WOODWARD

Product Manual 55106
(Revision NEW)
Original Instructions

Installation Instructions for Compression Type Hydraulic Fittings

Installation Manual

General Precautions

Read this entire manual and all other publications pertaining to the work to be performed before installing, operating, or servicing this equipment.

Practice all plant and safety instructions and precautions.

Failure to follow instructions can cause personal injury and/or property damage.

Revisions

This publication may have been revised or updated since this copy was produced. To verify that you have the latest revision, check manual *26311* , *Revision Status & Distribution Restrictions of Woodward Technical Publications*, on the *publications page* of the Woodward website:

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The latest version of most publications is available on the *publications page*. If your publication is not there, please contact your customer service representative to get the latest copy.

Proper Use

Any unauthorized modifications to or use of this equipment outside its specified mechanical, electrical, or other operating limits may cause personal injury and/or property damage, including damage to the equipment. Any such unauthorized modifications: (i) constitute "misuse" and/or "negligence" within the meaning of the product warranty thereby excluding warranty coverage for any resulting damage, and (ii) invalidate product certifications or listings.

Translated Publications

If the cover of this publication states "Translation of the Original Instructions" please note:

The original source of this publication may have been updated since this translation was made. Be sure to check manual *26311* , *Revision Status & Distribution Restrictions of Woodward Technical Publications*, to verify whether this translation is up to date. Out-of-date translations are marked with ⚠. Always compare with the original for technical specifications and for proper and safe installation and operation procedures.

Revisions—Changes in this publication since the last revision are indicated by a black line alongside the text.

Warnings and Notices

Important Definitions

This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

- **DANGER**—Indicates a hazardous situation which, if not avoided, will result in death or serious injury.
- **WARNING**—Indicates a hazardous situation which, if not avoided, could result in death or serious injury.
- **CAUTION**—Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.
- **NOTICE**—Indicates a hazard that could result in property damage only (including damage to the control).
- **IMPORTANT**—Designates an operating tip or maintenance suggestion.

⚠WARNING

Overspeed / Overtemperature / Overpressure

The engine, turbine, or other type of prime mover should be equipped with an overspeed shutdown device to protect against runaway or damage to the prime mover with possible personal injury, loss of life, or property damage.

The overspeed shutdown device must be totally independent of the prime mover control system. An overtemperature or overpressure shutdown device may also be needed for safety, as appropriate.

⚠WARNING

Personal Protective Equipment

The products described in this publication may present risks that could lead to personal injury, loss of life, or property damage. Always wear the appropriate personal protective equipment (PPE) for the job at hand. Equipment that should be considered includes but is not limited to:

- **Eye Protection**
- **Hearing Protection**
- **Hard Hat**
- **Gloves**
- **Safety Boots**
- **Respirator**

Always read the proper Material Safety Data Sheet (MSDS) for any working fluid(s) and comply with recommended safety equipment.

⚠WARNING

Start-up

Be prepared to make an emergency shutdown when starting the engine, turbine, or other type of prime mover, to protect against runaway or overspeed with possible personal injury, loss of life, or property damage.

⚠WARNING

Automotive Applications

On- and off-highway Mobile Applications: Unless Woodward's control functions as the supervisory control, customer should install a system totally independent of the prime mover control system that monitors for supervisory control of engine (and takes appropriate action if supervisory control is lost) to protect against loss of engine control with possible personal injury, loss of life, or property damage.

NOTICE

Battery Charging Device

To prevent damage to a control system that uses an alternator or battery-charging device, make sure the charging device is turned off before disconnecting the battery from the system.

Electrostatic Discharge Awareness

NOTICE

Electrostatic Precautions

Electronic controls contain static-sensitive parts. Observe the following precautions to prevent damage to these parts:

- **Discharge body static before handling the control (with power to the control turned off, contact a grounded surface and maintain contact while handling the control).**
- **Avoid all plastic, vinyl, and Styrofoam (except antistatic versions) around printed circuit boards.**
- **Do not touch the components or conductors on a printed circuit board with your hands or with conductive devices.**

To prevent damage to electronic components caused by improper handling, read and observe the precautions in Woodward manual *82715*, *Guide for Handling and Protection of Electronic Controls, Printed Circuit Boards, and Modules*.

Follow these precautions when working with or near the control.

1. Avoid the build-up of static electricity on your body by not wearing clothing made of synthetic materials. Wear cotton or cotton-blend materials as much as possible because these do not store static electric charges as much as synthetics.
2. Do not remove the printed circuit board (PCB) from the control cabinet unless absolutely necessary. If you must remove the PCB from the control cabinet, follow these precautions:
   - Do not touch any part of the PCB except the edges.
   - Do not touch the electrical conductors, the connectors, or the components with conductive devices or with your hands.
   - When replacing a PCB, keep the new PCB in the plastic antistatic protective bag it comes in until you are ready to install it. Immediately after removing the old PCB from the control cabinet, place it in the antistatic protective bag.

Installation Instructions for Compression Type Hydraulic Fittings

Introduction

Woodward has researched many different types of fittings for use with the TM series actuators. We have found that Aeroquip Versil-Flare™ flareless fittings are best suited to interface with the 37° fittings that are part of the TM actuators. For other applications, our preference is the dual-ferrule "Swagelok® type" compression fitting. This manual has been prepared with the permission of Aeroquip and Swagelok® companies to provide proper assembly procedures for each type of fitting. The following diagrams/procedures should prevent confusion during installation that may lead to leaks or failures in the system.

INSTALLATION INSTRUCTIONS

SWAGELOK Tube Fittings

SWAGELOK Tube Fittings come to you completely assembled, finger-tight. They are ready for immediate use.

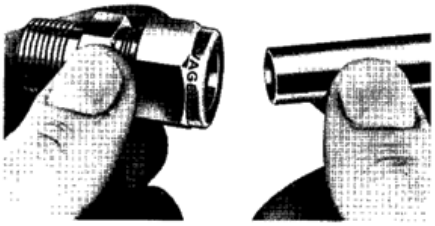
Disassembly before use is unnecessary and can result in dirt or foreign material getting into fitting and causing leaks.

High Pressure Applications or High Safety Factor Systems

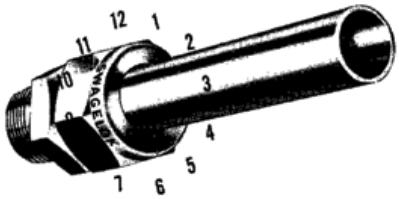
Due to variations in tubing diameters, a common starting point is desirable. Using a wrench, tighten the nut to the SNUG position. Snug is determined by tightening the nut until the tubing will not rotate freely (by hand) in the fitting. (If tube rotation is not possible, tighten the nut approximately 1/8 turn from the finger-tight position). At this point, scribe the nut at the 6 o'clock position and tighten the nut 1-1/4 turns.* The fitting will now hold pressures well above the rated working pressure of the tubing.

Use of the individual Gap Inspection Gage (1-1/4 turns* from snug end) ensures sufficient pull-up.

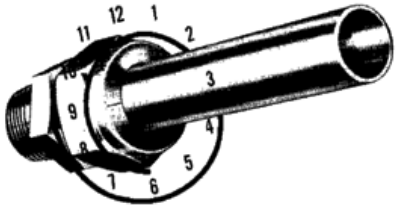
SWAGELOK Tube Fittings are installed in three easy steps:



Simply insert the tubing into the SWAGELOK Tube Fitting. ***Make sure that the tubing rests firmly on the shoulder of the fitting and that the nut is finger-tight.***



Before tightening the SWAGELOK nut, scribe the nut at the 6 o'clock position.



Now, while holding the fitting body steady with a backup wrench, tighten the nut 1-1/4 turns.* Watch the scribe mark, make one complete revolution and continue to the 9 o'clock position.

By scribing the nut at the 6 o'clock position as it appears to you, there will be no doubt as to the starting position. When tightened 1-1/4 turns* to the 9 o'clock position you can easily see that the fitting has been properly installed.

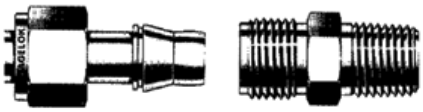
Use of the Gap Inspection Gage (1-1/4 turns* from finger-tight) assures sufficient pull-up.

*For 1/16", 1/8" and 3/16" size tube fittings, only 3/4 turn from finger-tight is necessary.

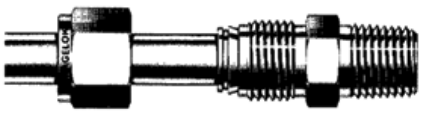
RE-TIGHTENING INSTRUCTIONS

Connections can be disconnected and re-tightened many times. The same reliable, leak-proof seal can be obtained every time the connection is remade.

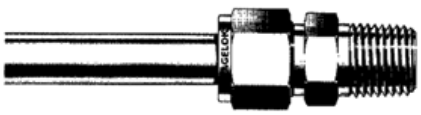
Fitting shown in disconnected position.



Tubing with pre-swaged ferrules inserted into the fitting until front ferrule seats in fitting.



Tighten nut by hand. Rotate nut to the original position with a wrench. (An increase in resistance will be encountered at the original position). Then tighten slightly with the wrench. (Smaller tube sizes will take less tightening to reach the original position, while larger tube sizes will require more tightening. The wall thickness will also have an effect on tightening).



Swagelok tube Fittings

Versil·Flare™ Tube Fittings

Assembly Instructions
Versil·Flare™ Tube Fittings

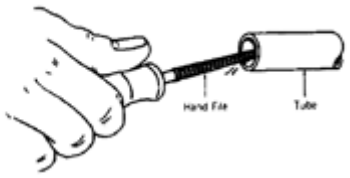
Assembly Instructions for Versil·Flare™ Tube Fittings

Cutting

To insure a leak-proof joint, the tubing should be cut square (±1°). A tube cutter is preferred, but a hacksaw or abrasive wheel can be used.

Deburring

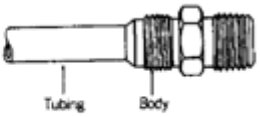
All cut tubes should be deburred. However, deburring is even more important if the tubing was cut with a hacksaw or abrasive wheel. Remove any burrs, both internally or externally, with a deburring tool, emery paper or fine file. Clean the tube before assembly. Clean all dirt and grit from the I.D. and O.D. of the tube.



Assembly Instructions for Aeroquip Versil·Flare™ tube fitting

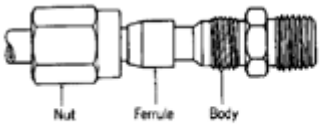
Tubing cut-off

1. Tube should be cut to fit tight against the face of standard SAE 37° flare body.

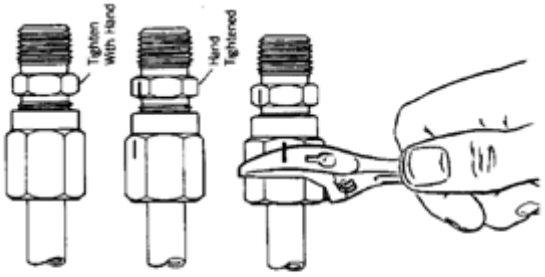


Initial assembly

1. Deburr the end internally and externally. Clean all dirt and grit from I.D. and O.D.
2. Slide the nut and then the ferrule into the tube. Make sure the tapered end of ferrule points toward the nut.



3. Lubricate all mating surfaces of nut, ferrule and body with a heavy lubricant such as Aeroquip 222070 Lube.
4. Place end of tube against standard SAE 37° flare body.
5. Slide the ferrule and nut against body and tighten the nut onto the body "Hand Tight." Mark the nut in relation to the body for location.



6. Hold tube against body and tighten nut a total of one and ¼ turns on –3 through –10 and one and ½ turns –12 through –32.

Reassembly

1. Slide nut against the body and tighten to "Hand Tight." Mark the nut for location.
2. Tighten nut a minimum of one "Hex" flat. The Aeroquip Versil·Flare™ flareless tube fitting is designed for a minimum of 10 reassemblies.

Aeroquip Tube Fittings

We appreciate your comments about the content of our publications.

Send comments to: icinfo@woodward.com

Please reference publication 55106.

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