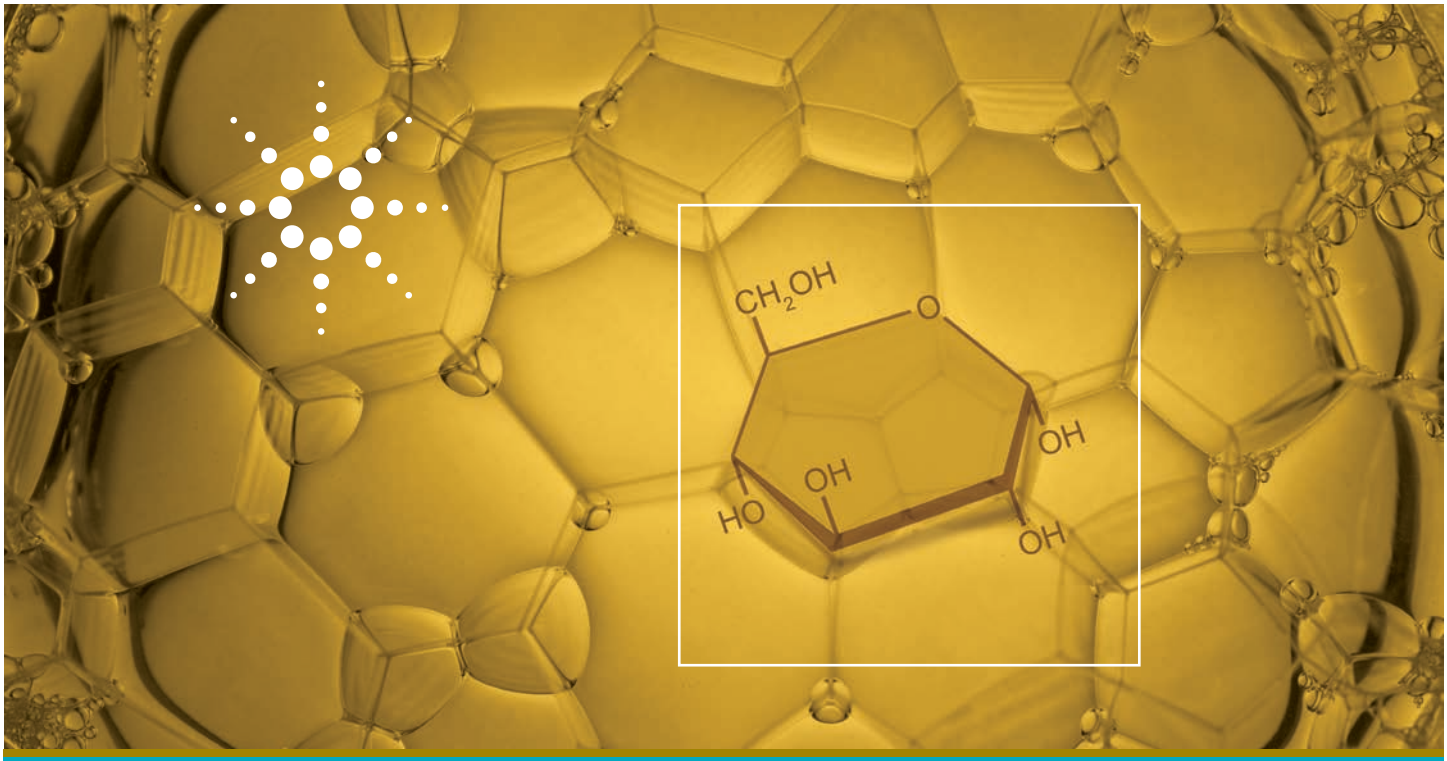


Confident, **lower-pressure analysis** of carbohydrates, alcohols, and organic acids

Agilent Hi-Plex Ligand-Exchange HPLC Columns

The Measure of Confidence

Agilent Technologies

Agilent Hi-Plex Ligand-Exchange HPLC columns

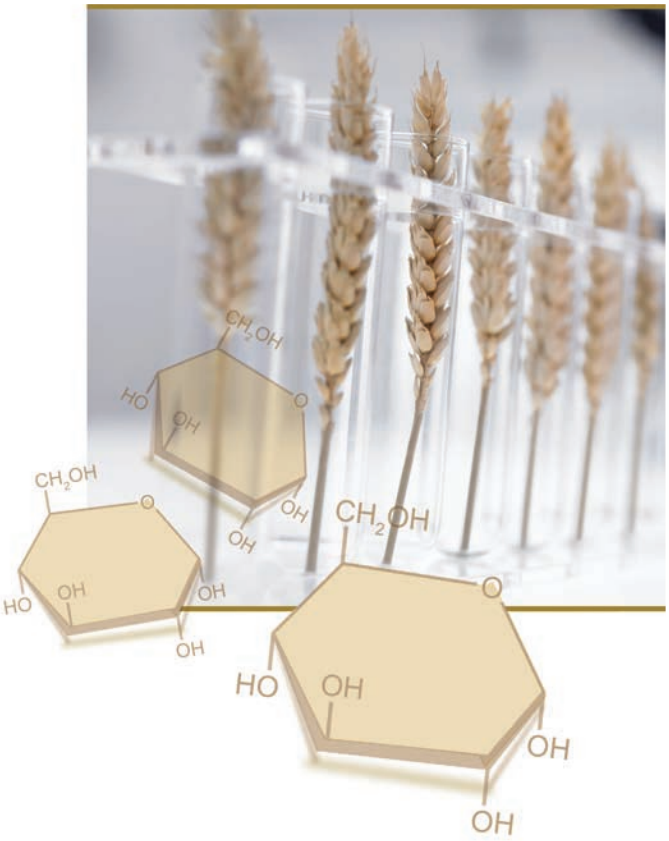
Satisfy your growing demands for the efficient analysis of carbohydrates, alcohols, and organic acids

The least complicated LC methods for detecting sugars, sugar alcohols, and organic acids call for ligand-exchange columns with a simple mobile phase. However, the wide particle size distribution of conventional resins can lead to high backpressures and reduced productivity.

Agilent Hi-Plex columns are a superior choice for accurate, low-pressure analysis of typical carbohydrates

Hi-Plex columns are engineered with monodisperse sulfonated particles, creating a high-performance media uniquely suited to stringent USP methods for analyzing carbohydrates, alcohols, and organic acids. Their advantages include:

- **Reliable lower-pressure analysis:** monodisperse particles allow you to reduce column operating pressures for repeatable performance and longer column life
- **Maximum selectivity and resolution:** a wide range of ligand counter ions and column configurations meet the requirements of challenging organic applications
- **Simplified HPLC system requirements** through isocratic separation capabilities
- **Reliable QA/QC:** excellent batch-to-batch reproducibility for ultimate confidence in your results
- **Less need for hazardous organic solvents:** Hi-Plex columns let you use water or dilute acid as an eluent
- **Choices for USP media types:** you can select from media types L17, L19, L34, and L58, along with the required column dimensions for each application



Download your copy of the Hi-Plex Application Notes compendium at

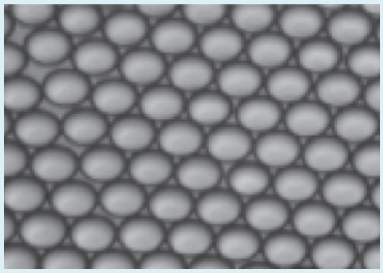
www.agilent.com/chem/Hi-Plex

Ensure reliable quantitative and qualitative analysis with leading-edge features

Control of pore size

The crosslink content of microporous resins controls the pore size and, therefore, the molecular weight range of the analysis. This, in turn, determines the resin's size exclusion properties. Two resin types are available:

- A 4% crosslinked resin for analyzing oligosaccharides
- An 8% crosslinked resin, which has a lower exclusion limit and is used for oligosaccharides with a degree of polymerization (Dp) less than 5



Optical microscope image of monodisperse particles. *The lower the crosslink content, the higher the molecular weight that can be analyzed.*

Ligand-exchange

Mono- and disaccharide resolution can be achieved by the secondary ligand-exchange mechanism – an interaction of the hydroxyl groups with the metal ion associated with the cation-exchange functionality of the sulfonic acid group. The various counter ions (such as calcium, lead, and potassium) provide selectivity differences through their ability to interact with the hydroxyl groups.

Ion-exchange

Agilent Hi-Plex columns with a hydrogen counter can be used with a water eluent for carbohydrate and alcohol analyses. They can also be used with a dilute acid eluent for the separation of organic acids, or for samples containing organic acids and carbohydrates.

Typical operating conditions

Column Type	Temperature	Flow Rate	Eluent
Hi-Plex Ca	80 - 90 °C	0.6 mL/min	Water
Hi-Plex Ca USP L19	80 - 90 °C	0.3 mL/min	Water
Hi-Plex Pb	70 - 90 °C	0.6 mL/min	Water
Hi-Plex H for carbohydrates	60 - 70 °C	0.6 mL/min	Water
Hi-Plex H for organic acids	40 - 60 °C	0.6 mL/min	Dilute acid
Hi-Plex Ca (Duo)	80 - 90 °C	0.6 mL/min	Water
Hi-Plex K	80 - 90 °C	0.6 mL/min	Water
Hi-Plex Na (Octo)	80 - 90 °C	0.6 mL/min	Water, sodium hydroxide
Hi-Plex Na	80 - 90 °C	0.3 mL/min	Water

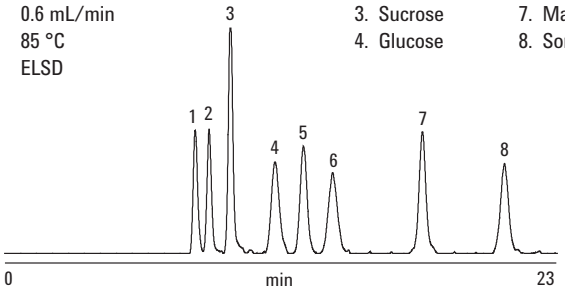
Typically, Agilent Hi-Plex columns use isocratic conditions with water as the eluent and temperature as the main variable for resolution control. The only exceptions are Hi-Plex Na (Octo) columns, used with sodium hydroxide and pulsed amperometric detection (PAD), and Hi-Plex H columns, used with dilute acid to analyze organic acids (see above). Detailed operating conditions can be found in the data sheet supplied with all columns.

For more Hi-Plex column information, visit **www.agilent.com/chem/Hi-Plex**

Rapidly identify and quantify components in food products for confident QC and authentication

Column: Agilent Hi-Plex Ca, 7.7 x 300 mm
Mobile Phase: Water
Flow Rate: 0.6 mL/min
Temperature: 85 °C
Detection: ELSD

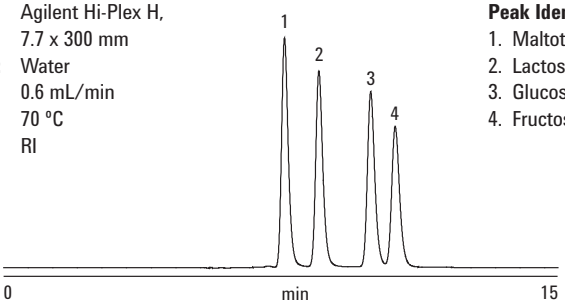
Peak Identification
1. Stachyose
2. Raffinose
3. Sucrose
4. Glucose
5. Galactose
6. Fructose
7. Mannitol
8. Sorbitol



Agilent Hi-Plex Ca columns are ideal for analyzing most sweeteners, including glucose and fructose (monosaccharides), sucrose (disaccharide), and mannitol and sorbitol (sugar alcohols).

Column: Agilent Hi-Plex H, 7.7 x 300 mm
Mobile Phase: Water
Flow Rate: 0.6 mL/min
Temperature: 70 °C
Detection: RI

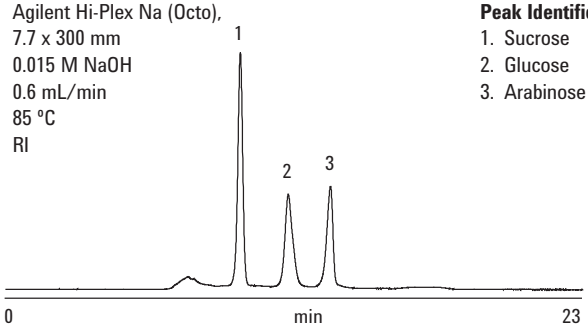
Peak Identification
1. Maltotriose
2. Lactose
3. Glucose
4. Fructose



For carbohydrate analysis of samples containing high levels of organic acids, Agilent Hi-Plex H columns deliver sharp, reproducible peaks. Note, however, that some sugars (such as raffinose) can undergo acid hydrolysis even when water is used as the eluent.

Column: Agilent Hi-Plex Na (Octo), 7.7 x 300 mm
Mobile Phase: 0.015 M NaOH
Flow Rate: 0.6 mL/min
Temperature: 85 °C
Detection: RI

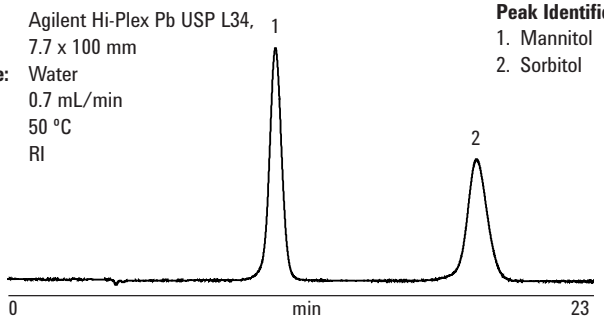
Peak Identification
1. Sucrose
2. Glucose
3. Arabinose



Food products containing high levels of sodium ions are best analyzed with Agilent Hi-Plex Na (Octo) columns. This saves time when sodium hydroxide is used as the eluent with PAD, because it eliminates the need for the post-column addition of sodium hydroxide.

Column: Agilent Hi-Plex Pb USP L34, 7.7 x 100 mm
Mobile Phase: Water
Flow Rate: 0.7 mL/min
Temperature: 50 °C
Detection: RI

Peak Identification
1. Mannitol
2. Sorbitol



USP method for sorbitol – a sugar alcohol and alternative sweetener – using mannitol as the internal standard. Agilent Hi-Plex Pb columns are recommended for alcoholic drinks that also contain glycerol, as well as sweetened dairy-based food products.

Which Agilent Hi-Plex column is right for your application?

Pharmacopeia methods specify the HPLC media and column dimensions that should be used for specific applications. The Agilent Hi-Plex column portfolio includes four materials that comply with USP definitions:

- **Media type L17** (Hi-Plex H): Strong cation-exchange resin consisting of sulfonated, crosslinked styrene-divinylbenzene copolymer in hydrogen form, 7 to 11 µm in diameter
- **Media type L19** (Hi-Plex Ca and Hi-Plex Ca [Duo]): Strong cation-exchange resin consisting of sulfonated, crosslinked styrene-divinylbenzene copolymer in calcium form, 9 µm in diameter
- **Media type L34** (Hi-Plex Pb): Strong cation-exchange resin consisting of sulfonated, crosslinked styrene-divinylbenzene copolymer in lead form, 9 µm in diameter
- **Media type L58** (Hi-Plex Na and Hi-Plex Na [Octo]): Strong cation-exchange resin consisting of sulfonated, crosslinked styrene-divinylbenzene copolymer in sodium form, 6 to 30 µm in diameter

In addition to standard column sizes, the media is also packed in specific column dimensions for different USP methods, including sugar alcohol analysis. For some applications, the choice of media will depend on the carbohydrate composition and matrix of the sample being analyzed.

Agilent Hi-Plex column selection guide

Application Areas	Recommended Column(s)
USP methods specifying L17 media	Hi-Plex H
USP methods specifying L19 media	Hi-Plex Ca, Hi-Plex Ca (Duo)
USP methods specifying L34 media	Hi-Plex Pb
USP methods specifying L58 media	Hi-Plex Na, Hi-Plex Na (Octo)
Mono- and disaccharides	Hi-Plex Ca, Hi-Plex Pb, Hi-Plex H, Hi-Plex Na (Octo)
Anomer separations	Hi-Plex Ca
Organic acids	Hi-Plex H
Alcohols	Hi-Plex Ca, Hi-Plex K, Hi-Plex H, Hi-Plex Pb
Adulteration of food and beverages	Hi-Plex Ca, Hi-Plex Pb
Food additives	Hi-Plex Ca, Hi-Plex Pb
Dairy products	Hi-Plex Ca, Hi-Plex H
Sweetened dairy products	Hi-Plex Pb
Confectionery	Hi-Plex Ca, Hi-Plex Pb
Fruit juice	Hi-Plex Ca
Wine	Hi-Plex H
Wood pulp hydrolysates (cellulose/hemicellulose)	Hi-Plex Pb
Fermentation monitoring	Hi-Plex H
Oligosaccharides	Hi-Plex Na
Samples with high salt content (molasses)	Hi-Plex Na (Octo)
Oligosaccharides < Dp 5 with monosaccharides	Hi-Plex Ca (Duo)
Corn syrups	Hi-Plex Na

For more Hi-Plex column information, visit **www.agilent.com/chem/Hi-Plex**

Take your carbohydrate analysis to the next level

Agilent 1260 Infinity LC

Infinitely more confident. The **new Agilent 1260 Infinity LC** sets higher standards in performance and value giving you more confidence in your results.

The 600 bar power range combines with 80 Hz UV detector speeds and up to ten times higher sensitivity. That's true UHPLC performance!

The modular design of the 1260 Infinity LC and the wide range of solvent delivery, injection, and detection options allow you to configure a system that exactly matches your needs for chromatographic performance and flexibility.

www.agilent.com/chem/infinity

Agilent 1260 Infinity RID

The **Agilent 1260 Infinity refractive index detector (RID)** is the ideal detector for fast and reliable LC results in the routine analysis of non-UV absorbing substances, such as carbohydrates, lipids, and polymers. Countercurrent heat exchangers keep the optical unit and the flow cells at constant temperature to achieve unmatched stability for reproducible results. The minimum baseline noise of the RID maximizes signal-to-noise ratio, and low limits of detection allow you to inject small amounts of sample.

www.agilent.com/chem/1260ri

Agilent 385-ELSD

Evaporating light scattering detection (ELSD) offers many advantages for carbohydrate analysis and is featured in many of our Hi-Plex Application Notes (download your compendium at **www.agilent.com/chem/hi-plex**).
The Agilent 385-ELSD is the only ELSD that delivers subambient operation, for unrivaled detection of thermally labile analytes that other ELSDs miss.

www.agilent.com/chem/elsd

Agilent HPLC and UHPLC supplies and sample prep products **ensure accurate measurements** right from the start

Vials, caps, and other small LC system components can contribute to big problems, such as injector damage, ghost peaks, and analyte degradation. Agilent supplies and sample preparation products are engineered with the same reliability and reproducibility you expect from Agilent instruments and columns. They help you keep your system operating at peak performance with the highest possible uptime.

Ordering information and specifications

Hi-Plex LC columns

Description	Crosslink Content	Particle Size	Counter Ion	Column Dimensions	Part Number
Hi-Plex Ca	8%	8 µm	Ca^{2}+	7.7 x 300 mm	PL1170-6810
Hi-Plex Ca USP L19	8%	8 µm	Ca^{2}+	4.0 x 250 mm	PL1570-5810
Hi-Plex Ca (Duo)	8%	8 µm	Ca^{2}+	6.5 x 300 mm	PL1F70-6850
Hi-Plex Pb	8%	8 µm	Pb^{2}+	7.7 x 300 mm	PL1170-6820
Hi-Plex Pb USP L34	8%	8 µm	Pb^{2}+	7.7 x 100 mm	PL1170-2820
Hi-Plex K	8%	8 µm	K+	7.7 x 300 mm	PL1170-6860
Hi-Plex H	8%	8 µm	H+	7.7 x 300 mm	PL1170-6830
Hi-Plex H	8%	8 µm	H+	6.5 x 300 mm	PL1F70-6830
Hi-Plex H USP L17	8%	8 µm	H+	7.7 x 100 mm	PL1170-2823
Hi-Plex Na	4%	10 µm	Na+	7.7 x 300 mm	PL1171-6140
Hi-Plex Na (Octo)	8%	8 µm	Na+	7.7 x 300 mm	PL1170-6840

Hi-Plex guard columns

Description	Crosslink Content	Particle Size	Counter Ion	Column Dimensions	Part Number
Hi-Plex Ca	8%	8 µm	Ca^{2}+	7.7 x 50 mm	PL1170-1810
Hi-Plex Ca (Duo)	8%	8 µm	Ca^{2}+	7.7 x 50 mm	PL1170-1850
Hi-Plex Pb	8%	8 µm	Pb^{2}+	7.7 x 50 mm	PL1170-1820
Hi-Plex K	8%	8 µm	K+	7.7 x 50 mm	PL1170-1860
Hi-Plex H	8%	8 µm	H+	7.7 x 50 mm	PL1170-1830
Hi-Plex Na	4%	10 µm	Na+	7.7 x 50 mm	PL1171-1140
Hi-Plex Na (Octo)	8%	8 µm	Na+	7.7 x 50 mm	PL1170-1840

Hi-Plex guard cartridges (2/pk)

Description	Crosslink Content	Particle Size	Counter Ion	Column Dimensions	Part Number
Hi-Plex Ca	8%	8 µm	Ca^{2}+	3 x 5 mm	PL1670-0810
Hi-Plex Ca (Duo)	8%	8 µm	Ca^{2}+	3 x 5 mm	PL1670-0850
Hi-Plex Pb	8%	8 µm	Pb^{2}+	3 x 5 mm	PL1670-0820
Hi-Plex K	8%	8 µm	K+	3 x 5 mm	PL1670-0860
Hi-Plex H	8%	8 µm	H+	3 x 5 mm	PL1670-0830
Hi-Plex Na	4%	10 µm	Na+	3 x 5 mm	PL1671-0140
Hi-Plex Na (Octo)	8%	8 µm	Na+	3 x 5 mm	PL1670-0840
Guard Cartridge Holder for 3 x 5 mm Cartridges					PL1310-0016

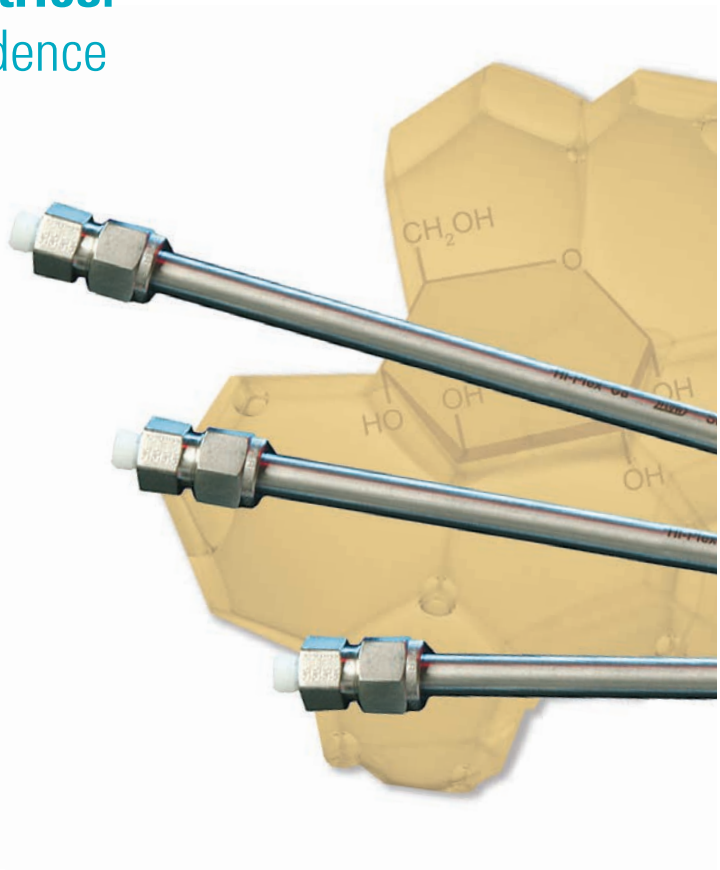
For more Hi-Plex column information, visit **www.agilent.com/chem/Hi-Plex**

Agilent LC columns chemistries:
providing you control and confidence

Agilent's broad chemistries selection puts you in control of even the most difficult analyses. We manufacture columns that suit most techniques for small molecule, large molecule, and synthetic polymer analysis, enabling scaling from conventional 5 µm to "fast LC" sub-2 µm and superficially porous particles, and up to prep scale.

You can be confident that Agilent's meticulous end-to-end oversight of production delivers you the highest column consistency and performance. With more than 40 years of experience in the production of polymers and silica chemistries, our team is committed to the continuous development of new column advances, so you stay ahead of the curve with the technology that will make you the most productive.

Our infrastructure and delivery network ensure that you have easy access to Agilent's LC columns, anywhere in the world. We also provide worldwide columns and chemistries technical support, as well as speedy problem resolution if you need it.



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