



R e i l o y   B a r r e l s

R e i l o y   S c r e w s

P M - H I P   T e c h n o l o g y



## Reiloy – The Quality Company

Highly wear resistant screws and barrels  
for extrusion and injection moulding

  
**Reiloy**  
Reifenhauser Group



## Reiloy – Ready for new challenges

### *Quality for the highest demands*

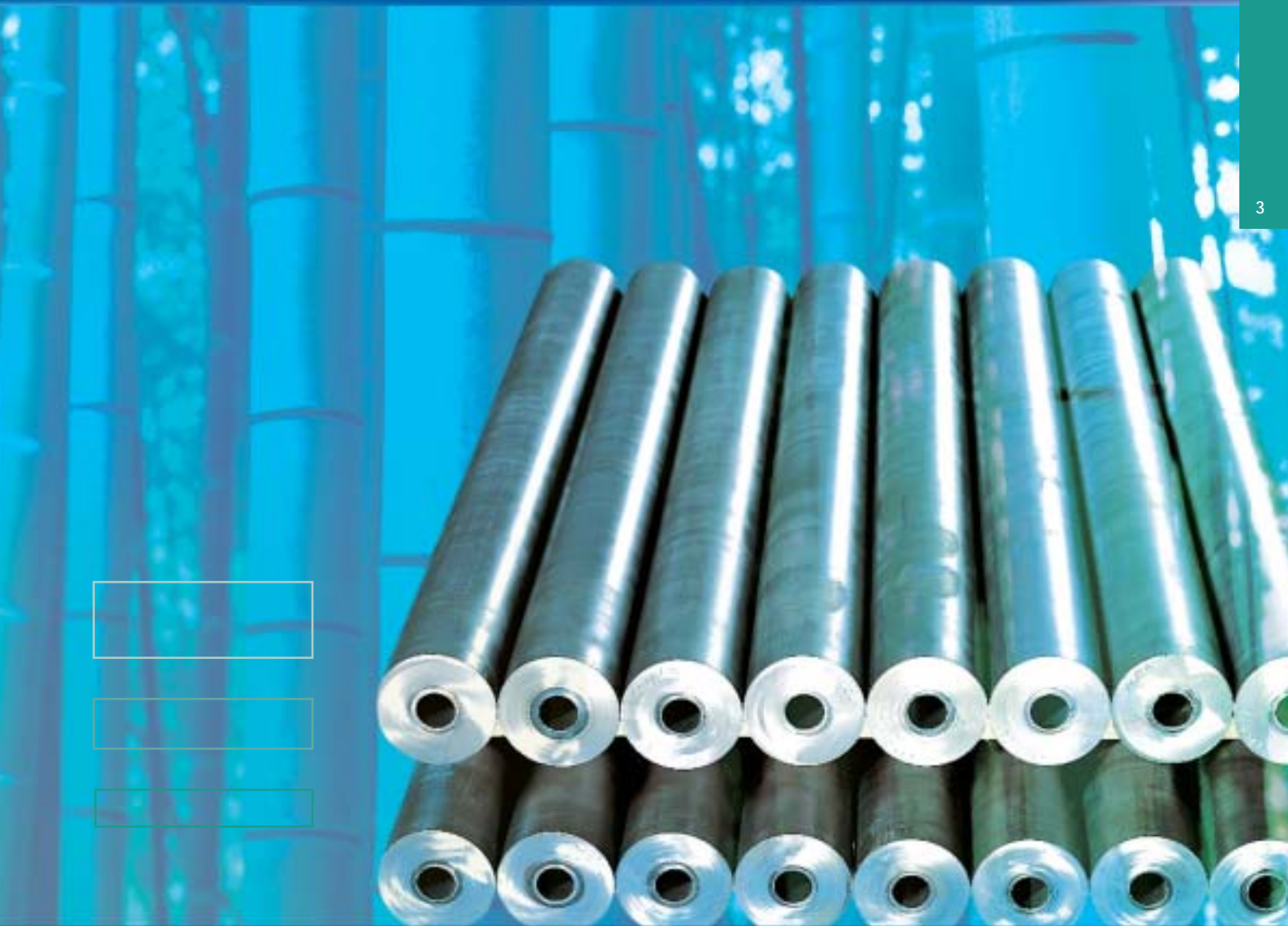
Today's plastic products have to comply with sophisticated tasks. Often this requires additives to achieve specific characteristics. These additives, coupled with higher throughput, as well as higher operating temperatures and pressures, create a more demanding wear environment on Screws and Barrels. This aggressive wear is a consequence of abrasion, adhesion and corrosion.

To ensure high quality, predictable, stable, and economical production of plastic parts, Screws and Barrels must be comprised of the proper alloys and dimensional precision.

From the beginning, Reiloy's mission has been to produce and sell custom-tailored, wear resistant Screws and Barrels. Reiloy's constant development of new hard alloys and procedures to improve wear protection has resulted in being recognized as a market leader. With continuous investments in highly automated production lines and an expansion of our production capacities, Reiloy has set the stage to continue its track record as a technology leader in the future.



# Reiloy Barrels



Induction field centrifugally cast bimetalllic barrels,  
wear and corrosion resistant

Reiloy developed lining and backing alloys engineered for processing today's plastics.

Technically proven manufacturing processes guarantee the highest quality.



Centrifugal Casting process



Finished Barrel Reiloy R121

## Reiloy Barrels



### *Bimetallic Cylinder*

Reiloy produces outstanding alloys for bimetallic Barrels, which are used in general as well as specific high demand applications to avoid the effects of wear and/or corrosion.

All armouring alloys are developed in our own material laboratory and continuously tested under tough operating conditions.

The armouring lining alloys are centrifugally cast into the barrels backing steel in high-performance induction field centrifugal casting plants. The resulting bimetallic barrel blank features a high strength backing steel and a homogenous metallurgical diffusion bond.

The barrel blanks are absolutely free from distortion; one result of Reiloy's proven production process. Time-consuming and labour-intensive straightening operations and stress-relief annealing can thus be eliminated during the subsequent mechanical machining.

Reiloy R112



Reiloy R215



Reiloy R130

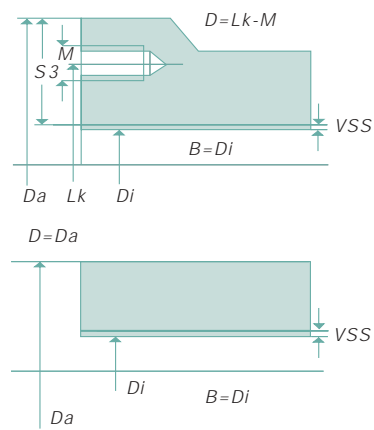
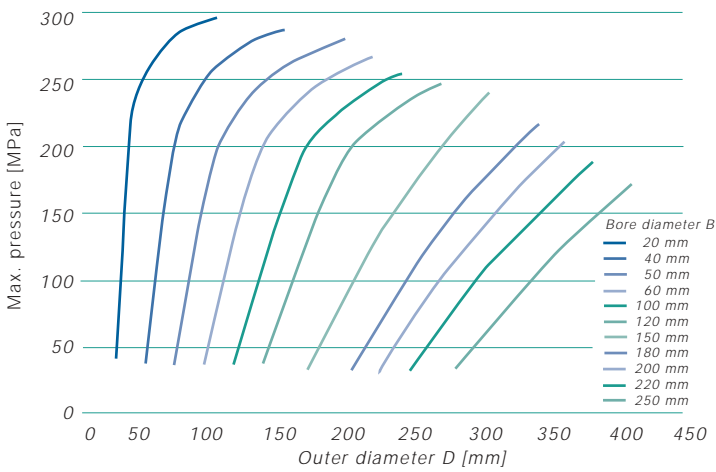




Finish machining of a bimetallic barrel

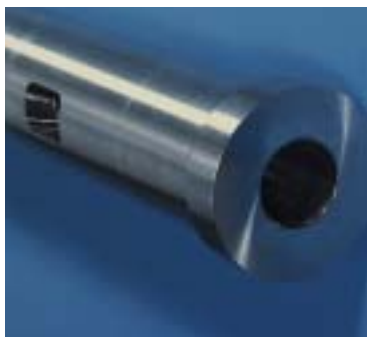
Reiloy's specially developed backing steels are designed to match specific applications in injection moulding machines and extruders. Reiloy's alloyed steels fulfil the demand of high operating pressure and corrosion resistance if necessary.

High pressure barrels, typically for injection moulding applications, receive the Cr-V-alloyed special backing steel "Reiloy Standard", produced according to Reiloy's chemistry and treatment instructions.



Maximum permissible pressure inside the barrel depending on outer diameter D for different bore diameters B  
Barrel material Reiloy Standard at 350°C working temperature.

Reiloy R115



Reiloy R121



## Selection of REILOY's centrifugal casting alloys for barrels

### Fe-base

REILOY material	Hardness [HRC]		Wear resistance	Corrosion resistance	thermal material expansion (25 - 400 °C) [1/MK]	essential alloy elements [weight-%]					
	RT	300 °C				Cr	Mo	V	Ni	B	C
R112	65 - 68	55 - 57	•••	-	12,8	1	-	-	4	2,1	3,6
R121	65 - 69	58 - 62	•••	•••	14,2	10	6	-	4	3,8	2,0
R130	65 - 69	58 - 62	••••	••	14,1	9	5	8	5	3,5	3,1

### Ni-base

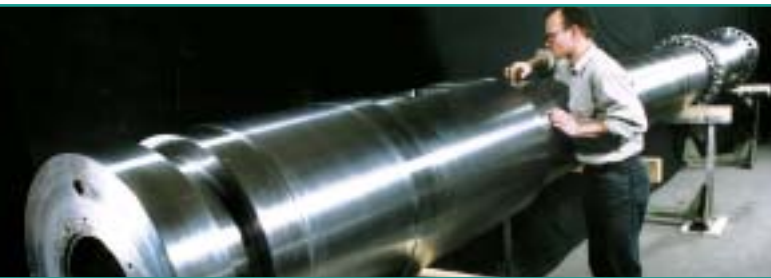
REILOY material	Hardness [HRC]		Wear resistance	Corrosion resistance	thermal material expansion (25 - 400 °C) [1/MK]	essential alloy elements [weight-%]					
	RT	300 °C				Cr	Mo	Co	B	W	C
R115	52 - 56	49 - 53	•	•••••	13,1	7	2	35	3,8		
R215	60 - 65	53 - 57	•••••	••••	11,5	4	1,5	15	2	40	1,9

## Selection of backing materials for bimetallic barrels Properties after the centrifugal casting process

### Backing materials

Material	Material No.	Yield strength $R_{p0.2}$ (300 °C) [MPa]	Tensile strength $R_m$ (RT) [MPa]	Elongation to fraction $A(l_0=5d)$ (300 °C) %
REILOY-Standard	-	580	980	15
C60	1.0601	360	800	12
Inconel 625	2.4856	300	630	40

Additional backing materials available on request



### Delivery parametres

- Layer thickness approx. 1,5 mm
- Bore honed to tolerance H7
- Peak-to-valley height min. 0,15 µm max. 0,8 µm  
Except R215 min. 0,5 µm, max. 0,8 µm

### Delivery dimensions

- Inside dia. 15 - 400 mm
- Outside dia. max. 650 mm
- Length max. 9000 mm

### Delivery form

- Barrel blank : Bore finished-honed, outer diameter and length with manufacturing overdimensions
- Semi-finished barrel: Bore finished-honed, outer diameter and length turned to dimension (eventually with feed opening) with shrink-fit sleeve at the outflow end if necessary completely finished according to the customer's drawing
- Finished barrel:

# Reiloy Screws



Through-hardened or flight armoured Screws

Quality without compromise, is the production standard for all of REILOY's highly wear resistant Screws

# Reiloy Screws



## Through hardened screws

Reiloy has developed and produces speciality vanadium PM-HIP screw bars specifically designed for injection and extrusion screw high performance processing. The Reiloy PM-alloys exhibit excellent wear resistance behaviour because of the high content of Vanadium, when compared with the qualities of typical melt metallurgy produced steels.

Screws produced from PM-HIP rods are through-hardened. They reach a high wear resistance and impart improved corrosion resistance for most processing applications due to the relatively high Chromium content.

### Selection of REILOY's PM-HIP alloys Fe-base

#### Fe-base

REILOY material	Norm description	Hardness [HRC]		Wear resistance*	Corrosion resistance	Thermal expansion elements (25 - 400 °C) [1/MK]	Significant chemical elements [weight-%]		
		RT	400 °C				Cr	V	C
R123.6	X230CrVMoW18-6	64	54	•••••	••	11,7	18,0	6,0	2,3
R123.3	X270CrVMoW17-9	64	54	•••••	••	12,1	17,0	9,0	2,7
R123	X220CrVMoW20-4	62	53	•••	••	11,4	20,0	4,0	2,2

Recommended hardness for screws 58-60 HRC

Additional qualities on request

\*Relative wear resistance compared to D2 (X155CrVMo12-1) = •

### Delivery dimensions

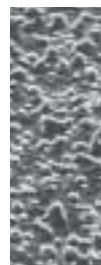
- Screws dia. 14 mm - 70 mm
- PM-HIP steel rods dia. 25 mm - 70 mm production-length up to 4000 mm

### Delivery form

- Screws: completely finished according to the customers drawing
- PM-HIP steel rods

Reiloy R123.3

Reiloy R123.6





## *Screws with armoured flights*

The flights of a screw are the most exposed to abrasion and corrosion. In order to minimize the rate of wear, Reiloy uses a hard facing process to armour the flight with a highly wear resistant layer.

The thickness of the armouring layer averages between 1,5 and 2 mm. The armouring layer is applied by means of the plasma powder arc welding (PTA) process, during which the armouring layer and the base material of the screw are metallurgically bonded together. This PTA screw armouring process is highly automated, precise, and reproducible with high quality.

The alloy composition, structural state, hot hardness and the sliding properties are the decisive factors for improved abrasion resistance.

In addition, to ensure that the screw root and the flight flanks are adequately protected against wear, the complete screw surface is ion-nitrided.

In case of higher corrosion exposure the screw root and the flight flanks are covered with hard-chrome or a corrosion resistant material according to the process demands.

*Reiloy RC3*



*Reiloy RS12*



*Reiloy RP50*



## Reiloy Screws

### Selection of REILOY's armouring alloys for screws

#### Fe-base

REILOY material	Norm description	Hardness [HRC]		Wear resistance	Corrosion resistance	Thermal expansion (25 - 400 °C) [1/MK]	Essential alloy elements [weight-%]		
		RT	300 °C				Cr	V	C
RC3	X395VCrWMo16-13	56 - 59	54	•••••	••	12,2	13	16	4,0

#### Co-base

REILOY material	Norm description	Hardness [HRC]		Wear resistance	Corrosion resistance	Thermal expansion (25 - 400 °C) [1/MK]	Essential alloy elements [weight-%]			
		RT	300 °C				Cr	W	Si	C
RS6	CoCr28W5	38 - 40	34	•	•••	13,9	28	5	1,5	0,9
RS12	CoCr27W10	45 - 48	41	••	•••	12,9	27	10	1,5	2,0
RS1	CoCr33W13	52 - 56	48	•••••	•••	12,1	33	13	1,2	2,5

#### Ni-base

REILOY material	Norm description	Hardness [HRC]		Wear resistance	Corrosion resistance	Thermal expansion (25 - 400 °C) [1/MK]	Essential alloy elements [weight-%]						
		RT	300 °C				Cr	Mo	W	Co	B	Si	C
RP50	NiCr17Mo16	49 - 52	49	•••	•••••	11,4	17	16	6	5	1	1,8	1,1
RP50 Plus	NiW20Cr14Mo13	51 - 55	52	•••••	•••••	11,4	14	13	20	4	0,8	1,5	1,9

Additional armouring alloys such as Colmonoy 56, Colmonoy 83 or alloys with WC-content on request.

### Selection of basic materials for flight armoured screws and their properties at 300°C

REILOY material	Material No.	Yield strength $R_{p0.2}$ [MPa]	Tensile strength $R_m$ [MPa]	Elongation to fraction $A(l_0=5d)$ [%]	Surface hardness after ion-nitriding HV5 bei RT	Depth of nitrided zone [mm]
31CrMoV9	1.8519	780	930	15	720	0,30
X35CrMo17-1	1.4122	470	850	14	1100	0,15
Inconel 625	2.4856	415	870	45	-	-

Additional materials such as Haynes Alloy 242 on request.

#### Delivery dimensions

- dia. 50 mm - 350 mm
- length max. 9000 mm

#### Delivery form

- Screw blanks with armouring, pre-ground +0,3 mm to nominal dimension
- Screws completely finished according to the customer's drawing

# PM-HIP Technology



Powder metallurgy and hot-isostatic pressing for highly wear-resistant screws and barrels

REILOY's in house PM and HIP plants are core components of our sophisticated technology which sets and assures the highest quality standards



## PM-HIP Technology



### *Screws and barrels using PM-HIP technology*

Processes requiring a high percentage of glass, mineral, and oxidizing fillers create an extreme wear environment for screws and barrels. In these applications the use of specialty hard-material alloys is indicated. These alloys can only be produced, technologically and cost-effectively, with the powder metallurgical process (PM) and subsequent **Hot-Isostatic-Pressing (HIP)**.

The positive result is that the mineral and oxidizing fillers, reinforcing materials as well as ceramic compounds, whose particle size can be less than 1  $\mu\text{m}$ , have practically no chance of causing wear on the HIP armouring layer.

Depending on the alloying constituents, the HIP armoured layers are highly corrosion resistant or have at least a limited resistance to corrosion.

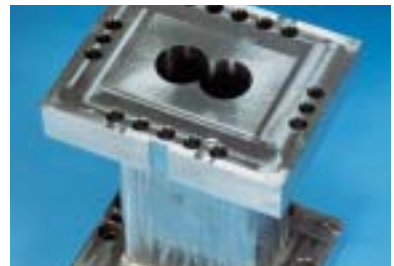
Reiloy PM-HIP RS12



Reiloy PM-HIP RC1



Reiloy PM-HIP RP15C2

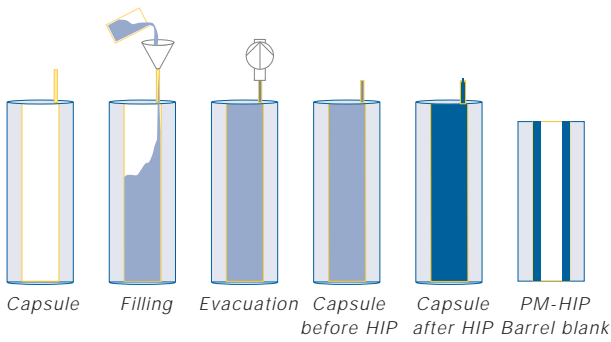




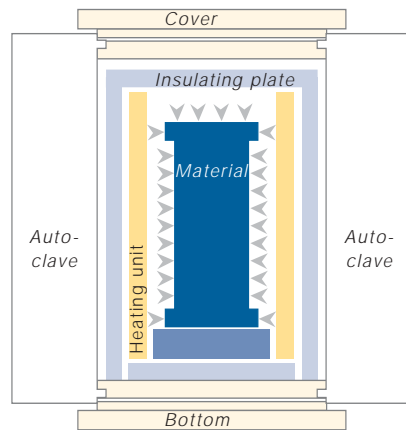
REILOY PM-HIP plant

PM-HIP alloys are distinguished by an extremely fine and isotropic structure which is crack-free and non-porous.

Reiloy has developed and produces, in our ultra-modern HIP-plant, all of our proprietary alloy powders. Extensive experience and stringent quality control guaranty high-quality composite materials ideally adapted to yield high performance properties.



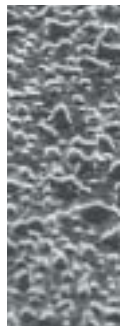
PM-HIP production process for a single screw barrel



Schematic sketch PM-HIP plant

Reiloy R123.6

Reiloy RC



## Selection of REILOY's PM-HIP alloys

### Fe-base

REILOY material	Hardness* [HRc]		Wear** resistance	Corrosion resistance	Thermal expansion (25 - 400 °C) [1/MK]	Essential alloy elements [weight-%]		
	RT	400 °C				Cr	V	C
	*salt bath hardened		**rel. volume loss					
R123.6	64	54	•• [2,2]	••	12,3	18	6	2,3
R123.3	64	54	••• [1,8]	••	12,1	17	9	2,7
RC	65	54	•••• [0,65]	-	12,5	9	13	3,5
RC1	65	54	•••• [0,75]	•	12,6	13	13	3,4
RC3	65	54	••••• [0,35]	••	12,2	13	16	4,0

Application field: Screws, Single-screw barrels, Twin-screw barrels

Reference wear resistance of D2 (X155CrVMo12-1): rel. volume loss = [7,5]; measured with pin on disc test.

### Co-base

REILOY material	Hardness* [HRc]		Wear resistance	Corrosion resistance	Thermal expansion (25 - 400 °C) [1/MK]	Essential alloy elements [weight-%]			
	RT	400 °C				Cr	W	Si	C
RS6	42	36	•	••••	14,3	28	5	1,5	0,9
RS12	53	45	••	••••	13,4	27	10	1,5	2,0
RS1	61	54	•••	••••	11,8	33	13	1,2	2,5

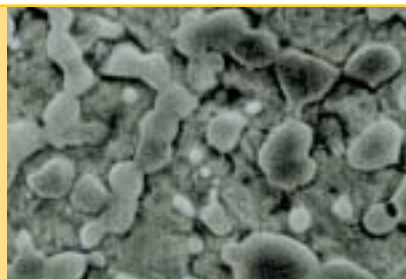
Application field: Single-screw barrels, Twin-screw barrels

### Ni-base

REILOY material	Hardness* [HRc]		Wear resistance	Corrosion resistance	Thermal expansion (25 - 400 °C) [1/MK]	Essential alloy elements [weight-%]					
	RT	400 °C				Cr	Mo	W	Co	B	Si
RP15C2	60	56	•••	••••	12,4	12	2	5	17	3,6	2,5
RP50H	58	55	•••	••••	10,6	17	22	5	5	2,1	1,8

Application field: Single-screw barrels, Twin-screw barrels

Further alloys on request.



### Delivery dimensions

- Screws dia. 14 - 70 mm
- Single-screw barrels dia. 14 - 200 mm
- Twin-Screw barrels dia. 25 - 200 mm
- Length and outer dimensions on request.

### Delivery form

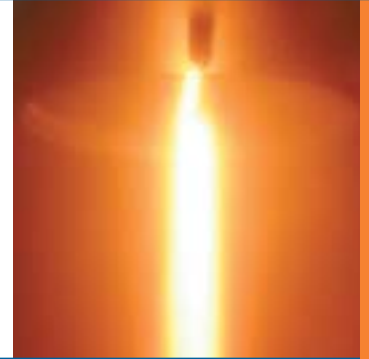
- Steel rod for screws
- Screws completely finished according to the customer's drawing
- Barrel blanks or semi-finished barrels
- Barrels completely finished according to the customer's drawing



*Raw material*



*Casting*



*Gas atomisation*

## *Powder production and quality assurance*

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Reiloy has successfully produced bimetallic barrels and screws for more than 30 years.

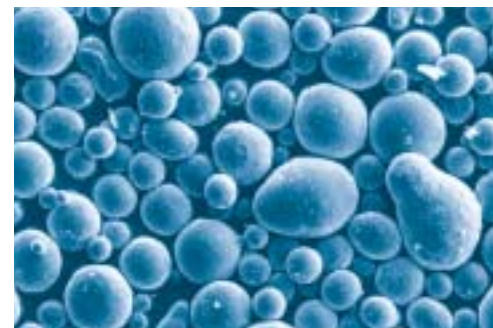
This success is founded in the fact that Reiloy controls the entire process from alloy development to finish machining. From materials development, wear resistant powder alloy production, in-house HIP plant, rotational casting, all the way to finish machining, all processes are in the control of a single source – Reiloy.

The gas atomisation plant for the production of highly alloyed metal powder in combination with a modern equipped laboratory assures our products will meet Reiloy's high quality standard, and offers the flexibility of developing products that will meet our customer's future demands.

*Gas atomisation plant*



*REM-picture of gas atomised powder*





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