Some shapes are so valuable, we must preserve them

arenz
plasticizing
and wear techniques

■ Every company has an image all of its own. We at ARENZ GmbH have continuously endeavoured to secure product quality and run a customer oriented business.

We have applied our accumulated know how efficiently to the varied areas of manufacturing and regenerating of wear parts in plastification units and also to the delivery of complete extruder units. First class products are the result of our labour and strategy.

The development of new technologies and products as well as a thorough knowledge of materials are the foundation of our innovative service to the customer.

Let us show you the solution to your specific requirements. The present catalogue will give you an impression of our performance capabilities.

Please contact us. ■

arenz
plasticizing
and wear techniques

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http://www.arenz-gmbh.de - e-mail: info@arenz-gmbh.de

1

Standard screws usually fail to meet all requirements

1. Process Optimisation

We offer you screw geometry optimised to suit your particular processing task.

Benefit from our many years of experience in the construction and design of screws for injection moulding and extrusion processes.

Using REX (computer-aided extruder design) and PSI (Paderborn injection moulding simulation) software, ARENZ has the facilities to offer quick and meaningful computer-aided optimisation. These simulation programs form an efficient complement to the many years of experience ARENZ has gained in the design of screw geometry.
The REX and PSI simulation programs were developed with the aid of extensive mathematical and physical models in a joint project between the Institute of Plastics Engineering (KTP) in the Mechanical Engineering faculty of the University of Paderborn and reputable mechanical engineering companies and manufacturers of raw materials. By employing rapid computational algorithms and approximation solutions, the software allows very short calculating times. Influencing variables and their effects can be recognised, evaluated and assessed very quickly.
Statements are obtained on the course of pressure, throughput characteristics, melting behaviour, homogeneity, performance course, shear effects, mixing ratios and wall shear stress.

This cost-free service is particularly interesting in connection with the extensive experience acquired by ARENZ in protection against wear.
This combination makes it possible to produce screws tailor-made to a particular application.

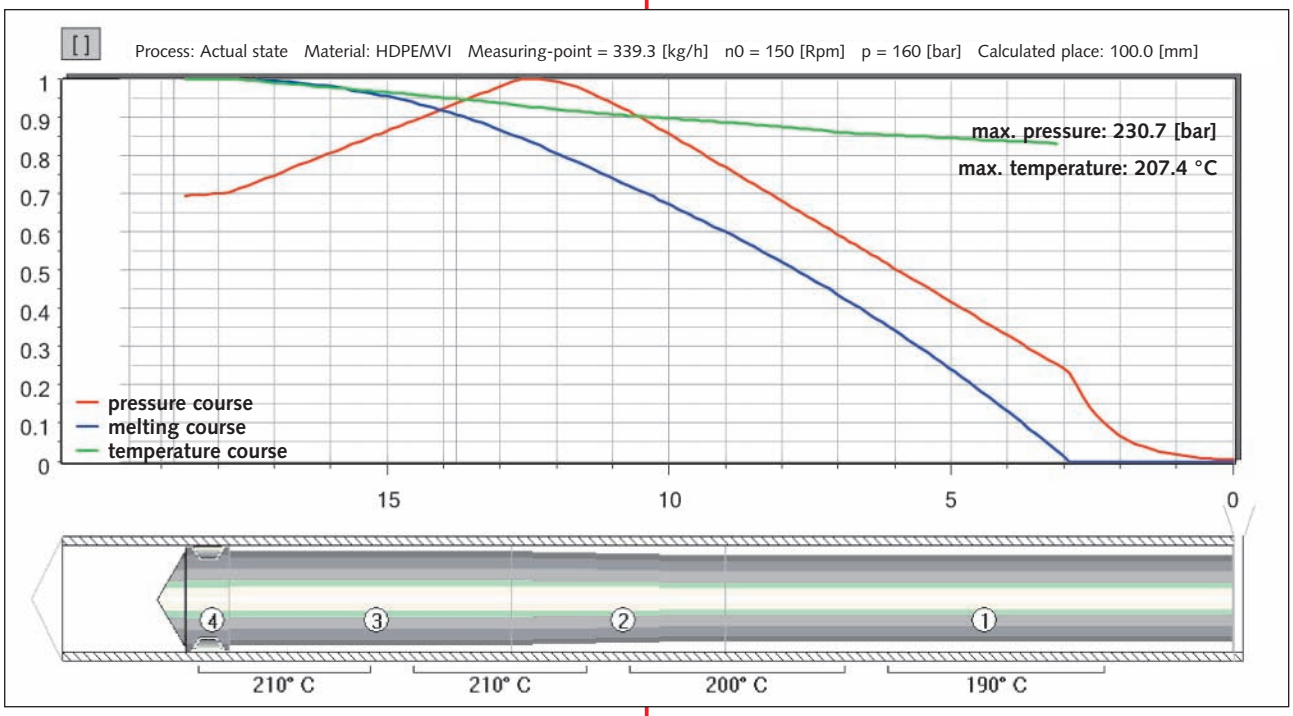
Optimisation is attained as follows:

1) Description of the problem
2) Recording of the actual states of all quality-relevant parameters. We draw up a checklist to help you in this.
3) The actual-state recording is then simulated and the process is readjusted by software.
4) Calculation of the new geometry
5) We record the results for you in informative diagrams, such as e.g. on pressure, melting behaviour, the course of temperature and mixing ratios.

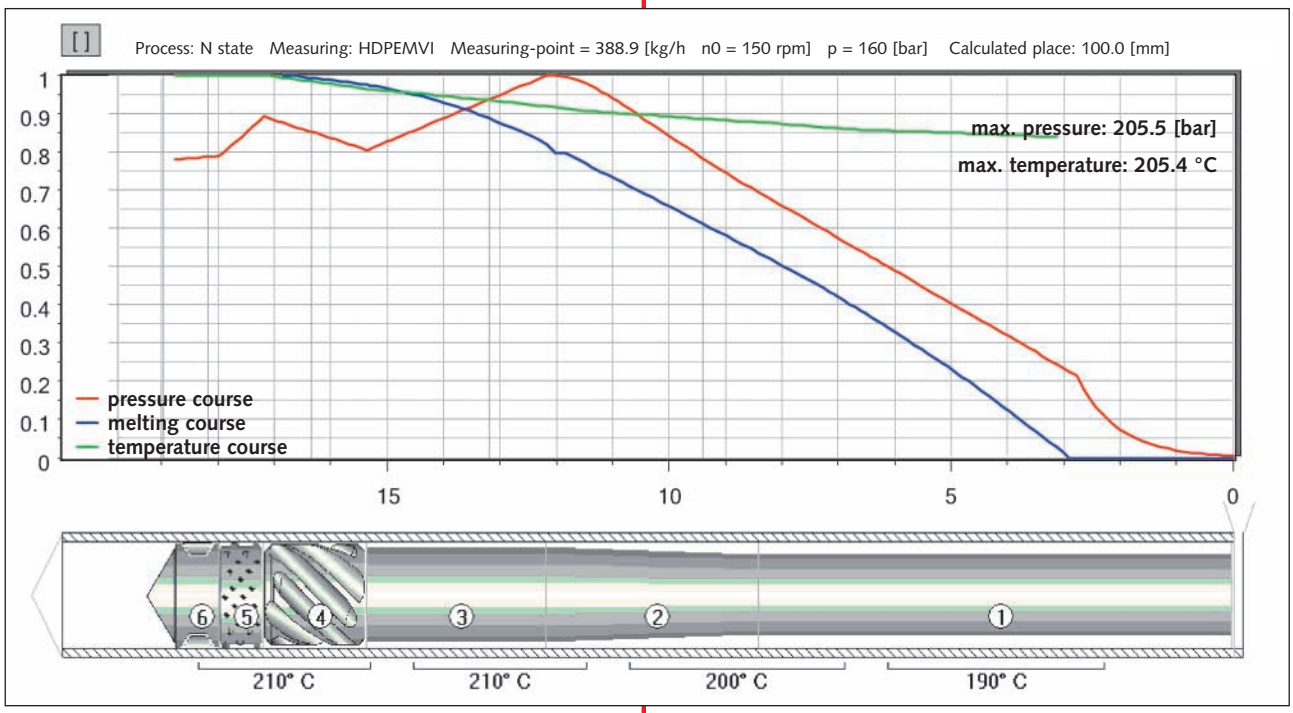
Our optimisation is aimed at attaining production-appropriate screw geometry which meets your requirements for increased throughput, good melting quality, wear prevention and cost-effective service life.

Adjacent example from actual practice:

	Injection moulding screw dia 100 mm
Tasks:	Improved dyeing and enhanced plastification performance from 94g/s to 108 g/s.
Raw materials:	HDPE, PP, PS

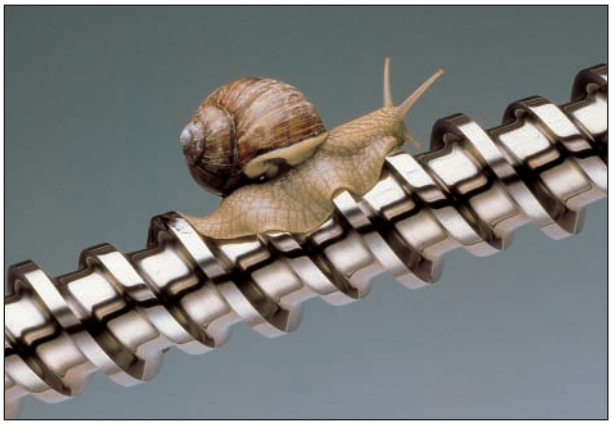


Readjustment and simulation of the actual state



Simulation of the new screw geometry

2

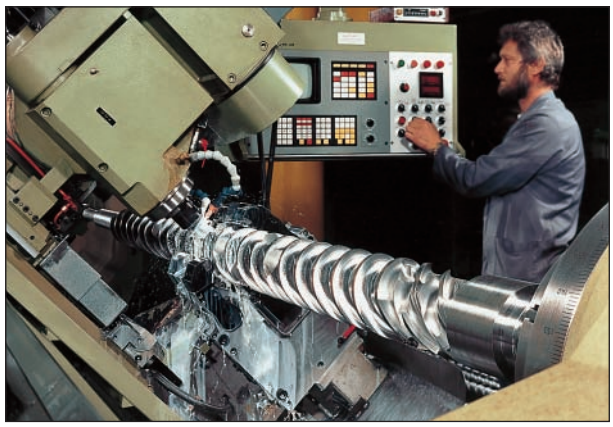


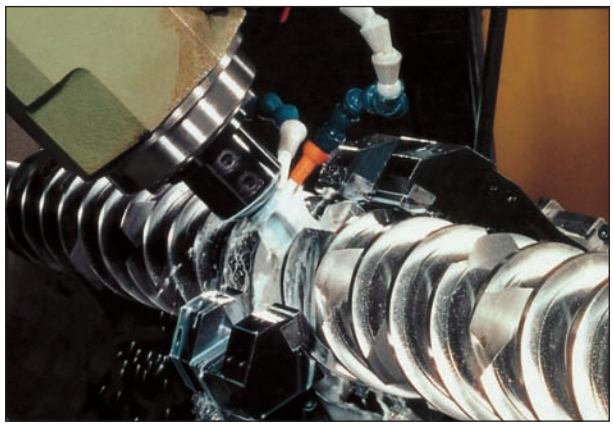
2.1 Screw Manufacturing

■ In the field of plastics processing, technical progress demands a continuous improvement of products and processing in order to be able to offer the customer the newest solutions.

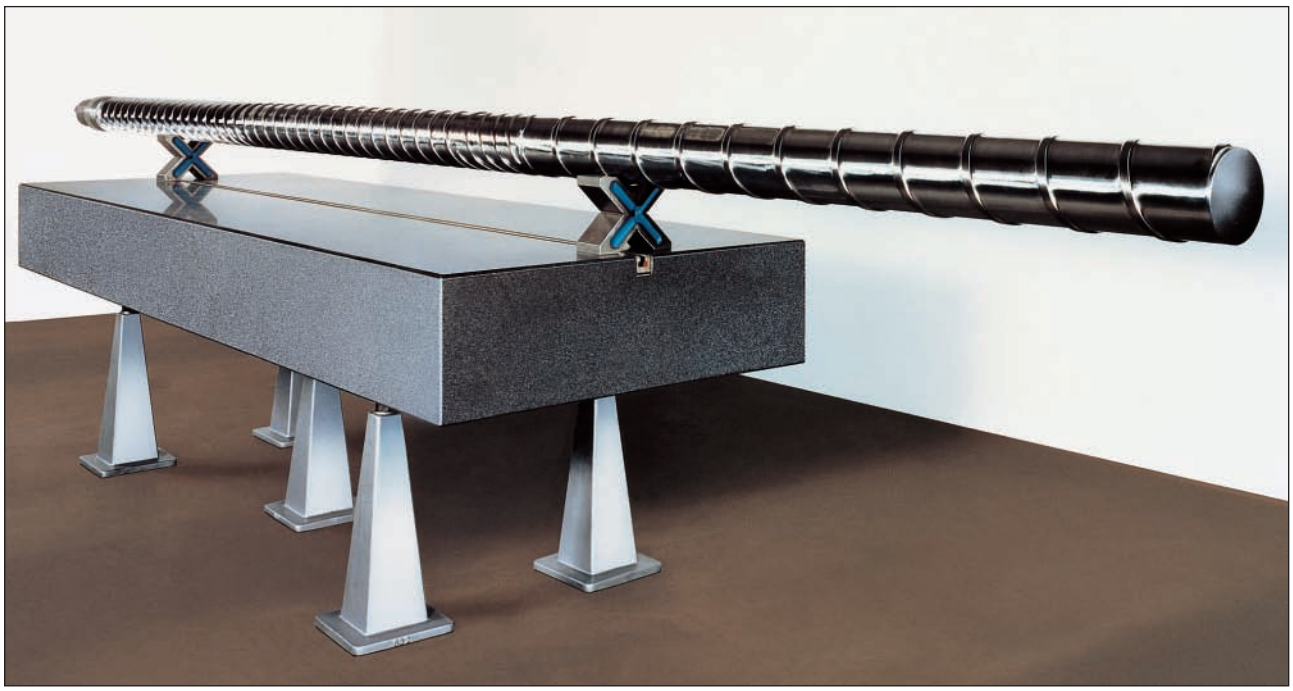
The high quality of our screws is maintained by modern, efficient processing methods and know how. Depending on your intended application we can place a broad range of products, geometries and materials at your disposal. In order to produce an optimal screw for our customers, we discuss the requirements and necessary profile and manufacture a tailor-made screw for your particular application. ■

We can deliver screws à la carte





Diameter:	18 to 300 mm
Length:	250 to 6.000 mm
Geometry:	- according to your drawings - according to sample - according to our drawings - according to our calculations - according to our suggestion - single and multi-thread - progressive core and pitch - two and multi-zone screws - degassing screws - mix and shear zones
Materials:	We have a broad range of materials at our disposal. Material selection depends on your requirements. Please see material selection in chapter 5 for further details.
Surface treatment:	The requirements on the screw surface by the plastics to be processed are met through the most modern surface treatment methods. For example: the screw surface is nitrated, ionitrated, chromium plated or hardened.



Some shapes are so valuable, we must preserve them

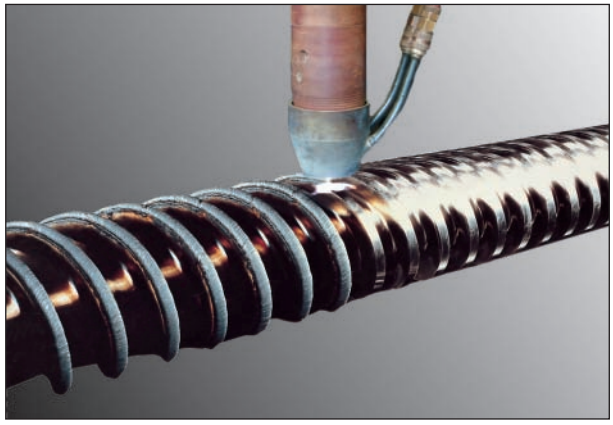
2

2.2 Screw Regeneration

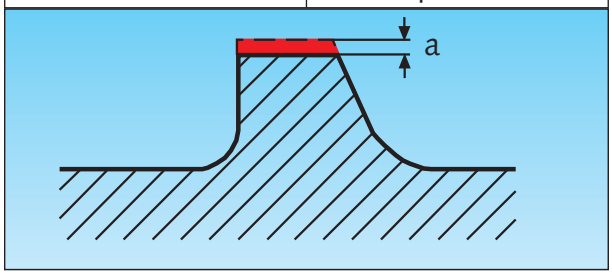
Friction between the screw tops and the internal wall of the cylinder causes wear. This wear is made worse by plastic additives such as glass fibre, pigments, flame retardants and other additives. Also, corrosive wear may occur. A newly developed Arnit hard-facing process has enabled us to succeed in regenerating worn screws by applying a wear resistant hard-faced deposit. This process produces a perfect metallic bond between the base material and the Arnit hard-faced deposit.

The Arnit hard-faced deposit is corrosion and wear resistant. Arnit 12, for example, reaches a hardness of approx. 50 HRC. Depending on the base material used, the screw is nitrated or ionitrated after hard-facing. During this application the base material acquires a surface hardness of approx. 800 to 1.100 HV 5.

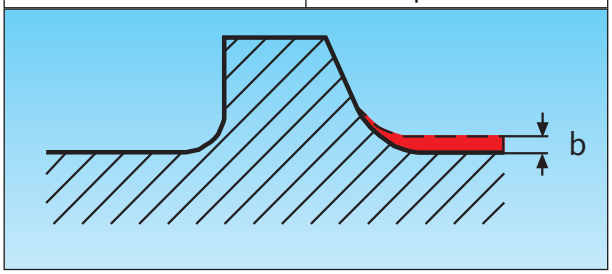
During the hard-facing process hairline cracking may occur due to different thermal coefficients between the base material and the hard-faced deposit, especially in the case of larger screw diameters. This hairline cracking, arising in the hard-facing towards the central shaft, has no influence on the service life and the hard-facing will not chip off. So far, no negative effect of hairline cracking during screw operations has been observed. However, if the customer has any doubts whatsoever, we recommend the hard-facing with Arnit 6, which can be applied absolutely crack free. Before going ahead with the repair work, we measure the screw and check for any damage such as torsion. The customer receives a copy of this trial record.

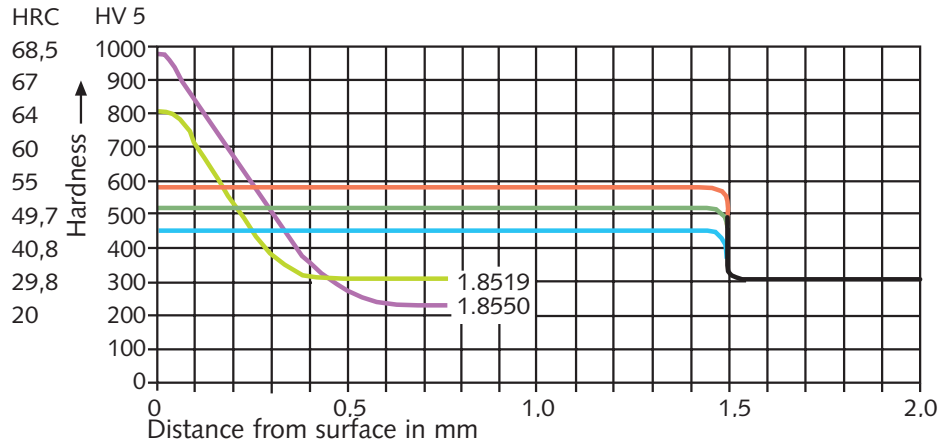


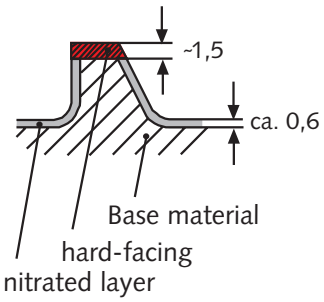
Screw Top	
Screw diameter in mm	**Screw wear a max. mm**
30	up to 2
- 40	up to 2
- 60	up to 3
- 90	up to 5
- 150	up to 8
- 300	up to 10
- 500	up to 15



Screw Core	
Screw diameter in mm	**Screw core wear b max. mm**
25	up to 0,3
- 40	up to 0,3
- 60	up to 0,5
- 90	up to 0,8
- 150	up to 1,0
- 300	up to 1,5
- 500	up to 2,0

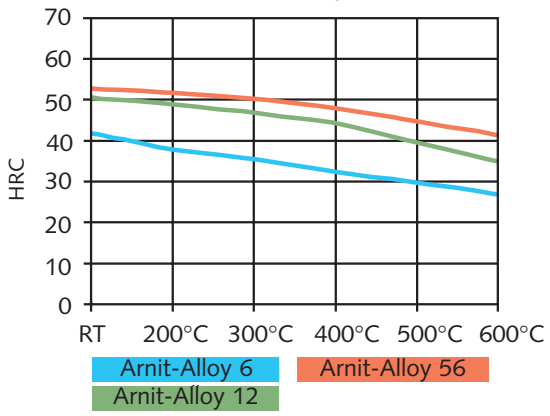




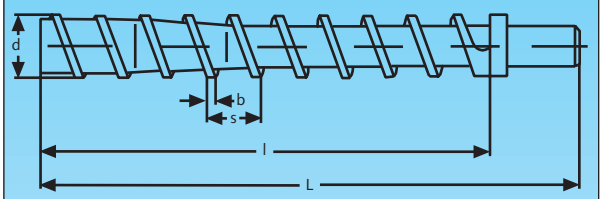


Heat Hardness

Arnit-hard-facing material



We require the following information to make an offer:



l = Lenght of thread/lenght of geometry
L = Overall screw lenght
s = Pitch
b = Top width
d = Screw diameter

Material, if known _____
Number of threads_____

It's not magic, but there is more to our cylinders than meets the eye

3.1 Cylinder Manufacturing

■ High mechanical and thermal demands characterize the working conditions of modern cylinders. In order to endure the strenuous demands of everyday use for an extended period, it is necessary to possess a technically refined product manufactured from high quality material.

ARENZ uses a wide variety of design, material and surface treatment at the most modern work stations to manufacture its cylinders. ■

Bore diameter:	18 to 300 mm
Bore tolerance:	H 7 surface roughness R_t 0.5
Outer cylinder diameter:	50 to 500 mm
Length:	250 to 6.000 mm
Design:	- according to your drawings - according to sample - according to our drawings - according to our calculations - according to our suggestion - with forged-on flange - with welded flange - with screwed-on flange - with grooved feed bushing - with jacket cooling - with feed cooling - with spiral cooling - with degassing vent - with feed pocket
Materials:	We have a wide variety of materials at our disposal. The material is adjusted to your demands. Please see material selection in chapter 5 for further details.
Surface treatment:	We have adjusted to the demands, that the plastic to be processed places on the bore surface, by using the most modern surface treatment methods. For example: the bore surface is nitrated, ionitrated, chromium plated, hard-faced, hardened or the step is nitrated.

Also cylinders do need a centre

Modern technology deep-hole drill and honing centre.

Machining centre for cylinders in different versions.

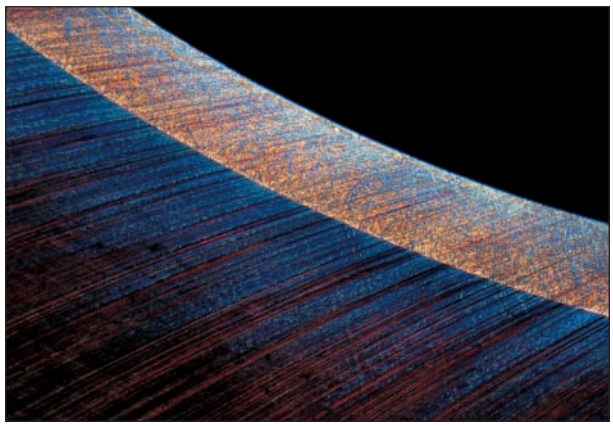
When Arnit-Alloy and steel engage in a long term relationship, bi-metal cylinders are born with above average capabilities.

3

3.2 Arnit-Alloy bi-metal cylinders

■ The ARENZ research division is concerned with new and progressive manufacturing processes and products, material development and methods to improve quality. The Arnit-Alloy bi-metal cylinders are the result of our continuous efforts.

A high degree of form and exact positioning are tokens of a low friction and as much as possible distortion-free cylinder type. Our Arnit-Alloy bi-metal cylinders, available in various designs and materials, represent the latest findings of the technique. ■

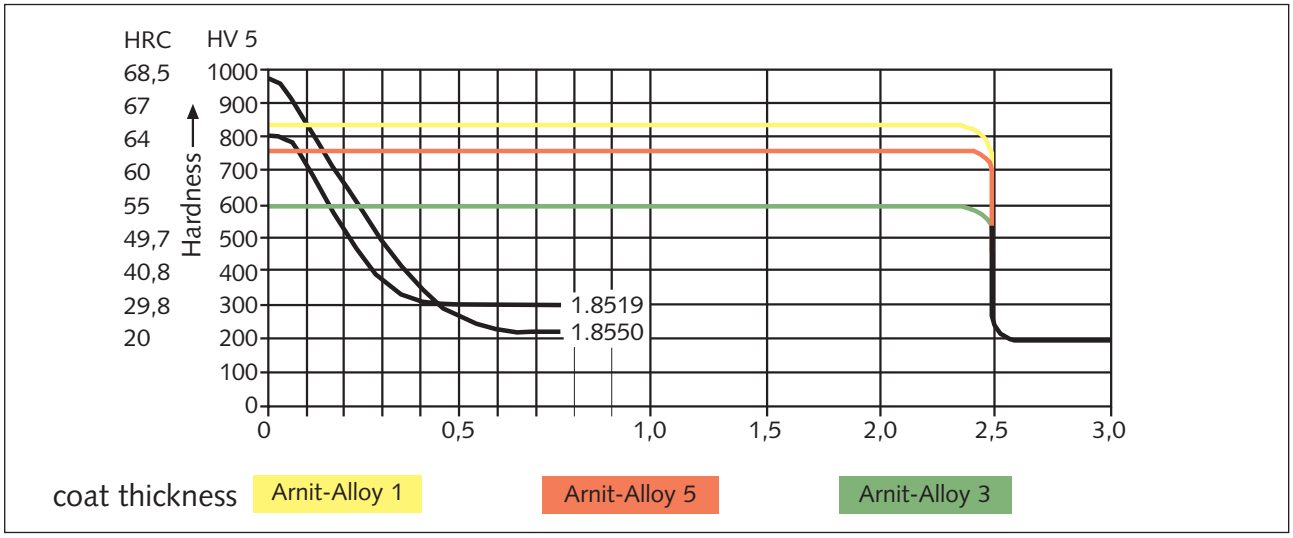


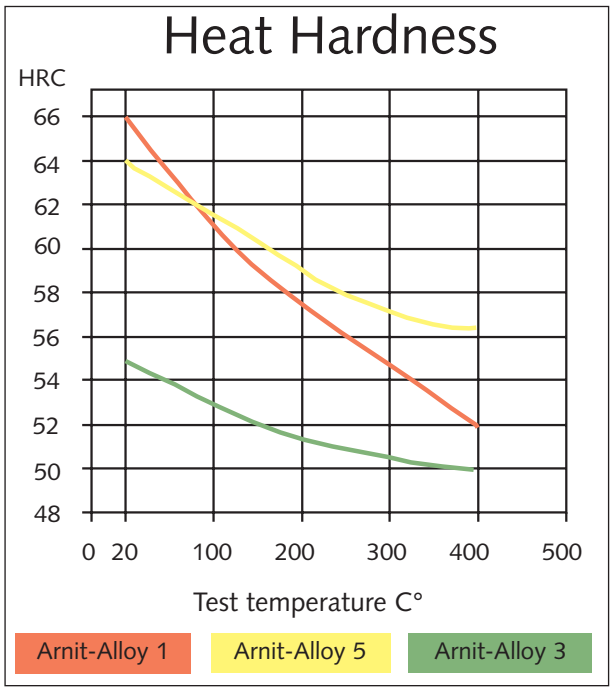
Bore diameter:	18 to 300 mm
Bore tolerance:	H 7 rough depth R_t 0.5
Outer cylinder diameter:	50 to 500 mm
Length:	250 to 6.000 mm
Design:	- according to your drawings - according to sample - according to our drawings - according to our suggestion - according to our calculations - with welded flange - with screwed-on flange - with grooved feed bushing - with jacket cooling - with feed cooling - with spiral cooling - with degassing vent - with feed pocket

Arnit-Alloy	1	3	5
Hardness Rockwell HRC	64 - 67	52 - 56	63 - 65
Temperature range max.	≤ 350° C	≤ 500° C	≤ 400° C
Properties	abrasion resistant	corrosion resistant	abrasion and corrosion resistant

The thickness of the Arnit-Alloy lining lies between 2 and 3 mm, depending on bore diameter.

Additional applications of the Arnit-Alloy bi-metal cylinders are as follows: chemical sludge pumps, food extruders, food transportation, bearing bushes, hydraulic cylinders.

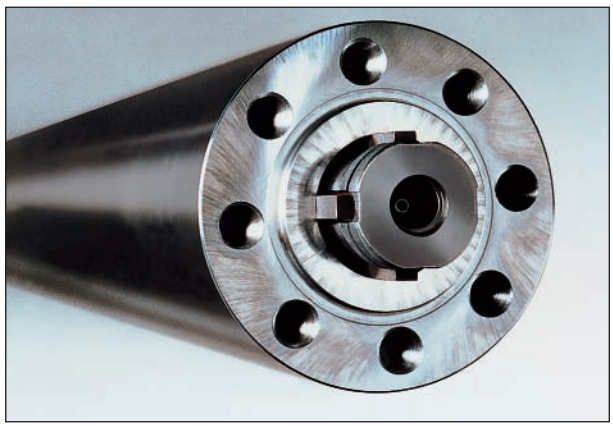




If you would like to know what kind of cylinders are better than new ones, an example occurred to us

3.3 Cylinder Regeneration

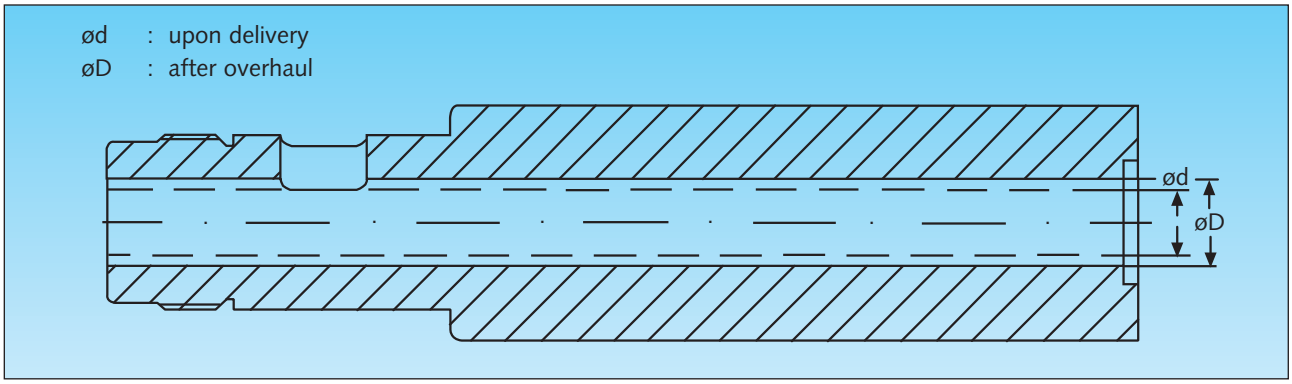
■ The cylinder regeneration process restores worn cylinders to a new condition. Because of high quality work and surface hardening processes, that we at Arenz have developed and optimized, and due to our long term experience, we are able to regenerate a cylinder to a state where it will even outperform new products in terms of quality and precision. Our basic programme offers two different regeneration processes. ■



Process 1:

The cylinder is cleanly honed throughout and then undergoes a hardening process.
(Bore tempering H7). The screw diameter is manufactured to fit the cylinder bore.
Nozzle tip and non-return flow valve are adjusted or newly manufactured.
Screw Manufacturing: see chapter 2.1
Screw Regeneration: see chapter 2.2
Non-Return Flow Valve: see chapter 4.

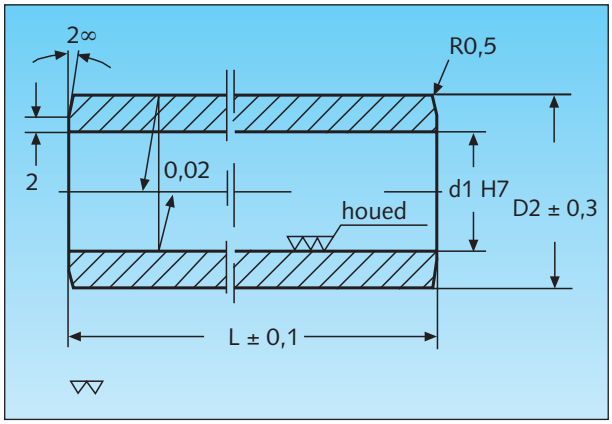
Screw Diameter		Cylinder Wear
from mm	up to mm	max. mm
30	40	1,0
40	50	1,0
50	60	1,0
60	80	1,0
80	100	1,5
100	120	1,5
120	300	2,0



In terms of costs, we can recommend this cylinder regeneration process as long as wear does not exceed 1 mm.

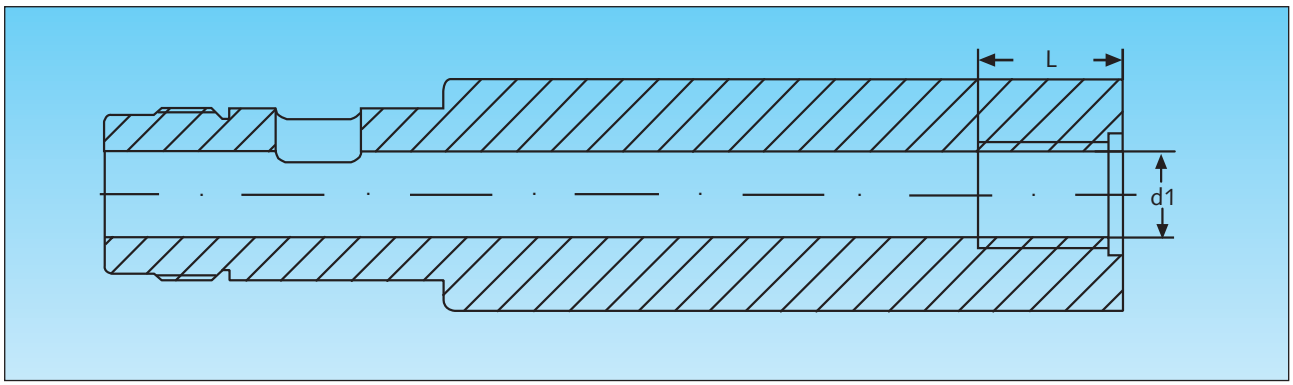
Process 2:

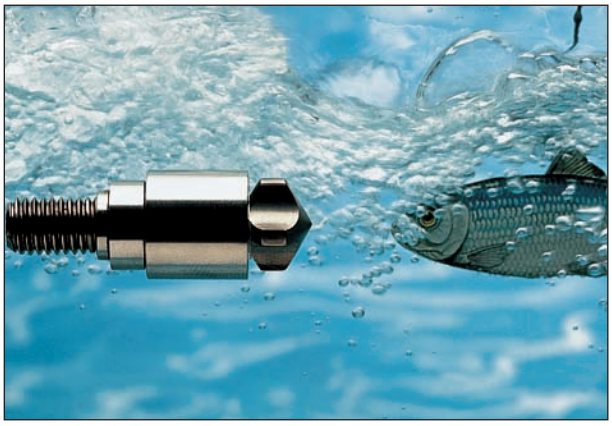
The cylinder is fitted with a sleeve and hardened in the section of the non return flow valve that is subject to the highest level of wear. Depending on the application, the drawback of possible streaks can be neglected.



d_1 (mm)	D_2 (mm)	L (mm)
18	29	100
22	33	120
25	36	150
30	41	200
35	46	200
40	51	350
45	56	350
50	61	350
55	66	420
60	71	420
70	85	550
80	95	550
90	105	600
100	115	600

Material: Arnit 8, Arnit 4, Arnit-Alloy 5.
For details concerning material selection see chapter 5.





4. Non-return flow valves Manufacturing

The non-return flow valve is the part of the plasticizing unit that is subject to the greatest stress:

- temperature up to approx. 500° C
- pressure up to approx. 2500 bar
- high wear of faying surfaces
- high torque load

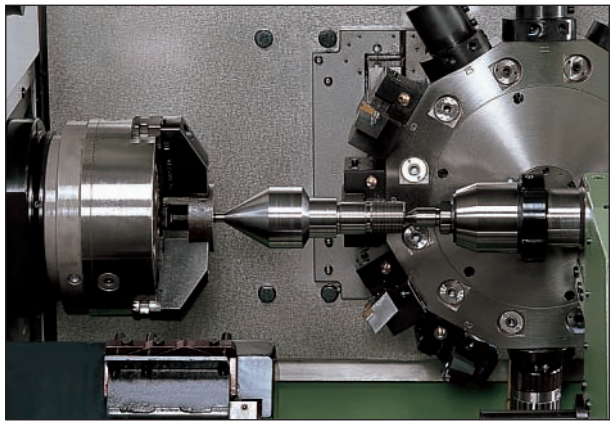
The valve function of the non-return flow valve has to meet the following requirements:

- long service life
- no damage to the polymers that are processed
- minimal wear of the plasticizing cylinder and screw
- low flow resistance
- fast closure

An optimal solution requires a careful design of assembly components and matching of appropriate materials. For normal stress and wear we recommend our Arnit 8 non-return flow valve.

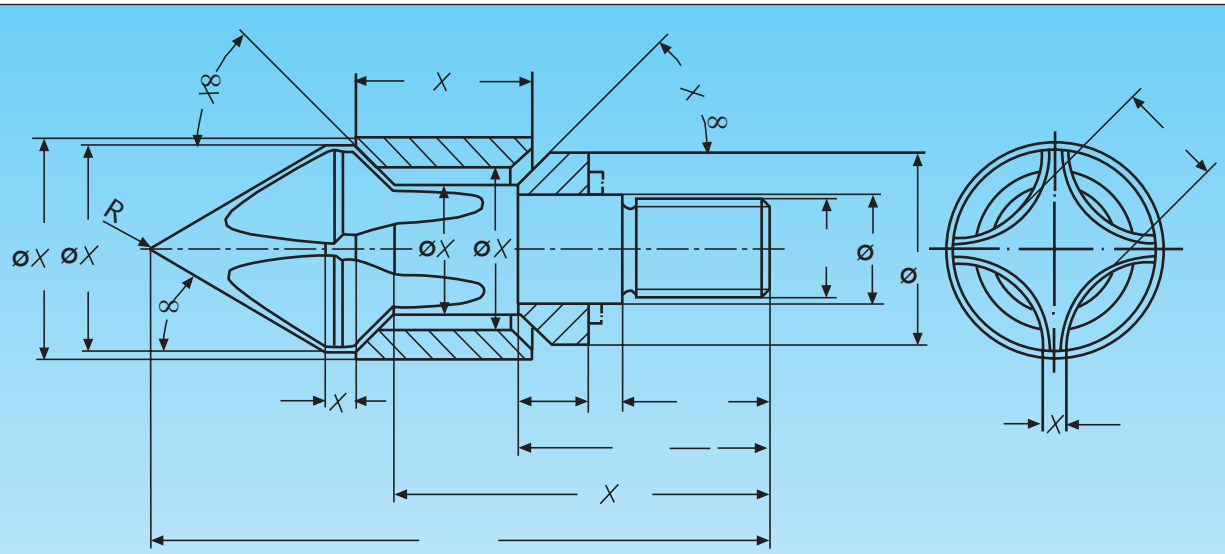
4

Where quality and function flow together



	Normal	Wear resistant	Extremely wear resistant
Tip	Arnit 8	hard-faced w/ Arnit 12	hard-faced w/Arnit 83
Retaining ring	Arnit 8	Arnit 2379	APM 1
Gasket	Arnit 8	Arnit 8	Arnit 8

Material selection see chapter 5.



x Dimensions can be determined by us
☐ Normal design
☐ Wear resistant design
☐ Highly wear resistant design

Regeneration

The regeneration process of the non-return flow valve includes the following:

- the tip of the contact surface is surface treated with Arnit 12 or Arnit 83
- the retainer ring is manufactured from Arnit 8
- the gasket is manufactured from Arnit 8

If the wear of the tip permits, regeneration may be recommended if the diameter > 40 mm.

5. Material selection

Arnit 8	Material analysis:	C: 0,3 - 0,37 / Si: 0,3 / Mn: 0,55 / P: 0,03 / S: 0,035 / Cr: 1,5 - 1,8 / Mo: 0,15 - 0,25 / Ni: 0,85 - 1,15 / Al: 0,8 - 1,2
	Hardening process:	long-term dry nitrating
	Hardness:	900 - 950 HV
	Application:	screws, cylinders, non-return flow valves
	Service life:	1, related to the processing of polyamide 6.6 with 30 % glass fibre
Arnit 9	Material analysis:	C: 0,26 - 0,34 / Si: 0,40 / Mn: 0,4 - 0,7 / P: 0,025 / S: 0,03 / Cr: 2,3 - 2,7 / Mo: 0,15 - 0,25
	Hardening process:	nitrating
	Hardness:	800 - 850 HV
	Application:	screws, cylinders, non-return flow valves
	Service life:	1, related to Arnit 8
Arnit 4	Material analysis:	C: 0,33 - 0,43 / Si: 1,0 / Mn: 1,0 / P: 0,03 - 0,045 / Cr: 15,5 - 17,5 / Mo: 1,0 - 1,3 / Ni: 1,0
	Hardening process:	ionitrating
	Hardness:	1000 - 1100 HV
	Application:	screws, cylinders, non-return flow valves (corrosion resistant)
	Service life:	about 2, related to Arnit 8
Arnit 23	Material analysis:	C: 0,37 - 0,43 / Si: 0,9 - 1,2 / Mn: 0,3 - 0,5 / P: 0,03 / S: 0,03 / Cr: 4,8 - 5,5 / Mo: 1,2 - 1,5 / V: 0,9 - 1,1
	Hardening process:	oil hardening
	Hardness:	52 HRC, additionally ionitrated to 1000 HV
	Application:	screws, barrel sleeves, nozzles
	Service life:	about 3, related to Arnit 8
Arnit 2379	Material analysis:	C: 1,5 - 1,6 / Si: 0,3 - 0,5 / Mn: 0,3 - 0,5 / P: 0,035 / S: 0,035 / Cr: 11,5 - 12,5 / Mo: 0,6 - 0,8 / V: 0,9 - 1,1
	Hardening process:	oil hardening and ionitrating
	Hardness:	63 HRC
	Application:	screws, retaining rings
	Service life:	5, related to Arnit 8
Arnit 6	Material analysis:	C: 1,1 / Cr: 28,0 / W: 4,5 / Co: balance and filler materials
	Hardness:	40 - 42 HRC
	Application:	hard-facing of screws at their roots
	Service life:	about 2, related to Arnit 8
Arnit 12	Material analysis:	C: 1,85 / Cr: 29,0 / W: 9,0 / Co: balance and filler materials
	Hardness:	50 - 52 HRC
	Application:	hard-facing of screw top area
	Service life:	about 2-3, related to Arnit 8

Arnit 56

Material analysis:	C: 0,7 / Cr: 12,5 / B: 2,75 / Si: 4,0 / rest Ni
Hardness:	52 - 55 HRC
Application:	hard-facing of screw top area and contact surface of non-return flow valve tip
Service life:	about 3-4, related to Arnit 8

Arnit 80

Alloy type cobalt, chrome, molybdenum

Hardness:	52 - 54 HRC
Application:	hard-facing of screw top area, particularly in double-led extruder screws
Service life:	about 3-4, related to Arnit 8

Arnit 83

Material analysis:	C: 2,2 / Cr: 2,0 / B: 1 / Wolframschmelzkarbid 35%
Hardness:	48 - 56 HRC
Application:	hard-facing of screw top area and contact surface of non-return flow valve tip
Service life:	about 6-8, related to Arnit 8

Arnit 200

Arnit 200 is an extremely corrosion resistant nickel chrome molybdenum alloy for use in contact with flourine and chlorine.

Arnit-Alloy 1

Alloy type Fe/Ni/B and filler materials

Hardness:	64 - 67 HRC
Application:	wear-resistant cylinder hard-facing
Service life:	about 5-10, related to Arnit 8

Arnit-Alloy 3

Alloy type Ni/Co/Cr/B and filler materials

Hardness:	52 - 56 HRC
Application:	corrosion-resistant cylinder hard-facing
Service life:	about 4-8, related to Arnit 8

Arnit-Alloy 5

Alloy type Fe/Cr/Ni/B and filler materials

Hardness:	63 - 65 HRC
Application:	wear and corrosion-resistant cylinder hard-facing
Service life:	about 6-8, related to Arnit 8

APM 1

Powder matallurgical HIP steel

Hardness:	60 - 64 HRC
Application:	screws, cylinders, barrel sleeves, non-return flow valves, wear-resistant
Service life:	about 8-12, related to Arnit 8

APM 5

Powder matallurgical HIP steel

Hardness:	59 - 63 HRC
Application:	screws, cylinders, barrel sleeves, non-return flow valves, wear and corrosion resistant
Service life:	about 6-8, related to Arnit 8

The ARENZ extruders have a broad range of applications

ARENZ extruders in the master line are efficient extruders with direct drive and groove feed bush changing system for processing all conventional raw materials and they can be used both as main extruders and also as ancillary extruders in large production lines.

Please demand our special brochure on extruders!

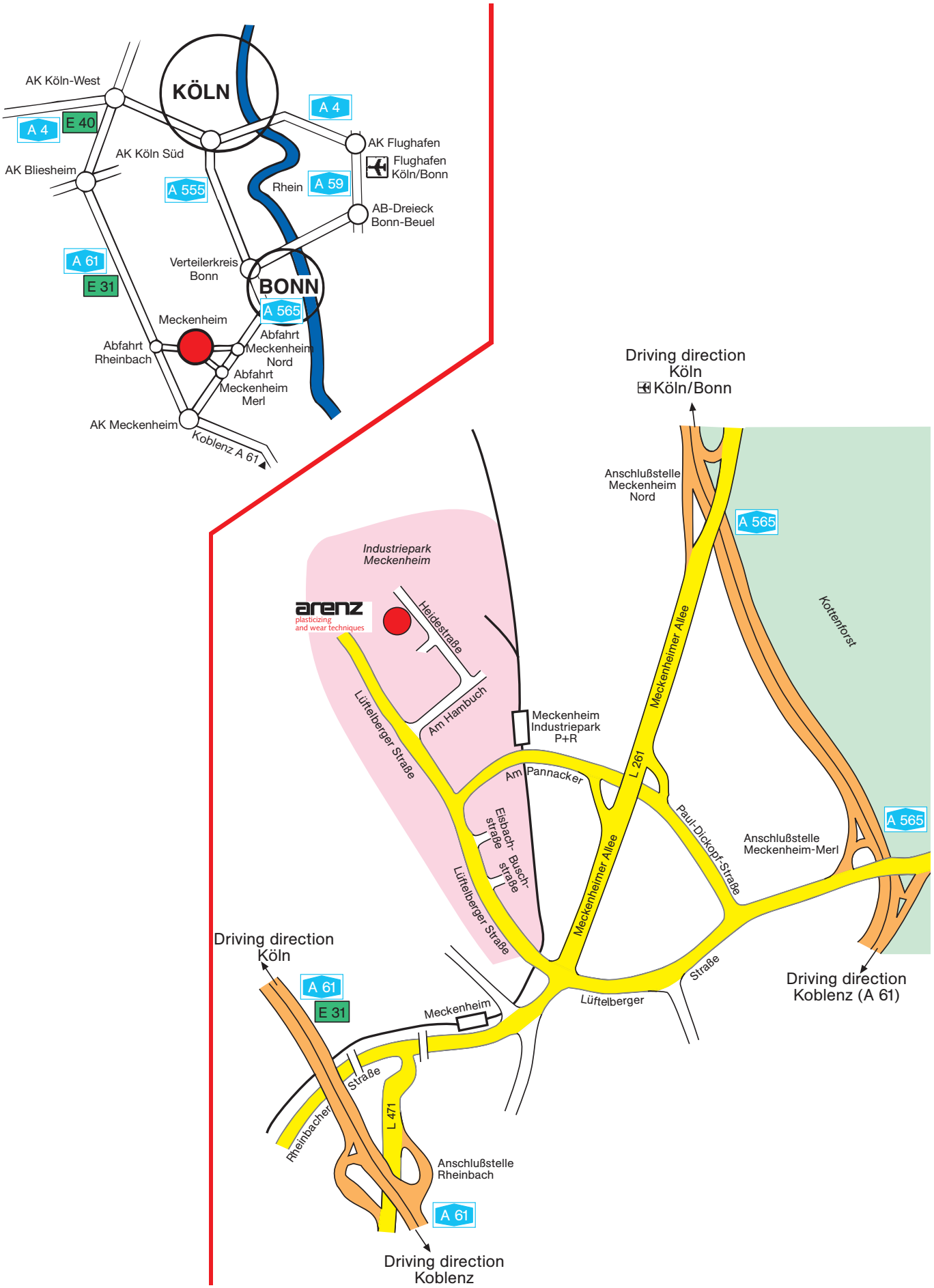
Our concept takes away all your worries

Arenz Laboratory Extruder

Arenz compact extruder for co-extrusion

6

The fast connection:



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Reply fax

To the technical sales department of Arenz GmbH

0 (049) 22 25 / 999 250

Please call me at tel. no. _____

Please visit on: _____ /appro.. _____ a.m./p.m.

Company: _____

Road: _____

Postcode/town: _____

Mr/Ms _____

Please send us a free quotation on

- ☐ regeneration
- ☐ manufacturing

with prices and delivery time for

Machine type

screw ø L/ Dia _____ _____

Cylinder dia L/ D _____

NRV dia

others _____

Please send us your "screw optimisation" check list for

- ☐ Injection moulding machines
- ☐ extruders

arenz
plasticizing
and wear techniques

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