C180-E101B

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Glass Insert Selection Guide for GC and GC-MS

GC/GC-MS Glass Insert/Liner Selection Guide

Contents

Chapter

1

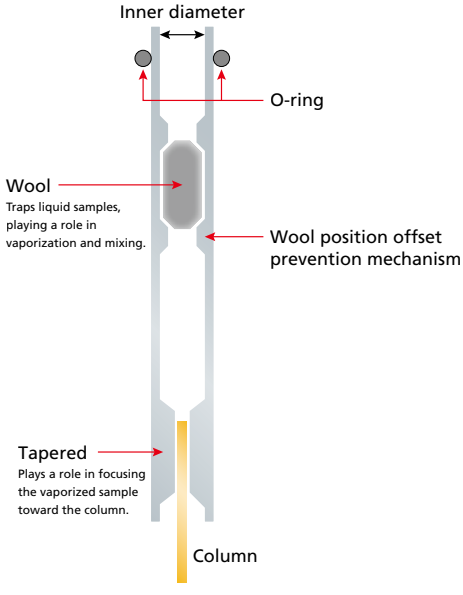
Introduction

1-1. Glass Inserts/Liners

A gas chromatograph (GC) introduces a sample into a column via an injection unit. Using a glass liner (glass insert) allows the sample to be vaporized efficiently and the vaporized sample to be mixed as uniformly as possible with the carrier gas before introduction into the column. It also reduces the extent to which contaminants such as high boiling point compounds from the sample contaminate the Injection Unit. Accordingly, selecting a glass liner appropriate for the objective improves the accuracy of analysis and leads to more reliable results.

The selection criteria for glass liners are as follows:
· Sample form
· Type of injection unit used
· Sample injection method during analysis
· Shape of the glass liner, presence of wool, and presence of surface treatment on the wool or glass liner

Glass liners with a variety of specifications are commercially available to suit these varied selection criteria, so selecting a glass liner can be challenging.
This selection guide describes how to select an appropriate glass liner for the objective/application as well as points to consider in accordance with elements of the glass liner configuration. Additionally, this guide introduces glass liners appropriate for your Shimadzu GC system.



Schematic Diagram of the Glass Liner and O-Ring

Element	Parameter	Explanation	Role
Wool	Position	Wool position within the glass liner	Controls the vaporization point
	Amount of filler	Weight of the wool	Controls the vaporization efficiency
Inner Diameter	Inner diameter	Inner diameter of the glass liner	Impact on the delivery rate of the vaporized components
	Capacity	Internal volume of the glass liner	Impact on the upper limit of the injection volume
Shape	Wool position offset prevention mechanism	Protrusion within the glass liner on the order of 1 mm	Prevents offset of the wool position
	Tapered	A narrowing of the inner diameter at the bottom of the glass liner on the order of 1 mm	Focuses the vaporized sample toward the column tip
Surface Treatment		Chemical treatment of the surface of the glass liner	Impact on adsorption and degradation of compounds

1-2. Sample Injection Units/Injection Methods

The glass liner is designed in accordance with the sample injection method. This section introduces typical sample injection units and injection methods.
Select a glass liner suited to the sample injection unit and injection method being used.

Sample Injection Unit	Injection Method	Glass Liner	Target Sample	Sample Injection	Compatible Columns
SPL	Split	Split glass liner, Split/Splitless glass liner	Medium to high-concentration samples	The sample is instantaneously vaporized, and some of it is injected into the column.	0.1 mm to 0.53 mm capillary columns
	Splitless	Splitless glass liner, Split/Splitless glass liner	Low-concentration samples	The sample is vaporized, and a large portion of it is injected into the column.	0.1 mm to 0.53 mm capillary columns (Wide diameter columns are more suitable)
MMI	Split	Split glass liner(78.5 mm length), Split/Splitless glass liner (78.5 mm length)	Medium to high-concentration samples	The sample is instantaneously vaporized, and some of it is injected into the column.	0.1 mm to 0.53 mm capillary columns
	Splitless	Splitless glass liner(78.5 mm length) ,Split/Splitless glass liner (78.5 mm length)	Low-concentration samples	The sample is vaporized, and a large portion of it is injected into the column.	0.1 mm to 0.53 mm capillary columns(Wide diameter columns are more suitable)
	Cold split	Split glass liner (78.5 mm length), Split/Splitless glass liner (78.5 mm length)	Medium to highconcentration samples prone to thermal decomposition, and samples with a wide range of boiling points	A heating program is used to vaporize the compounds in the sample in order of boiling point. A portion is then injected into the column.	0.1 mm to 0.53 mm capillary columns
	Cold splitless	Splitless glass liner (78.5 mm length) , Split/Splitless glass liner (78.5 mm length)	Low-concentration samples prone to thermal decomposition, and samples with a wide range of boiling points	A heating program is used to vaporize the compounds in the sample in order of boiling point. A large portion is then injected into the column.	0.1 mm to 0.53 mm capillary columns (Wide diameter columns are more suitable)
	Cold Direct	Direct glass liner (78.5 mm length)	Samples contained wide range of boiling points	Almost all sample introduced into the column before vaporization via specialized shape liner.	0.32 mm to 0.53 mm capillary columns (Wide diameter columns are more suitable)
	Large Volume Injection	Large-volume injection liner (78.5 mm length)	Extreme low-concentration samples	First, the injection unit will selectively vent the solvent from the sample. Then, a heating program will vaporize the solute and introduce it into the column.	0.1 mm to 0.53 mm capillary columns
	Thermal desorption	¼inch O.D TD tube, Splitless glass liner (78.5 mm length, monotrap analysis only)	Trace amounts of VOCs/ SVOCs contained in an adsorbent.	A heating program is used to vaporize the compounds in adsorbent.	0.1 mm to 0.53 mm capillary columns
WBI	Direct	Splitless glass liner/WBI glass liner	No concentration restriction	The sample is instantaneously vaporized, and the full amount is injected into the column.	0.53 mm capillary columns
OCI	On-Column	OCI glass liner	Samples with a wide range of boiling points, and samples with ultra-high boiling points	The entire sample solution is injected into the column before vaporization.	0.25 mm to 0.53 mm capillary columns
PTV	Cold split	PTV glass liner	Medium to high-concentration samples prone to thermal decomposition, and samples with a wide range of boiling points	A heating program is used to vaporize the compounds in the sample in order of boiling point. A portion is then injected into the column.	0.1 mm to 0.53 mm capillary columns
	Cold splitless	PTV glass liner	Low-concentration samples prone to thermal decomposition, and samples with a wide range of boiling points	A heating program is used to vaporize the compounds in the sample in order of boiling point. A large portion is then injected into the column.	0.1 mm to 0.53 mm capillary columns (Wide diameter columns are more suitable)
SINJ/DINJ	Full volume injection (Direct)	Packed glass liner	No concentration restriction	The sample is instantaneously vaporized, and the full amount is injected into the column.	Packed Columns

Refer to the following for details on the types of sample injection unit. Details

1-3. Selection Guide

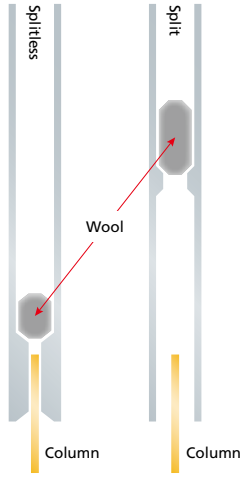
This section describes glass liner selection methods.

Selecting the Glass Liner Wool

Wool is used inside the glass liner when performing SPL, WBI, and PTV analysis. The wool traps the liquid sample injected into the glass liner, promoting efficient vaporization. The two main wool substances are hard glass and quartz glass. This section describes the role of the wool, and cautions when filling the glass liner with wool.

Wool Filling Position

Liquid samples are often vaporized on the wool surface or inside the wool plug. In other words, the wool position is the site at which the sample vaporizes, so controlling the position of the wool controls the timing of the sample vaporization.



For splitless or direct analysis with low carrier gas flow rates, it is common to fill the wool at the bottom of the glass liner.
If the vaporization site is too far away from the column inlet, it will take time for the vaporized sample to reach the column inlet, which can cause reduced sensitivity and peak shape problems. Additionally, there is a risk that the vaporized sample will spill over the top of the glass liner, leading to reversed flow or deviation from the septum purge flowrate. Caution is necessary when injecting 3 µL or more of the sample.
For split analysis with high total carrier gas flow rates, it is common to fill the wool at the top of the glass liner.
If the top is filled with wool, the syringe needle tip and the top edge of the wool tend to be in close proximity or contact. As a result, when the liquid sample is injected, the direction of scatter of the liquid from the syringe needle tip is uniform, leading to improved repeatability of area values.

Amount of Wool

The amount of wool filling differs depending on the injection unit and the injection method, but is generally between 2 mg and 20 mg.
The liquid sample is vaporized by the heat provided not only by the carrier gas but also by the filled wool. In particular, if the inside of the glass liner is not filled with wool, the liquid sample will not vaporize sufficiently, and repeatability will drop. The amount of heat provided by the wool changes depending on the amount of wool filler, so adjust the amount of wool filler if you are concerned about repeatability during liquid sample analysis.
In split analysis, the amount of wool must be increased to improve the sample vaporization efficiency.
The greater the amount of wool, the more efficient the sample vaporization, but this can also cause adsorption and degradation depending on the compound.
In splitless analysis, in which the sample retention time within the glass liner is long, if the amount of wool filler is large, excessive heat might be applied to the sample, which can cause sample adsorption or degradation. When increasing the amount of wool filler, be careful of adsorption and degradation of compounds in the sample. **With splitless analysis and direct analysis in pursuit of sensitivity, when analyzing target compounds that are comparatively prone to adsorption and degradation, it is recommended that you reduce the amount of wool filling for the analysis.**

Recommended Filling Position and Amount of Filler for Each Model

If purchasing a glass liner with no wool, and then filling the wool yourself, pay attention while filling to the amount and position of the wool. For details on the recommended wool amount and position, refer to the instruction manual and maintenance help for the applicable instrument.

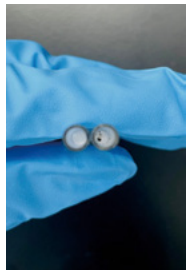
GC Model	Sample Injection Unit	Injection Method	Recommended Amount of Wool	Recommended Wool Position
GC-2060	SPL	Split	10 mg	22 mm from the top surface
		Splitless	4 mg	67 mm from the top surface (Filled to the tapered bottom)
	MMI	All Xtra Inert liners are pre-packed with wool.		
GC-2030 GC-2050	SPL	Split	10 mg	22 mm from the top surface
		Splitless/Full volume injection	4 mg	67 mm from the top surface (Filled to the tapered bottom)
	PTV	Cold split/Cold splitless	1 to 2 mg	22 mm from the top surface
GC-2014	SPL	Split	10 mg	20 mm from the top surface
		Splitless/Full volume injection	2 mg	67 mm from the top surface (Filled to the tapered bottom)
GC-2025 (SPL) GC-2010 series (SPL)	SPL	Split	10 mg	25 mm from the top surface
		Splitless/Full volume injection	2 mg	67 mm from the top surface (Filled to the tapered bottom)
GC-2010 series	PTV	Cold split/ Cold splitless	1 to 2 mg	25 mm from the top surface

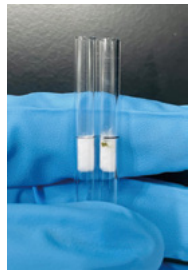
Note: The optimal wool position and amount of wool may differ depending on the sample, the measured components, and the injection volume. The above-mentioned are generally recommended values.
In split analysis, it is advisable to pack the upper surface of the wool as flat as possible, as this improves reproducibility. When injecting samples, having the upper surface of the wool as flat as possible is beneficial because it ensures stable sample vaporization, especially when the wool is in close proximity to the syringe tip.

Other Roles of the Wool

Trapping Nonvolatile Components

During analysis, as the number of injections increases, so too does the possibility that various nonvolatile components will be injected and accumulate within the sample Injection Unit.
· Nonvolatile components from the sample
· Contaminants and specks of silicon from the septum
· Metal powder from the syringe
When a large amount of nonvolatile components accumulate, this may have an impact on the analysis results.
Trapping as many of these nonvolatile components as possible with the wool, and reducing column contamination from nonvolatile components, leads to more reliable analysis results. Additionally, trapping nonvolatile components with the wool helps reduce the frequency of replacing columns and the frequency of maintenance for the GC system as a whole.





Mixing

Filling the glass liner with wool promotes mixing of the sample after vaporization with the carrier gas, reducing discrimination* during sample vaporization.

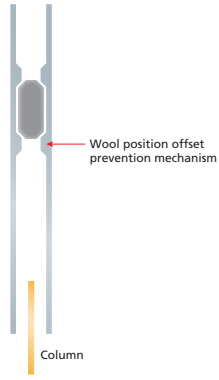
* Note: Discrimination refers to a compositional change that occurs when using a chromatograph to analyze mixed samples containing components with a range of boiling points from low to high.

Selecting the Shape of the Glass Liner

This section describes the role of the various shapes of glass liners, as well as points to consider when selecting the shape.

Wool Position Offset Prevention Mechanism

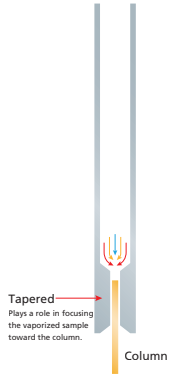
When there is a sudden pressure change in sample injection unit, such as during septum replacement, the wool position is sometimes offset, worsening the repeatability of the analysis results. Some glass liners are shaped with a protrusion to prevent wool position offset. Using a glass liner with a wool position offset prevention mechanism should provide analysis results with more stable repeatability.



Tapered Structure

A tapered part is one in which the inner diameter of the glass liner quickly narrows from the top down, from a position at the bottom of the glass liner (in proximity to the column inlet).

A tapered structure plays a role in focusing the injection of the vaporized sample toward the column. This structure is often used in glass liners for splitless and direct analysis. In these analyses, in which the total flowrate of the carrier gas is small, the delivery rate of the vaporized sample within the glass liner is slowed. For this reason, using a tapered structure helps the vaporized sample to collect at the column inlet more efficiently.



Selecting the Inner Diameter of the Glass Liner

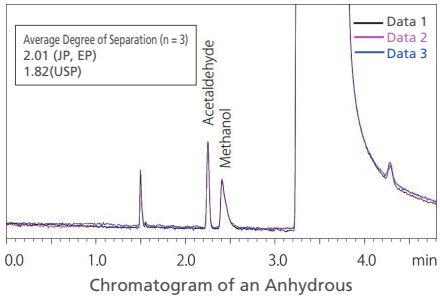
This section describes how to select the inner diameter of the glass liner in accordance with the analysis conditions.

Inner Diameter

The inner diameter of the glass liner has an impact on the sample delivery rate and the capacity of the glass liner. This section focuses on describing the impact on the sample delivery rate. (Capacity is described in the next section.)

In almost all liquid sample analysis, a thicker inner diameter of glass liner is appropriate. When the carrier gas passes through the glass liner, if the glass liner has a narrow inner diameter, the linear velocity will increase. Liquid samples take some time to vaporize, and the volume expands considerably, so the use of glass liners with extremely narrow inner diameters should be avoided.

However, when analyzing some samples containing low boiling point components, the peak bandwidth tends to spread, so a fast delivery rate is required. For this sort of analysis, a glass liner with a comparatively narrow inner diameter is suitable.



Chromatogram of an Anhydrous Ethanol Standard Solution

Application

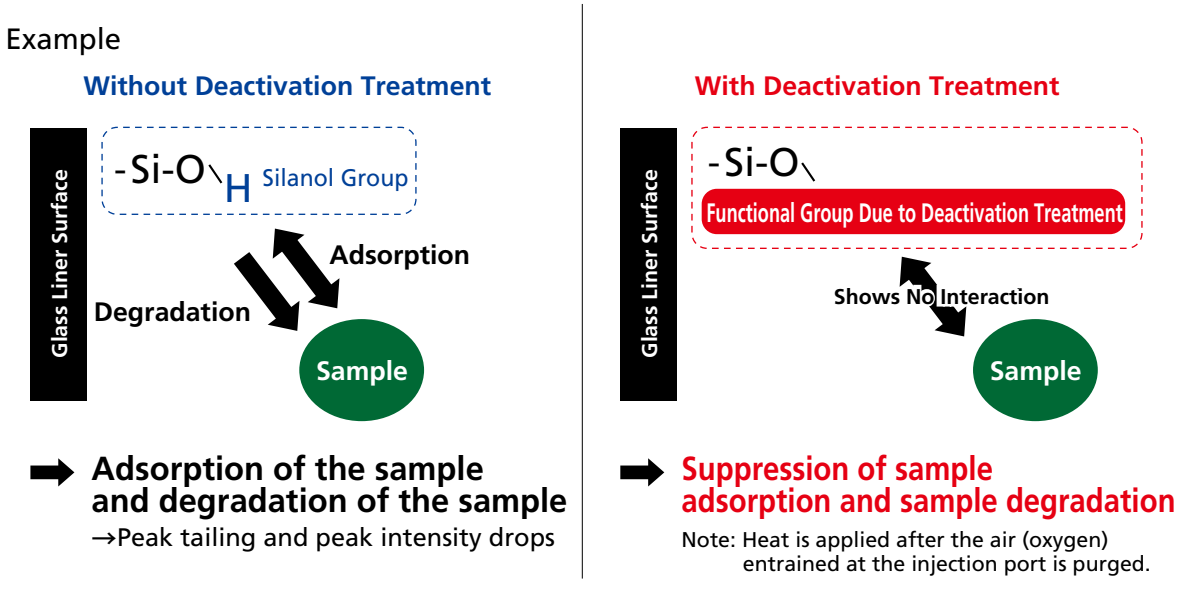
Capacity

The internal capacity of a glass liner is calculated as (Inner diameter of the glass liner/2)^2 x π x Length of the glass liner. The capacity of a GC glass liner is generally about 100 to 900 µL. Select a suitable glass liner in accordance with the vaporization volume of the sample for analysis. The following table shows the vaporization volume (at 250 °C and 140 kPa) of typical sample solvents utilized in analysis.

Solvent Type	1 µL Injection Volume	2 µL Injection Volume
Isooctane	110	220
n-Hexane	140	280
Toluene	170	340
Ethyl Acetate	185	370
Acetone	245	490
Dichloromethane	285	570
Carbon Disulfide	300	600
Acetonitrile	350	700
Methanol	450	900
Water	1010	2020

Surface Treatment of Glass Liners

Samples make direct contact with the inner walls of glass liners, so if a sample contains compounds prone to degradation, problems such as peak tailing and drops in peak intensity sometimes occur. In this case, the use of a glass liner and wool treated to deactivate the surface is recommended. Note that deactivated glass liners are rated for use up to approximately 350 °C. The non-deactivated glass liners are rated for use up to approximately 450 °C.



Chapter
2

Glass Liner Selection

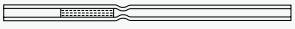
2-1. Glass Liners by GC Model/Sample Injection Unit

This section introduces frequently used, general-purpose glass liners for each GC model, sample injection unit, and injection method. If you are having difficulty making a selection, it is recommended that you start by selecting from the following lineup. The full glass liner list is provided in Chapter 4, so use that in combination with this section.

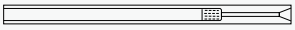
GC-2060

GC-2060

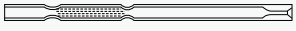
SPL (Split)

ID	Figure	P/N	Quantity	Wool Filling	Length (mm)	Outer Diameter (mm)	Inner Diameter (mm)	Capacity (µL)	Surface Treatment	Maximum Temperature	
1		227-35007-01	5	✓	95	4.9	3.4	863	Deactivation treatment	350°C	Standard accessory

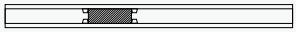
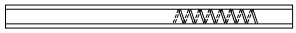
SPL (Splitless)

ID	Figure	P/N	Quantity	Wool Filling	Length (mm)	Outer Diameter (mm)	Inner Diameter (mm)	Capacity (µL)	Surface Treatment	Maximum Temperature	
19		227-35008-01	5	✓	95	5	3.4	654	Deactivation treatment	350°C	Standard accessory

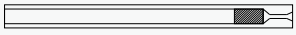
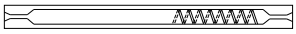
SPL (Split/Splitless)

ID	Figure	P/N	Quantity	Wool Filling	Length (mm)	Outer Diameter (mm)	Inner Diameter (mm)	Capacity (µL)	Surface Treatment	Maximum Temperature
8		227-35016-01	5	✓	95	5	3.5	847	Deactivation treatment	350°C

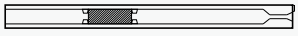
MMI (Split)

ID	Figure	P/N	Quantity	Wool Filling	Length (mm)	Outer Diameter (mm)	Inner Diameter (mm)	Capacity (µL)	Surface Treatment	Maximum Temperature*
44		227-36700-01	5	✓	78.5	6.3	4.0	986	Xtra Inert Deactivation treatment	350°C
50		227-36707-01	5	---	78.5	6.3	4.0	672	Xtra Inert Deactivation treatment	350°C

MMI (Splitless)

ID	Figure	P/N	Quantity	Wool Filling	Length (mm)	Outer Diameter (mm)	Inner Diameter (mm)	Capacity (µL)	Surface Treatment	Maximum Temperature*
45		227-36701-01	5	✓	78.5	6.5	4.0	924	Xtra Inert Deactivation treatment	350°C
46		227-36702-01	5	---	78.5	6.5	4.0	496	Xtra Inert Deactivation treatment	350°C

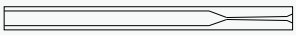
MMI (Large-volume injection, Split/Splitless)

ID	Figure	P/N	Quantity	Wool Filling	Length (mm)	Outer Diameter (mm)	Inner Diameter (mm)	Capacity (µL)	Surface Treatment	Maximum Temperature*
48		227-36704-01	5	✓	78.5	6.3	4.0	924	Xtra Inert Deactivation treatment	350°C

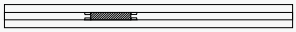
MMI (Split/Splitless)

ID	Figure	P/N	Quantity	Wool Filling	Length (mm)	Outer Diameter (mm)	Inner Diameter (mm)	Capacity (µL)	Surface Treatment	Maximum Temperature*
54		227-36711-01	5	✓	78.5	6.3	4.0	924	Xtra Inert Deactivation treatment	350°C

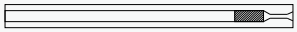
MMI (Direct)

ID	Figure	P/N	Quantity	Wool Filling	Length (mm)	Outer Diameter (mm)	Inner Diameter (mm)	Capacity (µL)	Surface Treatment	Maximum Temperature*
47		227-36703-01	5	---	78.5	6.3	4.0	697	Xtra Inert Deactivation treatment	350°C

MMI (Split, Low Inner Volume)

ID	Figure	P/N	Quantity	Wool Filling	Length (mm)	Outer Diameter (mm)	Inner Diameter (mm)	Capacity (µL)	Surface Treatment	Maximum Temperature*
53		227-36710-01	5	✓	78.5	6.3	2.0	247	Xtra Inert Deactivation treatment	350°C

MMI (Splitless, Middle Inner Volume)

ID	Figure	P/N	Quantity	Wool Filling	Length (mm)	Outer Diameter (mm)	Inner Diameter (mm)	Capacity (µL)	Surface Treatment	Maximum Temperature*
52		227-36709-01	5	✓	78.5	6.5	3.0	520	Xtra Inert Deactivation treatment	350°C

MMI (Gas analysis)

ID	Figure	P/N	Quantity	Wool Filling	Length (mm)	Outer Diameter (mm)	Inner Diameter (mm)	Capacity (µL)	Surface Treatment	Maximum Temperature*
51		227-36708-01	5	---	78.5	6.3	1.0	62	Xtra Inert Deactivation treatment	350°C

Note: The liners for MMI inlet in the Xtra Inert series are rated for use up to 350 °C to maintain the performance of the deactivation treatment. For applications where deactivation is not critical, they can be used at temperatures up to 450 °C.

WBI (Full Volume Injection)

ID	Figure	P/N	Quantity	Wool Filling	Length (mm)	Outer Diameter (mm)	Inner Diameter (mm)	Capacity (µL)	Surface Treatment	Maximum Temperature	
19		227-35008-01	5	✓	95	5	3.4	654	Deactivation treatment	350°C	Standard accessory

SINJ+WBC Attachment (WBC Full Volume Injection)

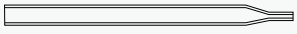
ID	Figure	P/N	Quantity	Wool Filling	Length (mm)	Outer Diameter (mm)	Inner Diameter (mm)	Capacity (µL)	Surface Treatment	Maximum Temperature
34		221-38107-02	1	---	126	4.8	3.4	870	None	450°C

OCI-2030 NX Liner (Metal)

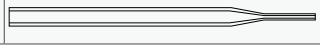
ID	Figure	P/N	Quantity	Wool Filling	Length (mm)	Outer Diameter (mm)	Inner Diameter (mm)	Capacity (µL)	Surface Treatment	Maximum Temperature
28		221-85694	1	---	11.5	-	-	-	None	450°C

Note: This can only be used with the OCI-2030 NX. This cannot be used with OCI-2030.

SINJ (Liner for UG-type columns)

ID	Figure	P/N	Quantity	Wool Filling	Length (mm)	Outer Diameter (mm)	Inner Diameter (mm)	Capacity (µL)	Surface Treatment	Maximum Temperature
43		222-30935	1	---	71	5	3.4	549	None	

SINJ (Liner for UG-type columns)

ID	Figure	P/N	Quantity	Wool Filling	Length (mm)	Outer Diameter (mm)	Inner Diameter (mm)	Capacity (µL)	Surface Treatment	Maximum Temperature
32		221-80902-84	1	---	93	5	3.4	726	None	

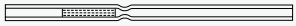
Nexis GC-2030

GCMS-QP2020 NX
GCMS-TQ8040 NX
GCMS-TQ8050 NX

Brevis GC-2050

GC-2030 GC-2050

SPL (Split)

ID	Figure	P/N	Quantity	Wool Filling	Length (mm)	Outer Diameter (mm)	Inner Diameter (mm)	Capacity (µL)	Surface Treatment	Maximum Temperature	
1		227-35007-01	5	✓	95	4.9	3.4	863	Deactivation treatment	350°C	Standard accessory

SPL (Splitless)

ID	Figure	P/N	Quantity	Wool Filling	Length (mm)	Outer Diameter (mm)	Inner Diameter (mm)	Capacity (µL)	Surface Treatment	Maximum Temperature	
19		227-35008-01	5	✓	95	5	3.4	654	Deactivation treatment	350°C	Standard accessory

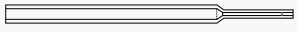
SPL (Split/Splitless)

ID	Figure	P/N	Quantity	Wool Filling	Length (mm)	Outer Diameter (mm)	Inner Diameter (mm)	Capacity (µL)	Surface Treatment	Maximum Temperature
8		227-35016-01	5	✓	95	5	3.5	847	Deactivation treatment	350°C

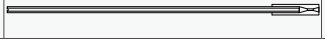
WBI (Full Volume Injection)

ID	Figure	P/N	Quantity	Wool Filling	Length (mm)	Outer Diameter (mm)	Inner Diameter (mm)	Capacity (µL)	Surface Treatment	Maximum Temperature	
19		227-35008-01	5	✓	95	5	3.4	654	Deactivation treatment	350°C	Standard accessory

SINJ+WBC Attachment (WBC Full Volume Injection)

ID	Figure	P/N	Quantity	Wool Filling	Length (mm)	Outer Diameter (mm)	Inner Diameter (mm)	Capacity (µL)	Surface Treatment	Maximum Temperature
34		221-38107-02	1	---	126	4.8	3.4	870	None	450°C

OCI-2030 Liner (Metal)

ID	Figure	P/N	Quantity	Wool Filling	Length (mm)	Outer Diameter (mm)	Inner Diameter (mm)	Capacity (µL)	Surface Treatment	Maximum Temperature
25		221-49298-91	1	---	103	2	1	81	None	450°C

Note: Cannot be used with the OCI-2030 NX.

Simple OCI Liner

ID	Figure	P/N	Quantity	Wool Filling	Length (mm)	Outer Diameter (mm)	Inner Diameter (mm)	Capacity (µL)	Surface Treatment	Maximum Temperature
27		221-49381-02	1	---	95	3.5	0.8	48	Deactivation treatment (Silanizing treatment)	350°C

Note: Cannot be used with the OCI-2030 NX.

OCI-2030 NX Liner (Metal)

ID	Figure	P/N	Quantity	Wool Filling	Length (mm)	Outer Diameter (mm)	Inner Diameter (mm)	Capacity (µL)	Surface Treatment	Maximum Temperature
28		221-85694	1	---	11.5	-	-	-	None	450°C

Note: This can only be used with the OCI-2030 NX. This cannot be used with OCI-2030.

PTV (Cold Split/Cold Splitless)

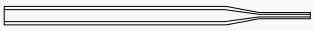
ID	Figure	P/N	Quantity	Wool Filling	Length (mm)	Outer Diameter (mm)	Inner Diameter (mm)	Capacity (µL)	Surface Treatment	Maximum Temperature
30		221-49300	1	---	95	3.5	1.5	168	None	450°C

Standard accessory

SINJ (Liner for UG-type columns)

ID	Figure	P/N	Quantity	Wool Filling	Length (mm)	Outer Diameter (mm)	Inner Diameter (mm)	Capacity (µL)	Surface Treatment	Maximum Temperature
43		222-30935	1	---	71	5	3.4	549	None	

SINJ (Liner for UG-type columns)

ID	Figure	P/N	Quantity	Wool Filling	Length (mm)	Outer Diameter (mm)	Inner Diameter (mm)	Capacity (µL)	Surface Treatment	Maximum Temperature
32		221-80902-84	1	---	93	5	3.4	726	None	

GC-2010 series

GCMS-QP2010 SE
GCMS-QP2020
GCMS-TQ8050/8040/8030

GC-2010

SPL (Split)

ID	Figure	P/N	Quantity	Wool Filling	Length (mm)	Outer Diameter (mm)	Inner Diameter (mm)	Capacity (µL)	Surface Treatment	Maximum Temperature	
1		227-35007-01	5	✓	95	4.9	3.4	863	Deactivation treatment	400°C	
2		221-41444-01	1	---	95	4.9	3.4	863	None	450°C	Standard accessory
21		225-20803-01	5	✓	95	5	3.5	914	Deactivation treatment	350°C	

· 227-35007-01 can be used with the GC-2010 series. The wool filling position differs from the recommended position for the 2010 series. If it is used in the default position, the form is such that as with the GC-2030, the tip of the syringe needle will enter the wool.
· 221-41444-01 is a standard accessory for the GC-2010 unit.
· 225-20803-01 has a history of being recommended for GCMS with the GC-2010 series.

SPL (Splitless)/WBI (Full Volume Injection)

ID	Figure	P/N	Quantity	Wool Filling	Length (mm)	Outer Diameter (mm)	Inner Diameter (mm)	Capacity (µL)	Surface Treatment	Maximum Temperature	
19		227-35008-01	5	✓	95	5	3.4	654	Deactivation treatment	400°C	
20		221-48335-01	1	---	95	5	3.4	654	None	450°C	Standard accessory
6		221-48876-03	5	✓	95	5	3.4	654	Deactivation treatment	350°C	

· 227-35008-01 can be used with the GC-2010 series.
· 221-48335-01 is a standard accessory for the GC-2010 unit.
· 221-48876-03 has a history of being recommended for GCMS with the GC-2010 series.

SPL (Split/Splitless)

ID	Figure	P/N	Quantity	Wool Filling	Length (mm)	Outer Diameter (mm)	Inner Diameter (mm)	Capacity (µL)	Surface Treatment	Maximum Temperature
8		227-35016-01	5	✓	95	5	3.5	847	Deactivation treatment	350°C

OCI Liner (Metal)

ID	Figure	P/N	Quantity	Wool Filling	Length (mm)	Outer Diameter (mm)	Inner Diameter (mm)	Capacity (µL)	Surface Treatment	Maximum Temperature
25		221-49298-91	1	---	103	2	1	81	None	450°C

Simple OCI Liner

ID	Figure	P/N	Quantity	Wool Filling	Length (mm)	Outer Diameter (mm)	Inner Diameter (mm)	Capacity (µL)	Surface Treatment	Maximum Temperature
27		221-49381-02	1	---	95	3.5	0.8	48	Deactivation treatment (Silanizing treatment)	350°C

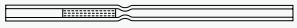
PTV (Cold Split/Cold Splitless)

ID	Figure	P/N	Quantity	Wool Filling	Length (mm)	Outer Diameter (mm)	Inner Diameter (mm)	Capacity (µL)	Surface Treatment	Maximum Temperature	
30		221-49300	1	---	95	3.5	1.5	168	None	450°C	Standard accessory

GC-2014 series

GC-2014/GC-2014s/GC-2014c

SPL (Split)

ID	Figure	P/N	Quantity	Wool Filling	Length (mm)	Outer Diameter (mm)	Inner Diameter (mm)	Capacity (µL)	Surface Treatment	Maximum Temperature	
1		227-35007-01	5	8.5	95	4.9	3.4	863	Deactivation treatment	350°C	
3		221-41444 221-41444-84	1 5	---	95	5	3.4	863	None	450°C	Standard accessory

· 227-35007-01 can be used with the GC-2014 series. The wool filling position differs from the recommended position for the 2014 series.
· 221-41444 is a standard accessory for the GC-2014 unit. It is not wool filled.

SPL (Splitless)/WBI (Full Volume Injection)

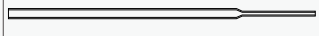
ID	Figure	P/N	Quantity	Wool Filling	Length (mm)	Outer Diameter (mm)	Inner Diameter (mm)	Capacity (µL)	Surface Treatment	Maximum Temperature	
19		227-35008-01	5	✓	95	5	3.4	654	Deactivation treatment	400°C	
20		221-48335-01	1	---	95	5	3.4	654	None	450°C	Standard accessory

· 227-35008-01 can be used with the GC-2014 series.
· 221-48335-01 is a standard accessory for the GC-2014 unit. It is not wool filled.

SINJ/DINJ+WBC Attachment (WBC Full Volume Injection)

ID	Figure	P/N	Quantity	Wool Filling	Length (mm)	Outer Diameter (mm)	Inner Diameter (mm)	Capacity (µL)	Surface Treatment	Maximum Temperature
33		221-38107	1	---	139	4.8	3.4	988	None	450°C

SINJ/DINJ (Dia. 3.2 mm Packed Column Full Volume Injection Method)

ID	Figure	P/N	Quantity	Wool Filling	Length (mm)	Outer Diameter (mm)	Inner Diameter (mm)	Capacity (µL)	Surface Treatment	Maximum Temperature	
37		221-14093 221-14093-84	1 5	---	139	4.4 (Tip 2.9)	3.5	1104	None	450°C	Standard accessory

· 221-14093 and 14093-84 are used for glass-packed or SUS-packed columns with a diameter of 3.0 to 3.4mm.

SINJ/DINJ (Dia. 2.6 mm Packed Column Full Volume Injection Method)

ID	Figure	P/N	Quantity	Wool Filling	Length (mm)	Outer Diameter (mm)	Inner Diameter (mm)	Capacity (µL)	Surface Treatment	Maximum Temperature	
38		221-14094 221-14094-84	1 5	---	139	4.4 (Tip 2.3)	3.4	825	None	450°C	Standard accessory

· 221-14094 and 14094-84 are used for glass-packed columns with a diameter of 2.4 to 2.8mm.

HS-10

With the HS-10 headspace sampler, the transfer line is connected to the GC SPL injection port. The sample is injected from the HS to the GC.
The HS-10 glass liner is used for the SPL.

HS-10

ID	Figure	P/N	Quantity	Wool Filling	Length (mm)	Outer Diameter (mm)	Inner Diameter (mm)	Capacity (µL)	Surface Treatment	Maximum Temperature
40		227-35014-01	1	---	95	5	1.2	107	Deactivation treatment	350°C

Shimadzu HS-20 series Headspace sampler has a short transfer line design that reduces carryover and enables highly sensitive analysis.
A glass liner is not required for HS-20 series because a column can be connected to them without going through a injection units such as SPL.

2-2. Glass Liner Selection by Application

SPME/SPME Arrow Analysis

AOC-6000 Plus

The solid phase micro extraction (SPME) method concentrates volatile components in SPME fibers, for sample loading into GC and GCMS systems. Analysis can be performed by the AOC-6000 Plus multi-functional autosampler system.
Refer also to C146-E424 "Smart SPME Fibers and Arrow Selection Guide". Brochure

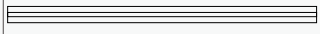
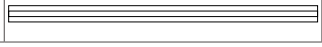
Favorably shaped peaks can be obtained by selecting the optimal GC glass liner for the Smart SPME fibers or Smart SPME Arrow. If an ordinary glass liner for liquid injection is used when using Smart SPME fibers, the bandwidth for low boiling point compounds widens, leading to wider peak shapes. For this reason, with the SPME method, use glass liners with as narrow an inner diameter as possible to obtain sharp peaks.

SPME (SPL)

ID	Figure	P/N	Quantity	Wool Filling	Length (mm)	Outer Diameter (mm)	Inner Diameter (mm)	Capacity (µL)	Surface Treatment	Maximum Temperature
18		221-75196	5	---	95	5	0.8	48	None	350°C

When using Smart SPME fibers, select a glass liner with a narrow 0.8 mm inner diameter for SPME.

SPME Arrow (SPL)

ID	Figure	P/N	Quantity	Wool Filling	Length (mm)	Outer Diameter (mm)	Inner Diameter (mm)	Capacity (µL)	Surface Treatment	Maximum Temperature
41		227-35327-03	3	---	95	5	1.3	126	None	350°C
42		227-35328-03	3	---	95	5	1.7	216	None	350°C

· When using Smart SPME Arrow with an outer diameter of 1.1 mm, use glass liners for SPME Arrow with an inner diameter of 1.3 or 1.7 mm.
· When using Smart SPME Arrow with an outer diameter of 1.5 mm, use glass liners for SPME Arrow with an inner diameter of 1.7 mm.

MMI (SPME)

ID	Figure	P/N	Quantity	Wool Filling	Length (mm)	Outer Diameter (mm)	Inner Diameter (mm)	Capacity (µL)	Surface Treatment	Maximum Temperature
49		227-36705-01	5	---	78.5	6.3	0.75	35	Xtra Inert Deactivation treatment	350°C

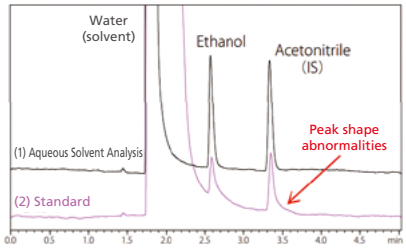
Aqueous Solvent Analysis (SPL)

GC-2030/GC-2050/GC-2010 series/GC-2014 series/GC-2025

ID	Figure	P/N	Quantity	Wool Filling	Length (mm)	Outer Diameter (mm)	Inner Diameter (mm)	Capacity (µL)	Surface Treatment	Maximum Temperature
39		227-35015-01	5	✓	95	5	3.4	863	Deactivation treatment	400°C

227-35015-01 is a glass liner for aqueous solvent analysis. The shape, wool amount, and wool filling position are optimized, enabling stable sample vaporization and good repeatability.
Application News (01-00328) introduces examples of the use of glass liners for aqueous solvent analysis.

Application



Measurement Results for a Standard Solution for Alcohol Concentration Measurements (TCD)

Chapter

3

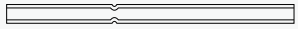
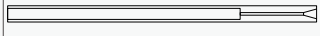
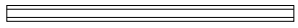
All Glass Liner List

This is a list of the glass liners provided by Shimadzu. Information on compatible GC instruments is also noted.
The same ID numbers used in the section list in Chapter 2 are used in this table.

3-1. List of Glass Liners and Compatible Instruments

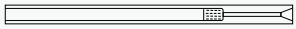
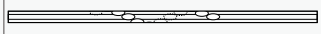
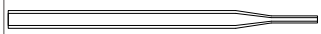
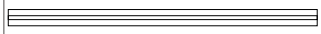
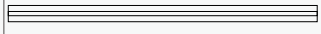
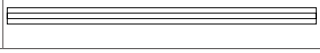
★···Standard accessory ●···Described as a recommended item in Chapter 2 ✓···Can be used

*1 Special order for glass column + pTCD
*2 Special order for glass column + packed detector other than a TCD
*3 It can be used by remodeling the GC unit SPL to WBI with WBI Modification Kit 221-74660-41.
*4 Connections to systems other than the GC-2010, GC-2014, or GC-2030 series are handled by special order.

ID	Figure	P/N	Quantity	Wool Filling	Category	GC-2026	GC-2030	GC-2050	GC-2010 series	GC-2014 series
1		227-35007-01	5	✓	SPL (Split)	★●	★●	★●	●	●
2		221-41444-01	1		SPL (Split)	✓	✓	✓	★●	✓
3		221-41444 221-41444-84	1 5		SPL (Split)	✓	✓	✓	✓	★
4		221-75193	5	✓	SPL (Split)	✓	✓	✓	✓	✓
5		221-48876-02	5		SPL (Splitless)	✓	✓	✓	✓	✓
6		221-48876-03	5	✓	SPL (Splitless)	✓	✓	✓	★●	✓
7		221-48876-05	5		SPL (Splitless)	✓	✓	✓	✓	✓
8		227-35016-01	5	✓	SPL (Split / Splitless)	★●	★●	★●	●	●
9		221-41544 221-41544-84	1 5		SPL (Split / Splitless)	✓	✓	✓	✓	✓
10		221-41544-05	5		SPL (Split / Splitless)	✓	✓	✓	✓	✓
11		221-75187	5	✓	SPL (Split / Splitless)	✓	✓	✓	✓	✓
12		221-75188	5	✓	SPL (Split / Splitless)	✓	✓	✓	✓	✓
13		221-75189	5	✓	SPL (Split / Splitless)	✓	✓	✓	✓	✓
14		221-75190	5		SPL (Split / Splitless)	✓	✓	✓	✓	✓
15		221-75192	5		SPL (Split / Splitless)	✓	✓	✓	✓	✓
16		221-75194	5		SPL (Split / Splitless)	✓	✓	✓	✓	✓

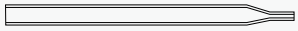
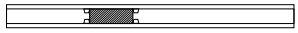
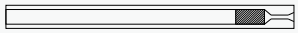
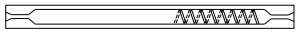
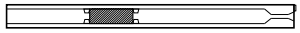
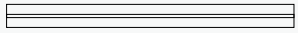
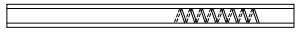
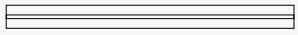
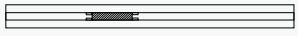
★···Standard accessory ●···Described as a recommended item in Chapter 2 ✓···Can be used

*1 Special order for glass column + pTCD
*2 Special order for glass column + packed detector other than a TCD
*3 It can be used by remodeling the GC unit SPL to WBI with 221-74660-41 WBI Modification Kit.
*4 Connections to systems other than the GC-2010, GC-2014, or GC-2030 series are handled by special order.

ID	Figure	P/N	Quantity	Wool Filling	Category	GC-2026	GC-2030	GC-2050	GC-2010 series	GC-2014 series
17		221-75195	5	✓	SPL (Split / Splitless)	✓	✓	✓	✓	✓
18		221-75196	5		SPME	✓	✓	✓	✓	✓
19		227-35008-01	5	✓	SPL/WBI (Splitless, Full Volume Injection)	★●	★●	★●	✓	✓
20		221-48335-01	1		SPL/WBI (Splitless, Full Volume Injection)	✓	✓	✓	★●	★●
21		225-20803-01	5	✓	SPL/WBI (Splitless, Full Volume Injection)	✓	✓	✓	★●	✓
22		221-75197	5	✓	SPL/WBI (Splitless, Full Volume Injection)	✓	✓	✓	✓	✓
23		221-41599 221-41599-84	1 5		WBI (Full Volume Injection)	✓	✓	✓	✓	✓
24		221-41599-05	5		WBI (Full Volume Injection)	✓	✓	✓	✓	✓
25		221-49298-91	1		OCI	★●	★●		★●	
26		221-49381-01	1		Simple OCI	✓	✓		✓	
27		221-49381-02	1		Simple OCI	●	●		●	
28		221-85694	1		OCI	★●	★●			
29		225-08184	1		PTV/OCI	✓	✓	✓	★	
30		221-49300	1		PTV	★●	★●	★●	★●	
31		221-74830-09	5	✓	PTV	✓	✓	✓	✓	
32		221-80902	1		SINJ (Packed Column Full Volume Injection)	●	●	●		
33		221-38107	1		SINJ/DINJ (WBC Full Volume Injection)					★●
34		221-38107-02	1		SINJ/DINJ (WBC Full Volume Injection)	★●	★●	★●		
35		221-48993	1		SPL/WBI (Packed Column Full Volume Injection Method)				✓*1	
36		221-48886	1		SPL/WBI (Packed Column Full Volume Injection Method)				✓*2	
37		221-14093 221-14093-84	1 5		SINJ/DINJ (Packed Column Full Volume Injection Method)					●
38		221-14094 221-14094-84	1 5		SINJ/DINJ (Packed Column Full Volume Injection Method)					●
39		227-35015-01	5	✓	Aqueous Solvent Analysis	✓	✓	✓	✓	✓
40		227-35014-01	1		HS-10	●	●	●	●	●
41		227-35327-03	3		AOC-6000 Plus SPME arrow	●	●	●	●	
42		227-35328-03	3		AOC-6000 Plus SPME arrow	●	●	●	●	

★···Standard accessory ●···Described as a recommended item in Chapter 2 ✓···Can be used

*1 Special order for glass column + pTCD
*2 Special order for glass column + packed detector other than a TCD
*3 It can be used by remodeling the GC unit SPL to WBI with 221-74660-41 WBI Modification Kit.
*4 Connections to systems other than the GC-2010, GC-2014, or GC-2030 series are handled by special order.

ID	Figure	P/N	Quantity	Wool Filling	Category	GC-2026	GC-2030	GC-2050	GC-2010 series	GC-2014 series
43		222-30935	1		SINJ (liner for UG-type columns)	★●	★●	★●		
44		227-36700-01	5	✓	MMI (Split)	●				
45		227-36701-01	5	✓	MMI (Splitless)	●				
46		227-36702-01	5		MMI (Splitless with Cyclo)	●				
47		227-36703-01	5		MMI (Direct)	●				
48		227-36704-01	5	✓	MMI (Large-volume injection, Split/Splitless)	●				
49		227-36705-01	5		MMI (SPME)	●				
50		227-36707-01	5		MMI (Split with Cyclo)	●				
51		227-36708-01	5		MMI (Gas analysis)	●				
52		227-36709-01	5	✓	MMI (Splitless, Middle Inner Volume)	●				
53		227-36710-01	5	✓	MMI (Split, Low Inner Volume)	●				
54		227-36711-01	5	✓	MMI (Split/Splitless)	●				

Standard Accessories for the GC-17A ver. 1-3, the GC-1700, and the GC-18A

ID	P/N	Category
3	221-41444 221-41444-84 (5 pc)	SPL (Split)
9	221-41544 221-41544-84 (5 pc)	SPL (Splitless)
23	221-41599 221-41599-84 (5 pc)	WBI (Full Volume Injection)
100	221-41484	Packed Column Full Volume Injection

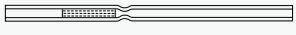
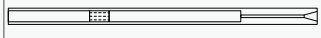
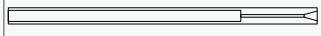
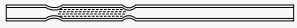
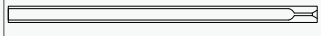
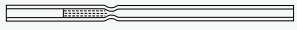
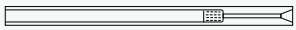
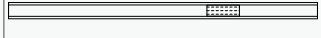
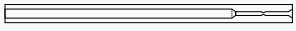
Standard Accessories for the GC-14A/B

ID	P/N	Category
101	221-32574-01	SPL (Split) without taper
102	221-32544-01	SPL (Split) with taper
103	221-32544	SPL (Splitless)
104	221-38151-04	Septum purge unit (Full Volume Injection)
33	221-38107	WBC attachment (Full Volume Injection)
105	221-32998-01	CLH (Injection unit)
106	221-33000	CLH (Detector)
37	221-14093 221-14093-84 (5 pc)	Dia. 3.2 mm packed Full Volume Injection
38	221-14094 221-14094-84 (5 pc)	Dia. 2.6 mm packed Full Volume Injection

Standard Accessories for the GC-8A

ID	P/N	Category
107	221-25822-03	SPL (Split)
108	221-25944-03	SPL (Splitless)
109	221-39148	WBC attachment (Full Volume Injection)
110	221-18384-04	CLH (Injection unit)
111	221-18756-02	CLH (Detector)

3-2. Glass Liner Information

ID	Figure	P/N	Quantity	Wool Filling	Length (mm)	Outer Diameter (mm)	Inner Diameter (mm)	Capacity (µL)	Surface Treatment	Maximum Temperature*
1		227-35007-01	5	✓	95	4.9	3.4	863	Deactivation treatment	350°C
2		221-41444-01	1		95	4.9	3.4	863	None	450°C
3		221-41444 221-41444-84	1 5		95	5	3.4	863	None	450°C
4		221-75193	5	✓	95	5	3.4	863	Deactivation treatment	350°C
5		221-48876-02	5	✓	95	5	3.4	654	Deactivation treatment	350°C
6		221-48876-03	5	✓	95	5	3.4	654	Deactivation treatment	350°C
7		221-48876-05	5		95	5	3.4	654	Deactivation treatment	350°C
8		227-35016-01	5	✓	95	5	3.5	847	Deactivation treatment	350°C
9		221-41544 221-41544-84	1 5		95	5	2.6	504	None	450°C
10		221-41544-05	5		95	5	2.6	504	Deactivation treatment	350°C
11		221-75187	5	✓	95	5	3.4	799	Deactivation treatment	350°C
12		221-75188	5	✓	94.5	5	3.4	858	Deactivation treatment	350°C
13		221-75189	5	✓	95	5	3.4	863	Deactivation treatment	350°C
14		221-75190	5		95	5	3.3	813	Deactivation treatment	350°C
15		221-75192	5		95	5	3.5	847	Deactivation treatment	350°C
16		221-75194	5		95	5	3.4	863	Deactivation treatment	350°C
17		221-75195	5	✓	95	5	3.4	863	Deactivation treatment	350°C
18		221-75196	5		95	5	0.8	48	Deactivation treatment	350°C
19		227-35008-01	5	✓	95	5	3.4	654	Deactivation treatment	350°C
20		221-48335-01	1		95	5	3.4	654	None	450°C
21		225-20803-01	5	✓	95	5	3.5	914	Deactivation treatment	350°C
22		221-75197	5	✓	95	5	3.3	599	Deactivation treatment	350°C
23		221-41599 221-41599-84	1 5		95	5	2.6	504	None	450°C

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