Instructions for Use
republic**Zr**® Y-ML

1. Product Description

republic**Zr**® Y-ML zirconia milling blanks are Class IIa medical devices in accordance with Article 51 of Regulation (EU) 2017/745 on medical devices (MDR) and are intended for dental applications. The blanks are pre-sintered and, after final sintering, meet the requirements of DIN EN ISO 6872 for a type II, class 5 ceramic, according to the manufacturer's specifications.

Available variants: diameter 98.5 mm, various heights, various colors

republic**Zr**® Y-ML **unlimited**	3Y-TZP & 4Y-PSZ Multi-yttrium (Y_2O_3) blanks with color and translucency gradient Suitable for all positions in the dental arch – monolithic posterior tooth translucency
republic**Zr**® Y-ML **pioneer**	4Y-PSZ & 5Y-PSZ Multi-yttrium (Y_2O_3) blanks with color and translucency gradient Suitable for all positions in the dental arch – monolithic anterior tooth translucency

2. Users

Professional, trained dental technicians and/or dental practitioners who manufacture individual dental restoration.

3. Patient Group

For the permanent dentition of fully grown patients of all ages and genders who require customized, fixed or conditionally removable dental prostheses.

4. Indications

All-ceramic restorations in the anterior and posterior regions such as inlays, onlays, veneers, monolithic (fully anatomical) or anatomically reduced crowns and bridges (maximum of two connected pontics), hybrid abutments and abutment crowns, primary telescopes, and cantilever bridges with a single pontic (the cantilever pontic should be designed approximately one third narrower in its mesio-distal dimension).

5. Contraindications

Do not use in cases of insufficient space, unsuitable preparation, parafunctions, or known hypersensitivity to any of the components. republicZr zirconia is a fully ceramic and metal-free material. Even in partially or fully stabilized forms, the metal-free nature of zirconia remains unchanged. Since metals in their oxide form lose their free electron mobility, they do not exhibit the typical characteristics of metallic materials (such as conductivity)

6. Precautions

During post-processing, milling, grinding, and polishing, use a suitable dust mask (FFP2) and an extraction system with an air filter to protect the lungs from inhaled dust. Wear protective goggles during processing to prevent dust from entering the eyes. If dust does get into the eyes, rinse immediately with plenty of water and consult a doctor. Keep away from food and drinks.

- This product is intended for dental use only.
- Do not touch heated objects from the furnace with bare hands.

7. Chemical Composition (wt.%)

republic**Zr**® Y-ML **unlimited &** Y-ML **pioneer**

$ZrO_2 + HfO_2 + Y_2O_3$	≥ 99 %
Y_2O_3	~ 6 - 9,7 %
Al_2O_3	≤ 0,5 %
Other Oxides	≤ 0,1 %
Coloring Oxides	≤ 1 % (Fe_2O_3 |Er_2O_3 | Mn_2O_3)

8. Physical Properties

Determined acc. to or based on: **DIN EN ISO 6872**	value	**Y-ML unlimited**	**Y-ML pioneer**
Density after sintering	g/cm^3	≥ 6.0	
CTE (25–500 °C)	$10^{-6}\ K^{-1}$	10.5 ±0.5	
Chemical solubility	$\mu g/cm^2$	<100	
Radioactivity	Bq/g	<0,1	
Monoclinic phase content after accelerated aging*	%	<5	
Fracture toughness** (KIc – body)	$MPa\sqrt{m}$	5,1	5,47
Flexural strength (incisal)**	MPa	1027	850
Flexural strength (body/cervical)**		1300	1.200
Sintering temperature (final)	°C	1.480 – 1.500	

*determined according to DIN EN ISO 13356
**Flexural strength tests are carried out according to DIN EN ISO 6872 using the three-point or biaxial testing method. The determination of fracture toughness (K_Ic) is a recommendation from the standard. Values are published based on the CNB method. SEVNB values are available upon request.

9. Minimum Layer Thicknesses and Connector Cross-Sections

republic**Zr**® Y-ML **unlimited &** Y-ML **pioneer**

To ensure clinical success, the following minimum wall thicknesses and connector cross-sections must not be undercut in the fully sintered state:

	Anterior Region		Posterior Region	
	min. wall thickness	Connector cross-section	min. wall thickness	Connector cross-section
Full Anatomy				
Single crown	0.8 mm	-	1.0 mm	-
3- unit bridge	1.0 mm	9 mm^{2}*	1.0 mm	12 mm^{2}*
Bridge with 4 or more units Max. of 2 connected pontics	1.0 mm	12 mm^{2}*	1.0 mm	15 mm^{2}*
Cantilever bridge with 1 pontic	1.0 mm	12 mm^{2}*	1.0 mm	15 mm^{2}*
Frameworks				
Single crown	04 mm	-	0.6 mm	-
3- unit bridge	0.6 mm	9 mm^{2}*	0.6 mm	9 mm^{2}*
Bridge with 4 or more units Max. of 2 connected pontics	0.7 mm	12 mm^{2}*	1.0 mm	15 mm^{2}*
Cantilever bridge with 1 pontic	1.0 mm	12 mm^{2}*	1.0 mm	15 mm^{2}*

***Connector Rule: Height > Width:**

✓ The height of the connector area should be as large as possible.
✘ The height should not be smaller than the width.
✓ The height should be at least as large as the width.

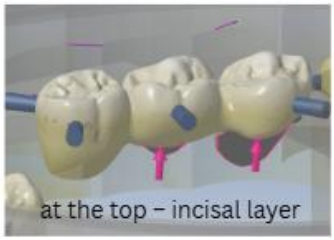
10. CAM- Nesting

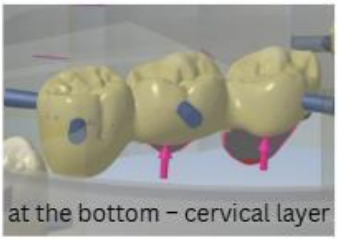
For an optimal and individualized color result, you can refer to the layering scheme in the following tables:

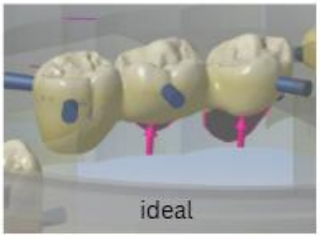
republic**Zr**® Y-ML **unlimited**	**5 Main Layers (4 Transition Layers)**									
Blank height	Incisal 1		Layer 2		Layer 3		Layer 4		Cervical 5	
16 mm	23%	3,68 mm	18%	2,88 mm	18%	2,88 mm	18%	2,88 mm	23%	3,68 mm
20 mm	23%	4,60 mm	18%	3,60 mm	18%	3,60 mm	18%	3,60 mm	23%	4,60 mm
25 mm	23%	5,75 mm	18%	4,50 mm	18%	4,50 mm	18%	4,50 mm	23%	5,75 mm
Do not position the specified minimum connector cross-section in the incisal area of the disc.										

republic**Zr**® Y-ML **pioneer**	**6 Main Layers (5 Transition Layers)**											
Blank height	Incisal 1		Layer 2		Layer 3		Layer 4		Layer 5		Cervical 6	
14 mm	23%	3,22 mm	10%	1,40 mm	10%	1,40 mm	19%	2,66 mm	19%	2,66 mm	19%	2,66 mm
16 mm	23%	3,68 mm	10%	1,60 mm	10%	1,60 mm	19%	3,04 mm	19%	3,04 mm	19%	3,04 mm
18 mm	23%	4,14 mm	10%	1,8 0 mm	10%	1,80 mm	19%	3,24 mm	19%	3,24 mm	19%	3,24 mm
20 mm	23%	4,60 mm	10%	2,00 mm	10%	2,00 mm	19%	3,80 mm	19%	3,80 mm	19%	3,80 mm
25 mm	**20%**	5,00 mm	10%	2,50 mm	10%	2,50 mm	20%	5,00 mm	20%	5,00 mm	20%	5,00 mm
Do not position the specified minimum connector cross-section in the incisal and Layer 2 areas of the disc.												

If your CAM software allows the implementation of the layering schemes, you can increase planning reliability through a visually supported workflow.







11. Milling

1. For optimal fit accuracy, the batch-specific expansion or sintering shrinkage value is provided on the edge of the blanks and/or on the outer packaging (label).
2. Enter the corresponding value in the respective CAM software according to the requirements. If there are any uncertainties, contact your CAM software manufacturer.
3. The printed side corresponds to the incisal/occlusal area ("chewing surface icon").
4. When clamping the blank into the holder, ensure that the surrounding notch and the disc holder are absolutely clean, and when securing with screws, tighten evenly in a cross pattern, not too tightly (to avoid stresses).
5. Process the blanks with the milling machine using the milling strategies intended for the material.
6. It is recommended to use milling tools with sufficient cutting edge quality.

12. Cutting and Finishing

1. The pre-sintered material is sensitive (chalk-like) and requires careful handling. However, corrections in the pre-sintered state are generally more material-friendly than processing after sintering.
2. Suitable rotating tools are recommended for cutting the blank (e.g., fine carbide burs); avoid using cutting discs.
3. For finishing the connectors, suitable rotating tools (e.g., fine carbide burs) should also be used. Coarse carbide burs and/or grinding instruments are not suitable as they may cause chipping, among other issues.
4. When partially applying liquid coloring (brush infiltration technique, e.g., in the incisal area), ensure that the surfaces of the restorations are not contaminated with grease or oily substances, as this can negatively affect the color result.
5. After finishing, thoroughly remove the zirconia dust with a soft brush and then air-blast the restoration with oil-free compressed air.

13. Final Sintering

The constructions are sintered in a suitable high-temperature furnace at 1,480°C (up to 1,500°C). Detailed recommendations can be found in the separate sintering instructions available in the download section at www.dentrepublic.de/downloads.

14. Post-Processing

After sintering, ideally, as little post-processing as possible should be done. If necessary, use a water-cooled laboratory turbine and appropriate diamond burs under low pressure (recommended grain size: approx. 40 µm). Avoid excessive heat generation and localized overheating, as this can lead to micro-cracks in the material. Areas such as connectors, which will experience tensile stress in clinical use, should not be post-processed. Do not separate at interdental connection points (if necessary, it's better to do this before sintering). Avoid sharp edges.

15. Ceramic Veneering, Coloring, Glazing

Commercially available veneering ceramics can be used. Please follow the manufacturer's instructions and ensure an appropriate coefficient of thermal expansion (CTE).

As usual, ensure sufficient anatomical support for a stress-free and even veneer.

The republic**Zr**® Y-ML blanks are particularly suitable for cut-back (minimal layering) and full monolithic restorations that are painted and/or glazed, due to their color and optical light properties.

For solid constructions, a slow heating and cooling rate is recommended. For bridges with five or more units and bridges with solid pontics, a gradual long-term cooling down to 500°C is advisable. This approach reduces thermal stresses and avoids thermal cycling loads, helping to maintain the material's structural integrity. The risk of fractures can be significantly reduced.

16. Processing in Dental Practice

1. Preparation: All prosthetic components must be cleaned, disinfected, and/or sterilized before each use in the patient's mouth.
2. Cementation:
    - Conventional: Zinc phosphate cements or glass ionomer cements.
    - Adhesive: Composite cements.
    - For conventional cementation, ensure sufficient retention and a minimum abutment height of 4 mm.
    - For additional cleaning, the internal surfaces of the bonding area can be sandblasted with aluminum oxide (50 µm at 1–2 bar).
    - Please follow the specific processing instructions of the cementation material used.
3. Provisional cementation is not recommended, as frameworks may be damaged during removal.
4. For extraoral bonding of a hybrid abutment to a titanium base, the use of Multilink Hybrid Abutment (Ivoclar Vivadent) is recommended. Always follow the manufacturer's instructions for both the titanium base and the bonding material.
5. Post-Processing:
    - If occlusal adjustments are necessary in the dental practice, the surface must be polished to a high gloss afterward.
    - For adjustments, use only diamond grinding instruments (recommended grain size: approx. 40 µm). For polishing, use diamond polishers.

17. Storage of Blanks:

The estimated shelf life is 5 years. No material degradation is expected within this period. Store the container in a dry place. Keep at room temperature.

12. Disposal

Dispose of in accordance with local regulatory requirements. Non-contaminated and empty packaging can be recycled (refer to the safety data sheet).

18. Explanation of Symbols

					
European conformity marking with identification number of the notified body	Date of manufacture	Expiry date	Batch code	Non-sterile	Do not reuse
					
Variant designation	Unique product identifier	Medical device	Wear eye protection	Wear a mask	Refer to electronic instructions for use
					
Manufacturer	Importer	Authorised Representative in the EU			

Warranty / Disclaimer

Any application-related recommendations, whether given verbally, in writing, or as part of practical instruction, are to be considered guidelines. Our products are subject to continuous development and are tested in accordance with the current state of science and legal requirements. We reserve the right to make changes to handling and composition as a result.

The current valid version of the instructions for use can be found at: www.dentrepublic.de/downloads

This version replaces all previous versions.