

# Arnitel® VT EXTRUSION GRADES

## TPC

Print date: 2024-03-06

### Grade coding

Arnitel® VT Extrusion Grades.

### **MATERIAL HANDLING**

#### Storage

To prevent moisture pick up and contamination, supplied packaging should be kept closed and undamaged. For the same reason, partial bags should be sealed before re-storage. Allow the material that has been stored elsewhere to adapt to the temperature in the processing room while keeping the bag closed.

#### Packaging

Arnitel® VT Extrusion Grades are supplied in airtight, moisture-proof packaging.

#### Moisture content as delivered

Arnitel® VT Extrusion Grades are packaged at a moisture level  $\leq 0.05$  w%.

#### Conditioning before molding

To prevent moisture condensing on granules, bring cold granules up to ambient temperature in the extrusion shop while keeping the packaging closed.

#### Moisture content before extrusion

Since Arnitel® VT Extrusion Grades are delivered at molding moisture specification ( $\leq 0.05$  w%), the resin can be extruded without pre-drying. However, to overcome the fluctuation from package to package we advise to pre-dry (see drying section below). Furthermore, pre-drying is required in case the material is exposed to moisture before molding (package damage or open for longer period). Moisture content can be checked by water evaporation methods or manometric methods (ISO 15512).

#### Drying

Arnitel® VT Extrusion Grades are hygroscopic and absorb moisture from the air relatively quickly. Preferred driers are de-humidified driers with dew points maintained between  $-30$  and  $-40^{\circ}\text{C}$  /  $-22$  and  $-40^{\circ}\text{F}$ . Vacuum driers with  $\text{N}_2$  purge can also be used. Hot air ovens or hopper driers are not suitable for pre-drying Arnitel® VT Extrusion Grades; the use of such driers may result in non-optimum performance. Table 1 enlists the preferred drying conditions, depending on moisture content, for Arnitel® VT Extrusion Grades. Be aware that granules typically require a heat up time of 1 h during the first stage of drying. Arnitel® VT Extrusion Grades are preferably dried at  $80^{\circ}\text{C}$ , the material should not be dried at temperatures above  $110^{\circ}\text{C}$ .

All the trademarks mentioned here are trademarks of Envalior.

Seller represents and warrants exclusively that on the date of delivery by Seller the product shall be in conformity with the specifications agreed upon. Seller makes no other representations or warranties, whether express or implied.

Seller is not responsible or liable for the design of the products of the Customer and it is the responsibility of the Customer to determine that the Seller's product is safe, complies with application laws and regulations, and is technically or otherwise fit for its intended use. Seller does not endorse or claim suitability of its products for a specific application and disclaims each and every representation or warranty, whether express or implied, in that respect.

Typical values are indicative only and are not to be construed as being binding specifications. Colorants in the product or other additives may cause significant variations in typical values.

Copyright © Envalior 2023. All rights reserved. No part of the information may be reproduced, distributed, or transmitted in any form or by any means, including photocopying, recording, or other electronic or mechanical methods, without the prior written permission of Envalior.

# Arnitel® VT EXTRUSION GRADES

Print date: 2024-03-06

## Drying conditions

Moisture content [%]	Time* [h]	Temperature	
		[°C]	[°F]
Arnitel® VT <0.05 and as delivered	4-8	80	176
Arnitel® VT (open bag) 0.05 – 10	24	100	212
Arnitel® VT (open bag) > 10	72	100	212

## **MACHINERY**

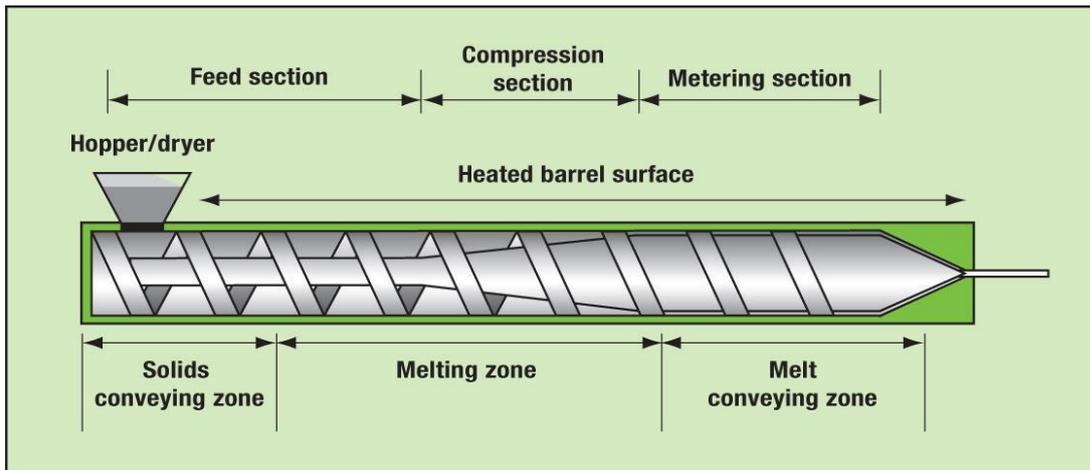
Conventional single screw extruders can be used for the extrusion processing of Arnitel®.

### Extruder barrel

Extruder barrels for polyamide, polyester and polyolefins are usually suitable for Arnitel®. Barrels with axial grooves and intense cooling of the intake zone require special attention during startup and cooling should be avoided.

### Screw design

Good melt quality can be obtained with conventional single screw extruders equipped with a 3-zone screw as shown in the figure below. However well-designed barrier screw achieves the best results in terms of melt quality without any possibility of any part of unmolten polymer. Also, a mixing device at the end of the metering section enforces a homogenous melt temperature.



All the trademarks mentioned here are trademarks of Envalior.

Seller represents and warrants exclusively that on the date of delivery by Seller the product shall be in conformity with the specifications agreed upon. Seller makes no other representations or warranties, whether express or implied.

Seller is not responsible or liable for the design of the products of the Customer and it is the responsibility of the Customer to determine that the Seller's product is safe, complies with application laws and regulations, and is technically or otherwise fit for its intended use. Seller does not endorse or claim suitability of its products for a specific application and disclaims each and every representation or warranty, whether express or implied, in that respect.

Typical values are indicative only and are not to be construed as being binding specifications. Colorants in the product or other additives may cause significant variations in typical values.

Copyright © Envalior 2023. All rights reserved. No part of the information may be reproduced, distributed, or transmitted in any form or by any means, including photocopying, recording, or other electronic or mechanical methods, without the prior written permission of Envalior.

# Arnitel® VT EXTRUSION GRADES

Print date: 2024-03-06

Length to diameter ratios of 25 or higher provides the best melt quality.

The compression ratios should be between 2.4 and 3.2, determined by the depth of the feed section divided by the depth of the metering section. For continuous extrusion a ratio of 3 is preferred.

The channel depth of both the feed and metering section is important. If the feed channel is too deep and not long enough, particularly with large diameter screws, poor feeding and loss of output can be the result.

If the metering channel is too deep, insufficient pressure will be built up resulting in irregular output, particularly with low viscosity grades. A metering channel, which is too shallow can result in overheating of the melt due to high shear, particularly with high-viscosity types.

Characteristic design parameters 3-zone screw					
Screw length		25 – 30			
Pitch		1D			
Extruder diameter	[mm]	30	45	60	90
<b>Length section</b>					
Feed section	D	7 – 10	7 – 10	7 – 10	7 – 10
Compression section	D	4 – 6	4 – 6	4 – 6	4 – 6
Metering section	D	4 – 11	4 – 11	4 – 11	4 – 11
<b>Channel depth</b>					
Feed section	[mm]	6	7	11	17
Metering section	[mm]	2	2.5	4	5

**All the trademarks mentioned here are trademarks of Envalior.**

Seller represents and warrants exclusively that on the date of delivery by Seller the product shall be in conformity with the specifications agreed upon. Seller makes no other representations or warranties, whether express or implied.

Seller is not responsible or liable for the design of the products of the Customer and it is the responsibility of the Customer to determine that the Seller's product is safe, complies with application laws and regulations, and is technically or otherwise fit for its intended use. Seller does not endorse or claim suitability of its products for a specific application and disclaims each and every representation or warranty, whether express or implied, in that respect.

Typical values are indicative only and are not to be construed as being binding specifications. Colorants in the product or other additives may cause significant variations in typical values.

Copyright © Envalior 2023. All rights reserved. No part of the information may be reproduced, distributed, or transmitted in any form or by any means, including photocopying, recording, or other electronic or mechanical methods, without the prior written permission of Envalior.

# Arnitel® VT EXTRUSION GRADES

Print date: 2024-03-06

## PROCESSING TEMPERATURES

Typical processing temperatures of Arnitel® Extrusion coating grades are mentioned below in the table.

Category	Zone 1 Setpoint [°C] [°F]	Zone 2 Setpoint [°C] [°F]	Zone 3 Setpoint [°C] [°F]	Zone 4 Setpoint [°C] [°F]	Adapter Setpoint [°C] [°F]	Die Setpoint [°C] [°F]
1	160-180 320-356	180-200 356-392	200-220 392-428	210-225 410-439	225 439	215 419
2	160-180 320-356	190-210 374-410	210-230 410-446	215-230 419-446	230 446	215 419
3	200-210 392-410	210-220 410-428	220-230 426-446	220-230 426-446	230 446	220 428
4	200-210 392-410	210-220 410-428	220-235 426-455	220-235 426-455	235 455	220 428

## ADDITIONAL INFORMATION REGARDING PROCESSING

### **VT3118:**

For Arnitel VT3118 blown film we advise the temperature profile of category 2. This profile is suitable to achieve a stable bubble and the required BUR.

There is no de-blocking MB necessary, because separation of the film is no issue.

It is possible to add a micro talc MB in case separation issues would occur.

Micro talc creates no disturbances like holes or gels during processing.

For cast films category 2 would be suitable to, but due to the high viscosity of this grade, increasing the temperature settings slightly will be beneficial to reduce the load/pressure (category 3).

Production of thinner films approximately 10 µm is possible without problems. In general, due to the elasticity handling can be more critical.

### **VT3108:**

For Arnitel VT3108 we advise the temperature profile of category 2. VT3108 is mainly designed for cast film process.

Calcium stearate is used as a slip agent to create a better release from rolls and to provide a lubricant against stationary components in the web, especially sliding blocks in a collapsing frame for blown film.

The typical master batch concentration used is around 1 wt-%.

**All the trademarks mentioned here are trademarks of Envalior.**

Seller represents and warrants exclusively that on the date of delivery by Seller the product shall be in conformity with the specifications agreed upon. Seller makes no other representations or warranties, whether express or implied.

Seller is not responsible or liable for the design of the products of the Customer and it is the responsibility of the Customer to determine that the Seller's product is safe, complies with application laws and regulations, and is technically or otherwise fit for its intended use. Seller does not endorse or claim suitability of its products for a specific application and disclaims each and every representation or warranty, whether express or implied, in that respect.

Typical values are indicative only and are not to be construed as being binding specifications. Colorants in the product or other additives may cause significant variations in typical values.

Copyright © Envalior 2023. All rights reserved. No part of the information may be reproduced, distributed, or transmitted in any form or by any means, including photocopying, recording, or other electronic or mechanical methods, without the prior written permission of Envalior.

# Arnitel® VT EXTRUSION GRADES

Print date: 2024-03-06

During cast film production the sticking behavior on the chill roll should be critically observed. Measures to reduce or overcome sticking to the rolls are as follows:

- The chill roll is preferably set at lower temperature (20-30°C)
- Create a rough surface (sand blasted or embossed) to reduce the contact surface of the material to the metal roll.
- Alternative is a Siliconized or PTFE chill roll.
- Adding 1 wt-% of Ca Stearate will reduce this sticking behaviour and creates no holes or gels during processing.

Production of thinner films than 20 µm is more challenging because of winding a very elastic material. The DDR is typical 1,5-2,0: die opening for the blown film is maximum 1,5 mm.

## **VT3104:**

This grade is mostly used for cast film production and the preferred temperature setting are in category 3. Adding 1% of Ca Stearate masterbatch will reduce this sticking behavior and creates no hole or gels during processing. (See information VT3108).

## **VT7812:**

This grade is high viscous grade and is very moisture sensitive. The temperature profile for this grade is category 4. An anti-blocking MB is most likely necessary. Micro talc is normally used for this AB functionally with a maximum concentration of approx. 1 wt-%.

## **ADDITIONAL INFORMATION**

### **Effect of Moisture on Properties**

Essentially all thermoplastics undergo some deterioration in properties when melt processed due to degradation. In Arnitel®, the level of degradation is a function of the melt temperature, the residence time in the melt and the moisture level prior to processing. Over-shearing the polymer can also increase the amount of degradation by locally increasing the melt temperature.

In general, the following holds true for the effect of moisture on the degradation of Arnitel® resins:

1. At low melt temperatures even very high moisture levels and long residence times have minimal effect on the viscosity.
2. When high melt temperatures are used low moisture levels are required.
3. For critical applications (i.e. thin film) precautions must be taken to assure that the resin is kept very dry throughout the processing run.

**All the trademarks mentioned here are trademarks of Envalior.**

Seller represents and warrants exclusively that on the date of delivery by Seller the product shall be in conformity with the specifications agreed upon. Seller makes no other representations or warranties, whether express or implied.

Seller is not responsible or liable for the design of the products of the Customer and it is the responsibility of the Customer to determine that the Seller's product is safe, complies with application laws and regulations, and is technically or otherwise fit for its intended use. Seller does not endorse or claim suitability of its products for a specific application and disclaims each and every representation or warranty, whether express or implied, in that respect.

Typical values are indicative only and are not to be construed as being binding specifications. Colorants in the product or other additives may cause significant variations in typical values.

Copyright © Envalior 2023. All rights reserved. No part of the information may be reproduced, distributed, or transmitted in any form or by any means, including photocopying, recording, or other electronic or mechanical methods, without the prior written permission of Envalior.

# Arnitel® VT EXTRUSION GRADES

Print date: 2024-03-06

## **Cast film:**

In the cast film process, molten Arnitel® is extruded through a slit die onto a metal roll, usually known as the “quench roll” or “chill roll”, which serves to quench the hot melt. From the quench roll, the film passes around a series of other rolls designed to guide and keep it wrinkle-free at windup. This process provides a high degree of control over film properties and thicknesses. Arnitel® films are typically run with a die gap between 16 and 30 times greater than the finished film. Film thickness is controlled by the relationship between the extruder output and surface speed of the quench roll. Films of Arnitel® engineering thermoplastic elastomer as thin as 0.010 mm have been made with this method.

The thinner the film and the more flexible the grade of Arnitel®, the more critical is the tension control in order to produce a uniformly wound roll of wrinkle-free film. Of course, air jets can be used to pin the edges of the melt web to the chill roll, to minimize edge weaving and to reduce neck-in.

Trimming or slitting of thin, flexible films also requires precise tension control. The best results have been obtained by isolating the slitting location from any vibrations or variations in tension that can be created by the wind up or trim removal systems. Driven rolls on both sides of the slitting location are recommended.

If the power of the machine reaches the maximum power of the extruder:

Increase overall barrel temperature or shift from an increasing barrel temperature profile to a decreasing temperature profile (when having a grooved intake zone) by increasing the temperature at the intake/feed zone(s) → inverse/reverse temperature profile.

A melt sieve can be used in case the extruder pressure become too low (<100 bars).

It is possible to use a support film during the cast film process (for example PP or siliconized paper) to avoid the sticking behavior on the chill roll and improving handling of the thin films. These support film will improve the mechanical performance.

## **Blown Film**

Due to the elastomeric nature of Arnitel, the bubble must be inflated carefully and gradually in order to avoid bulges in the bubble. This elasticity can also cause the bubble to stick to the collapsing frame and to itself. To avoid sticking to the collapsing frame, a low friction, textile lining can be attached. To keep the film from sticking to itself, anti-blocking additives, which do not effect secondary lamination or printing operations, are available by contacting your Envalior representative. The exact blow-up ratio will depend on the equipment and process conditions. However, ratios of 1.8 and 2.5:1 are typical. Winding the softer grades usually requires accurate control of low tensions. This again is due to the elasticity of the film.

## **Melt temperature**

It is advised to measure the melt temperature by inserting a thermocouple into the melt (handheld) to assure that the real melt temperature is at the desired level to take into account the induced heat by the shear energy of the screw.

### **All the trademarks mentioned here are trademarks of Envalior.**

Seller represents and warrants exclusively that on the date of delivery by Seller the product shall be in conformity with the specifications agreed upon. Seller makes no other representations or warranties, whether express or implied.

Seller is not responsible or liable for the design of the products of the Customer and it is the responsibility of the Customer to determine that the Seller's product is safe, complies with application laws and regulations, and is technically or otherwise fit for its intended use. Seller does not endorse or claim suitability of its products for a specific application and disclaims each and every representation or warranty, whether express or implied, in that respect.

Typical values are indicative only and are not to be construed as being binding specifications. Colorants in the product or other additives may cause significant variations in typical values.

Copyright © Envalior 2023. All rights reserved. No part of the information may be reproduced, distributed, or transmitted in any form or by any means, including photocopying, recording, or other electronic or mechanical methods, without the prior written permission of Envalior.

# Arnitel® VT EXTRUSION GRADES

Print date: 2024-03-06

## SAFETY

For the safety properties of the material, we refer to our SDS which can be ordered at our sales offices. During practical operation, it is recommended to wear personal safety protections for hand/eye/body.

## STARTUP/SHUT DOWN/CLEANING

Production must be started and stopped with a clean machine. Cleaning can be done with all Arnitel® VT Extrusion Grades, applicable cleaning agents or high viscous HDPE. (MI<2).

For brief shutdowns of 20 minutes or less, no action is required, other than a short purge with new resin after start-up. If the extruder is to be shut down for longer periods, empty the barrel and turn off the heat controllers or keep running at low rpm (5rpm) during production interruptions via the start-up valve.

If the extruder is so equipped, barrel cooling may be used to cool the residual melt rapidly and prevent polymer degradation. During the next start-up, any material contained in the screw should be expelled and not used. Venting of gases that may be generated should be considered (see "Safety Precautions"). Purging with polyethylene or other polymers is not normally advised, except when other resins from previous running need to be removed, or just prior to strip-down of the equipment for cleaning. It can take a long period after start-up to completely eliminate traces of polyethylene from the Arnitel®. Any purging should be done with temperatures set to a value that is above the melting point of the resin being purged. Special purging compounds (e.g., cast-acrylic resins) may be used to purge the extruder. Since these cross-linked materials do not melt but only soften, it is necessary to remove the die, screens, and breaker plate before purging. If this is not done, unsafe amperages and pressures may result that may damage the machine or injure the operators.

Always wear personal safety protections for hand/eye/body.

## TROUBLESHOOTING

Contact Envalior in case more information is required from the aspect of material or processing.

### All the trademarks mentioned here are trademarks of Envalior.

Seller represents and warrants exclusively that on the date of delivery by Seller the product shall be in conformity with the specifications agreed upon. Seller makes no other representations or warranties, whether express or implied.

Seller is not responsible or liable for the design of the products of the Customer and it is the responsibility of the Customer to determine that the Seller's product is safe, complies with application laws and regulations, and is technically or otherwise fit for its intended use. Seller does not endorse or claim suitability of its products for a specific application and disclaims each and every representation or warranty, whether express or implied, in that respect.

Typical values are indicative only and are not to be construed as being binding specifications. Colorants in the product or other additives may cause significant variations in typical values.

Copyright © Envalior 2023. All rights reserved. No part of the information may be reproduced, distributed, or transmitted in any form or by any means, including photocopying, recording, or other electronic or mechanical methods, without the prior written permission of Envalior.