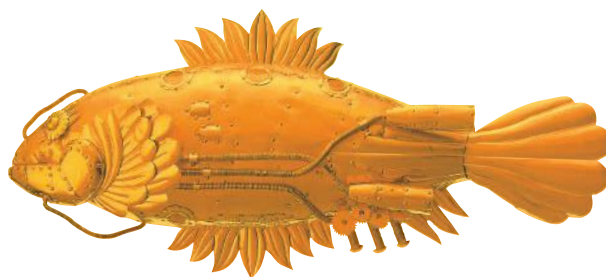


# Shodex™



## HPLC Columns

MANUAL

GPC 2000  
series

**SHOWA**  
**DENKO**  
EUROPE

Columns manufactured by Showa Denko K.K Japan  
Made in Japan

**Shodex HPLC Columns**  
Europe, Middle East, Africa, Russia

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# Operation Manual

## Shodex™ GPC 2000 series

### (K-2000, KF-2000, H-2000, HF-2000)

(Please read this manual carefully before using the column to ensure performance and life.)

#### 1. Introduction

The packed columns of Shodex GPC K-2000, KF-2000, H-2000 and HF-2000 series are high-performance preparative columns for HPLC. Having polystyrene gels as the packing material and an organic solvent as the eluent, they separate organics, oligomers and macromolecular substances for the purpose of identification.

Careful observation of the instruction in this operation manual will enable the packed columns to function as designed over the longest possible period of time.

#### 2. Specifications

Nomenclature	Exclusion limit	Theoretical plates/30cm	Solvent packed
Shodex GPC K-2001	$1.5 \times 10^3$	17,000 minimum	Chloroform
Shodex GPC K-2002	$5 \times 10^3$	17,000 minimum	Chloroform
Shodex GPC K-2002.5	$2 \times 10^4$	17,000 minimum	Chloroform
Shodex GPC K-2003	$7 \times 10^4$	17,000 minimum	Chloroform
Shodex GPC K-2004	$4 \times 10^5$	14,000 minimum	Chloroform
Shodex GPC K-2005	$4 \times 10^6$	10,000 minimum	Chloroform
Shodex GPC K-2006	$(2 \times 10^7)$	10,000 minimum	Chloroform
Shodex GPC K-2006M	$(2 \times 10^7)$	10,000 minimum	Chloroform
Shodex GPC K-LG	Guard column	Guard column	Chloroform
Shodex GPC KF-2001	$1 \times 10^3$	17,000 minimum	THF
Shodex GPC KF-2002	$5 \times 10^3$	17,000 minimum	THF
Shodex GPC KF-2002.5	$2 \times 10^4$	17,000 minimum	THF
Shodex GPC KF-2003	$7 \times 10^4$	17,000 minimum	THF
Shodex GPC KF-2004	$4 \times 10^6$	14,000 minimum	THF
Shodex GPC KF-2005	$4 \times 10^6$	10,000 minimum	THF
Shodex GPC KF-2006	$(2 \times 10^7)$	10,000 minimum	THF
Shodex GPC KF-2006M	$(2 \times 10^7)$	10,000 minimum	THF
Shodex GPC KF-LG	Guard column	Guard column	THF

Nomenclature	Exclusion limit	Theoretical plates/50 cm	Solvent packed
Shodex GPC H-2001	$1 \times 10^3$	12,000 minimum	Chloroform
Shodex GPC H-2002	$5 \times 10^3$	12,000 minimum	Chloroform
Shodex GPC H-2002.5	$2 \times 10^4$	12,000 minimum	Chloroform
Shodex GPC H-2003	$7 \times 10^4$	12,000 minimum	Chloroform
Shodex GPC H-2004	$5 \times 10^5$	12,000 minimum	Chloroform
Shodex GPC H-2005	$5 \times 10^6$	12,000 minimum	Chloroform
Shodex GPC H-2006	$(5 \times 10^7)$	12,000 minimum	Chloroform
Shodex GPC H-2006M	$(5 \times 10^7)$	10,000 minimum	Chloroform
Shodex GPC H-G	Guard column	Guard column	Chloroform
Shodex GPC HF-2001	$1 \times 10^3$	12,000 minimum	THF
Shodex GPC HF-2002	$5 \times 10^3$	12,000 minimum	THF
Shodex GPC HF-2002.5	$2 \times 10^4$	12,000 minimum	THF
Shodex GPC HF-2003	$7 \times 10^4$	12,000 minimum	THF
Shodex GPC HF-2004	$5 \times 10^5$	12,000 minimum	THF
Shodex GPC HF-2005	$5 \times 10^6$	12,000 minimum	THF
Shodex GPC HF-2006	$(5 \times 10^7)$	12,000 minimum	THF
Shodex GPC HF-2006M	$(5 \times 10^7)$	10,000 minimum	THF
Shodex GPC HF-G	Guard column	Guard column	THF

Note: Exclusion limits are the molecular weight of polystyrene.

Size: 20mm I.D. x 500mm length (H, HF- main column).

20mm I.D. x 300mm length (K, KF- main column).

8mm I.D. x 50mm length (guard column).

Endfitting: Internally-threaded type, No. 10-32 UNF.

Column material: SUS 316.

Packing material: Styrene-divinylbenzene gels

Working temperature: Room temperature.

### Caution!

1) Do not use any solvent that shrink styrene-divinylbenzene gels, as the eluent, e.g., such as water, alcohol and hexane.

2) Do not set the flow rate above 4.5 ml/min. 2.0 MPa max/column room temp to 60°C.

3) Do not abruptly change the column pressure or the flow rate while the liquid chromatograph is in operation.

Use a damper-equipped or pulseless pump to maintain the performance of the column at the designed level for a long period of time.

4) Do not impact or bend the column.

5) Do not remove the endfittings of the column under any circumstances; otherwise, its performance will deteriorate.

6) Install guard column immediately upstream of the main column to protect it from contamination by the sample.

The guard column is intended to maintain the column performance as designed for a long period of time and not to improve its resolving power.

### **3. Installation and start-up**

1) Prior to connection of the column to the liquid chromatograph, replace the solvent in the chromatograph with the solvent that is to be used as the eluent.

In replacing water with, for instance, chloroform, which is not soluble in water, first replace the water with acetone and then replace the acetone with chloroform.

If the liquid chromatograph is equipped with a device in which complete replacement of the solvent is not possible, e. g., a Bourdon pressure gauge, disassemble the device and wash it with the solvent that is to be used as the eluent.

2) Thoroughly degas the solvent that is to be used as the eluent, by subjecting it to ultrasonic vibration and simultaneous heating or pressure reduction with an aspirator.

Use of solvent degassing devices of Shodex DEGAS KT series will facilitate the degassing work.

Do not use THF that has been exposed to air for a long period of time or any solvent that has high water content, as the eluent.

3) After replacing the solvent in the chromatograph, set the flow rate at 3.5 ml/min.

4) Connect the column to the chromatograph as that the arrow mark on the column will face downstream.

5) Upon completion of the connection, start the pump, watching for any sudden change in the column pressure or the flow rate.

#### **4. Pre-treatment of sample**

1) Dissolve the sample in the same solvent that is to be used as the eluent.

To make the blank peaks as small as possible when a detector such as a differential refractometer is used, it is recommended that the sample be dissolved in the eluent obtained from the reservoir.

2) In case of the sample is an organic, the maximum extent of its concentration in the solution and the maximum amount in which it is injected should be 10% and 3 ml respectively; if it is a macromolecular substance, the maximum should be normally be 1% and 6ml respectively.

Owing to their marked viscosity, macromolecular substances develop a viscous fingering effect when the concentration is higher.

It is, therefore, necessary in the case of macromolecular substance to inject a larger amount having a smaller extent of concentration than in case of organics.

We recommend that, when injecting more than 6 ml of a macromolecular substance, a minimum of four packed columns be used in series. If only one column is being used, the macromolecular substance should be recycle through the column as many times as requested.

3) Remove extraneous matter or gels from the dissolved sample by passing it through a 0.45  $\mu\text{m}$  filter.

Use of the disposable filter unit Shodex DT is recommended.

4) Dewater any sample that contains a large quantity of water.

#### **5. Preheating of column**

Preheating the column will improve its separation performance. However, do not raise the column temperature any higher than 60°C.

#### **6. Replacement of eluent**

Prior to delivery to the user, each column is filled with chloroform(K-2000 and H-2000 series) or THF(KF-2000 and HF-2000 series).

Although other solvents such as dichloromethane and toluene can be used as the eluent, repeated replacement of one eluent with another may shorten the service life of the column, because the degree of swelling of the packing material varies slightly with the kind of solvent

used as the eluent. This makes it important to avoid repeated replacement as far as circumstances permit.

If unavoidable, replacement should be performed at the flow rate of 1.5 ml/min. maximum and at room temperature.

## 7. Safekeeping

- 1) Cap both end of the column to prevent the eluent from leaking out.
- 2) Package it as delivered from the manufacturer.
- 3) Store it at a place where temperature change is minimum.
- 4) When a column is not expected to be used for a long period of time detach the detector inlet line from the column and connect a Teflon tube of 1/16 inch in outside diameter, 0.8mm in inside diameter and 500mm in length to the column outlet.

Start pumping the eluent at a flow rate of 0.5 ml/ min. and stop the pump as soon as it begins to flow out from the free end of the tube.

Put 80ml of toluene into a 100ml bottle and soak the free end of the toluene to prevent air from entering the column.

Dismount the column from the chromatograph, blank the column's inlet end and store it in a room that has little temperature fluctuation.

## 7. Warranty

- 1) Showa Denko K. K. warrants that the Shodex Column, at the time of delivery to the user, will conform to the specification of the attached Certificate of Analysis, if the Shodex Column is used in accordance with the operating manual. The foregoing warranty is exclusive and is in lieu of all other warranties with respect to the Shodex Column, whether written, oral, implied, statutory or otherwise. No warranties by Showa Denko K. K. are implied or otherwise created, including, but not limited to, the warranty of merchantability and fitness for particular purposes.
- 2) Any claim of inconformity to the specification must be notified to Showa Denko K.K. within ten (10) days after delivery to the user. User's exclusive remedy and Showa Denko K.K.'s exclusive liability for such claim are limited to the replacement of the Shodex Column in question. In no event is Showa Denko K.K. liable for any indirect, incidental or consequential

damage arising out of in connection with the Shodex Instrument, whether or not such damage is allegedly based on breach of warranty, negligence or otherwise.

3) No warranty is made in any of the following cases:

(1) If the Shodex Column is not used in accordance with the operating manual.

(2) If the Shodex Column is remodeled by anyone other than person or firm designated by Showa Denko K.K.

(3) If the Shodex Column is resold by the user without giving prior written notice to Showa Denko K.K.

(4) If the performance of the Shodex Column is not conform to the specification of the attached Certificate of Analysis due to any of the reasons below:

a) Computer virus

b) Impurities contained in the sample, reagent, gas air or cooling water provided by the user

c) Breakdown or malfunction of equipment, apparatus or component used in combination with the Shodex Column

d) Force majeure such as fire, earthquake, flood, other natural disaster, rime, riot, act of terrorism, war or radioactive contamination

4) In no event is Showa Denko K.K. liable for (i) the results of analyses or preparations using the Shodex Column or any portion of the same, including, but not limited to, the reliability, accuracy, efficacy and safety of said results, and (ii) the occupational hazard in the use of the Shodex Column, whether or not such use is made in accordance with the attached Conditions for use.

5) The Shodex instrument is for laboratory use only. It must not be used for clinical diagnosis. Showa Denko K.K. is not liable for any use of the Shodex Instrument except laboratory use.