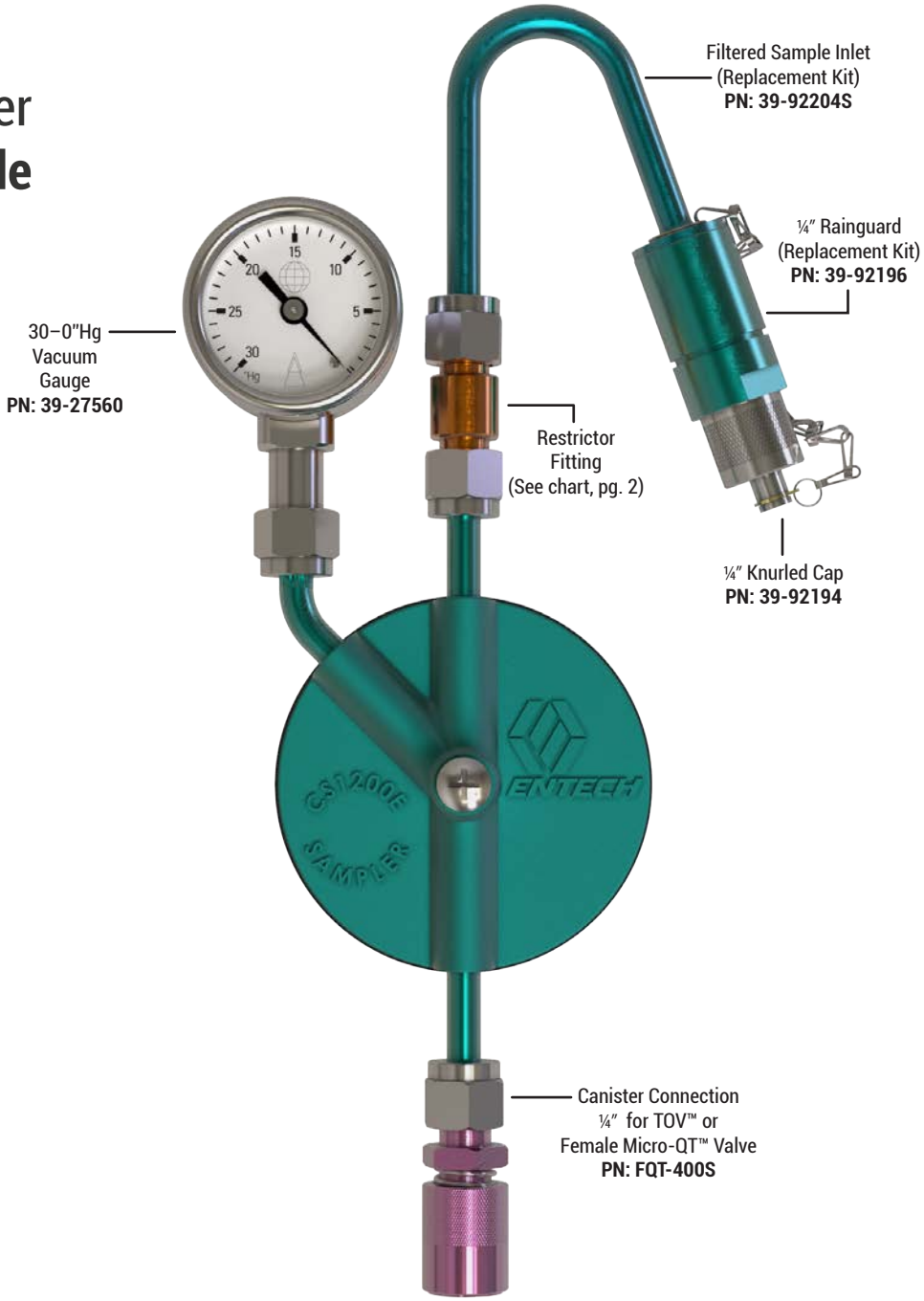
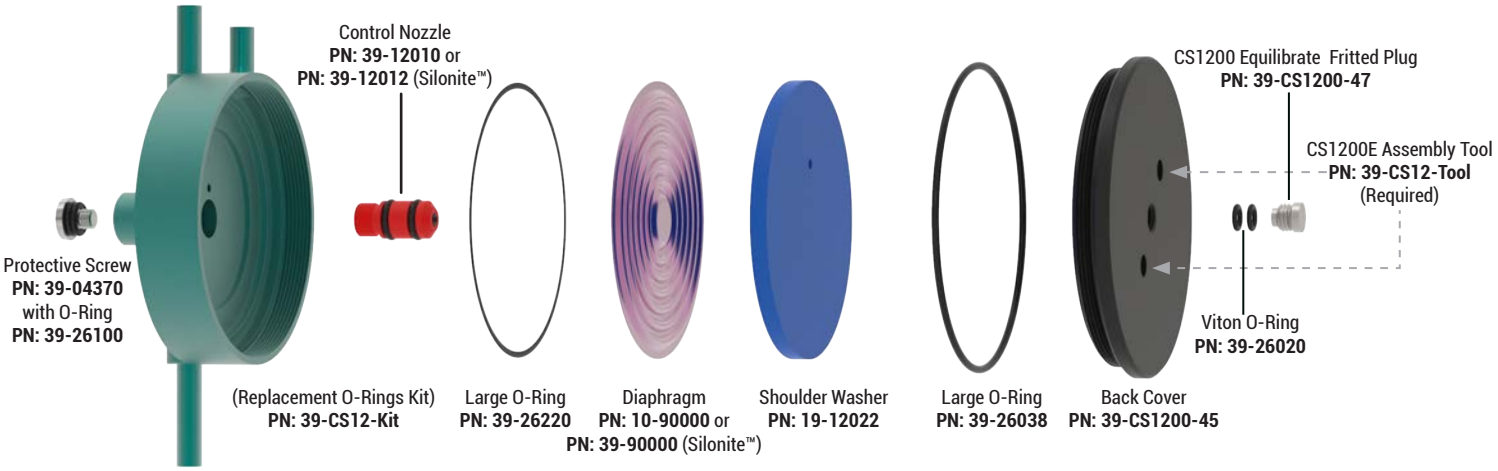
CS1200E Flow Controller
Operation and Care Guide

Revision 11/2021 *(For CS1200E with new rainguard and tool-free cap)*



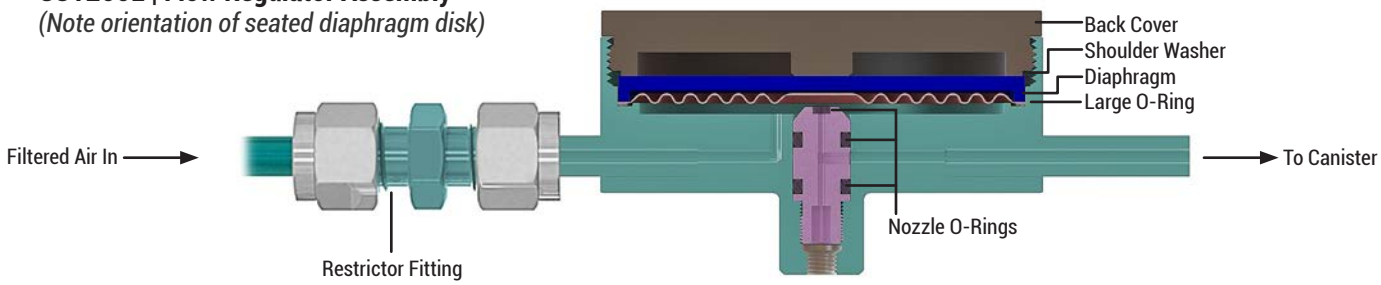
• CS1200E | About

The CS1200E is a high purity flow regulation system used to fill canisters at a constant rate from vacuum to within 1psi of atmospheric pressure without requiring power. The CS1200E fully meets the requirements of US EPA Method TO15 and other canister based VOC air sampling methods. The CS1200E consists of three main parts – the vacuum regulator, the flow restrictor, and the inlet. The vacuum regulator houses a diaphragm and a control nozzle that allows the pressure to be maintained just below atmospheric pressure even as the pressure in the attached canister increases. By choosing the appropriate restrictor (Code = 0 - 7) based on the canister size and sampling duration required, the flow rate will remain constant. With any given restrictor, the flow rate can be adjusted by a factor of 3x by adjusting the position of the control nozzle.



CS1200E | Flow Regulator Assembly

(Note orientation of seated diaphragm disk)



CS1200E | Restrictors and Flow Range

CS1200E Restrictors – The CS1200E features easily changed restrictor fittings with a stamped code to designate the general flow range. Further calibration using the control nozzle is required to fine tune the actual flow rate to achieve the desired canister fill duration.

Table 1 – CS1200E | Restrictors and Canister Fill Duration Range

CS1200E with stamped flow range code – PN: 39-CS1200E(S)x. Add "S" to order Silonite™ Coated version and replace "x" with desired flow code.

CS1200E | Restrictors					Recommended Restrictor for Volumes and Fill Times									
Part #		Flow Range	Code	Replacement Restrictor Part #	Fill Duration	450mL	600mL	1L	1.4L	2.5L	2.7L	3.2L	6L	15L
Silonite™ Coated	Uncoated			Silonite™ Coated										
39-CS1200ES0	39-CS1200E0	150 – 450 cc/min.	0	39-23000S	15 min.	2+	2	1	1	1	0	0	0	—
39-CS1200ES1	39-CS1200E1	50 – 150 cc/min.	1	39-23010S	1 hr.	3+	3+	3	2+	2	2	2	1	0
39-CS1200ES2	39-CS1200E2	25 – 75 cc/min.	2	39-23030S	3 hrs.	4+	4	4	3+	3	3	3	2+	1
39-CS1200ES2+	39-CS1200E2+	12 – 36 cc/min	2+	39-23060S	8 hrs.	5	5	4+	4+	4	4	3+	3	2+
39-CS1200ES3	39-CS1200E3	6 – 18 cc/min.	3	39-23080S	12 hrs.	6	5	5	4+	4	4	4	3+	2+
39-CS1200ES3+	39-CS1200E3+	4 – 12 cc/min.	3+	39-23160S	1 day	6	6	5	5	4+	4+	4+	4	3+
39-CS1200ES4	39-CS1200E4	2 – 6 cc/min.	4	39-23240S	2 days	7	7	6	6	5	5	5	4+	4
39-CS1200ES4+	39-CS1200E4+	1 – 3 cc/min.	4+	39-23480S	7 days	—	—	—	7	7	7	7	6	5
39-CS1200ES5	39-CS1200E5	0.5 – 1.5 cc/min.	5	39-24010S	14 days	—	—	—	—	7	7	7	7	5
39-CS1200ES6	n/a	0.2 – 0.6 cc/min.	6	39-24020S	30 days	—	—	—	—	—	—	—	7	6
39-CS1200ES7	n/a	0.1 – 0.3 cc/min.	7	39-24040S										

Assuming canisters are filled to 4" Hg below atmosphere

• CS1200E | Target Flow Rates for Filling Silonite™ Canisters

CS1200E Calibration – In order to maintain sample integrity, the CS1200E flow rates should always be verified and/or calibrated immediately prior to delivery to customer for field sampling.

Table 2 – CS1200E | Canister Target Flow Rate and Fill Duration[1]

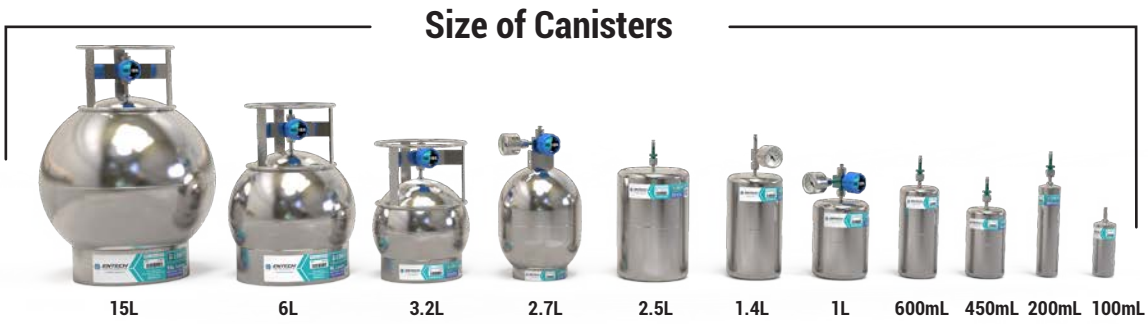
Target Flow Rates shown in cc/min. for canisters with Micro-QT™ Valves and the TrueSeal™ Valve only.

Fill Duration	450mL cc/min.	600mL[2] cc/min.	1L cc/min.	1.4L cc/min.	2.5L cc/min.	2.7L cc/min.	3.2L cc/min.	6L cc/min.	15L cc/min.
1 Hour	6.5	8.7	14.5	20.3	36	39.2	46.4	87	–
2 Hours	3.3	4.4	7.3	10	18	20	23.2	43.5	109
3 Hours	2.2	2.9	4.8	6.8	12	13.1	15.5	29	72.5
4 Hours	1.63	2.2	3.6	5.1	9	9.8	11.6	21.8	54.4
8 Hours	0.82	1.1	1.8	2.5	4.5	4.9	5.8	10.9	27.2
12 Hours	0.54	0.73	1.2	1.7	3	3.3	3.9	7.3	18.2
24 Hours	–	–	0.60	0.85	1.5	1.6	1.9	3.6	9.06
2 Days	–	–	–	–	0.75	0.82	0.97	1.8	4.5
1 Week	–	–	–	–	–	–	–	0.52	1.3

Tables are calculated for an 87% final fill volume.
.87 x Volume (cc) = 87% Volume.
87% Volume ÷ Minutes = Target Flow Rate (cc / min.).

[1] For sampling events above 3000 feet, reduce flow rate by 15%. MicroValves™ are recommended for use on Silonite™ Canisters and MiniCans™ up to 3.2L. Larger canisters with MicroValves™ may require longer cleaning times due to the added restriction of the valve. The TrueSeal™ Valve can be used with all canister sizes with the exception of the 600mL.

[2] The 600mL Minican™ with an integrated Micro-QT2™ Valve is designed only for MicroValve™ connections.



Leak Check Procedure for CS1200E

1. Attach and securely tighten the CS1200E's ¼" tool-free cap with chain onto the filtered inlet.
2. Connect the CS1200E to an evacuated canister. *(evacuated to below 20"Hg)*
3. If the CS1200E is connected to a canister using a TrueSeal Valve, turn knob to open valve momentarily and then close. If the CS1200E includes a MicroValve™, simply connect and disconnect the CS1200E to and from a Micro-QT™ Valve canister.
4. Verify no vacuum loss. If leaks occur, tighten fittings as needed to ensure vacuum integrity and repeat process above.

Manual Calibration Procedure for CS1200E – Time measurement, manual adjustments.

(Use the Flow Professor™ for flow rates >10cc/min)

1. Perform leak check as shown above. Connect CS1200E to evacuated canister. *(evacuated to below 20"Hg)*
2. If the CS1200E is connected to a TrueSeal™ Valve, open valve momentarily and then close. If the CS1200E is connected using a MicroValve™, simply connect and then disconnect canister. *(additionally, decrease the time by 7%)*
3. Measure the time it takes for pressure to rise from 20"Hg to 10"Hg. Use tables below to calculate the flow rate.
4. Turn the control nozzle to increase or decrease flow rate and retest using pressure rise time measurement.

The following tables shows the target flow rates for various canister sizes and sampling durations.

(Target pressure is 0.87 atmospheres)

450mL MiniCan™ – Time from 20"Hg to 10"Hg

Gauge Seconds	Code	Target Flow Rate cc/min.	Duration
15.5	4	2.12	3 Hours
31	5	1.09	6 Hours
41.5	5	0.82	8 Hours

1L MiniCan™ – Time from 20"Hg to 10"Hg

Gauge Seconds	Code	Target Flow Rate cc/min.	Duration
7	4	4.8	3 Hours
18.5	4	1.80	8 Hours
56	5	0.60	24 Hours

3.2L Silonite™ Canister – Time from 20"Hg to 10"Hg

Gauge Seconds	Code	Target Flow Rate cc/min.	Duration
6	4	5.8	8 Hours
17.5	4	1.93	24 Hours
35	5	0.96	2 Days

6L Silonite™ Canister – Time from 20"Hg to 10"Hg

Gauge Seconds	Code	Target Flow Rate cc/min.	Duration
5	3	7.3	12 Hours
9.5	4	3.6	24 Hours
65.5	5	0.52	1 Week

CAUTION: TO AVOID INTERNAL DIAPHRAGM DAMAGE, REFRAIN FROM OVER-TIGHTENING THE CONTROL NOZZLE AGAINST THE DIAPHRAGM.

Flow Professor™ CS1200E Calibration – *(For the most accurate CS1200E calibrations, use the Flow Professor™)*

The Flow Professor™ automates the calibration process for sampling into canisters as small as 450mL and as large as 15L.

1. Set canister size in the Flow Professor WIN7/10 Software.
2. Select sampling duration and vacuum to leave inside the canister after sampling (typically 2-4" Hg).
3. Attach Flow Professor to the CS1200E.
4. Select START CALIBRATION.

See Flow Professor operations guide for more details.

The Flow Professor™ automatically adjusts the the CS1200E to the correct flow rate. The software also adjusts for estimated field temperatures and sampling site elevation to optimize sampling rates under any environmental condition. The Flow Professor also identifies when a wrong or fouled restrictor has been installed, and when a diaphragm has become damaged. Flow vs pressure charts are created that validate sampling accuracy prior to field deployment.

The Flow Professor™ shown with CS1200ES

• CS1200E | Maintenance and Troubleshooting

CS1200E Cleaning – **CAUTION! - The CS1200E should not be placed under vacuum for long periods of time with the inlet cap on.** The diaphragm is meant to control to within approximately 1 psi of atmospheric pressure, and with the cap off, there is no way for a larger vacuum to develop. With the inlet cap installed, the inside of the flow controller can eventually reach negative 14 psig with continued application of a strong outlet vacuum. This can warp the diaphragm as it is forced downward into the control nozzle.

When to Clean

The internal volume of the CS1200E is so low that cleaning isn't necessary when it has been utilized exclusively for ambient air analysis. The remaining gas volume is small enough that it will not contaminate the next sample.

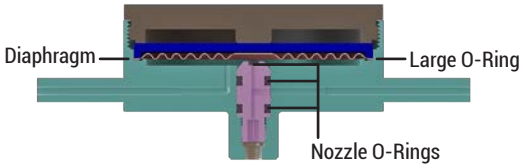
When performing higher concentration sampling, use one of the 3 choices below when purging the CS1200E using your Entech canister cleaning system:

1. Cap off the CS1200E inlet, and cycle between roughly 15 psia and 1 psia, without engaging the high vacuum pump. 5 cycles should be sufficient.
2. Or, remove the cap and just pressurize the cleaning system to 20 psia (not much higher) to allow reverse flow through the sampler.
3. Alternatively, remove the cap and pull a vacuum on the CS1200E, allowing lab air to be slowly pulled in. If the CS1200s are used for soil gas or other high concentration samples, lab air will be well below your detection limits. There is a big dilution factor when considering the 2cc internal volume of the sampler and the 1-6L volume of the canister. After slowly pulling room air through the unit, the CS1200E can be backflushed with N2 at a maximum of 20 psia for another 5 minutes before removal and capping to eliminate the room air.

Damaged Diaphragm –Over-tightening the flow adjust screw and can lead to reduced precision or inability to adjust the flow rate.

Tools Needed: ⅛" Hex Key, 5⁄64" Hex Key, Forceps, Cover Removal Tool (PN: 39-CS12-TOOL), Safety Glasses.

1. Remove the front protective screw and turn the adjustment screw counter-clockwise until it stops.
2. With the flow controller body face down on a table, remove the back cover using the cover removal tool.
3. Flip the flow controller body over to dump the back cover plate and metal disc to the table surface.
4. Examine diaphragm for damage *(diaphragm is a thin ribbed, metallic disk)*. A damaged diaphragm surface will appear deformed, creased, or wrinkled. If diaphragm is undamaged and correctly seated, reassemble and proceed to **step 9**.
5. Gently pry the edges of the diaphragm up with forceps and invert the controller body to remove the diaphragm.
6. Inspect to make certain that the large O-Ring is seated snugly in the groove inside the flow controller body. Also, ensure that the small O-Rings are present in the center and sides of the adjustment nozzle.



7. Insert diaphragm into the flow controller as shown in this diagram. *(The raised edge will be seated flat against the O-ring)*
8. Place the metal disc on top of the diaphragm with the flat side facing up and screw the back plate on by hand, then gently tighten with the same tool used to remove the cover. Only gentle tightening is required for leak-tight CS1200E operation.
9. Recalibrate the flow controller.

Filter Replacement –The Silonite™ coated filter may need to be replaced if it becomes contaminated / clogged.

Tools Needed: Cotton or Latex® gloves

1. Unscrew filter cover and remove from the end of the threaded inlet tube.
2. Unscrew filter and remove from end of the threaded inlet tube.
3. Remove and replace small O-ring with the new O-ring provided with replacement filter.
4. Install new filter and replace filter cover.

Replacement Silonite™ Filter with O-Ring
PN: 39-92150

Restrictor Replacement –Restrictor union may be replaced if it becomes contaminated, clogged or to provide different flow range.

Tools Needed: 9⁄16" Wrench, and ½" Wrench

1. Remove inlet tube assembly by loosening ¼" compression nut at top of restrictor union.
2. Loosen ¼" compression nut connecting bottom of restrictor union fitting to CS1200E body.
3. Remove and replace union with desired flow range restrictor union.
4. Reconnect inlet tube.

Replacement Restrictor Fittings.
Add "S" for Silonite™ Version

Restrictor Code	Part Number
0	**39-23000**(S)
1	**39-23010**(S)
2	**39-23030**(S)
2+	**39-23060**(S)
3	**39-23080**(S)
3+	**39-23160**(S)
4	**39-23240S**
4+	**39-23480S**
5	**39-24010S**
6	**39-24020S**
7	**39-24040S**

PLEASE NOTE!
Flow controllers shipped after October 2016 now use pure Nickel ferrules. They are extremely leak tight, but can be removed using a Nickel Ferrule Puller extraction tool from Entech.

NiFTY – Nickel Ferrules (10 Pack)
PN: 30-40400

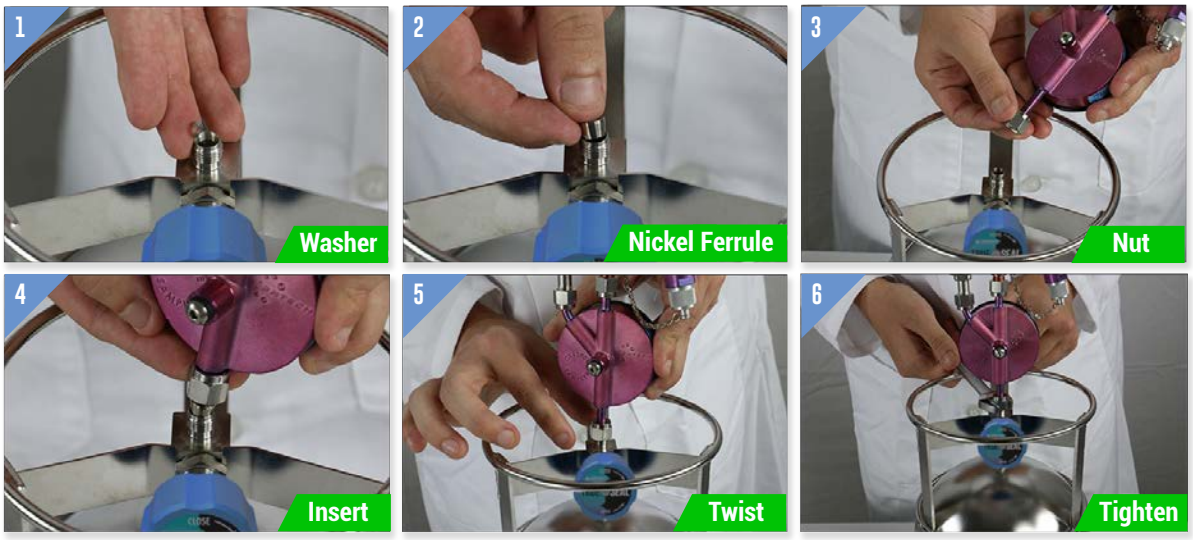
NiFTY – Nickel Ferrule Remover
PN: 30-40900

- **About Entech NiFTY Nickel Ferrules**

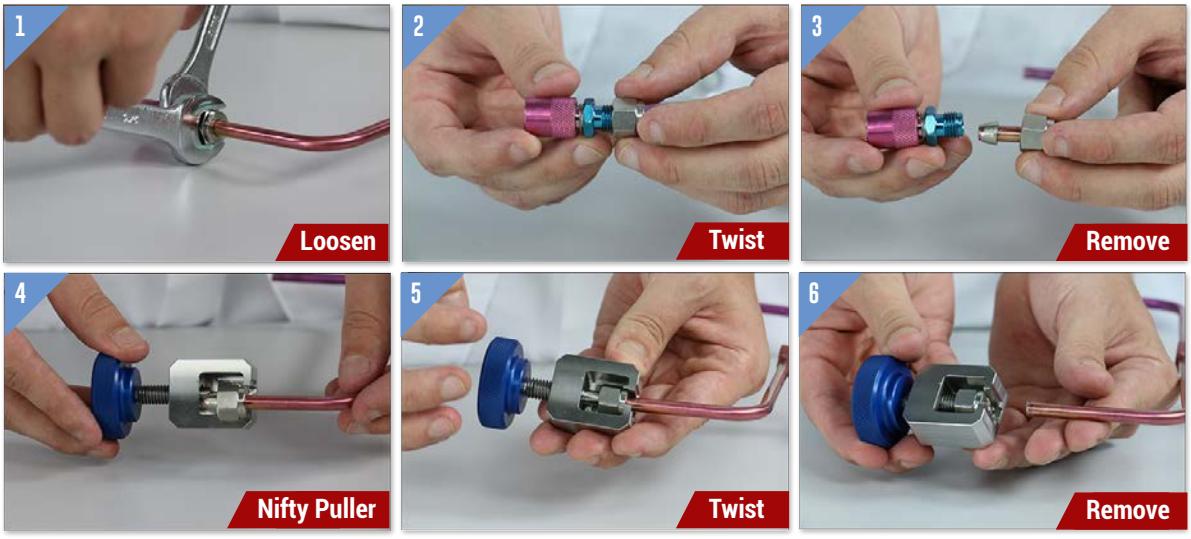
NiFTY
NICKEL FERRULE TECHNOLOGY

The ferrule, a small but critical component to leak tight sampling, has evolved. Your order is now using the latest ferrule technology from Entech. Through years of development, Entech has created a pure Nickel Ferrule that improves overall performance when compared to any other ferrule currently used for whole air sampling and analysis. The unique properties of Nickel create the best combination of inertness, low carryover, and replaceability, so you never have to throw away a fitting, flow controller, a 6L canister because your ferrule or ¼" Swagelok™ style nut failed you. Nickel ferrules seal and are easily replaceable just like Graphite-Vespel™ Ferrules, yet just like stainless steel ferrules, they are also non-contaminating and cannot be removed by hand.
See instructions below for installation or removal.

Installing Nickel Ferrules



Removing Nickel Ferrules



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