What do you need to know?

1. Flow rate of irrigation system (often in gal/min).
2. Injection rate (often in gal/hr).
3. Travel time of chemical through the irrigation system.





0'-0"

1'-0"

2'-0"

3'-0"

4'-0"

5'-0"

6'-0"

7'-0"

8'-0"

9'-0"

10'-0"

11'-0"

12'-0"

1'-6"

2'-6"

3'-6"

4'-6"

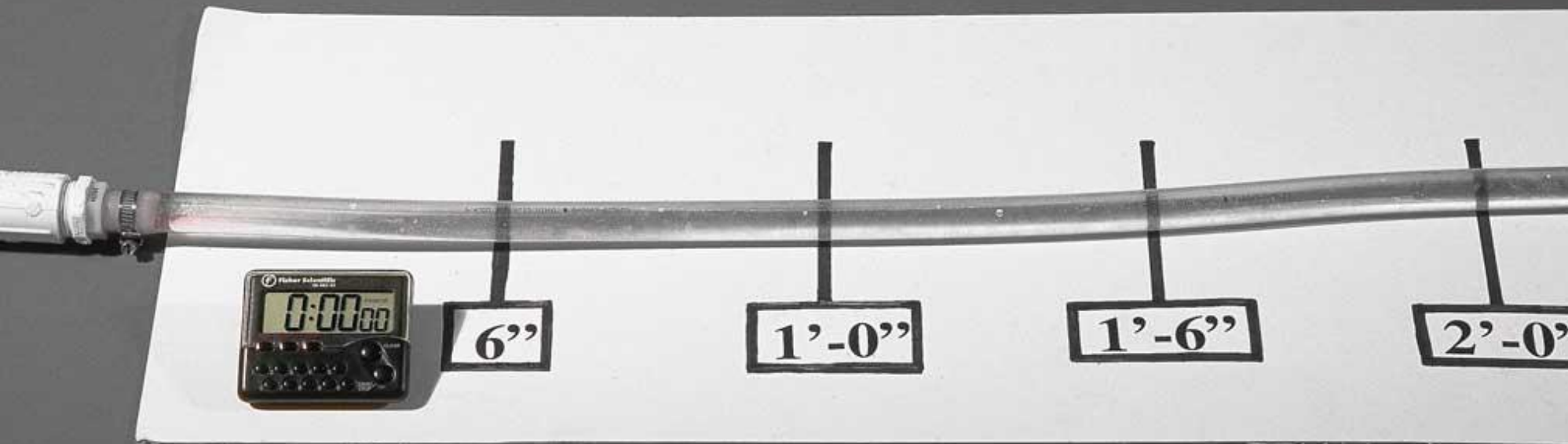
5'-6"

6'-6"

7'-6"

8'-6"

0:00 00



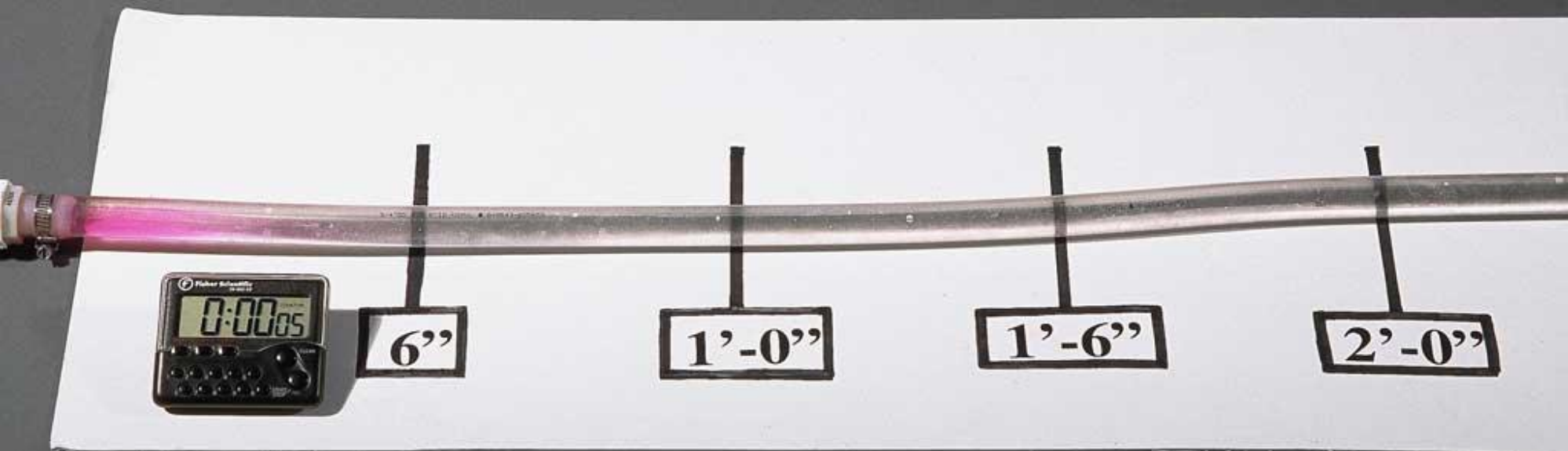
6"

1'-0"

1'-6"

2'-0"

0:00 05



6"

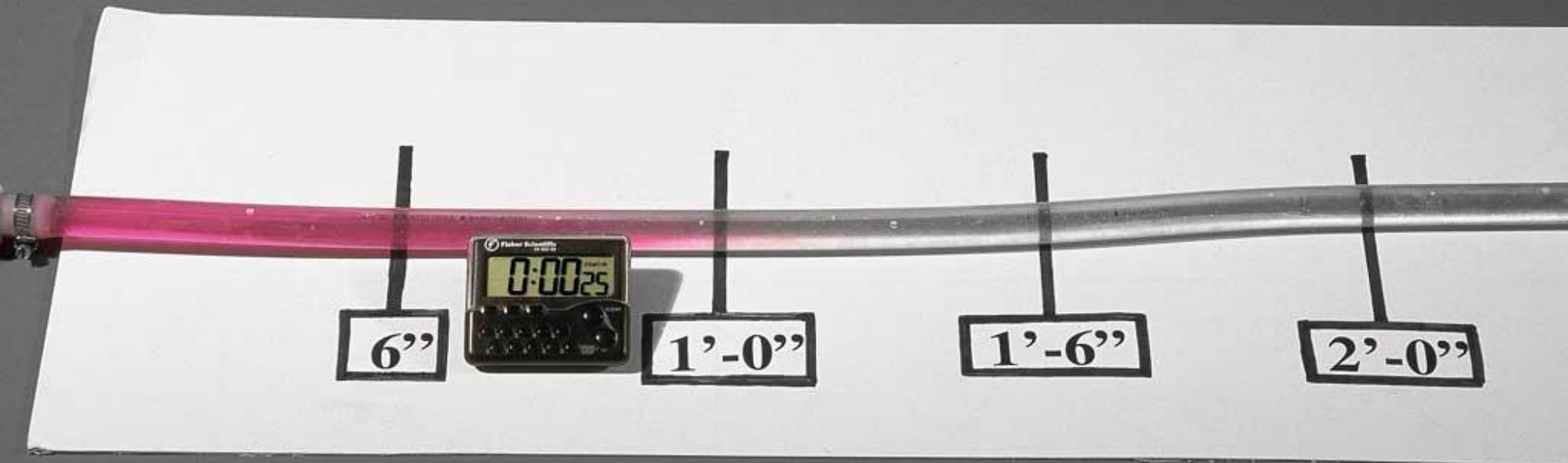
1'-0"

1'-6"

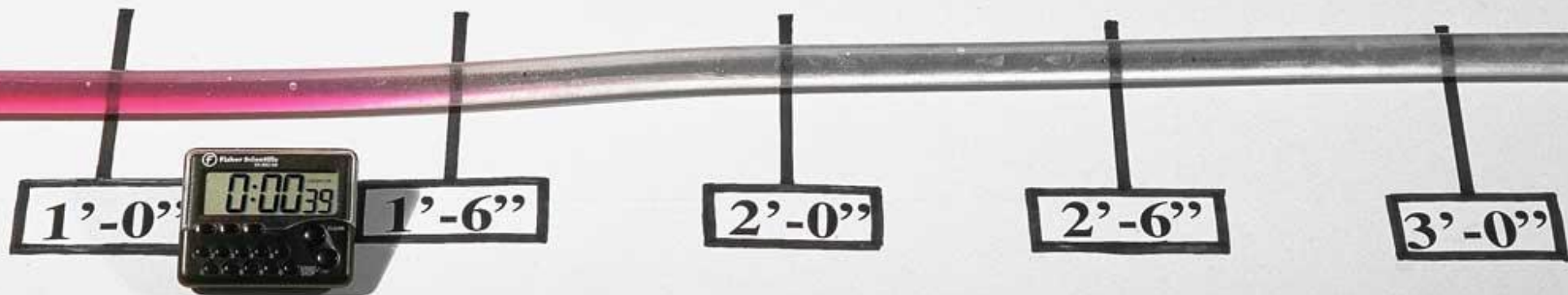
2'-0"

0:00 05

0:00 25



0:00 39



0:00 49



1'-0"

1'-6"

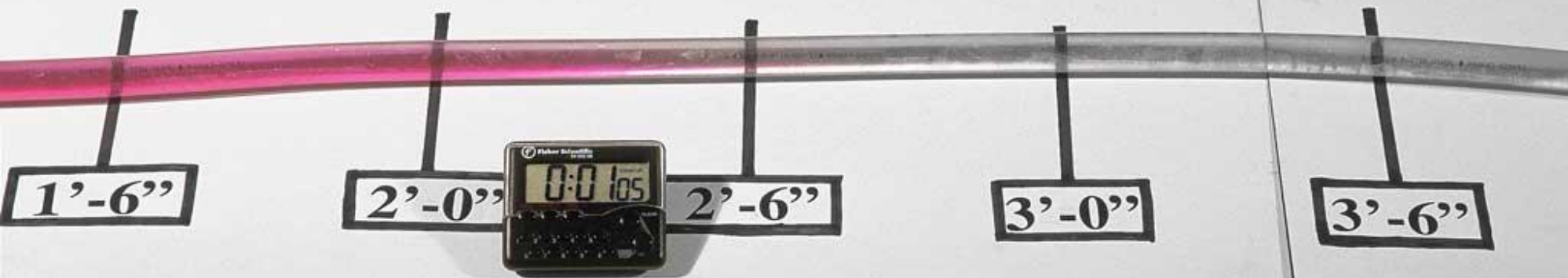
0:00 49

2'-0"

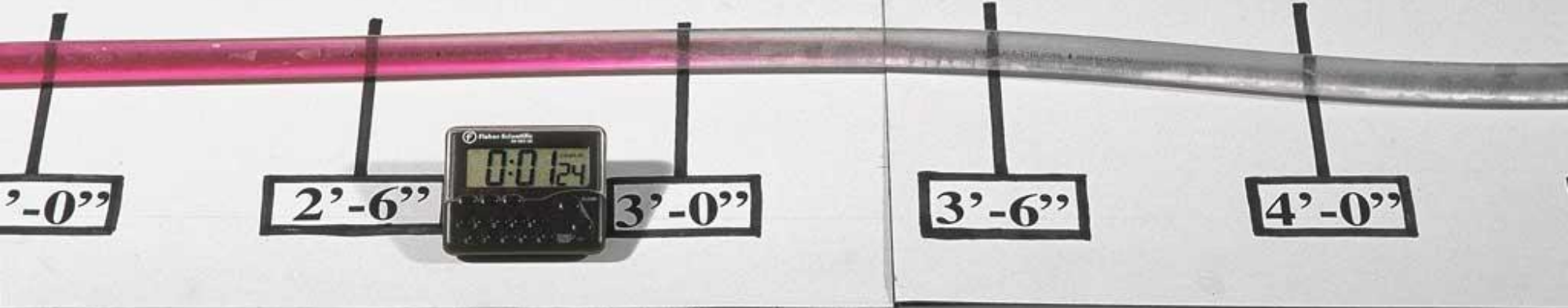
2'-6"

3'-0"

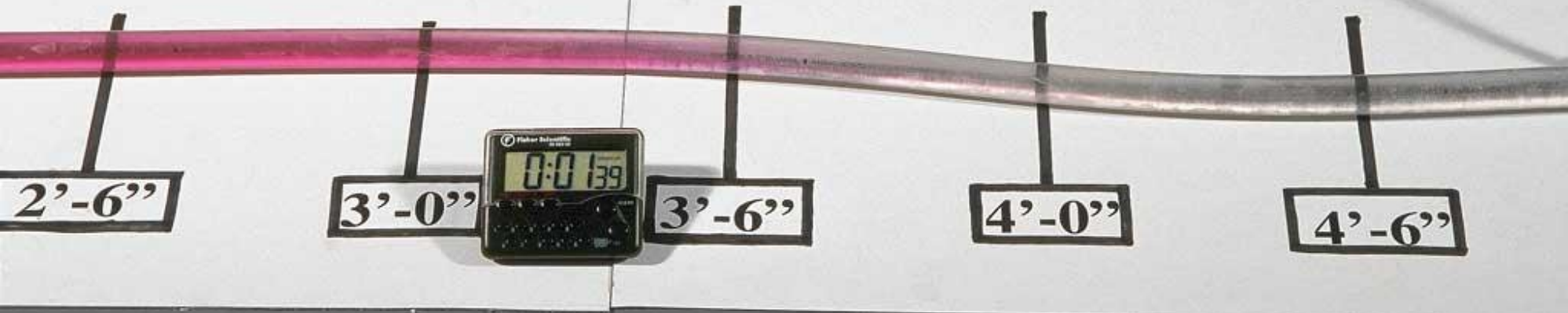
0:01 05



0:01 24



0:01 39



2'-6"

3'-0"

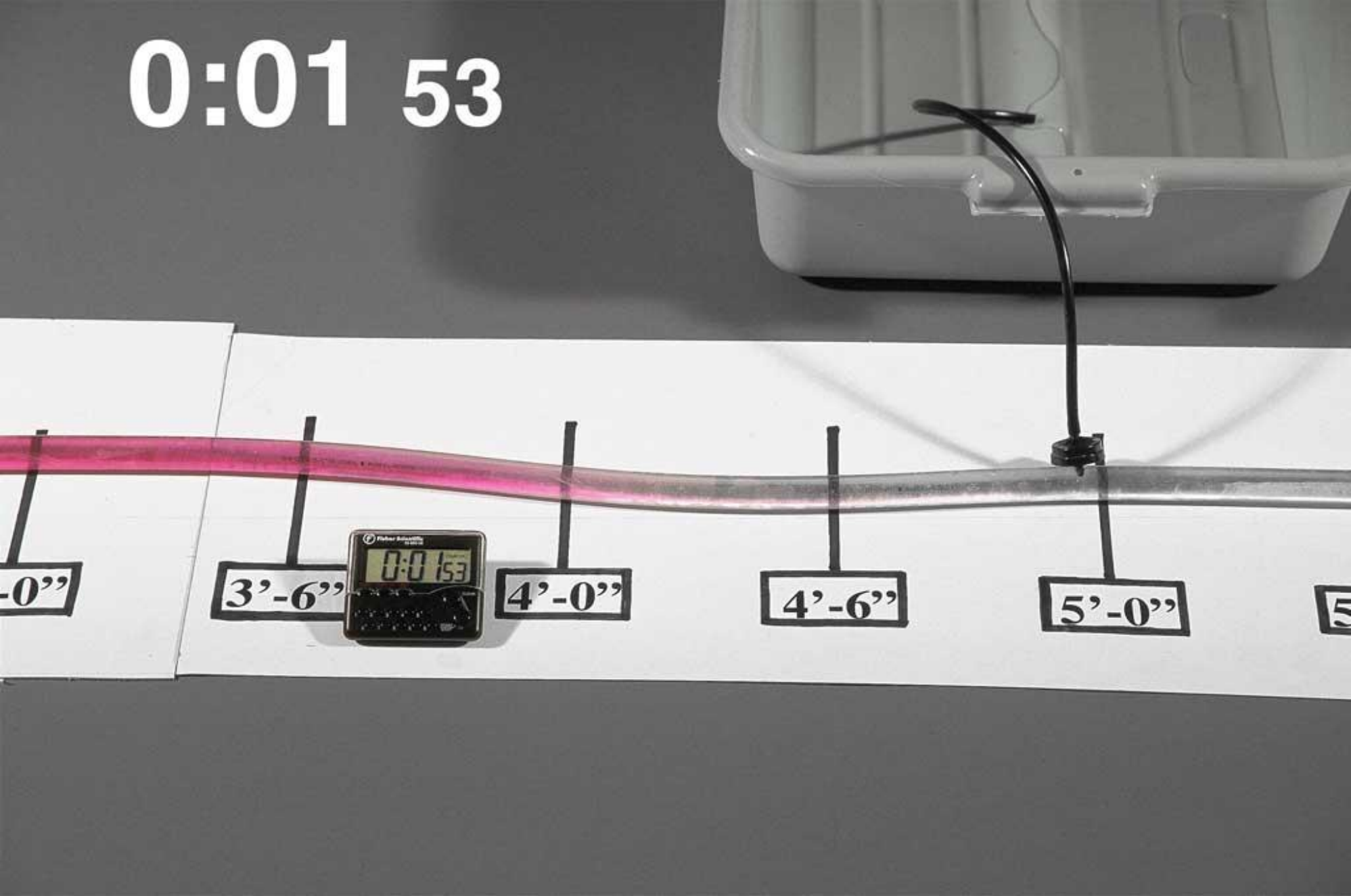


3'-6"

4'-0"

4'-6"

0:01 53



-0"

3'-6"



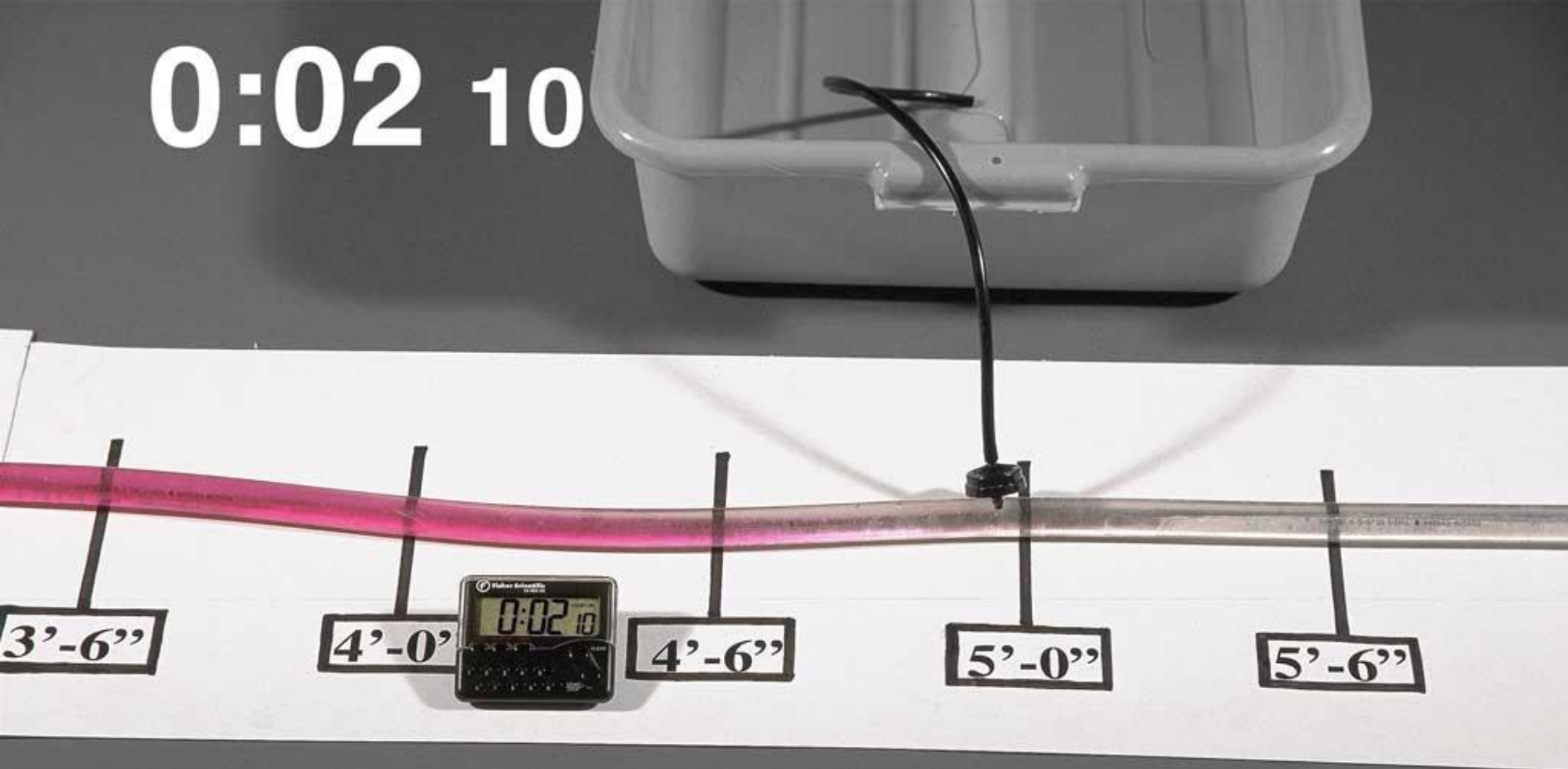
4'-0"

4'-6"

5'-0"

5'

0:02 10



3'-6"

4'-0"

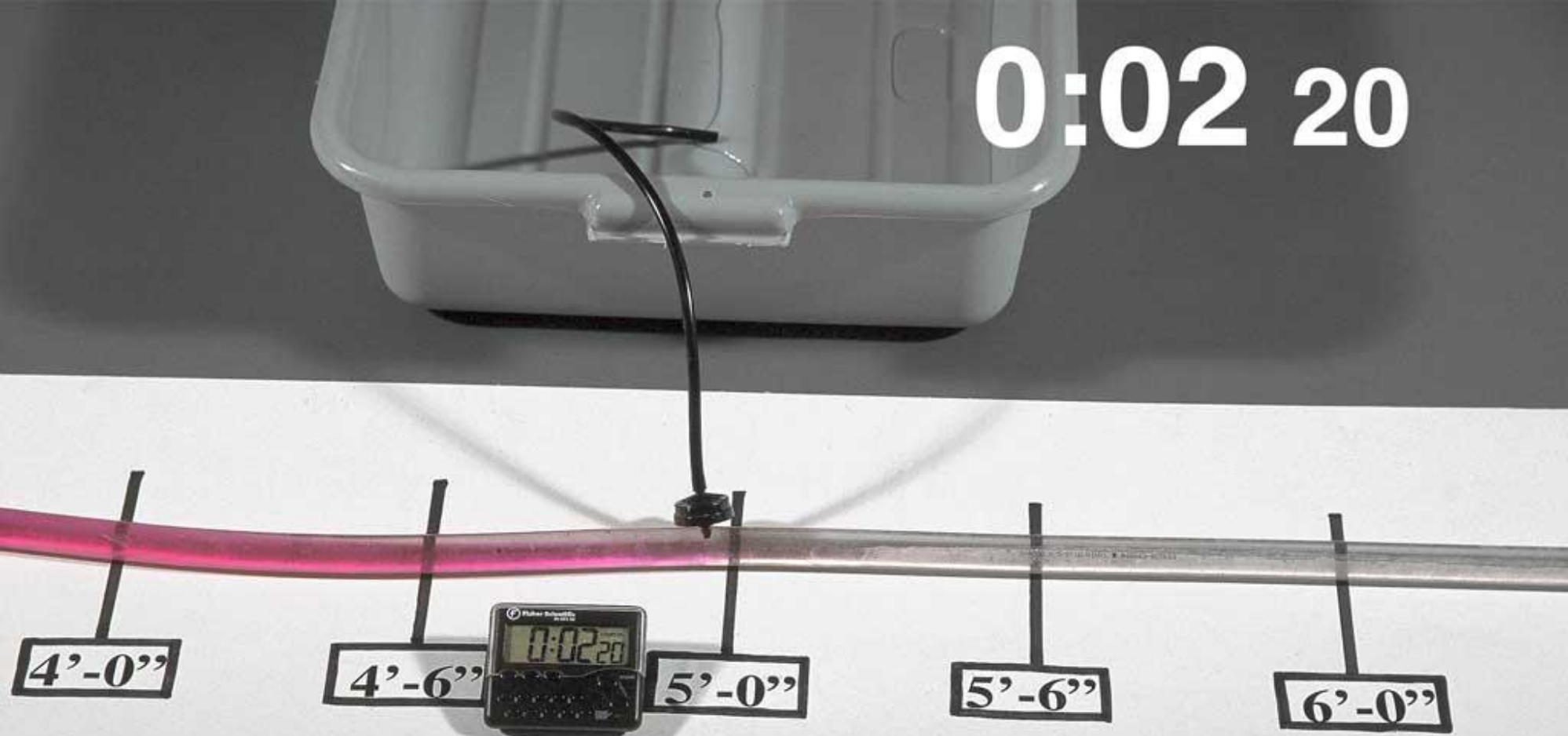
4'-6"

5'-0"

5'-6"



0:02 20



4'-0"

4'-6"

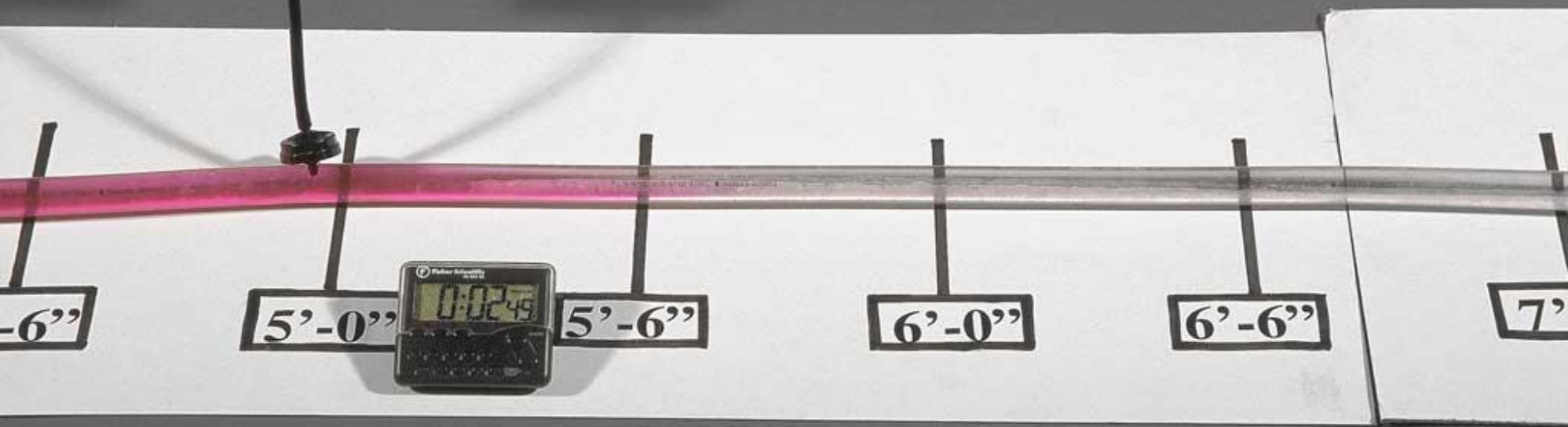
0:02 20

5'-0"

5'-6"

6'-0"

0:02 49



-6"

5'-0"

5'-6"

6'-0"

6'-6"

7'

0:03 39

5'-6"

6'-0"



6'-6"

7'-0"

7'-6"

0:04 11

6'-0"

6'-6"



7'-0"

7'-6"

8'-0"

0:04 42

6'-6"

7'-0"



7'-6"

8'-0"

8'-6"

0:05 10

7'-0"

7'-6"



8'-0"

8'-6"

9'-0"

0:05 44

7'-6"

8'-0"



8'-6"

9'-0"

9'-6"

0:06 11



0:06 42



0:07 06

8'-0"

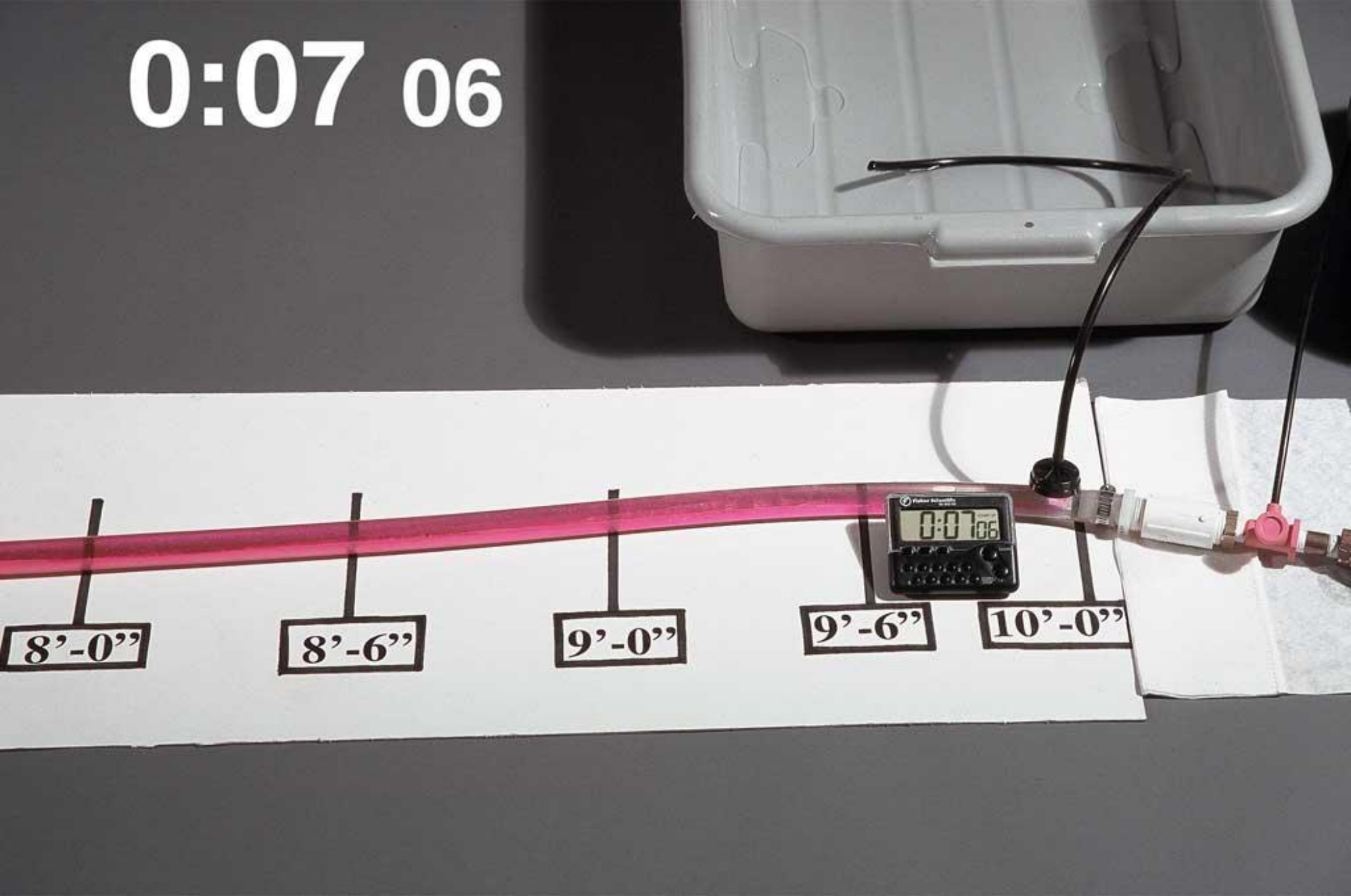
8'-6"

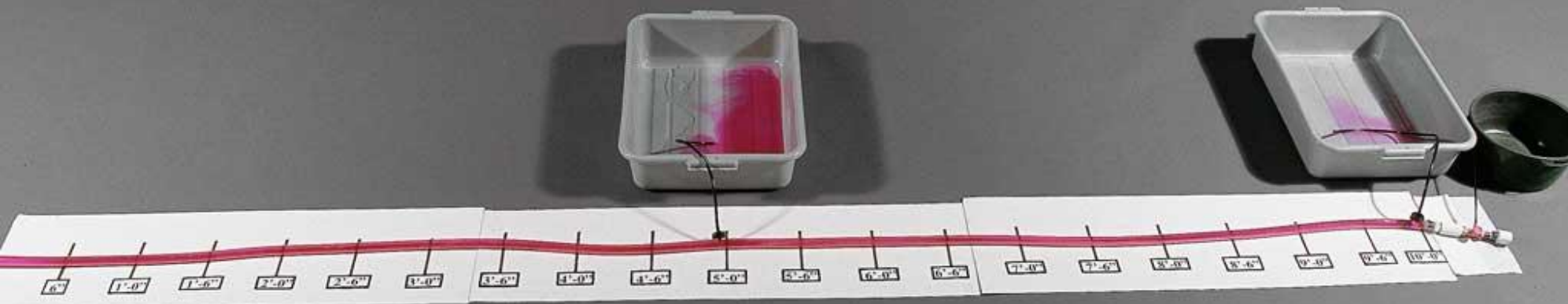
9'-0"

9'-6"

10'-0"

0:07 06





Uniform Chemigation

What happens when we stop the injection?

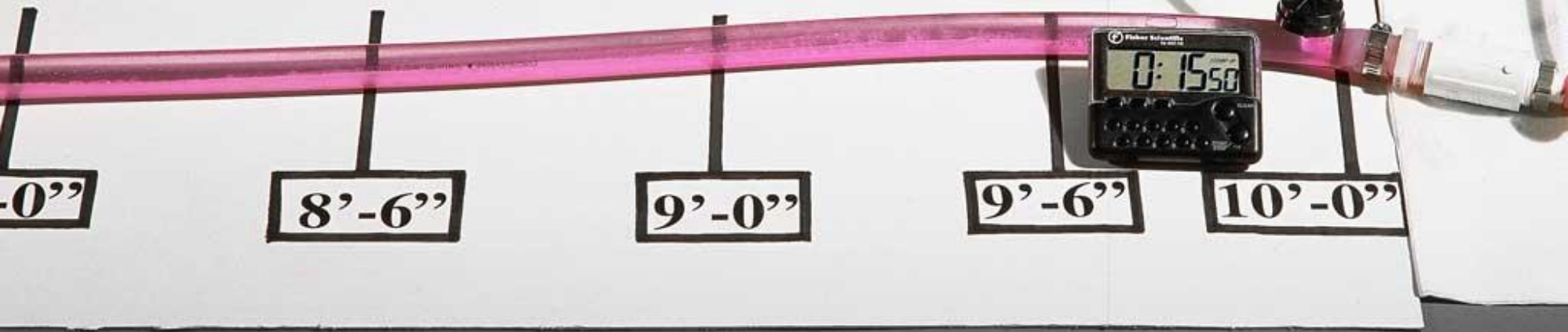
.

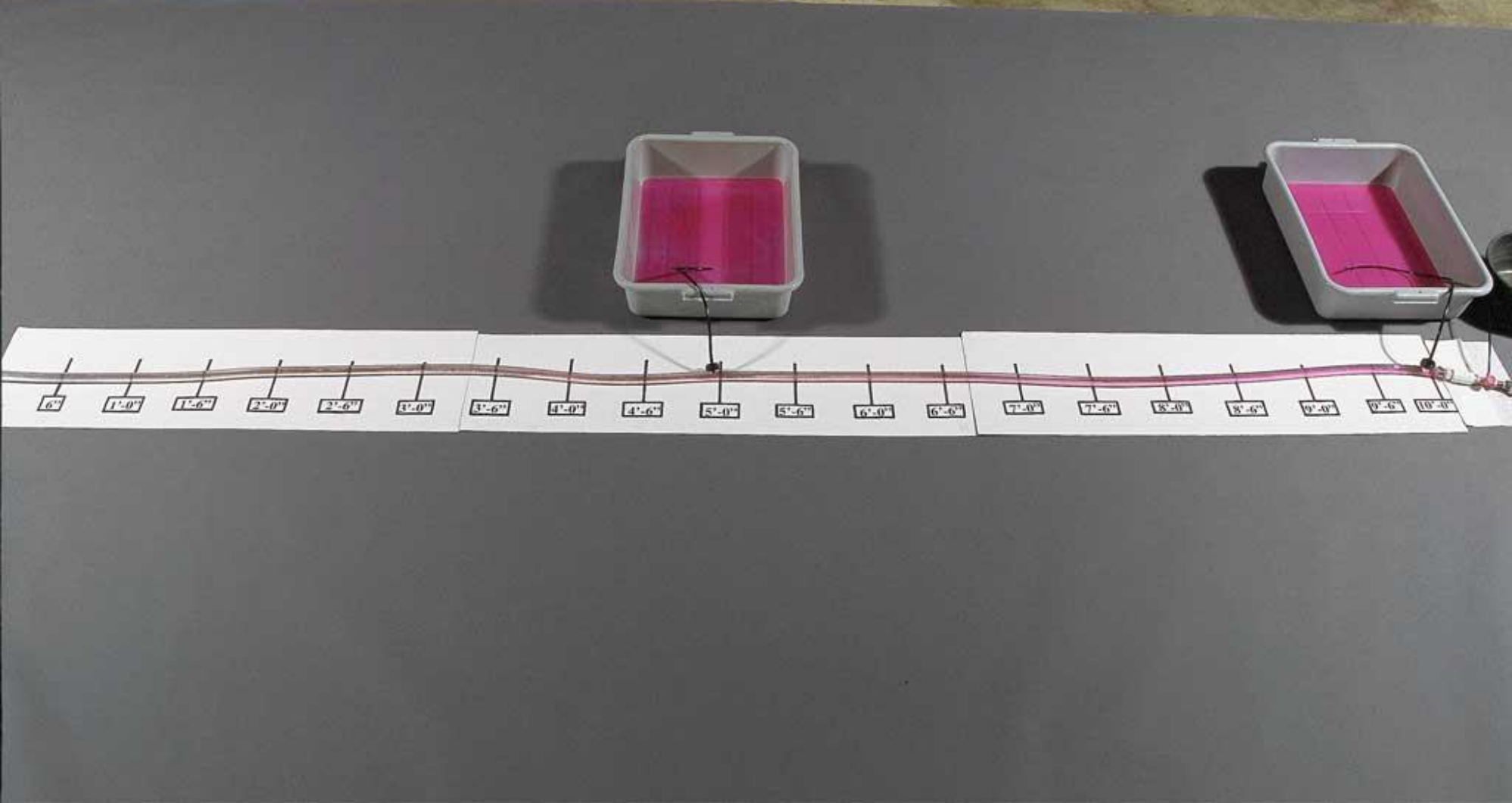
Uniform Chemigation

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.

0:15 50



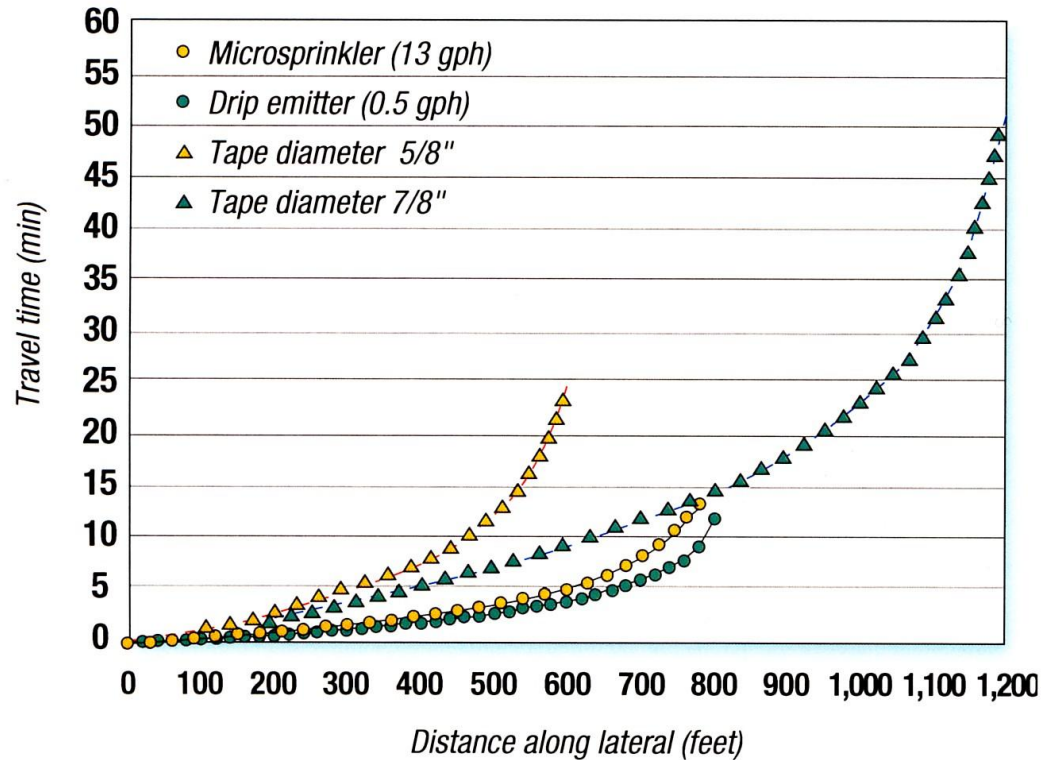


6" 1'-0" 1'-6" 2'-0" 2'-6" 3'-0" 3'-6" 4'-0" 4'-6" 5'-0" 5'-6" 6'-0" 6'-6" 7'-0" 7'-6" 8'-0" 8'-6" 9'-0" 9'-6" 10'-0"

Travel Times

Figure 4.

Travel times along drip lines for various drip line lengths, diameters, and emitter types.



Source: Fertilization with Microirrigation by Blaine Hanson, et al.

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.**
- **You can spot when chlorine reaches any point by testing the water with a pool/spa test kit. *Not so easy if drip is subsurface.***

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.

Always run clean water after an injection.

What NOT TO DO

- **Worst practice is to inject for a short period of time and then shut down the irrigation system.**

Questions?

Larry Schwankl

559-646-6569

e-mail: schwankl@uckac.edu

