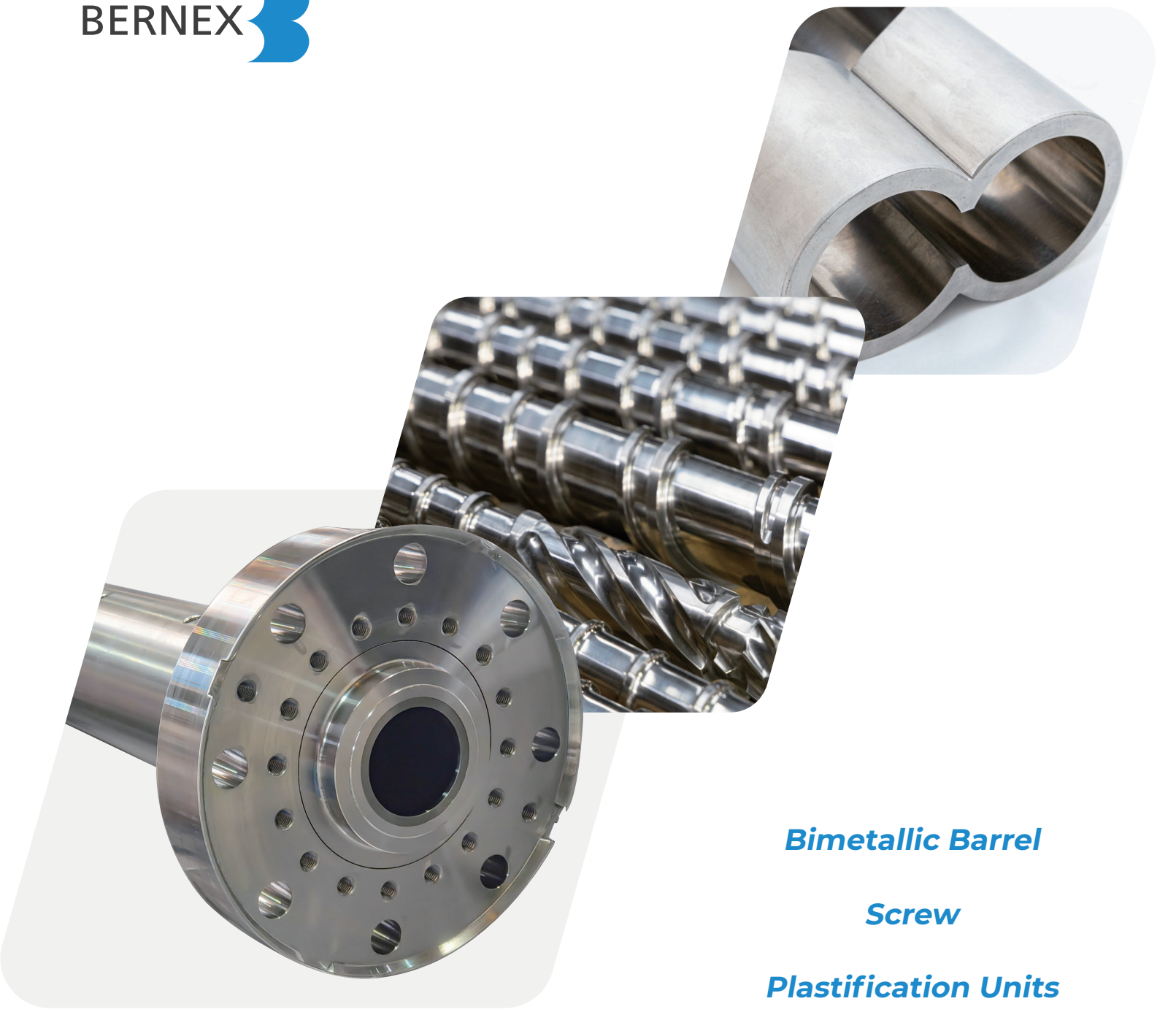
BERNEX



Bimetallic Barrel

Screw

Plastification Units

SOLUTIONS FOR YOUR SUCCESS

www.bernexgroup.com

Bernex Group

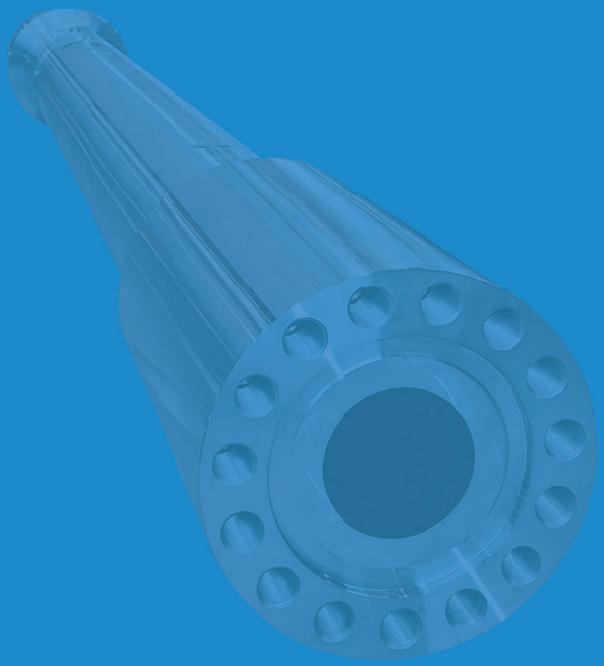
Bernex Group, headquartered in Switzerland is a world leading manufacturer of **BIMETALLIC barrel, screw and plastification technology** for mission-critical injection molding and extrusion applications.

- 50+ years of focus on tailored solutions for customers in the plastic industry.
- Our product know-how is extensive, and we have an in-depth understanding of the customers' processes.
- Uncompromised Swiss quality and customer service with production facilities in Italy, Czech Republic, and Thailand.
- Pioneer manufacturer of highly wear resistant spin cast lined bimetallic barrels using state-of-the-art induction furnaces and CNC machining centers.
- One Stop supplier for all your single and twin barrel, screw and plastification needs.
- Customized barrel screw portfolio for specific request, provide comprehensive solutions for today's plastification challenges.
- Reliable partner to both OEM and Processor customers with competitive delivery lead time using our advanced production process.

Thailand Factory

Czech Factory

Italy Factory



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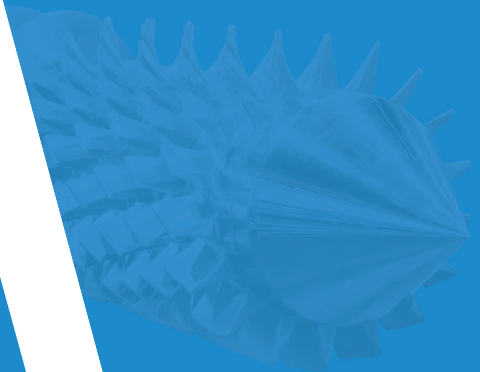
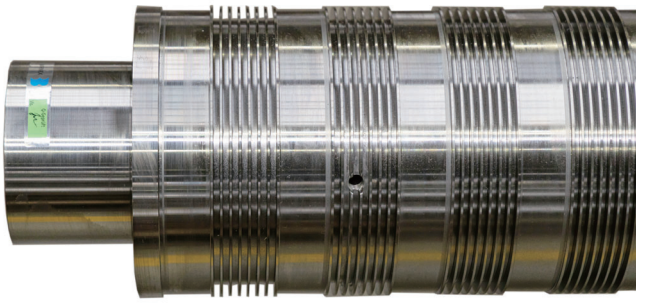


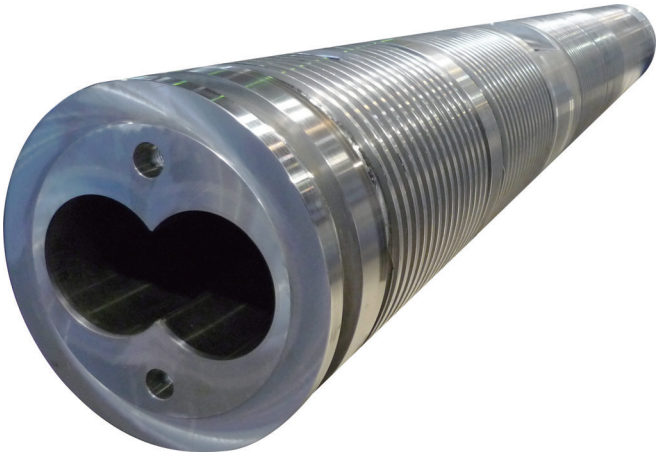
Barrels

Bernex group are equipped with advanced induction spin-casting ovens for heating process, owns state-of-the-art CNC machining center and laboratory for continually developing our engineering expertise.



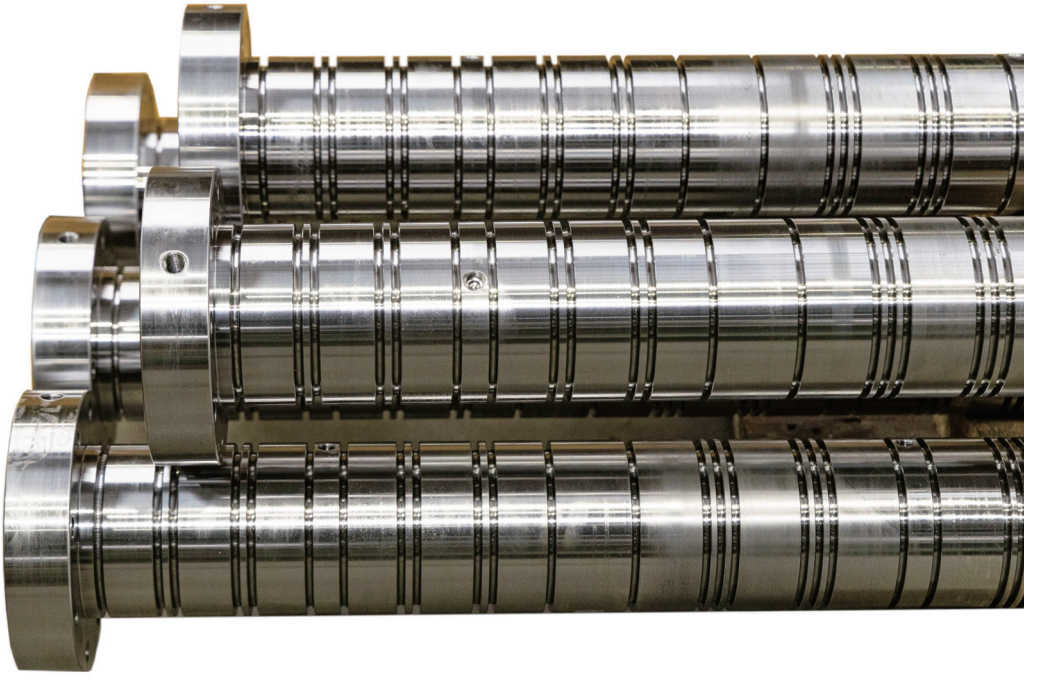
Our production lines are optimally suited to spin cast and manufacture large, complex barrels.

We produce highly wear-resistant bimetallic barrels as well as a wide range of nitriding steel barrels. Almost all versions are available as single and twin barrels.



Scope of offer

- Bimetallic Barrel
  - Single
  - Twin Barrel
- Nitriding Barrel
  - Single
  - Twin Barrel



Bimetallic barrels

Benefits of Bernex Bimetallic barrels:

World's leading heating technology with **special designed induction furnace** enabling:

- Precise control on process temperature with absolute repeatability.
- Better maintain barrel straightness during heat.
- Competitive and reliable manufacture lead time.
- Even distribution of metallic melt brings better cast stability, uniformed alloy thickness, premium bimetallic quality.

Multiple types of protection alloys are available:

- Cover various requirements of abrasion and corrosion resistance.
- Extend service life of barrel with enhanced layer protection.
- Benefit to process consistency.

Types of Bimetallic alloys:

Alloy Type	Base	Hardness (HRC)	Wear Resistance	Corrosion Resistance
A110	Fe	58-65	★★	★
AC333	Fe-Cr	62-69	★★★	★★
C242	Ni-Co	48-56	★	★★★★★
ACW800	Ni	58-66	★★★★★	★★★★

Suitability: "★"good to "★★★★★"excellent

Manufacturing capability:

- Single Barrel:
  Inner diameter from 16mm - 500mm.
- Twin Barrel:
  Inner diameter from 45mm - 200mm.

A110

Basic protection from abrasion

A **general-purpose** bimetallic alloy, recommended to process resin with filler content up to 10% (fibers and minerals)

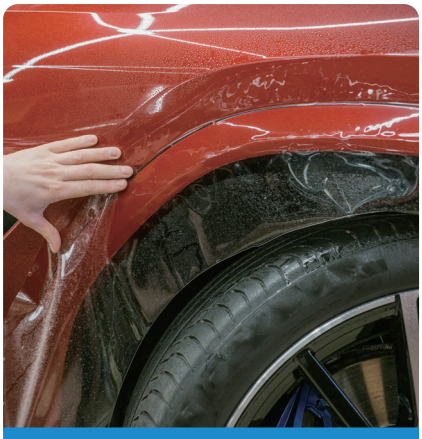
Typical resins to process:

- ABS, PP, PE, PS, PA, PLA

General parameter:

- Fe based alloy
- Hardness 58-65HRC
- Max process temperature 400°C

Recommended Applications:



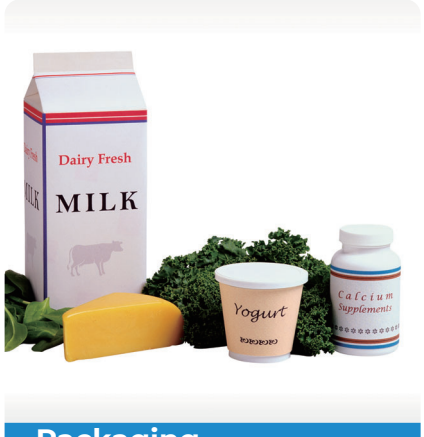
Automotive
TPU Paint protective film

Medical
TPU Medical Tubing

New Energy
CPP Lithium battery separator

New Energy
EVA film for PV Module

Packaging
PP,PE food packaging bag



Packaging
LDPE; mLLDPE Color-printing soft packaging

AC333

Good protection against abrasion and corrosion

A **multi-functional** alloy with good protection against abrasion and moderate corrosion resistance. Recommended to process resin with filler up to 30%.

General parameter:

- Fe-Cr based alloy
- Hardness 62-69HRC
- Max process temperature 500°C

Typical resins to process:

- PMMA, SAN, PC, PI, PET, PBT

Recommended applications:

Environmental Protection
PLA Bio-degradable Tableware

Automotive
PC, PMMA Car Light

Automotive
Rubber sealing strip

Building Construction
UPVC Pipe

Appliance
ABS-FR Housing of washing Machine

Appliance
PBT+30%GF Impeller

C242

Complete protection from corrosion

A **nickel-based** iron-free alloy specially formulated to provide **maximum protection against corrosion**. Recommended to process resin with highly corrosive properties. Suitable for process where high clarity is valued.

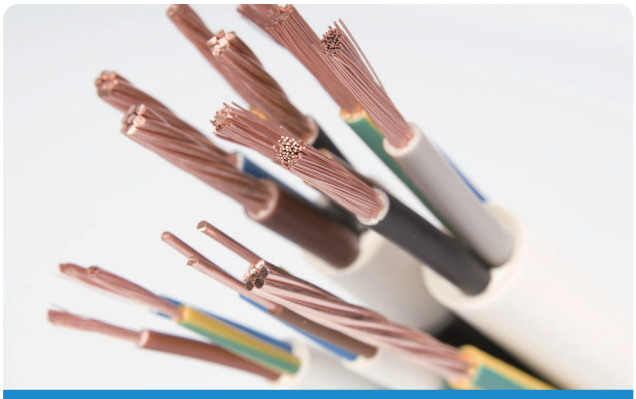
General parameter:

- Ni-Co based alloy
- Hardness 48-56HRC
- Max process temperature 600℃

Typical resins to process:

- PVC, PUR, PVDC, FEP, ETFE

Recommended Applications



Electronics
FEP; ETFE cable insulation layer

Packaging
PVDC Food grade shrink package casing Film

Medical
PTFE Medical Tubing

Chemical Industry
PVDF Valve

ACW800

Combined optimum protection against both abrasion and corrosion

The alloy **mixing tungsten carbides with nickel matrix**, offering optimum combined protection against abrasion and corrosion. Recommended to process any highly filled and corrosive plastics, regrind, halogen free flame retardants.

General parameter:

- Tungsten carbide-based alloy
- Hardness 58-66HRC
- Max process temperature 650°C

Typical resins to process:

Engineering resin with ≥ 30% filler content, Fluoroplastics, regrind material, halogen free flame retardants, high temperature resin.

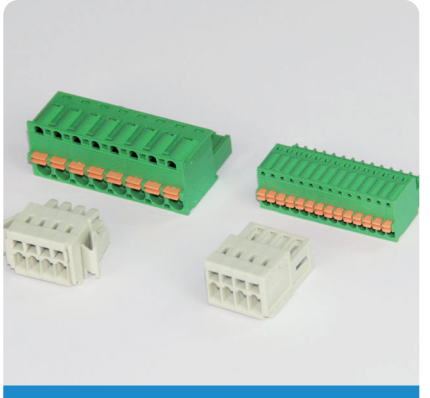
Recommended Applications

Semiconductor
PFA Wafer Cassette

Automotive
Long Glass Fiber filled Bumper

Automotive
PA+ 50%GF
Rearview mirror bracket

Optical
Clear PC, COC
Mobile Phone lens



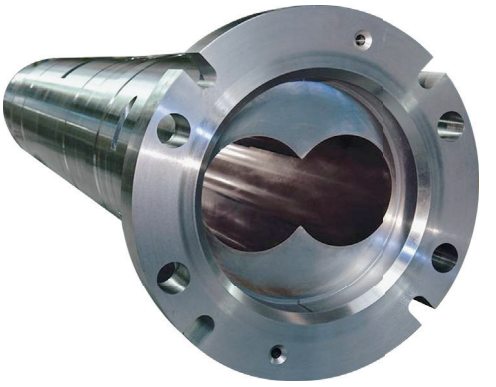
Electronics
HF-FR Electronic Connector

Chemical Industry
PEEK Profile

Twin Barrel

For different processing requirements and types of screws, Bernex offers twin barrels in different constructions and materials.

- Bimetallic
- Nitride



Manufacture Capability:

- Inner diameter: 30-200 mm
- Length: up to 3000mm or 20xD

Typical Applications:

PVC pipe and profile extrusion, Foaming sheet, Rubber extrusion, Pelletizing, Wood composites, Masterbatch, Compounding Devolatilization, Chemical reaction.

Benefits of Bernex Twin barrel:

- Mono-block housing for optimal heat transfer and minimal deviation.
- Maximum wear protection with different functional layer alloys.
- Segmented barrel design available for easier replacement and application flexibility.
- Offers reline service to help extend service life of twin barrel.
  Cost-effective barrel reline service is offered only for Bernex made bimetallic barrel.
  Exclusive offer with special discount is prepared for new customers.

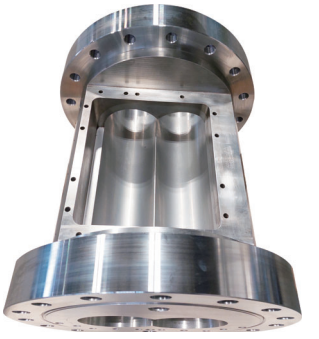
Services:

Liner Exchange:

- Available in all bimetallic layers.
- Barrel only for use with counter-rotating screw.
- Integrated Structure.
- Liner length: max. 1750 mm

Bush Exchange:

- Barrel for co-rotating screw only
- Modular construction
- Length: up to 8 x Inner-ø



Nitriding Barrel

Nitriding barrel is advised to process general resin with no abrasion nor corrosion.

Manufacturing capability:

Single Barrel

- Inner diameter from 20mm-610mm

Twin Barrel

- Inner diameter from 30mm - 200mm

Typical resin to process:

General purpose resin with no filler

Screws

Rely on our technical know-how and extensive practical experience in the plastic industry, Bernex design and manufacture screws which are uniquely suited to specific processes. These can be **single screw or twin screws, for injection, extrusion** or for other customer requests.

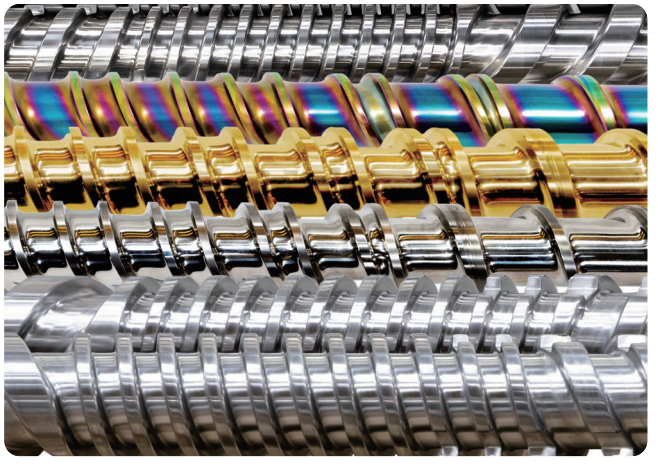
Manufacture capability:

Single screw:

- Nitralloy, Alloy Steel Screws
  Diameter: 16 - 600mm
  Length: max 9000mm.
- Tool Steel, PM steel, Nickel Alloy Screws
  Diameter: 16 - 80mm
  Length: max 2000mm.

Twin Screw:

- Nitralloy, Alloy Steel Screws
  Diameter: 40-200mm
  Length: max 6000mm



Benefits of Bernex screws:

- Manufactured with world's leading CNC machining center and precise inspection tools, skilled to produce **any complex screw geometries** without compromise.

- Our state-of-the-art PTA welding systems reliably hardface flight lands with all known alloys, **quality guaranteed**.

- Wide range of material combinations available to meet different wear challenges, provides superior **protection** to your screw.

- **Customized design** for **optimized performance.**

Injection Screws

Bernex customizes injection molding screw materials, sizes and specialized design based on the resins being processed and the requirements of product.

Single Flight

An upgraded and customized version of standard 3-zone screw. The L/D ratio, compression ratio, root depth and length of each section can be tailored design.

Benefits:

- Better temperature control
- Fast screw recovery
- General applicability
- Economic choice

Applications:

General resin like PC, PP, ABS
High glass-fiber filled material, Fluoroplastics.

Specialized Barrier design

Benefits:

- Higher output
- Lower melt temperature
- Reduce recovery time **up to 20%**
- Flexible use, combined with different mixers

Applications:

Polyolefin (HDPE, PP) and PET

OEM replacement & Extension

Bernex's extensive experience working with world's leading manufacturers of different plastication processes enhanced our dependability as a provider of screw replacement and rebuild in any geometries.

Bernex is always committed to continued improving screw geometry for latest demand.

Special mixers

Bernex supplies various types of high-performance mixers to meet specific demand of different processes.

We customized design for:

- Maximum fiber retention
- Optimum transparency
- High uniformity of color, additive distribution
- Self-clean for quick material change
- Injection foaming
- Quick recovery, fast cycle
- High speed process
- Shear/ temperature sensitive material
- High viscosity resin

Injection Accessories

Bernex manufacture precise:

• **Valve** • **Endcap** • **Nozzle**

To improve **shot consistency and repeatability** of injection molding unit.

Various materials are available to address varying degrees of abrasion and corrosion challenges.

Valves

Ring Type Valve:

- Universal applicability:
  The common design for general applications
- Flow path is optimized for each resin
- Easy for partial replacement and cleaning

Application:

General purpose

Locking Type Valve:

- The claw of the ring rotates with screw to minimize wear between ring and seat
- Excellent volume consistency

Application:

General resin with abrasive filler
Low viscosity material

Ball check Valve:

- Precise shot weight consistency
- Easy assembly of pin and ball
- Self-cleaning

Application:

Fluoroplastics, LSR

Endcap

High-strength and toughness alloy steel is used to manufacture endcap installed at the discharge end of barrel.

Customized endcap is available for abrasive and corrosive applications.

Nozzle

Available in both OEM design and customized modification to fit with existing unit.

Extrusion Screws

Bernex owns extensive practical experience in manufacturing and designing extrusion screws. We apply rheology test to gain a comprehensive understanding of material properties, considering with process parameters and requirements for the product, we then recommend optimum material selection and design solutions which maximize extrusion output while ensuring optimal quality of the product.

The Extrusion processes our screw serves:

- Cast Film
- Sheet
- Wire and cable
- Profile
- Etc.
- Blown film
- Coating
- Tubing
- Rubber

Special mixers

Bernex supplies various types of high-performance mixers to meet specific demand of different processes.

We customized design for:

- Increased yield
- Improve output consistency
- Superior melt quality
- High uniformity of color, additive distribution
- Self-clean for quick material change
- Low shear
- Reduce temperature increase during melt

Specialized Barrier design

Benefits:

- **About 20%+ throughout**
- Lower shear stress, better temperature control
- Mild shear
- Excellent compatibility with different mixers
- Customized L/D ratio, length, and root depth of each zone, ensure stable melt flow till output, minimize head pressure fluctuation, improve product quality and consistency.
- Wide applicability in almost all extrusion processes.

Common processes:

Cast Film, Coating Extrusion.
Sheet, Tubing, Blown Film Extrusion

Twin Screws

Bernex produces various types of precision designed twin screws to fulfill different process needs

-Parallel

Co-rotating
Counter rotating

-Conical

Counter rotating

Material:

- Bimetallic
- Tool Steel
- Nitride

Manufacture Capability:

- Diameter: 40 - 200 mm
- Length: Up to 6000 mm

Benefits of Bernex Twin Screws:

- Customized design for individual requirements.
- CNC programmed manufacturing for any complex geometry.
- Wide application range and operational flexibility.
- Extend service life with Bernex customized wear off protection.

Parallel Twin Screws

Advantages:

- Excellent mixing and blending, improve melt uniformity
- Higher Output
- Flexible to use
  Modular design, length, L/D can be adjusted by adding or removing screw elements
- Wide application range

Co-rotating Parallel Type

Features:

- Self-cleaning ability
  The high screw speed can eliminate resin adhering to the screw
- Short residence time
  Reduce risk of resin degradation
- Higher output efficiency
- Better homogeneity of melt
- Higher shear
- Greater pressure stability

Applications:

- Compounding
- Masterbatch
- Devolatilization
- Chemical Reaction
- Engineering resin reinforced with fiber

Twin Screws

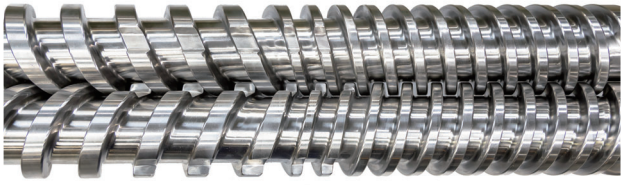
Counter rotating Parallel Type

Features:

- Lower screw speed
- Lower shear
- Lower processing temperature
- Higher feeding efficiency
  Compare with Co-rotating Parallel Type

Applications:

PVC Pipe & Profile & Sheet Extrusion
Thermal-sensitive materials



Counter rotating Conical Type

Features:

- Compact design in taper shape
- Customized design for specific application, not available for modification with elements or shaft.
- Higher pressure and improved compounding
- Good melt homogeneity

Applications:

PVC compounding,
PVC profile extrusion
PVC Foaming Sheet
Wood composite
Thermal-sensitive materials

Twin screw elements:

- CNC machining ensures precise geometry and surface finish, enables perfect engagement, and fast assembly.
- Advanced heat treatment technology enhances the durability of the elements.
- Improved applicability through tailored design
- Reducing frequency of replacement, improve production efficiency.

Bernex Screw Material

Base Material

Base Material	Hardening	Hardness	Treatment		Resistance Property	
			Armored flight	Coating	Abrasion	Corrosive
Nitriding Steel						
SN 1	Nitriding	—	√	X	★	★
SN 2		—	√	X	★	★
Alloy Steel						
SA 1	Flame/laser hardened	—	√	√	★★	★
Stainless Steel						
SS 1	Through-hardened	—	X	√	★	★★
SS 2		—	√	√	★	★★
SS 3		—	√	√	★	★★★★
SS 4		—	√	√	★	★★★
Nickel-based Steel						
SNI 1	Age hardened	—	√	√	★★	★★★★★
SNI 2		—	√	√	★★	★★★★
SNI 3		—	√	√	★★	★★★★
Standard Tool Steel						
ST 1	Through-hardened	50-55HRC	X	√	★★	★★
ST 2		59-63HRC	X	√	★★	★★
ST 3		63-65HRC	X	√	★★★	★★
PM Steel						
SPM 1	Through-hardened	58-60HRC	X	√	★★★	★★
SPM 2		58-62HRC	X	√	★★★	★★★★
SPM 3		62-64HRC	X	√	★★★	★★★★★
SPM 4		64-66HRC	X	√	★★★★	★★★
SPM 5		60-62HRC	X	√	★★★★	★★★
SPM 6		62-64HRC	X	√	★★★★★	★★★★★

1. Other materials upon request, please consult with Bernex sales representative.
2. Resistance property listed stands for base material itself, excluding surface treatment.
3. "√" appliable, "X" not appliable
4. "★" fair to "★★★★★" excellent

Bernex Screw Material

Wear Protection on Screw Flight

Armored Flight	Base alloy	Hardness(HRC)	Resistance	
			Abrasion	Corrosion
BC 1	Cobalt base	52-57	★★★	★★★
BC 6	Cobalt base	38-42	★	★★★
BC 12	Cobalt base	44-48	★★	★★★
BN 56	Nickel base	52-56	★★★	★★★
BF 60	Iron base	51-58	★★★★	★★
BF 62	Iron base	58-62	★★★★	★★
BNW 83	Nickel base	52-56	★★★★	★★★
BNW 830	Nickel base	56-60	★★★★★	★★★★

Suitability:

"★" fair to "★★★★★" excellent

Coating

Coating Type	Thickness(mm)	Hardness	Resistance	
			Abrasion	Corrosion
Chrome Plate	0.020-0.035	800-1100 HV0.1	★★★★	★★
PVD,TiN	0.004	2500 HV0.05	★★★	★★★
PVD,CrN	0.004	2100 HV0.05	★★★	★★★★
PVD,CrN Plus	0.008	2100 HV0.05	★★★★	★★★★★
BNW 8000	0.10-0.15	1000-1400 HV0.2	★★★★★	★★★★★

Suitability:

"★" fair to "★★★★★" excellent

Coatings

PVD Coating

Benefits

- Provides extra protection to **reduce wear** and extend service life.
- Improved **surface smoothness**, prevent melt from sticking to screw, reduce cost of maintenance and cleaning.
- Reinforced screw hardness and chemical resistance, provides **enhanced durability** for **higher productivity**.
- Better process consistency and reliability, saving cost through reduction of scrap rate.

PVD-TiN Coating:

- Provides a smooth surface finish to reduce resin sticking, therefore higher clarity output can be achieved.
- Recommended for applications where high transparency is required. Typical use is PC, PMMA for optical application.

PVD-CrN Coating:

- High-level adhesion, abrasion and corrosion resistance, smooth and hard surface to reduce friction and scratch.
- Recommended to process engineering resin reinforced with high glass fiber, halogen-free flame-retardant additives.

PVD-CrN Plus Coating:

- **Double thickness multi-layer structure** coating applied via cross spray, forms high density coating with minimal porosity.
- The coating surface is extremely hard and smooth, maximally reducing or even eliminating resin adhesion.

BNW 8000 Coating

Advantages:

- Tungsten carbide coating, delivers optimum resistance to abrasion and corrosion.
- Flexible application: can be applied on entire flight or area where wear is likely to occur.
- Fusion spray with strong metallurgical bonding, minimal porosity and eliminate chipping.
- Reliable coating for stable performance, improving productivity while reducing scrap.

Applications:

Work together with **ACW800 nickel-base tungsten carbide barrel**, provides **exceptional abrasion and corrosion resistance** to highly filled material (reinforced with >40% glass fiber, carbon fiber), halogen-free flame retardants, regrind recycle materials which are aggressive and challenging to process.

Barrel Screw Combination

Choosing the appropriate material for your screw is critical, not only to optimize the screw function itself but also to ensure compatibility with barrel.

Bernex customize barrel screw combination, delivers **impressive melt quality, process stability and cost efficiency** to customer's production line.

Barrel	Screw							
				Nitriding Steel with Armored Flight				
	Standard Tool Steel	PM Steel	Nitriding Steel	BC 6	BC 12	BN56	BF60	BNW830
A110	•••	–	••	•	••	•••	••	–
AC333	•••	••	••	•	••	•••	••	••
C242	–	–	–	•••	••	••	–	–
ACW800	••	•••	–	–	–	••	•••	•••
Nitriding Steel	••	–	••	••	••	•••	•	–

Suitability:

– not suitable
• low suitability
•• suitable
••• highly suitable

These are general recommendations.
For detailed information on your application, please contact the Bernex sales team.

Material Selection

Material Type	Resin		Diameter	Barrel
				Option 1
General Thermoplastics Without fillers	PE, PP, PS, ABS, PA		≤ 60mm	A 110
			> 60mm	
	PC, PMMA		≤ 60mm	AC 333
			> 60mm	
	Clear PC for Optical purpose		≤ 60mm	ACW 800
	Biodegradable Resin, PLA		≤ 60mm	AC333
			> 60mm	
	PVC (CPVC, RPVC,UPVC)		All Sizes	ACW 800
Engineering Plastics	Filler Reinforced (long glass Fiber, high glass fiber, carbon fiber)	≤ 20%	≤ 60mm	AC 333
			> 60mm	
		20%-40%	≤ 60mm	ACW 800
			> 60mm	
		＞40%	≤ 60mm	ACW 800
			> 60mm	
	High viscosity material POM, PC		≤ 60mm	AC 333
			> 60mm	
	High temperature resin PEEK, PAI, PPS		≤ 60mm	ACW 800
			> 60mm	
Thermoplastic elastomer	TPU,TPE		≤ 60mm	A 110
			> 60mm	
Fluoroplastics	PFA, FEP,PTFE, PVDF		All Sizes	ACW 800
Halogen Free	Low smoke halogen free		All Sizes	A 110
	Halogen free flame retardants		All Sizes	ACW 800
Rubber			All Sizes	ACW 800

Screw			Applications
Option 2	Option 1	Option 2	
-	ST	SA/BN56/CP	
	SA/BN56/CP	SN/BN56/NIT	
A 110	SA/BNW83/CP	SA/BN56/CP	
AC 333	SPM/PVD	SA/BNW83/CP	
A110	ST/HT	SA/BN56/CP	
	SA/BN56/CP	SS/BN56	
AC 333	SS/BNW83	SA/BNW83/CP	
A 110	ST/HT	SA/BN56/CP	
	SN/BN56/NIT	SA/BN56/CP	
AC 333	SPM	SA/BF60/CP	
	SN/BNW83/NIT	SA/BNW83/CP	
-	SPM/PVD	-	
	SA/BNW830/BNW8000	SA/BNW83/BNW8000	
-	ST/PVD	ST/HT	
	SA/BNW83/CP	SA/BN56/CP	
-	SPM/NIT	SPM	
	SA/BNW83/BNW8000	SA/BNW83/CP	
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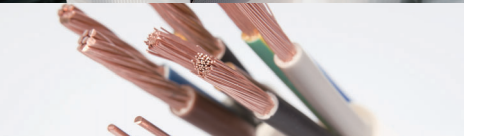
	SA/BN56/CP	-	
C 242	SNI/BNW830	SNI/BN56	
-	SA/BN56/CP	SS/BN56	
C 242	SNI/BNW83	SNI/NIT	
AC 333	SA/BNW83/CP	-	

Service

Take advantage of Bernex's professional service package to upgrade your plastification unit with:

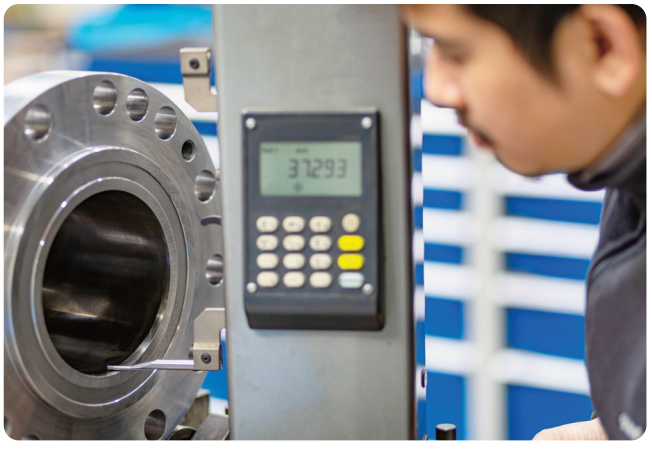
- Premium quality
- Prolonged service life
- Optimal process performance
- Downtime reduction
- Cost efficiency

What Bernex can do for you?

Consultancy PLUS:

- Precise inspection and measurement services are available as first stage of Bernex consultancy service. "Consultancy PLUS" stands for one step ahead to get start and one step further to serve.

- We would access the degree of wear and condition of unit, a complete record of your component range and the condition of each part would then be logged for easy tracking.



Irradiate new vitality, find more possibilities!

- Based on the record, Bernex will recommend a replacement or upgrade solution at the appropriate time. Therefore, the plan of repair is a one-stop service taken care by Bernex. Customer no needs to worry about when and how to renew, nor be bothered with organizing inspection repeatedly.

- This systematic maintenance service benefits the customer with reliable traceability, professional support and time saving.

Upsize & Downsize

Upsizing and downsizing service aimed to optimize the performance of existing injection machines through “remolding” plastification units inside.

Benefits:

- Cost efficiency, instead of ordering new machine
- Higher flexibility upon setting, compared with standard unit
- Better suitability to specific process

The property of resin, specification of product, process parameter setting can be very different for individual customers. Bernex will comprehensively analyse your injection process, assessing the shot size, product, and target performance, and then suggest the optimal size for refitting your injection unit.

Reline barrel sleeve:

It is critical that the new sleeve must be fit perfectly with inner diameter of barrel.

Bernex applies precise measurement and control over the dimension, tolerance of sleeve to ensure it can be incorporated perfectly into original barrel.

To ensure accuracy of rework and reliability of finish barrels, our barrel reline service is available only to bimetallic barrels made by Bernex, it can be single or twin barrels.

Solutions for your Success

Concerted effort has been made in the last years toward sustainable manufacturing process. Increased efficiency and use of induction heating ovens allow Bernex to run new generation of CO_2 free production lines. In addition, Bernex's products have enabled sustainable use of plastic and contributes towards reducing the human footprint in the planet through efficient plastic recycling and adoption of bio-polymers.

Bernex products are sold and distributed all over the world. Our main customers are the leading global plastic machine manufacturers for extrusion, injection, recycling and compounding of polymers; and renown polymer processors in the above diversified applications.

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