

Outline of water purification facilities by the purification plant type

Type	Purification plant	Kunijima Purification Plant¹				Niwakubo Purification Plant			Toyono Purification Plant			
Facility capacity		1,180,000 m³/day				800,000 m³/day			450,000 m³/day			
Water intake facilities	Intake port, sedimentation reservoir	Kunijima Purification Plant: 3 water intake towers, 6 sedimentation reservoirs Hitotsuya Water Intake Station: 1 water intake tower, 8 sedimentation reservoirs (8 reservoirs in Osaka City x (200+1,030))				2 water intake points, 6 sedimentation reservoirs			Kuzuha Water Intake Station: 2 water intake ports, 4 sedimentation reservoirs			
	Intake pump system	Hitotsuya water intake pumping station First water intake pumping station Third water intake pumping station Second water intake pumping station				Water intake pumping station Second water intake pumping station (2nd system) Second water intake pumping station (3rd system)			Water intake Water pumping			
Water purification facilities	Intake pump	Number of units				Number of units			Number of units			
	Water purification system	System 1	System 3	System 2	System 4	System 1	System 2	System 3				
	Mixing reservoir	Number of reservoirs	1 reservoir	2 reservoirs	1 reservoir	2 reservoirs	1 reservoir	1 reservoir	4 reservoirs	6 reservoirs		
	Mixing method	Top to bottom flow system	Flush mixer	Flush mixer	Flush mixer	Overflow distribution type	Flush mixer	Flush mixer	Flush mixer	Top to bottom flow system		
	Flocculation reservoir	Number of reservoirs	2 reservoirs	6 reservoirs	4 reservoirs	6 reservoirs	4 reservoirs	4 reservoirs	4 reservoirs	6 reservoirs		
	Flow direction	Top to bottom flow system	Perpendicular direct flow system	Top to bottom flow system	Perpendicular direct flow system	Top to bottom flow system	Top to bottom flow system	Top to bottom flow system	Top to bottom flow system	Top to bottom flow system		
	Stirring device	Flow blocking board	Flocculator	Flow blocking board	Flocculator	Flow blocking board	Flow blocking board	Flow blocking board	Flow blocking board			
	Sedimentation reservoir	Number of reservoirs	3 reservoirs	6 reservoirs	8 reservoirs	6 reservoirs	4 reservoirs	4 reservoirs	4 reservoirs	6 reservoirs		
	Method	Lateral flow system	Lateral flow system	Lateral flow system	Lateral flow system	Lateral flow system	Lateral flow system	2-level parallel flow system	2-level parallel flow system			
	Desludging method	Atmospheric pressure system	Link belt type	Link belt type	Link belt type	Link belt type	Running type Meader type	Link belt type	Link belt type			
	Med-ozone contact reservoir	Number of reservoirs	3 reservoirs	4 reservoirs	4 reservoirs	4 reservoirs	4 reservoirs	4 reservoirs	4 reservoirs	4 reservoirs		
	Method	Contra flow distributed air piping system	Contra flow distributed air piping system	Contra flow distributed air piping system	Contra flow distributed air piping system	Contra flow distributed air piping system	Contra flow distributed air piping system	Contra flow distributed air piping system	Contra flow distributed air piping system			
	Contact time	5 min.	5 min.	5 min.	5 min.	5 min.	5 min.	5 min.	5 min.			
	Number of contact stages	2 stages	2 stages	2 stages	2 stages	2 stages	2 stages	3 stages	2 stages			
	Rapid filtration reservoir	Number of reservoirs	12 reservoirs	24 reservoirs	24 reservoirs	20 reservoirs	20 reservoirs	24 reservoirs	28 reservoirs			
	Filter surface area	80 m²	126 m²	108 m²	126 m²	116 m²	116 m²	127 m²	126 m²			
	Sand layer thickness	75 cm	60 cm	75 cm	60 cm	75 cm	75 cm	70 cm	60 cm			
	Gravel layer thickness	35 cm	26 cm	35 cm	26 cm	35 cm	35 cm	44 cm	20 cm			
	Water collection method	Wheeler type	Porous block type	Wheeler type	Porous block type	Porous block type	Wheeler type	Wheeler type Porous block type	Porous block type			
Surface washing method	Fixed type	Fixed type	Fixed type	Fixed type	Fixed type	Fixed type	Fixed type	Fixed type				
Backwashing method	Direct pump transmission	Direct pump transmission	Direct pump transmission	Direct pump transmission	Direct pump transmission	Direct pump transmission	Direct pump transmission	Direct pump transmission				
Lift pump	Units	5			6			4				
Post-ozone contact reservoir	Number of reservoirs	3 reservoirs			3 reservoirs			4 units				
	Method	Contra flow distributed air piping system			Contra flow distributed air piping system			U tube system				
	Contact time	5 min.			5 min.			4.2 min.				
Granular activated carbon reservoir	Reaction time	5 min.			5 min.							
	Number of contact stages	2 stages			2 stages							
	Number of reservoirs	12 reservoirs	14 reservoirs	14 reservoirs	16 reservoirs	10 reservoirs						
Area	101.4 m²/reservoir			112.7 m²/reservoir		116.9 m²/reservoir		109.6 m²/reservoir				
Layer thickness	2.1 m			2.1 m		2.1 m		2.1 m				
Water collection device	Porous plat type			Porous plat type		Porous plat type		Porous plat type				
Chlorine contact reservoir	Number of reservoirs	2 reservoirs			2 reservoirs			2 reservoirs				
Contact time	15 min.			15 min.			15 min.					
Purification reservoir	Number of reservoirs				2 reservoirs		2 reservoirs		5 reservoirs			
Total capacity				10,000 m³		10,000 m³		13,400 m³		75,300 m³		
Water transmission pump	Units	4			4			5				
Chemical injection equipment	Concentrated sulfuric acid	Storage tank	10 m³ × 2 tanks			13 m³ × 2 tanks			11 m³ × 2 tanks		8 m³ × 2 tanks	
		Lift pump	2			2			2		2	
	Aluminum sulfate	Small extraction tank	0.5 m³ × 2 tanks			0.7 m³ × 2 tanks			0.5 m³ × 2 tanks		0.4 m³ × 2 tanks	
		Injector	4			4			4		5	
		Storage tank	210 m³ × 4 tanks			210 m³ × 2 tanks			250 m³ × 6 tanks		250 m³ × 2 tanks	
	Lift pump	2			2			5		2		
	Caustic soda	Small extraction tank	3.5 m³ × 2 tanks			3.5 m³ × 2 tanks			2.3 m³ × 2 tanks		4 m³ × 2 tanks	
		Injector	3			3			3		4	
		Storage tank	210 m³ × 2 tanks			225 m³ × 2 tanks			200 m³ × 5 tanks		100 m³ × 3 tanks	
		Lift pump	2			2			2		2	
		Injector	Pre	2			2			2		3
	Post	5			5			5		6		
	Ozone	Mid Non-ozone processing equipment	Ozone generator	8.8 kgO₂/h × 1 unit	17.5 kgO₂/h × 1 unit	7.5 kgO₂/h × 1 unit	7.3 kgO₂/h × 1 unit	5.3 kgO₂/h × 1 unit	5.3 kgO₂/h × 1 unit	3.5 kgO₂/h × 2 units	9.9 kgO₂/h × 1 unit	
Number of units			3	2	2	2	2	2	4	2		
Post Non-ozone processing equipment		Ozone generator	11.2 kgO₂/h × 2 units + 17.5 kgO₂/h × 1 unit			14.7 kgO₂/h × 2 units			17.5 kgO₂/h × 2 units		9.9 kgO₂/h × 2 units	
Number of units	4			3			3		3			
Sodium hypochlorite	Storage tank	40 m³ × 6 tanks			65 m³ × 5 tanks			46 m³ × 8 tanks		22 m³ × 6 tanks		
	Lift pump	2			2			2		2		
	Small extraction tank	10 m³ × 6 tanks			13 m³ × 2 tanks			16 m³ × 2 tanks		5.5 m³ × 2 tanks		
	Injector	9			9			16		10		
Powdered activated carbon	Dissolution tank	102 m³ × tanks						87 m³ × 2 tanks		56.25 m³ × 2 tanks		
	Injector	3						1		2		
Waste water treatment equipment	Concentration tank	Capacity/Number of tanks			3,000 m³ × 4 tanks			1,500 m³ × 4 units		700 m³ × 1 tank 1,050 m³ × 1 tank		
	Pressure dehydrator	Area/Number of units			1,150 m³ × 5 tanks 25 m³ × 3 tanks			1,100 m³ × 6 units				
	Solar drying reservoir	Number of reservoirs								25 reservoirs		
Total area									29,600 m²			

Note: The Kunijima Purification Plant uses part of the industrial water facilities.

Distribution facilities	No. Distribution Pumping Station	No. 1 Distribution Pumping Station	No. 2 Distribution Pumping Station	No. 3 Distribution Pumping Station	Otsuwa Distribution Plant	Hokko Pumping Station	Maishima Water Supply Tower	Tatsumi Distribution Plant	Oyodo Distribution Plant	Sumiyoshi Distribution Plant	Suminoe Distribution Plant	Sakishima Distribution Plant	Nagai Distribution Plant	Minato Distribution Plant	Izuo Distribution Plant	Joto Distribution Plant	Sanadaya Pumping Station	Number of reservoirs	Total capacity											
																			9 reservoirs	4 reservoirs	6 reservoirs	3 reservoirs	—	1 reservoir	8 reservoirs	4 reservoirs	2 reservoirs	2 reservoirs	3 reservoirs	2 reservoirs
		112,400 m³	55,000 m³	106,200 m³	33,700 m³	—	500 m³	100,900 m³	55,000 m³	12,000 m³	27,300 m³	30,000 m³	42,000 m³	15,000 m³	24,000 m³	67,000 m³	—													
		7	5	7	4	—	—	12	5	4	4	4	5	4	5	6	—													
Disinfection equipment	Sodium Hypochlorite	Storage tank	—			—			0.2 m³ × 2 tanks		0.3 m³ × 2 tanks		0.3 m³ × 2 tanks		1.3 m³ × 3 tanks		2.0 m³ × 3 tanks		1.5 m³ × 2 tanks		4.5 m³ × 2 tanks		—		0.8 m³ × 3 tanks		1 m³ × 3 tanks		—	
		Injector	—			—			—		2		2		2		2		2		—		3		2		—			

Changes in Osaka City water supply pipes (cast iron straight pipes)

Year	Name	Standard	Diameter	Type	Material	Joint shape	Interior coating	Remarks
1908-1930	Cast iron pipes for waterworks	Osaka City type	31/2" (89 mm) ~42" (1067 mm)		Ordinary cast iron	Socket	Tar	Imported and domestic products
1930-1932	"	Clean Water Council type	75~1500 mm		"	"	"	"
1932-1933	"	"	"		High-class cast iron	"	"	"
1933-1954	"	Japan Waterworks Association type	"		"	"	"	"
1954-1958	Vertical-type cast iron straight pipes for waterworks	JIS G 5521	"	Normal pressure pipe	"	"	Mortar lining	"
"	Centrifugal force dust-type cast iron pipes for waterworks	JIS G 5522	75~900 mm	"	"	"	"	"
"	Centrifugal force gold dust-type cast iron pipes for waterworks	JIS G 5523	75~250 mm	"	"	"	"	"
1954-1955	Cast iron pipes with rubber joints	Osaka City type	1000~1500 mm	"	"	B type	Tar	Used on main Sumiyoshi line
1955-1962	Ductile cast iron pipes with rubber joints	"	800~1500 mm	"	Ductile cast iron	"	Mortar lining	"
1958-1966	Cast iron pipes with mechanical joints for waterworks	JWWA G 102	75~900 mm	"	High-class cast iron	A type	"	"
1961-1965	Centrifugal force ductile cast iron pipes for waterworks	JWWA G 105	1200~1500 mm	Type 2 pipe	Ductile cast iron	B type	"	"
"	"	"	800~1100 mm	"	"	A type	"	"
1963-1965	"	"	600~700 mm	"	"	"	"	"
1964-1968	"	"	300~500 mm	"	"	"	"	"
1965-1968	"	"	500~1100 mm	Type 3 pipe	"	"	"	"
1965-1987	"	"	300~350 mm	Type 1 pipe	"	"	"	"
1966-1987	"	"	75~250 mm	"	"	"	"	"
1965	K-shaped centrifugal force ductile cast iron pipes	JDPA G 1001	1200~2200 mm	Type 2 pipe	"	K type	"	1974: JIS G 5526 1982: JWWA G 113 established
1965 onward	"	"	"	Type 3 pipe	"	"	"	Tar epoxy resin coating has been used on irregular-shaped pipes of 400 mm or more since about 1967.
1968 onward	"	"	500~1100 mm	"	"	"	"	"
"	"	"	400~450 mm	Type 2 pipe	"	"	"	"
1967 onward	U-shaped centrifugal force ductile cast iron pipes	Osaka City type	1000~2200 mm 1100~1500 mm	" Type 3 pipe	"	U type	"	1974: JIS G 5526 1982: JWWA G 113 established
1969 onward	T-shaped centrifugal force ductile cast iron pipes for waterworks	JWWA G 110	75~250 mm	Type 1 pipe	"	T type	"	Interior powder coating has been used in T type irregular-shaped pipes since 1975 (since 1977 in A type)
1977 onward	S-shaped centrifugal force ductile cast iron pipes	JDPA G 1019	500~2000 mm	Type 1-3 pipes	"	S type	"	1974: JIS G 5526 1982: JWWA G 113 established
1980 onward	SII-shaped centrifugal force ductile cast iron pipes	JDPA G 1021	100~450 mm	"	"	SII type	"	"
1982 onward	Ductile cast iron pipes for inner pipe insertion	OWMS G 1026 OWMS G 1027	300~1350 mm	Type 1-4 pipes	"	PI type PII type	"	OMMS was abolished in 1995 and the transition was made to JWWA G 113 (PI and PII types). PIII-shaped types have been used for irregular-shaped pipes since 1963.
1987 onward	"	JWWA G 113	75~350 mm	Type 1 pipe	"	K type	"	"
1989 onward	Ductile cast iron pipes for waterworks	JWWA G 113	75~2600 mm	Type 1-4 pipes	"	All types	"	Transparent seal coating used, non-tar epoxy resin material used for exterior coating
1990 onward	"	"	"	Type 1-4.5 pipes	"	"	"	JWWA G 113 revised (transition to S1 unit, etc.)
1992 onward	"	"	"	"	"	"	"	JWWA G 113 revised (coating standards) JWWA K 139 established
1996 onward	NS-shaped ductile cast iron pipes	JDPA G 1042	75~250 mm	Type 1 & 3 pipes	"	NS type	"	JIS A 5314 transferred to JWWA G 113 in 2000.
2000 onward	Ductile cast iron pipes for waterworks	JWWA G 113	75~2600 mm	Type 1-4.5 pipes	"	All types	"	Leachability and leaching test method added
2003 onward	Ductile cast iron pipes for PN	Osaka City type	300~1500 mm	Type 1-4 pipes	"	PN type	"	PI and PII types used as improved pipes from 2003.
2005 onward	Ductile cast iron pipes for waterworks	Osaka City type JWWA G 112	75~350 mm	Type 1 pipe	"	All types	Interior surface epoxy resin powder	All bores targeted in Maishima and Yumeshima areas, etc.
"	NS-shaped ductile cast iron pipes	JDPA G 1042	300~450 mm	Type 1 pipe	"	NS type	Interior surface epoxy resin powder Mortar lining	"
2010 onward	NS-shaped ductile cast iron pipes	JDPA G 1042	500~1000 mm	Type S pipe	"	NS type	Mortar lining	Bore expansion
2013 onward	GX-shaped ductile cast iron pipes	JDPA G 1049	75~250 mm	Type 1 pipe	"	GX type	Interior surface epoxy resin powder	"