Macromelt Molding

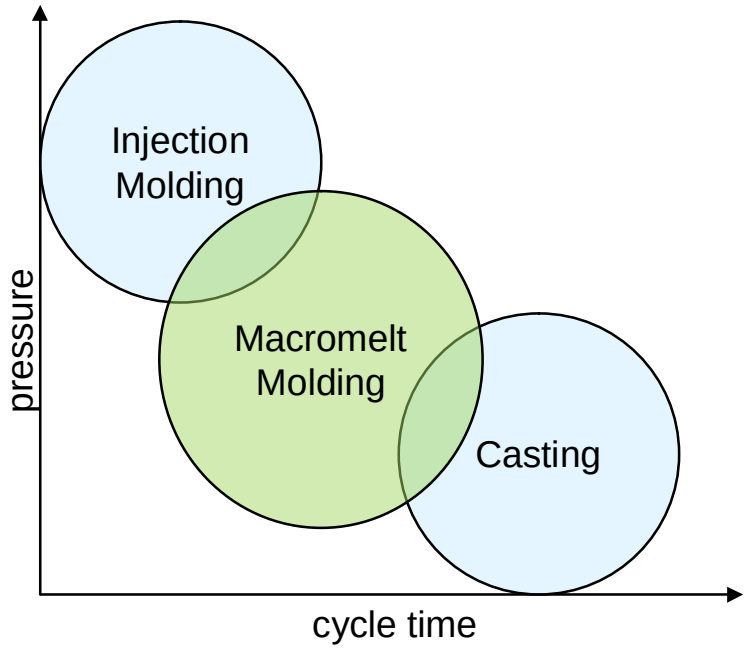
Agenda

1. Technology Introduction & Benefits
2. Product Range
3. Typical Project Procedure
4. Equipment
5. Design Guidelines
6. Contacts & Further Information

1. Technology Introduction & Benefits

What is Macromelt Molding?

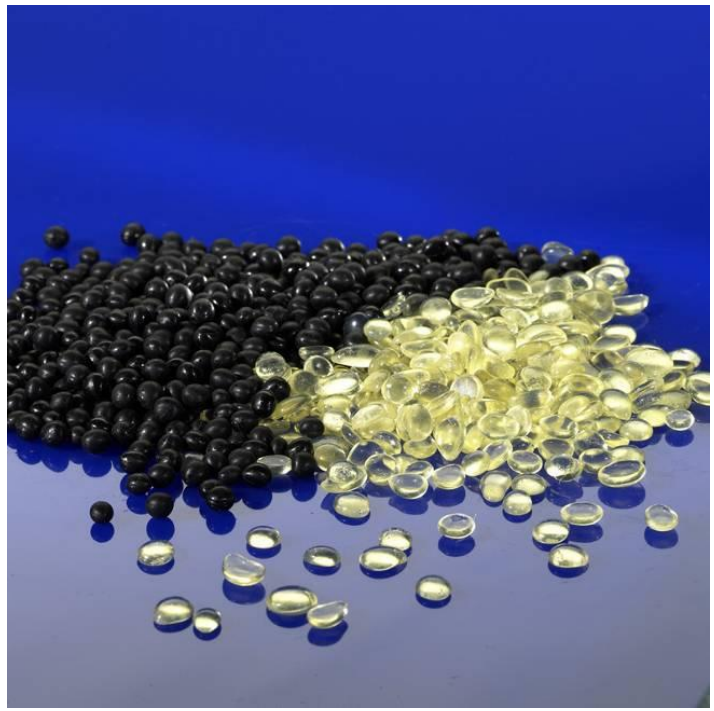
- Macromelt Molding = **Low Pressure, Adhesive, Injection Molding**
- A process innovation positioned between casting and injection molding technologies



1. Technology Introduction & Benefits

Technology Background

- High performance polyamide hotmelts
- Solvent free, no safety labels
- >50% of raw materials are based on renewables (vegetable oils)
- Long shelf life (2+ years)
- Standard colors: black and amber



1. Technology Introduction & Benefits

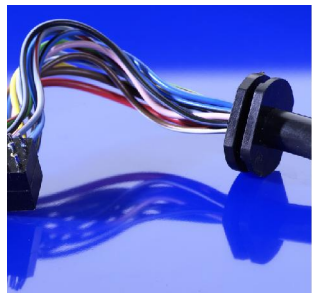
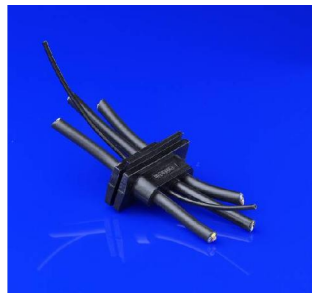
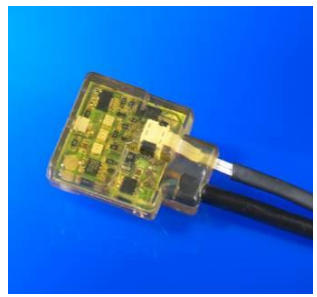
Typical Applications

1. Encapsulation of Connectors
- To protect against heat, water, dust
- To obtain strain relief

2. Grommets / Sockets
- To obtain strain relief
- To fix molded part in correct position

3. Encapsulation of Electronic Devices
- To protect against heat, water, dust




1. Technology Introduction & Benefits

And Many Other Applications...

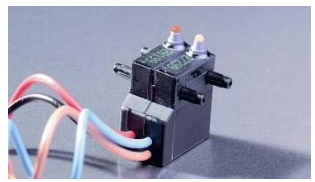
- Medical connector

- Induction electronic switch

- Control unit for small E-Motors

- Socket for heating unit

- Signal light for filling quantities



- Micro switches

1. Technology Introduction & Benefits

Technical Features

- **Low Pressure**
  - Injection pressure between 2 and 40 bar
  - No damage of electronic parts
  - Molds can be made of aluminum (low costs)
- **Adhesive**
  - To manufacture electrical devices which are water tight
  - To fix molded part in correct position
  - To obtain strain relief on cables
  - Products based on natural raw materials – environmentally compatible
- **Injection Molding**
  - Cycle times typically between 10 and 50 seconds
  - Allows higher output than with casting applications
  - Clean and simple to use process

1. Technology Introduction & Benefits

Benefits

- **Cost Savings**
  - Molds can be made of aluminum instead of steel
  - Less adhesive needed compared to traditional casting
  - Saves energy by eliminating the heat curing process
- **Time Savings**
  - Fast cycle times (10 to 50 seconds); no extra time for curing
  - Simple and clean process with low machine maintenance needs
- **Production Space Savings**
  - No space needed for case storage and curing

2. Product Range

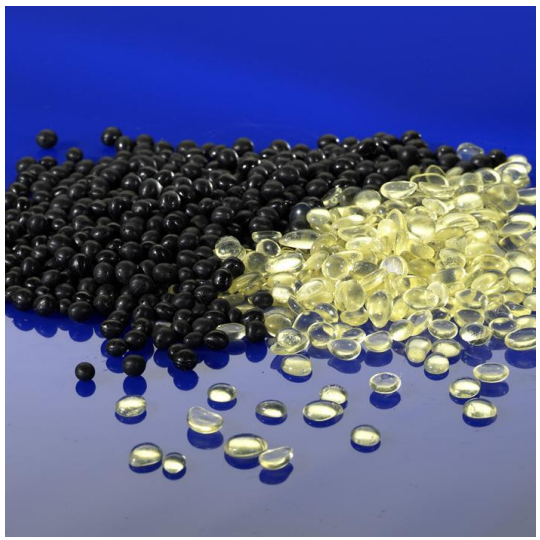
Our Standard Product Range

Properties	Macromelt OM 652/657	Macromelt OM 633/638	Macromelt OM 673/678
Technology	polyamide	polyamide	polyamide
Color	amber/black	amber/black	amber/black
Service temperature range in °C	-40 to +100	-40 to +130	-40 to +140
Cold flexibility in °C	-50	-30	-40
Application temperature range in °C	+180 to +230	+200 to +240	+210 to +240
Shore hardness	A 77	A 90	A 90
Adhesion (example: adhesion to PA)	+++	++	+
Elongation at break in %	400	300	400
Remarks	UL94-V0, Good cold flexibility	UL94-V0	UL94-V0

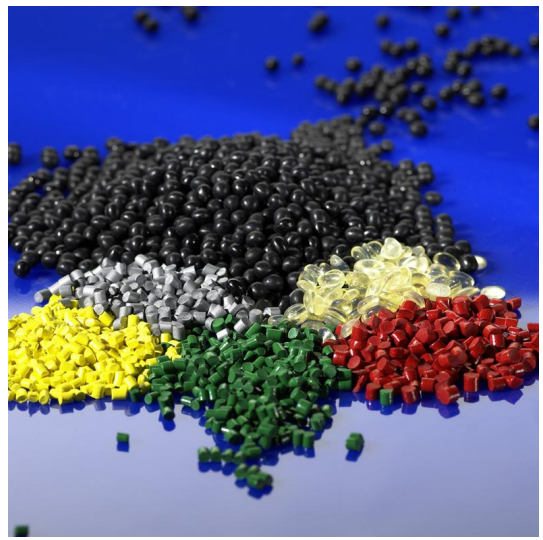
2. Product Range

Colors

- Henkel standard colors are amber or black



- Via colored master batches* you can achieve almost every color you need



*** Available from selected molding partners**

2. Product Range

Order Information for Direct Customers

Product Name	Color	Packaging	Henkel IDH Number
Macromelt OM 652	amber	20 kg bag	273329
Macromelt OM 657	black	20 kg bag	251715
Macromelt OM 633	amber	20 kg bag	122242
Macromelt OM 638	black	20 kg bag	79123
Macromelt OM 673	amber	20 kg bag	319194
Macromelt OM 678	black	20 kg bag	319193

2. Product Range

Our Standard Product Range

Properties	Macromelt OM 652/657	Macromelt OM 633/638	Macromelt OM 673/678	Macromelt Q 5375
Technology	polyamide	polyamide	polyamide	polyolefin
Color	amber/black	amber/black	amber/black	white-light-beige
Service temperature range in °C	-40 to +100	-40 to +130	-40 to +140	-30 to +85
Cold flexibility in °C	-50	-30	-40	-30
Application temperature range in °C	+180 to +230	+200 to +240	+210 to +240	+160 to +200
Shore hardness	A 77	A 90	A 90	A 50
Adhesion (example: adhesion to PA)	+++	++	+	+++
Elongation at break in %	400	300	400	400
Remarks	UL94-V0, Good cold flexibility	UL94-V0	UL94-V0	superior adhesion to PP, PE, PET

2. Product Range

Our Product Innovations:

Macromelt OM 653 – high moisture resistance

- **Applications**
  - Any kind of electronics (e.g. circuit boards, electronic components, sensors, control systems) which should be protected against environmental influences like the 85/85 test (85°C; 85% humidity, 1.000 h)

- **Characteristics**
  - Suitable for a temperature range of -40°C to +100°C
  - Adheres to polar plastic like PA, ABS and PVC
  - Maintains stable mechanical values after 85/85 test

2. Product Range

Our Product Innovations:

Macromelt 6208 / 6208 S – RTI listed

- **Applications**
  - Any kind of electronics (e.g. circuit boards, electronic components, sensors, control systems) which need to be protected against environmental conditions.

- **Characteristics**
  - Suitable for a temperature range of -40°C to +100°C
  - Adheres to polar plastic like PA, ABS and PVC
  - RTI 95°C
  - Macromelt 6208 S fully UL listed with HAI, HWI, RTI, CTI, UL94

2. Product Range

Our Product Innovations:

Macromelt OM 641 / OM 646 – for big parts

- **Applications**
  - Any kind of electronics (e.g. circuit boards, electronic components, sensors, control systems) which need to be protected against environmental conditions. Is often used for bigger parts because of the high elongation at break.

- **Characteristics**
  - Suitable for a temperature range of -40°C to +130°C
  - Adheres to polar plastic like PA, ABS and PVC
  - Elongation at break 650 %

2. Product Range

Our Product Innovations:

Macromelt OM 648 – UV stabilized

- **Applications**
  - Any kind of electronics (e.g. circuit boards, electronic components, sensors, control systems) which need to be protected against weather and UV-radiation. Typical examples are grommets and plugs molded for solar connection cables and the molding of solar connection boxes.

- **Characteristics**
  - UV-stabilized and weatherproof
  - Adaptable to optical requirements
  - Process approved and clean handling
  - Eliminates the application of plastic housings due to its “plastic like” attributes
  - Shorten the cycle times for the injection-molding compared to 2-component casting

2. Product Range

Our Product Innovations:

Macromelt OM 730 – reactive PA, high temp. resistance

- **Applications**
  - Any kind of electronics (e.g. circuit boards, electronic components, sensors, control systems) which need to be protected against environmental conditions and high temperatures
  - Foil bag adhesive applicator, Cleaner: Purmelt Cleaner 2

- **Characteristics**
  - Remains inherently stable up to more than +200°C
  - Short-term stability up to +270°C
  - Applicable in processes with reflow-soldering

2. Product Range

Our Product Innovations Polyamide Basis:

Properties	Macromelt OM 653	Macromelt 6208/6208 S	Macromelt OM 641/646	Macromelt OM 648
Color	amber	amber/black	amber/black	black
Service temperature range in °C	-40 to +100	-40 to +100	-40 to +130	-40 to +130
Cold flexibility in °C	-50	-40	-35	-30
Application temperature range in °C	+180 to +230	+180 to +230	+200 to +240	+200 to +240
Shore hardness	A 77	A 82	A 92	A 93
Adhesion (example: adhesion to PA)	+++	+++	+	+
Elongation at break in %	400	600/450	650	550
Remarks	-	UL94-V0	UL94-V0	-

2. Product Range

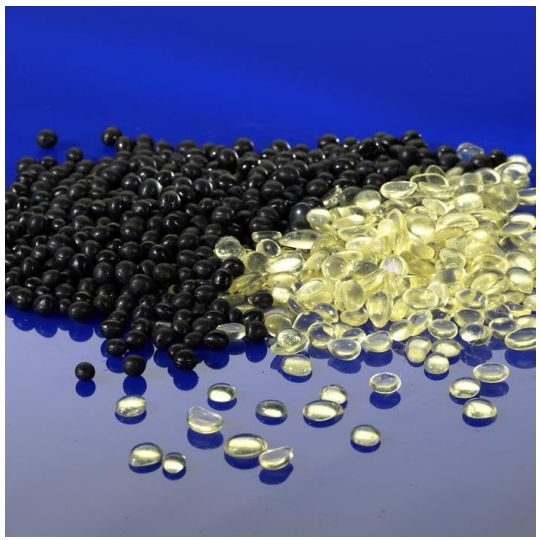
Our Product Innovation on PAX Hotmelt Basis:

Properties	Macromelt OM 730
Color	amber
Service temperature range in °C	-20 to +150
Cold flexibility in °C	-15
Application temperature range in °C	+200 to +240
Shore hardness	D 42
Adhesion (example: adhesion to PA)	-
Elongation at break in %	150

2. Product Range

Colors

- Henkel standard colors are amber or black



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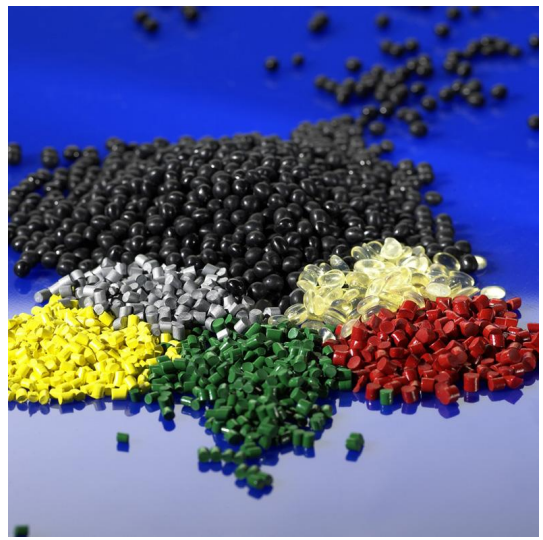

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Macromelt OM 678	black	20 kg bag	319193
Macromelt Q 5375	white-light-beige	25 kg box	1114447
Macromelt OM 653	amber	20 kg bag	1410385
Macromelt 6208	amber	20 kg bag	114369
Macromelt 6208 S	black	20 kg bag	36580
Macromelt OM 641	amber	20 kg bag	122243
Macromelt OM 646	black	20 kg bag	1055521
Macromelt OM 648	black	20 kg bag	1066640
Macromelt OM 730	amber	12 kg box	1321568

3. Typical Project Procedure

1. Collect the requirements

- Temperatures in the final application
- Material(s) which have to be over-molded
- Resistance against chemicals

→ **These three parameters are most important to determine the suitable adhesive(s)!**

2. Conduct spot test on the parts for a first impression of the adhesion

3. Typical Project Procedure

3. Test procedure (example)

- Construction of trial mold for the production of professional samples. Different adhesives can be tried out.
- The tests need to be run and evaluated by the customer to make sure all requirements are fulfilled.
- In case the tests are not successful a different adhesive or an improved design can be a solution.

3. Typical Project Procedure

4. Production

- After a successful test procedure the right design and the right adhesive will be known.
- With the design in mind it is possible to calculate the possible number of cavities of the mold.
- With the production figures of the customer, it will be possible to find the right molding machine.
- After a successful test procedure, the customer will have the confidence that all requirements are fulfilled.

4. Equipment

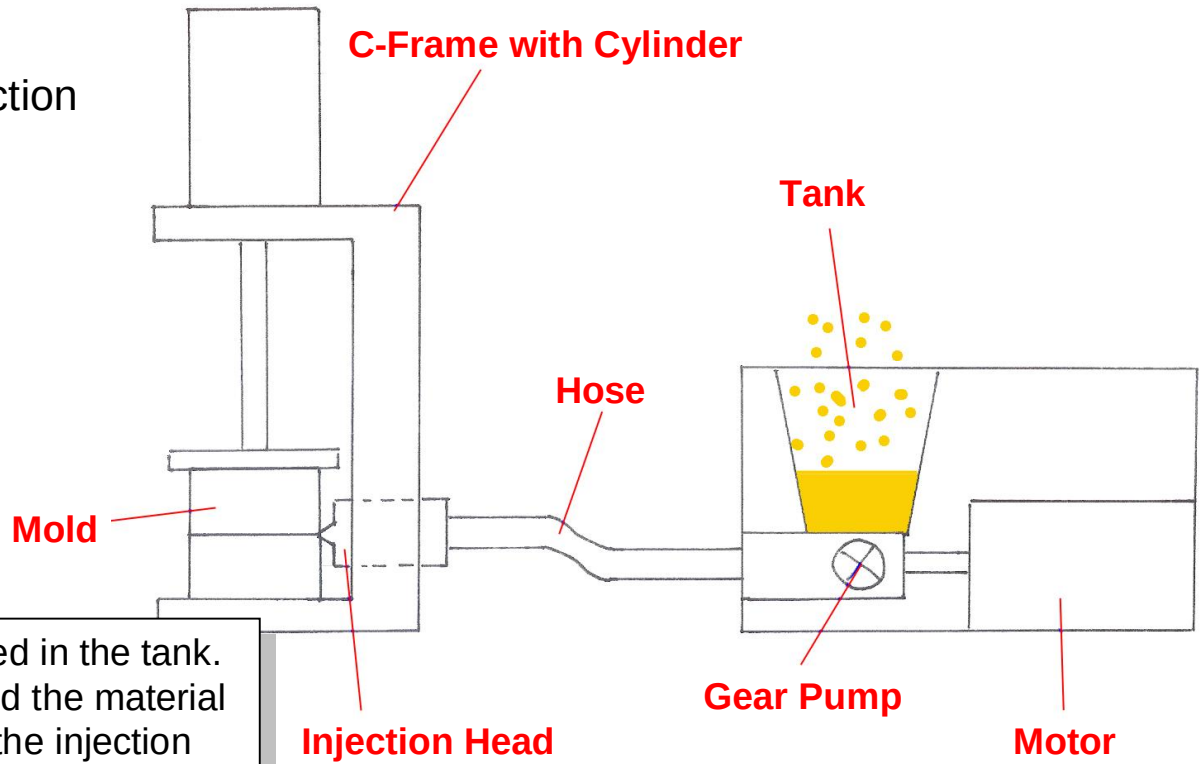
Manual Hand Gun

- Typical usage
  Trials or small production
- Typical output
  500 to 10.000 parts/year
- Typical part size
  1-20 gr.
- Costs
  Appr. 2.000 €

4. Equipment

Automated Molding Machine

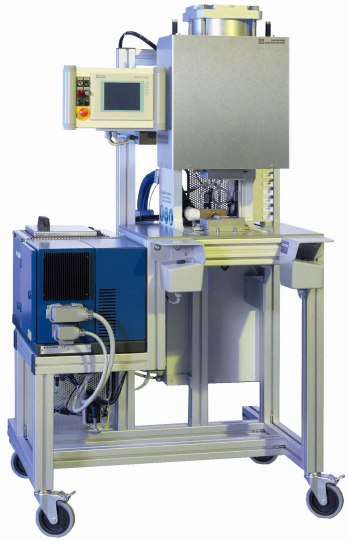
- Typical usage
  Mid-size to high volume production
- Typical output
  20.000 to 400.000 parts/year
- Typical part size
  1-50 gr.
- Costs
  Appr. 20.000 to 70.000 €

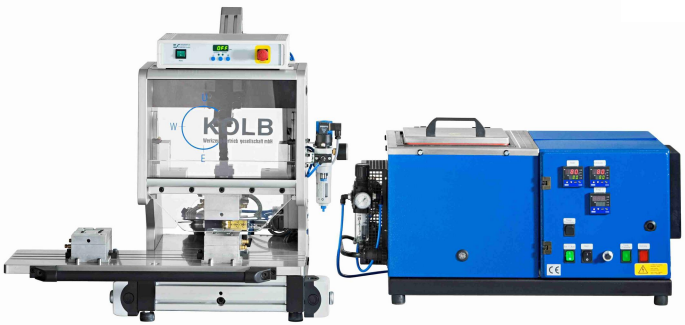


The Macromelt granulates are melted in the tank. A gear pump builds the pressure and the material flows through the heated hose and the injection head into the mould. The Cylinder of the C-frame closes and opens the mold.

4. Equipment

Examples of Automated Molding Machines



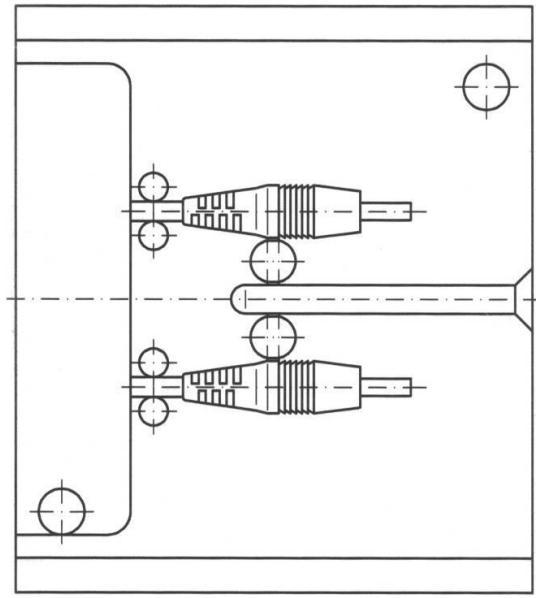


4. Equipment

Molds

- Material
  Usually aluminum
  - Easy to mill, drill, erode
  - Good release of the molded pieces

  Steel inserts recommended in contact areas to plastic or metal parts
- Lifetime
  Very long, as Macromelt is not abrasive nor corrosive
- Costs
  Appr. 3.000 to 50.000 €, depending on
  - Size & material
  - Number of cavities
  - Ejectors, grade of automation

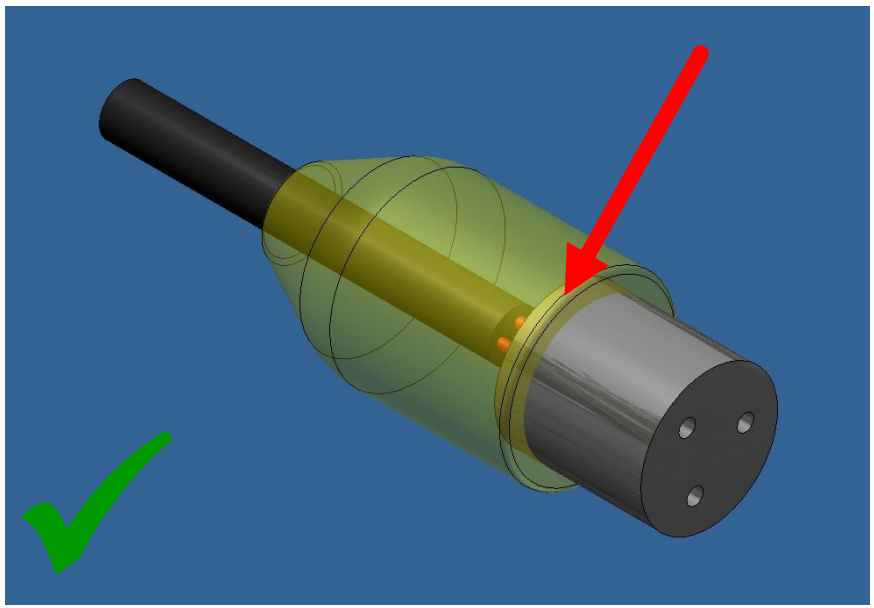


5. Design Guidelines

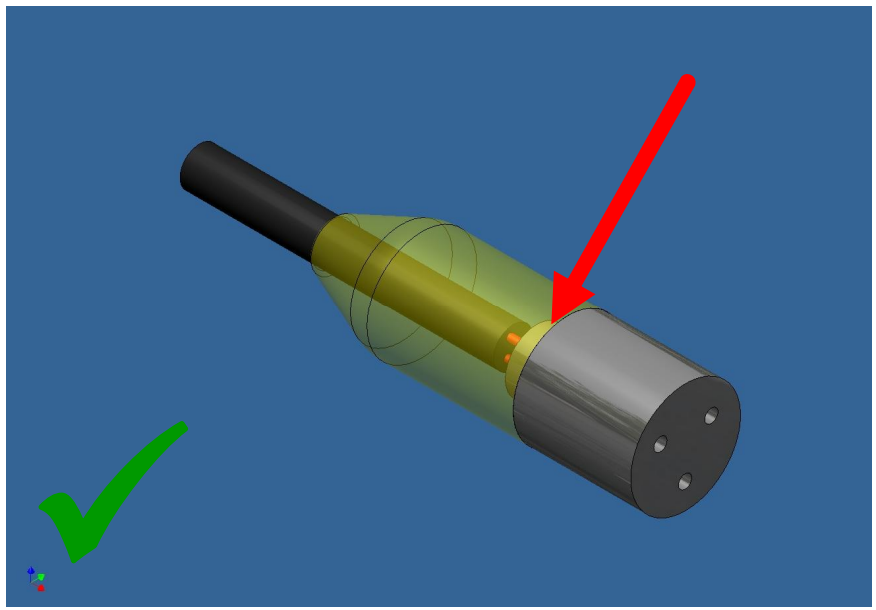
Overmolding

- For tight connections during lifetime of parts, adhesive must completely cover connector and cable (pic.1), using adhesion plus shrinkage force of Macromelt
- If there is not enough space outside, create an inner shrinkage area (pic. 2)

Picture 1



Picture 2

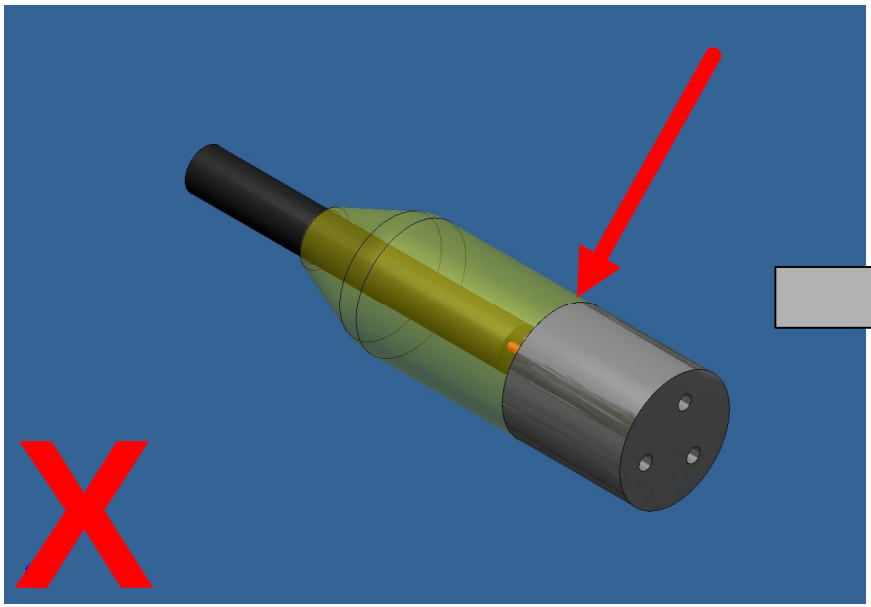


5. Design Guidelines

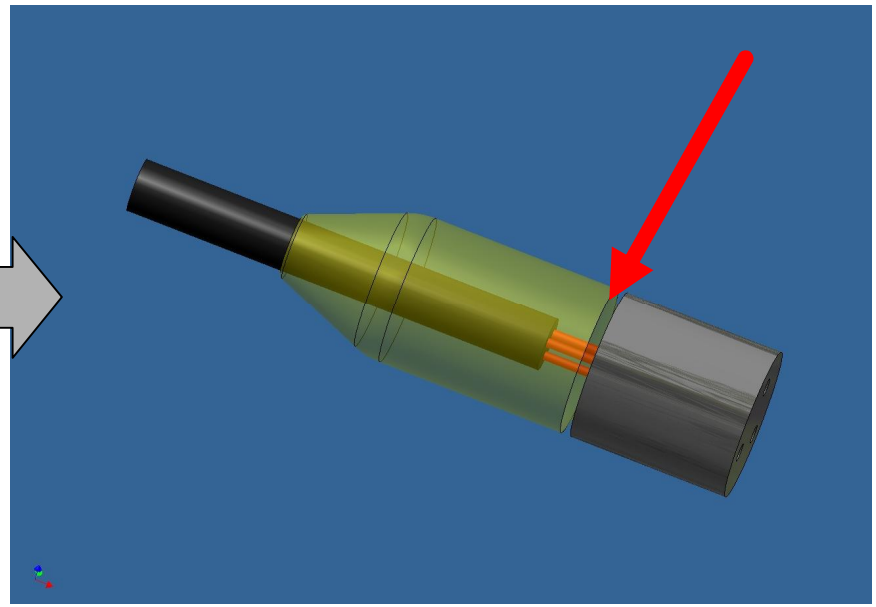
Overmolding

- Avoid connections without shrinkage area (pic. 3)
- After temperature cycles, Macromelt might release from the parts (pic. 4)

Picture 3



Picture 4

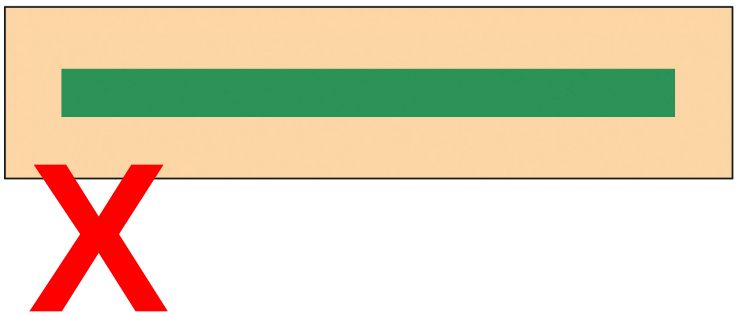


5. Design Guidelines

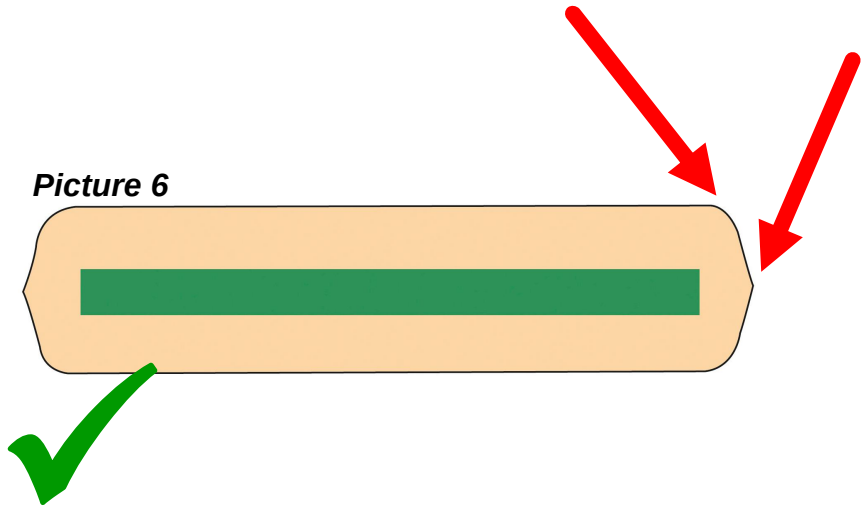
Radius and Release Angle

- Avoid rectangular designs (pic. 5)
- Design corners with a radius for better flow of adhesive and easier release; release angles help to remove parts more easily out of the mold (pic. 6)

Picture 5



Picture 6

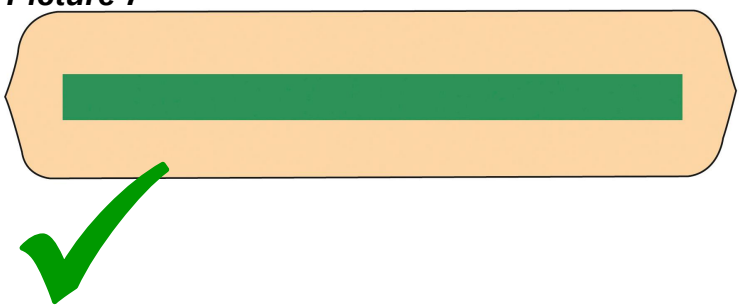


5. Design Guidelines

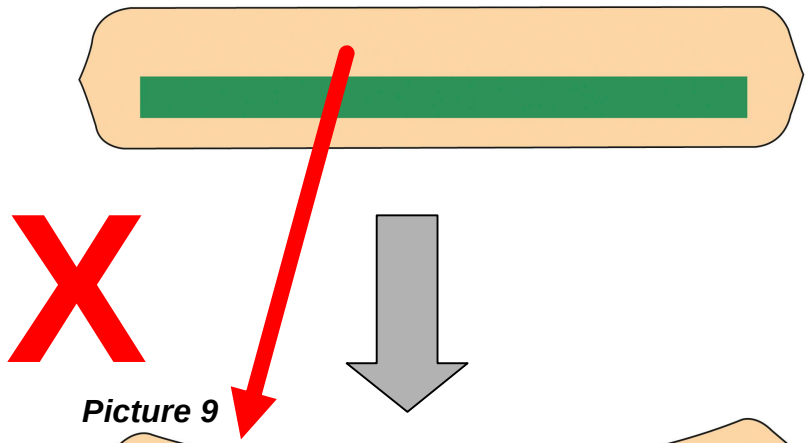
Same Amount of Material

- Flexible parts need same amount of material on both sides (pic. 7)
- With different amounts of adhesives (pic. 8), the shrinkage force will bend the parts (pic. 9)

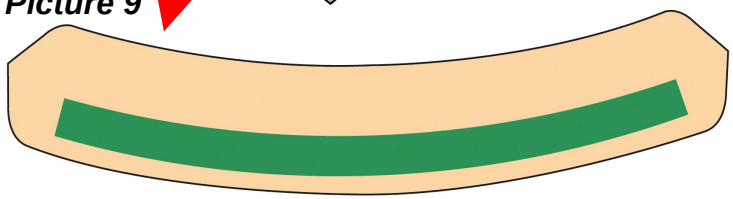
Picture 7



Picture 8



Picture 9

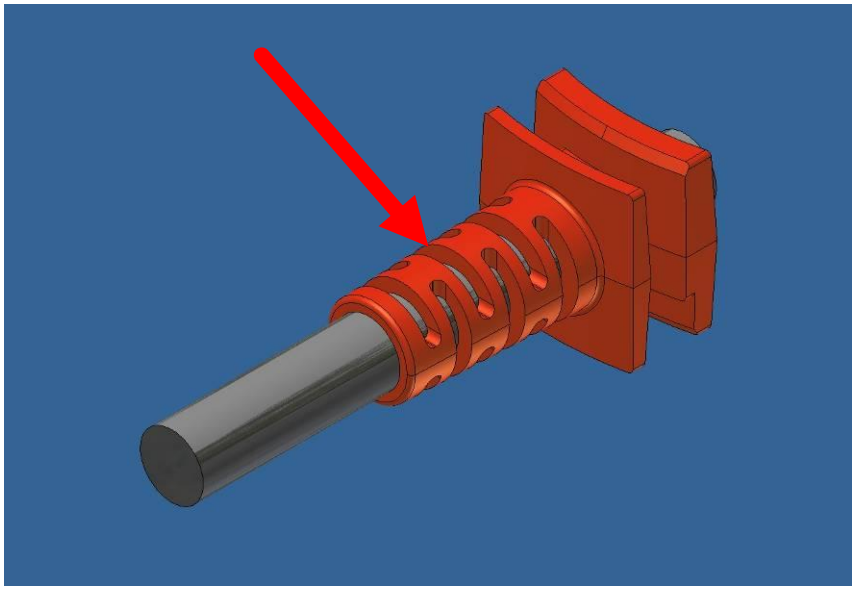


5. Design Guidelines

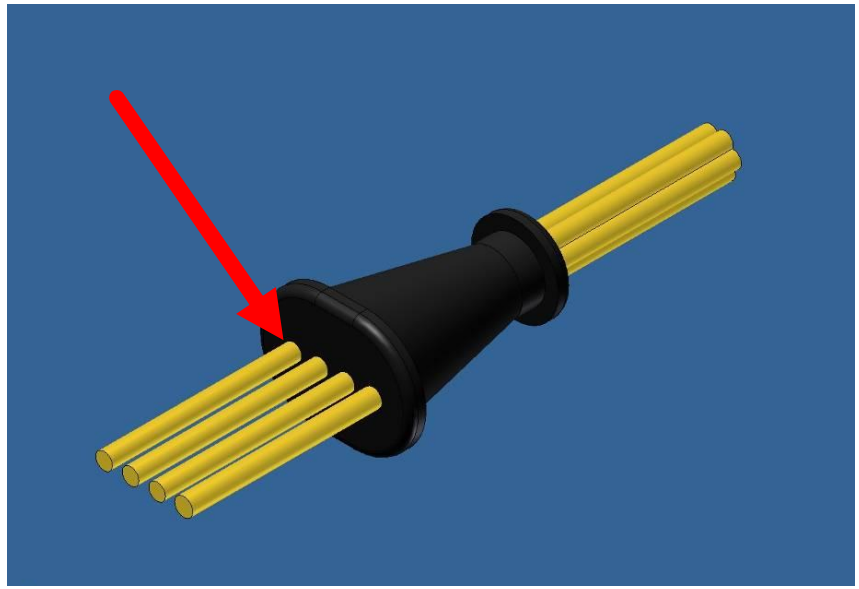
Grommets

- Design a bending area to have the bending point away from the sealing area (pic. 10)
- For water tight grommets each single cable needs to be covered with adhesive (pic. 11)

Picture 10



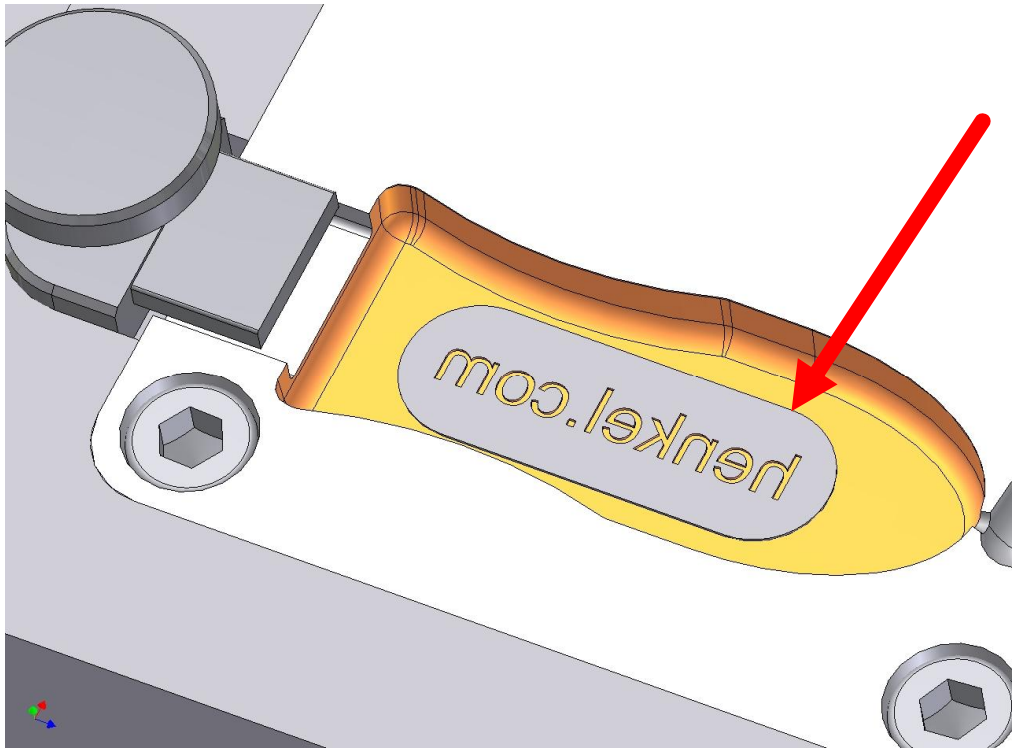
Picture 11



5. Design Guidelines

Venting

- To avoid trapped air allow venting of the mould by inserts like ejectors, marking inlets or other inlets



5. Design Guidelines

Ejection

- Eject parts on solid areas like connectors
- Use large area ejectors when pushing parts on the adhesive to spread the forces