Saga of Service Tubing

Kevin Waugh
Utility Solutions, Inc.
kevin@utility-solutions.com

Types of Service Tubing

- - Lead
- - Steel (Galvanized)
- - Copper
- - Polybutylene
- - PVC
- - HDPE (Polyethylene)
- - CPVC-Aluminum-CPVC
- - MUNICIPEX

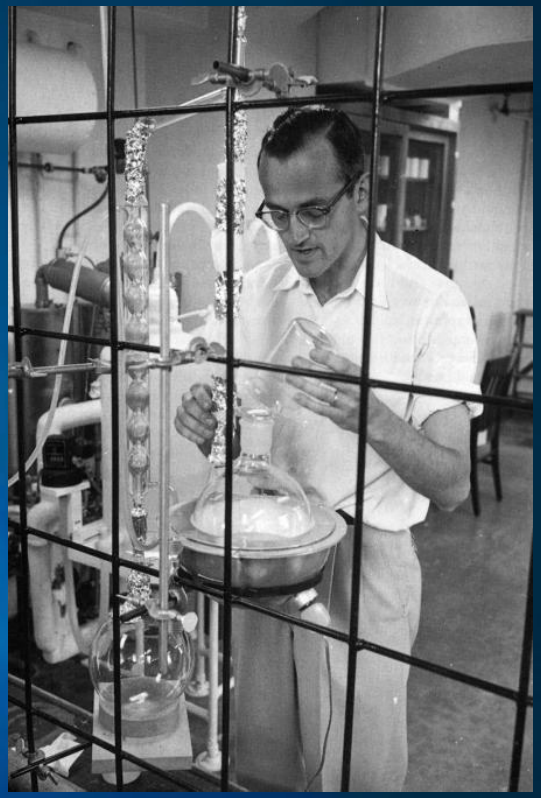
Lead Pipe

- - Latin *plumbum*
- Vitruvius, designer of aqueducts for Juilius Cesar stated that water from earthenware pipes was much more wholesome than from Lead pipes
- They knew there was health issues

- *CREDITS: Science Museum London*
- *http://www.sciencemuseum.org.uk/hommedia.ashx?id=9266&size=Large*

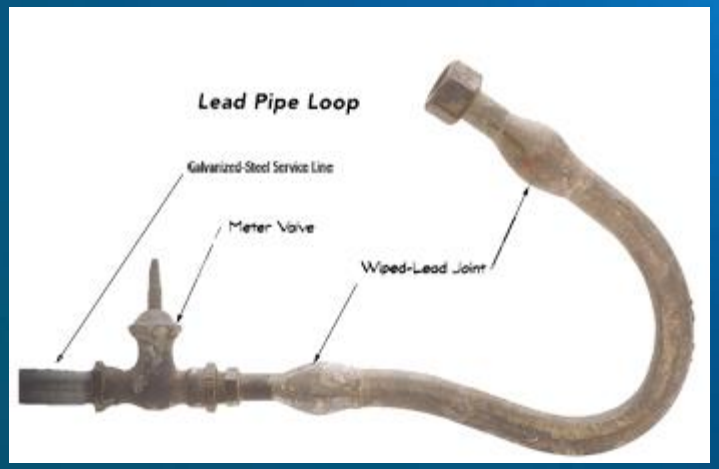
Lead in our Environment

- Geochemist Clair Patterson
- - Earth – how old?
- He sampled snow from the ice caps of Greenland and Antarctica that had fallen hundreds or thousands of years earlier, showing that there had been significant increases in lead in the Northern Hemisphere when the Greeks and Romans smelted lead in antiquity.
- - 100 times our ancestors
- - Tetra-ethyl lead (Gasoline)
- - Clean Air Act 1974
- 1976 – 100,000 tons/Missouri



History of Lead in USA

- Late 1800's we knew about lead poisoning
- 1900 - 70% of services were made from Lead Pipe
- 1920's - health over engineering.
- 1930's - LIA made an effective campaign to promote and prolong the use of lead pipe
- 1974 - Safe Drinking Water Act



Flint, Michigan

- Switching water sources changed the lead leaching rates

Flint Michigan

- - the city switched from purchasing treated Lake Huron water from Detroit, as it had done for 50 years, to treating water from the Flint River
- It was discovered that the high levels of lead were due to orthophosphate being omitted from the water treatment process
- The river water, which, due to higher chloride concentration, is more corrosive than the lake water, and was leaching lead from aging pipes

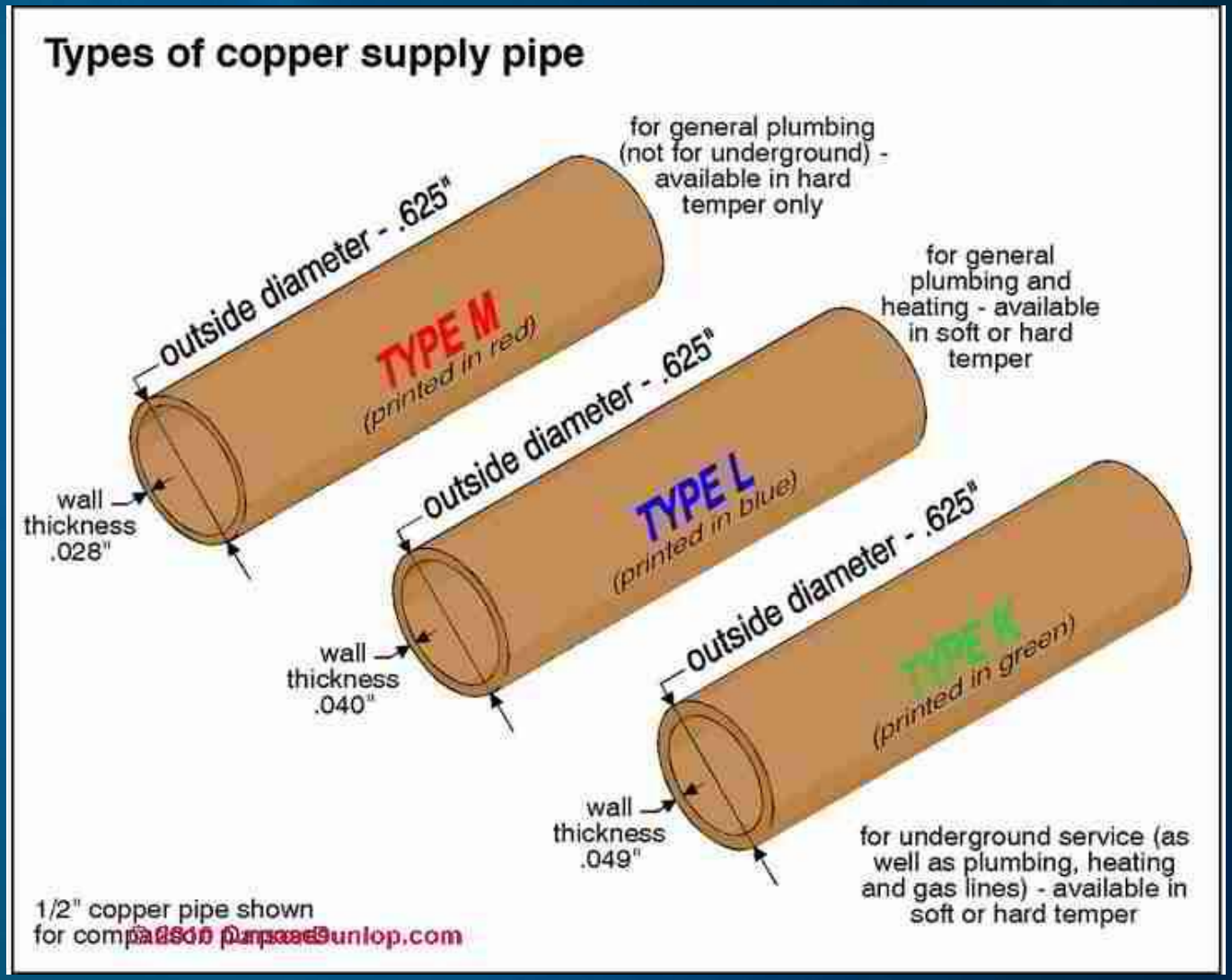
Steel (Galvanized)

- *Inexpensive*
- *Corrosion*
- *Lead and Tin*
- *Fresno 8/16/2016*

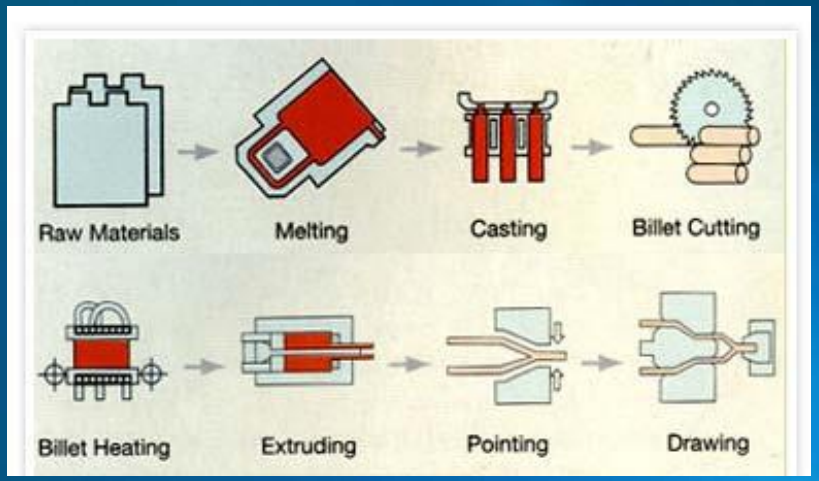
Copper Pipe

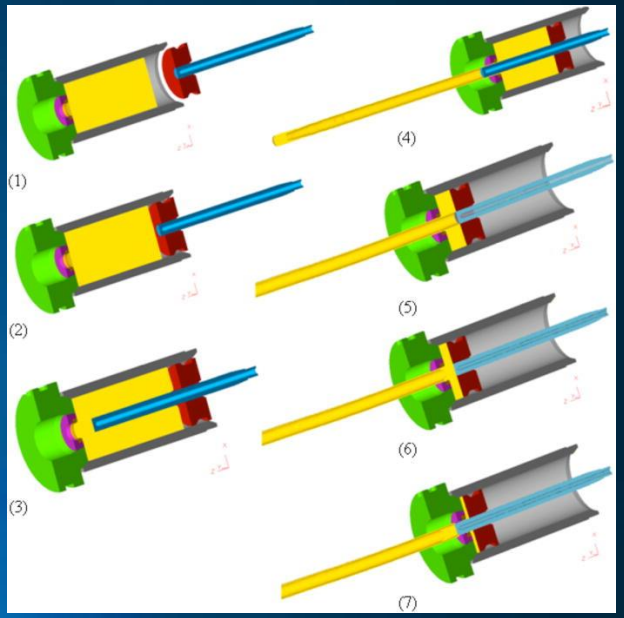
- CTS – Actual O.D. is +1/8”

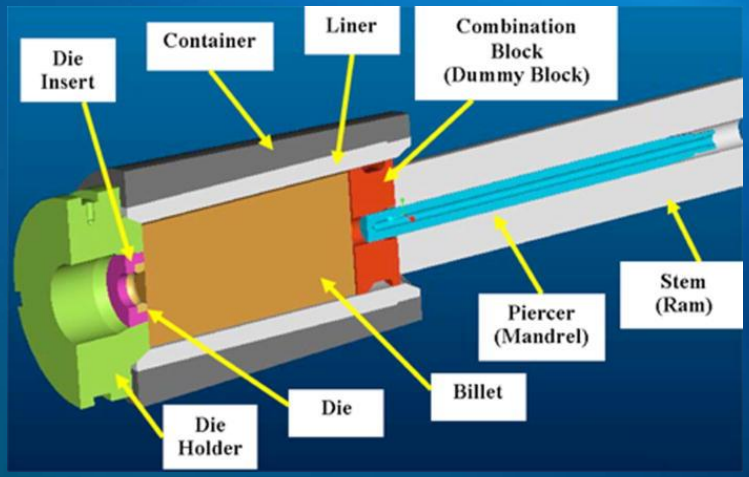
Common Types of Copper pipe



Copper Pipe Manufacturing

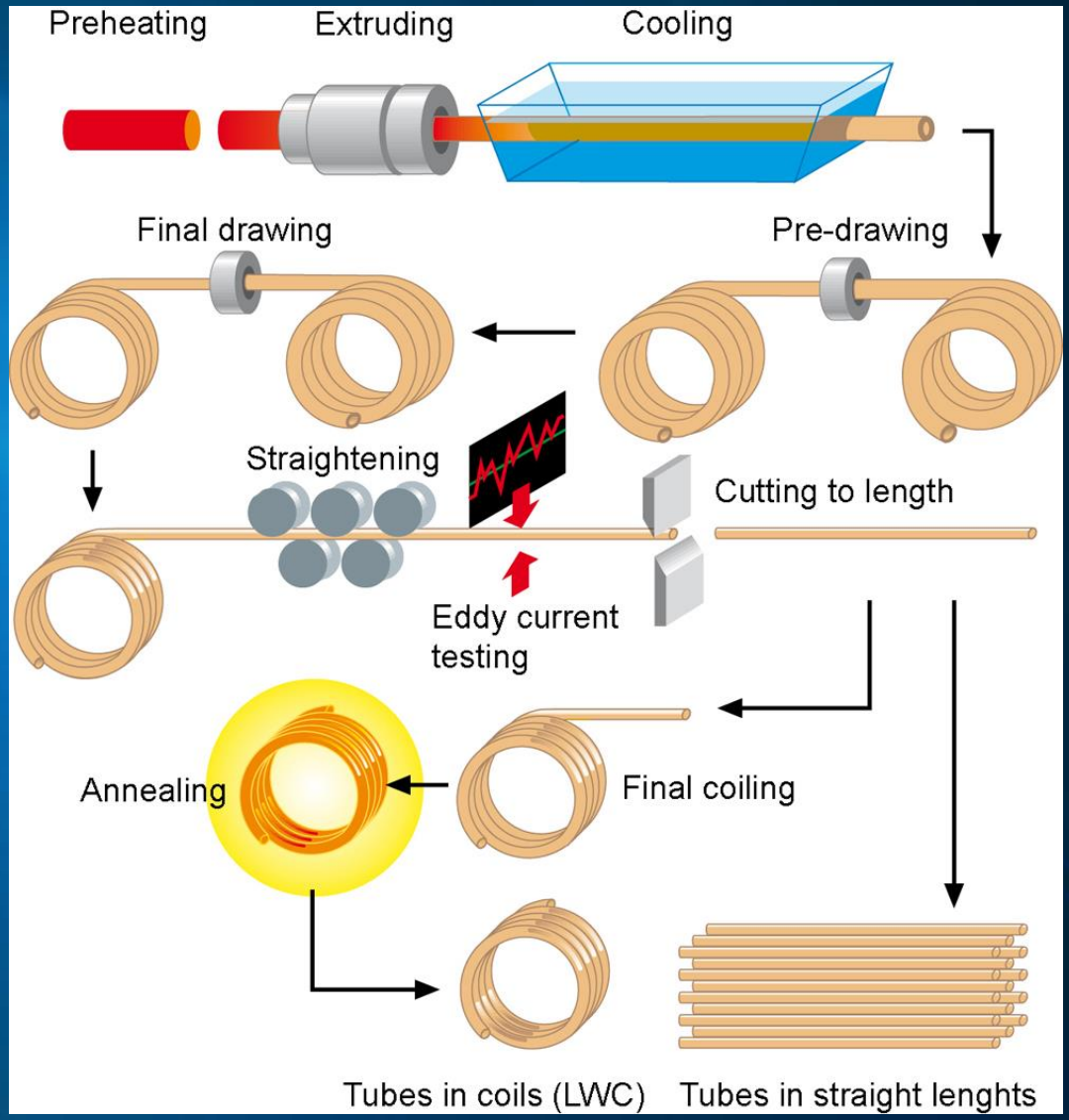






Soft vs Hard Copper

- Work Hardened
- Annealed
  - Recrystallization
  - Nitrogen Atmosphere



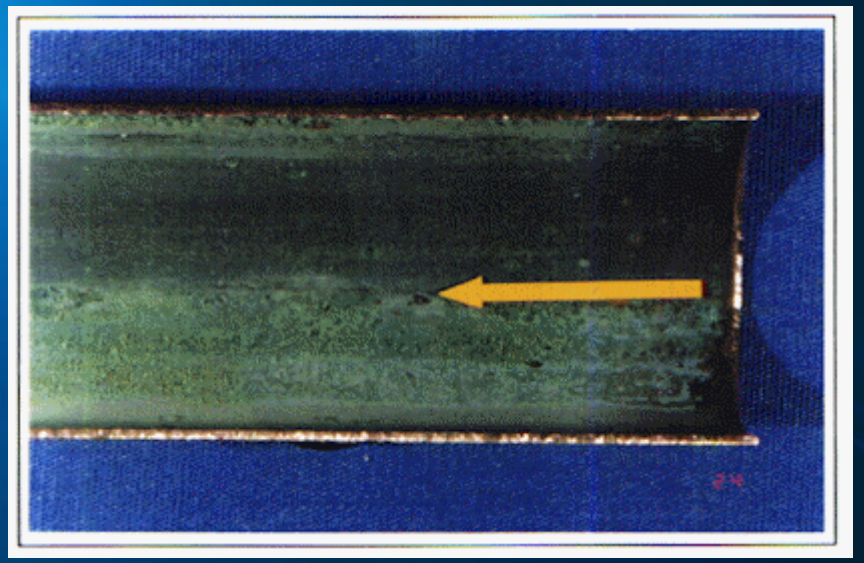
Production Lengths

- Soft
  - Coils
    - 40’, 60’, 100’
- Hard
  - Sticks
    - 10’, 20’

Copper Corrosion

- Cold Water Pitting

- Erosion Corrosion



What causes this?

External Corrosion

- Pinholes if pipe is improperly grounded
- Acid
- Salt

External Corrosion

- Pinholes if pipe is improperly grounded
- Acid
- Salt

- Solution:

Concerns with Copper

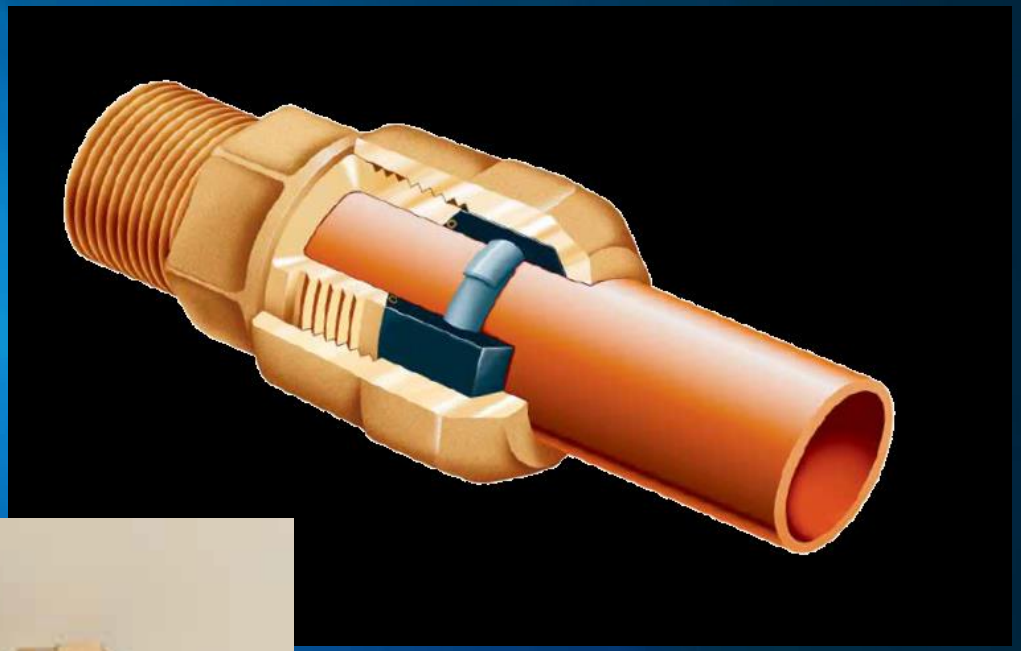
- Price Variability
- Waste
- Theft
- Weight

Connections to Copper Pipe

- Soft or Hard
  - Sweat
  - Compression
  - Pack Joint
- Soft Only
  - Flare

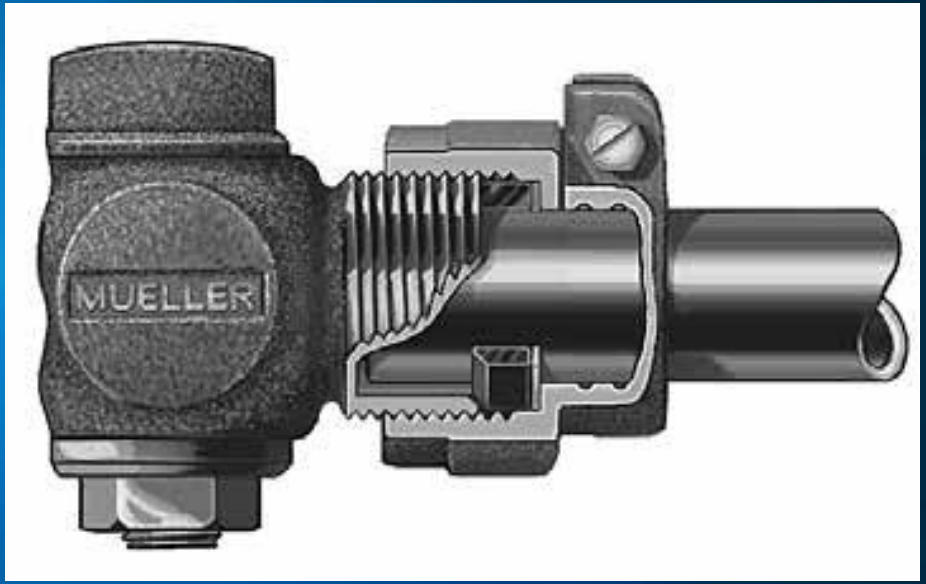
Compression Fittings

- CTS or IPS
- High Resistance to pull out
- Easy Installation
- Available for other pipe



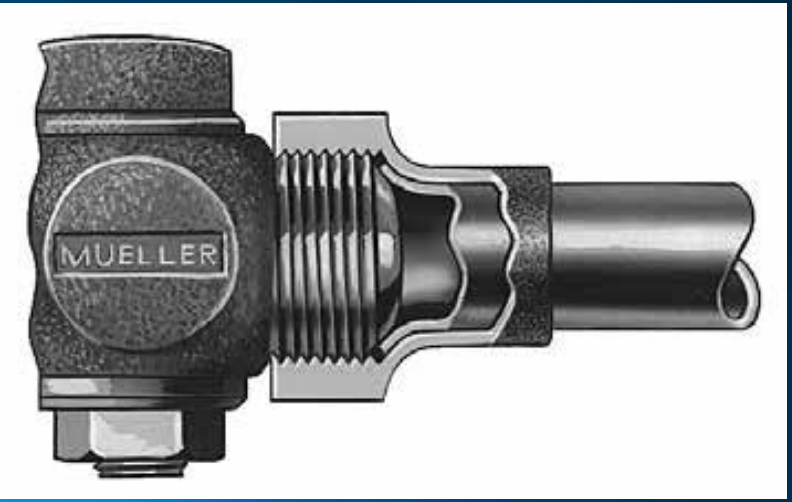
Pack Joint

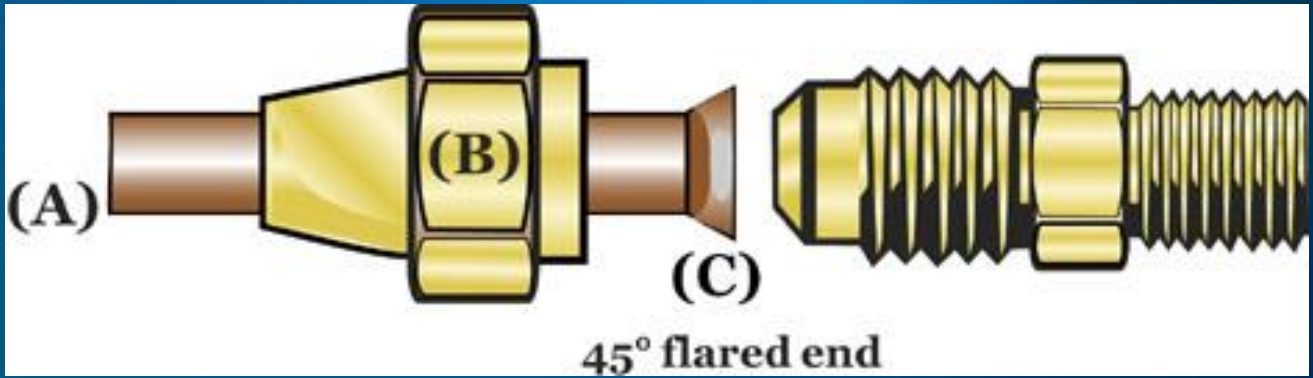
- What it says
- Different nuts
- Available for other pipe



Flare

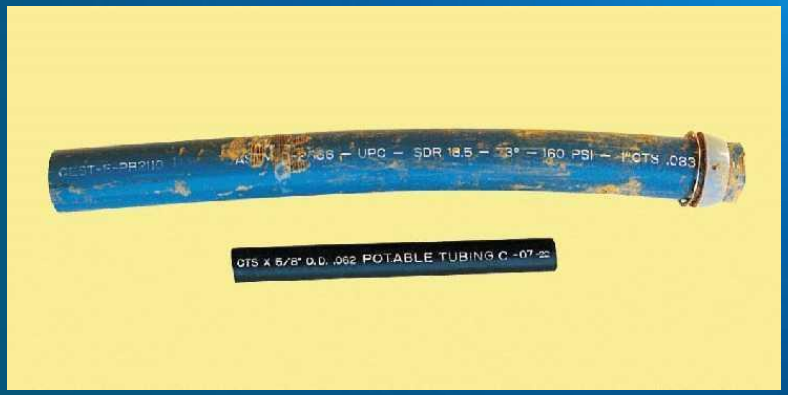
- Soft only
- Application Critical
  - Brakes, HVAC, Propane
- Skill & Time
- Appropriate tools





Polybutylene (PB)

- 1978-1995
- Low Cost
- Cox vs Shell Oil

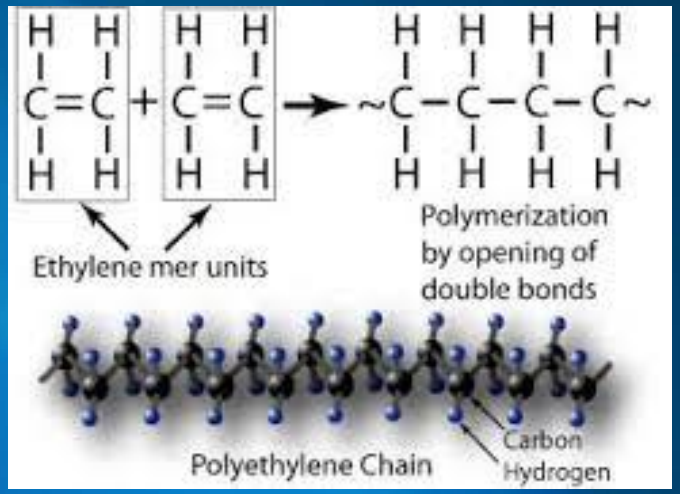


PVC (Polyvinyl Chloride)

- Schedule 40/80
  - 1” – 270 psi
  - 2” – 166 psi
- IPS
- Inexpensive

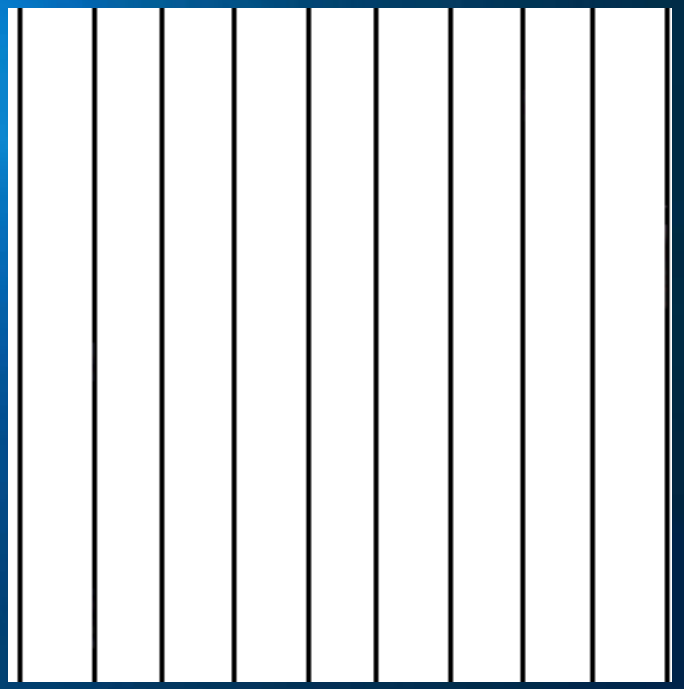
(HDPE) Polyethylene

- 1950's
- Petroleum derivative
- High impact
- 200-250 psi
- Carbon Black



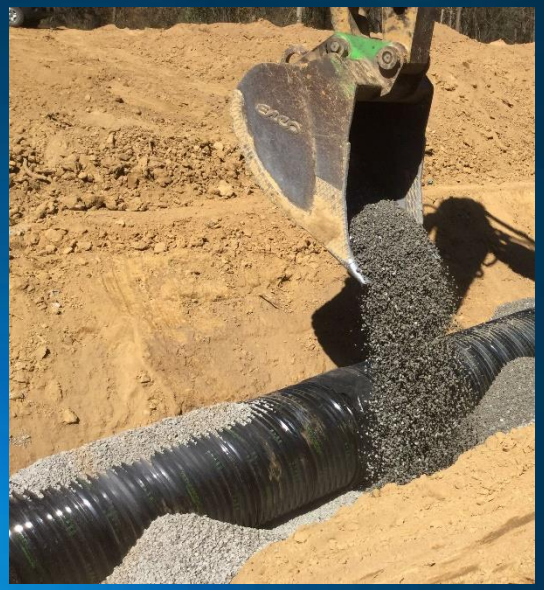
History of PE

- Orangeburg (3306)
- PE3408
- PE3608 (200 psi)
- PE4710 (250 psi)
  - Density
  - SCG



Failure Modes

- Minimum Radius
- Service Brass
- Temperature
- Backfill



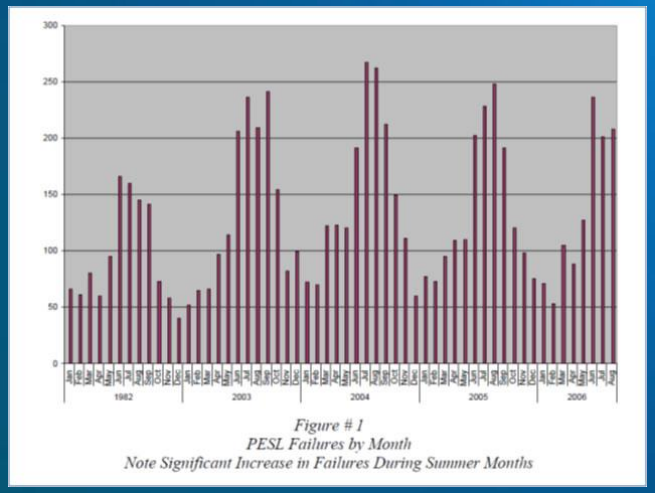
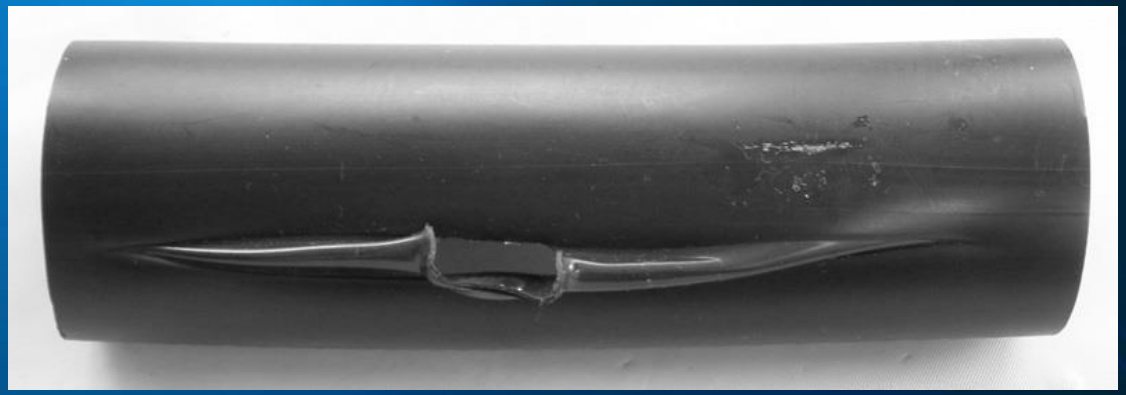
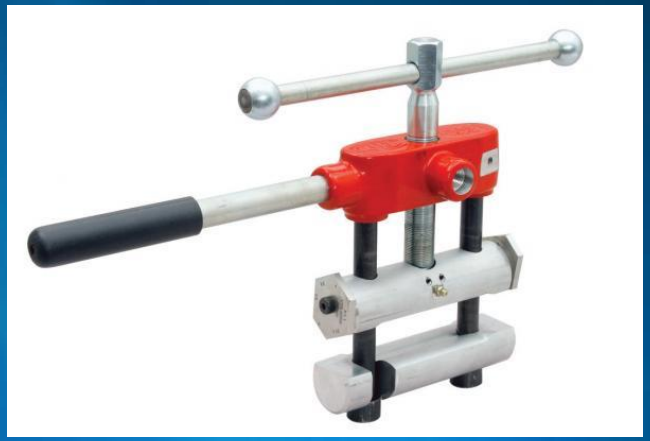


Figure # 1
PESL Failures by Month
Note Significant Increase in Failures During Summer Months



Crimping HDPE

- Once



HDPE Fittings

- Compression or Pack Joint
- Inserts

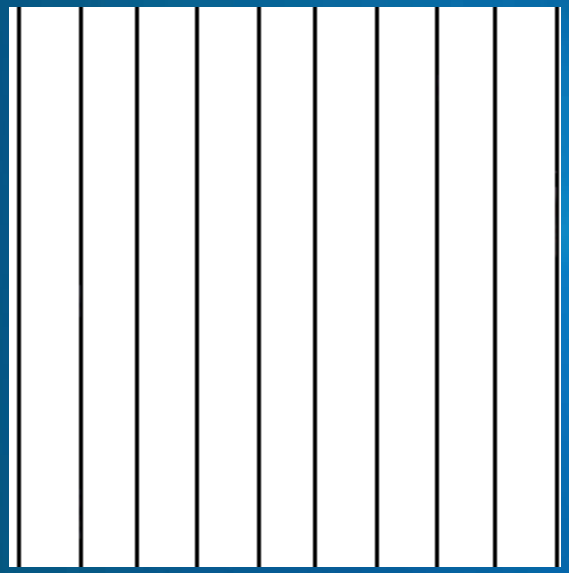
- Stab Fit
  - Bevel

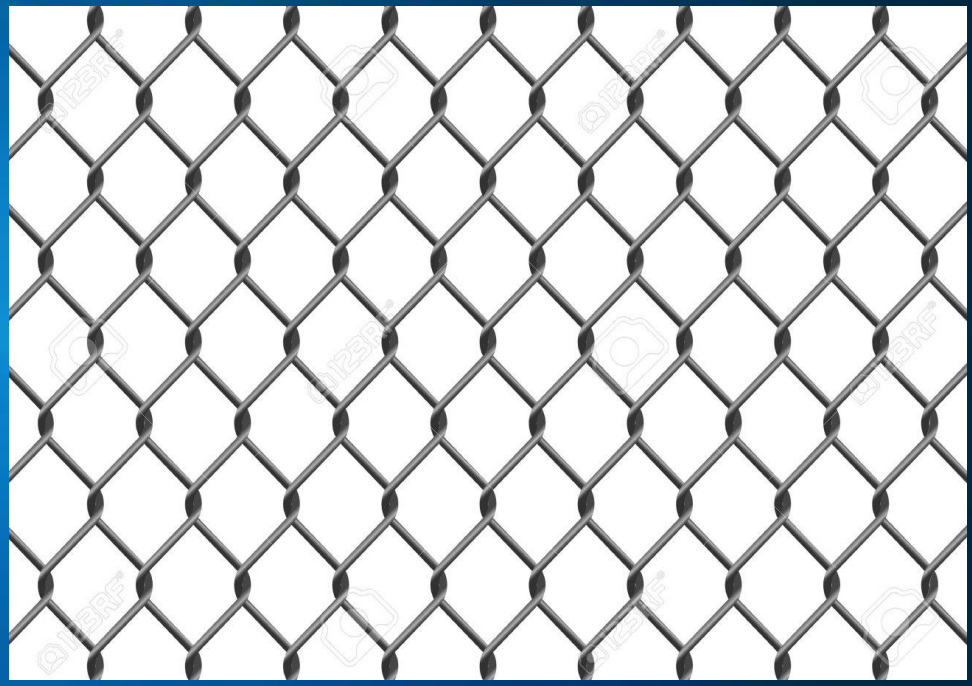
Composite Pipe

- Composite
- CPVC-AL-CPVC
- ¾” & 1” CTS
- 400 psi
- No longer available

PEX

- Polyethylene – Crosslinked





- Thermoplastic vs Thermoset/Thermoplastic

Thermoset/ Thermoplastic Composite Materials

- Strength
- Rigidity
- Dimensional Stability
- Do not Melt, Creep Expand, Contract

Examples: Unsaturated Polyesters, Vinyl Esters, Phenolics (Bakelite), Urethanes, Epoxies, Silicones, Urea, Crosslinked Polyethylene

- Irreversible Cure – Like Boiling an Egg

Difference types of PEXes

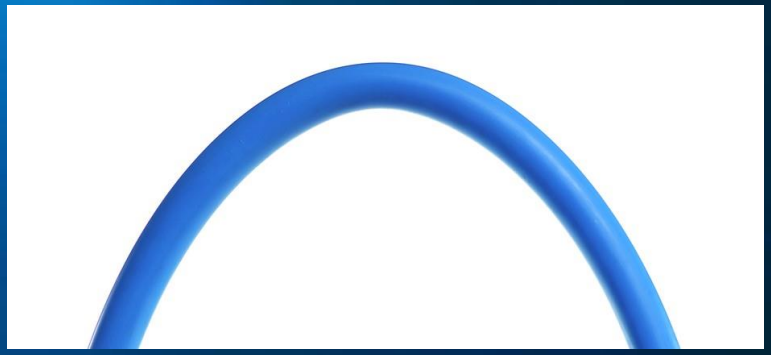
- PEXa – 85-90%
  - Bridge molecules

- PEXb – 65-70%
  - Bonding molecules

- PEXc – 70%-75%

MUNICIPEX

- 1990’s
- 200 psi
- ¾”, 1”, 1 ¼”, 1 ½”, 2” sizes
- CTS
- 5 to 1 bend ratio in all sizes
- Extended UV protection
- Resistance to slow growth crack
- Excellent corrosion resistance

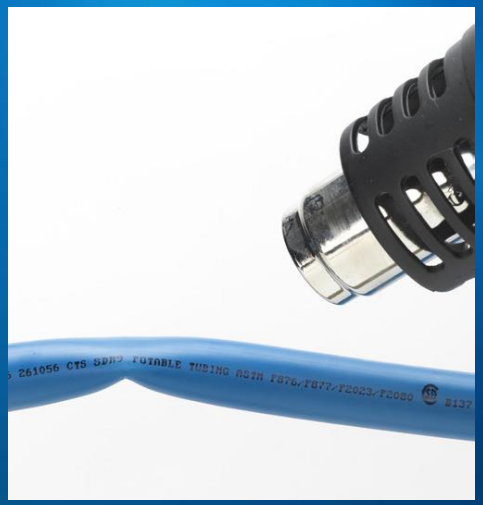


MUNICIPEX

- Increased Flexibility
- Superior kink resistance
- Resistant to corrosion and pitting
- Horizontal directional drilling

MUNICIPEX

- Ease of installation
- Significantly improved chlorine and chloramines resistance
- Cost savings in material and labor
- Can be installed in native soil
- Repair kinks without cutting
- Longer life



MUNICIPEX

- MUNICIPEX – Backfill
  - Native backfill
  - Resists gouges and scratches from rocks
  - Thanks to excellent resistance to slow crack growth (SGC), native backfill is often used
  - Saves time, material and money

HDPE pipe requires sand backfill in rocky soils

MUNICIPEX works with native backfill even in rocky soils

MUNICIPEX

- Material Advantages
  - MUNICIPEX doesn't oxidize, erode or scale
  - MUNICIPEX is more freeze resistant than metallic piping
  - Impact and drop damage resistance is better with MUNICIPEX
  - MUNICIPEX pipe isn't as much of a jobsite theft risk as metallic pipe

Viable Service Tubing options today

- - Copper
- - HDPE (Polyethylene)
- - MUNICIPEX - PEXa

HOPE YOU LEARNED SOMETHING NEW TODAY

- - QUESTIONS???