



Betapure™ NT-P Series Pharmaceutical Grade Filters

the next generation in depth filter technology



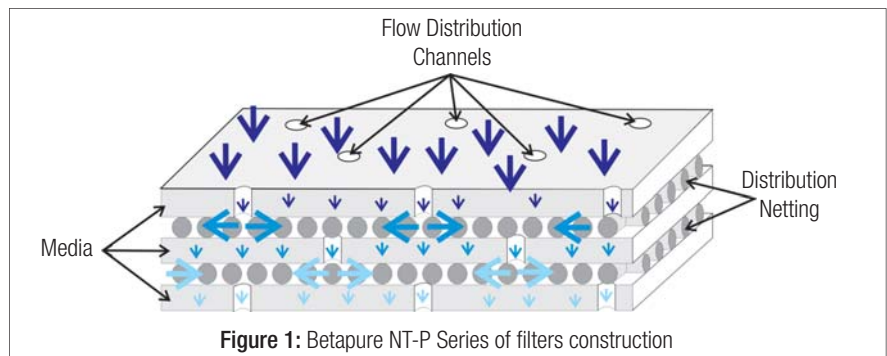
The Next Generation In Depth Filter Technology

Betapure NT-P Series filter cartridges are 3M Purification's advance in depth filtration technology. The all polypropylene filter is constructed using a design that utilises flow enhancing filter media and an innovative flow pattern. The result is an absolute-rated filter with vastly superior on-stream life that provides more cost effective filtration than conventional melt-blown filter technologies. Betapure NT-P Series filter cartridges - the new leader in filtration performance.

Betapure NT-P Series Construction

3M Purification designed the Betapure NT-P Series cartridge to provide significantly superior service life while maintaining a consistent filtration efficiency. Betapure NT-P Series of filters achieve this through an innovative cartridge design that allows uniform distribution of fluid flow and contaminant throughout the entire depth of the cartridge (See Figure 1). Betapure NT-P Series filter construction combines a unique polypropylene media with fluid distribution netting to form multiple layers. Critically positioned media flow channels allow greater movement of fluid from layer to layer. Three distinct media sections, made from multiple media/netting layers, are combined to form the filter cartridge.

The outer and middle sections contain multiple layers of interleaved filter media and fluid distribution netting. Within each media layer a portion of the fluid travels through the media while the balance of the fluid is delivered directly to the next distribution layer through the flow channels. The fluid distribution netting provides longitudinal and latitudinal flow paths to evenly distribute fluid flow across the surface of each successive media layer.



Features and Benefits

- Superior Service Life as much as 4 times greater contaminant holding capacity.
- All polypropylene depth filter cartridges allow for broad chemical and temperature compatibility.
- Ratings from 0.5 - 70 micron suit a wide range of applications.
- Absolute-Rated Performance allows for consistent filtration quality.
- Provided with Certificate of Quality documenting pharmaceutical testing and lot release criteria.

The Difference is Performance

Flow channels appear in the outer and middle sections of the filter matrix, as seen in the cartridge cut-away. The size, number and location of the flow channels combined with the fluid distribution netting ensure that a uniform amount of contaminant is distributed to each layer within these two sections, while maintaining a consistent flow.

The number of media flow channels decrease from the outer to middle sections to ensure even contaminant loading throughout the entire filter matrix. Extensive laboratory testing has demonstrated that 3M Purification has developed the optimal filter cartridge design.

The inner section, supported by a rigid polypropylene core and equal to approximately one third of the filter's depth, contains no flow channels and is the final qualifying section ensuring absolute rated performance.

The even distribution of contaminated fluid throughout the depth of the cartridge is the key to Betapure NT-P Series filters exceptionally long service life, low pressure drop and increased cost effectiveness.



Cut-away of the Betapure NT-P Series filter cartridge showing the three sections of Media layers and core

The Result

Superior Filter Service Life

Extensive testing has demonstrated that competitive filters of equivalent removal ratings subjected to the same contaminant load plug more quickly than Betapure NT-P Series filters. The result is significantly shorter service life and unpredictable filtration efficiencies. Betapure NT-P Series filters provide a service life improvement of up to 3 times greater than competitive products (see Graph 1 on following page).

Lower Pressure Drop

The unique design and construction of the Betapure NT-P Series cartridge allow for significantly lower pressure drops compared to equivalently rated melt-blown depth filters. Based on published data, a Betapure NT-P Series filter system with a given flow would use up to 75% fewer cartridges than Competitor C, 68% fewer than Competitor B, and 42% fewer than Competitor A. To underscore the Betapure NT-P Series filter cost benefit, use the example in Table 1 below as a guideline.

	Betapure NT-P Series Filters	Competitor A	Competitor B	Competitor C
Flow (l/min) / 10" Cartridge at 69 mbar	11.7	6.8	3.8	3.0
Number of Filters for a 416 l/min Flow Rate	12 - 30" Cartridges	21 - 30" Cartridges	37 - 30" Cartridges	43 - 30" Cartridges

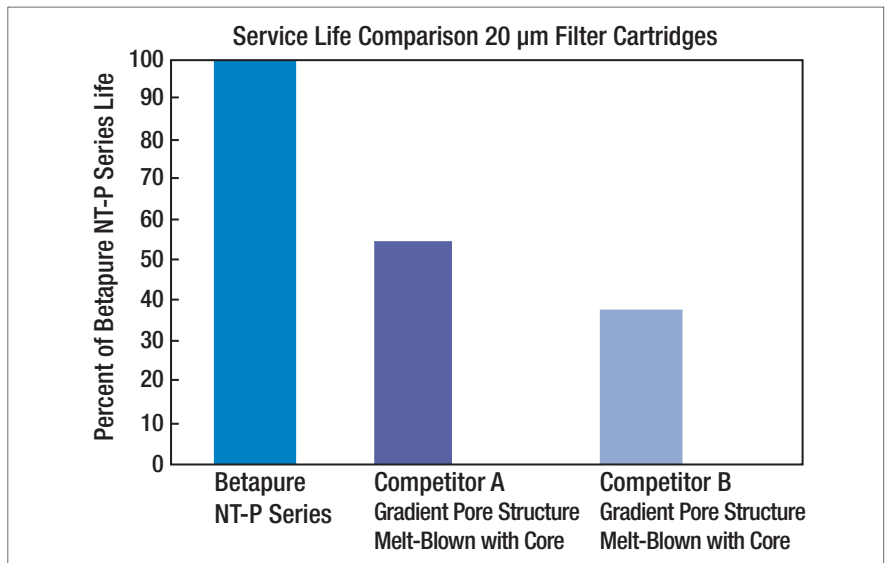
* Based on the manufacturers published rating.

For the same initial cartridge differential pressure, a 416 l/min system using Betapure NT-P Series filters require significantly fewer cartridges. This results in lower capital investment for the filter housing and fewer cartridges to purchase.

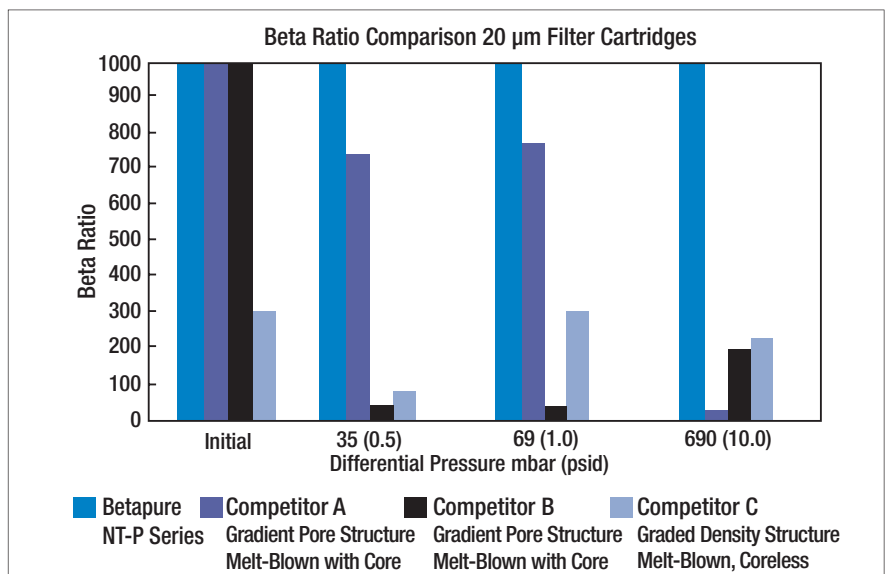


The Confidence of Consistency

Betapure NT-P Series filters utilise advanced design and construction to achieve a level of filtration consistency unattainable by competitive filters. Combined with an exceptionally long service life, the Betapure NT-P Series filter’s consistent performance, as illustrated by comparative Beta-Ratio vs. Differential Pressure (Graph 2), provides predictable results throughout the usable filter life. Filters A, B and C show a degradation in the Beta-Ratio as psid increases. These filters exhibit a pattern of either unloading previously held particles or a loss of filtration efficiency. The result of this inconsistent performance is a reduction in finished product quality, product yield and an increase in total filtration cost.



Graph 1: Betapure NT-P Series filters deliver longer service life



Graph 2: Beta Ratios demonstrate the Betapure NT-P Series filter’s ability to perform consistently throughout its life

Your Benefit - Total Filtration Cost Reduction

The Betapure NT-P Series filter cartridge’s performance and superior life advantage allow direct cost savings by reducing the number of filters used. In addition, the resulting reduction in filter change-out frequency decreases direct labour and filter disposal costs. Betapure NT-P Series cartridge cartridges - providing performance and value.

Absolute Betapure NT-P Series Filter Cartridges

Consistent filtration performance, time after time, from start to finish - the goal of every filter user, the solution provided by Betapure NT-P Series filters. Absolute removal ratings for Betapure NT-P Series filters are determined using a filter performance test developed by 3M Purification to comply with the general procedures outlined in ASTM STP 975. 3M defines absolute rating as the particle size (x) providing an initial Beta Ratio (Bx) = 1000. At this Beta Ratio, the removal efficiency is equal to 99.9%. Betapure NT-P Series filter ratings are specified in Table 2.

Pharmaceutical Testing and Optimisation

Betapure NT-P filters undergo extensive quality testing prior to release, assuring safe and consistent performance in critical applications. Betapure NT-P filter cartridges are manufactured and tested in accordance with an ISO 9001:2000 Quality Management Systems Standard. Betapure NT-P filter cartridges are supplied with a Certificate of Quality for traceability and documentation control. Filter cartridges are marked with a unique lot number to provide full traceability through manufacturing records of raw material components. A Regulatory Support File is available for ease of compliance to regulatory requirements.

Specific bio-safety and effluent quality tests include the following:

- Meets USP Biological Reactivity, In Vivo, for Class VI 121°C Plastics
- Non-pyrogenic per USP Bacterial Endotoxins Test (<0.25 EU/ml)
- Meets oxidisable substances and pH test per USP Purified Water
- Cleanliness - Meets USP Particulates in Injectables limits, microscopic examination of effluent particle counts serve to conform with requirements for non-fibre releasing filter per CFR 21
- Conductivity & Total Organic Carbon (TOC) - Meets requirements of USP Purified Water after flushing

Applications

Increasing emphasis on pharmaceutical process economies and end product purity are driving today's pharmaceutical and biotechnology industries to high technology filtration products that offer tangible performance benefits. Betapure NT-P filters provide high throughput, enabling reduced filter change-outs, longer on-stream service life and significant improvements in overall process economies.

Pharmaceutical

- Large and Small Volume Parenterals (LVP/SVP)
- Fine Chemical/Bulk Pharmaceutical Chemical
- Antibiotics
- Ophthalmics
- Diagnostic Reagents & Buffers
- Orals & Topicals
- Solvent streams

Biologicals & Bioprocessing

- Plasma Fractionation
- Vaccines
- Animal Sera & Media Feeds
- Mammalian Cell Culture
- Bacterial Fermentation
- Downstream Protein Purification
- Pre-column clarification (protection)
- TFF Protection

Facilities & Plant Services

- Deionised Water
- Water-for-Injection Systems (WFI)
- Air/Gas Prefiltration
- Solvent Streams

Table 2: Betapure NT-P Series Filter Ratings

Grade designation	Absolute rating in micron
P005	0.5*
P010	1
P020	2
P030	3
P050	5
P100	10
P200	20
P300	30
P400	40
P500	50
P700	70
* extrapolated	



Filter Housings

3M Purification provides a wide array of filter housings designed to meet the sanitary requirements of the pharmaceutical and biological manufacturing industries. Surface finishes of all sanitary housings are mirror polished 316L stainless steel, providing a high quality, low adhesion surface for full cleanability.

Model	Number of Cartridge	Cartridge Height	Closure Type	Connection Sizes	Maximum Operating Pressure	Maximum Operating Temperature
IW	1, 3, 5, 8	1, 2, 3 & 4 high	Clamped	<ul style="list-style-type: none"> Threaded Male DIN 11851 Triclover DIN 2633 Flanges MACON 	10 bar g	150 °C
	12		Bolted		9 bar g	
	18, 24	3 & 4 high	Bolted		8 bar g	

Betapure NT-P Series Specifications

Materials of Construction*	
Filter Media, Netting, Core, End Connector	Polypropylene
Support Ring	Stainless Steel or Polysulfone
Gaskets & O-ring Options (see ordering guide)	Silicone, Fluorocarbon, EPR, Nitrile, PTFE Encapsulated Fluorocarbon
Operating Conditions	
Maximum Operating Temperature	82 °C 3.4 bar at 30 °C
Maximum Differential Pressure	2.0 bar at 55 °C 1.0 bar at 82 °C
Recommended Change-Out Differential Pressure	2.4 bar at 30 °C
<i>In-situ</i> steam sterilisation	Maximum ten (10) 1 hour cycle at 126 °C
Hot water sanitation	100 hours at 90 °C
Cartridge Dimensions	
Inside Diameter	28 mm
Outside Diameter	64 mm
Length	9 ¾", 10", 19 ½", 20", 29 ¼", 30", 39" and 40"
* All materials are FDA compliant per 21 CFR	

Table 3 : Betapure NT-P Series Flow Rates

Grade	Absolute Rating (µm)	Specific Pressure Drop per 10" Cartridge*
		mbar/litre per min/cps
P005	0,5	81.9
P010	1	45.5
P020	2	15.9
P030	3	8.0
P050	5	5.9
P100	10	2.5
P200	20	1.2
P300	30	0.91
P400	40	0.76
P500	50	0.52
P700	70	0.45

* Specific aqueous pressure drop at ambient temperature for a single length equivalent (10") cartridge. For multiple cartridge lengths, divide the total flow by the number of equivalent lengths. For liquids other than water, multiply the specific pressure drop value provided in the table by the viscosity in centipoises.

Flow Rates

Flow vs. differential pressure in water is depicted for each Betapure NT-P Series filter grade in the graph below. Detailed information for calculating flows for fluids with other viscosities is located in the following table. Use the formula in conjunction with the values from columns 3 or 4 in table 3. The specific pressure drop values may be effectively used when three of the four variables (viscosity, flow, differential pressure, and cartridge grade) are set.

$$\Delta p \text{ (psi)} = \frac{\left(\frac{\text{Total system}}{\text{l/min (gpm)}} \right) \left(\frac{\text{Viscosity in}}{\text{cP}} \right) \left(\frac{\text{Value from}}{\text{table}} \right)}{\left(\frac{\text{Number of Equivalent Single Length Cartridges in}}{\text{housing}} \right)}$$

Chemical Compatibility

The 100% polypropylene construction provides excellent chemical compatibility in many demanding process fluid applications. Compatibility is influenced by process operating conditions: in critical applications, cartridges should be tested under actual conditions to ensure correct selection.

Scientific Application Support Services (SASS)

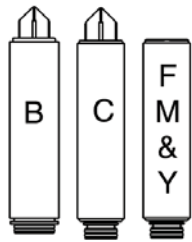
Dedicated technical support teams comprised of 3M scientists and engineers are available to provide application specific recommendations for the most effective and economical filtration system. In addition to comprehensive testing and analysis conducted at 3M's advanced laboratories, the SASS staff frequently performs on-site testing at customer's facilities. Contact your 3M Purification representative for additional information.



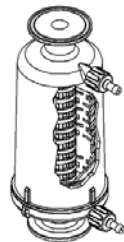
Betapure NT-P Series Ordering Guide

Cartridge Type	Length	Grade Code	Grade Rating (µm)	Packaging Option	Support Ring Option	End Modification	Gasket/O-ring Material
NT - Betapure NT-P Series	06 - 5"	P005	0,5	S - Standard	0 - None 1 - Polysulfone 2 - Stainless Steel	B - 226 O-ring with spear C - 222 O-ring with spear F - 222 O-ring with flat cap M - 222 O-ring with Flat Cap Y - Single O-ring (40" Length Only)	A - Silicone B - Fluorocarbon C - EPR D - Nitrile K - PTFE Encapsulated Fluorocarbon
	09 - 9 ¾"	P010	1				
	10 - 10"	P020	2				
	19 - 19½"	P030	3				
	20 - 20"	P050	5				
	29 - 29 ¼"	P100	10				
	30 - 30"	P200	20				
	39 - 39"	P300	30				
	40 - 40"	P400	40				
		P500	50				
	P700	70					

Cartridge End Modifications



Capsule Example



Betapure NT-P Series Capsule Ordering Guide

Cartridge Type	Grade Code	Grade Rating (µm)	Configuration	Nominal Length	End Modification	Vent O-ring Option	Packaging Option
NT - Betapure NT-P Series	P005	0,5	C - Capsule	01 - 2 ½" 02 - 5"	A - 1½" sanitary Flange B - ½" (14mm) Hose Barb C - ¼" MNPT D - 3/8" FNPT E - ¼" - 5/16" - 3/8" Tapered Hose Barb	A - Silicone B - Fluorocarbon C - EPR	01 - Single Pack 03 - 3-Pack 20 - 20-Pack
	P010	1					
	P020	2					
	P030	3					
	P050	5					
	P100	10					
	P200	20					
	P300	30					
	P400	40					
	P500	50					
P700	70						

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3M Purification MAKES NO WARRANTIES, EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. Since a variety of factors can affect the use and performance of a 3M Purification product in a particular application, some of which are uniquely within the user's knowledge and control, user is responsible for determining whether or not the 3M Purification product is fit for a particular purpose and suitable for user's method of application.

Limited Warranty

3M Purification warrants it this product to be free from defects in material and workmanship during normal use for a period of one (1) year from the date of shipment from the factory. If the Product(s) is (are) defective within this warranty period, your exclusive remedy and 3M Purification's sole obligations shall be, at 3M Purification's option, to replace or repair the Product(s) or refund the original purchase price of the Product(s) This warranty does not apply to failures that result from abuse, misuse, alteration or damage not caused by 3M Purification or failure to properly follow installation and use instructions.

Limitation of Liability: 3M Purification will not be liable for any loss or damage arising from the use of the Product(s), whether direct, indirect, special, incidental, or consequential, regardless of the legal theory asserted, including warranty, contract, negligence or strict liability. Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation may not apply to you.

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