Accessories and Supplies for Shimadzu Gas Chromatographs
Capillary gas chromatographs are widely used for R&D and quality control in the fields of petrochemistry, pharmaceuticals, food, and the environmental analysis. However, public liability and ISO-9000 (International Standards for Quality Management Systems) concerns require instruments with greater accuracy than before. Higher analysis speed is also demanded to handle the ever-increasing number of analysis samples. The GC-2010 was developed to meet these demands. The shorter analysis time, enhanced analysis efficiency, and easier operation contribute to reduced operator load.

GC-17A Ver.3 Series are the top-of-the-line gas chromatographs designed to ensure high performance, ease of operation, and high degree of automation in capillary gas chromatography. The Shimadzu’s original Advanced Flow Control System provides digital setting of carrier gas inlet pressure and split ratio. All the instrument parameters may be set through remote operation, allowing automated gas chromatography to be carried out with a different set of operational parameters for each run. The dynamic range of the FID is wide enough to permit quantitation of impurities of ppm concentration level as well as the major components.

GC-14B Series gas chromatographs are designed to provide high separating efficiency and high precision in capillary gas chromatography, but yet to readily accept packed columns. High repeatability required especially in routine works is ensured by the use of the optional AOC-20i Auto Injector. Addition of the AOC-20i allows sample injection in the solvent flush mode to be carried out in a completely automated sequence. This provides outstanding analytical productivity and repeatability.

GC-8A Series is compact and low-cost gas chromatograph, designed to provide high performance in isothermal and temperature programmed runs. It ensures temperature control accuracy and detector sensitivity comparable to those of a higher level instrument. Temperature programming is made in linear mode with automatic column oven door opening functions. Any one of TCD, FID, ECD, and FPD is installed.
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Workstation/Data Processors

GC Workstation

**GCsolution Ver.2**
(Cat. No. 223-05430-92)

• Adopts the LabSolutions Series operation interface, featuring the Assistant Bar and Data Explorer, for ease-of-use, high performance, and high productivity.
• Controls and conducts data processing for four independent GC Systems. In a dual injection system, it permits chromatographic analysis of eight flowpaths simultaneously.
• The GC-LAN connection option permits connection of GC instruments via a LAN adapter to PCs on a LAN (Local Area Network).
• Supports the control of GC-14A/14B, GC-17A, gas chromatographs, in addition to GC-2010*. With other models, the CBM-102 can be used for analog output from detectors, data collection and analysis.

* CBM-102 is required for control, data collection, and acquisition of other analog data for GC-14A/14B and GC-17A instruments.
Control of some GC-14A functions is restricted.
Modifications may be required to the GC-14A/14B unit.

C-R7A plus Chromatopac
(Cat. No. 223-04220-**)

• Top-of-the-line, multitasking, multiwindowing data processor designed for any demanding chromatographer.
• Real-time multitasking OS: 2-channel independent asynchronous analysis may be readily performed.
• 64 Mbyte hard disk: The memory is large enough for automated continuous operation using an auto sampler.
• LCD display can be positioned backward and forward. Use of a support rack minimizes the floor space.
• Automatic storage of analysis files.
• Automatic directory management.
• Pop-up menus providing quick access to operation.
• HELP functions are incorporated.
• Simple Operation keyboard: Ideal for routine analyses.

C-R8A Chromatopac
(Cat. No. 223-04500-**)

• Proven Algorithm of Shimadzu Chromatopac and Ease of Operation
  The C-R8A includes many function peak processing and quantitative calculations of the high-end versions of Shimadzu Chromatopac integrators. The C-R8A operation is easy and suitable for routine work in quality control laboratories.
• Automated Validation Function
  The C-R8A includes a hardware validation software program, VP features based on Shimadzu VP concept, accessible by the VP key, several log functions, security, sample index functions to support GLP/GMP/ISO requirements.
• Network Expandability
  The C-R8A includes a high speed RS-232C port (19,200bps) as standard equipment for networking using CLASS-Agent or Chromatopac manager software programs.
Optional Boards

For C-R7Aplus, C-R8A
- 2-channel Board (Cat. No. 223-04202-91)
- Transmission Interface (Cat. No. 223-02983-91)

For C-R7Aplus
- Printer Cable, 2m (Cat. No. 670-10231-03)

For C-R5A
- 2-channel Board (Cat. No. 223-01486-90)
- Transmission Interface (Cat. No. 221-21710-90)

For Chromatopac
- Auto Zero Unit AZA-2 (Cat. No. 223-01320-10)
- Current Loop Interface (GC-14/PAC) (Cat. No. 221-24200-93)
- Current Loop Interface (PAC/PAC) (Cat. No. 221-21187-90)
- Opt-link Transmission Interface (GC-17/C-R7A, 8A) (Cat. No. 221-21477-91)
- 3-channel Opt-link Transmission Interface (Cat. No. 223-03727-91)

* Not required for GC-17A (Ver. 2 or later) and for GC-17AAFw (Ver.1)

Direct-connection Signal Cord
(Cat. No. 221-26917-91 for GC-14A/14B and GC-17A)
(Cat. No. 221-26918-91 for GC-8A)

This signal cord allows the gas chromatograph and the Chromatopac to be connected directly without using relay terminals. Length: 2m

Expansion Case (for C-R8A)
(Cat. No. 223-04592-91)

C-R8A has 2 slots as standard.
This Expansion Case is required to install more than 3 optional boards.

PRG-102A External Device Controller
(Cat. No. 221-17084-90)

By connection with a C-R7Aplus or C-R8A, an automatic analysis system can be obtained with solenoid or other valves controlled by the controller for automatic sample injection, column switching and signal switching. (PC-17N Interface required.)

SEL-2 Input Switch
(Cat. No. 221-26823-90)

Connected with 4 chromatographs or detectors simultaneously for selection and processing by switch. As a remote start cord is attached, executing START from a place distant from the Chromatopac possible.

Optional Software for Workstation
- Distillation GC software for GCsolution (Cat. No. 221-57807-92)
  To enable distillation GC analysis with GCsolution (Ver. 2.0 or later).
- PONA software for GCsolution (Cat. No. 221-57833-92)
  To enable PONA analysis with GCsolution (Ver. 2.0 or later).
  Requires fixed table for analysis targets.

Chart Paper for Chromatopacs

For C-R7A plus, C-R8A

<table>
<thead>
<tr>
<th>Description</th>
<th>Cat. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thermal Chart Paper (10 rolls)</td>
<td>223-04230-81</td>
</tr>
<tr>
<td>Anti-fade Thermal Chart Paper (10 rolls)</td>
<td>223-04231-81</td>
</tr>
<tr>
<td>Z-fold Thermal Chart Paper (1 set)</td>
<td>223-04232-80</td>
</tr>
<tr>
<td>Z-fold, Anti-fade Thermal Chart Paper (1 set)</td>
<td>223-04233-80</td>
</tr>
</tbody>
</table>

For C-R5A

<table>
<thead>
<tr>
<th>Description</th>
<th>Cat. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thermal Chart Paper (10 rolls)</td>
<td>223-02037-82</td>
</tr>
<tr>
<td>Anti-fade Thermal Chart Paper (10 rolls)</td>
<td>223-04300-81</td>
</tr>
</tbody>
</table>

For C-R6A

<table>
<thead>
<tr>
<th>Description</th>
<th>Cat. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thermal Chart Paper (20 rolls)</td>
<td>221-25412-84</td>
</tr>
<tr>
<td>Anti-fade Thermal Chart Paper (10 rolls)</td>
<td>223-04231-81</td>
</tr>
</tbody>
</table>
AOC-20i Auto Injector

Supplies and options for AOC-20i

1. Long Sample Rack Assembly (Cat. No. 221-45622-91)
   Provides rack for the injection of 12 samples
2. Sample cooling fan (Cat. No. 221-44995-91)
   Provides cooling for samples in the sampler
3. Large Vial Holder 6 position (Cat. No. 221-32949-01)
   Rack for 4mL Vials
4. Microsyringe (10µL) (Cat. No. 221-34618)
5. Microsyringe (50µL) (Cat. No. 221-45243)
6. Microsyringe (250µL) (Cat. No. 221-45244)
7. 1.5mL sample vial set (Cat. No. 221-34274-91)
   100pc., white cap, w/septum
8. 4mL sample vial set (Cat. No. 221-34269-91)
   50pc., white cap, w/septum

- Compact, sturdy, light weight and easy to install.
- Newly designed needle guide provides high injection reliability.
- Solvent flush, internal standard simultaneous injection, large volume sampling, etc. to suit every injection requirement.
- Sampling position can be changed, independent sampling in dual tower system.
- Both 1.5mL and 4mL samples vials can be used.

Compatible for GC-14A/14B and GC-17A Series systems.
Note: The following items must be ordered separately.
- GC-14A/14B installation parts (Cat. No. 221-44549-91)
- GC-17A installation parts (Cat. No. 221-44548-91)

Following kit is required to install AOC-20i for GC-14A/14B/17A to GC-2010.
- AOC-20i installation attachment kit (Cat. No. 221-48545-91)

AOC-20s Auto Sampler

Options for AOC-20s

1. Small Vial Rack 25 position (Cat. No. 221-44709-91)
   Single rack for 1.5mL vials
2. Large Vial Rack 16 position (Cat. No. 221-44878-91)
   6 racks set for 4.0mL vials

- Up to 150 samples can be analyzed (1.5mL vials)
- Teaching function, learning function, high transport reliability.
- Can also be used with dual injection system. (GC-17A only)
AOC-5000 Liquid, Headspace and SPME GC Injection System

The AOC-5000 is GC sample injection system that combines liquid, large volume and headspace injection in one single instrument. This unique capability allows quick switching from one application to another on the same GC workstation.

The AOC-5000 provides a fully automated SPME (solid phase microextraction) sample preparation process.* All movements of the SPME fiber from precondition, adsorption and desorption are precisely controlled for optimum precision.

* Automation of SPME technology licensed from Varian Inc. Solid Phase Microextraction (SPME) Technology licensed exclusively to Supelco Inc. US patent #5,691,296 European patent #0523092

PYR-4A Pyrolyzer
(Cat No. 221-50383-** for GC-14A/14B)
(Cat No. 221-43845-** for GC-17A ver.2/3)

Pyrolyzers
Solid samples are decomposed under heat and the decomposition products are analyzed by gas chromatography for structure study.
• Since the sample container is dropped into the furnace, the loss of low-boiling components is far smaller compared with the conventional methods.
• The sample containers are so small in heat capacity that the sample is heated quickly to decompose the sample rapidly.
• The decomposition products do not come in contact with any metals, and so there occurs no further decomposition or adsorption.
• The pyrolyzing temperature is adjustable up to 800°C in 1°C steps.
• Both solid and liquid samples are applicable; the PYR-4A is also useful as a reliable solid sampler.
Flame Ionization Detector (FID)
Flame ionization detector is the most popular detector for gas chromatography because it is highly sensitive to almost all organic compounds and, being little influenced by changes in temperature and flow rate, it ensures high signal-to-noise ratio and wide dynamic range and is easy to operate.

- FID for GC-14A/14B (Cat. No. 221-41677-**)  
  - FID with bellows valve for carrier gas control  
  - FID with mass flow controller for carrier gas control  
- FID for GC-17A Ver.2/3  
  - FID for linear addition  
    (Cat. No. 221-43826-92: 115V, -34: 230/240V, CE)  
  - FID for wide addition  
    (Cat. No. 221-43827-92: 115V, -34: 230/240V, CE)  
  - FID for GC-2010  
    (AFC included)

Note 1: Most FIDs are of a dual cell type (two cells are installed as a pair), but the FID for the GC-14A/14B is of a single cell type, which can be converted into dual cell type by adding the following attachments.

- FID-14 Dual Cell Unit for GC-14A/14B (Cat. No. 221-33672-91)

Note 2: Detectors for the GC-8A cannot be purchased separately. To use an FID, purchase a GC-8A model with one incorporated (e.g., GC-8APF or GC-8AIF).

FTD Attachment
Adding this attachment converts an FID into a flame thermionic detector (FTD) which has high selective sensitivity to nitrogen and phosphorus compounds. Since the alkali-ion source is directly heated by electric power, the detector has a long service life and ensures high stability.

<table>
<thead>
<tr>
<th>Model name</th>
<th>FTD-14</th>
<th>FTD-17 Ver.2</th>
<th>FTD-2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>Applicable GC</td>
<td>GC-14A/14B</td>
<td>GC-17A Ver.2/3</td>
<td>GC-2010</td>
</tr>
<tr>
<td>Cat. No.</td>
<td>221-41808-**</td>
<td>221-43762-**</td>
<td>221-47732-**</td>
</tr>
</tbody>
</table>

FTD-2010 Collector Regeneration Kit (Cat. No. 221-49079-91)  
This kit allows the reuse of the FTD collector by replenishing the alkali-ion source.

MTN-1 Methanizer
(Cat. No. 221-41820-**)

The MTN-1 reduces CO and CO₂ into CH₄ using nickel catalyst.
Adding this attachment between the column and the FID allows CO and CO₂ to be detected at a high sensitivity through simple operation. The detection limits for CO and CO₂ are below 10ppm, which is entirely impossible with a TCD. Nickel catalyst (5mL) is supplied as standard.

FLM-2 Flame Monitor
(Cat. No. 221-41845-97 for GC-14A/14B)  
(Cat. No. 221-41590-91 for GC-17A Ver.2/3)

If the flame of FID should die out during operation, unburnt hydrogen will flow out of the detector cell, which is quite dangerous. With this attachment, the hydrogen flow will be automatically turned off, by the solenoid valve, if the flame should die out.

FLM-2 Flame Monitor (Cat. No. 221-41845-97 for GC-14A/14B)  
(Cat. No. 221-41590-91 for GC-17A Ver.2/3)

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FLM-2 Flame Monitor (Cat. No. 221-41845-97 for GC-14A/14B)  
(Cat. No. 221-41590-91 for GC-17A Ver.2/3)

If the flame of FID should die out during operation, unburnt hydrogen will flow out of the detector cell, which is quite dangerous. With this attachment, the hydrogen flow will be automatically turned off, by the solenoid valve, if the flame should die out.

FLM-2 Flame Monitor (Cat. No. 221-41845-97 for GC-14A/14B)  
(Cat. No. 221-41590-91 for GC-17A Ver.2/3)
**Flame Photometric Detector (FPD)**

FPD for GC-14A/14B (Cat. No. 221-41807-**)  
FPD for GC-17A Ver.2 (Cat. No. 221-43756-**)

The characteristic light emitted in the combustion of sulfur or phosphorus compounds is selected with an optical filter and detected by a photomultiplier, to permit selective detection. FPDs are now extensively used for determination of such malodorous compounds as hydrogen sulfide and methyl sulfide, and determination of residual phosphoric pesticides.

Note: The FPD for the GC-8A Series is to be installed at Shimadzu factory.

**Specifications**
- Detection limit: 5×10^{-11}g/s for sulfur in thiophene and 1.4×10^{-12}g/s for phosphorus in parathion or in DDVP (With GC-2010):  
  S: 4×10^{-12}gS/s (dodecane thiol)  
  P: 2×10^{-13}gP/s (tributyl phosphate)
- Power source: -700V stabilized
- Maximum temperature: 350°C

**Options**
- Filter
  - Filter for Sulfur Detection
    (Cat. No. 221-00892-01)  
  - Filter for Phosphorus Detection
    (Cat. No. 221-00897-01)  
  For GC-2010  
  - Filter for Sulfur Detection
    (Cat. No. 221-46310-01)  
  - Filter for Phosphorus Detection
    (Cat. No. 221-46310-02)
- FID Parts Set  
  (Cat. No. 221-38651-91)

**FID Monitor (for FPD)**  
(Cat. No. 221-42064-91 for GC-14A/14B, GC-17A Ver.2)

This option is used to monitor the hydrocarbon contents, which often causes quenching of the flame. It consists of an FID monitor electrode and an electrometer. A recorder is required.

**Filter for Organic Tin Compound Detection**  
(Cat. No. 221-27398-91 for GC-14A/14B, GC-17A)  
(Cat. No. 221-46310-03 for GC-2010)

This filter is effective for determination, with FPD, of trace quantity of tributylstannane which is used in the paints of ships and anticontamination reagent of fish nets and is now attracting attention as a sea water contaminant.
Electron Capture Detector (ECD)

Using radioisotope, this detector provides extremely high selective sensitivity to halogen and nitro compounds. It is especially sensitive to chlorinated compounds: it permits reliable detection of chlorinated compounds of pico gram quantity level. The clean ECD is designed so that the column effluent does not come in contact with the radiation source, and hence the radiation source is hardly contaminated.

<table>
<thead>
<tr>
<th>Type</th>
<th>ECD (Normal type)</th>
<th>Clean ECD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radiation source</td>
<td>Constant current; pulse frequency control</td>
<td>Constant DC current</td>
</tr>
<tr>
<td>Electric current</td>
<td>0.5, 1, 2nA</td>
<td>0.5, 1, 2nA</td>
</tr>
<tr>
<td>Dynamic range</td>
<td>$10^4$</td>
<td>$3 \times 10^3$</td>
</tr>
<tr>
<td>Min. detectable q'ty</td>
<td>0.2pg (y-BHC)</td>
<td>0.5pg (y-BHC)</td>
</tr>
<tr>
<td>Max. operating temperature</td>
<td>400°C</td>
<td>400°C</td>
</tr>
</tbody>
</table>

Since ECD uses a radioisotope as the radiation source, please check all local laws and regulations in advance.

Oxgen Trap (Cat. No. 221-46985-91)

Residual oxygen in carrier gas can cause unstable baseline. Installed in the carrier gas supply line, this trap reduces the oxygen content in the carrier gas (nitrogen, helium, argon, hydrogen) to 0.1ppm quantity level. This trap has a capacity to absorb about 2.5L of oxygen, and can be regenerated by allowing hydrogen to flow under heat. Thus, it can be used repeatedly. This trap is also effective for preventing capillary columns from deterioration due to oxygen contents.

Make-up Gas Supply Line Parts

When an ECD is used in capillary gas chromatography, where helium is usually used as carrier gas, it is necessary to supply nitrogen as make-up gas.

<table>
<thead>
<tr>
<th>PPR-N2 Pressure Regulatore (Cat. No. 221-35999-01)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gas Supply Pipe (Cat. No. 201-48067)</td>
</tr>
<tr>
<td>Gas Filter (Cat. No. 221-05619-01)</td>
</tr>
</tbody>
</table>

It is recommendable to use an Oxygen Trap in the make-up gas supply line.
**Thermal Conductivity Detector (TCD)** (Cat. No. 221-31775-91 TCD for GC-14A/14B)

This detector features simple design and easy operation, and is able to sense any substances except the gas used as carrier. A bridge circuit is formed with four matched tungsten-rhenium filaments (100Ω, each).

**Note**: A TCD cell must be installed in the Shimadzu factory; otherwise the specified noise level and sensitivity cannot be guaranteed.

**Capillary Adapter for TCD** (Cat. No. 221-34012-91)

When a capillary column (including wide-bore type) is connected to a TCD, it is necessary to use this pipe to supply make-up gas. Make-up gas supply line parts are not included.

**AMP-7B Preamplifier** (Cat. No. 221-41816-91)

This unit enhances the sensitivity of TCD by ten times. It is equipped with two output terminals, for recorder (0~1mV) and for data processor (0~1V). This unit also provides longer life of the filaments because filament current can be halved keeping the sensitivity at the same level.
SPL Series Split/Splitless Sample Injection Systems

Of the various types of sample injection systems for capillary gas chromatography, the SPL Series is most widely used, because it permits both split mode and splitless mode (Grob method). The Grob method features that the injection port is purged a few minutes after sample injection. The valve operation for this purging is carried out at the best timing by the user-defined time program. The dimensions and construction of the injection port are different with models, and select the appropriate one from the table below.

<table>
<thead>
<tr>
<th>Model</th>
<th>Cat. No.</th>
<th>Applicable GC</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPL-G9</td>
<td>221-27331-**</td>
<td>GC-8A</td>
</tr>
<tr>
<td>SPL-14</td>
<td>221-41810-**</td>
<td>GC-14A/B</td>
</tr>
<tr>
<td>SPL-17 ver.2</td>
<td>221-43834-**</td>
<td>GC-17A ver.2/3</td>
</tr>
<tr>
<td>SPL-2010</td>
<td>221-47729-**</td>
<td>GC-2010 (AFC included)</td>
</tr>
</tbody>
</table>

Wide-Bore Injection Unit (WBI)
(Cat. No. 221-43828-** for GC-17A ver.2/3)
(Cat. No. 221-47726-** for GC-2010)

This unit is ideal for achieving a higher resolution than with packed columns. The direct injection method, where all of the sample is injected using a wide-bore column of internal diameter 0.53mm, is gaining attention because it allows the same ease of use as packed columns while taking full advantage of the inertness of fused silica columns. In particular, this method achieves a high level of reproducibility with unstable substances that have a strong polarity, an application that is very difficult using packed columns. Also, the sample does not split and so the sensitivity can be maintained, and there are no inconsistencies in data due to differences in
OCI-14 On-Column Injector
OCI-17 Ver.2 On-Column Injector
OCI/PTV-2010 On-Column Injector

With the on-column sample injection method, the sample solution is injected directly into the column and the entire sample is subjected to analysis. As a result, there is no discrimination due to differences in boiling points, and this method can be used for a wide range of samples with both low and high boiling points.

In contrast with the method of injecting into a high-temperature vaporizing chamber, the sample is not heated to a temperature exceeding the column temperature, making it ideal for analyzing thermally labile samples.

The maximum temperature of the injection port is 399°C for the OCI-14 and 450°C for the OCI-17 and OCI/PTV-2010, and the maximum programming rate is 200°C/min for the OCI-14 and 250°C/min for the OCI-17 and OCI/PTV-2010, allowing multi-step heating. After heating, cooling is performed using a stream of compressed air (OCI-14) or a fan (OCI-17 and OCI/PTV-2010).

Features
1. Independent heating of sample injection port:
   The injection port can be heated rapidly independent from the column oven.
2. Automatic injection
3. Analysis with a standard syringe:
   A standard microsyringe (outer diameter of needle: 0.47mm max.) can be used.

Options
• OCI-14 Fitting Part Set (Cat. No. 221-35039-91)
  Required to install the OCI-14 to the GC-14A/14B. Not required when the GC is equipped with an SPL-14 or a CLH-14.
• Microsyringe (Cat. No. 221-37282-02)
  Special syringe required for automatic injection with the AOC-20i.
• Simple OCI Insert (Cat. No. 221-49381-01)
  Using this insert with the OCI-17 or OCI/PTV-2010 enables injection into capillary columns with small internal diameters without using a pre-column (internal diameter: 0.53mm). Instead, a standard AOC syringe can be used.

Wide-Bore Capillary Column Attachment (Cat. No. 221-29992-91 for GC-14A/14B)

This attachment is used when a wide-bore capillary column (0.53mm ID) is used in the direct injection method in a packed column GC instrument.

This attachment does not include the column holder, which is separately available.

Column Holder
(Cat. No. 221-31567-91)

Note: When the column is to be connected to a TCD, the Capillary Column Adapter (Cat. No. 221-34012-91) is additionally required.

CLH Series Splitter

Attached to the injection port for packed columns, this attachment permits reliable use of capillary columns. The sample injected is split and only 1/30–1/300 is introduced into the column. Simple in design and easy to operate, this method is widely used for analysis of high-concentration samples in petroleum and related fields.

When two capillary columns and two detectors are used in parallel, the following Parallel Column Operation Set is required.

Parallel Column Operation Set (Cat. No. 221-33494-91)
Fused Silica Capillary Columns
Rtx Series (for high-sensitivity analysis)

The demand for high-sensitivity analysis with GC and GCMS continues to increase. The Rtx-series capillary columns are chemically bonded and offer a level of inertness suited to high-sensitivity microanalysis with minimal bleeding.

Use the Rtx-5ms for GCMS analysis with extremely low column bleed.

## Analytical conditions

- **Column**: 30m x 0.25mm ID x 0.25um, Rtx®-5ms (P/N 12623)
- **Concentration**: 5-10ng on-column.
- **Injection**: Splitless, purge on @ 1 min.
- **Oven temp**: 35°C (hold 1 min.) to 300°C @ 10°C/min. (hold 15 min.)
- **Inj. & Det. temp**: 275°C & 310°C
- **Carrier gas**: He

## Peak identification

1. t-butyl phenol
2. n-pentyl phenol
3. n-hexyl phenol
4. n-heptyl phenol
5. t-octyl phenol
6. n-octyl phenol
7. n-nonyl phenol
8. bisphenol A

## Analysis of Endocrine Disrupters (Alkyl Phenols and Bisphenol A)

* The maximum temperature differs with the film thickness: It is lower with the thicker film. The maximum temperature for 5-μm columns is 270°C.
**Fused Silica Capillary Columns**

**Rtx Series (special analysis columns)**

With GC analysis, the need to adapt to special applications is increasing. The Rtx-series capillary columns offer a level of inertness suited to special types of analysis and the microanalysis of special components with minimal bleeding.

When performing special sample analysis, use the specially tuned Rtx series to obtain sufficient separation in a short time.

### Analytical conditions

- **Column**: 30m x 0.25mm ID x 0.50um, Rtx-5Amine (P/N 12338)
- **Concentration**: 5-80ng on-column.
- **Injection**: 3.0μL split injection of ethyleneamine industrial sample
- **Oven temp**: 40°C (hold 4 min.) to 315°C @ 10°C/min. (hold 5 min.)
- **Inj. & Det. temp**: 315°C
- **Carrier gas**: H2

### Peak identification

1. isopropanol
2. monoethanolamine
3. ethylenediamine
4. piperazine
5. diethylenetriamine
6. aminoethylethanolamine
7. aminoethylpiperazine

### Dimensions and Polarity, application and Cat. No.

<table>
<thead>
<tr>
<th>Liquid phase</th>
<th>I.D. (mm)</th>
<th>Film thickness (mm)</th>
<th>Length (m)</th>
<th>Slightly polar</th>
<th>Slightly/medially polar</th>
<th>Strongly polar</th>
<th>Strongly polar</th>
<th>Slightly polar</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Rtx-5Amine</td>
<td>Rtx-G27, G43**</td>
<td>Stabilwax-DA</td>
<td>Rtx-2330</td>
<td>Rtx-QPLOT</td>
</tr>
<tr>
<td>0.25</td>
<td>0.10</td>
<td></td>
<td></td>
<td>11008</td>
<td>11023</td>
<td>10708</td>
<td>10723</td>
<td>11038</td>
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<tr>
<td></td>
<td>0.25 (0.2)*</td>
<td></td>
<td></td>
<td>12338</td>
<td>11023</td>
<td>11038</td>
<td></td>
<td>11038</td>
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<tr>
<td></td>
<td>0.50</td>
<td></td>
<td></td>
<td>12353</td>
<td>11039</td>
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<td></td>
<td>30</td>
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<td>0.32</td>
<td>0.50</td>
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<tr>
<td></td>
<td>1.00</td>
<td></td>
<td>30</td>
<td>11039</td>
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<tr>
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<td>1.50</td>
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<td>0.53</td>
<td>1.00</td>
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<td>12355</td>
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<tr>
<td></td>
<td>3.00</td>
<td></td>
<td></td>
<td>12385</td>
<td>(G43)16085-126**</td>
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<td></td>
</tr>
<tr>
<td></td>
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<td></td>
<td></td>
<td>12354</td>
<td>(G27)10279-126**</td>
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<td></td>
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</tr>
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<td></td>
<td>19716</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- The film thickness for the Rtx-2330 is slightly different.
- **G27 and G43** are new types of column with a built-in guard column.

Other column sizes (15m, 60m, and different film thickness) are also available. Inquire for details.

### Analysis of Ethylenediamines

- Name of liquid phase: Rtx-5Amine (P/N 12338)
- Applicable component:
  - Basic type: 5% diphenyl silicone - methyl silicone
  - Acid type: Polyethylene glycol
  - Basic compounds and amines: 0% diphenyl silicone
  - Residual solvents in pharmaceuticals: 0% diphenyl silicone

- Max. temp. *:
  - 295~315°C
- Polarity:
  - Permanent gases and hydrocarbons with low boiling points
  - Free fatty acids
  - Furane and dioxin isomers

* The film thickness for the Rtx-2330 is slightly different.

**The G27 and G43 are new types of column with a built-in guard column.**

Other column sizes (15m, 60m, and different film thickness) are also available. Inquire for details.

### Analysis of Ethylenediamines

- **Peak identification**
  1. isopropanol
  2. monoethanolamine
  3. ethylenediamine
  4. piperazine
  5. diethylenetriamine
  6. aminoethylethanolamine
  7. aminoethylpiperazine

### Analytical conditions

- Column: 30m x 0.25mm ID x 0.50um, Rtx-5Amine (P/N 12338)
- Concentration: 5-80ng on-column.
- Injection: 3.0μL split injection of ethyleneamine industrial sample
- Oven temp: 40°C (hold 4 min.) to 315°C @ 10°C/min. (hold 5 min.)
- Inj. & Det. temp: 315°C
- Carrier gas: H2
Fused Silica Capillary Columns

**Hicap-DB Series (for universal use)**

The Hicap DB Series column are fused silica capillary tubes with the inner wall coated with polymers and/or chemically bonded. Column-to-column reproducibility is excellent.

---

### Dimensions

<table>
<thead>
<tr>
<th>I.D. (mm)</th>
<th>Film thickness (µm)</th>
<th>Length (m)</th>
<th>Nonpolar DB-1</th>
<th>Slightly polar DB-5</th>
<th>Medially polar DB-17</th>
<th>Strongly polar DB-WAX</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.25</td>
<td>0.25</td>
<td>30</td>
<td>DB-1-30N-STD 122-1032</td>
<td>DB-5-30N-STD 122-5032</td>
<td>DB-17-30N-STD 122-1732</td>
<td>DB-WAX-30N-STD 122-7032</td>
</tr>
<tr>
<td></td>
<td></td>
<td>60</td>
<td>DB-1-60N-STD 122-1062</td>
<td>DB-5-60N-STD 122-5062</td>
<td>DB-17-60N-STD 122-1762</td>
<td>DB-WAX-60N-STD 122-7062</td>
</tr>
<tr>
<td>0.25</td>
<td>0.32</td>
<td>30</td>
<td>DB-1-30W-STD 123-1032</td>
<td>DB-5-30W-STD 123-5032</td>
<td>DB-17-30W-STD 123-1732</td>
<td>DB-WAX-30W-THK 123-7033</td>
</tr>
<tr>
<td>0.50</td>
<td>0.50</td>
<td>30</td>
<td>DB-1-30W-THK 123-103E</td>
<td>DB-5-30W-THK 123-503E</td>
<td>DB-17-30W-THK 123-1733</td>
<td>DB-WAX-30W-THK 123-7033</td>
</tr>
<tr>
<td>1.0</td>
<td>60</td>
<td>123-1063</td>
<td>DB-1-60W-THK 123-1063</td>
<td>DB-5-60W-THK 123-5063</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.32</td>
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<td>15</td>
<td>DB-1-30M-STD 125-1012</td>
<td>DB-5-30M-STD 125-5012</td>
<td>DB-17-30M-STD 125-1713</td>
<td></td>
</tr>
<tr>
<td>0.25</td>
<td></td>
<td>30</td>
<td>DB-1-30M-ETK 125-1035</td>
<td>DB-5-30M-ETK 125-5035</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Name of liquid phase**
- 100% methyl silicone
- 5% phenyl silicone-methyl silicone
- 50% phenyl silicone-methyl silicone
- Polymethyleneglycol

**Equivalent to**
- OV-1, 101
- SE-30
- SE-52
- SE-54
- OV-17
- PEG-20M

**Max. temp. (°C)**
- 320°C~350°C
- 280°C~300°C
- 230°C~250°C

---

### Analysis of Halogenated Hydrocarbons

**Column**: DB624-30M-VTK
**Column temp.**: 35°C → 140°C
**Detector**: ECD

**Peak identification**
- Chloromethane
- Vinyl chloride
- Bromoethane
- Chloroform
- 1,1-Dichloroethylene
- Methylene chloride
- 1,2-Dichloroethylene
- Chloroform
- 1,1,2-Trichloroethane
- Bromodichloromethane
- 1,3-Dichloropropylene
- 1,2-Dichloropropane
- Dibromochloromethane
- Chlorobenzene
- 1,1,1-Trichloroethane
- Tetrachloroethylene
- 1,1,2,2-Tetrachloroethane
- Carbon tetrachloride
- 1,1,1,2-Tetrachloroethane
- 1,1,2-Dichlorobenzene
- 1,1,1,2-Tetrachlorobenzene
- 1,2-Dichlorobenzene
- 1,1,1,2-Tetrachlorobenzene
**Fused Silica Capillary Columns**

**Hicap-CBP Series (for universal use)**

Having highly pure silica inner surface, this Series columns minimize adsorption and decomposition of sample components, providing very sharp peaks. Since the molecules of the liquid phase are cross-linked and chemically bonded to the silica layer of the inner wall of the column, the column bleed is minimum, and the liquid phase is highly immune to organic solvents.

<table>
<thead>
<tr>
<th>Liquid phase</th>
<th>Polarity, Model name, &amp; GLC Cat. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Nonpolar</td>
</tr>
<tr>
<td><strong>I.D. (mm)</strong></td>
<td><strong>Film thickness (μm)</strong></td>
</tr>
<tr>
<td>0.1</td>
<td>0.1</td>
</tr>
<tr>
<td>0.22</td>
<td>0.25</td>
</tr>
<tr>
<td>0.32</td>
<td>0.5</td>
</tr>
<tr>
<td>1.0</td>
<td>12</td>
</tr>
<tr>
<td>0.53</td>
<td>12</td>
</tr>
</tbody>
</table>

- **Name of liquid phase**: Methyl silicone, 5% phenyl silicone-methyl silicone, Cyanopropyl, Polyethyleneglycol
- **Equivalent to**: OV-1, SE-30, SE-52, SE-54, OV-1701, PEG-20M
- **Max. temp.**: 320°C, 300°C, 270°C, 250°C

*The maximum temperature differs with the film thickness: It is lower with thicker film. It is 20~30°C lower in isothermal works.*
Capillary Column Accessory Set
(Cat. No. 221-38652-91)

This set contains tools, supplies, etc. which are used to ensure high analytical productivity in capillary gas chromatography.

The set includes:
• Graphite Ferrule
• Nut
• Soap film flow meter
• Spanner, 6×7mm
• Tweezers
• Magnifying Lens
• Measure, stainless steel, 150mm
• Accessory Box
• Pin Vise
• Drill
• Presstight Connector
• Compact vise
• Adapter Socket (MM-C)
• Magnet grips

Capillary Tube Cutter
(Cat. No. 221-50595-91)

To cut a fused silica capillary tube, score the desired part with this cutter, which has a ceramic blade, and snap at the position. This cutter is an easy-to-use pen type. A spare blade is supplied.

Capillary Column Cutter
(with Rotating Diamond Blade)
(Cat. No. 221-48862)

This tool enables the precision cutting of fused silica capillary columns. Using this cutter, even inexperienced personnel can achieve the kind of clean, straight cut that is demanded in high-level chemical analysis.

Diamond Blade Replacement Kit
(Cat. No. 221-48862-01)

Capillary Column Rinsing Device
(Cat. No. 221-51028-91)

Capillary columns are often deteriorated by the residual deposit of high boiling components. Some of such columns can be regenerated by rinsing with solvent. This devise is used to force solvent to flow through the column by means of gas pressure, supplied from the gas chromatograph main.

The solvent container has an outer container made of plastics, which ensures safety even if the inner container should burst due to an excessive pressure. A set of tubing and joints are supplied.

The solvent container accepts up to 10mL of solvent and bears a pressure up to 300kPa.

Magnifying Lens
(Cat. No. 670-12327)

When capillary tubes are connected in series, it is essential that the both ends have smooth cut surfaces. This magnifying lens is used to check the cut edges, before connection.
Capillary Column Joint

A capillary column is installed in a GC with a graphite ferrule and a nut. The nut is available in two types, with slit and without slit. The nut with slit can be removed from the column without removing the ferrule from it, while the nut without slit features compact design and rapid temperature response. The 0.5 graphite ferrule is used for capillary columns of 0.1-0.32 mmID, and the 0.8 graphite ferrule is used for wide-bore capillary columns.

<table>
<thead>
<tr>
<th>Description</th>
<th>Cat. No.</th>
<th>Net</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nut with slit</td>
<td>221-32705</td>
<td></td>
</tr>
<tr>
<td>Nut without slit</td>
<td>221-16325-81</td>
<td>10pcs.</td>
</tr>
<tr>
<td>0.5 Graphite ferrule</td>
<td>221-32126-05</td>
<td>10pcs.</td>
</tr>
<tr>
<td>0.8 Graphite ferrule</td>
<td>221-32126-08</td>
<td>10pcs.</td>
</tr>
</tbody>
</table>

Prestight Connector

(Cat. No. 221-38102-91) (Five pieces as a set)

This connector is used to connect capillary columns quite easily. Connection is accomplished just by inserting the capillary tubes into the connector from the both ends. When the tubes are coated with polyimide resin before insertion, the connection will remain tight almost permanently and will be completely free of leakage. Applicable to capillary tubes ranging 0.35mm to 0.8mm in outer diameter. Also available is a set of five connectors and five grams of polyimide resin (Cat. No. 221-38102-92).

Glass-Lined Stainless Steel Joint

This is a compact joint to connect capillary columns in series. The glass lining minimizes the adsorption of sample components. To ensure positive connection, it is necessary that the two ends have been beautifully cut and that they are made to be in close contact.

<table>
<thead>
<tr>
<th>Description</th>
<th>Cat. No.</th>
<th>applicable capillary diameter (mm)</th>
<th>Net</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mini-union</td>
<td>670-11424-11</td>
<td>0.4</td>
<td>5pcs.</td>
</tr>
<tr>
<td></td>
<td>670-11424-12</td>
<td>0.5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>670-11424-13</td>
<td>0.8</td>
<td></td>
</tr>
<tr>
<td>Graphite ferrule</td>
<td>670-11424-21</td>
<td>0.4-0.5</td>
<td>10pcs.</td>
</tr>
<tr>
<td></td>
<td>670-11424-22</td>
<td>0.8</td>
<td></td>
</tr>
</tbody>
</table>

Main Application of Prestight Connector

- Connection of broken capillary tubes:
  The connected parts will be smooth.
- On-column sample injection:
  Any capillary columns can be used in the on-column injection mode by connecting a short wide-bore capillary columns to the inlet of the column.
- Retention gap method:
  An about 2 meters long capillary tube, with no stationary phase, is connected to the head of analytical capillary column. This prevents peaks from being split into two or more.
- Column conditioning:
  A short capillary tube is connected to the outlet of the column. This prevents air (oxygen) from diffusing into the column, thus preventing the deterioration of liquid phase which is kept at a high temperature.
- Stable storing of capillary columns:
  Deterioration by air and contamination can be prevented by connecting the both ends with a capillary tube.

Injection Port Septums

<table>
<thead>
<tr>
<th>Product name</th>
<th>Cat. No.</th>
<th>Net</th>
<th>Color</th>
<th>Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard type</td>
<td>201-35584</td>
<td>20pcs.</td>
<td>White</td>
<td>The low durability usually experienced with conventional low-bleed septums has been reduced with this septum, which offers both low bleed and long life. It is harder for septum cuttings to fall into the insert and cost reductions are also possible. The problem of sticking to the vaporizing chamber during continuous use at high temperatures, a problem experienced with conventional septums, has been eliminated.</td>
</tr>
<tr>
<td>LL septum (long life)</td>
<td>221-48972-91</td>
<td>20pcs.</td>
<td>Blue</td>
<td>Maximum temperature (INJ setting temperature): 450°C</td>
</tr>
<tr>
<td>HT septum (hi-temp)</td>
<td>221-48938-91</td>
<td>20pcs.</td>
<td>Brown</td>
<td>Using this septum alleviates the problem of reduced durability when the vaporizing chamber is used continuously at 450°C. Compared to the LL septum, the increase in bleed when used at high temperatures is kept at a lower level. The problem of sticking to the vaporizing chamber during continuous use at high temperatures, a problem experienced with conventional septums, has been eliminated.</td>
</tr>
<tr>
<td>GLC “Komachi”</td>
<td>Shimadzu GLC</td>
<td>25pcs.</td>
<td>Light green</td>
<td>Suitable for high-sensitivity analysis at high temperatures</td>
</tr>
<tr>
<td>Enduro blue Septa</td>
<td>Shimadzu GLC</td>
<td>50pcs.</td>
<td>Light blue</td>
<td>Maximum temperature (INJ setting temperature): 240°C</td>
</tr>
<tr>
<td>Thermogreen LB-2</td>
<td>221-35507-01</td>
<td>10pcs.</td>
<td>Green</td>
<td>Low-bleed septum suitable for high-sensitivity analysis; This septum is the least influenced by plasticizer. However, because of its hardness, it is easy for septum cuttings to fall into the insert, and it is not suited to continuous analysis of multiple samples.</td>
</tr>
</tbody>
</table>

Low-bleed septums are not completely free of bleeding. The type of bleeding that occurs varies with the septum, and this results in different patterns on chromatograms. With high-sensitivity analysis, it is necessary to select a septum for which bleeding will not occur at a point that interferes with the peak of the target compound. Conditioning for several hours between 200°C and 250°C after extraction with hexane may help to reduce bleeding.
Glass Insert for Capillary Columns

Even in capillary GC, glass insert is very important because it prevents the column from contamination by sample components. Select the type that meets your GC and the method of sample injection, and replace it with a new one at an appropriate frequency.

<table>
<thead>
<tr>
<th>Model →</th>
<th>GC-8A</th>
<th>GC-14A/14B</th>
<th>GC-17A ver.2/3</th>
<th>GC-2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>Split/Splitless injection</td>
<td>(SPL-G9)</td>
<td>(SPL-14)</td>
<td>(SPL-17)</td>
<td>(SPL-2010)</td>
</tr>
<tr>
<td>For Split use</td>
<td><img src="221-25822-03" alt="Image" /> L-87</td>
<td><img src="221-37574-01" alt="Image" /> L-99</td>
<td><img src="221-41444" alt="Image" /> L-95</td>
<td><img src="221-41444-01" alt="Image" /> L-95</td>
</tr>
<tr>
<td>For Splitless use</td>
<td><img src="221-25944-03" alt="Image" /> L-87</td>
<td><img src="221-32544" alt="Image" /> L-99</td>
<td><img src="221-41544" alt="Image" /> L-95</td>
<td><img src="222-48335-01" alt="Image" /> L-95</td>
</tr>
<tr>
<td>Split injection</td>
<td>(CLH-800)</td>
<td>(CLH-14)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>For Splitless use</td>
<td><img src="221-18384-04" alt="Image" /> L-78</td>
<td><img src="221-32998-01" alt="Image" /> L-118</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(WBC Attachment)</td>
<td>(WBC Attachment) *1</td>
<td>(WBC-17)</td>
<td>(WBI-17)</td>
<td>(WBI-2010)</td>
</tr>
<tr>
<td>Direct injection</td>
<td><img src="221-39148" alt="Image" /> L-86</td>
<td><img src="221-38107" alt="Image" /> L-139</td>
<td><img src="221-41599" alt="Image" /> L-95</td>
<td><img src="222-48335-01" alt="Image" /> L-95</td>
</tr>
<tr>
<td>Detector side *2</td>
<td><img src="221-18756-02" alt="Image" /> L-78</td>
<td><img src="221-33000" alt="Image" /> L-71</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*1 Insert for GC-14 septum purge unit is Cat. No. 221-38151-04.

*2 Glass insert on detector side not required for SPL-14, SPL-17, SPL-2010 and WBI-17, WBI-2010, WBC attachment.

---

**Part of Injection Port**

**Parts for GC-14A/14B**

1. Septum cap (Cat. No. 221-13372)
2. Needle guide (Cat. No. 221-14773)

**Parts for GC-17A ver.2010**

1. Septum holding nut (Cat. No. 221-41286)
2. Needle guide (for AOC) (Cat. No. 221-44823-91) (2 per set)
3. Refer to the previous page for details on septums.

---

**Quartz Wool**

(Cat. No. 201-47616-01) (2g per piece)

This quartz wool features minimum adsorptive properties.

**Inert Quartz Wool**

(Cat. No. 221-48600) (2g per piece)

This quartz wool has been processed to make it inert.

**Shimadzu Q Quartz Beads**

(Cat. No. 670-10458-73)

Glass insert is often packed with the beads to enhance the mixing property. The beads are also used in flow restrictor tubes.
Glass Columns

<table>
<thead>
<tr>
<th>Model</th>
<th>8G 3.2</th>
<th>7GE 3.2</th>
<th>14G 3.2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Shape</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Applicable GC</strong></td>
<td>8A</td>
<td>9A, 12A, 14A/14B, 15A, 16A</td>
<td>14A/14B, 15A, 16A</td>
</tr>
<tr>
<td><strong>Outer diameter × inner diameter</strong></td>
<td>5×3.2</td>
<td>5×3.2</td>
<td>5×3.2</td>
</tr>
<tr>
<td><strong>Cat. No.</strong></td>
<td>221-22949-05</td>
<td>221-00838-05</td>
<td>221-34393-31</td>
</tr>
<tr>
<td>Multiply the last two digits of Cat. No. by ten to know the length (cm).</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: 8G 3.2 columns are supplied in 2pcs./set.

Glass Insert (Cat. No. 221-14093-84) (5pcs./set)

When the longer leg of the glass column is used as the inlet, sample injection is made in the on-column method.
When the shorter leg of the glass column is used as the inlet, this glass insert is used as the connector, and the sample is injected into this glass insert. A glass insert contaminated with nonvolatile components may be replaced or washed. (Not applicable to GC-8A Series.)

Glass Column Joint

To install a glass column, the following items are used:

- ①~④: Glass column joint set (Cat. No. 221-15561-91)
- ⑤: Graphite ferrule (Cat. No. 221-15563-91) (4 pieces per set)
- ⑥: Silicone rubber O ring (Cat. No. 201-47614) (20 pieces per set)

Two sets of glass column joints (①~④) are required for one column, one at each end. Connections are made leak-free through the use of the graphite ferrules ⑤; since the ferrules are very hard, take reasonable care not to break the glass column. When the column temperature is below 150°C, it is recommendable to use the silicone rubber O ring ⑥.

Glass Insert (Cat. No. 221-14093-84) (5pcs./set)

When the longer leg of the glass column is used as the inlet, sample injection is made in the on-column method.
When the shorter leg of the glass column is used as the inlet, this glass insert is used as the connector, and the sample is injected into this glass insert. A glass insert contaminated with nonvolatile components may be replaced or washed. (Not applicable to GC-8A Series.)

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Tubing for Conditioning of Glass Columns (Cat. No. 221-08309-92)

This is a fused silica tube, which is flexible enough not to apply excessive force to the glass column. Also used for gas supply or to plug a column during storage.
Stainless Steel Columns

Applicable GC: GC-8A/9A/12A/14A/14B/15A/16A

Connectors and Other Parts for Stainless Steel Columns

(1) Parallel column joint (Cat. No. 201-35555)
(2) Series column joint (Cat. No. 201-35041-01)
(3) Column gasket, aluminum (Cat. No. 201-35183-84), 500pcs./set
(4) G-type plug (Cat. No. 221-35566-92), 2pcs./set. For stopping columns.

Stainless Steel Column Adapter

Required when a stainless steel column is used in a Shimadzu gas chromatograph.

<table>
<thead>
<tr>
<th>Applicable GC</th>
<th>GC-8A</th>
<th>GC-9A/12A/14A/14B/15A/16A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Injection side</td>
<td>Cat. No.</td>
<td>Cat. No.</td>
</tr>
<tr>
<td></td>
<td>221-22954-91</td>
<td>221-14087-91*</td>
</tr>
<tr>
<td>Detector side</td>
<td>221-08882-91</td>
<td></td>
</tr>
<tr>
<td>Detector (TCD) side</td>
<td>221-10079-91</td>
<td></td>
</tr>
</tbody>
</table>

* Additionally requires the glass insert (p.19) and the inset ring (See figure to the right).

Column Tag

The name of the column packing, the date of preparation, etc. are written on the tag and fixed to the column. A memo may be written with a ball-point pen, but it is better to engrave it with the electric engraving device (also used as a vibrator; see page 21.)

(Cat. No. 221-92348-91: 10pcs./set.)
(Cat. No. 221-37387-93: An electric engraving device and 50 pieces of tag.)
**Set of Devices for Packing Columns**
(Cat. No. 221-37387-91)

Allows easy packing and re-packing of columns. Detailed instruction manual and a convenient plastic case are supplied.

**How to Pack Columns**

1. Plug one end of the empty column with silica wool and fit a funnel to the other end.
2. Fit an aspirator to a water faucet and connect the aspirator with the rubber tube, etc., as shown in the figure.
3. Adjust the water flow rate in the aspirator higher than 5L/min., and then let the packing material flow into the funnel.
4. Pack tightly using the vibrator.
5. Remove the funnel and plug the inlet of the column with silica wool.
6. Install the column in the column oven of the GC, allow carrier gas (inert gas) to flow (Tubing for conditioning is required for a glass column.), and keep the column at about 20°C lower than the maximum temperature of the column, for several hours to condition the column.
7. After conditioning, vibrate the column without turning off the carrier gas to make the packing uniform, adding packing material if necessary.
8. Write memo on a tag and attach it to the column.
Valves and Valve Applied Devices

Valve

Stainless steel valves, having 4, 6, 8, or 10 ports are available to permit various applications, e.g. gas sampling.

Backflushing

A 4-port valve may be used to reverse the carrier gas stream to allow some group of sample components to elute as one peak.

Precutting

An 8-port valve is used to reverse the carrier gas stream in the short precolumn in order to allow uninteresting high boiling components and water contents to be cut off and removed, so that the analysis time is shortened or the column deterioration is prevented.

MGS-4 Gas Sampler (Cat. No. 221-42574-02)
MGS-5 Gas Sampler (Cat. No. 221-42576)

These gas samplers are used to introduce gas samples through manual operation, under ambient temperature conditions. The sample volume to be introduced is selectable in three steps of 1, 2, and 5 milliliters by valve operation (MGS-5) or by changing the sample loops (MGS-4). A mounting plate is additionally required.

<table>
<thead>
<tr>
<th>Number of ports</th>
<th>For manual operation</th>
<th>For valve actuator</th>
<th>For use outside of oven</th>
<th>For valve unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>201-35597-02</td>
<td>221-26253-96</td>
<td>221-26366-91</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>201-35011-05</td>
<td>“-97”</td>
<td>“-92”</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>201-35109-03</td>
<td>“-98”</td>
<td>“-93”</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>221-25500-91</td>
<td>“-99”</td>
<td>“-94”</td>
<td></td>
</tr>
</tbody>
</table>

For MGS-4 For MGS-5
GC-8A 201-38304
GC14B
GC-17A 221-42868-91 221-42585-91
GC-2010

HGS-2 Heated Gas Sampler (Cat. No. 221-42571)
PRC-2 Precut Device (Cat. No. 221-42572)
BFC-2 Backflush Device (Cat. No. 221-42577)

A 4-, 6-, or 8-port valve is housed in an oven temperature controllable up to 150°C, to permit backflushing, gas sampling, or precutting operation. These are to be installed on the leftside panel of the GC and require a mounting plate. (Cat. No. 201-37173 for GC-8A and Cat. No. 221-08333-90 for GC-9A-17A).
VLA-1 Valve Actuator (Cat. No. 221-25930-91)

This is a rotary air cylinder used for automated operation of valves. It is driven pneumatically and controlled electrically. The VLA-1 is to be connected to the external installation type manual control valve described on page 22 and the pneumatic force is supplied from the air cylinder for the FID via a branch pipe and an air hose.

Shown above is an example of automatic gas sampling system, which is to be installed on the outer side of the column oven. The system consists of the following items.

<table>
<thead>
<tr>
<th>No. in Fig.</th>
<th>Cat. No.</th>
<th>Description</th>
<th>Qty</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>221-25930-91</td>
<td>VLA-1 Valve actuator</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>221-26000-90</td>
<td>Valve actuator case ASSY</td>
<td>1</td>
</tr>
<tr>
<td>1 + 2</td>
<td>221-26000-91</td>
<td>Valve actuator unit ASSY</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>221-26255-91</td>
<td>Mount plate ASSY</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>221-26253-97</td>
<td>6-port valve, with shaft</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>201-48555-00</td>
<td>MF-MF pipe, 1m long</td>
<td>2</td>
</tr>
<tr>
<td>6</td>
<td>201-48560-50</td>
<td>MF-GF pipe, 500mm long</td>
<td>1</td>
</tr>
</tbody>
</table>

Valve Unit (Cat. No. 221-26238-91)

This unit drives valves by pneumatic force and is to be mounted on the front panel of the GC, replacing the sub-door. (Not applicable to GC-8A Series or GC-17A Series.) Valve(s) are kept at a high temperature in the column oven, and hence are effectively used for heated gas sampling, precutting, and backflushing. This valve unit accepts only the one described as “For valve unit” on page 22. A Valve Unit accepts only one valve; when two valves are to be used, the VLA-1 is additionally required.

Heated Oven Coupling Unit (Cat. No. 221-32112-91)

When valve(s) are housed in the column oven, the column oven temperature cannot be raised above 150°C, the maximum temperature limit of the valves. When a higher column temperature is required, the valves are housed in another column oven which is connected via this coupling unit. The coupling unit may be kept at a high temperature to prevent sample components from condensation. (Applicable to GC-14A/14B/15A/16A)
**DFM-1000 Digital Flow Meter**
(Cat. No. 080-68520-01)

The DFM-1000 is a digital gas flow meter that requires no stopwatch. The speed of gas bubble is timed with a photo sensor, and the result is converted into flow rate by a microcomputer and displayed on a three-digit meter. It is also capable of displaying split ratios in capillary GC.

- Measuring range: 0.1~1000 mL/min.
- Precision: ± 3%
- Power source: Dry cell, 9V, automatic power OFF function.
- Dimension: 100W×190D×60H mm

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**Accessory/Supply Set** (Cat. No. 221-38650-90)

To carry out analyses with a gas chromatograph, some accessories and supplies are required besides the gas chromatograph itself. It is troublesome to select those items that are necessary for your analyses, and it often happens some necessary items have not been ordered. Shimadzu provides standard set of accessories and supplies, which are used in most types of gas chromatographic analyses. The sets with a carrier gas pressure regulator are also available.

The standard set includes, a carrier gas supply pipe, a gas filter, leak check fluid, tools, a timer of pocket type, a mirror for flame checking, a microliter syringe, column tags, quartz beads, color markers, a power outlet, a case, etc.

Note: In the case of a GC equipped with an FID (or FPD and FTD), the FID operation parts and an air compressor described on the next page are additionally required. Also, the Accessories for Capillary Columns described on page 18 may be required.
Air Compressor

This supplies clean (oil mist free) compressed air to support combustion in FID and FPD.

- Output: 1/4HP
- Delivery pressure: 400±50kPa
- Maximum delivery flow rate: 20L/min. (NTP)

<table>
<thead>
<tr>
<th>Type</th>
<th>Oil-less</th>
<th>Oil-less, silent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cat. No.</td>
<td>607-12099</td>
<td>607-12138</td>
</tr>
<tr>
<td>Weight</td>
<td>20kg</td>
<td>44kg</td>
</tr>
<tr>
<td>Noise</td>
<td>—</td>
<td>58db</td>
</tr>
</tbody>
</table>

Hydrogen Generator

Compact hydrogen generator by ion exchange membrane water electrolysis.
High purity hydrogen is formed through electrolysis of pure water.
OPGU-2100S/2200S are compact to fit the side of gas chromatograph.

<table>
<thead>
<tr>
<th>Model</th>
<th>OPGU-2200S</th>
<th>OPGU-2100S</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cat. No.</td>
<td>221-45131-91</td>
<td>221-45130-91</td>
</tr>
<tr>
<td>Max. delivery flow rate</td>
<td>225mL/min</td>
<td>100mL/min</td>
</tr>
<tr>
<td>Max. delivery pressure</td>
<td>20~400kPa</td>
<td>20~400kPa</td>
</tr>
</tbody>
</table>

Air Filter/Regulator Unit

This unit regulates the pressure, removes dust, and dehumidifies the compressed air. A silica gel type (below ①) and maintenance-free hollow fiber membrane type (below ①+②) are available.
Hollow fiber membrane is a new material that allows vapor pass through but air does not pass, and there is no need to replace or regenerate.

<table>
<thead>
<tr>
<th>Type</th>
<th>Silica Gel</th>
<th>—</th>
<th>Hollow fiber membrane</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cat. No.</td>
<td>221-38251-91</td>
<td>221-51658-91</td>
<td>Combination of two items in left</td>
</tr>
</tbody>
</table>
FID Operation Parts Set (Cat. No. 221-38651-91)

This set includes the parts required to supply air and hydrogen to an FID (or FPD and FTD) and the parts to clean an FID jet.

The items with a catalog number may be sold independently.
PPR Series Pressure Regulator for High Purity Gases
(Cat. No. 221-35999-01 Pressure Regulator for Nitrogen and Argon)
(Cat. No. 221-35999-02 Pressure Regulator for Hydrogen)
(Cat. No. 221-35999-03 Pressure Regulator for Helium)

Air, even of a small amount, contained in carrier gas can cause trouble. Conventional pressure regulators have the drawback that, when the gas cylinder is replaced, some air flows into the regulator. The carrier gas will then contain that air and flows into the gas chromatograph; this air will cause the baseline to be unstable; it can even oxidize and decompose the liquid phase.

This problem is especially serious for capillary columns which have only very thin film of liquid phase.

The PPR Series Pressure Regulators have an air purge valve to solve this problem.

Features of PPR Series

- Air can be purged when replacing the cylinder.
  The two valves on the inlet side prevent air from flowing into the regulator and also can discharge the air from the cylinder joint.
- The gas can be enclosed in the pressure regulator.
  The valves at the entrance and the exit can enclose the gas in the pressure regulator; it is not necessary to purge the pressure regulator at the start of the next series of analysis. This dramatically shortens the startup time.
- Cylinders can be exchanged without suspending the analysis.
  Close the valve A and dismount the pressure regulator from the cylinder; the analysis can be continued for several minutes using the gas remaining in the enclosed flow line. The cylinders can be exchanged within this time.

Gas Supply Pipe

These are stainless steel pipes, 3mmOD and 2mmID. The joints on the pressure regulator side are Type M16P1.5. (That of the hydrogen supply pipe is of the same size but of a left-hand thread.) The joints on the GC side are all Shimadzu M Type. The air supply pipe also has a Shimadzu M Type joint at the both ends.

<table>
<thead>
<tr>
<th>Cat. No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>201-48067</td>
<td>Gas Supply Pipe, 2.5m (right-hand thread)</td>
</tr>
<tr>
<td>201-48067-05</td>
<td>Gas Supply Pipe, 5m (right-hand thread)</td>
</tr>
<tr>
<td>201-48067-10</td>
<td>Gas Supply Pipe, 10m (right-hand thread)</td>
</tr>
<tr>
<td>201-48067-15</td>
<td>Gas Supply Pipe, 15m (right-hand thread)</td>
</tr>
<tr>
<td>221-18990-00</td>
<td>Hydrogen Supply Pipe, 10m (left-hand thread)</td>
</tr>
<tr>
<td>221-18990-25</td>
<td>Hydrogen Supply Pipe, 2.5m (left-hand thread)</td>
</tr>
<tr>
<td>221-18990-50</td>
<td>Hydrogen Supply Pipe, 5m (left-hand thread)</td>
</tr>
<tr>
<td>201-48070</td>
<td>Air Supply Pipe (2pcs. as a pair, 3m in total)</td>
</tr>
</tbody>
</table>
**Economy Type Pressure Regulator**  
(Cat. No. 042-41099-01 Pressure Regulator for Nitrogen and Argon)  
(Cat. No. 042-41099-02 Pressure Regulator for Hydrogen)  
(Cat. No. 042-41099-03 Pressure Regulator for Helium)  

These pressure regulators are effectively used in packed column GC, using an FID or a TCD at a relatively low sensitivity.

**Gas Filter**  
(Cat. No. 221-06619-01)  

This removes organic compounds and water contents from the gas to enhance its purity, using Molecular Sieve 5A as the adsorbent. About 200mL of Molecular Sieve 5A is contained in a metallic tube having a one meter long connecting tube. The Molecular Sieve 5A may be easily regenerated by heating in a furnace.

**Branch Pipe**  
(Cat. No. 221-33973-92)  

This is useful when carrier gas is supplied to two GCs from one gas cylinder. This is also used as the stop valve for the GC-14A/14B/17A which has no stop valve at the carrier gas inlet.

**Oxygen Trap**  
(Cat. No. 221-46985-91)  

This adsorbs the oxygen in a gas. One piece of this is capable of adsorbing about 500mL of oxygen. The trap is easily regenerated by allowing hydrogen to flow under a high temperature condition of 100~150°C. Equipped with 1/8inch Swagelok joints, and supplied with two adapters for Shimadzu M Type joints.

**Fluid for Leak Check**  
(Cat. No. 670-11514)  

Since the fluid volatilizes rapidly, it does not cause any trouble after use. The nozzle may be pulled out to a length of 30cm; this feature provides ease in leakage check at inmost positions. (238mL/bottle)
When a GC column must be kept below the ambient temperature, some coolant (liquid CO₂ for down to -50°C and liquid N₂ for lower temperature) is injected into the column oven. The CRG Series keeps the column oven temperature at the desired point by controlling the injection rate of the coolant. Select the suitable model according to the model of your gas chromatograph.

This unit is available in two types, to be selected according to the type of the coolant used. These two types are applicable to all of the CRG Series.

Addition of the TPR-8 to the GC-8AP Series (GC-8A Series with temperature programming functions) provides the following additional functions:

1. Automatically opens the door of the column oven and controls the oven temperature near the ambient point.
2. At the end of a temperature programmed run, this unit automatically opens the door of the column oven and keeps the oven temperature at the initial point.
3. Permits cryogenic work down to -100°C in combination with the cryogenic valve unit described below. (The CRG Series is not required because the TPR-8 incorporates the functions of the CRG-8).

The temperature controller of CRG belongs to GC-17AVer.2/3. Therefore, when GC-17A Ver.2/3 must be kept below the ambient temperature, please provide the only cryogenic valve unit as shown below.

<table>
<thead>
<tr>
<th>Model</th>
<th>CRG-8/12</th>
<th>CRG-15</th>
<th>CRG-2010 CO₂</th>
</tr>
</thead>
<tbody>
<tr>
<td>Applicable GC</td>
<td>GC-12A/8A</td>
<td>GC-14A/16A/18A/17A Ver.2/3</td>
<td>GC-2010</td>
</tr>
<tr>
<td>Cat. No.</td>
<td>221-24660-92</td>
<td>221-25347-94</td>
<td>221-48703-38</td>
</tr>
</tbody>
</table>

* The coolant of CRG belongs to GC-17AVer.2/3.
Microsyringes

Standard Syringes

Ranging from 25μL to 500μL in capacity, this type of syringes are most widely used in analytical gas chromatography.

• Barrel size: 8dia.×120mm

<table>
<thead>
<tr>
<th>Cat. No.</th>
<th>Model</th>
<th>Capacity (μL)</th>
<th>Cat. No. of spare needle</th>
</tr>
</thead>
<tbody>
<tr>
<td>670-12510-74</td>
<td>25R</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td>670-12510-75</td>
<td>50R</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>670-12510-76</td>
<td>100R</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>670-12510-77</td>
<td>250R</td>
<td>250</td>
<td></td>
</tr>
<tr>
<td>670-12510-78</td>
<td>500R</td>
<td>500</td>
<td></td>
</tr>
</tbody>
</table>

• Also available are fixed needle type syringes, ranging from 25μL to 500μL in capacity.

Microsyringes with Plunger Guide

The plunger of a microsyringe is so thin that a novice might break it during operation. This type of microsyringes have an extended barrel (120mm long) to prevent the plunger from bending.

<table>
<thead>
<tr>
<th>Cat. No.</th>
<th>Model</th>
<th>Capacity (μL)</th>
<th>Cat. No. of spare needle</th>
</tr>
</thead>
<tbody>
<tr>
<td>670-12510-80</td>
<td>10R-GP</td>
<td>10</td>
<td>670-12510-95</td>
</tr>
<tr>
<td>670-12510-86</td>
<td>5R-GPS</td>
<td>5</td>
<td>670-12510-94</td>
</tr>
</tbody>
</table>

• Also available are fixed needle type syringes, 5μL to 10μL in capacity.

Gastight Microsyringes

A gas seal gland is provided at the rear of the barrel to ensure pressure resistancy of 15kgf/cm² (100μL or less in capacity) or 12kgf/cm² (250μL or larger in capacity).

<table>
<thead>
<tr>
<th>Cat. No.</th>
<th>Model</th>
<th>Capacity (μL)</th>
<th>Cat. No. of spare needle</th>
</tr>
</thead>
<tbody>
<tr>
<td>670-12510-81</td>
<td>25R-GSG</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td>670-12510-82</td>
<td>50R-GSG</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>670-12510-83</td>
<td>100R-GSG</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>670-12510-84</td>
<td>250R-GSG</td>
<td>250</td>
<td></td>
</tr>
<tr>
<td>670-12510-85</td>
<td>500R-GSG</td>
<td>500</td>
<td></td>
</tr>
</tbody>
</table>

• Also available is the fixed needle type ranging in capacity from 25μL to 500μL.

Microsyringes with Replaceable Plunger

The plunger is made leak-free by a PTFE chip at the tip of the plunger. Since it is not necessary to precision-machine the plunger, this type of microsyringes are low in cost and allows easy replacement of the plungers. The syringes ensure improved tightness of gas or liquid, compared with conventional syringes. The capacity is 100μL.

<table>
<thead>
<tr>
<th>Cat. No.</th>
<th>Model</th>
<th>Capacity (μL)</th>
<th>Cat. No. of spare needle</th>
</tr>
</thead>
<tbody>
<tr>
<td>670-12553-21</td>
<td>10R-GT</td>
<td>10</td>
<td>670-12553-41</td>
</tr>
<tr>
<td>670-12553-33</td>
<td>plunger: 2/set</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>

• Also available are syringes, 25μL and 100μL in capacity.
Economy Set of Microsyringes

Microsyringes of 10μL capacity are most widely used in gas chromatography. They are mass-produced, resulting in lower cost. Further, they are available as a set of six pieces. Having 0.4mm O.D. needle with a tapered tip, they are recommended for on-column injection into capillary columns.

<table>
<thead>
<tr>
<th>Cat. No.</th>
<th>Model</th>
<th>Capacity (μL)</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>670-12552-01</td>
<td>10F</td>
<td>10</td>
<td>Fixed needle</td>
</tr>
<tr>
<td>670-12552-21</td>
<td>10R</td>
<td>10</td>
<td>Changeable needle</td>
</tr>
<tr>
<td>670-12510-95</td>
<td>—</td>
<td>—</td>
<td>5 spare needles</td>
</tr>
<tr>
<td>670-12552-60</td>
<td>SK-10F</td>
<td>10</td>
<td>10F (6/pack)</td>
</tr>
<tr>
<td>670-12550-62</td>
<td>SK-10R</td>
<td>10</td>
<td>10R (6/pack)</td>
</tr>
</tbody>
</table>

PIN Type Microsyringes

The plunger goes to the needle tip to eliminate dead volume. Best suitable to highly precise analysis of micro samples.

<table>
<thead>
<tr>
<th>Cat. No.</th>
<th>Model</th>
<th>Capacity (μL)</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>670-12510-71</td>
<td>0.5BR-7</td>
<td>0.5</td>
<td></td>
</tr>
<tr>
<td>670-12510-72</td>
<td>1BR-7</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>670-12510-73</td>
<td>5BR-7</td>
<td>5</td>
<td></td>
</tr>
</tbody>
</table>

LL-GT Type Syringe for Gas Analysis

Gastight syringes with capacity of milliliter level. Accepts commercially available lurelock type needle of various sizes.

<table>
<thead>
<tr>
<th>Cat. No.</th>
<th>Model</th>
<th>Capacity (mL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>221-54778-01</td>
<td>1MDF-LL-GT</td>
<td>1</td>
</tr>
<tr>
<td>221-54778-02</td>
<td>5MDR-LL-GT</td>
<td>5</td>
</tr>
<tr>
<td>221-54778-03</td>
<td>10MDR-LL-GT</td>
<td>10</td>
</tr>
<tr>
<td>221-54778-04</td>
<td>25MDR-LL-GT</td>
<td>25</td>
</tr>
<tr>
<td>221-54778-05</td>
<td>50MR-LL-GT</td>
<td>50</td>
</tr>
<tr>
<td>221-54778-06</td>
<td>100MR-LL-GT</td>
<td>100</td>
</tr>
<tr>
<td>221-54778-50</td>
<td>Syringe valve VLL</td>
<td>Less than 5</td>
</tr>
<tr>
<td>221-54778-51</td>
<td>Lure lock type needle NLL-5/23</td>
<td>—</td>
</tr>
<tr>
<td>221-54778-52</td>
<td>Lure lock type needle NLL-5/19</td>
<td>—</td>
</tr>
<tr>
<td>221-54778-54</td>
<td>Lure lock type needle NLL-5/14</td>
<td>—</td>
</tr>
</tbody>
</table>

SCK Syringe Cleaner (Cat. No. 670-12556-01)

A contaminated syringe can cause ghost peaks and/or cross contamination. This cleaner removes organic residues by heating and aspiration. The operation is quite simple: just insert the syringe needle, wait about 30 seconds, and pump the plunger several times. (Connect the unit to a vacuum of about 10 Torr., such as an aspirator or a vacuum pump.)
Hamilton Microsyringes

These are globally accepted as high precision microsyringes.

<table>
<thead>
<tr>
<th>Cat. No.</th>
<th>Model</th>
<th>Capacity (μL)</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>046-00025-01</td>
<td>701RN</td>
<td>10</td>
<td>Fixed needle</td>
</tr>
<tr>
<td>046-00025-03</td>
<td>26S</td>
<td>—</td>
<td>3 changeable needles</td>
</tr>
<tr>
<td>670-12504-01</td>
<td>7001N</td>
<td>1</td>
<td>Fixed needle</td>
</tr>
<tr>
<td>670-12504-56</td>
<td>7105N</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>670-12504-02</td>
<td>701N</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>670-12504-03</td>
<td>705N</td>
<td>50</td>
<td></td>
</tr>
</tbody>
</table>

The Model 7001N and 7105N are plunger-in-needle type, best suitable to injection of micro samples.

Titanium Plunger Microsyringes

These syringes use a titanium alloy plunger, which is highly flexible and corrosion resistant. The high flexibility of the plunger ensures stable injection of samples as small as 5μL.

The needle is 0.41mm in tip diameter, which is suitable for on-column injection into a capillary column.

<table>
<thead>
<tr>
<th>Cat. No.</th>
<th>Model</th>
<th>Capacity (μL)</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>670-12580-21</td>
<td>MS-E05-CS</td>
<td>5</td>
<td>Fixed needle</td>
</tr>
<tr>
<td>670-12580-22</td>
<td>MS-E10-CS</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>670-12580-25</td>
<td>MS-NE05-CS</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>670-12580-26</td>
<td>MS-NE10-CS</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>670-12580-31</td>
<td>XX-CS</td>
<td>—</td>
<td>5 changeable needles</td>
</tr>
</tbody>
</table>

Microsyringes with Guide Bar

A guide bar is installed parallel to the plunger, to prevent the plunger from bending. A stopper is also provided to allow a preset amount of sample to be injected accurately without reading the scale in each run.

<table>
<thead>
<tr>
<th>Cat. No.</th>
<th>Model</th>
<th>Capacity (μL)</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>670-12504-25</td>
<td>MS-G10</td>
<td>10</td>
<td>Fixed needle</td>
</tr>
<tr>
<td>670-12504-22</td>
<td>MS-NG10</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>670-12504-86</td>
<td>XX-MSF</td>
<td>—</td>
<td>5 changeable needles</td>
</tr>
</tbody>
</table>

MS-GAN Microsyringes for Gas Analysis

Gastight syringes with a capacity of milliliter quantity level. The needle is 30mm long and is of a screw-in type, which ensures ease of exchange.

<table>
<thead>
<tr>
<th>Cat. No.</th>
<th>Model</th>
<th>Capacity (μL)</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>670-12504-28</td>
<td>MS-GAN025</td>
<td>0.25</td>
<td>Changeable needle</td>
</tr>
<tr>
<td>670-12504-29</td>
<td>MS-GAN050</td>
<td>0.5</td>
<td></td>
</tr>
<tr>
<td>670-12504-30</td>
<td>MS-GAN100</td>
<td>1.0</td>
<td></td>
</tr>
<tr>
<td>670-12504-31</td>
<td>MS-GAN250</td>
<td>2.5</td>
<td></td>
</tr>
<tr>
<td>670-12504-32</td>
<td>MS-GAN500</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>670-12504-33</td>
<td>MS-GANX00</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>670-12504-85</td>
<td>XX-MS61</td>
<td>—</td>
<td>5 changeable needles</td>
</tr>
</tbody>
</table>
Shimadzu M Type Joints
The Shimadzu M Type Joints are widely used for tubing inside and outside of Shimadzu gas chromatographs. The connections are made leak-free by the contact of metal surfaces. 12mm spanners are used for connection.

Note: The ** at the end of a catalog number indicates the length of the pipe in centimeter units.

Swagelok Adapter (Cat. No. 221-25975-92)
This is used to connect a 1/8” stainless pipe to a Shimadzu M Type Joint (Supplied with a Swagelok union.)

Thread Adapter (Cat. No. 201-34675 MM-PT1/4) (Cat. No. 201-03106 MM-PT1/8)
Used to connect Shimadzu M Type joint to JIS Type tapered thread.

Needle Valve (Cat. No. 221-17482)
Used to control gas flow rate. The control range is 0~0.8L/min. for nitrogen, with an inlet pressure of 3kgf/cm². A Shimadzu M type joint is used both at the inlet and outlet.

Syringe for Cleaning (Cat. No. 221-35641-91)
This is a 10mL syringe with an M Type Joint. Conveniently used to wash inside of a tube with a solvent.

Silver Soldering Tool Set (Cat. No. 221-35801-91)
This set is conveniently used to attach a G-type or M-type joint to a pipe of the desired length. All you have to do is to fit a preformed silver solder ring to the pipe and heat it with a burner. The set contains a burner, 40 pieces each of the various types of joints, 20 pieces of 2mmOD pipes ranging from 10cm to 1 meter in length, 50 silver solder rings, a file, a reamer, and an instruction manual.