# How to Reduce Pressure Drop in Compressed Air Piping: Fittings & Design

David and Kevin King
Connecticut Compressor Systems
*Keynote Speakers*

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PDH Certificates will be e-mailed to attendees within 2 days

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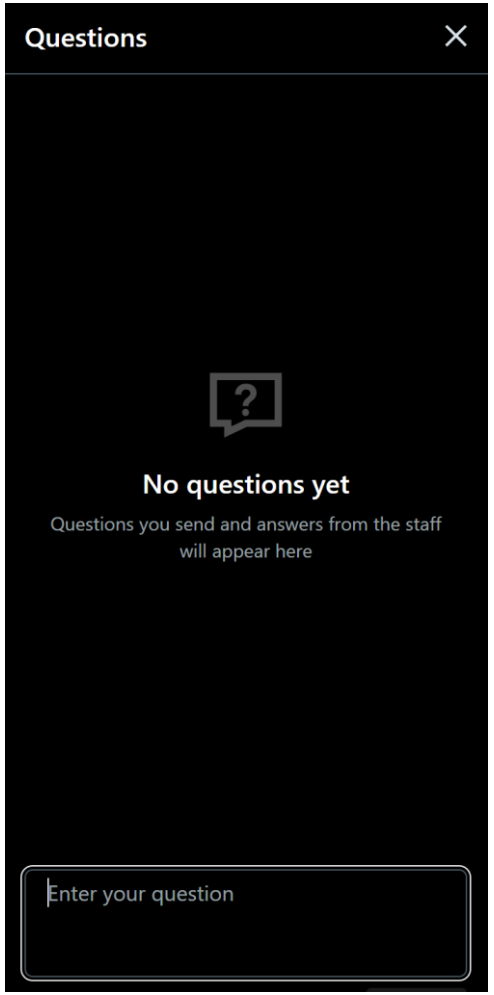
# Q&A Format




- Panelists will answer your questions during the Q&A session at the end of the Webinar.

- Please post your questions in the Questions Window in your GoToWebinar interface.

- Direct all questions to Compressed Air Best Practices® Magazine

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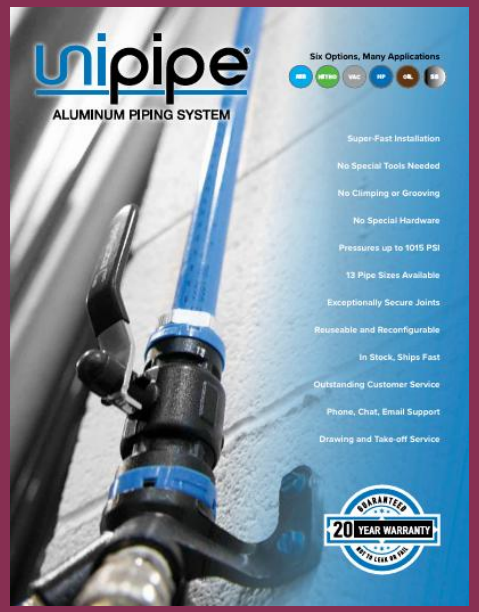
# Handouts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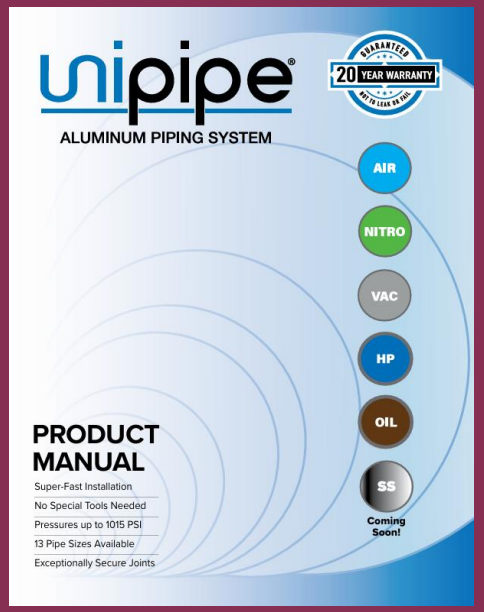
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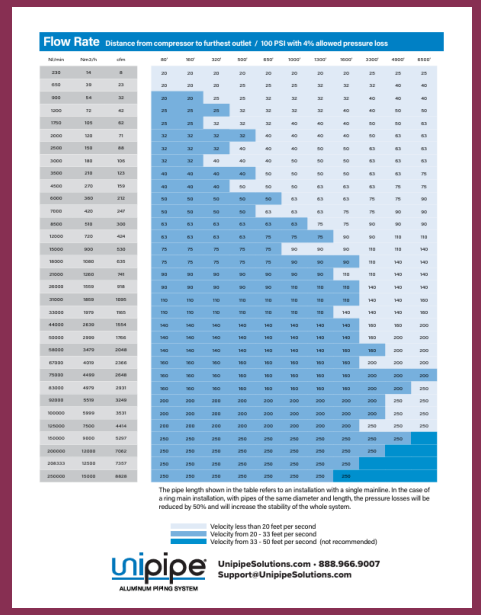
Flow Rate Distance from compressor to furthest outlet / 100 PSI with 4% allowed pressure loss
Velocity less than 20 feet per second
Velocity from 20 - 33 feet per second
Velocity from 33 - 50 feet per second (not recommended)
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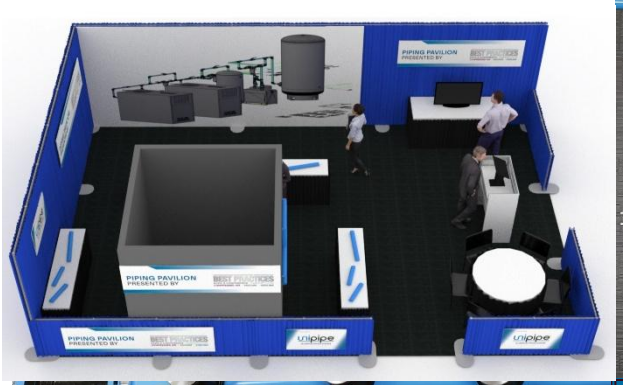

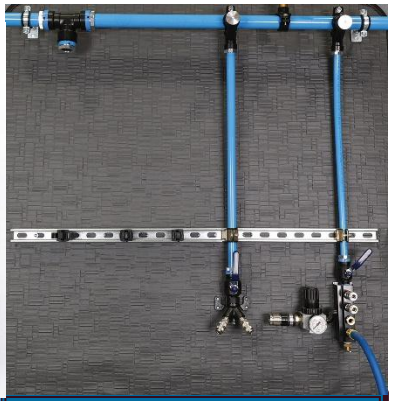

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# How to Reduce Pressure Drop in Compressed Air Piping: Fittings & Design

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# About the Speakers

**David King**
Connecticut Compressor Systems

**Kevin King**
Connecticut Compressor Systems

**Lance Frederick**
Unipipe Solutions

# Goal & Mission

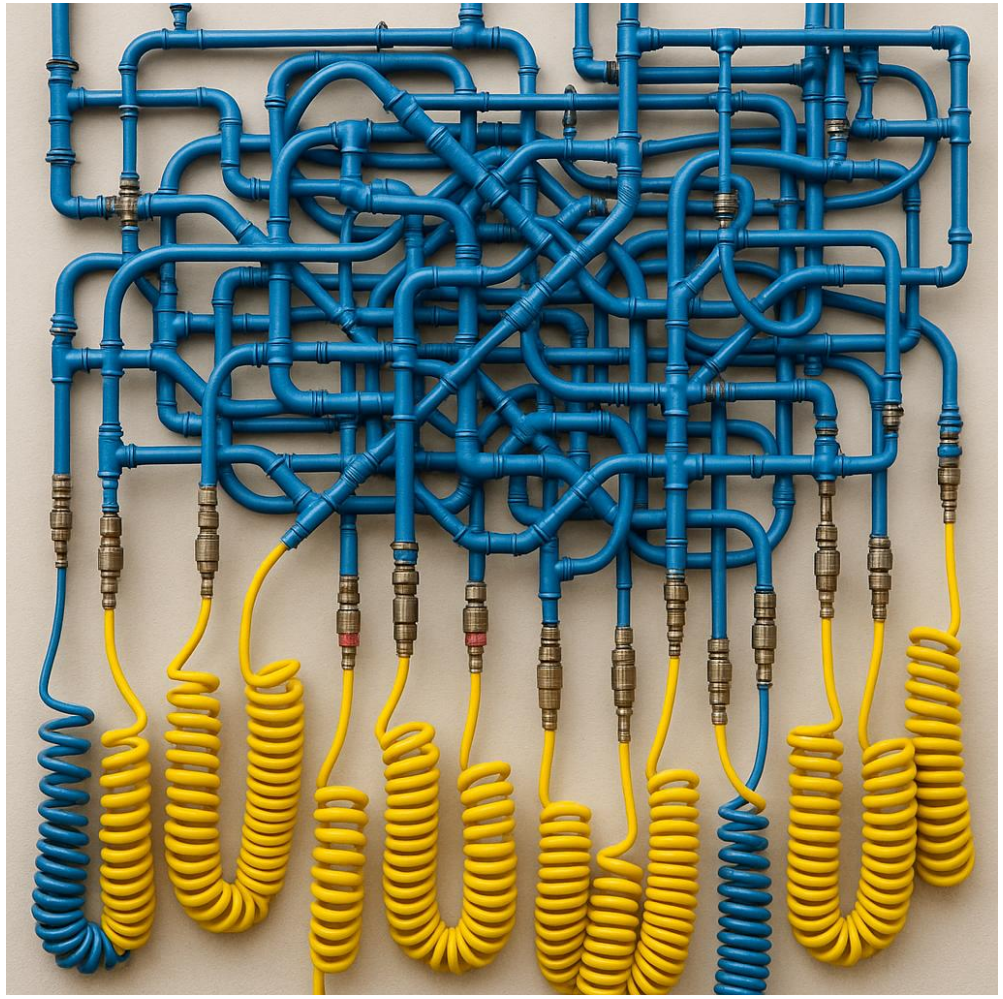
**Goal:** Getting the right flow and the right pressure to the Point-of-Use with as little pressure drop as possible.

**The Mission:** Convince air users that many of the techniques and standards that are commonly in use cause enormous Pressure Loss, which causes compressors to be operated at elevated Pressure Settings, which causes tremendous energy and productivity loss.

# Goal & Mission

***Let's Look At Ways to Mitigate Pressure Loss***

- ***In The Compressor Room***
- ***In The Supply To The System***
- ***In the last 30' "The Dirty Thirty"***

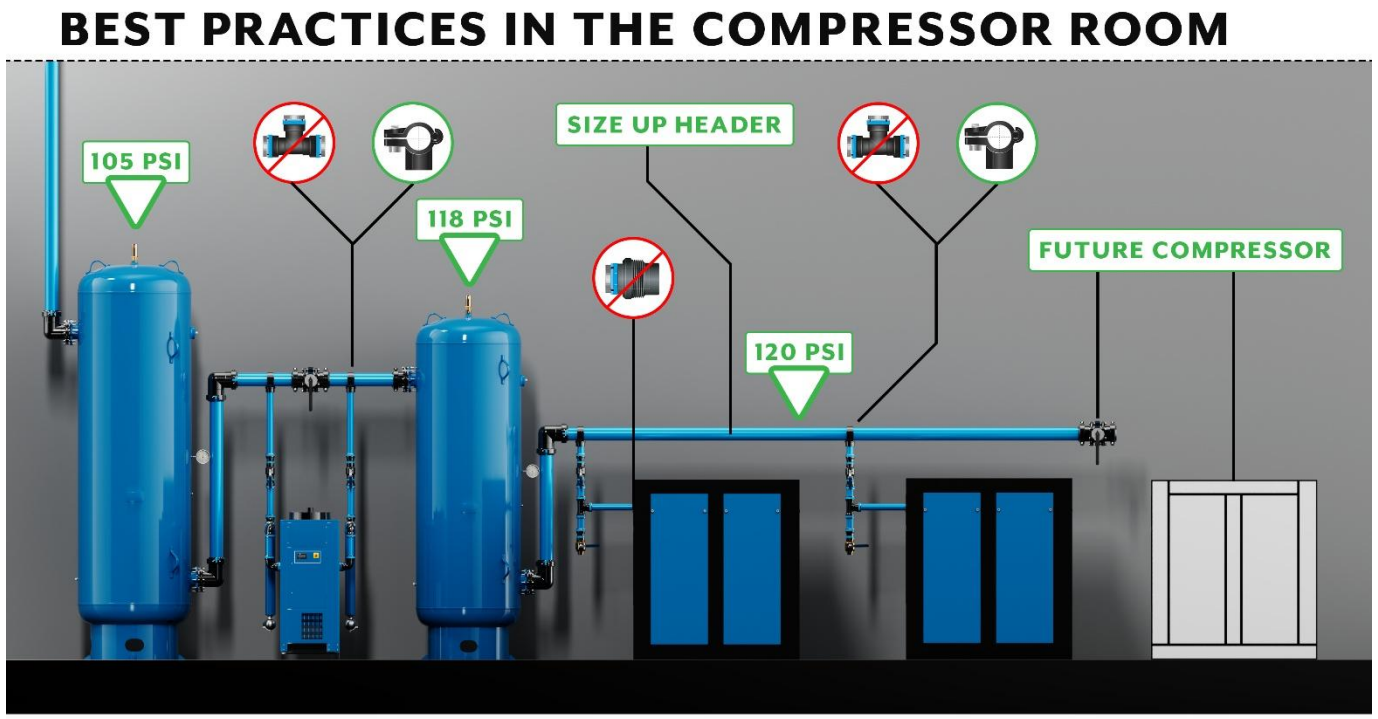


# Best Practices in the Compressor Room

There should be less than 10PSI pressure loss from compressor to the receiver tank.

A well-designed compressor room is key.
- Every elbow yields Pressure Drop
- Allow 5-10 feet of linear pipe to pressure drop calculations per elbow

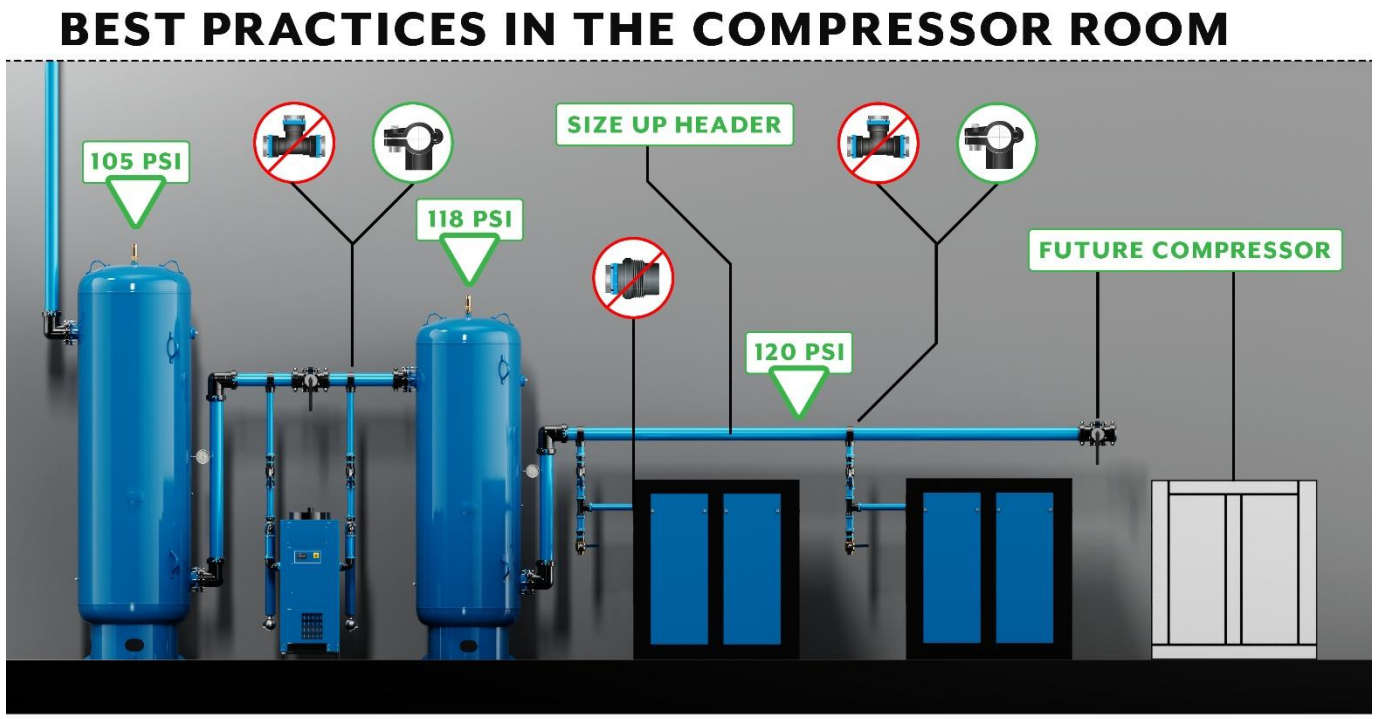
Need to create a system that maintains stable pressure



# Best Practices in the Compressor Room

**TIP:** Add threaded Saddles to attach pressure gauges, flow meters, or as a convenient access point for an air auditor to take these measurement

**TIP:** Size the header pipe that leaves the compressor room to be one size larger than needed. Allow for compressed air from ALL compressors and allow for future growth.

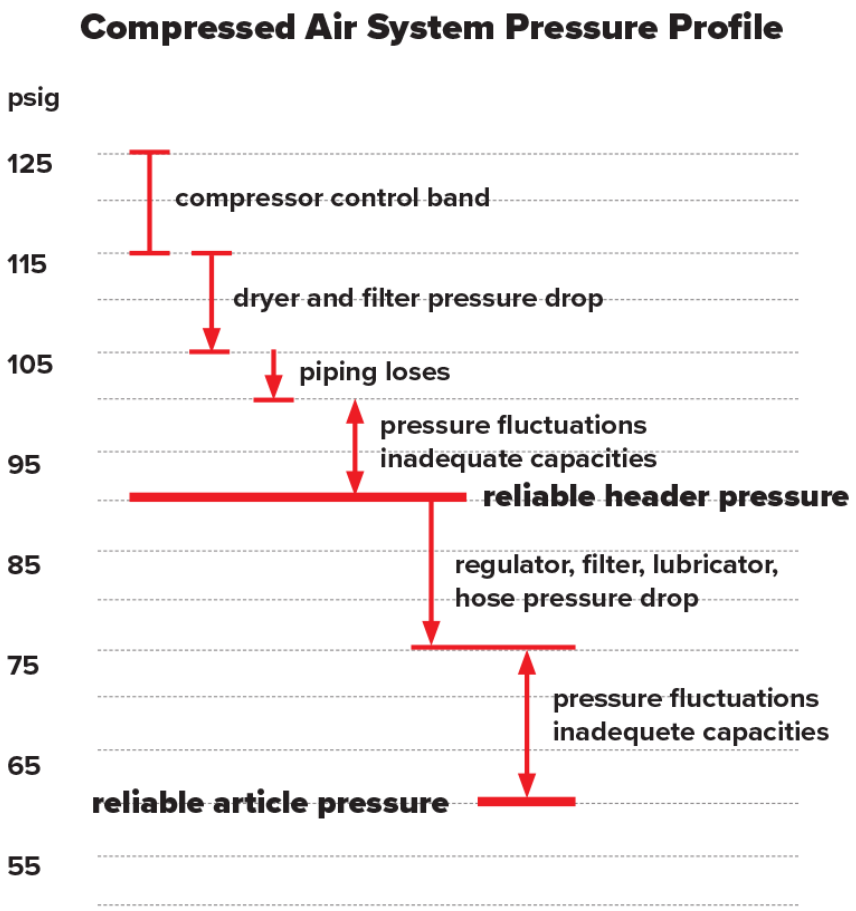


# Optimizing the Compressed Air System to Header

**Is Compressed Air Equipment Sized Properly?**
Compressors to Dryers to Filters to the Tank
Standardize Port Size Across All of the Equipment

**Increase the "backbone" in the Compressor Room (Supply to header)**
Should be larger (Example: 6" Supply in compressor room to 4" Header)

**The Compressor Room is the point of the highest pressure in the system**

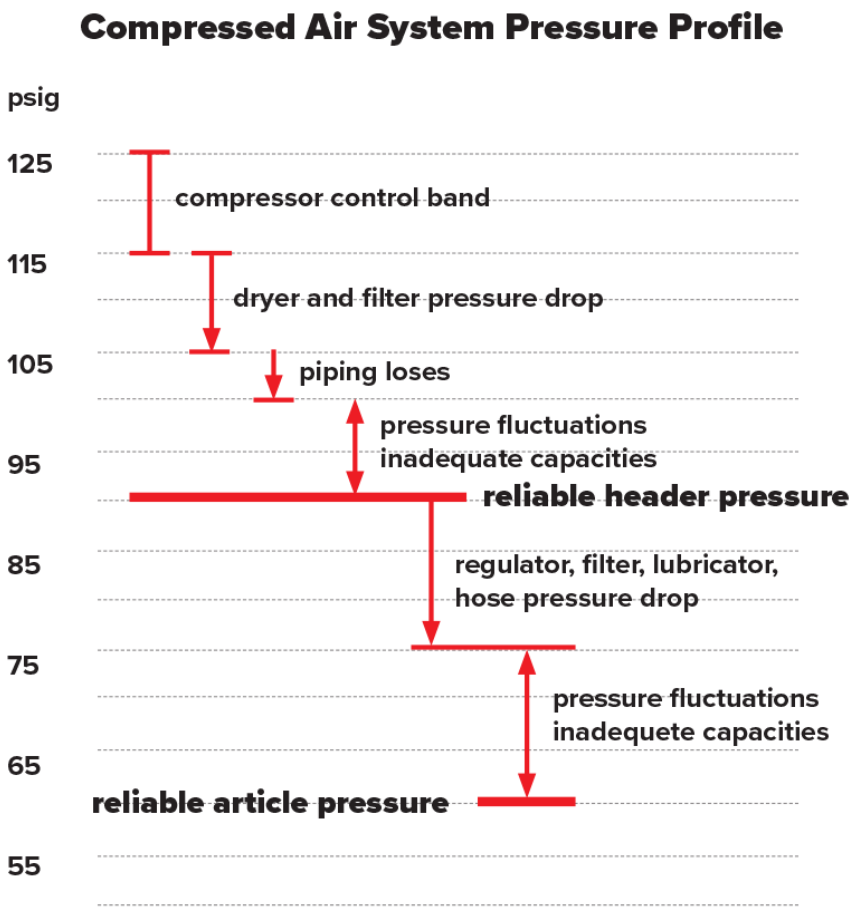


# Optimizing the Compressed Air System to Header

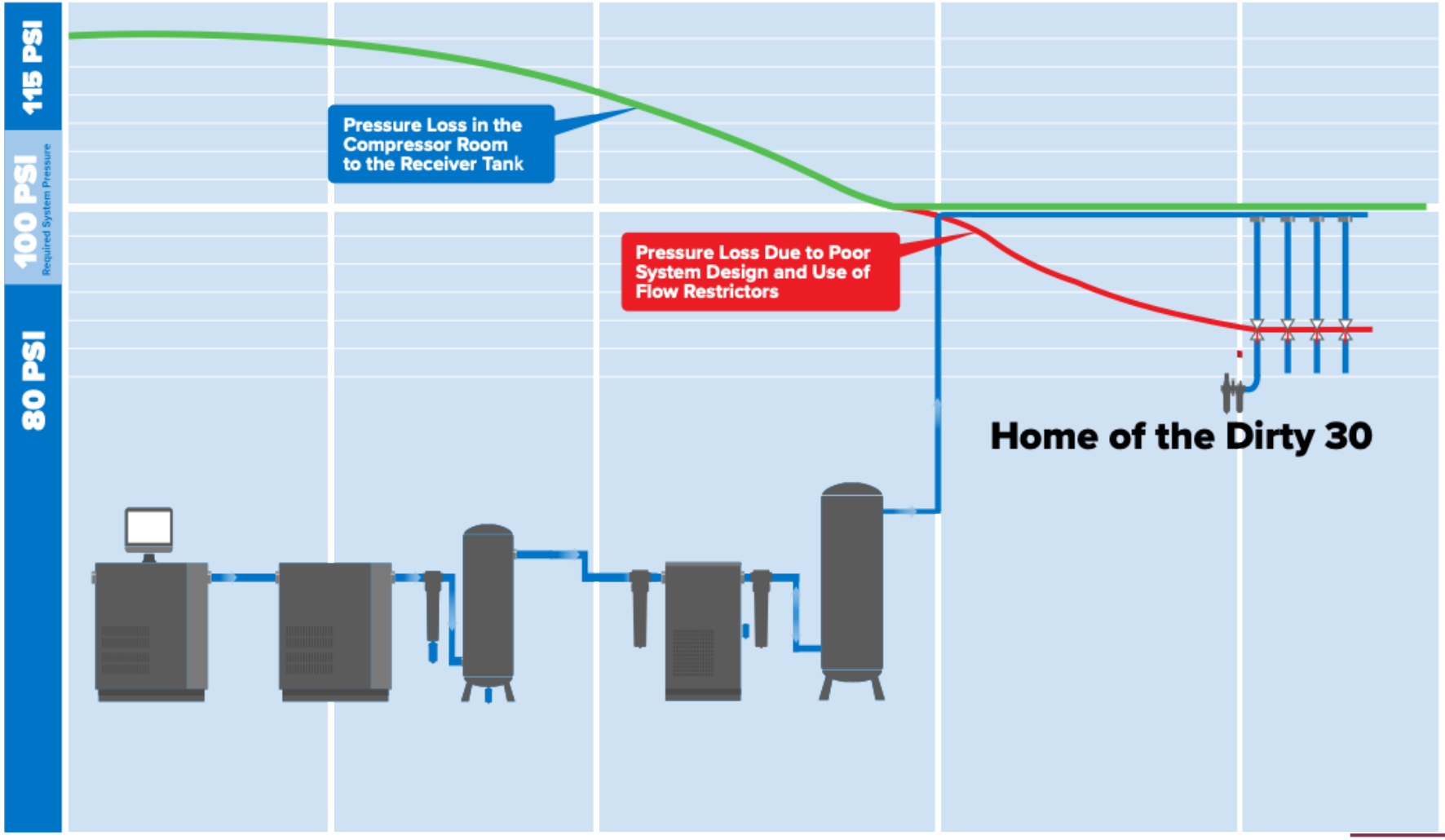
**Create a Pressure Profile**

- Determine what the Static PSI is:

Pressure reading of the Compressor
Pressure reading of the Wet Tank inlet
Pressure reading of the Dryer inlet
Pressure reading into the Dry Receiver Tank
Pressure reading at the Header
Pressure reading at the Subheader
Pressure reading at Point(s) of Use



# Pressure Loss Across the Compressed Air System



# What is the REAL Demand for Air in the Operation?

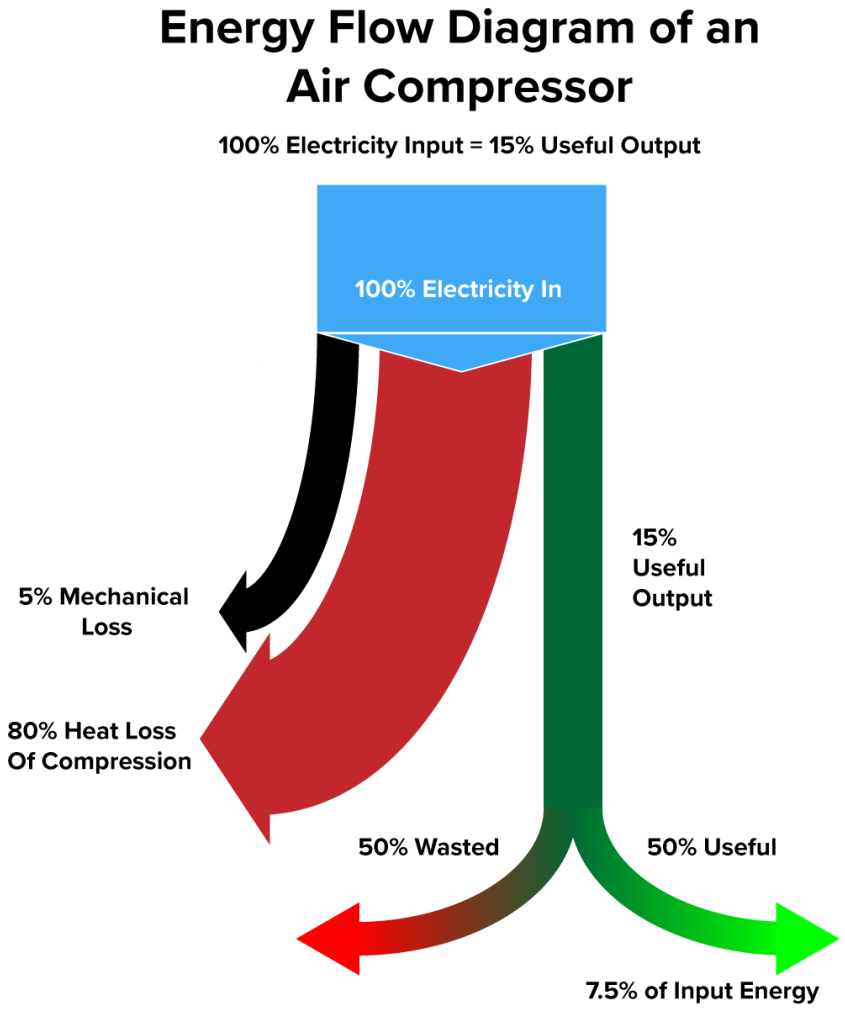
Determine what the REAL working pressure of the equipment in the plant demands

Should be 10 PSI over stall

Rule of Thumb: Every 2% pressure drop = losing 1% in energy!

Compressed Air is expensive! (kW/Hundred CFM = $.18 to $.24)

Determine the speed of your air
Proper "Air Speed" is usually 25-30 feet per second - In the header
Loop not to exceed 10-15 feet per second . Controlled by pipe size



# Use an Efficient Configuration for the Supply to the System

**Poor Practice - Deadend or Straight Line Configuration**

Deadend/Straight Line Configuration will always yield varying psi in drops

The pressure will decline the further away from the compressor the point of use is

# Use an Efficient Configuration for the Supply to the System

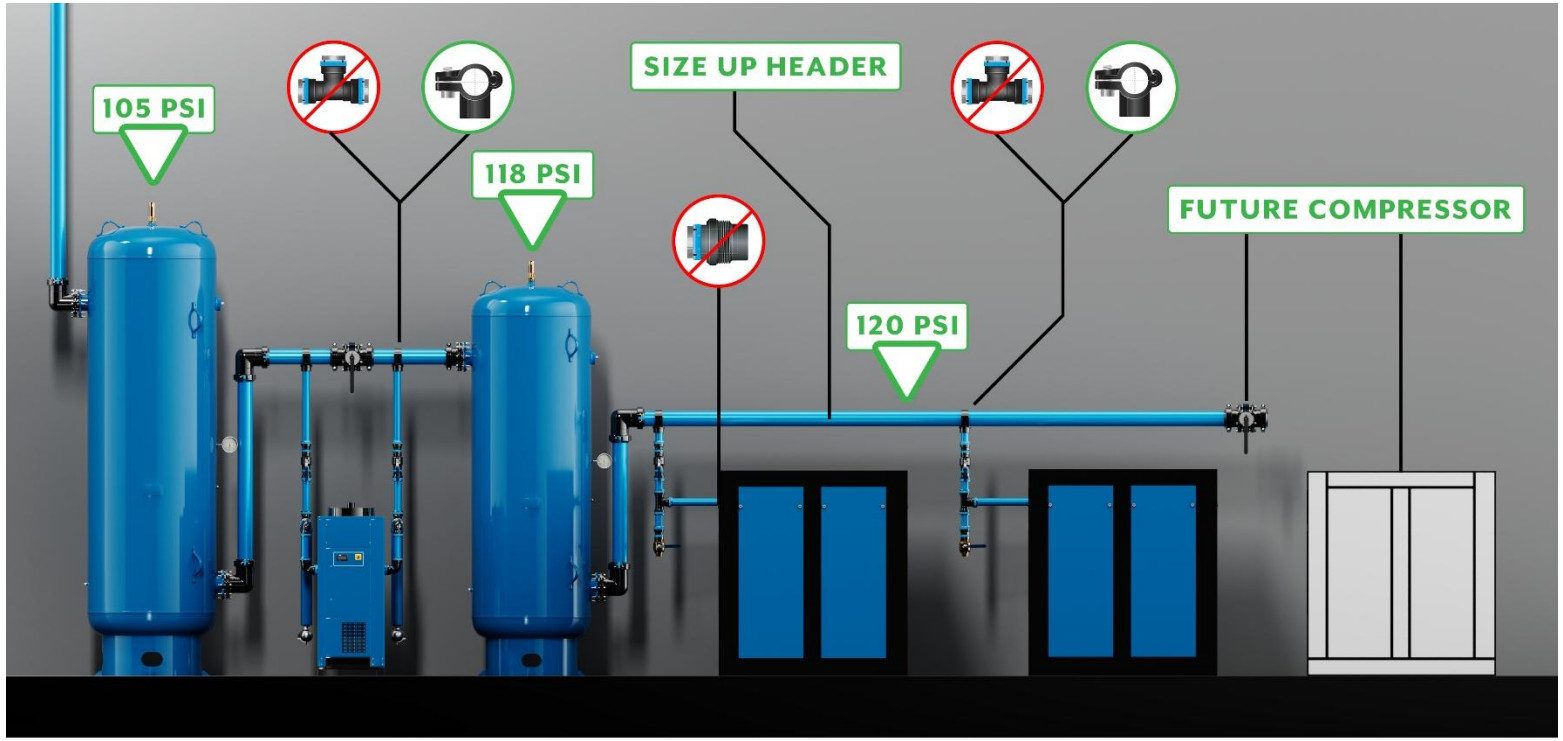
**Best Practice - Loop and Subloop Configuration**

Yields 50% more air flow than a deadend
Overcomes distance and ensures the equal pressure flow to drops

# Use an Efficient Configuration for the Supply to the System

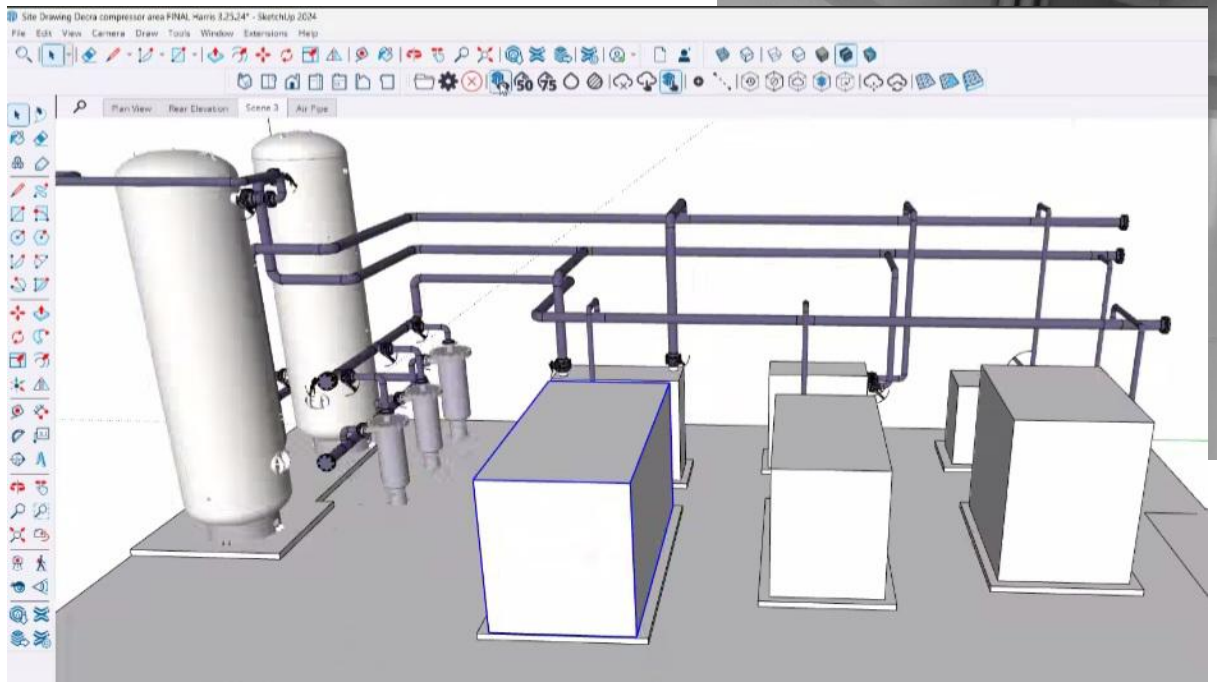
Continue with the same header size coming from the Compressor Room

If the “Backbone” Header in the compressor room is 6” to the Receiver Tank, continue to the header, then reduce to 4”. (depending on proximity to compressor room)



# Use an Efficient Configuration for the Supply to the System

From System Drawing…



…to optimal design and installation of the backbone.

# Is Your Iron Pipe Clogged with Rust Dust?

Check your piping for air-choaking rust-dust

Builds up like plaque in an artery

Rust-dust is damaging to the internal workings of the equipment or tools being fed by the compressed air system

# The Dirty Thirty – Points of Uses and the Abuses

Why doesn't my compressor keep up?

Why does this machine shut down regularly?

Why do we keep running out of air?

I have a dryer… why do we still have water in our lines?

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# The Dirty Thirty

**The answers are usually in the Dirty Thirty**

Christmas Trees
Quick connects
Fittings
Regulators
Filters
Adapters
Accessories
Couplers
Flexible hoses
Cheap Hoses
Hoses That Are Too Long
Hoses That Are Too Small

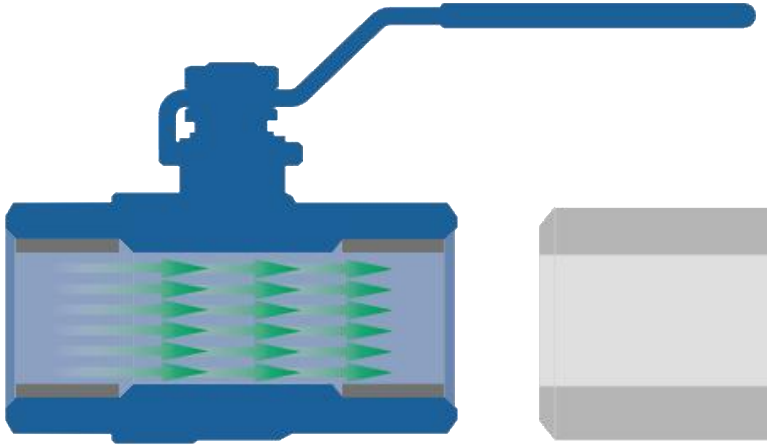
These components provide flexibility, convenience and protection at the point of use

Introduce potential failure points—leaks, restrictions, pressure drops and contamination

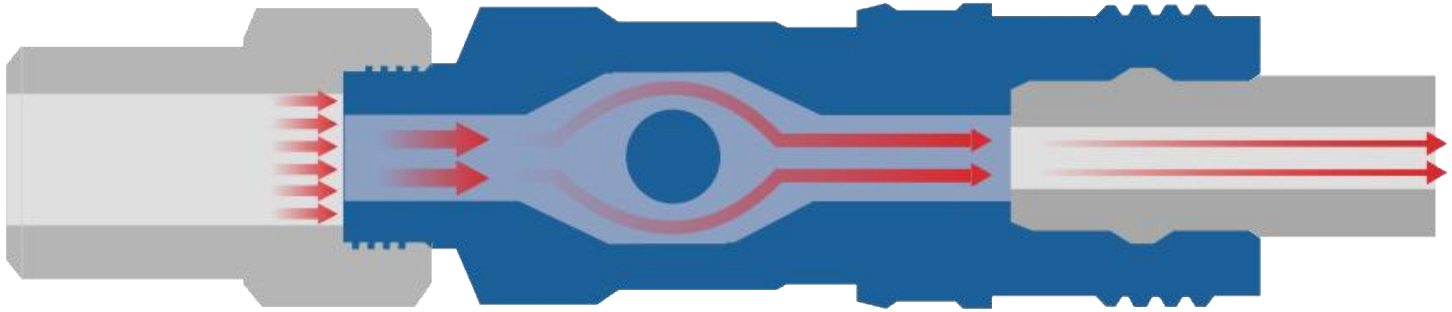
Can compromise the efficiency and performance of the entire system

# Couplers ALWAYS Come with A Cost

Unrestricted Air Flow of Full Port Ball Valve

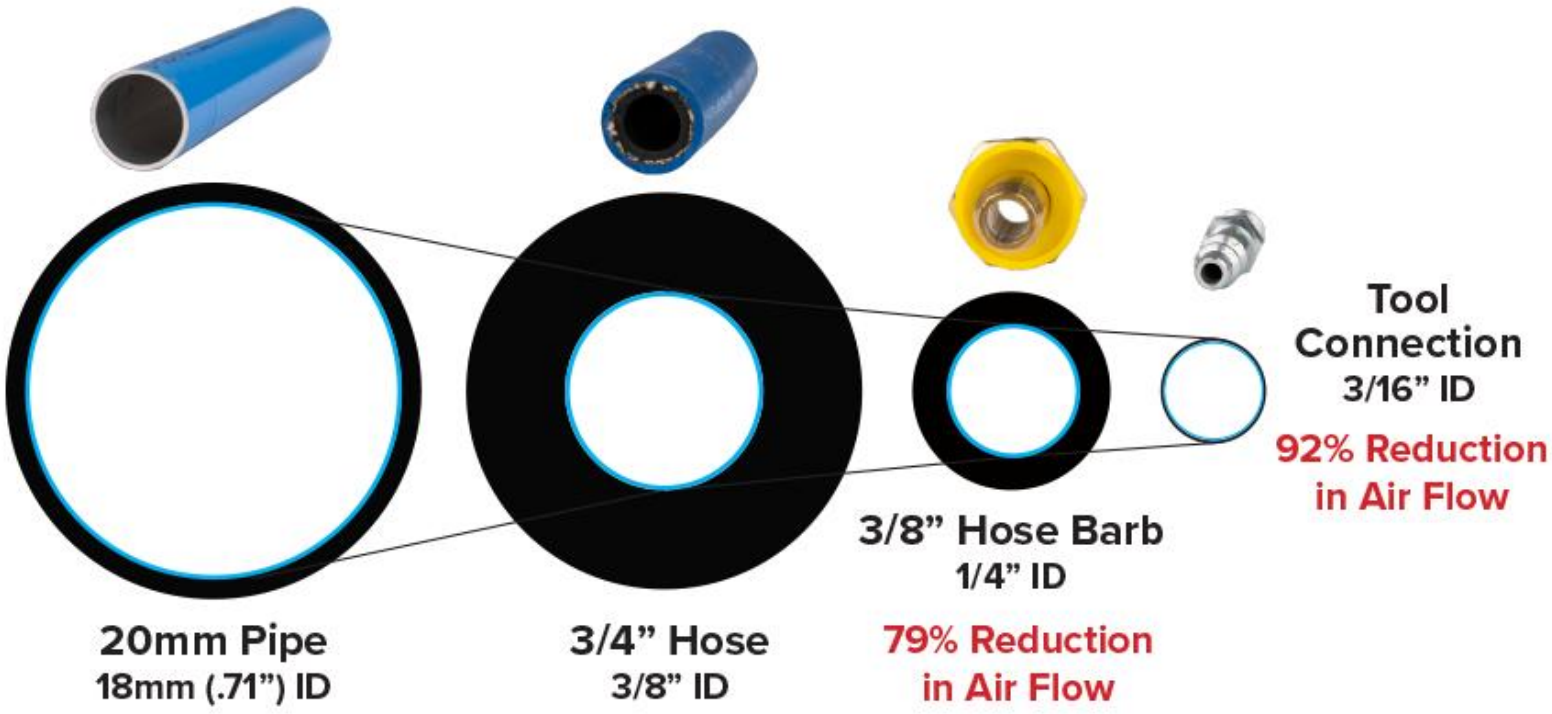


Restricted Air Flow of a Coupler and Nipple



Quick couplers SHOULD NEVER be
used for permanent connections.
They are for convenience of connecting and
disconnecting tools when air flow is not critical.

# The Dirty Thirty – Points of Uses and the Abuses




Quick couplers SHOULD NEVER be
used for permanent connections.
They are for convenience of connecting and
disconnecting tools when air flow is not critical.

# Go with the Flow…Don’t Choke It!

# Go with the Flow…Don’t Choke It!

# BEWARE OF AIR THIEVES!

**Large, Immediate Air Demands**
Dust Collector?
Sand Blaster?
Blower or Cooling of Parts?
Workspace and Cleaning
Using Compressed Air as a Blower

**Other Compressed Air Thieves**
Air Leaks
Inappropriate Use of Compressed Air
Unregulated Demand and Artificial Demand
Poor System Design or Layout
Neglected Components

# BEWARE OF AIR THIEVES!

**Air Leaks**
The single largest source of waste
Can account for 20–30% or more of total compressed air usage.
Worn couplings, pipe joints, hoses, and seals
Quick-connect fittings

Causes constant demand on the compressor,
leading to higher energy consumption and maintenance costs.

**Inappropriate Use of Compressed Air**
Using compressed air for cooling personnel or equipment
Cleaning workstations or machinery (blow-offs)
Operating pneumatic tools where electric alternatives would be more efficient
Wastes valuable compressed air where other energy sources (e.g., fans, vacuums) would be more suitable.

# BEWARE OF AIR THIEVES!

**Unregulated Demand and Artificial Demand**
**Unregulated Demand**
Equipment takes more air than necessary due to lack of flow/pressure control.
**Artificial Demand**
Result of supplying air at higher pressure than equipment actually needs.

**Poor System Design or Layout**
Long piping runs with too many bends and fittings
Inadequate pipe sizing causing pressure drops
Centralized systems serving distant applications inefficiently
Lack of Proper Maintenance

# BEWARE OF AIR THIEVES!

**Neglected Components**
Filters (clogged filters increase pressure drop)
Lubricators

Drains
(manual drains left open or malfunctioning automatic drains)

Uncontrolled End-Use Equipment

Pneumatic cylinders or actuators operating
without timers or position feedback

Valves or solenoids left open

Causes continuous flow of air even when not needed,
increasing overall consumption.

# Want to Read More?

For more details on the subject of pressure drops in compressed air systems, check out numerous titles available in the Best Practices Library:

System Analysis

Dirty Thirty

Fittings & Pressure Loss

Pressure Vs. Flow

Pressure Loss Solutions

Unipipe Pressure Drop Calculator

# Make The Switch

Make The Switch

Unipipe Branch

Saddle Branch

Female Threaded Branch

# The Unipipe Aluminum Saddle

*Unique in the Market*

**Other systems require tedious alignment of drilled hole**

**Saves time and elimates risk of misalignment and leaks**

**Saddle Branch (pipe x FNPT) version**

aka - direct feed bracket swan neck or candy cane

- Can come off the top and off the side of the pipe
- Used for Main Header to Subbranches
- A better choice than traditional spec of regular placement of future lines with equal tees and ball valves. (every 40 ft!)
- Useful for gauge, hot tap, flow meter or data collection devices

**Female Threaded Branch (pipe x FNPT)**

- Used for hose drops with coupler (better served with a full port ball valve)
- Also good for recoil hose at work stations

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# The Plan ALWAYS Changes

***With Unipipe Saddles - Things CAN Change Easily***

- Benefits the customer, mechanical, and the engineer. All parties are happy!
  Engineer = Air Off the Top / Customer/Project Manager = Placement Satisfaction
  Mechanical Contractor = Keeps Moving

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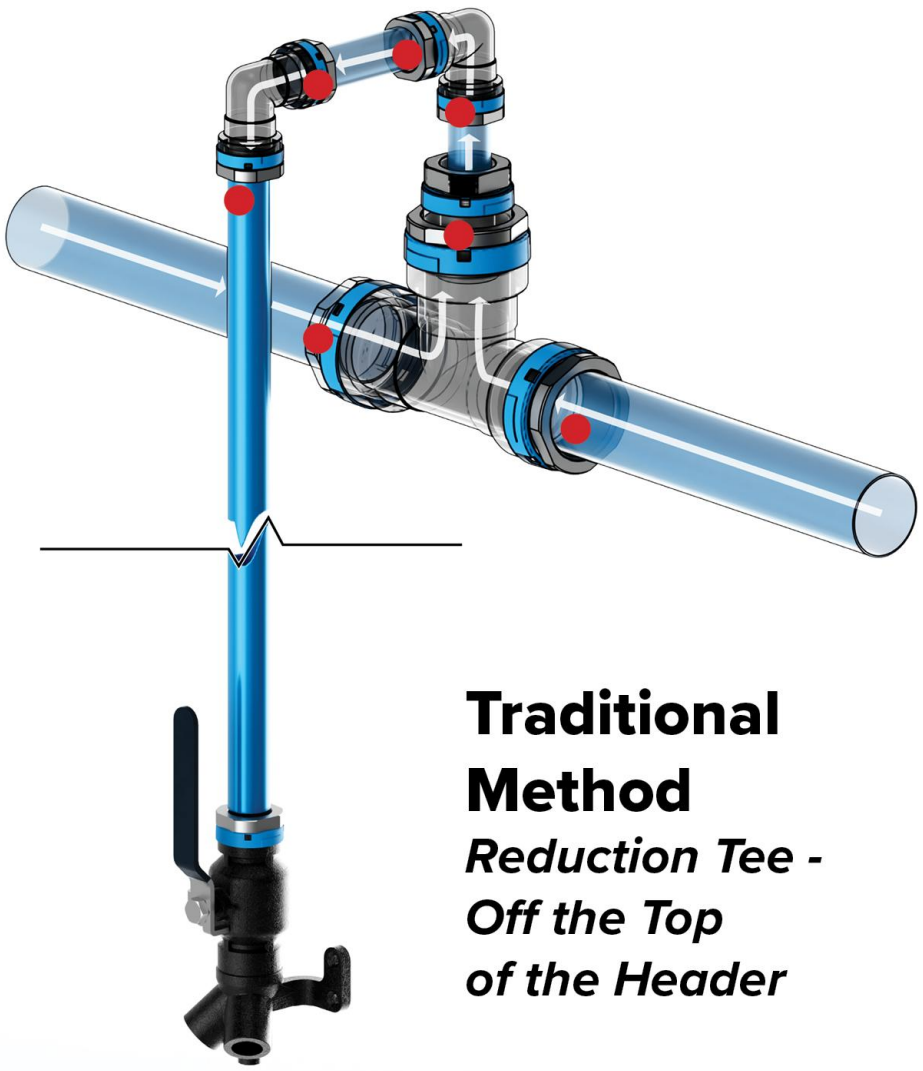
Make The Switch



**Traditional Method**

***Reduction Tee - Off the Top of the Header***

# The Unipipe Aluminum Saddle

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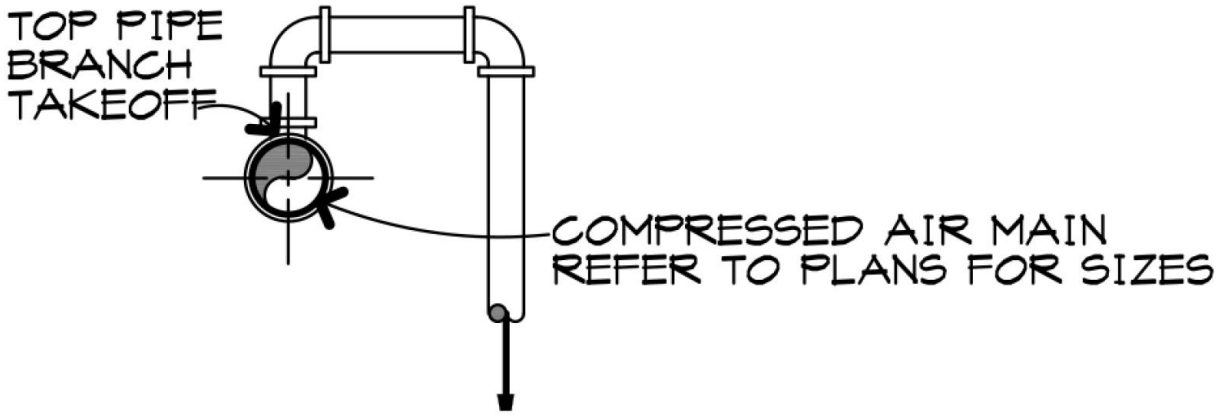


- 7 Potential Leak Points
- Traditonal Specification by Engineers
- Tees cut in where indicated and not repositionable
- “Off the Top of Pipe” - No deviation

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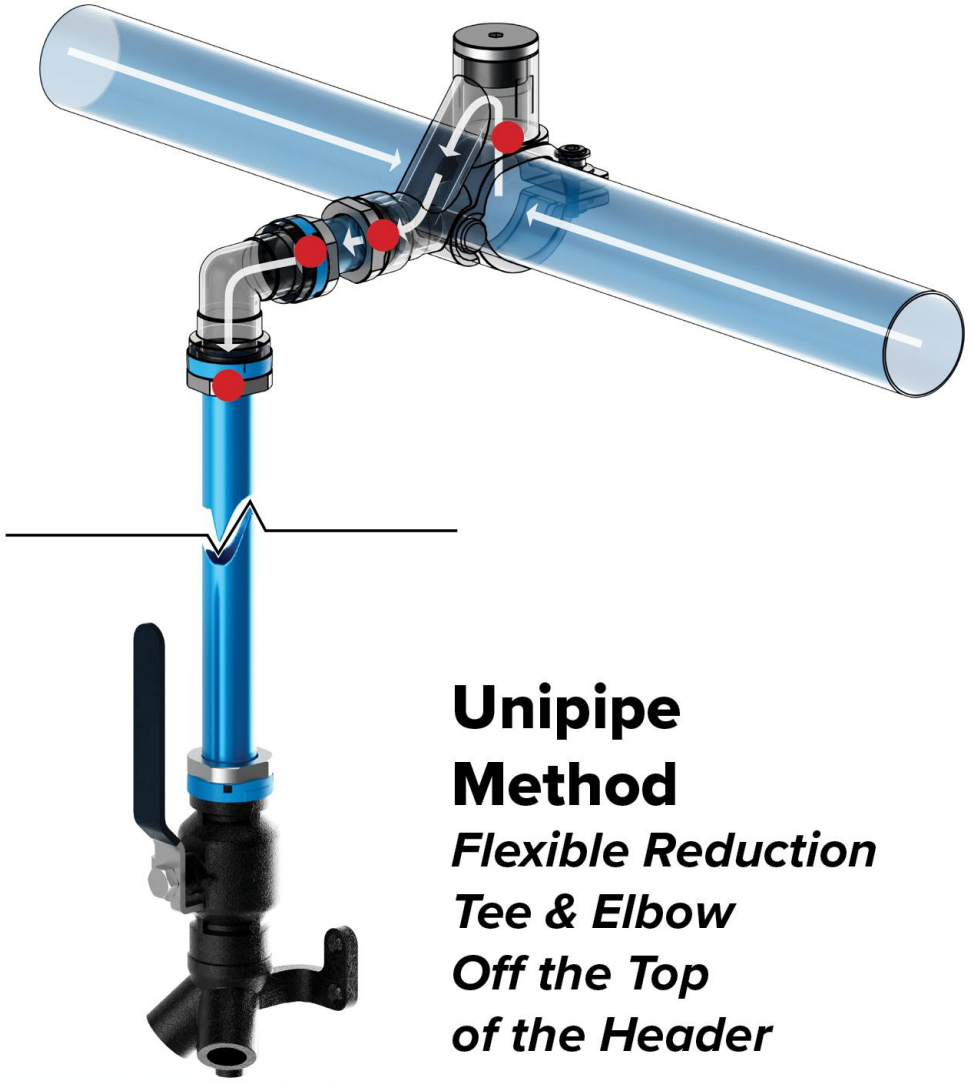
Make The Switch



**Unipipe Method**

***Flexible Reduction Tee & Elbow Off the Top of the Header***

# The Unipipe Aluminum Saddle

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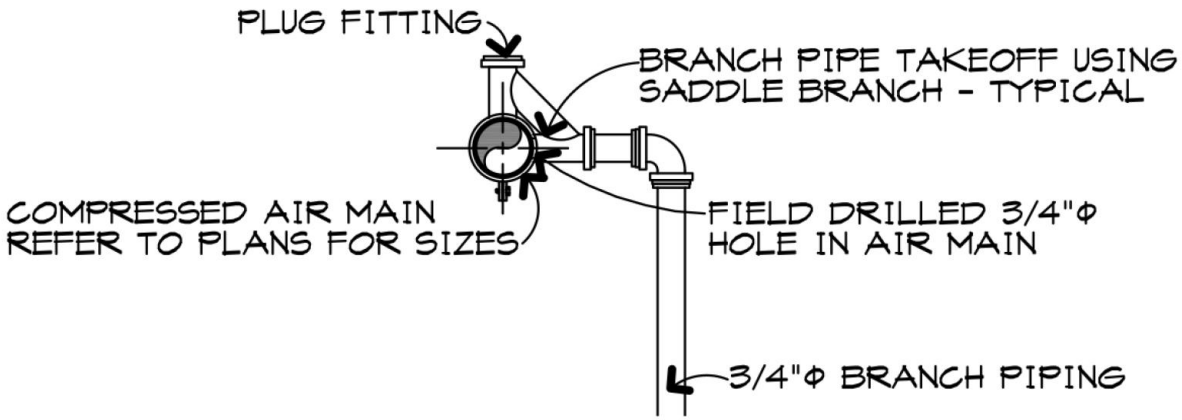


- 4 Potential Leak Points
- Aluminum Saddle - Pipe to Pipe Configuation
- Reduction Tee and Elbow in one design
- An alternative to the traditional requirement
- Respects the requirements of the eng - Off top of pipe
- Flexibility to Install AFTER equipment is placed
- Offers cleaner path to supply
- No change order needed
- 80% of Drops in the Market

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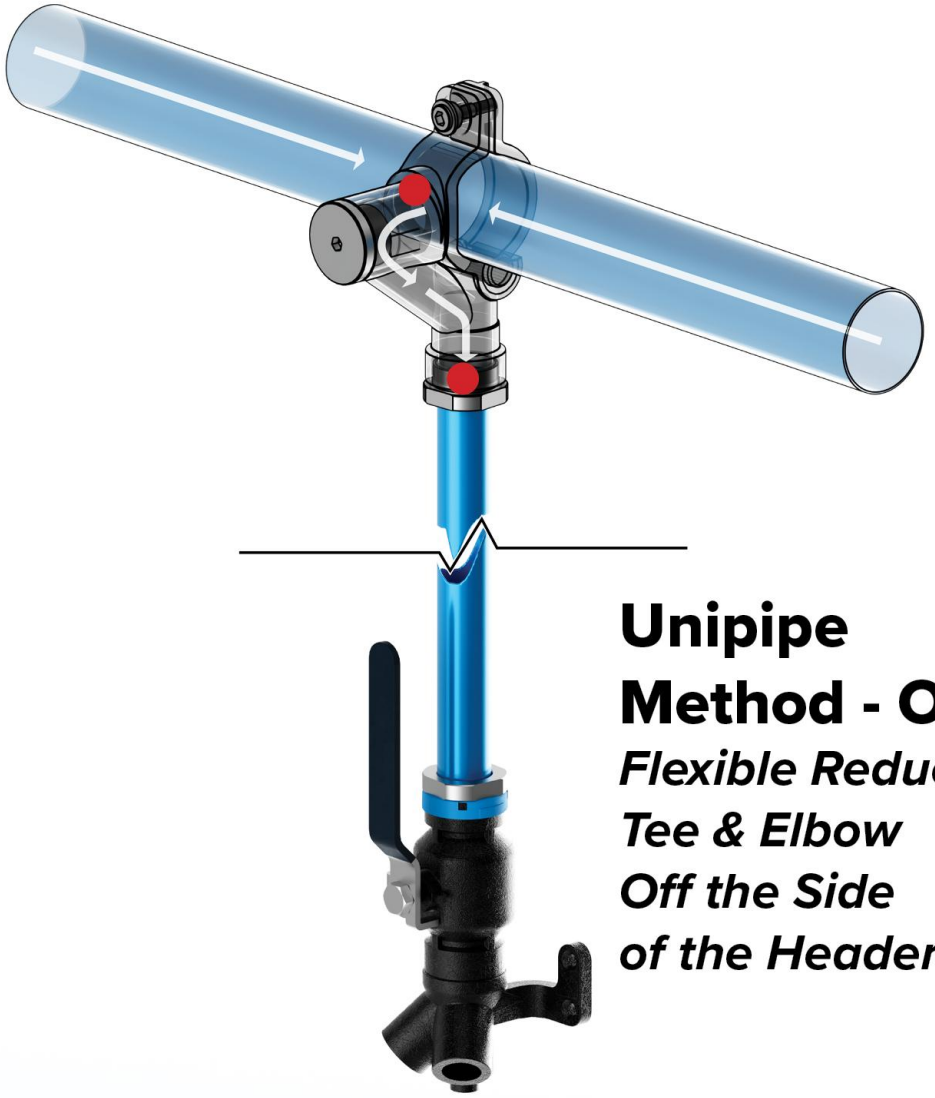

**Unipipe Method - Option**

***Flexible Reduction Tee & Elbow Off the Side of the Header***

# The Unipipe Aluminum Saddle

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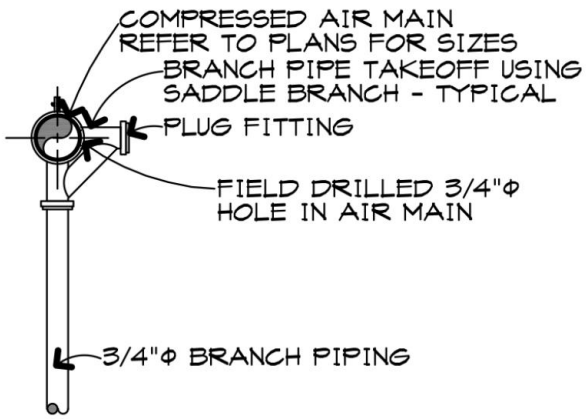


- 2 Potential Leak Points
- Aluminum Saddle - Pipe to Pipe Configuation
- Reduction Tee and Elbow in one design
- An alternative to the traditional requirement
- Air off the side of the pipe
- Flexibility to Install AFTER equipment is placed
- Offers cleaner path to supply
- No change order needed

- Note: 3/4 and 1” Pipe can be bent with standard conduit bender in 90° sweeps and normal offsets

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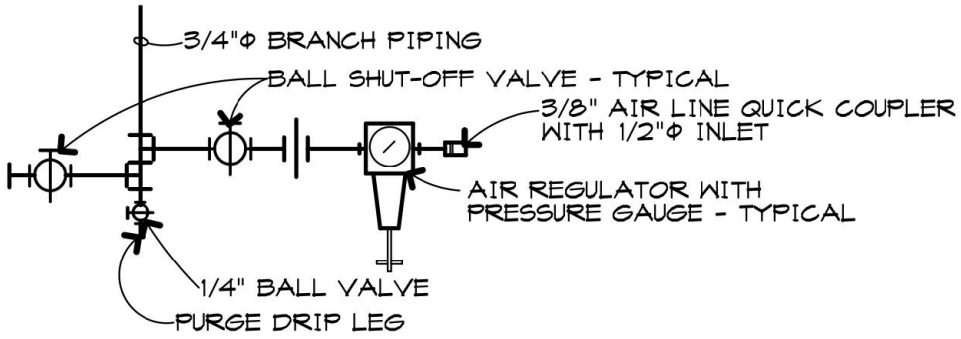
Make The Switch

*A couple of more things...*

# The Unipipe Wall Mounted Drop End Assembly

- The Ultimate in Compressed Air System Drops
- Cast Aluminum
- Dual Port 1/2” FNPT Outlet
- Mountable with Pretapped Unistrut Back Plate
- Full Port Valve
- 1/4” Drain Port



## Multi-Port Threaded Manifolds

Custom built multi-drop projects welcome

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# Make The Switch

## Interested in becoming a Distributor?

## Want to learn more about Unipipe?

## Request A Demo Kit.

## Let's Talk!

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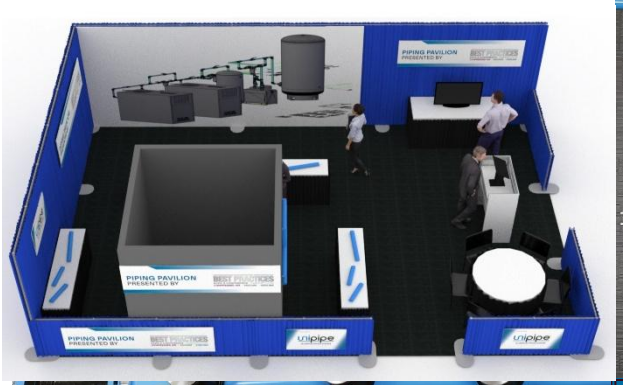

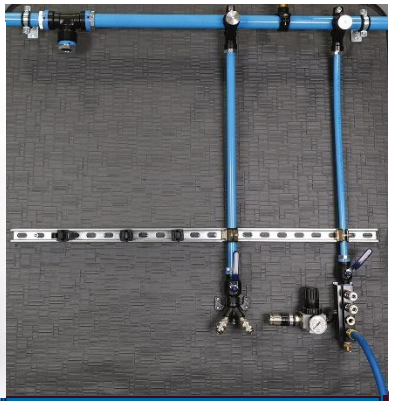

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Which configuration gives the most even pressure

A
- Loop

B
- Straight Line

C
- Upside Down

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*By entering you are giving permission to announce your name if you are a winner

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## Q&A

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**Juan Londono**
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