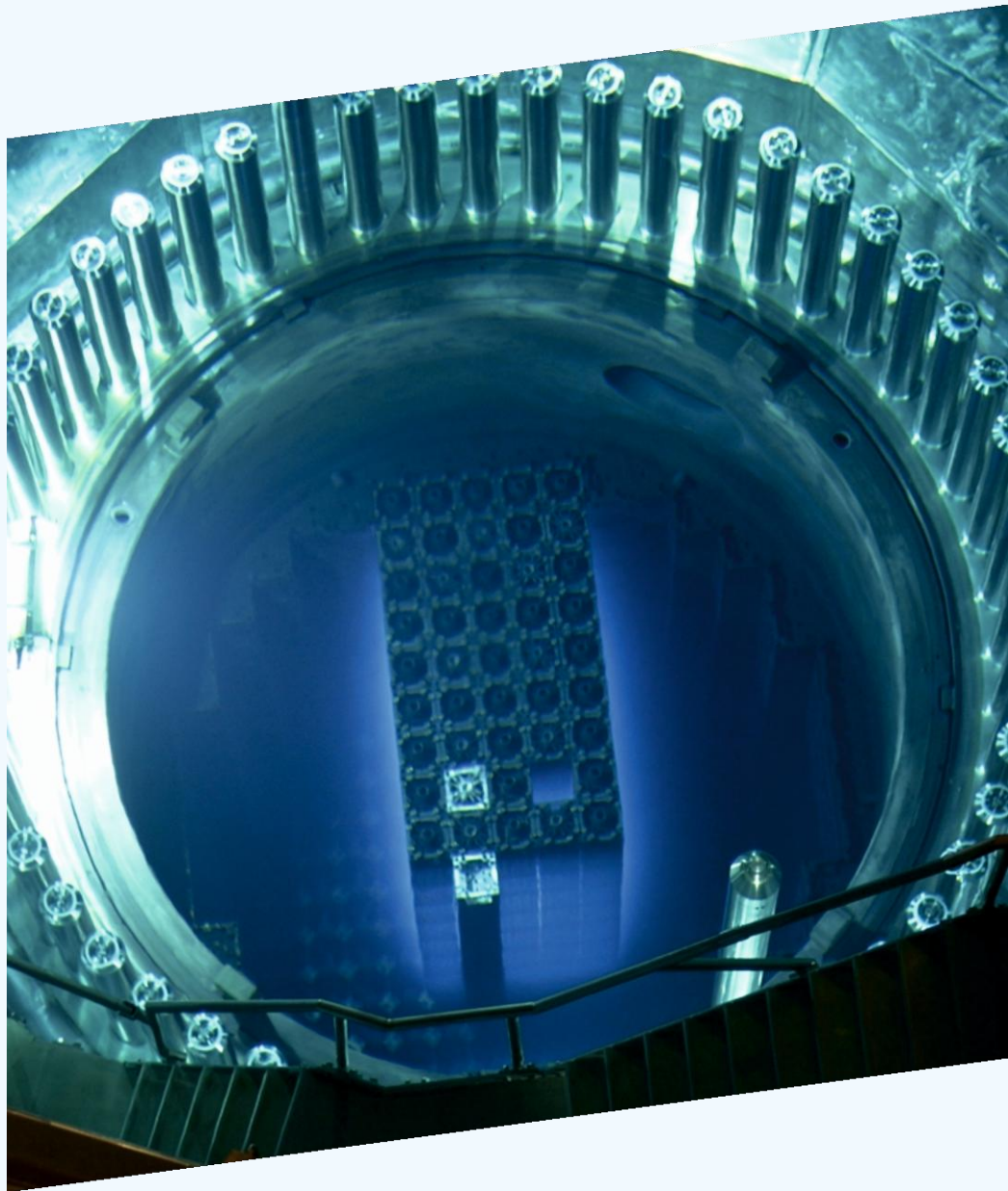


CATALOGUE OF THE PRODUCTS

# FOR NUCLEAR POWER GENERATION

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TOKEM

# HIGH-TECH PRODUCTION OF ION EXCHANGE RESINS

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Dear colleagues ad partners,

I am pleased to introduce here the general information on ion exchange resins produced by “TOKEM” Production Association LLC (OOO).



**A.L. Tikhomirov**

Director General  
“TOKEM” Production Association LLC (OOO)



The history of our company dates back to February 3, 1942, when the plant "Karbolit" evacuated from Orekhovo-Zuevo (Moscow region) rearwards to Kuzbass put out its first products. This day is considered the birthday of Kemerovo company "Karbolit". In 1991, in the course of corporatization Kemerovo Research and Production Association "Karbolit" was converted into JSC Company "ТОКЕМ", and since August 2004 we are "ТОКЕМ" Production Association LLC (ООО). Applying the results of our own research and experience, the company "ТОКЕМ" provides commercial supply of ion exchange resins for various applications in accordance with the wishes and requirements of customers.

The most significant of all existing technological problems is, undoubtedly, the problem of water supply and efficient use of water resources for population and industry needs. One can neither live nor can carry out production processes without quality water. Water is a key strategic product, thus technology aimed at obtaining high-quality water is becoming increasingly more important. Ion exchange resins are used not only in water treatment, but also in virtually all industries.

Our company possesses a state-of-the-art technology of production of monodisperse ion exchange resins that allows us to produce and deliver to the market the most effective and demanded materials.

Development and production of ion exchange resins is fully consistent with our forward strategy, namely, to be a leading Russian company in the field of ion exchange.

Products supplied by our company are the outcomes of our own research center providing the implementation of innovation and development of production. Our main goal is to satisfy the requests, wishes, and requirements of customers, which is ensured by a professional team of experienced engineers and researchers.

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**A.L. Tikhomirov**

Honoured Chemist of the Russian Federation  
Director General of "ТОКЕМ" Production Association LLC (ООО)



TOKEM

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## CATION EXCHANGE RESIN TOKEM-105-10 NR

TR 2227-042-72285630-2015

Strong acid nuclear class cation exchange resin (gel type).

GENERAL DESCRIPTION	
Matrix	styrene-DVB
Functional group	Sulfonic acid
Polymer structure	gel
Ionic form	H <sup>+</sup> Hydrogen

### Application area (according to Standard Protocol RD EO 1.1.2.25.0161-2009 and Industrial Standard STO 1.1.1.02.013.0715-2009):

- for using in cation exchange filters of special water treatment SVO-1 in SCWR reactors;
- for using in cation exchange filters of special water treatment SVO-2,4,6 (boron concentrate treatment) in SCWR reactors;
- for using in nonregenerable cation exchange filters of special water treatment SVO in LWGR reactors;
- for using in nonregenerable mix bed filters of special water treatment SVO-1 in SCWR reactors together with anion exchange resin TOKEM-805 NR;
- for using in nonregenerable mix bed filters of special water treatment SVO in LWGR reactors together with anion exchange resin TOKEM-805 NR.

### Physical and Chemical Characteristics: (and Industrial Standard STO 1.1.1.07.003.0368-2011):

CHARACTERISTICS	STANDARD VALUE
Appearance	Spherical beads, yellow to dark brown in colour
Particle size range, mm	0.40-1.25
Volume of effective size fraction, % min	98
Total uncracked beads as shipped, %, min	97
Osmotic stability, %, min	94
Moisture retention, %	45-51
Total capacity, mmol/cm <sup>3</sup> (mg-eq/cm <sup>3</sup> ), min	2.0
Water product oxidation in oxygen equivalent, mg/g max	0.5
Mass fraction of chloride ions, mg/cm <sup>3</sup> , max	0.01



Table con'd (Physical and Chemical Characteristics)

Mean mechanical toughness, g/bead, min	400
Beads with toughness below 200 g/bead, %, max	5
Difference between settling times of anion and cation resins, sec, max	6
Electrostatic coefficient, % max	15



## CATION EXCHANGE RESIN TOKEM-145-10 NR

TR 2227-042-72285630-2015

Strong acid nuclear grade cation exchange resin (gel type) with uniform particle range composition.

GENERAL DESCRIPTION	
Matrix	styrene-DVB
Functional group	Sulfonic Acid
Polymer structure	gel
Ionic form	H <sup>+</sup> Hydrogen

### Application area (according to Standard Protocol RD EO 1.1.2.25.0161-2009 and Industrial Standard STO 1.1.1.02.013.0715-2009):

- for using in cation exchange filters of special water treatment SVO-1 in SCWR reactors;
- for using in cation exchange filters of special water treatment SVO-2,4,6 (boron concentrate treatment) in SCWR reactors;
- for using in cation exchange nonregenerable filters of special water treatment SVO in LWGR reactors.

### Physical and Chemical Characteristics (according to Standard STO 1.1.1.07.003.0368-2011):

CHARACTERISTICS	STANDARD VALUE
Appearance	Spherical beads, yellow to dark brown in colour
Mean particle size, mm Uniformity coefficient, max	0.65±0.05
Volume ratio of beads passing through N04 mesh, % max	1.1
Osmotic stability, %, min	1.0
Total uncracked beads as shipped, %, min	94
Moisture retention, %	97
Total capacity, mmol/cm <sup>3</sup> (mg-eq/cm <sup>3</sup> ), min	45-51
Product oxidation in oxygen equivalent, mg/g, max	2.0
Mass fraction of chloride ions, mg/cm <sup>3</sup> , max	0.5
Mean mechanical strength, g/bead, min	0.01
Beads with toughness below 200 g/bead, %, max	400
	5



## CATION EXCHANGE RESIN TOKEM-145-16

TR 2227-042-72285630-2015

Strong acid cation exchange resin (gel type). It is characterized with uniform particle range composition and high conversion to H<sup>+</sup> form.

### GENERAL DESCRIPTION

Matrix	styrene-DVB
Functional group	Sulfonic Acid
Polymer structure	gel
Ionic form	H <sup>+</sup> Hydrogen

### Application area (according to Standard Protocol RD EO 1.1.2.25.0161-2009 and Industrial Standard STO 1.1.1.02.013.0715-2009):

- for using in cation exchange filters of special water treatment SVO-5 in SCWR reactors in morpholine-ethanol amine regime;
- for using in mix bed filters of condensate purification plants in SCWR reactors in morpholine-ethanol amine regime together with anion exchange resin TOKEM-845.

### Physical and Chemical Characteristics (according to Industrial Standard STO 1.1.1.07.003.0368-2011):

CHARACTERISTICS	STANDARD VALUE
Appearance	Spherical beads, yellow to dark brown in colour
Mean particle size, mm	0.65±0.05
Uniformity coefficient, max	1.1
Volume ratio of beads passing through N04 mesh, % max	1.0
Degree of conversion to H <sup>+</sup> form, % min	99
Moisture retention, %	40-45
Osmotic stability, %, min	94
Total uncracked beads as shipped, %, min	98
Total capacity, mmol/cm <sup>3</sup> (mg-eq/cm <sup>3</sup> ), min	2.2
Mean mechanical strength, g/bead, min	450
Particles with toughness below 200 g/bead, %, max	5
Difference between setline times of anion and cation resins, sec, min-max	7-10
Electrostatic coefficient, % max	20





# CATION EXCHANGE RESIN TOKEM-145-10

TR 2227-042-72285630-2015

Strong acid cation exchange resin (gel type). It is characterized with uniform particle range composition and high conversion to H<sup>+</sup> form.

## GENERAL DESCRIPTION

Matrix	styrene-DVB
Functional group	Sulfonic Acid
Polymer structure	gel
Ionic form	H <sup>+</sup> Hydrogen*

### Application area (according to Standard Protocol RD EO 1.1.2.25.0161-2009 and Industrial Standard STO 1.1.1.02.013.0715-2009):

- for using in cation exchange filters of special water treatment SVO-3,6 (advanced water product treatment), 7 in SCWR reactors;
- for using in cation exchange filters of special water treatment SVO-5 in SCWR reactors in ammonia-hydrazine regime;
- for using in cation exchange regeneration filters of special water treatment SVO in LWGR reactors;
- for using in mix bed regeneration filters of special water treatment SVO in LWGR reactors together with anion exchange resin TOKEM-845;
- for using in mix bed filters of condensate polishing systems in LWGR reactors together with anion exchange resin TOKEM-845;
- for using in mix bed filters of water purification plants together with anion exchange resin TOKEM-845.

### Physical and Chemical Characteristics (according to Industrial Standard STO 1.1.1.07.003.0368-2011):

CHARACTERISTICS	STANDARD VALUE
Appearance	Spherical beads, yellow to dark brown
Mean particle size, mm	0.65±0.05
Uniformity coefficient, max	1.1
Volume ratio of beads passing through N04 mesh, % max	1.0
Degree of conversion to H <sup>+</sup> form, % min	99
Osmotic stability, %, min	94
Total uncracked beads as shipped, %, min	98
Moisture retention, %	45-51
Total capacity, mmol/cm <sup>3</sup> (mg-eq/cm <sup>3</sup> ), min	2.0



Table con'd (Physical and Chemical Characteristics)

Mean mechanical toughness, g/bead, min	450
Particles with toughness below 200 g/bead, %, max	5
Difference between settling times of anion and cation resins, sec, min-max	7-10
Electrostatic coefficient, % max	20

\* - If demanded by the customer in can be produced in Na+ form for application in mix bed filters **SOSTG\COCTI** ??? of SCWR reactors. In this case, quality indicators are to be discussed specially.



# CATION EXCHANGE RESIN TOKEM-105-10

TR 2227-042-72285630-2015

Strong acid cation exchange resin (gel type) with high conversion to H<sup>+</sup> form.

GENERAL DESCRIPTION	
Matrix	styrene-DVB
Functional group	Sulfonic Acid
Polymer structure	gel
Ionic form	H <sup>+</sup> Hydrogen

## Application area (according to Standard Protocol RD EO 1.1.2.25.0161-2009 and Industrial Standard STO 1.1.1.02.013.0715-2009):

- for using in cation exchange filters of special water treatment SVO-3,6 (advanced water product treatment), 7 in SCWR reactors;
- for using in cation exchange filters of special water treatment SVO-5 in SCWR reactors in ammonia-hydrazine regime;
- for using in cation exchange regeneration filters of special water treatment SVO in LWGR reactors.

## Physical and Chemical Characteristics (according to Industrial Standard STO 1.1.1.07.003.0368-2011):

CHARACTERISTICS	STANDARD VALUE
Appearance	Spherical beads. Yellow to dark brown in colour
Particle size range, mm	0.40-1.25
Volume of effective size fraction, % min	97
Conversion to H <sup>+</sup> form, %, min	99
Total uncracked beads as shipped, %, min	97
Moisture retention, %	45-51
Osmotic stability, %, min	94
Total capacity, mmol/cm <sup>3</sup> (mg-eq/cm <sup>3</sup> ), min	2.0
Mean mechanical toughness, g/bead, min	450
Beads with toughness below 200 g/bead, %, max	5



# CATION EXCHANGE RESIN TOKEM-100

TR 2227-023-72285630-2011

High capacity strong acid cation exchange resin with improved particle range composition. It is characterized with high chemical stability and mechanical toughness.

## GENERAL DESCRIPTION

Matrix	styrene-DVB
Functional group	Sulfonic acid
Polymer structure	gel
Ionic form	H <sup>+</sup> Hydrogen Na <sup>+</sup> Sodium

### Application area:

The cation exchange resin can be applied in all conventional ion exchange processes, including:

- softening and demineralizing water treatment systems with co-current regeneration.

### Physical and Chemical Characteristics:

CHARACTERISTICS	STANDARD VALUE	
Appearance	Spherical beads, yellow to dark brown	
Ionic form	H <sup>+</sup>	Na <sup>+</sup>
Particle size range, mm	0.40-1.25	
Uniformity coefficient, max	1.6	
Volume of effective size fraction, % min	98	
Effective particle size, mm max	0.40-0.55	
Moisture retention, %	48-56	43-53
Osmotic stability, %, min	98	
Total uncracked beads as shipped, %, min	90(95*)	
Total capacity, mmol/cm <sup>3</sup> (mg-eq/cm <sup>3</sup> ), min	1.9	2.0
Mean mechanical toughness, g/bead, min	300	
Beads with toughness below 200 g/bead, %, max	10	
Shipping weight, g/cm <sup>3</sup>	0.75-0.82	0.80 – 0.85
Particle density, g/cm <sup>3</sup>	1.17-1.25	1.25-1.29

\* - Values given in brackets are for products supplied to atomic power plants



**Processing Characteristics:**

SUGGESTED OPERATING CONDITIONS AND MODES:

Bed depth min, mm	800
Pressure drop coefficient, kPa·h/m <sup>2</sup>	1.35
Temperature limit, ° C	120
pH limit	0-14
Swelling at H <sup>+</sup> → Na <sup>+</sup> , %	5-8
Regenerant, % H <sup>+</sup> form	(1-1.5-3.0) H <sub>2</sub> SO <sub>4</sub> (4-5) HCl
Na <sup>+</sup> form	(6-10) NaCl
Total rinse requirement, BV	3-5
Backwashing bed expansion, %	50-80





# CATION EXCHANGE RESIN TOKEM-140

TR 2227-016-72285630-2010

Strong acid cation exchange resin (gel type) with uniform particle range composition. It possesses uniformity range of less than 1.1.

High monodispersity and the absence of small fraction contributes to significantly decreased pressure drop across the bed height. These features enable high flow rates enhancing regeneration effectiveness and reducing reagent and rinsing water requirements.

Uniform particle composition, compact bed packing, and no dead zones increase diffusion rate and contact area thus leading to better ion exchange kinetics.

The cation exchange resin is stable to chemical and mechanical stress, it is characterized with a high osmotic stability. It results in doubling service life of the monodispersed resin compared to that of polydispersed cation exchange resins.

GENERAL DESCRIPTION	
Matrix	styrene-DVB
Functional group	Sulfonic acid
Polymer structure	gel
Ionic form	H <sup>+</sup> Hydrogen Na <sup>+</sup> Sodium

## Application area:

Monodispersed cation exchange resin TOKEM-140 can be applied in all conventional water treatment systems, including:

- softening and demineralizing water treatment systems with co-current regeneration;
- softening and demineralizing water treatment systems with packed bed counter-current regeneration.

## Physical and Chemical Characteristics:

CHARACTERISTICS	STANDARD VALUE	
Appearance	Spherical beads, yellow to dark brown in colour	
Ionic form	H <sup>+</sup>	Na <sup>+</sup>



Table con'd (Physical and Chemical Characteristics)

Mean particle size, mm	0.65±0.05	
Uniformity coefficient, max	1.1	
Volume ratio of beads passing through N04 mesh, % max	1.0	
Volume ratio of beads on N08 mesh, % max	2.0	
Moisture retention, %	48-55	
Osmotic stability, %, min	98	
Total capacity, mmol/cm <sup>3</sup> (mg-eq/cm <sup>3</sup> ), min	1.9	2.0
Total uncracked beads as shipped, %, min	95	
Mean mechanical toughness, g/bead, min	300	
Beads with toughness below 200 g/bead, %, max	10	
Shipping weight, g/cm <sup>3</sup>	0.75-0.80	0.80-0.85
Particle density, g/cm <sup>3</sup>	1.20-1.25	1.26-1.30

**Processing Characteristics:****SUGGESTED OPERATING CONDITIONS AND MODES:**

Bed depth min, mm	800	
Pressure drop coefficient, kPa·h/m <sup>2</sup>	1.0	
Temperature limit, ° C	120	
pH limit	0-14	
Swelling at H <sup>+</sup> → Na <sup>+</sup> , %	5-8	
Regenerant, %		
H <sup>+</sup> form	(1-1.5-3.0) H <sub>2</sub> SO <sub>4</sub> (4-5) HCl	
Na <sup>+</sup> form	(6-10) NaCl	
Total rinse requirement, BV	2-4	
Backwashing bed expansion, %	50-80	



# CATION EXCHANGE RESIN TOKEM-200

TR-2227-019-72285630-2009

Weak acid cation exchange resin (porous type) with improved particle range composition and osmotic stability. It is characterized with high total and dynamic exchange capacities.

GENERAL DESCRIPTION	
Matrix	acryl-DVB
Functional group	carboxyl group
Polymer structure	macroporous
Ionic form	H <sup>+</sup> Hydrogen Na <sup>+</sup> Sodium

## Application area:

- removal of bicarbonate water hardness;
- selective removal of iron and other bivalent metals (copper, nickel, zinc);
- in combination with a strong acid cation exchange resin for cation removal;
- as a buffer membrane prior to a strong acid cation exchange resin;
- purification, extraction, concentration and selection of substances in various industries.

## Physical and Chemical Characteristics:

CHARACTERISTICS	STANDARD VALUE	
Appearance	Spherical opaque beads white to light yellow	
Ionic form	H <sup>+</sup>	Na <sup>+</sup>
Particle size range, mm	0.315-1.600	
Uniformity coefficient, max	1.6	
Effective size fraction proportion, % min	98	
Effective particle size, mm max	0.4-0.6	
Moisture retention, %	45-55	55-65
Osmotic stability, %, min	98	
Total uncracked beads as shipped, %, min	95	
Total capacity, mmol/cm <sup>3</sup> (mg-eq/cm <sup>3</sup> ), min	4.3	
Dynamic exchange capacity with regenerant requirement target, mmol/m <sup>3</sup> (g-eq/m <sup>3</sup> ), min	2300	



Table con'd (Physical and Chemical Characteristics)

Mean mechanical toughness, g/bead, min	300	
Particles with toughness below 200 g/bead, %, max	10	
Shipping weight, g/cm <sup>3</sup>	0.74-0.80	0.78-0.88
Particle density, g/cm <sup>3</sup>	1.14-1.20	1.20-1.25

**Processing Characteristics:**

SUGGESTED OPERATING CONDITIONS AND MODES:	
Bed depth min, mm	600
Temperature limit, ° C	120
pH limit	5-14
Swelling at: H <sup>+</sup> → Na <sup>+</sup> H <sup>+</sup> → Ca <sup>+</sup> , %	40-60 7
Regenerant, % H <sup>+</sup> form	(0.3-0.8) H <sub>2</sub> SO <sub>4</sub> (4-5) HCl
Total rinse requirement, BV	3-5
Backwashing bed expansion, %	80-100



# ANION EXCHANGE RESIN TOKEM-805 NR

TR 2227-042-72285630-2015

Strong base nuclear grade anion exchange resin (gel type).

GENERAL DESCRIPTION	
Matrix	styrene-DVB
Functional group	quaternary ammonium basic groups (type 1)
Polymer structure	gel
Ionic form	OH <sup>-</sup> hydroxyl

## Application area (according to Standard Protocol RD EO 1.1.2.25.0161-2009 and Industrial Standard STO 1.1.1.02.013.0715-2009):

- for using in anion exchange filters of special water treatment SVO-1 in SCWR reactors;
- for using in anion exchange filters of special water treatment SVO-2,4,6 (boron concentrate treatment) in SCWR reactors;
- for using in nonregenerable anion exchange filters of special water treatment SVO in LWGR reactors;
- for using in nonregenerable mix bed filters of special water treatment SVO-1 in SCWR reactors together with cation exchange resin TOKEM-105-10 NR;
- for using in nonregenerable mix bed filters of special water treatment SVO in LGWR reactors together with cation exchange resin TOKEM-105-10 NR.

## Physical and Chemical Characteristics (according to Industrial Standard STO 1.1.1.07.003.0368-2011):

CHARACTERISTICS	STANDARD VALUE
Appearance	Spherical beads, light yellow to brown in colour
Particle size range, mm	0.4-1.25
Volume of effective size fraction, % min	98
Total uncracked beads as shipped, %, min	97
Osmotic stability, %, min	90
Moisture retention, %	55-60
Total capacity, mmol/cm <sup>3</sup> (mg-eq/cm <sup>3</sup> ), min	1.10
Oxidation in oxygen equivalent, mg/l, max	0.5
Mass fraction of chloride ions, mg/cm <sup>3</sup> , max	0.15





Table con'd (Physical and Chemical Characteristics)

Mean mechanical toughness, g/bead, min	400
Particles with toughness below 200 g/bead, %, max	5
Difference between settling times of anion and cation resins, sec, max	6
Electrostatic coefficient, % max	15



## ANION EXCHANGE RESIN TOKEM-805

TR 2227-042-72285630-2015

Strong base anion exchange resin (gel type) in ready for operation form.

### GENERAL DESCRIPTION

Matrix	styrene-DVB
Functional group	quaternary ammonium basic groups (type 1)
Polymer structure	gel
Ionic form	OH <sup>-</sup> hydroxyl

### Application area (according to Standard Protocol RD EO 1.1.2.25.0161-2009 and Industrial Standard STO 1.1.1.02.013.0715-2009):

- for using in anion exchange filters of special water treatment SVO-3,6 (advanced water product treatment), 7 in SCWR reactors;
- for using in anion exchange filters of special water treatment SVO-5 in SCWR reactors;
- for using in anion exchange regeneration filters of special water treatment SVO in LWGR reactors.

### Physical and Chemical Characteristics (according to Industrial Standard STO 1.1.1.07.003.0368-2011):

CHARACTERISTICS	STANDARD VALUE
Appearance	Spherical beads, light yellow to brown in colour
Particle size range, mm	0.4-1.25
Volume of effective size fraction, % min	97
Degree of conversion to OH <sup>-</sup> form, % min	95
Total uncracked beads as shipped, % min	97
Osmotic stability, %, min	90
Total capacity, mmol/cm <sup>3</sup> (mg-eq/cm <sup>3</sup> ), min	1.10
Moisture retention, %	55-60
Oxidation in oxygen equivalent, mg/l, max	0.5
Dynamic exchange capacity, mmol/m <sup>3</sup> , min	600
Mean mechanical toughness, g/bead, min	450
Beads with toughness below 200 g/bead, %, max	5



# ANION EXCHANGE RESIN TOKEM-845

TR 2227-042-72285630-2015

Strong base anion exchange resin (gel type) with uniform particle size range in ready for operation form.

## GENERAL DESCRIPTION

Matrix	styrene-DVB
Functional group	quaternary ammonium basic groups (type 1)
Polymer structure	gel
Ionic form	OH <sup>-</sup> hydroxyl

### Область применения (according to Standard Protocol RD EO 1.1.2.25.0161-2009 and Industrial Standard STO 1.1.1.02.013.0715-2009):

- for using in anion exchange filters of special water treatment SVO-3,6 (advanced water product treatment), 7 in SCWR reactors;
- for using in anion exchange filters of special water treatment SVO-5 in SCWR reactors;
- for using in anion exchange regeneration filters of special water treatment SVO in LWGR reactors;
- for using in mix bed filters of condensate polishing systems in SCWR reactors together with cation exchange resin TOKEM-145-10 and TOKEM-145-16 in any water chemistry regime;
- for using in mix bed regeneration filters of special water treatment SVO in LWGR reactors together with cation exchange resin TOKEM-145-10;
- for using in mix bed filters of condensate polishing systems in LWGR reactors together with cation exchange resin TOKEM-145-10;
- for using in mix bed filters of water purification plants together with cation exchange resin TOKEM-145-10;
- for using in mix bed filters **COCTI** of SCWR reactors together with TOKEM-145-10(Na<sup>+</sup>).

### Physical and Chemical Characteristics (according to Industrial Standard STO 1.1.1.07.003.0368-2011):

CHARACTERISTICS	STANDARD VALUE
Appearance	Spherical beads, white to light yellow in colour
Mean particle size, mm	0.60±0.05
Uniformity coefficient, max	1.1
Volume ratio of beads passing through N04 mesh, % max	1.0
Total uncracked beads as shipped, %, min	98
Osmotic stability, %, min	90
Total capacity, mmol/cm <sup>3</sup> (mg-eq/cm <sup>3</sup> ), min	1.1
Dynamic exchange capacity, mmol/m <sup>3</sup> , min	600
Moisture retention, %	50–55



Table con'd (Physical and Chemical Characteristics)

Product oxidation in oxygen equivalent, mg/l, max	0.5
Degree of conversion to OH <sup>-</sup> form, % min	95
Mean mechanical toughness, g/bead, min	450
Particles with toughness below 200 g/bead, %, max	5
Difference between settling times of anion and cation resins, sec, min-max	7-10
Electrostatic coefficient, % max	20



# ANION EXCHANGE RESIN TOKEM-845 NR

TR 2227-042-72285630-2015

Strong base nuclear grade anion exchange resin (gel type) with uniform particle size range.

## GENERAL DESCRIPTION

Matrix	styrene-DVB
Functional group	quaternary ammonium basic groups (type 1)
Polymer structure Ionic	gel
Form	OH- hydroxyl

### Application area (according to Standard Protocol RD EO 1.1.2.25.0161-2009 and Industrial Standard STO 1.1.1.02.013.0715-2009):

- for using in anion exchange filters of special water treatment SVO-1 in SCWR reactors;
- for using in anion exchange filters of special water treatment SVO-2,4,6 (boron concentrate treatment) in SCWR reactors;
- for using in anion exchange nonregenerable filters of special water treatment SVO in LWGR reactors.

### Physical and Chemical Characteristics (according to Industrial Standard STO 1.1.1.07.003.0368-2011):

CHARACTERISTICS	STANDARD VALUE
Appearance	Spherical beads, white to light yellow in colour
Mean particle size, mm	0.60±0.05
Uniformity coefficient, max	1.1
Volume ratio of beads passing through N04 mesh, % max	1.0
Total uncracked beads as shipped, %, min	97
Osmotic stability, %, min	90
Total capacity, mmol/cm <sup>3</sup> (mg-eq/cm <sup>3</sup> ), min	1.1
Moisture retention, %	50-55
Product oxidation in oxygen equivalent, mg/dm <sup>3</sup> , max	0.5
Mass fraction of chloride ions, mg/cm <sup>3</sup> , max	0.15
Mean mechanical toughness, g/bead, min	400
Particles with toughness below 200 g/bead, %, max	5





# ANION EXCHANGE RESIN TOKEM-405 NR

TR 2227-042-72285630-2015

Weak base nuclear grade anion exchange resin (gel type).

GENERAL DESCRIPTION	
Matrix	Polyacrylate
Functional group	tertiary amine
Polymer structure	gel
Ionic form	free base

## Application area (according to Standard Protocol RD EO 1.1.2.25.0161-2009):

- for using in anion exchange filters of special water treatment SVO-4 in SCWR reactors.

## Physical and Chemical Characteristics (according to Industrial Standard STO 1.1.1.07.003.0368-2011):

CHARACTERISTICS	STANDARD VALUE
Appearance	Spherical beads, opaline to yellow in colour
Particle size range, mm	0.40-1.25
Volume of effective size fraction, % min	98
Total uncracked beads as shipped, %, min	97
Osmotic stability, %, min	85
Moisture retention, %	54-64
Total capacity, mmol/cm <sup>3</sup> (mg-eq/cm <sup>3</sup> ), min	1.6
Mass fraction of chloride ions, mg/cm <sup>3</sup> , max	0.15
Mean mechanical toughness, g/bead, min	400
Particles with toughness below 200 g/bead, % max	5



# ANION EXCHANGE RESIN TOKEM-800

TR 2227-025-72285630-2011

High capacity strong base anion exchange resin (gel type) with improved particle range composition and osmotic stability.

It effectively removes silicic acid and acid anions from water.

## GENERAL DESCRIPTION

Matrix	styrene-DVB
Functional group	quaternary ammonium basic groups (type 1)
Polymer structure	gel
Ionic form	Cl <sup>-</sup> chloride OH <sup>-</sup> hydroxyl

### Application area:

This anion exchange resin can be applied in all conventional ion exchange processes, including:

- demineralization water treatment systems at co-current regeneration;
- condensate polishing.

### Physical and Chemical Characteristics:

CHARACTERISTICS	STANDARD
Appearance	Spherical beads, white to brown in colour
Particle size range, mm	0.40-1.25
Volume of effective size fraction, % min	96
Effective particle size, mm max	0.6
Uniformity coefficient, max	1.6
Moisture retention, in Cl <sup>-</sup> form, %	35-50
Osmotic stability, %, min	95
Bulk volume factor in OH <sup>-</sup> form, cm <sup>3</sup> /g	2.7-3.3
Total capacity, mmol/cm <sup>3</sup> (mg-eq/cm <sup>3</sup> ), min	1.15
Equilibrium static exchange capacity in OH <sup>-</sup> form, mmol/cm <sup>3</sup> (mg-eq/cm <sup>3</sup> ), min	1.0



Table con'd (Physical and Chemical Characteristics)

Dynamic exchange capacity with regenerant flowrate target, mmol/m <sup>3</sup> (g-eq/m <sup>3</sup> ), min	700
Oxidation in oxygen equivalent, mg/l, max	0.55 (0.5)*
Total uncracked beads as shipped, %, min	90 (95)*
Mean mechanical toughness, g/bead, min	300
Particles with toughness below 200 g/bead, %, max	10
Shipping weight, g/cm <sup>3</sup>	0.70-0.74
Particle density, g/cm <sup>3</sup>	1.06-1.10

\* - Values given in brackets are for products supplied to atomic power plants

### Processing Characteristics:

#### SUGGESTED OPERATING CONDITIONS AND MODES:

Bed depth min, mm	800
Pressure drop coefficient, kPa·h/m <sup>2</sup>	1.35
Temperature limit, ° C	
Cl <sup>-</sup> form	80
OH <sup>-</sup> form	60
pH limit	0-14
Swelling at Cl <sup>-</sup> → OH <sup>-</sup> , %	20
Regenerant, %	(3-4) NaOH
Total rinse requirement, BV	3-6
Backwashing bed expansion, %	80-100

# ANION EXCHANGE RESIN TOKEM-840

TR 2227-016-72285630-2010

Strong base anion exchange resin (gel type) with uniform particle range composition. It possesses uniformity range of less than 1.1. High monodispersity and the absence of small fraction contributes to significantly decreased pressure drop across the bed height. This enables high flow rates enhancing regeneration effectiveness and reducing reagent and rinsing water requirements. Increased regeneration rate allows decreasing negative impact of organic substances on the ionite. It is particularly important for an anion exchange resin which by its nature possesses affinity to organic compounds.

Uniform particle composition, compact bed packing, and no dead zones increase diffusion rate and contact area. These features, in turn, lead to better ion exchange kinetics.

This monodispersed anion exchange resin is characterized with a high osmotic stability resulting in longer service life compared to that of polydispersed products.

GENERAL DESCRIPTION	
Матрица	styrene-DVB
Functional group	quaternary ammonium basic groups (type 1)
Polymer structure	gel
Ionic form	Cl <sup>-</sup> chloride OH <sup>-</sup> hydroxyl

## Application area:

Monodispersed anion exchange resin TOKEM-840 can be applied in all conventional water treatment systems, including:

- ionization water treatment systems with co-current regeneration;
- ionization water treatment systems with counter-current packed bed regeneration;
- condensate polishing.

## Physical and Chemical Characteristics:

CHARACTERISTICS	STANDARD
Appearance	Spherical beads, white to brown in colour



Table con'd (Physical and Chemical Characteristics)

Mean particle size, mm	0.60±0.05
Uniformity coefficient, max	1.1
Volume ratio of beads passing through N04 mesh, % max	1.0
Volume ratio of beads on N08 mesh, % max	2.0
Moisture retention in Cl <sup>-</sup> form, %	35-50
Osmotic stability, %, min	98
Total uncracked beads as shipped, %, min	95
Total capacity in OH <sup>-</sup> form, mmol/cm <sup>3</sup> (mg-eq/cm <sup>3</sup> ), min	1.15
Equilibrium static exchange capacity in OH <sup>-</sup> form, mmol/cm <sup>3</sup> (mg-eq/cm <sup>3</sup> ), min	1.0
Oxidation in oxygen equivalent, mg/l, max	0.55 (0.5)*
Mean mechanical toughness, g/bead, min	300
Beads with toughness below 200 g/bead, %, max	10
Shipping weight, g/cm <sup>3</sup>	0.66-0.72
Particle density, g/cm <sup>3</sup>	1.06-1.10

\* - Values given in brackets are for products supplied to atomic power plants

## Processing Characteristics:

### SUGGESTED OPERATING CONDITIONS AND MODES:

Bed depth, min, mm	800
Pressure drop coefficient, kPa·h/m <sup>2</sup>	1.0
Temperature limit, ° C	
Cl <sup>-</sup> form	80
OH <sup>-</sup> form	60
pH limit	0-14
Swelling at Cl <sup>-</sup> → OH <sup>-</sup> , %	20
Regenerant, %	(3-4) NaOH
Total rinse requirement, BV	2-4
Backwashing bed expansion, %	80-100



## ANION EXCHANGE RESIN TOKEM-400

TR 2227-032-72285630-2014

Weak base anion exchange resin (gel type) with high exchange capacity, mechanical and osmotic stability, resistant to organic fouling. The resin possesses higher capacities and better resistance to organic contamination than with weak base polystyrene anion exchange resins.

### GENERAL DESCRIPTION

Matrix	Polyacrylate
Functional group	tertiary amine
Polymer structure	gel
Ionic form	free base

### Application area:

- water desalination for industrial vapour generation;
- organic matter removal.

### Physical and Chemical Characteristics:

CHARACTERISTICS	STANDARD VALUE
Appearance	Spherical beads, opaline to yellow in colour
Particle size range, mm	0.315-1.25
Uniformity coefficient, max	1,6
Volume of effective size fraction, % min	95
Effective particle size, mm	0.4-0.7
Moisture retention, %	54-64
Osmotic stability, %, min	98
Total capacity, mmol/cm <sup>3</sup> (mg-eq/cm <sup>3</sup> ), min	1.6
Dynamic exchange capacity with regenerant requirement target, mmol/m <sup>3</sup> (g-eq/m <sup>3</sup> ), min	1200
Total uncracked beads as shipped, %, min	95



Table con'd (Physical and Chemical Characteristics)

Mean mechanical toughness, g/bead, min	300
Particles with toughness below 200 g/bead, % max	10
Shipping weight, g/cm <sup>3</sup>	0.66-0.74
Particle density, g/cm <sup>3</sup>	1.04-1.09

**Processing Characteristics:**

**SUGGESTED OPERATING CONDITIONS AND MODES:**

Bed depth min, mm	800
Temperature limit, ° C	40
pH limit	0-8
Swelling at Cl <sup>-</sup> → free base, %	25
Regenerant, %	(2-4) NaOH
Total rinse requirement, BV	8-14
Backwashing bed expansion, %	80-100





“TOKEM” Production Association LLC (OOO) has implemented quality management system with regard to development and production of chemical products in accordance with GOST ISO 9001 – 2015 (ISO 9001 : 2015). Registration N ROSS RU.AC13.K00030





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