RESTEK REFINED innovative petrochemical solutions

Analyze Trace Polar Hydrocarbons More Accurately and Reliably With New **Alumina BOND/MAPD PLOT Columns!**

- Reproducible, predictable responses for reduced calibration frequency.
- Exceptional capacity which improves resolution and response.
- Highest temperature stability—application range extended to 250 °C.

Available in both fused silica and metal MXT® tubing!

RESTEK **Innovative Chromatography Products** www.restek.com • 800-356-1688 • 814-353-1300

New Technology Improves Trace Analysis of Polar Hydrocarbons

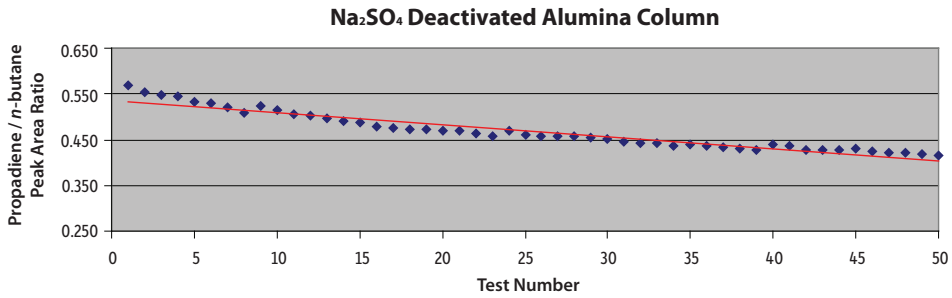
The chromatographic analysis of light hydrocarbons, including unsaturated isomers, is common in the petrochemical industry. Adsorption chromatography using alumina stationary phases has proven to be very effective for the separation of these compounds. However, challenges still exist, particularly for trace analysis of polar hydrocarbons like propadiene, acetylene, and methyl acetylene. Successful analysis of these compounds is highly dependent on the deactivation of the alumina. For example, response factors for these analytes are highly variable on sodium sulfate deactivated columns (Figure 1). While some columns, known as MAPD columns (for methyl acetylene and propadiene), have been developed specifically for these compounds, existing MAPD column solutions show limitations in response factor reproducibility, capacity, and temperature stability.

Restek has solved these problems by developing a new line of MAPD alumina columns with a unique, high-performance deactivation. These columns—the Rt®-Alumina BOND/MAPD (fused silica) and MXT®-Alumina BOND/MAPD (metal) columns—offer several significant improvements over conventional MAPD columns:

- Reproducible, predictable responses for reduced calibration frequency.
- Exceptional capacity which improves resolution and response.
- Highest temperature stability—application range extended to 250 °C.

These features are a significant step forward in MAPD column technology and have resulted in improvements in column performance compared to other MAPD columns. New Rt®-Alumina BOND/MAPD and MXT®-Alumina BOND/MAPD columns are not only perfect for analysis of polar hydrocarbons such as acetylene, methyl acetylene, and propadiene, but also perform well for generic light hydrocarbon analysis.

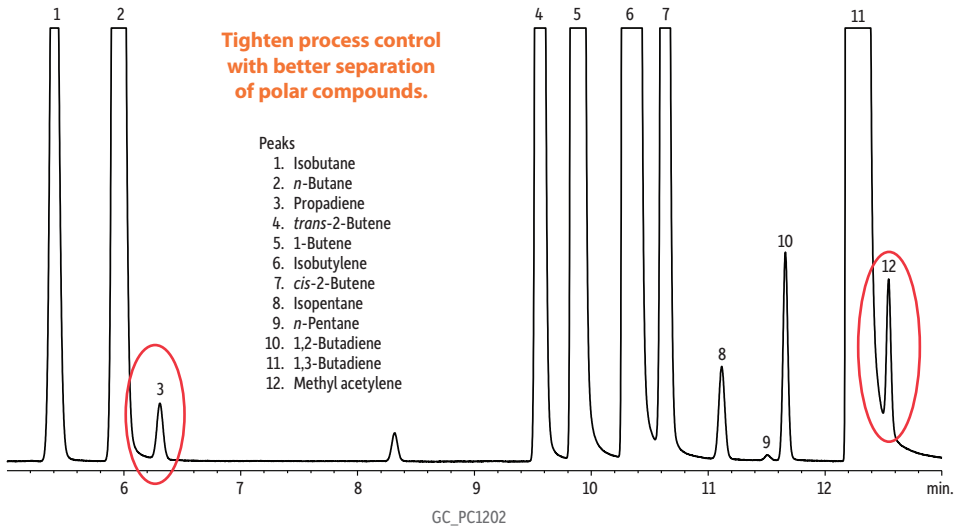
Figure 1 Conventional Na_2SO_4 deactivated columns show poor response stability over time.



Key Application: Separation of Methyl Acetylene (MA) and Propadiene (PD)

Since small amounts of methyl acetylene and propadiene can interfere with the conversion of propylene, ethylene, or 1,3-butadiene into polypropylene, polyethylene, or synthetic butadiene rubber, respectively, separation and quantification of these compounds at trace levels is critical. The new Rt®- and MXT®-Alumina BOND/MAPD columns not only provide excellent separation of these analytes (Figure 2), but also elute them with high response factors due to the inertness of the column. This makes light hydrocarbon purity methods more sensitive and accurate, allowing much tighter process control.

Figure 2 Excellent separation of methyl acetylene and propadiene from 1,3-butadiene and other hydrocarbons.

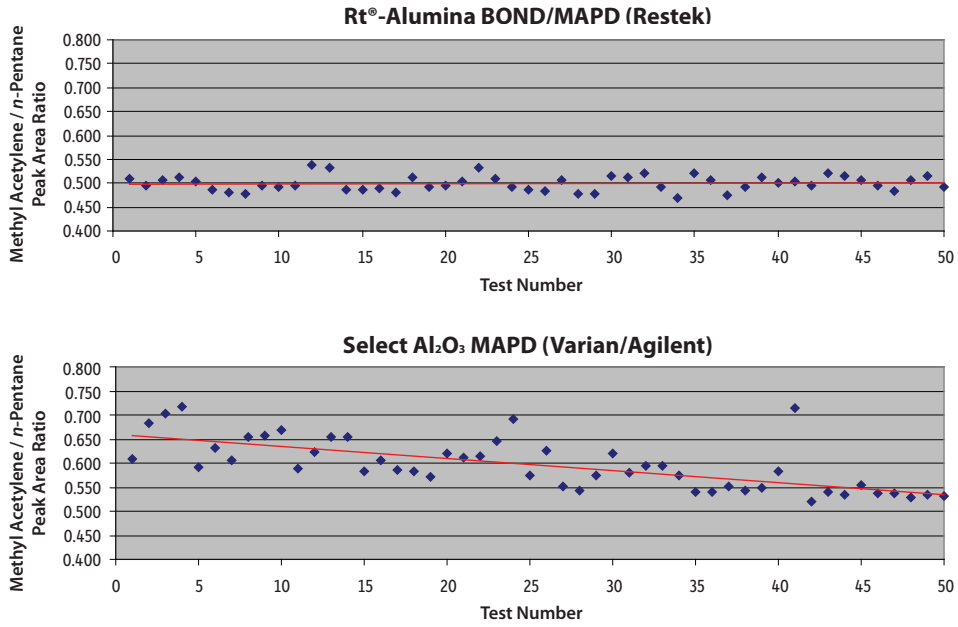


Column: Rt®-Alumina BOND/MAPD, 50 m, 0.53 mm ID, 10 µm (cat.# 19778); **Sample:** crude 1,3-butadiene; Diluent: none; **Injection:** Inj. Vol.: 5 µL split; Liner: 2 mm ID straight inlet liner (cat.# 20712); Inj. Temp.: 200 °C; Split Vent Flow Rate: 45 mL/min.; **Oven:** Oven Temp: 70 °C (hold 5 min.) to 200 °C at 10 °C/min. (hold 10 min.); **Carrier Gas:** He, constant pressure (20 psi, 137.9 kPa); Temp.: 70 °C; **Detector:** FID @ 200 °C; Make-up Gas Flow Rate: 30 mL/min.; Make-up Gas Type: N_2; Data Rate: 20 Hz; **Instrument:** HP5890 GC

Reproducible Responses Reduce Calibration Frequency

The technology employed in making Restek's new alumina BOND/MAPD columns ensures more consistent, predictable responses for critical compounds like methyl acetylene over many injections. As shown in Figure 3, methyl acetylene response is much more reproducible when using a Restek alumina MAPD column compared to other commercially available MAPD columns. Greater response stability reduces the frequency of recalibration, which is a key benefit for process-type applications.

Figure 3 New Rt®- Alumina BOND/MAPD columns outperform conventional MAPD columns, giving reproducible, reliable results every time!



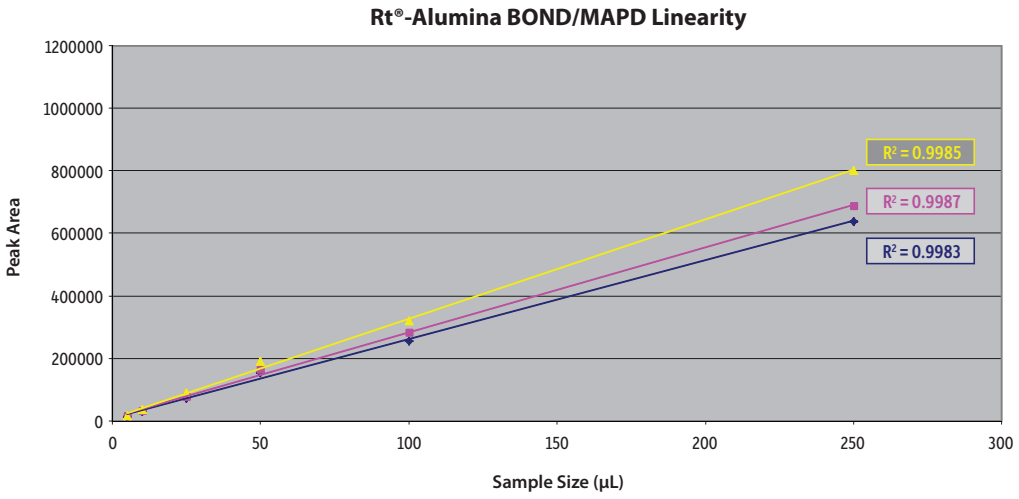
Exceptional Capacity Improves Resolution and Response

In gas-solid chromatography, phase overload produces tailing peaks, an issue that is further complicated by activity on adsorptive surfaces like alumina. This activity, which is defined by the nature of the alumina, contributes to the behavioral differences observed between different brands of alumina columns. The new Rt®-Alumina BOND/MAPD and MXT®-Alumina BOND/MAPD columns are designed to maintain the retention characteristics of a typical alumina column, but with much greater capacity. As shown in Table I, the Rt®-Alumina BOND/MAPD column shows less tailing (i.e., higher capacity) over a broad range of concentrations, compared to another commercially available alumina MAPD column. Less tailing results in higher signal-to-noise ratios, which produces better separations and higher responses. In addition, the Restek alumina BOND/MAPD column produces excellent response linearity over a wide range of concentrations (Figure 4).

Table I Peak symmetry comparison. Poor capacity is evident even at 25 µL on a conventional Al_2O_3 MAPD column, while the new Rt®-Alumina BOND/MAPD column shows higher capacity over a broad concentration range.

	Rt®-Alumina Bond/MAPD		Select Al_2O_3 MAPD	
Sample Size (µL)	1,3-Butadiene	Methyl Acetylene	1,3-Butadiene	Methyl Acetylene
5	1.02	1.08	1.11	1.13
10	1.06	1.13	1.18	1.23
25	1.16	1.22	1.37	1.52
50	1.29	1.39	1.69	1.90
100	1.48	1.55	2.14	2.53
250	2.15	2.22	3.44	4.11

Figure 4 Not only does the Rt®-Alumina BOND/MAPD column show higher capacity, but it also produces excellent linearity for propadiene (blue line), acetylene (pink line), and methyl acetylene (yellow line) over a wide range of concentrations.



Higher Temperature Stability Extends Application Range

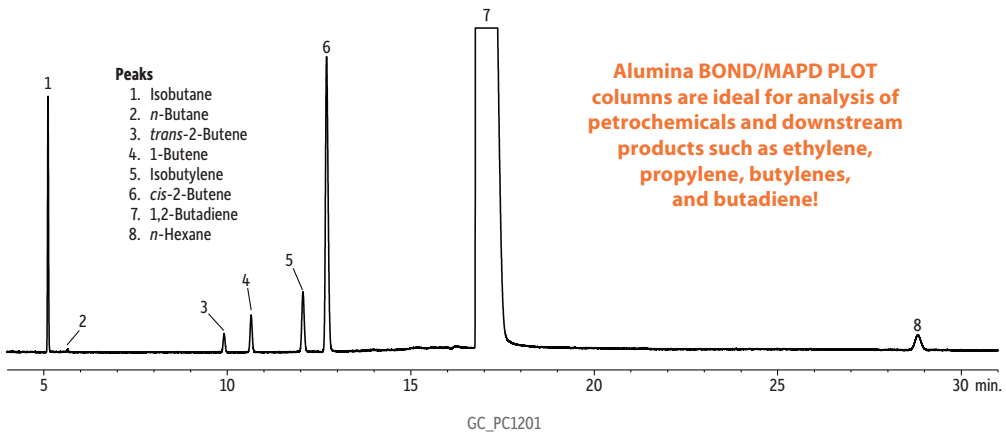
Conventional alumina PLOT columns have a maximum temperature of 200 °C. Above this temperature, a systematic shift in column polarity can occur, which causes the retention of polar hydrocarbons to change. The technology used in making new Rt®- and MXT®-Alumina BOND/MAPD columns ensures no change in column polarity—even at 250 °C! This higher maximum temperature means higher molecular weight hydrocarbons can be eluted quickly, extending the typical application range of alumina PLOT columns. In addition, the higher temperature tolerance allows faster column regeneration to remove adsorbed water, shorter conditioning times, and the flexibility of operating 2 columns in 1 oven up to 250 °C.

Restek Alumina BOND/MAPD Columns— The Best Choice for Polar Hydrocarbon Analysis!

The proprietary deactivation technology used for new Rt®-Alumina BOND/MAPD and MXT®-Alumina BOND/MAPD columns results in improved analysis of trace polar hydrocarbons like acetylene, methyl acetylene, and propadiene in typical C1-C5 hydrocarbon streams. Figures 2 and 5 show real-world examples of column performance. The new deactivation produces a highly inert column that offers superior response reproducibility, which allows analysts to maximize the number of samples analyzed before recalibration is required. Significantly higher capacity reduces peak tailing, further improving the separation and response of target compounds.

In addition, only Rt®-Alumina BOND/MAPD and MXT®-Alumina BOND/MAPD columns are stable up to 250 °C, extending the application range beyond what conventional MAPD columns offer. This means higher molecular weight hydrocarbons can be eluted more quickly, and it also reduces regeneration time when the column is exposed to water from samples or carrier gases. Whether you use fused silica columns in a laboratory environment or require stainless steel columns for process GCs or field instruments, Restek alumina BOND/MAPD columns are the best choice for polar hydrocarbon analysis.

Figure 5 1,2-butadiene analyzed on an Rt®-Alumina BOND/MAPD column.



Column: Rt®-Alumina BOND/MAPD, 50 m, 0.32 mm ID, 5.0 µm (cat.# 19780); **Sample:** Crude 1,2-butadiene; Diluent: none; **Injection:** Inj. Vol.: 1 µL split; Liner: 2.0 mm ID Straight Inlet Liner (cat.# 20712); Inj. Temp.: 200 °C; Split Vent Flow Rate: 80 mL/min.; **Oven:** Oven Temp: 100 °C (hold 31 min.); **Carrier Gas:** H_2, constant linear velocity; Linear Velocity: 17.40 psi, 120.0 kPa @ 100 °C; **Detector:** FID @ 200 °C; Make-up Gas Flow Rate: 30 mL/min.; Make-up Gas Type: N_2; Data Rate: 20 Hz; **Instrument:** HP5890 GC

tech tip

Traces of water in the carrier gas and sample will affect the retention and selectivity of alumina. If the column is exposed to water, the retention times will shorten. Alumina columns can be regenerated by conditioning for 15-30 minutes at 200-250 °C under normal carrier gas flow. Periodic conditioning ensures excellent run-to-run retention time reproducibility.

The maximum programmable temperature for Rt®- and MXT®-Alumina BOND/MAPD columns is 250 °C. Higher temperatures cause irreversible changes to the porous layer adsorption properties.

Alumina BOND/MAPD PLOT Columns

Rt®-Alumina BOND/MAPD Columns (fused silica PLOT)

ID	df	temp. limits	30-Meter	50-Meter
0.32mm	5µm	to 250°C	19779	19780
0.53mm	10µm	to 250°C	19777	19778

MXT®-Alumina BOND/MAPD Columns (Siltek®-treated stainless steel PLOT)

			3.5" coil	7" diameter 11-pin cage
ID	df	temp. limits	30-Meter	30-Meter
0.53mm	10µm	to 250°C	79728-273	79728

Restek Thermolite® Septa

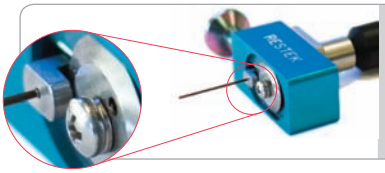
- Usable to 340 °C inlet temperature.
- Precision molding assures consistent, accurate fit.
- Excellent puncturability.
- Preconditioned and ready to use.
- Do not adhere to hot metal surfaces.
- Packaged in precleaned glass jars.
- A Restek exclusive!

Septum Diameter	25-pk.	50-pk.	100-pk.
5mm (3/16")	27120	27121	27122
6mm (1/4")	27123	27124	27125
7mm	27126	27127	27128
8mm	27129	27130	27131
9mm	27132	27133	27134
9.5mm (3/8")	27135	27136	27137
10mm	27138	27139	27140
11mm (7/16")	27141	27142	27143
11.5mm	27144	27145	27146
12.7mm (1/2")	27147	27148	27149
17mm	27150	27151	27152
Shimadzu Plug	27153	27154	27155

Restek Tubing Scorer

for MXT® Columns

- Makes a perfect cut every time.
- Easy to use.
- Leaves column entrance perfectly round.



Prevent column crushing with an easy-to-use Restek Tubing Scorer!

Description	qty.	cat.#
Restek Tubing Scorer for MXT Columns (0.25-0.53mm ID & 0.5-0.8mm OD)	ea.	20523
Replacement Scoring Wheel	ea.	20522

Restek Electronic Leak Detector

Don't let a small leak turn into a costly repair—protect your instrument and analytical column by using a Restek Leak Detector.

Description	qty.	cat.#
Leak Detector with Hard-Sided Carrying Case and Universal Charger Set (US, UK, European, Australian)	ea.	22839
Leak Detector Routine Maintenance Review**	ea.	22839-R
Soft-Side Storage Case	ea.	22657
Small Probe Adaptor	ea.	22658

Avoid using liquid leak detectors on a GC! Liquids can be drawn into the system.

*Caution: The Restek Electronic Leak Detector is designed to detect trace amounts of hydrogen in a noncombustible environment. It is NOT designed for determining leaks in a combustible environment. A combustible gas detector should be used for determining combustible gas leaks under any condition. The Restek Electronic Leak Detector may be used for determining trace amounts of hydrogen in a GC environment only.

**Routine maintenance includes inspection of the probe tip, internal/external tubing and a battery replacement.

Restek ProFLOW 6000 Electronic Flowmeter

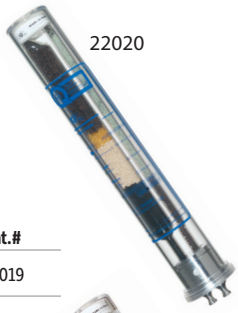
Flowmeters that can measure flammable gases are becoming mandatory, due to the increased use of hydrogen in chromatography. With its Ex rating, the Restek ProFLOW 6000 flowmeter is designed specifically with explosive and flammable gases in mind.

The new Restek ProFLOW 6000 is the only flowmeter you need for any type of chromatography gas measurement because of its wide range of capabilities. The ProFLOW 6000 is an electronic device capable of measuring volumetric flow for most gases. Real-time measurements can be made for various types of flow paths, including continually changing gas types. This portable unit is designed for easy hand-held use, and the stand adds bench-top convenience.

Description	qty.	cat.#
Restek ProFLOW 6000 Electronic Flowmeter with Hard-Sided Carrying Case	ea.	22656
ProFLOW 6000 Recalibration Service	ea.	22656-R

*The flowmeter is designed to measure clean, dry, non-corrosive gases.

Restek Super-Clean Gas Filter Kits and Replacements


22020


21982

- High-purity output ensures 99.9999% pure gas (at max. flow of 2 L/min.).
- "Quick connect" fittings for easy, leak-tight cartridge changes.
- Glass inside to prevent diffusion; polycarbonate housing outside for safety.
- All traps measure 10 5/8" x 1 3/4" (27 x 4.4 cm).
- Each base plate unit measures 4" x 4" x 1 7/8" (10.2 x 10.2 x 4.8 cm).

Description	qty.	cat.#
Carrier Gas Cleaning Kit Includes: mounting base plate, 1/8" inlet/outlet fittings, and oxygen/moisture/hydrocarbon Triple Gas Filter	kit	22019
Fuel Gas Purification Kit Includes: mounting base plate, 1/8" inlet/outlet fittings, and hydrocarbon/moisture Fuel Gas Filter	kit	22021
Ultra-High Capacity Hydrocarbon Filter	ea.	22030
Ultra-High Capacity Moisture Filter	ea.	22028
Ultra-High Capacity Oxygen Filter	ea.	22029
Replacement Triple Gas Filter (removes oxygen, moisture and hydrocarbons)	ea.	22020
Replacement Fuel Gas Filter (removes moisture and hydrocarbons)	ea.	22022
Helium-Specific Carrier Gas Cleaning Kit Includes: mounting base plate, 1/8" inlet/outlet fittings, and oxygen/moisture/hydrocarbon Helium-Specific Filter	kit	21983
Replacement Helium-Specific Gas Filter (removes oxygen, moisture and hydrocarbons)	ea.	21982
Gas Filter Bundle Kit Includes: one Triple Gas Filter (cat.# 22020) and two Fuel Gas Filters (cat.# 22022)	kit	22031

Restek Filter Base Plates

- Standard base plate fittings are 1/8". To adapt to 1/4", order 1/8" to 1/4" tube-end unions.
- End fittings available in brass or stainless steel.
- Base plates fit all stand-alone Super-Clean gas filters offered.


22025


22026


22027

	Brass		Stainless Steel	
Description	qty.	cat.#	qty.	cat.#
Filter Base Plate, Single-Position	ea.	22025	ea.	22344
Filter Base Plate, 2-Position	ea.	22026	ea.	22345
Filter Base Plate, 3-Position	ea.	22027	ea.	22346

Sample Cylinders

- All cylinders have 1/4" female NPT threads on both ends.
- TPED compliant cylinders available.

Swagelok® sample cylinders are made of 304L and 316L stainless steel to resist corrosion and DOT rated to 1,800 and 5,000 psig (TPED cylinders rated to 1,450 and 4,350 psig), which allows sampling at gas wellheads as well as on-site refineries. Each cylinder is hydrostatically tested to at least 5/3 the working pressure.

Sample Cylinders, Ultra-High Pressure

(Stainless Steel & Sulfinert® Treated)

- 316L stainless steel; DOT rating to 5,000 psig (TPED cylinders to 4,350 psig).
- Range of cylinder sizes, 150 cc to 500 cc.

	5,000psig, 316L SS		TPED, 4,350psig, 316L SS	
	Stainless Steel	Sulfinert Treated	Stainless Steel	Sulfinert Treated
Size	cat.#	cat.#	cat.#	cat.#
150cc	22927	22111	22927-PI	22111-PI
300cc	22928	22112	22928-PI	22112-PI
500cc	22929	22113	22929-PI	22113-PI

Sample Cylinders, High Pressure

(Stainless Steel & Sulfinert® Treated)

- 304L stainless steel; DOT rating to 1,800 psig (TPED cylinders to 1,450 psig).
- Range of cylinder sizes, 75 cc to 2250 cc.

	1,800psig, 304L SS		TPED, 1,450psig, 304L SS	
	Stainless Steel	Sulfinert Treated	Stainless Steel	Sulfinert Treated
Size	cat.#	cat.#	cat.#	cat.#
75cc	22921	24130	22921-PI	24130-PI
150cc	22922	24131	22922-PI	24131-PI
300cc	22923	24132	22923-PI	24132-PI
500cc	22924	24133	22924-PI	24133-PI
1000cc	22925	24134	22925-PI	24134-PI
2250cc	22926	21394	22926-PI	21394-PI

Sample Valves

(Stainless Steel & Sulfinert® Treated)

21401

- Multiple valve configurations, including dip tube and rupture disks.
- Large, durable, Kel-F® seat ensures leak-free operation.
- Temperature range: -40 °C to 120 °C

Description	Stainless Steel cat.#	Sulfinert Treated cat.#
3,500 psig DOT Pressure Rating		
1/4" Male NPT x 1/4" Male NPT	26297	21400
1/4" Male NPT x 1/4" Female NPT	26298	26299
1/4" Male NPT x 1/4" Male Compression	26300	21401
1/4" Male NPT x 1/4" Male NPT w/5.25" Dip Tube*	26301	21402*
1/4" Male NPT x 1/4" Male NPT w/1,800 psi Rupture Disc	26302	26303
1/4" Male NPT x 1/4" Female NPT w/1,800 psi Rupture Disc	26304	26305
Replacement Rupture Disc, 1,800 psig	26320	
5,000 psig DOT Pressure Rating		
1/4" Male NPT x 1/4" Male NPT	26306	26307
1/4" Male NPT x 1/4" Female NPT	26308	26309
1/4" Male NPT x 1/4" Male Compression	26310	26311
1/4" Male NPT x 1/4" Male NPT w/5.25" Dip Tube*	26312	26313
1/4" Male NPT x 1/4" Male NPT w/2,850 psi Rupture Disc	26314	26315
1/4" Male NPT x 1/4" Female NPT w/2,850 psi Rupture Disc	26316	26317
Replacement Rupture Disc, 2,850 psig	26324	

*To order Sample Cylinder Valve with Dip Tube, please call Customer Service at 800-356-1688, ext. 3, or contact your Restek representative. Specify dip tube length or % outage when ordering (maximum length = 5.25"/ 13.3 cm). Note: End of part will not be treated after cutting tube to length.

RESTEK

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