Filter Configurations

- Technical Manual
(for High Resolution NMR and HR MAS)

Version 010

Innovation with Integrity

NMR

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Table of Contents

1 About This Manual

This manual is the technical documentation for Bruker Service technicians.

Before starting any work, personnel must read the manual thoroughly and understand its contents. Compliance with all specified safety and operating instructions, as well as local work safety regulations, are vital to ensure safe operation.

The figures shown in this manual are designed to be general and informative and may not represent the specific Bruker model, component or software/firmware version you are working with. Options and accessories may or may not be illustrated in each figure.

1.1 Policy Statement

It is Bruker's policy to improve products as new techniques and components become available. Bruker reserves the right to change specifications at any time.

Every effort has been made to avoid errors in text and Figure presentation in this publication. In order to produce useful and appropriate documentation, we welcome your comments on this publication. Field Service Engineers are advised to check regularly with Bruker for updated information.

Bruker is committed to providing customers with inventive, high-quality, environmentally-sound products and services.

1.2 Symbols and Conventions

Safety instructions in this manual are marked with symbols.

The safety instructions are introduced using indicative words which express the extent of the hazard.

In order to avoid accidents, personal injury or damage to property, always observe safety instructions and proceed with care.

⚠ DANGER

DANGER indicates a hazardous situation which, if not avoided, will result in death or serious injury.

This is the consequence of not following the warning.

1. This is the safety instruction.

▶ This is the safety instruction.

⚠ WARNING

WARNING indicates a hazardous situation, which, if not avoided, could result in death or serious injury.

This is the consequence of not following the warning.

1. This is the safety instruction.

▶ This is the safety instruction.

⚠ CAUTION

CAUTION indicates a hazardous situation, which, if not avoided, may result in minor or moderate injury or severe material or property damage.

This is the consequence of not following the warning.

1. This is the safety instruction.

▶ This is the safety instruction.

NOTICE

NOTICE indicates a property damage message.

This is the consequence of not following the notice.

1. This is the safety instruction.

▶ This is the safety instruction.

SAFETY INSTRUCTIONS

SAFETY INSTRUCTIONS are used for control flow and shutdowns in the event of an error or emergency.

This is the consequence of not following the safety instructions.

1. This is the safety instruction.

▶ This is the safety instruction.

This symb ol hig hlights useful tip s an d recommendations as well as infor mation designed to ensure efficient and smooth operation.

2 Introduction

2.1 Overview

2.1.1 Intended Use

The device has been designed and constructed solely for the intended use described here:

Filters for AVANCE NEO Systems for high resolution NMR and high resolution MAS.

Intended use also includes compliance with all specifications within this manual.
Any use which exceeds or differs from the intended use shall be considered improper use.
No claims of any kind for damage will be entertained if such claims result from improper use.

2.2 Installation and Initial Commissioning

Installation, initial commissioning, retrofitting, repairs, adjustments or dismantling of the device must only be carried out by Bruker Service or personnel authorized by Bruker. Damage due to servicing that is not authorized by Bruker is not covered by your warranty.

2.3 Limitation of Liability

All specifications and instructions in this manual have been compiled taking account of applicable standards and regulations, the current state of technology and the experience and insights we have gained over the years.

The manufacturer accepts no liability for damage due to:

- Failure to observe this manual
- Improper use
- Deployment of untrained personnel
- Unauthorized modifications
- Technical modifications
- Use of unauthorized spare parts

The actual scope of supply may differ from the explanations and depictions in this man-

ual in the case of special designs, take-up of additional ordering options, or as a result of the latest technical modifications.

The undertakings agreed in the supply contract as well as the manufacturer's Terms and Conditions and Terms of Delivery and the legal regulations applicable at the time of conclusion of the contract shall apply.

2.4 Warranty Terms

The warranty terms are included in the manufacturer's Terms and Conditions.

2.5 Customer Service

Our customer service division is available to provide technical information. See the chapter Contact for contact information.

In addition, our employees are always interested in acquiring new information and experience gained from practical application; such information and experience may help improve our products.

2.6 Product Safety and Electromagnetic Compatibility

The device complies with the standard

- IEC 61010-1 and with UL 61010-1 / CSA C22 .2 No. 61010-1-04 Safety Requirements for Electrical Equipment.
- IEC 61326-1 for Electromagnetic Compatibility (EMC)

3 Safety

This section provides an overview of all the main safety aspects involved in ensuring optimal personnel protection and safe and smooth operation.

Non-compliance with the action guidelines and safety instructions contained in this manual may result in serious hazards.

3.1 General

Before you start any repair inside of the device, be aware of the high 230/115V voltages. Even if these voltages are protected by security features to avoid any physical contact, it is still possible that the voltage sources can be unintentionally touched with a tool, object, etc.

Therefore, always check if you really need the power supply to be switched on during your work. Otherwise turn the device off and disconnect the power cable from the wall socket to the device. Safeguard that no one is able to re-power the system without your approval.

3.2 System Owner‘s Responsibility

System Owner

The term *system owner* refers to the person who himself operates the device for trade or commercial purposes, or who surrenders the device to a third party for use/application, and who bears the legal product liability for protecting the user, the personnel or third parties during the operation.

System Owner‘s Obligations

The device is used in the industrial sector, universities and research laboratories. The system owner of the device must therefore comply with statutory occupational safety requirements.

In addition to the safety instructions in this manual, the safety, accident prevention and environmental protection regulations governing the operating area of the device must be observed.

In this regard, the following requirements should be particularly observed:

- The system owner must obtain information about the applicable occupational safety regulations, and - in the context of a risk assessment - must determine any additional dangers resulting from the specific working conditions at the usage location of the device.
  The system owner must then implement this information in a set of operating instructions governing operation of the device.

- During the complete operating time of the device, the system owner must assess whether the operating instructions issued comply with the current status of regulations, and must update the operating instructions if necessary.
- The system owner must clearly lay down and specify responsibilities with respect to installation, operation, troubleshooting, maintenance and cleaning.
- The system owner must ensure that all personnel dealing with the device have read and understood this manual. In addition, the system owner must provide personnel with training and hazards information at regular intervals.
- The system owner must provide the personnel with the necessary protective equipment.
- The system owner must warrant that the device is operated by trained and authorized personnel as well as all other work, such as transportation, mounting, start-up, the installation, maintenance, cleaning, service, repair and shutdown, that is carried out on the device.
- All personnel who work with, or in the close proximity of the device, need to be informed of all safety issues and emergency procedures as outlined in this user manual.
- The system owner must document the information about all safety issues and emergency procedures in a laboratory SOP (Standard Operating Procedure). Routine briefings and briefings for new personnel must take place.
- The system owner must ensure that new personnel are supervised by experienced personnel. It is highly recommended to implement a company training program for new personnel on all aspects of product safety and operation.
- The system owner must ensure that personnel are regularly informed of the potential hazards within the laboratory. This is all personnel that work in the area, but in particular laboratory personnel and external personnel such as cleaning and service personnel.
- The system owner is responsible for taking measures to avoid inherent risks in the handling of dangerous substances, preventing industrial disease, and providing medical first aid in emergencies.
- The system owner is responsible for providing facilities according to the local regulations for the prevention of industrial accidents and generally accepted safety regulations according to the rules of occupational medicine.
- All substances needed for operating and cleaning the device samples, solvents, cleaning agents, gases, etc. have to be handled with care and disposed of appropriately. All hints and warnings on storage containers must be read and adhered to.
- The system owner must ensure that the work area is sufficiently illuminated to avoid reading errors and faulty operation.
- The system owner must ensure that the laboratory is equipped with an oxygen warning device, in case the device is operated with nitrogen.

Furthermore, the system owner is responsible for ensuring that the device is always in a technically faultless condition. Therefore, the following applies:

- The system owner must ensure that the maintenance intervals described in this manual are observed.

- The system owner must ensure that all (electrical, mechanical, etc.) safety devices are regularly checked to ensure full safety functionality and completeness.

3.3 Personnel Requirements

Only trained Bruker personnel are allowed to mount, retrofit, repair, adjust and dismantle the unit!

3.3.1 Qualifications

This manual specifies the personnel qualifications required for the different areas of work, listed below:

Laboratory Personnel

Laboratory personnel are health care professionals, technicians, and assistants staffing a research or health care facility where specimens are grown, tested, or evaluated and the results of such measurements are recorded. Laboratory personnel are able to carry out assigned work and to recognize and prevent possible dangers self-reliant due to their professional training, knowledge and experience as well as profound knowledge of applicable regulations.

The workforce must only consist of persons who can be expected to carry out their work reliably. Persons with impaired reactions due to, for example, the consumption of drugs, alcohol, or medication are prohibited from carrying out work on the device.

When selecting personnel, the age-related and occupation-related regulations governing the usage location must be observed.

3.3.2 Unauthorized Persons

⚠ WARNING

Risk to life for unauthorized personnel due to hazards in the danger and working zone!

Unauthorized personnel who do not meet the requirements described in this manual will not be familiar with the dangers in the working zone. Therefore, unauthorized persons face the risk of serious injury or death.

- ▶ Unauthorized persons must be kept away from the danger and working zone.
- ▶ If in doubt, address the persons in question and ask them to leave the danger and working zone.
- ▶ Cease work while unauthorized persons are in the danger and working zone.

3.3.3 Instruction

The personnel must receive regular instruction from the owner. The instruction must be documented to facilitate improved verification.

Date	Name	Type of Instruction	Instruction Provided By	Signature

3.4 Personal Protective Equipment

Personal protective equipment is used to protect the personnel from dangers which could affect their safety or health while working.

The personnel must wear personal protective equipment while carrying out the different operations at and with the device.

This equipment will be defined by the head of laboratory. Always comply with the instructions governing personal protective equipment posted in the work area.

3.5 Location of the Safety Label

The laboratory supervisor is responsible for ensuring that all the warning labels are maintained in their proper place any time that the device is used.

3.6 Basic Dangers

The following section specifies residual risks which may result from using the device and have been established by means of a risk assessment.

In order to minimize health hazards and avoid dangerous situations, follow the safety instructions specified here as well as in the following chapters of this manual.

3.6.1 General Workplace Dangers

⚠ CAUTION

Danger of injury from tripping over dirt and scattered objects!

Dirt and scattered objects may cause people to slip or trip, resulting in personal injuries.

- ▶ Always keep the work area clean.
- ▶ Remove objects which are no longer required from the work area and particularly from the floor.
- ▶ Indicate unavoidable hazards using marking tape.

NOTICE

Material damage hazard due to impacting the magnet!

Impacting the magnet may result in a quench.

- ▶ Mount the device carefully on the magnet.
- ▶ Avoid banging the magnet during installation and operation, e.g. when replacing the sample carousel.

3.6.2 Dangers from Electric Power

Installed filters must always be connected on both side to the corresponding cables and HPPR/2 modules.

Never touch an open RF connector on a running spectrometer.

⚠ DANGER

Danger to life from stored charges!

Electric charges may be stored in electrical components even after the system has been switched off and disconnected from the power supply. Contact with these components may result in serious or fatal injury.

- ▶ Before working on the specified components, ensure that they have been completely disconnected from the power supply.
- ▶ Allow 10 minutes to elapse in order to ensure that the internal capacitors have been fully discharged.

⚠ WARNING

Danger of injury from electrical shock!

A life threatening shock may result when the housing is open during operation.

- ▶ Only qualified personnel should open the housing.
- ▶ Disconnect the device from the electrical power supply before opening the device. Use a voltmeter to verify that the device is not under power!
- ▶ Be sure that the power supply cannot be reconnected without notice.

⚠ WARNING

Danger to life from residual electrostatic potentials!

Friction between material being conveyed may result in significant development of electrostatic potential. Therefore, contact with parts immediately following the conveying operation may be life-threatening.

- ▶ Potential equalisation must be ensured before making contact with parts, unless such equalisation is provided by the customer.

Electrostatic discharge from friction may occur, resulting in an electric spark and loud bang. Use ESD flooring and wear ESD shoes.

⚠ WARNING

Danger to life from contact voltage!

Absent or faulty protective earth conductor may result in contact voltage. This may pose a risk of injury or death.

- ▶ Before the initial commissioning of the device, connect the main power supply to the socket and verify the complete functionality of the protective earth conductor.

3.6.3 Dangers from Magnetic Fields

⚠ WARNING

Risk to life due to high magnetic fields

A magnetic field of more than 0.5 mT (5 Gauss) is life-threatening for people with pacemakers or active metal implants. Exposure to more than 8 T can cause damage to health. Duration of exposure (8 h/day) above the limit of 200 mT can cause damage to health. Ferromagnetic tools in the magnetic field are significantly hazardous. Disks and electronic devices may be damaged.

- ▶ Mark the magnetic field of more than 0.5 mT (5 Gauss) before start up.
- ▶ Keep people with active medical implants or heart pacemakers away from the 0.5 mT (5 Gauss) area.
- ▶ The permanent workplace of employees must be outside the 0.5 mT (5 Gauss) area.
- ▶ Do not stay or work at magnetic fields of more than 8 T.
- ▶ Prevent exposure of more than 200 mT for more than 8 h/day.
- ▶ Keep disks, credit cards and electronic devices away from the identified area.
- ▶ Do not use ferromagnetic tools or items within the identified area.
- ▶ Only use non-ferromagnetic transportation dewars or pressure cylinders for the cryogenic agents.
- ▶ Only use non-ferromagnetic ladders or steps.
- ▶ Remove magnetic items (jewelry, watches, pens etc.) before carrying out maintenance work.

The magnetic field of the device does not cause any personal injuries or property damage. For further information see the manual of the magnet used.

3.7 Environmental Protection

NOTICE

Danger to the environment from incorrect handling of pollutants!

Incorrect handling of pollutants, particularly incorrect waste disposal, may cause serious damage to the environment.

- ▶ Always observe local environmental regulations regarding handling and disposal of pollutants.
- ▶ Take the appropriate actions immediately if pollutants escape accidentally into the environment. If in do ubt, inform the responsible municipal authorities about the damage and ask about the appropriate actions to be taken.

The following pollutants are used:

Nitrogen gas	Nitrogen gas may cause suffocation at high concentrations. Disposal of the empty gas cylinders must be performed by a specialist disposal company.
Helium inert gas	Helium inert gas may cause suffocation at high concentrations. Disposal of the empty gas cylinders must be performed by a specialist disposal company.
Coolants	When released, coolants develop decomposition products which are hazardous to the environment. Maximum care and caution are required when handling coolants. Always observe the safety data sheet issued by the manufacturer. Ensure that personnel handling coolants are regularly informed about potential dangers and are instructed in the safe handling of coolants.
Cleaning liquids	leaning liquids incorporating solvents contain toxic sub -stances. They must not be allowed to escape into the environment. Disposal must be carried out by a specialist disposal company.

3.8 Signage

The following symbols and information signs can be found in the work area. They refer to their immediate surroundings.

The identification and placement of warning labels are included in the manual. The laboratory supervisor is responsible for ensuring that all the warning labels are maintained in their proper place any time that the device is used.

Electrical Voltage

Only qualified electricians are permitted to work in a work room marked by this sign. Unauthorized persons must not enter the workplaces thus marked and must not open the marked cabinet.

Danger Spot

Warning indicating a danger spot in work rooms.

The warning label may be ordered using Bruker Part Number 67470.

4 Filter Configurations for HR-NMR and HR-MAS

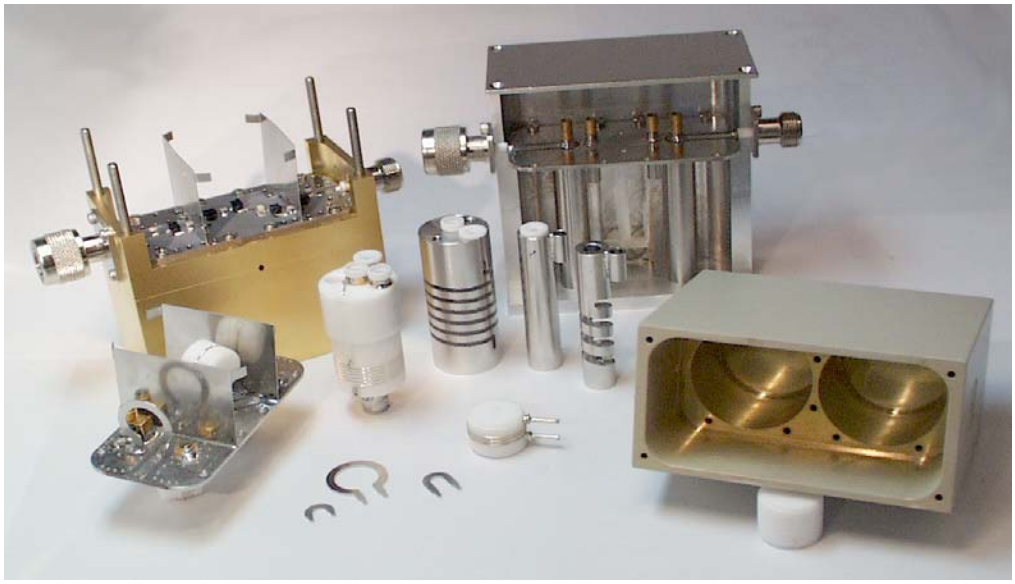


Figure 4.1 High Resolution NMR Filters and Filtercomponents

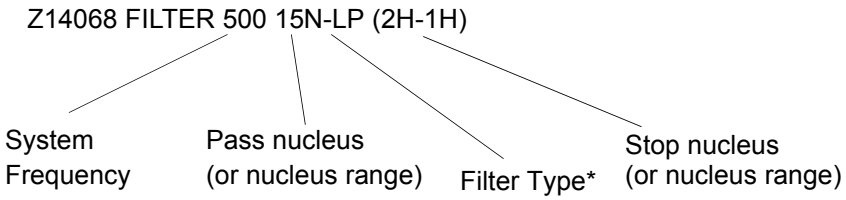
4.1 Introduction

For use of phased-out filters or old HPPR modules see previous manual versions.

- The following chapter helps to select the necessary filter type dependent on the pre-amplifier and the probe.
- System orders with multiple probes require only the combined minimum set of filters.
- Only standard operation is guaranteed with the recommended filter configuration. Non-standard operation (observe on outer coil and decoupling on inner coil) may also be possible with the recommended filter configuration.
- With individual probe orders the current configuration at the customer‘s labs should be obtained to avoid ordering filters which are already at the site.

- If your probe is not included in this list, please fill in the filter requirements questionnaire on page 22 and send it to BBIO-CH, Production Department.
- The exact order number for the corresponding magnet frequency can be taken from the chapter "Filter Part-Numbers" on page 59.
- No additional filters are necessary in the lock channel.
- No additional filters are necessary for cryoprobe operation.
- For HR MAS are exactly the same filters required as for high resolution NMR (for the corresponding probe).
- All filters should be mounted on the HPPR/2 and not on the probe
- In cause of more than one filter, the 2H stop should be mounted closer to the HPPR
- For filters with increased EMC and shielding requirements see the corresponding EC.

Explanation of the filter nomenclature:



*) LP=low pass, HP= high pass, BP=band pass

- Special“ non reflective” (NR) filters are available for 15N (e.g. FILTER 900 15N-NR (2H,F-H). The second harmonic of 15N is being terminated and not reflected by the filter.

4.1.1 HPPR/2 Overview

Preamplifier	
HPPR/2 1H MODULE 200-250	
AQS 1H2H PREAMP 300-400	
HPPR/2 1H2H MODULE 300-400	
HPPR/2 1H LNA MODULE 500-900	
HPPR/2 1H[a] HPLNA MODULE 200-1000	

Table 4.1 Currently used preamplifiers for 1H (HR)

a. with 19F capability, depending on ECL (see ECH3791)

Preamplifier	
HPPR/2 XBB19F 2HS MODULE 200-250, 500-700	
HPPR/2 XBB31P 2HS MODULE 750-1000	
AQS XBB19F 2HS PREAMP 300-400	
HPPR/2 XBB19F 2HS MODULE 300-400	

Table 4.2 Currently used preamplifiers for X (HR)

4.2 Filter Requirements Questionnaire

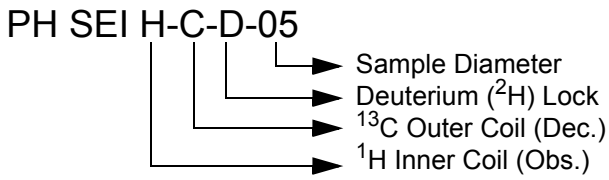
Please fill in the following questionnaire for each probe.

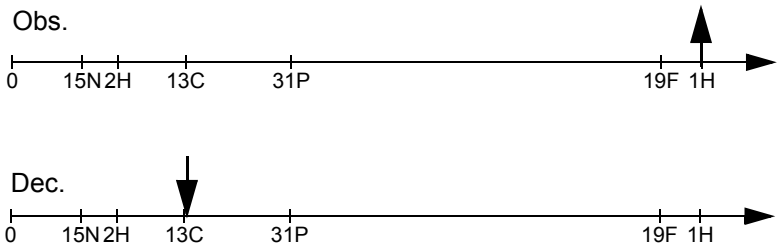
		(Part. Nr. / Ser. Nr.)
Bruker Order Number		
Spectrometer Type		
Probe		
Transmitter Configuration	1H	
	19F	
	X	
	Y	
	Z	
HPPR/2 Configuration	1H	
	19F	
	XBB	
	...	
Lock	2H	
	19F	
	2H Lockswitch	
Existing Filter 1		
Existing Filter 2		
...		
Experiment 1	Obs1 {Dec1}	
Experiment 2	Obs2 {Dec2}	
...		

Table 4.3 Questionnaire

4.3 SEI (Selective Inverse)

Example:





Channel (Obs/Dec)	Preamplifier Module Type	Required Filters
Observe Path 1H	HPPR/2 1H HPLNA MODULE 200-1000 	1H-Pass/19F-Stop[a] 
	HPPR/2 1H MODULE 200-250 	-
	AQS 1H2H PREAMP 300-400 	-
	HPPR/2 1H2H MODULE 300-400 	-
	HPPR/2 1H LNA MODULE 500-900 	-
Decoupling Path 13C	HPPR/2 XBB19F 2HS MODULE 200-250, 500-700 	0-31P-LP (19F-3H) 
	HPPR/2 XBB31P 2HS MODULE 750-1000 	-
	AQS XBB19F 2HS PREAMP 300-400 	-
	HPPR/2 XBB19F 2HS MODULE 300-400 	-

Table 4.4 Required Filters PH SEI H-C-D

a. This filter is only required in configurations with a XBB19F 2HS preamplifier (without any additonal low-pass filter)

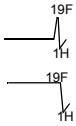
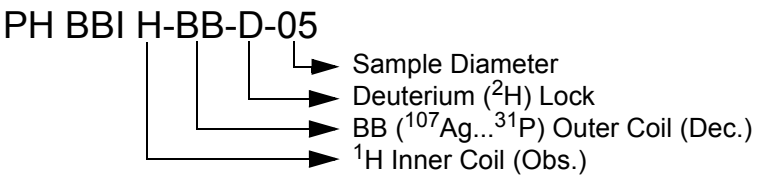
Channel (Obs/Dec)	Preamplifier Module Type	Required Filters
Observe Path 1H	HPPR/2 1H HPLNA MODULE 200-1000 	1H-Pass/19F-Stop 
	HPPR/2 1H MODULE 200-250 	1H-Pass/19F-Stop 
	AQS 1H2H PREAMP 300-400 	-
	HPPR/2 1H2H MODULE 300-400 	-
	HPPR/2 1H LNA MODULE 500-900 	1H-Pass/19F-Stop 
Decoupling Path 19F	HPPR/2 XBB19F 2HS MODULE 200-250, 500-700 	0-31P,19F-LP (1H) 
	HPPR/2 XBB31P 2HS MODULE 750-1000 	not possible
	AQS XBB19F 2HS PREAMP 300-400 	-[a]
	HPPR/2 XBB19F 2HS MODULE 300-400 	-
	HPPR/2 1H HPLNA MODULE 200-1000 	19F-BP(1H) or 0-31P,19F-LP(1H) 

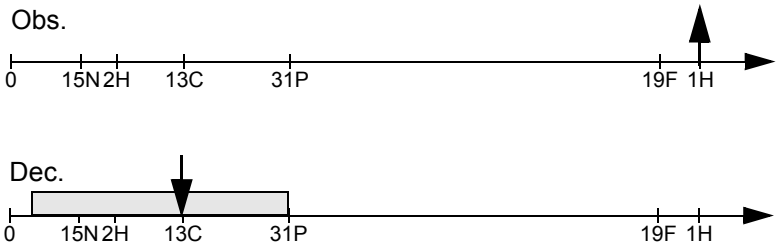
Table 4.5 Required Filters PH SEI H-F-D

a. only for ECL<=1: Filter 0-31P,19F-LP(1H) is required for 19F Observe and 1H Decoupling

4.4 BBI (Broad Band Inverse)

Example:





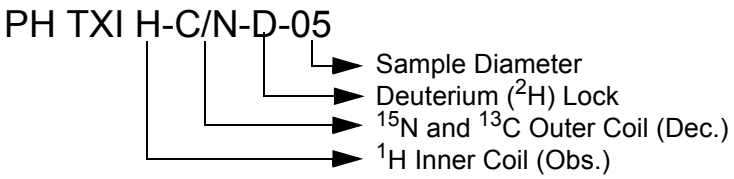
Channel (Obs/Dec)	Preamplifier Module Type	Required Filters
Observe Path 1H	HPPR/2 1H HPLNA MODULE 200-1000 	1H-Pass/19F-Stop[a] 
	HPPR/2 1H MODULE 200-250 	-
	AQS 1H2H PREAMP 300-400 	-
	HPPR/2 1H2H MODULE 300-400 	-
	HPPR/2 1H LNA MODULE 500-900 	-
Decoupling Path BB	HPPR/2 XBB19F 2HS MODULE 200-250, 500-700 	0-31P-LP (19F-3H) 
	HPPR/2 XBB31P 2HS MODULE 750-1000 	-
	AQS XBB19F 2HS PREAMP 300-400 	-
	HPPR/2 XBB19F 2HS MODULE 300-400 	-

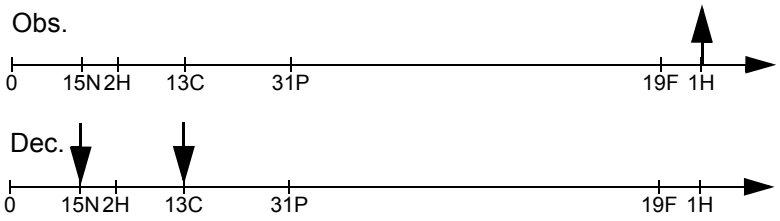
Table 4.6 Required Filters PH BBI H-BB-D

a. This filter is only required in configurations with a XBB19F 2HS preamplifier (without any additonal low-pass filter)

4.5 TXI (Triple X-Nuclei Inverse)

Example:





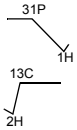
Channel (Obs/Dec)	Preamplifier Module Type	Required Filters
Observe Path 1H	HPPR/2 1H HPLNA MODULE 200-1000 	1H-Pass/19F-Stop[a] 
	HPPR/2 1H MODULE 200-250 	-
	AQS 1H2H PREAMP 300-400 	-
	HPPR/2 1H2H MODULE 300-400 	-
	HPPR/2 1H LNA MODULE 500-900 	-
Decoupling Path 13C	HPPR/2 XBB19F 2HS MODULE 200-250, 500-700 	0-31P-LP (19F-3H) and 13C-Pass / 2H-Stop 
	HPPR/2 XBB31P 2HS MODULE 750-1000 	13C-Pass / 2H-Stop 
	AQS XBB19F 2HS PREAMP 300-400 	13C-Pass / 2H-Stop 
	HPPR/2 XBB19F 2HS MODULE 300-400 	13C-Pass / 2H-Stop 
Decoupling Path 15N	some X-BB Preamplifier	15N-Pass / 2H-Stop 

Table 4.7 Required Filters PH TXI H-C/N-D

a. This filter is only required in configurations with a XBB19F 2HS preamplifier (without any additonal low-pass filter)

Channel (Obs/Dec)	Preamplifier Module Type	Required Filters
Observe Path 1H	HPPR/2 1H HPLNA MODULE 200-1000 	1H-Pass/19F-Stop[a] 
	HPPR/2 1H MODULE 200-250 	-
	AQS 1H2H PREAMP 300-400 	-
	HPPR/2 1H2H MODULE 300-400 	-
	HPPR/2 1H LNA MODULE 500-900 	-
Decoupling Path 13C	HPPR/2 XBB19F 2HS MODULE 200-250, 500-700 	13C-Pass / 31P-Stop 
	HPPR/2 XBB31P 2HS MODULE 750-1000 	13C-Pass / 31P-Stop 
	AQS XBB19F 2HS PREAMP 300-400 	13C-Pass / 31P-Stop 
	HPPR/2 XBB19F 2HS MODULE 300-400 	13C-Pass / 31P-Stop 
Decoupling Path 31P	HPPR/2 XBB19F 2HS MODULE 200-250, 500-700 	31-P-Pass /13C-Stop 
	HPPR/2 XBB31P 2HS MODULE 750-1000 	31-P-Pass /13C-Stop 
	AQS XBB19F 2HS PREAMP 300-400 	31-P-Pass /13C-Stop 
	HPPR/2 XBB19F 2HS MODULE 300-400 	31-P-Pass /13C-Stop 

Table 4.8 Required Filters PH TXI H-C/P-D

a. This filter is only required in configurations with a XBB19F 2HS preamplifier (without any additonal low-pass filter)

13C Observe/ 1H Decoupling might be possible with this configuration.

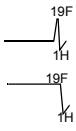
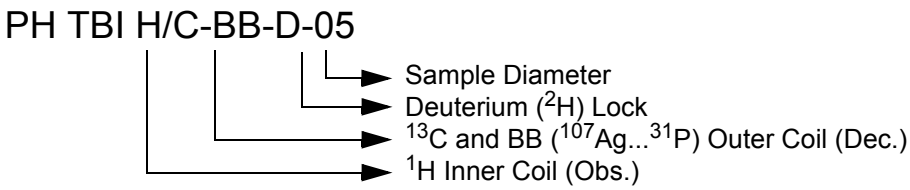
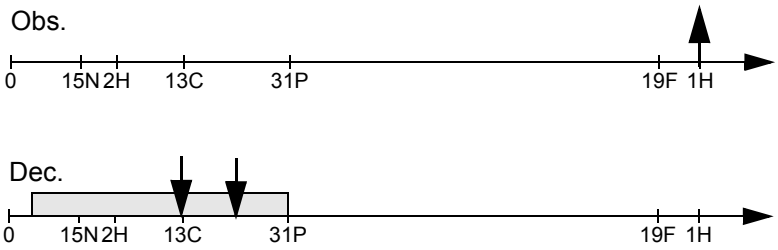
Channel (Obs/Dec)	Preamplifier Module Type	Required Filters
Observe Path 1H	HPPR/2 1H HPLNA MODULE 200-1000 	1H-Pass/19F-Stop 
	HPPR/2 1H MODULE 200-250 	1H-Pass/19F-Stop 
	AQS 1H2H PREAMP 300-400 	-
	HPPR/2 1H2H MODULE 300-400 	-
	HPPR/2 1H LNA MODULE 500-900 	1H-Pass/19F-Stop 
Decoupling Path 13C	HPPR/2 XBB19F 2HS MODULE 200-250, 500-700 	0-31P-LP (19F-3H) 
	HPPR/2 XBB31P 2HS MODULE 750-1000 	0-31P-LP (19F-3H) 
	AQS XBB19F 2HS PREAMP 300-400 	0-31P-LP (19F-3H) 
	HPPR/2 XBB19F 2HS MODULE 300-400 	0-31P-LP (19F-3H) 
Decoupling Path 19F	HPPR/2 XBB19F 2HS MODULE 200-250, 500-700 	19F-BANDPASS 
	HPPR/2 XBB31P 2HS MODULE 750-1000 	not possible
	AQS XBB19F 2HS PREAMP 300-400 	19F-BANDPASS 
	HPPR/2 XBB19F 2HS MODULE 300-400 	19F-BANDPASS 
	HPPR/2 1H HPLNA MODULE 200-1000 	19F-BP(1H) or 0-31P,19F-LP(1H) 

Table 4.9 Required Filters PH TXI H/C-F-D

4.6 TBI (Triple Broad Band Inverse)

Example:





Channel (Obs/Dec)	Preamplifier Module Type	Required Filters
Observe Path 1H	HPPR/2 1H HPLNA MODULE 200-1000 	1H-Pass/19F-Stop[a] 
	HPPR/2 1H MODULE 200-250 	-
	AQS 1H2H PREAMP 300-400 	-
	HPPR/2 1H2H MODULE 300-400 	-
	HPPR/2 1H LNA MODULE 500-900 	-
Decoupling Path 13C	HPPR/2 XBB19F 2HS MODULE 200-250, 500-700 	b c
	HPPR/2 XBB31P 2HS MODULE 750-1000 	b c
	AQS XBB19F 2HS PREAMP 300-400 	b c
	HPPR/2 XBB19F 2HS MODULE 300-400 	b c
Decoupling Path BB	some X-BB Preamplifier	b c

Table 4.10 Required Filters PH TBI H-C/BB-D

a. This filter is only required in configurations with a XBB19F 2HS preamplifier (without any additonal low-pass filter)

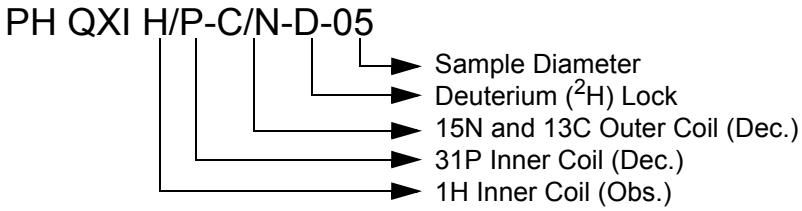
b. For 13C and 15N decoupling filter requirements is the same as "Required Filters PH TXI H-C/N-D" on page 29

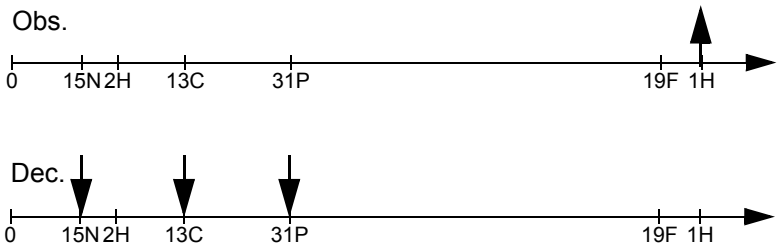
c. For 13C and 31P decoupling filter requirements is the same as "Required Filters PH TXI H-C/P-D" on page 30

For additional decoupling nuclei please contact the nearest local Bruker office.

4.7 QXI (Quadruple X-Nuclei Inverse)

Example:





Channel (Obs/Dec)	Preamplifier Module Type	Required Filters
Observe Path 1H	HPPR/2 1H HPLNA MODULE 200-1000 	-
	HPPR/2 1H MODULE 200-250 	-
	AQS 1H2H PREAMP 300-400 	-
	HPPR/2 1H2H MODULE 300-400 	-
	HPPR/2 1H LNA MODULE 500-900 	-
Decoupling Path 13C	HPPR/2 XBB19F 2HS MODULE 200-250, 500-700 	13C-BP (0-SI,11B-H) 
	HPPR/2 XBB31P 2HS MODULE 750-1000 	13C-BP (0-SI,11B-H) 
	AQS XBB19F 2HS PREAMP 300-400 	13C-BP (0-SI,11B-H) 
	HPPR/2 XBB19F 2HS MODULE 300-400 	13C-BP (0-SI,11B-H) 
Decoupling Path 15N	some X-BB Preamplifier	15N-Pass / 2H-Stop 
Decoupling Path 31P	some X-BB Preamplifier	31P-BP(0-11B,19F-H) 

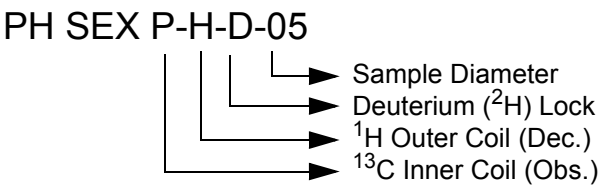
Table 4.11 Required Filters PH QXI H/P-C/N-D

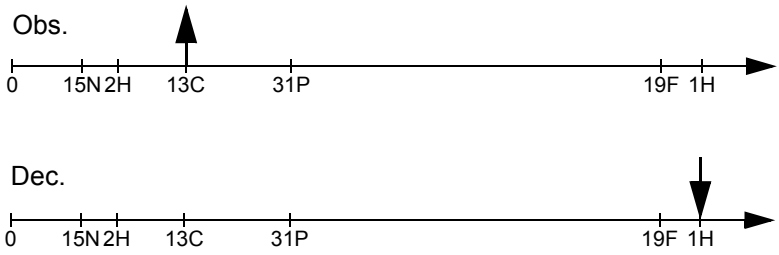
Channel (Obs/Dec)	Preamplifier Module Type	Required Filters
Observe Path 1H	HPPR/2 1H HPLNA MODULE 200-1000 	1H-Pass/19F-Stop 
	HPPR/2 1H MODULE 200-250 	1H-Pass/19F-Stop 
	AQS 1H2H PREAMP 300-400 	1H-Pass/19F-Stop 
	HPPR/2 1H2H MODULE 300-400 	1H-Pass/19F-Stop 
	HPPR/2 1H LNA MODULE 500-900 	1H-Pass/19F-Stop 
Decoupling Path 13C	HPPR/2 XBB19F 2HS MODULE 200-250, 500-700 	13C-BP (0-SI,11B-H) 
	HPPR/2 XBB31P 2HS MODULE 750-1000 	13C-BP (0-SI,11B-H) 
	AQS XBB19F 2HS PREAMP 300-400 	13C-BP (0-SI,11B-H) 
	HPPR/2 XBB19F 2HS MODULE 300-400 	13C-BP (0-SI,11B-H) 
Decoupling Path 15N	some X-BB Preamplifier	15N-Pass / 2H-Stop 
Decoupling Path 19F	some X-BB Preamplifier	0-31P,19F-LP (1H) and 19F-BANDPASS   or 19F-BP(1H) 
	HPPR/2 1H HPLNA MODULE 200-1000 	19F-BP(1H) or 0-31P,19F-LP(1H)  

Table 4.12 Required Filters PH QXI H/F-C/N-D

4.8 SEX, Dual (Selective X-Nuclei)

Example:





Filter Configurations for HR-NMR and HR-MAS

Channel (Obs/Dec)	Preamplifier Module Type	Required Filters
Observe Path 13C	HPPR/2 XBB19F 2HS MODULE 200-250, 500-700 	0-31P-LP (19F-3H) 
	HPPR/2 XBB31P 2HS MODULE 750-1000 	-
	AQS XBB19F 2HS PREAMP 300-400 	-
	HPPR/2 XBB19F 2HS MODULE 300-400 	-
Decoupling Path 1H	HPPR/2 1H HPLNA MODULE 200-1000 	1H-Pass/19F-Stop[a] 
	HPPR/2 1H MODULE 200-250 	-
	AQS 1H2H PREAMP 300-400 	-
	HPPR/2 1H2H MODULE 300-400 	-
	HPPR/2 1H LNA MODULE 500-900 	1H-Pass/19F-Stop 

Table 4.13 Required Filters PH SEX C-H-D

a. This filter is only required in configurations with a XBB19F 2HS preamplifier (without any additonal low-pass filter)

Channel (Obs/Dec)	Preamplifier Module Type	Required Filters
Observe Path 3H	HPPR/2 3H MODULE 	3H-HP(1H) 
	HPPR/2 3H HPLNA MODULE 200-1000 	3H-HP(1H) 
Decoupling Path 1H	HPPR/2 1H HPLNA MODULE 200-1000 	1H-LP(3H) 
	HPPR/2 1H MODULE 200-250 	1H-LP(3H) 
	AQS 1H2H PREAMP 300-400 	1H-LP(3H) 
	HPPR/2 1H2H MODULE 300-400 	1H-LP(3H) 
	HPPR/2 1H LNA MODULE 500-900 	1H-LP(3H) 

Table 4.14 Required Filters PH SEX 3H-H-D

1H Observe/ 3H Decoupling might be possible with this configuration.

Channel (Obs/Dec)	Preamplifier Module Type	Required Filters
Observe Path 2H	HPPR/2 2H MODULE 200-250, 500-900 	-
	AQS 1H2H PREAMP 300-400 	-
	HPPR/2 1H2H MODULE 300-400 	-
Decoupling Path 1H	HPPR/2 1H HPLNA MODULE 200-1000 	1H-Pass / 19F-Stop 
	HPPR/2 1H MODULE 200-250 	1H-Pass / 19F-Stop 
	AQS 1H2H PREAMP 300-400 	
	HPPR/2 1H2H MODULE 300-400 	
	HPPR/2 1H LNA MODULE 500-900 	1H-Pass / 19F-Stop 

Table 4.15 Required Filters PH SEX 2H-H-F

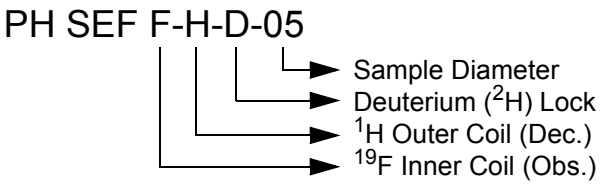
Channel (Obs/Dec)	Preamplifier Module Type	Required Filters
Observe Path BB	HPPR/2 XBB19F 2HS MODULE 200-250, 500-700 	-
	HPPR/2 XBB31P 2HS MODULE 750-1000 	-
	AQS XBB19F 2HS PREAMP 300-400 	-
	HPPR/2 XBB19F 2HS MODULE 300-400 	-
Decoupling Path 1H	HPPR/2 1H HPLNA MODULE 200-1000 	1H-Pass/19F-Stop[a] 
	HPPR/2 1H MODULE 200-250 	-
	AQS 1H2H PREAMP 300-400 	-
	HPPR/2 1H2H MODULE 300-400 	-
	HPPR/2 1H LNA MODULE 500-900 	-

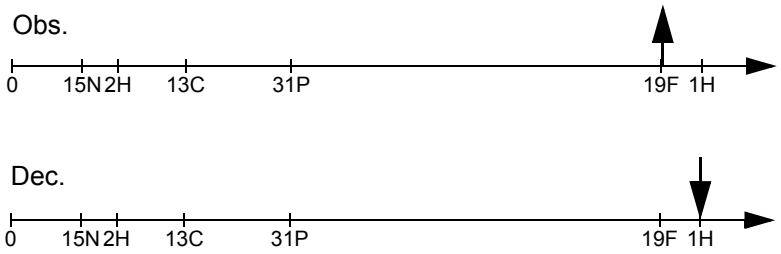
Table 4.16 Required Filters for PH SEX X-H-D (x=all X-nuclei except 2H, 3H, 13C)

a. This filter is only required in configurations with a XBB19F 2HS preamplifier (without any additonal low-pass filter)

4.9 SEF (Selective 19F)

Example:





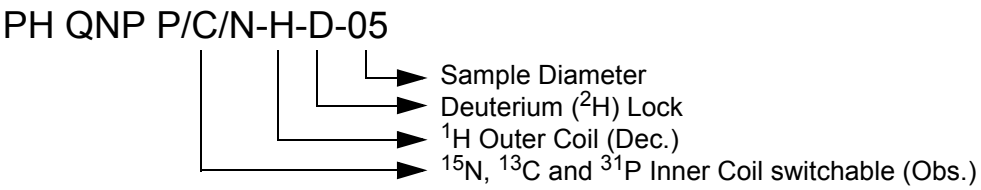
Channel (Obs/Dec)	Preamplifier Module Type	Required Filters
Observe Path 19F	HPPR/2 19F MODULE 200-1000 	0-31P,19F-LP (1H) 
	HPPR/2 1H HPLNA MOD ULE 200-1000 	19F-BP(1H)  or 0-31P,19F-LP (1H) 
	HPPR/2 XBB19F 2HS MODULE 200-250, 500-700 	0-31P,19F-LP (1H) 
	AQS XBB19F 2HS PREAMP 300-400 	-[a]
	HPPR/2 XBB19F 2HS MODULE 300-400 	-
Decoupling Path 1H	HPPR/2 1H HPLNA MODULE 200-1000 	1H-Pass/19F-Stop 
	HPPR/2 1H MODULE 200-250 	1H-Pass/19F-Stop 
	AQS 1H2H PREAMP 300-400 	-
	HPPR/2 1H2H MODULE 300-400 	-
	HPPR/2 1H LNA MODULE 500-900 	1H-Pass/19F-Stop 

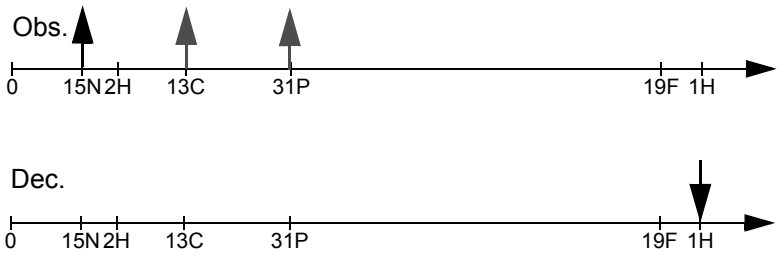
Table 4.17 Required Filters for PH SEF F-H-D

a. only for ECL <=1 Filter 0-31P,19F-LP(1H) is required

4.10 QNP (Quadruple Nuclei Probe)

Example:





Channel (Obs/Dec)	Preamplifier Module Type	Required Filters
Observe Path 31P/13C/15N	HPPR/2 XBB19F 2HS MODULE 200-250, 500-700 	0-31P-LP (19F-3H) 
	HPPR/2 XBB31P 2HS MODULE 750-1000 	-
	AQS XBB19F 2HS PREAMP 300-400 	-
	HPPR/2 XBB19F 2HS MODULE 300-400 	-
Decoupling Path 1H	HPPR/2 1H HPLNA MODULE 200-1000 	1H-Pass/19F-Stop[a] 
	HPPR/2 1H MODULE 200-250 	-
	AQS 1H2H PREAMP 300-400 	-
	HPPR/2 1H2H MODULE 300-400 	-
	HPPR/2 1H LNA MODULE 500-900 	-

Table 4.18 Required Filters for PH QNP P/C/N-H-D

a. This filter is only required in configurations with a XBB19F 2HS preamplifier (without any additonal low-pass filter)

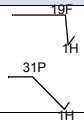
Channel (Obs/Dec)	Preamplifier Module Type	Required Filters
Observe Path 19F/31P/13C	HPPR/2 XBB19F 2HS MODULE 200-250, 500-700 	0-31P,19F-LP (1H) or 0-31P-LP (19F-3H)[a] 
	HPPR/2 XBB31P 2HS MODULE 750-1000 	19F observe not possible
	AQS XBB19F 2HS PREAMP 300-400 	-[b]
	HPPR/2 XBB19F 2HS MODULE 300-400 	-
Decoupling Path 1H	HPPR/2 1H HPLNA MODULE 200-1000 	1H-Pass/19F-Stop 
	HPPR/2 1H MODULE 200-250 	1H-Pass/19F-Stop 
	AQS 1H2H PREAMP 300-400 	-
	HPPR/2 1H2H MODULE 300-400 	-
	HPPR/2 1H LNA MODULE 500-900 	1H-Pass/19F-Stop 

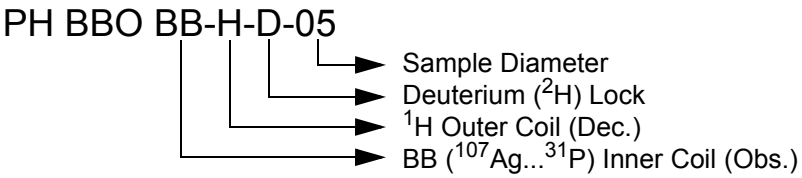
Table 4.19 Required Filters for PH QNP F/P/C-H-D

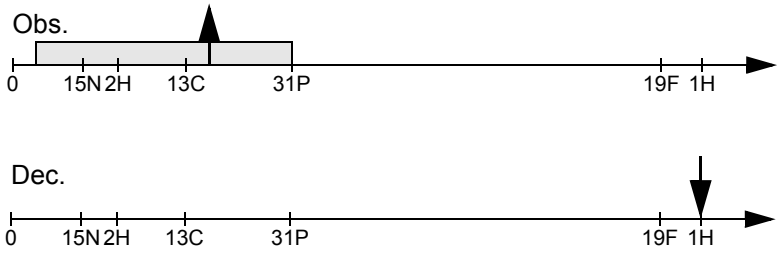
a. This filter is only necessary for 13C decoupling and must be removed for 19F decoupling or observe

b. only for ECL <=1 Filter 0-31P,19F-LP(1H) is required

4.11 BBO (Broad Band Observe)

Example:





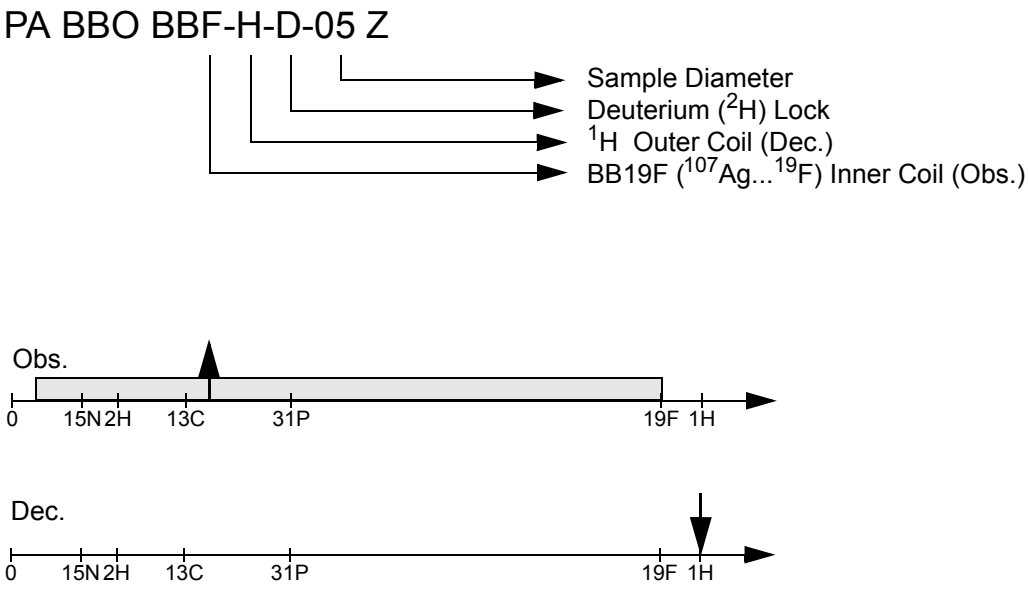
Channel (Obs/Dec)	Preamplifier Module Type	Required Filters
Observe Path BB	HPPR/2 XBB19F 2HS MODULE 200-250, 500-700 	0-31P-LP (19F-3H) 
	HPPR/2 XBB31P 2HS MODULE 750-1000 	-
	AQS XBB19F 2HS PREAMP 300-400 	-
	HPPR/2 XBB19F 2HS MODULE 300-400 	-
Decoupling Path 1H	HPPR/2 1H HPLNA MODULE 200-1000 	1H-Pass/19F-Stop[a] 
	HPPR/2 1H MODULE 200-250 	
	AQS 1H2H PREAMP 300-400 	-
	HPPR/2 1H2H MODULE 300-400 	-
	HPPR/2 1H LNA MODULE 500-900 	-

Table 4.20 Required Filters for PH BBO-H-D

a. This filter is only in configurations with a XBB19F 2HS preamplifier (without any additonal low-pass filter) required

4.12 BBO BBF-H (Broad Band Observe)

Example:



Remark:

This BBO probe-type is also available as iProbe (BBF/H/D, BBF/H/D...2H-P)

Channel (Obs/Dec)	Preamplifier Module Type	Required Filters
Observe Path BB	HPPR/2 XBB19F 2HS MODULE 200-250, 500-700 	0-31P,19F-LP (1H)[a] 
	HPPR/2 XBB31P 2HS MODULE 750-1000 	19F observe not possible
	AQS XBB19F 2HS PREAMP 300-400 	-[b]
	HPPR/2 XBB19F 2HS MODULE 300-400 	-[c]
Decoupling Path 1H	HPPR/2 1H HPLNA MODULE 200-1000 	1H-Pass/19F-Stop[a] 
	HPPR/2 1H MODULE 200-250 	1H-Pass/19F-Stop 
	AQS 1H2H PREAMP 300-400 	-
	HPPR/2 1H2H MODULE 300-400 	-
	HPPR/2 1H LNA MODULE 500-900 	1H-Pass/19F-Stop 

Table 4.21 Required Filters for PH BBO BBF-H (valid for Standard-, Plus- and Smart-Probes)

a) not required for iProbe

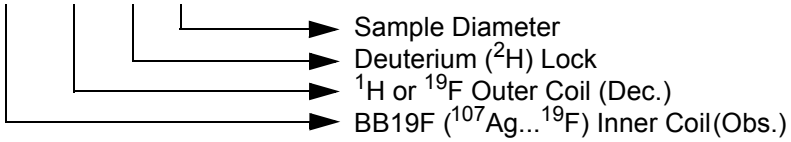
b) only for ECL <=1 Filter 0-31P,19F-LP(1H) is required

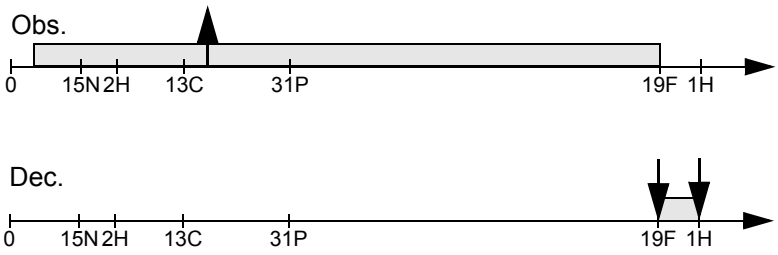
c) in combination with a HPLNA 1H module, the selectivity of the HPPR/2 XBB19F 2HS Module 300-400 may not be sufficient and an additional lowpass filter 0-31P,19F-LP(1H) is required

4.13 BBO BBF-H&F (Broad Band Observe)

Example:

PA BBO BBF-H&F-D-05 Z





Depending on the decoupling nucleus, different filter configurations are required.

Channel (Obs/Dec)	Preamplifier Module Type	Required Filters
Observe Path BB	HPPR/2 XBB19F 2HS MODULE 200-250, 500-700 	0-31P,19F-LP (1H) 
	HPPR/2 XBB31P 2HS MODULE 750-1000 	19F observe not possible
	AQS XBB19F 2HS PREAMP 300-400 	-[a]
	HPPR/2 XBB19F 2HS MODULE 300-400 	-
Decoupling Path 1H	HPPR/2 1H HPLNA MODULE 200-1000 	1H-Pass/19F-Stop 
	HPPR/2 1H MODULE 200-250 	1H-Pass/19F-Stop 
	AQS 1H2H PREAMP 300-400 	-
	HPPR/2 1H2H MODULE 300-400 	-
	HPPR/2 1H LNA MODULE 500-900 	1H-Pass/19F-Stop 

Table 4.22 Required Filters for PH BBO BBF-H&F (Valid for Standard-, Plus and Smart-Probes) for 1H Decoupling

a. only for ECL <=1 Filter 0-31P,19F-LP(1H) is required

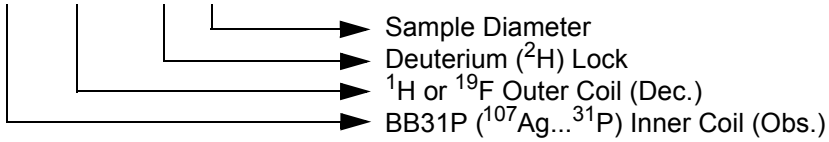
Channel (Obs/Dec)	Preamplifier Module Type	Required Filters
Observe Path BB	HPPR/2 XBB19F 2HS MODULE 200-250, 500-700 	0-31P-LP (19F-3H) 
	HPPR/2 XBB31P 2HS MODULE 750-1000 	-
	AQS XBB19F 2HS PREAMP 300-400 	0-31P-LP (19F-3H) 
	HPPR/2 XBB19F 2HS MODULE 300-400 	0-31P-LP (19F-3H) 
Decoupling Path 19F	no pr eamplifier (1 H p reamplifier must be bypassed for 19F decou-pling)	19F-BANDPASS 
	HPPR/2 1H HPLNA MOD ULE 200-1000 	

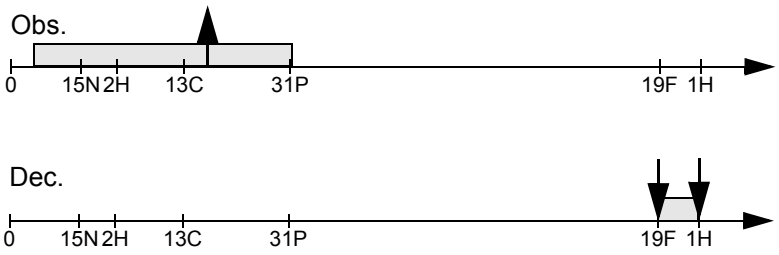
Table 4.23 Required F ilters for P H BB O BBF-H&F (Valid for Standard-, Plus and SmartP robes) for 19 F decoupling a nd 107Ag-31P Observe.

4.14 BBO BB-H&F (Broad Band Observe)

Example:

PA BBO BB-H&F-D-05 Z





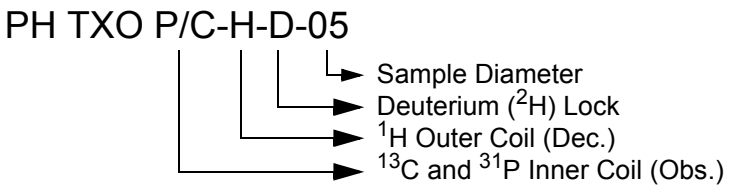
Channel (Obs/Dec)	Preamplifier Module Type	Required Filters
Observe Path BB	HPPR/2 XBB19F 2HS MODULE 200-250, 500-700 	0-31P-LP (19F-3H) 
	HPPR/2 XBB31P 2HS MODULE 750-1000 	-
	AQS XBB19F 2HS PREAMP 300-400 	-
	HPPR/2 XBB19F 2HS MODULE 300-400 	0-31P-LP (19F-3H)[a] 
Decoupling Path 1H	HPPR/2 1H HPLNA MODULE 200-1000 	-
	HPPR/2 1H MODULE 200-250 	19F de coupling not possible
	AQS 1H2H PREAMP 300-400 	19F de coupling not possible
	HPPR/2 1H2H MODULE 300-400 	19F de coupling not possible
	HPPR/2 1H LNA MODULE 500-900 	19F de coupling not possible

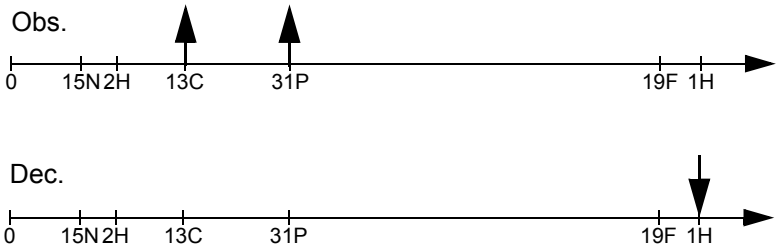
Table 4.24 Required Filters for PH BBO BB-H&F (Valid for Standard-, and SmartProbes)

a. Lowpass only required in combination with HPLNA 1H

4.15 TXO (Triple X-Nuclei Observe)

Example:





Channel (Obs/Dec)	Preamplifier Module Type	Required Filters
Observe Path X	HPPR/2 XBB19F 2HS MODULE 200-250, 500-700 	X-Pass / Y-Stop 
	HPPR/2 XBB31P 2HS MODULE 750-1000 	X-Pass / Y-Stop 
	AQS XBB19F 2HS PREAMP 300-400 	X-Pass / Y-Stop 
	HPPR/2 XBB19F 2HS MODULE 300-400 	X-Pass / Y-Stop 
Decoupling Path 1H	HPPR/2 1H HPLNA MODULE 200-1000 	1H-Pass /19F-Stop[a] 
	HPPR/2 1H MODULE 200-250 	-
	AQS 1H2H PREAMP 300-400 	-
	HPPR/2 1H2H MODULE 300-400 	-
	HPPR/2 1H LNA MODULE 500-900 	-
Decoupling Path Y	HPPR/2 XBB19F 2HS MODULE 200-250, 500-700 	Y-Pass / X-Stop 
	HPPR/2 XBB31P 2HS MODULE 750-1000 	Y-Pass / X-Stop 
	AQS XBB19F 2HS PREAMP 300-400 	Y-Pass / X-Stop 
	HPPR/2 XBB19F 2HS MODULE 300-400 	Y-Pass / X-Stop 

Table 4.25 Required Filters for PH TXO X/Y-H-D (without 19F)

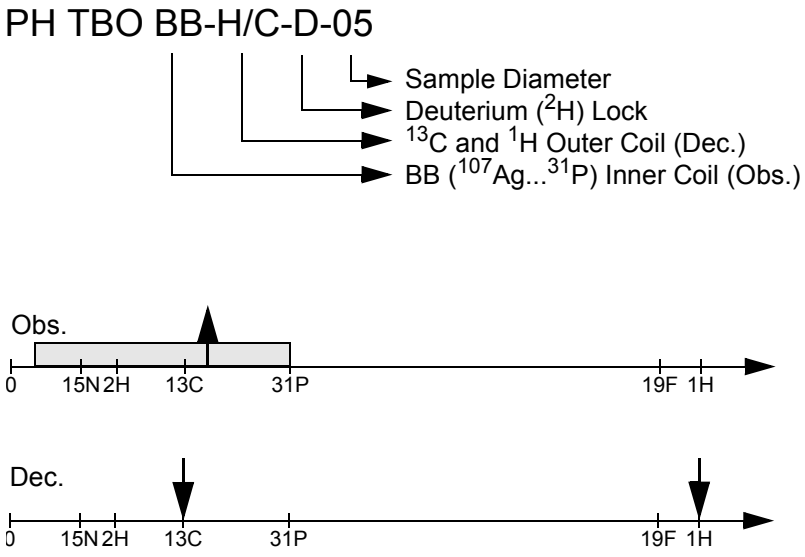
a. This filter is only requred in configurations with a XBB19F 2HS preamplifier (without any additonal low-pass filter)

Channel (Obs/Dec)	Preamplifier Module Type	Required Filters
Observe Path 19F	HPPR/2 XBB19F 2HS MODULE 200-250, 500-700 	19F-Bandpass 
	HPPR/2 XBB31P 2HS MODULE 750-1000 	-not possible 
	AQS XBB19F 2HS PREAMP 300-400 	19F-Bandpass 
	HPPR/2 XBB19F 2HS MODULE 300-400 	19F-Bandpass 
Decoupling Path 1H	HPPR/2 1H HPLNA MODULE 200-1000 	1H-Pass / 19F-Stop 
	HPPR/2 1H MODULE 200-250 	1H-Pass / 19F-Stop 
	AQS 1H2H PREAMP 300-400 	-
	HPPR/2 1H2H MODULE 300-400 	-
	HPPR/2 1H LNA MODULE 500-900 	1H-Pass / 19F-Stop 
Decoupling Path Y	HPPR/2 XBB19F 2HS MODULE 200-250, 500-700 	0-31P-LP (19F-3H) 
	HPPR/2 XBB31P 2HS MODULE 750-1000 	-
	AQS XBB19F 2HS PREAMP 300-400 	0-31P-LP (19F-3H) 
	HPPR/2 XBB19F 2HS MODULE 300-400 	0-31P-LP (19F-3H) 

Table 4.26 Required Filters for PH TXO F/Y-H-D (with X=19F)

4.16 TBO (Triple Broad Band Observe)

Example:



Required Filters:

Please contact the nearest Bruker head office for TBO filter requirements.

5 Filter Part-Numbers

(Status: February 2012)

Z002054 FIL TER BIOSPEC-200 1H+19F PASS
Z13381 FILTER 200 1H-BANDPASS
Z13281 FILTER 200 1H-PASS / 19F-STOP
Z00114 FILTER 200 2H STOP
Z107721 FILTER 200 2H-LP(13C)
Z13327 FILTER 200 0-31P,19F-LP (1H)
Z14329 FILTER 200 0-31P-LP (19F-3H)
Z13088 FILTER 200 11B-PASS / 13C-STOP
Z41000 FILTER 200 11B-PASS / 31P-STOP
Z13087 FIL TER 200 13C-PASS / 11B-STOP
Z13083 FIL TER 200 13C-PASS / 2H-STOP
Z6842 FIL TER 200 13C-PASS / 31P-STOP
Z13908 FILTER 200 19F-BANDPASS
Z12967 FILTER 200 23NA-PASS /31P-STOP
Z13015 FILTER 200 27AL-PASS /31P-STOP
Z41001 FIL TER 200 31P-PASS / 11B-STOP
Z6843 FIL TER 200 31P-PASS / 13C-STOP
Z12968 FIL TER 200 31P-PASS /23NA-STOP

Z13382 FILTER 250 1H-BANDPASS
Z13279 FILTER 250 1H-PASS / 19F-STOP
Z00115 FILTER 250 2H STOP
Z13439 FILTER 250 3H-PASS / 1H-STOP
Z13328 FILTER 250 0-31P,19F-LP (1H)
Z14330 FILTER 250 0-31P-LP (19F-3H)
Z12810 FIL TER 250 103RH-PASS/31P-STOP
Z9146 FIL TER 250 13C-PASS / 2H-STOP
Z6818 FIL TER 250 13C-PASS / 31P-STOP
Z13375 FIL TER 250 14N-PASS/195PT-STOP
Z42386 FIL TER 250 15N-PASS / 2H-STOP
Z13376 FILTER 250 195PT-PASS/14N-STOP

Filter Part-Numbers

Z13902 FILTER 250 19F-BANDPASS
Z110651 FILTER 250 1H-HP(0-13C)
Z9774 FILTER 250 205TL-PASS/ 1H-STOP
Z6819 FILTER 250 31P-PASS / 13C-STOP
Z12811 FILTER 250 31P-PASS/103RH-STOP

Z002084 FILTER BIOSPEC-300 1H+19F PASS
Z13383 FILTER 300 1H-BANDPASS
Z13763 FILTER 300 1H-LP (3H)
Z13270 FIL TER 300 1H-PASS / 19F-STOP
Z00116 FILTER 300 2H STOP
Z9327 FILTER 300 2H-PASS / 13C-STOP
Z9330 FILTER 300 2H-PASS / 15N-STOP
Z7781 FILTER 300 2H-PASS / 19F-STOP
Z13764 FILTER 300 3H-HP (1H)
Z13329 FILTER 300 0-31P,19F-LP (1H)
Z14331 FILTER 300 0-31P-LP (19F-3H)
Z100288 FILTER 300 0-195PT-LP(13C)
Z13029 FILTER 300 119SN-P 13C-29SI-ST
Z8742 FILTER 300 119SN-PASS/31P-STOP
Z9229 FILTER 300 11B-PASS / 31P-STOP
Z13972 FILTER 300 13C-BP (0-SI,11B-H)
Z9328 FILTER 300 13C-PASS / 2H-STOP
Z12853 FILTER 300 13C-PASS / 14N-STOP
Z8955 FILTER 300 13C-PASS / 15N-STOP
Z6845 FILTER 300 13C-PASS / 31P-STOP
Z9329 FILTER 300 15N-PASS / 2H-STOP
Z8954 FILTER 300 15N-PASS / 13C-STOP
Z13773 FILTER 300 19F-BANDPASS
Z42428 FILTER 300 27A-PASS / 31P-STOP
Z15174 FILTER 300 31P-BP(0-11B,19F-H)
Z9228 FILTER 300 31P-PASS / 11B-STOP
Z6844 FILTER 300 31P-PASS / 13C-STOP
Z42427 FILTER 300 31P-PASS / 27A-STOP
Z8741 FILTER 300 31P-PASS /119S-STOP
Z13373 FILTER 300 31P-PASS/195PT-STOP

Z9244 FIL TER 300 6LI-PASS / 2H-STOP
Z7779 FIL TER 300 6LI-PASS / 15N-STOP
Z102690 FILTER 300 7LI - 1H-HP (13C)

Z13385 FILTER 400 1H-BANDPASS
Z13271 FILTER 400 1H-PASS / 19F-STOP (replaced by Z165600, Sept. 2018)
Z103107 FILTER 400 1H-LP (3H)
Z6850 FILTER 400 1H-PASS/205TL-STOP
Z00118 FILTER 400 2H STOP
Z9032 FILTER 400 2H-PASS / 13C-STOP
Z9093 FILTER 400 2H-PASS / 15N-STOP
Z12805 FILTER 400 2H-PASS / 171YB-ST
Z5785 FILTER 400 2H-PASS / 31P-STOP
Z14181 FILTER 400 3H-HP (1H)
Z104117 FILTER 400 0-13C LP (119SN)
Z13331 FILTER 400 0-31P,19F-LP (1H)
Z14333 FILTER 400 0-31P-LP (19F-3H)
Z13148 FIL TER 400 10B-PASS / 11B-STOP
Z104116 FILTER 400 119SN BP(0-24NA,19F-1H)
Z14324 FILTER 400 11B-BP (0-23NA,P-H)
Z13149 FILTER 400 11B-PASS / 10B-STOP
Z14107 FILTER 400 13C-BP (0-SI,11B-H)
Z9095 FIL TER 400 13C-PASS / 2H-STOP
Z13432 FIL TER 400 13C-PASS / 11B-STOP
Z8831 FIL TER 400 13C-PASS / 15N-STOP
Z107715 FILTER 400 13C-LP(31P)
Z107713 FILTER 400 15N-NR(2H,F-H)
Z8832 FIL TER 400 15N-PASS / 13C-STOP
Z12806 FILTER 400 171YB-PASS / 2H-STO
Z104194 FILTER 400 19F-1H HP(0-31P)
Z13774 FILTER 400 19F-BANDPASS
Z14180 FILTER 400 1H-LP (3H)
Z6849 FILTER 400 205TL-PASS/ 1H-STOP
Z13202 FILTER 400 23NA-PASS /31P-STOP
Z13322 FILTER 400 27AL-PASS /31P-STOP
Z15309 FILTER 400 29SI-BP(0-2H,13C-H)

Filter Part-Numbers

Z13976 FILTER 400 31P-BP(0-11B,19F-H)
Z6840 FILTER 400 31P-PASS / 13C-STOP
Z13323 FILTER 400 31P-PASS /27AL-STOP
Z7785 FILTER 400 57FE PASS / 1H-STOP
Z42408 FILTER 400 6LI-PASS / 2H-STOP

Z13794 FILTER 500 1H-LP (3H)
Z13272 FILTER 500 1H-PASS / 19F-STOP (replaced by Z165601, Sept. 2018)
Z00119 FILTER 500 2H STOP
Z9031 FILTER 500 2H-PASS / 13C-STOP
Z9033 FILTER 500 2H-PASS / 15N-STOP
Z4637 FILTER 500 2H-PASS / 31P-STOP
Z13795 FILTER 500 3H-HP (1H)
Z102949 FILTER 500 0-13C LP (119SN)
Z13332 FILTER 500 0-31P,19F-LP (1H)
Z14334 FILTER 500 0-31P-LP (19F-3H)
Z14299 FILTER 500 117SN-LP (119SN)
Z14300 FILTER 500 119SN-HP (117SN)
Z13114 FILTER 500 11B-PASS / 13C-STOP
Z14067 FILTER 500 13C-BP (0-SI,11B-H)
Z8917 FILTER 500 13C-PASS / 2H-STOP
Z13113 FILTER 500 13C-PASS / 11B-STOP
Z8745 FILTER 500 13C-PASS / 15N-STOP
Z107716 FILTER 500 13C-LP(31P)
Z42638 FILTER 500 13C-PASS /203TL-STP
Z8916 FILTER 500 15N-NR(2H,F-H)
Z8744 FILTER 500 15N-PASS / 13C-STOP
Z13597 FILTER 500 19F-BANDPASS
Z12866 FIL TER 500 19F-PASS / 31P-STOP
Z13346 FIL TER 500 19F-PASS /205TL-STP
Z42639 FILTER 500 203T-PASS / 13C-STP
Z13345 FILTER 500 205TL-PASS /19F-STP
Z104159 FILTER 500 31P-1H HP(13C)
Z14071 FILTER 500 31P-BP(0-11B,19F-H)
Z14973 FILTER 500 31P-HP (2H)
Z6808 FILTER 500 31P-PASS / 13C-STOP

Z13145 FIL TER 500 31P-PASS/29SI-STOP
Z118480 FILTER 500 57FE-NR(2H-1H)
Z13697 FIL TER 500 6LI-PASS / 2H-STOP

Z14042 FILTER 600 1H-LP (3H)
Z13273 FILTER 600 1H-PASS / 19F-STOP (replaced by Z165727, Sept. 2018)
Z6685 FILTER 600 2H STOP
Z9087 FILTER 600 2H-PASS / 13C-STOP
Z9089 FILTER 600 2H-PASS / 15N-STOP
Z8753 FILTER 600 2H-PASS / 19F-STOP
Z14260 FILTER 600 3H-HP (1H)
Z105097 FILTER 600 6Li-LP (2H)
Z13333 FILTER 600 0-31P,19F-LP (1H)
Z14335 FILTER 600 0-31P-LP (19F-3H)
Z100315 FILTER 600 101RU-LP (15N-H)
Z14631 FILTER 600 13C-BP(0-SI,11B-H)
Z9086 FIL TER 600 13C-PASS / 2H-STOP
Z4132 FIL TER 600 13C-PASS / 15N-STOP
Z107714 FILTER 600 13C-LP(31P)
Z9088 FILTER 600 15N-NR(2H,F-H)
Z4131 FIL TER 600 15N-PASS / 13C-STOP
Z13904 FILTER 600 19F-BANDPASS
Z14632 FILTER 600 31P-BP(0-11B,19F-H)
Z15088 FILTER 600 31P-HP (2H)
Z6900 FIL TER 600 31P-PASS / 13C-STOP

Z13900 FILTER 700 1H-BANDPASS
Z14841 FILTER 700 0-13C-LP (31P)
Z13501 FILTER 700 0-31P-LP (19F-3H)
Z14711 FILTER 700 13C-1H-HP(15N)
Z15283 FILTER 700 13C-BP (0-29SI,P-H)
Z13500 FIL TER 700 13C-PASS / 2H-STOP
Z13498 FILTER 700 15N-NR(2H,F-H)
Z13905 FILTER 700 19F-BANDPASS
Z14993 FILTER 700 19F-BP (0-31P,1H)
Z14842 FILTER 700 31P-1H-HP (2H)

Z15105 FILTER 700 31P-BP(0-11B,19F-H)

Z112898 FILTER 750 1H-BP (0-31P,3H)
Z12935 FILTER 750 2H STOP
Z13099 FILTER 750 2H-PASS / 15N-STOP
Z112897 FILTER 750 3H-BP (0-31P,1H)
Z14336 FILTER 750 0-31P-LP (19F-3H)
Z14216 FILTER 750 13C-BP (0-29SI,P-H)
Z41122 FILTER 750 13C-PASS / 2H-STOP
Z12864 FILTER 750 13C-PASS / 15N-STOP
Z12812 FILTER 750 13C-PASS / 31P-STOP
Z41123 FILTER 750 15N-NR(2H,F-H)
Z12865 FILTER 750 15N-PASS / 13C-STOP
Z13906 FILTER 750 19F-BANDPASS
Z15033 FILTER 750 31P-1H HP(2H)
Z12813 FILTER 750 31P-PASS / 13C-STOP

Z7839 FILTER 800 2H-PASS / 15N-STOP
Z13936 FILTER 800 0-13C LP (31P)
Z13937 FILTER 800 0-31P-LP (19F-3H)
Z103187 FILTER 800 13C-BP(0-Si,11B-H)
Z7837 FILTER 800 13C-PASS / 2H-STOP
Z7838 FILTER 800 15N-NR(2H,F-H)
Z13909 FILTER 800 19F-BANDPASS
Z13288 FILTER 800 1H-BP (0-31P,19F)
Z13938 FILTER 800 31P-1H HP (2H)
Z103105 FILTER 800 31P-BP(0-11B, 19F-1H)

Z122536 FILTER 850 1H-BP (0-31P,19F)
Z117428 FILTER 850 13C-BP(0-Si,11B-H)
Z117430 FILTER 850 15N-NR(2H,F-H)
Z122535 FILTER 850 19F-BP (0-31P,1H)
Z117429 FILTER 850 31P-BP(0-11B,19F-1H)
Z104178 FILTER 850 0-31P-LP (19F-3H)

Z13901 FILTER 900 1H-BANDPASS

Z14645 FILTER 900 0-13C-LP (31P)

Z14123 FILTER 900 0-31P-LP (19F-3H)

Z13550 FILTER 900 13C-1H-HP (2H)

Z13551 FILTER 900 15N-NR(2H,F-H)

Z13907 FILTER 900 19F-BANDPASS

Z103107 FILTER 900 31P-BP(0-11B, 19F-1H)

Z106115 FILTER 950 0-31P-LP (19F-3H)

Z106131 FILTER 950 13C-1H-HP (2H)

Z106130 FILTER 950 15N-NR(2H,F-H)

Z109597 FILTER 1000 0-31P-LP (19F-3H)

Z109596 FILTER 1000 13C-1H-HP (2H)

Z109595 FIL TER 1000 15N-NR(2H,F-H)

Filter Part-Numbers

6 Contact

Manufacturer:

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Contact

A Appendix

A.1 Index

Appendix

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