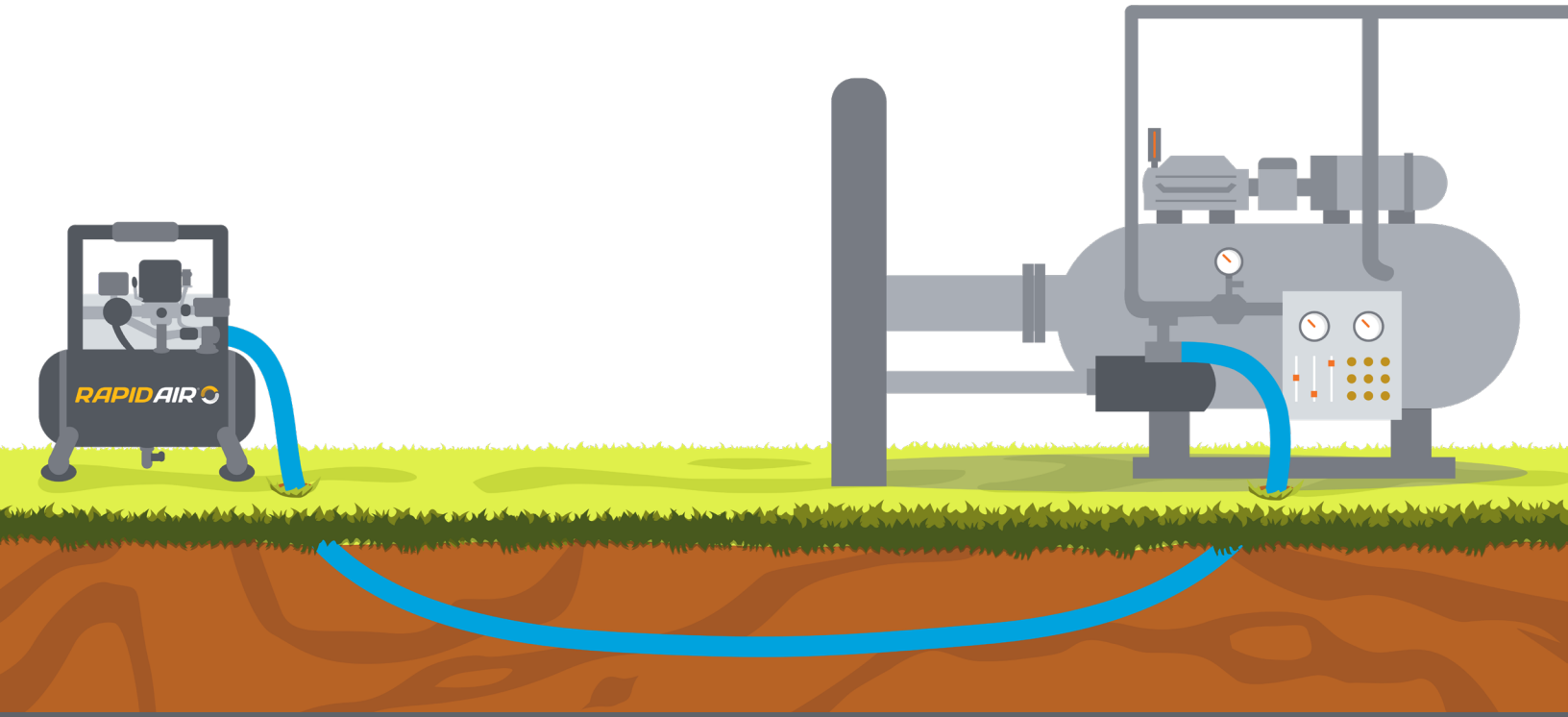
RAPIDAIR®
COMPRESSED AIR PRODUCTS

Eliminate Pneumatic Controller Emissions and Reporting

WITH COMPRESSED AIR

A white paper exploring the financial, environmental and time-saving benefits of powering the natural gas production process with compressed air **via buried piping.**



PREPARED BY RAPIDAIR | WWW.RAPIDAIRPRODUCTS.COM | SEPTEMBER 2022

Contents

There's a Better Way

Problem

Traditional upstream pneumatic production is typically powered by natural gas, which leaks/is vented from the system at several points during the retrieval process, which needs to be accounted for and reported to the EPA.

This perpetual loss of natural gas unnecessarily emits harmful methane into the atmosphere, precipitates meticulous tracking and reporting for the company, monopolizes costly resources, and ultimately results in less usable product to sell.

As government agencies and task forces double down on methane emission reduction, organizations need innovative solutions to meet stricter ESG requirements.

Solution

As recommended by the Methane Guiding Principles partnership, powering the natural gas gathering process with compressed air alleviates the need for a system of multiple methane-leaking machines by running a multilayer semi flexible compressed air pipe underground directly between the air compressor and the field equipment.

In turn, this eliminates pneumatic controller emissions and reporting, earns carbon credits, recoups system investment in just one year and ultimately contributes to a more socially responsible gas production process[1,5,10].

Eliminate

Pneumatic controller emissions and reporting[5].

Save **50 hours per year** for each reporting engineer.[7]

Reduce

Harmful methane emissions up to 70,000 Mcf (33,350 metric tons) of CO2 per year, per facility.[4,8]

It would take **39,468 acres** of U.S. forests one year to sequester this much CO2.[8]

Maximize

Amount of natural gas captured in retrieval process.

Instrument air **eliminates methane emissions** and increases volume of gas available for sale.[6]

Capitalize

Economic benefits follow more usable end-product and the removal of emissions tracking/ reporting processes from your payroll.

Initial system investment pays for itself in approximately **one year.**[9]

Estimated annual savings of up to approximately **$490,000+ per facility**.[4]

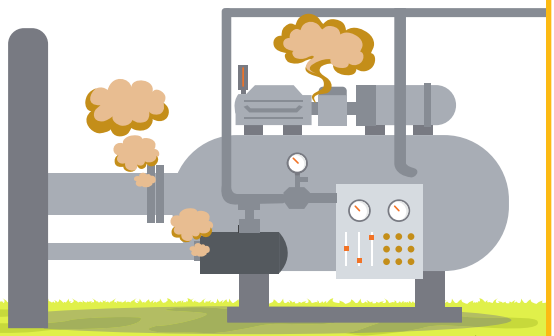
Traditional Methods

POWERED BY GAS

The oil and gas industry uses millions of pneumatic controllers to power control valves that open and close to regulate liquid levels, pressure, temperature or flow. When powered by natural gas pressure, multiple regulators are required to stamp down pressure throughout the process.

Pneumatic controllers vent that gas continuously or intermittently at each connection point within the system, making them **one of the largest sources of methane emissions in petroleum and natural-gas supply chains[1].**

In this traditional setup, there is a bleed rate associated with every piece of equipment in the field, which needs to be calculated and reported to the government[7].



Emissions are typically quantified by multiplying the number of pumps by the estimated or measured emissions from a single pump. However, a number of activity factors contribute to variability in methane emissions in pneumatic devices, including how they are used and whether they are functioning properly[1].

In 2021, the Environmental Protection Agency reported updated baseline emissions for production pneumatic controllers. The average medium plant size emits 11.2 metric tons of methane per year via pneumatic controllers, or the equivalent of the carbon sequestered by 331 acres of U.S. forests in one year.[12,8]

ENVIRONMENTAL PROTECTION AGENCY

Model Plant Baseline Emissions for Pneumatic Controllers at Production and Transmission and Storage Sites[12]

MODEL PLANT SIZE	TOTAL NUMBER OF PNEUMATIC CONTROLLERS				BASELINE EMISSIONS (TPY)			
	HIGH-BLEED	LOW-BLEED	INTERMITTENT VENT	TOTAL	PRODUCTION		TRANSMISSION AND STORAGE	
					METHANE	VOC	METHANE	VOC
Small	1	1	2	4	5.7	1.6	4.1	0.1
Medium	1	1	6	8	11.2	3.1	5.7	0.2
Large	1	4	15	20	24.9	6.9	10.0	0.3

Traditional Methods

ENVIRONMENTAL & POLITICAL CHALLENGES

Environmental Implications

In recent years, there have been considerable advances made in data collection and technology to detect and quantify methane emissions from a variety of sources including venting, that could otherwise go undetected for long periods of time.

In the United States, methane contributes to about 10% of human-caused greenhouse gas emissions[2]. Further, it is estimated that 97% of methane emissions from the oil and gas industry are attributed to pneumatic controllers[3]. One pneumatic device venting controller emits an equivalent of 30.4 metric tons of CO2 a year, which is the equivalent of the amount of carbon sequestered by 36 acres of U.S. forests in one year.[11,8]

Methane is a "short lived climate forcer," which means the warming impact of one ton of methane in the atmosphere is 80 times greater than a ton of carbon dioxide. Approximately 30% of today's human-caused climate change is attributed to methane emission[2].

10% of human-caused greenhouse emissions is methane

97% of methane emissions come from pneumatic controller

80x greater impact of methane in atmosphere than carbon dioxide

30% human-caused climate change attributed to methane emissions

Political Implications

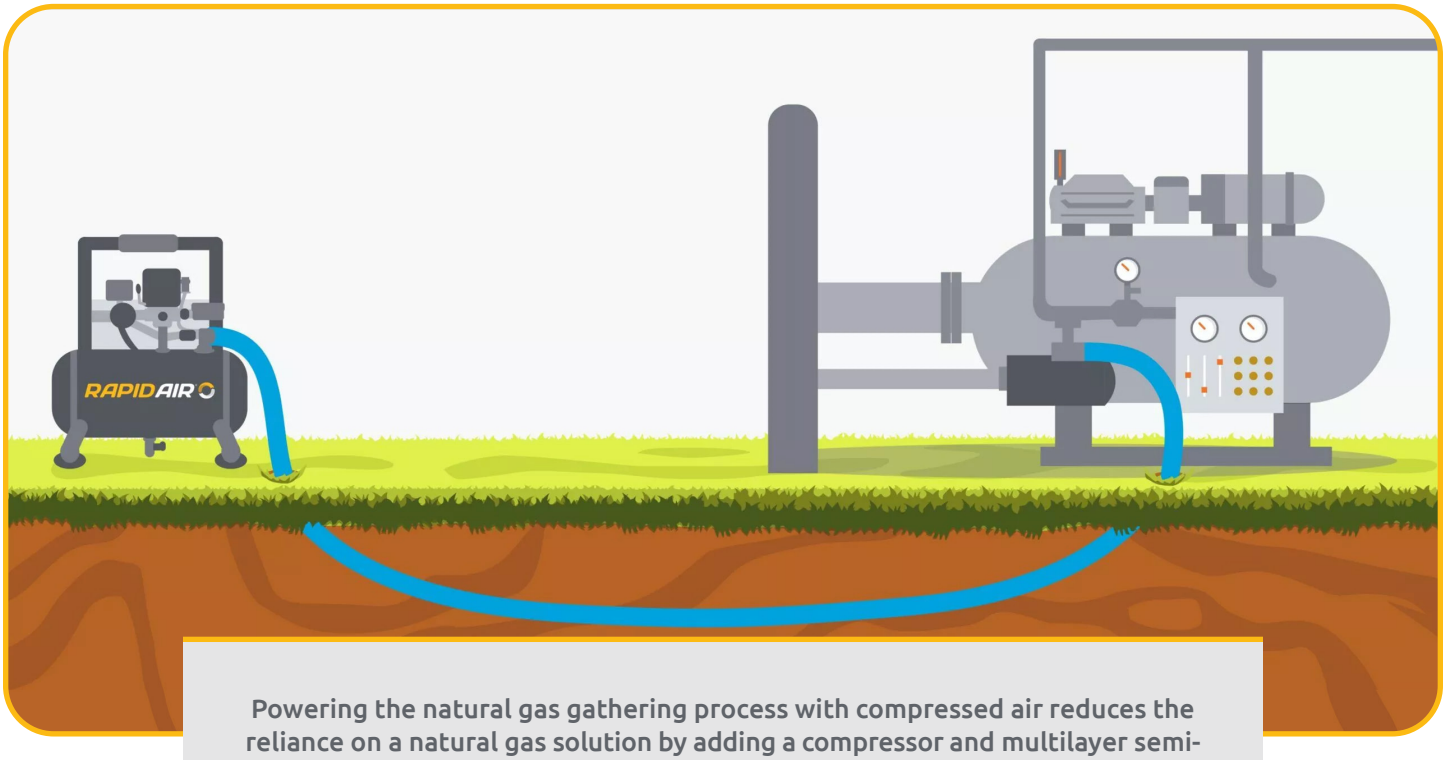
The U.S. Methane Emissions Reduction Action Plan championed by the Biden-Harris Administration focuses on reducing pollution from the country's largest sources. It outlines the use of all available resources from regulations to financial incentives to greater transparency / disclosure of actionable data, and public / private partnerships, all to ultimately reduce methane emissions.

Specific to the oil and gas sector, the following items will require new action for many organizations:

- **In January 2021, President Biden issued an Executive Order directing the EPA to issue regulations under the Clean Air Act to reduce oil and gas emissions. The EPA has since proposed updated methane regulations from new oil and gas sources, as well as new requirements / limits for existing sources, ultimately to reduce emissions from covered sources, equipment and operations by approximately 75%. This proposal would regulate natural gas-driven intermittent vent pneumatic controllers for the first time.**
- **The Department of the Interior is ramping up efforts to reduce venting / flaring of methane from oil and gas operations.**
- **The non-profit Carbon Mapper is partnering with NASA's Jet Propulsion Laboratory to launch prototype satellites to track methane emissions at facilities using high-resolution images that identify previously undetected sources of methane. In turn, the data will be accessible to anyone interested, including public and private key decision makers.**
- **Enhanced technology and cost declines for emissions-sensing equipment and zero-emissions pneumatic equipment empower industries to pursue greater economic benefits while reducing methane emissions; President Biden's Build Back Better initiative would accelerate many of these methane emissions reduction efforts[2].**

There's a Better Way

REPLACE GAS SUPPLY WITH AIR COMPRESSION



Powering the natural gas gathering process with compressed air reduces the reliance on a natural gas solution by adding a compressor and multilayer semi-flexible compressed air tubing placed underground, running compressed air piping directly between the air compressor and field equipment.

Key Advantages

Innovative process
removes methane emissions from natural gas extraction process.

Alleviates need
for pneumatic control emissions tracking and reporting by field personnel.

Maximizes
amount of natural gas captured in the extraction process.

Key Considerations for Powering Pneumatic Devices with Compressed Air

According to Natural Gas Star partners, compressed air systems should provide **1.7 scm per hour** (1 scf per minute) of compressed air to each controller[4].

When considering air compressor size, the air delivered to controllers should be about two-thirds of the volume of the atmospheric air drawn into the compressor[1].

There's a Better Way

A CLEANER, CHEAPER ALTERNATIVE

Environmental Implications

As with many other sectors, pursuing ESG initiatives is becoming increasingly important in oil and gas companies. For companies that haven't historically prioritized sustainability, stricter enforcement of methane emission reduction necessitates the adoption of new and innovative practices to minimize, detect and repair methane leaks.

> **Replacing pressurized natural gas with compressed air completely eliminates methane emissions from pneumatic devices.**

Reducing methane emissions supports substantial near-term climate benefits, as methane is a more powerful greenhouse gas than carbon dioxide. By capturing gas that would otherwise be lost, this method also supports the conservation of finite natural gas resources, while reducing air pollution[2].

Operational Implications

Using compressed air instead of pressurized natural gas to power pneumatic devices is one way to reduce methane emissions in the oil and gas industry, without necessitating a complete overhaul in operations set-up, as traditional pneumatic controllers that are standard / familiar to operators can still be used.

Other Benefits of Compressed Air

- **Harmful emissions no longer escape at each point in the process or leak through old seals.**
- **Compressed air systems use compression fittings for leak-proof performance, delivering clean, compressed air.**
- **Delivery of clean air protects and extends the life of other equipment.**
- **When flexible, aluminum and HDPE tubing is used, air is delivered efficiently and remains corrosion free for decades.**
- **Perfect for rugged sites, the right tubing can be buried underground to provide additional operational protection and maximize efficiency.**

Cost Implications

> **Any gas you lose to the atmosphere via leaks is gas you ultimately can't sell; compressed air systems remove that variability to impact the bottom line, while reducing operational costs of staff tracking and reporting processes.**

According to Natural Gas Star partners, by replacing the natural gas equivalent with systems that provide 60scm to more than 1500scm per hour of compressed air equivalent of natural gas, priced at $0.25 per scm, compressed air systems can pay for themselves within two to seven months.[4] **In addition, reduced methane emissions would help each facility earn approximately $100,000+ in carbon credits annually - approximately 33,350 Carbon Credits per year.[10]**

There's a Better Way

A CLEANER, CHEAPER ALTERNATIVE

For additional reference, below are average cost analyses for large production sites with 20 or more pneumatic controllers, for both new and existing source builds.[12]

Cost-Effectiveness of Representative Air Systems at New Production and Transmission and Storage Sites[12]

MODEL PLANT	SEGMENT	BASELINE EMISSIONS - PER FACIILTY (TPY)		EMISSIONS REDUCTION - PER FACIILTY (TPY)[a]		CAPITAL COST ($/YR)	WITHOUT SAVINGS			WITH SAVINGS			
		VOC	METHANE	VOC	METHANE		ANNUAL COST ($/YR)	COST EFFECTIVENESS ($/TON)		ANNUAL COST OF NATURAL GAS SAVED ($)	ANNUAL COST ($)	COST EFFECTIVENESS ($/TON)	
								VOC	METHANE			VOC	METHANE
Large	Production	6.92	24.91	6.92	24.91	$95,602	$10,497	$1,516	$421	$4,519	$5,978	$863	$240
	Transmission and Storage	.28	9.97	.28	9.97	$95,602	$10,497	$38,036	$1,053	NA	NA	NA	NA

NA = Not Applicable [a]100% Reduction

Cost-Effectiveness of Representative Air Systems at Existing Production and Transmission and Storage Sites[12]

MODEL PLANT	BASELINE METHANE EMISSIONS - PER FACILITY (TYP)	METHANE EMISSIONS REDUCTION - PER FACILITY (TYP)[a]	CAPITAL COST ($)	WITHOUT SAVINGS		WITH SAVINGS		
				ANNUAL COST ($/YR)	COST EFFECTIVENESS ($/TON)	ANNUAL COST OF NATURAL GAS SAVED ($/YR)	ANNUAL COST ($/YR)	COST EFFECTIVENESS ($0/TON)
Large - Production	24.91	24.91	$127,469	$13,995	$562	$4,519	$9,477	$380
Large - Transmission and Storage	9.97	9.97	$127,469	$13,995	$1,404	NA	NA	NA

NA = Not Applicable [a]100% Reduction

Application Case Study

LEADING NATURAL GAS PRODUCER USES MAXLINE TO POWER CONTROL VALVES

In further support of their ESG initiatives, one of the top 20 natural gas producers in the United States made the switch from leaky regulators / valves that emit gas at multiple connection points, to a pressure control system powered by compressed air. This removed the need for methane-leaking equipment by running a compressed air pipe directly between the air compressor and the field equipment.

They chose RapidAir's MaxLine Semi-Flexible Compressed Air System to power the move, as the HDPE compressed air tubing is perfect for underground applications, and allowed the producer to withstand rugged conditions by burying the tubing on-site to streamline operations. MaxLine's tubing maintains its shape after bending and is made of several layers: the inner and outer layer are HDPE and the center layer is aluminum; its smooth inner surface delivers air efficiently and remains corrosion free for decades.

Trench

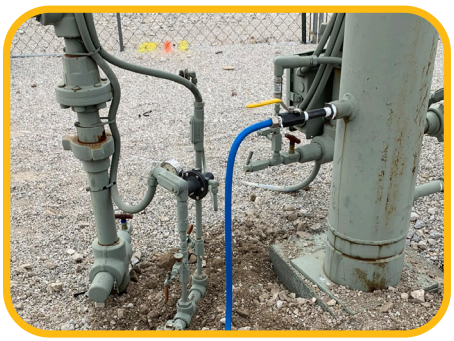
MaxLine in ground

MaxLine on spool outside

MaxLine on spool inside

MaxLine spool and trench

MaxLine attached to piston



MaxLine attached to piston 2

MaxLine attached to air compressor

MaxLine attached to air compressor

Powering Leak-Proof Performance

MAXLINE INDUSTRIAL SEMI-FLEXIBLE COMPRESSED AIR TUBING

Powering the natural gas gathering process with compressed air reduces the reliance on a natural gas solution by running compressed air piping directly between the air compressor and the field equipment.

Compressed Air Key Benefits

Promotes a more socially responsible gas retrieval processn process

Eliminates pneumatic controller emissions and reporting

Operation cost savings

MaxLine Key Benefits

MaxLines's semi-flexible tubing comes in 100 or 300 ft coils (special orders for longer lengths), using compression fittings for leak proof performance, delivering clean compressed air.

Perfect for "rugged" sites with obstructions and corners, MaxLine can be buried underground and can be installed in half the time of traditional methods.

MaxLine's tubing maintains its shape after bending and is made of several layers: the inner and outer layer are HDPE and the center layer is aluminum; its smooth inner surface delivers air efficiently and remains corrosion free for decades.

In Summary

Powering the natural gas gathering process with compressed air reduces the reliance on a natural gas solution by running compressed air piping directly between the air compressor and the field equipment.

Natural gas companies can power the production process with compressed air to eliminate pneumatic controller emissions and reporting, earn carbon credits, and recoup system investment costs in just one year.

Set up a free consultation

with RapidAir to discuss the switch to compressed air systems to power pneumatic controllers.
866-253-2093 | info@rapidairproducts.com

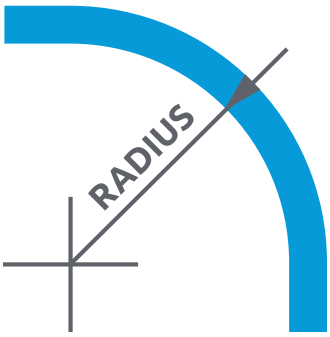
Tech Specs

MAXLINE INDUSTRIAL SEMI-FLEXIBLE COMPRESSED AIR TUBING

- Compressed Air – Inert Gas – 200 psi max
- Vacuum to 29 inHg
- 1/2”, 3/4” and 1”, and 2” sizes (inside diameter)
- 100 and 300 ft. rolls available, special orders up to 900 ft.
- ComPRESSed fittings available for added pressure opportunities
- Operating working pressure 200 psi @73˚F, 160 psi @140˚F
- Temperature range -40˚F to 140˚F
- Compatible with common compressor oils
- Can be buried underground or in concrete
- For outside installation, cover or paint the tubing to protect from direct sunlight (UV rays)
- ASTM F128

Bend Radius

MaxLine Air Compressor piping will hold any bent shape. When you’re ready for installation, you may want to straighten it out, especially if it will be mounted on a wall. It’s easy to straighten the tubing. Simply run it through our straightening tool. We also carry a bender tool so you can bend the piping to the exact angles you need.



MAXLINE AIR COMPRESSOR PIPING WILL HOLD ANY BENT SHAPE

1/2" MaxLine
- Bend Radius: 4-6"
- Outside Diameter: .63"
- Inside Diameter: .50"

3/4" MaxLine
- Bend Radius: 6-8"
- Outside Diameter: .98"
- Inside Diameter: .80"

1" MaxLine
- Bend Radius: 10-12"
- Outside Diameter: 1.26"
- Inside Diameter: 1.02"

2" MaxLine
- Bend Radius: 36-48"
- Outside Diameter: 2.50"
- Inside Diameter: 2.00"

Tech Specs

MAXLINE INDUSTRIAL SEMI-FLEXIBLE COMPRESSED AIR TUBING

Fittings & Installation
1/2", 3/4", and 1"

- Compression style
- Nickel plated brass
- Double O ring seal, Buna N
- Split ring allow disassembly
- No expensive install tools required
- ASTM F1974

CUT the tubing square with the cutter, ROTATING wrist while cutting

BEVEL the inside of the tubing by inserting the reaming tool and rotating it at least 3 full turns. Use:

- Peg #32 for 1" tubing
- Peg #25 for 3/4" tubing
- Peg #16 for 1/2" tubing

Remove nut and split ring from fitting and place on tubing

PUSH the fitting onto the tubing and fully against the shoulder of the fitting (soapy water will help this process)

TURN the nut hand tight. Put a reference mark on the nut and fitting body

TIGHTEN nut with wrench a minimum 3/4 of a turn or until tight

Fittings & Installation
2"

- Compression style
- Nickel plated brass
- Double O ring seal, Buna N
- Stainless Crimp Ring

CUT the tubing square with the wheeltype cutter, apply extra pressure so wheel does not walk out of cut groove.

APPLY soapy water to the ALUMINUM plunger. Use a soft hammer to pound the plunger into the tubing and back out again (this makes the tubing round after cutting.

BEVEL the inside of the tubing with the reaming tool. Rotating repeatedly until a large chamfer forms.

APPLY soapy water to the fitting and tubing end. Put crimp sleeve on the tubing, and push fitting stem into the tubing fully.

CRIMP fitting with tool to 6500 psi.

COMPLETED

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