

A Comparison of Fittings

For Use with Plastic & Rubber Tubing

NewAge® Industries, Inc.

Introduction

When you're using plastic tubing or rubber hose, you will, in most cases, need to attach it to something . . . a piece of equipment or another section of tubing. Fittings or connectors are a common means to accomplish this and come in many different materials — polyethylene, nylon, PVDF, fluoropolymer, stainless steel, brass — so you can select the best match for your application.

There are many styles of fittings, from simple barbed varieties to multi-component compression types to heavy duty cam couplings. This paper examines each style, what materials are offered, what tubing materials each works best with, how complicated (or not) installation is, and usage tips. Clamps are also reviewed.

This document explores products available from NewAge Industries, Inc.



Barbed Fittings

As the name states, barbed fittings have a single barb or multiple barbs on at least one end. The barbed end is inserted into the tubing. The function of the barbs is to grip the interior wall of the tubing, without damaging the wall, to hold the fitting in place.

Barbed fittings work best with soft tubing (flexible PVC, polyurethane, silicone, thermoplastic rubber), as the tubing must give a bit to fit around the barbed end. Leaks can occur when there isn't a good fit, i.e. the fitting is too small. In fact, the O.D. (outer diameter) of the barbed area on the fitting must be larger than the I.D. (inner diameter) of the tubing, and there should be some resistance when the fitting is inserted into the tubing. As an example, .250" (1/4") I.D. tubing should use a barbed fitting with a barb O.D. of at least .270".



Barbed fittings are usually applied by hand without tools, and typically clamps or cable ties are used to securely attach the fitting to the tubing and ensure a good seal. Sometimes on lower pressure applications, clamps may not be necessary, but that is the exception rather than the rule and should always be determined by testing the connections as they will be used in the actual application.

Tubing and fitting materials must mate well with each other as well as to the application. For instance, a brass barbed fitting may not be a good match for silicone tubing. The barb could be too sharp for the silicone material and could cut into the wall, resulting in a failure. Polyurethane tubing, which is much more resilient and resistant to tearing than silicone, may be a better choice for a brass barbed fitting. Less aggressive barb designs are recommended for silicone tubing, along with plastic clamps or lined metal clamps.

Push-To-Connect Fittings

Push-to-connect fittings attach to tubing by simply pushing the tubing into the fitting to connect the two items. But how exactly does this work, and how do they stay attached?

Each port or opening in a push-to-connect fitting typically has a collet (or collar), a gripper, and an O-ring, surrounded by a body. The collet and the gripper may be integrated into a single component, depending on the manufacturer. But whether they're two pieces or one, their job is to keep the tubing secured within the fitting's body.

The gripper does just what it says — it literally grips the tubing. The O-ring forms a seal between the exterior of the tubing and the interior of the fitting body to prevent leaks. The body's job is to provide a smooth interior for fluid or air flow between sections of tubing and to hold everything in place.

Unlike barbed fittings where the barbs are on the interior of the tubing, push-to-connect fittings hold onto the tubing's O.D., thereby having much less effect on the interior flow. But push-to-connect styles can have an end that's threaded, barbed, or straight (called a stem), and swivel types are available as well. Your application and tubing material will help determine what's needed.

Push-to-connect fittings work best with rigid and semi-rigid tubing such as nylon, polyethylene, polypropylene and hard durometer polyurethane. They may be used with some softer tubing materials — PVC, for instance — when a tube support is employed. The fittings perform best when the end of the tubing going into the fitting is round, cleanly cut and free of exterior scratches. Tubing may need to be recut if removed from the fitting and reinserted.

Covers for collets are available to help prevent accidental depression of the collet and tubing disconnection. Collet covers come in colors, making coding and line identification quick and easy.



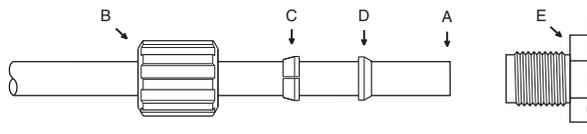
Compression Fittings

Compression fittings use three or four components per fitting to put pressure on the tubing's O.D. to create a secure seal. These fittings are commonly used in applications involving fluids but may also be used for gas.

Because the interior of the tubing is unencumbered by inserts like barbs, compression fittings offer good flow characteristics. Depending on the application and materials involved (plastic, metal), the fittings may be reused. They're a good choice for rigid and semi-rigid tubing materials.



Compression fittings consist of a fitting body (E), an outer compression nut (B), an inner compression ring or ferrule (D), and in some cases a gripper (C). When the nut is tightened onto the fitting body, the ferrule compresses around the O.D. of the tubing (A) creating a secure seal. The nut is normally finger tightened, and then further tightened one additional turn using a wrench. It is important to avoid over-tightening, as the ferrule may deform and cause the seal to fail.



Cam Operated Couplings

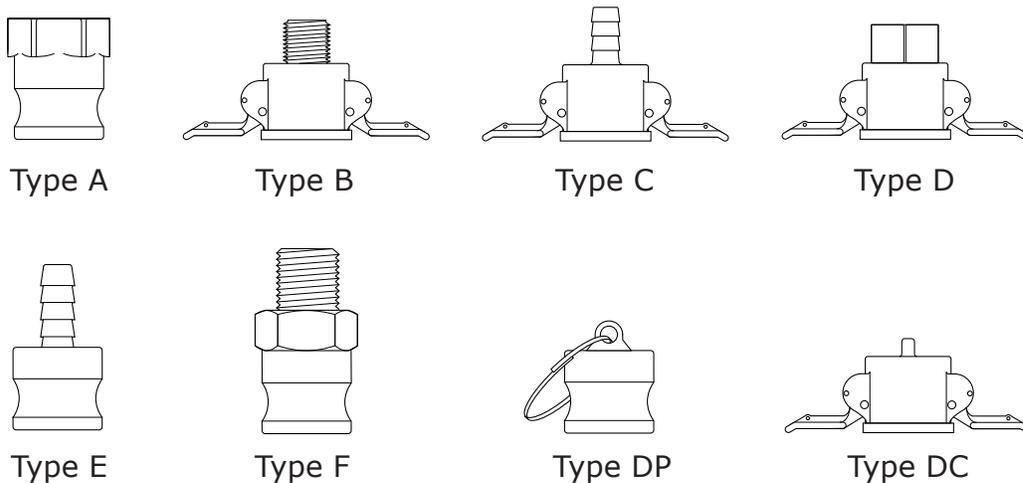
Besides the term “cam operated couplings,” these connectors are known by several names including cam and groove, cam groove, cam op, cam lever, cam lock, cam couplings or cam fittings.

Cam operated couplings are intended for quick and easy connection and disconnection. No tools or special skills are needed. The design involves a coupler and a grooved adapter. Each coupler has two cams — movable pieces that fit into the groove, then rotate and lock the two fitting components into place. This ensures a proper fit and a tight seal against the gasket inside. Many cam couplings have a retaining pin that can be used to make sure the cams remain locked in place. Clamps are typically used with barbed versions.

Cam couplings are available in the following universal styles:



- Type A: male adapter on one end with a FNPT (Female National Pipe Thread) on the other
- Type B: female coupler and MNPT (Male National Pipe Thread)
- Type C: female coupler and hose barb
- Type D: female coupler and FNPT
- Type E: male adapter and hose barb
- Type F: male adapter and MNPT
- Type DP: plug (also called a dust plug)
- Type DC: cap (also called a dust cap)



Materials used in cam coupling manufacture include aluminum, stainless steel, brass, other metals, and various plastics such as polypropylene, PVDF and nylon. Sizes can range from as small as 1/4" to as large as 8". The application will determine which cam coupling material and size is needed. One important thing to keep in mind is that cam couplings generally have a much larger body as compared to barbed, push-to-connect or compression fittings. This should be carefully considered with the overall fluid transfer system design.

Cam operated coupling uses include positive pressure fluid and dry product handling such as petroleum, chemicals, agricultural commodities, water and other liquids. The couplings should not be used for steam or compressed air applications.

Clamps

When tubing needs to be securely attached to another piece of equipment by use of a fitting, most manufacturers of the tubing recommend using a clamp to help hold the tubing and the fitting together. Without a securely-fastened clamp, the potential for the two components to separate exists, and that can result in costly and time-consuming leaks.

There are several types of hose clamps, and each has its place depending on the application. Three popular styles are ear type, worm gear and double bond. They're used in industries such as food and beverage, chemical, laboratory, medical, pharmaceutical, OEM, MRO, pool and spa, automotive, appliance, marine and others.

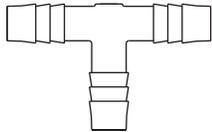
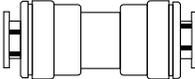
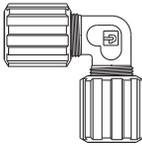
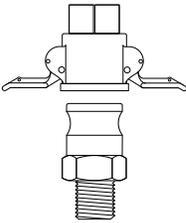


Ear type clamps are tightened around tubing when part of the clamp is crimped using a special tool called a pincer. They're known as breathable clamps, because they adapt to expansion and contraction — a benefit when varying temperatures are involved. Ear type clamps are lightweight and typically made from steel (stainless, galvanized or zinc-plated carbon). One ear, two ear and one ear stepless styles offer options for different tubing materials. The clamps provide a compact design, making them well suited for limited-space applications.

Worm gear clamps, which are also known as screw or band clamps, are easily installed with a standard screwdriver or ratcheting socket. Tightening the screw pulls a band through a housing, thereby tightening the band around the hose or tubing. Like ear type clamps, they are constructed of steel. Styles designed to work with soft tubing, such as silicone, and with harder tubing are available. Worm gear clamps may be reused.

When a non-metallic clamp is needed, **double bond clamps**, commonly made of nylon, may be used. Double bond (also called double grip) clamps offer two rows of teeth to ensure a strong hold and can be easily adjusted for a tighter fit around tubing. These clamps are non-conductive and will not rust or corrode. They are typically hand applied, although pliers or channel locks can be used to tighten the clamp. Like worm gear clamps, double bond clamps may be reused.

Comparison Chart 1: Appearance, Styles, Function

Fitting Type	Barbed	Push-to-Connect	Compression	Cam Operated Coupling
What It Looks Like	A single barb or multiple barbs on at least one end	Each port typically has a collet (collar), gripper, & O-ring, surrounded by a body	Three-to-four components (body, nut, ferrule, sometimes a gripper) combined during installation	Two components: a coupler with handles & a grooved adapter
Example				
Styles Available	Tees (T's), wyes (Y's), elbows, adapters, swivels, single use/disposable	Tees (T's), wyes (Y's), elbows, adapters, straight connectors, reducers, three-way & four-way connectors, end stops, check valves	Tees (T's), elbows, adapters, straight connectors	Adapters & couplers with barbed or National Pipe Thread ends; plugs & caps
How It Works	Insert a barbed end into a section of tubing. The barbs function to grip the interior wall of the tubing, without damage, to assist with holding the fitting in place.	The fitting's gripper tightly grasps the exterior of the tubing. An O-ring forms a seal between the exterior of the tubing & the interior of the fitting body to prevent leaks. The body provides a smooth interior & holds all components in place.	The nut of the fitting is tightened onto the fitting body, & a ferrule compresses around the O.D. of the tubing to create a seal.	A coupler is attached to one end of a hose using a clamp; an adapter is attached to another hose. A coupler's two cams – movable pieces that fit into a groove in an adapter – rotate & lock the two pieces into place.

Comparison Chart 2:

Tubing Compatibility, Installation Requirements, Tips, Materials, Brand Names

Fitting Type	Barbed	Push-to-Connect	Compression	Cam Operated Coupling
Tubing/Hose It Works Best With	Soft tubing such as flexible PVC, silicone, polyurethane, TPR (thermoplastic rubber), latex & Viton™	Rigid & semi-rigid tubing like nylon, polyethylene, polypropylene & hard durometer polyurethane	Rigid tubing such as fluoropolymer	Softer hose such as flexible PVC & polyurethane; typically used with reinforced hose
Tools Needed for Installation	None, except those that may be needed for clamp installation	None	Wrench	None, except those that may be needed for clamp installation
Clamps Required?	Yes, except in very low pressure applications	No	No	Yes
Tips	The O.D. of the barbed area on the fitting must be larger than the I.D. of the tubing, & there should be some resistance when the fitting is inserted into the tubing.	Covers for collets are available to help prevent accidental depression of the collet, resulting in tubing disconnection. Collets come in colors for coding & identification.	Well suited for corrosive environments & chemicals & for ultra-pure fluid applications where contamination-free systems are needed. A complete fluid transfer system made of fluoropolymer is possible.	Also known as cam & groove, cam groove, cam op, cam lever, cam lock, cam couplings or cam fittings.
Fitting Materials Offered by NewAge	Nylon, polyethylene, PVDF, polypropylene, brass	Acetal, brass	PFA fluoropolymer	Nylon & polypropylene
NewAge's Brand Name	Thermobarb®	Newloc®	Pureloc®	n/a

Conclusions

The determining factor for what type of fitting and clamp to use depends on the specifics of your application. Evaluate needs based on tubing material and hardness, temperatures involved, the product being transferred through the tubing and fitting, harsh or mild environments, performance expectations, durability requirements and styles needed (elbows, tees, etc.).

When you need help deciding what to use, give the *Fluid Transfer Specialists*® a call. We'll help. Contact us at 800-506-3924 (U.S. only), 215-526-2300, info@newageindustries.com or visit www.newageindustries.com.

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The Top 20 Tubing and Hose Buying Tips, #s 11-20

PVC vs. Polyurethane - A Tubing Comparison

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