

Extensive List of Ozone Compatible Materials

TABLE 1 OZONE DISINFECTION SYSTEMS CONSTRUCTION MATERIALS COMPATIBILITY CHART BASED ON LITERATURE SURVEYS & SERVICE EXPERIENCE				
Service Area or Area of Application	Service Condition or Environment	Function or Component	Material Type and Designation	Comments
Air Preparation Equipment and Components	Ambient air & compressed air.	Piping, fittings, flanges, tanks, pressure vessels, valves, desiccant dryers, compressors, etc.	Carbon steel, cast iron, aluminum	For use up to but not including isolation valves for the ozone generator feed systems; conventional gaskets materials may be employed.
	Warm humid air.		304 & 316 S.S.	
Oxygen Preparation Equipment and Components	Treated as wet oxygen-rich gas.	Piping	304 & 316 S.S.	Where no welding is required.
		Piping	304L & 316L S.S.	Where welding is required. The TIG welding process should be employed using compatible electrode materials.
		Fittings & Flanges		Compatible with piping.
		Gate Valves		Minimum of 150#, ANSI class flanges.
		Butterfly Valves		Wafer type; minimum of 125#, ANSI class flanges.
		Dry Oxygen Gas	Piping	Carbon Steel
Ozone Generating Equipment and Components	Dry Ozonized Gas	Ozone Generator	316 & 321 S.S.	Non-welded applications.
			316L & 321 S.S.	Welding process - TIG and approved electrode materials; also applies to cooling water jacket.
		Piping	304 & 316 S.S.	Non-welded applications.
			304L & 316L S.S.	TIG welding with compatible electrode materials.
		Valves		
		- Gasket - Body	PTFE filled Viton-A lined cast iron or 316 S.S.	
		- Shaft - Disc - Seat - Seal	316 S.S. 316 S.S. Viton-A Viton-A	
Contactor and Destruct System (including recycle streams)	Wet Ozonized Oxygen rich gas	Piping, Fittings, Flanges, Valving, Demisters, Destruct Cabinets, etc.	316 & 316L S.S.	Not directly associated with ozone contactor construction, but applies to all other appurtenances.
		Head Space Seals & Gas Stops	PTFE, 316 S.S., Hypalon	
		Contactor	Type II & V Portland Cement	Use low water to cement mix ratio
		Reinforcing Bar	Galvanized or 10% oversized	Minimum cover, 2 inches of concrete.
		Fittings, Hatch Ways, Vents, Valves, etc.	316L S.S.	Especially concrete penetrations.
Contactor Wetted Parameter	Aqueous Ozone	Water Bearing Structures, Electrical Conduit	Type II & V Portland Cement, PVC and 316 S.S.	Use conventional water stops, water filled in Contractor area.

TABLE 3 CORROSION RATE OF METAL ALLOYS (mils per year)				
METAL ALLOY	CONTACTOR	OFF GAS	SIDE STREAM	FINISHED WATER
<i>STAINLESS STEELS</i>				
304 S.S.	0.007	0.006	-0.001	-0.007
304 S.S. Welded	0.007	0.008	0.002	-0.002
316 SS	0.002	0.002	0.004	0.004
316 SS Welded	0.006	0.007	0.002	0.002
410 SS	0.034	0.003	0.006	0.000
410 SS Welded	0.020	0.000	0.013	-0.029
430 SS	0.004	0.004	0.000	0.001
CA-6NM SS	-0.002	0.005	0.014	0.012
17-4PH SS	0.001	0.001	-0.006	0.001
Nitronic 60 SS	0.003	0.003	0.001	0.000
<i>COPPER BASED ALLOYS</i>				
CDA-706 (Cu/Ni Alloy)	0.361	0.498	0.184	0.015
CDA-655 (Si Bronze)	0.343	0.017	0.240	0.098
CDA-230 (Red Brass)	0.861	0.048	0.344	0.090
CDA-240 (Low Brass)	1.086	0.040	0.349	0.092
<i>IRON BASED ALLOYS</i>				
ASTM A285 Mild Steel	9.567	0.341	4.348	3.192
ASTM A515 Mild Steel	8.488	0.527	4.522	3.040
1010 Plain Carbon Steel	8.709	0.169	4.420	2.565
4140 HSLA Steel	9.231	0.340	4.495	3.092
4340 HSLA Steel	7.513	0.070	3.304	2.786
Grey Cast Iron	4.296	0.629	4.809	4.226
Hot Dipped Galvanized Steel	4.926	0.007	1.674	1.203
Durachlor-51	0.008	0.000	0.012	-0.962
<i>ACTIVE METALS</i>				
Magnesium	3.056	-0.460	1.993	2.480
Zinc	6.573	-0.019	3.855	1.431
Aluminum 6061	5.369	-0.004	2.319	1.199
Aluminum 5054	4.440	-0.004	1.909	0.758

TABLE 4 BREAKING STRENGTH OF ELASTOMERS Tensile Load (LBS)					
MATERIAL	CONTROL	CONTACTOR	OFF-GAS	SIDE STREAM	FINISHED WATER
Red Silicone Rubber	25	12	10	17	21
Hypalon Rubber	41	25	23	20	18
Viton "A" Rubber	9	10	6	8	10
Ethylene propylene dimonomer (EPDM) Rubber	13	10	11	13	14
Natural Gum Rubber	47	43	Disintegrated	84	69
#2 Natural Gum Rubber		Disintegrated	Disintegrated	23	24
Polychloroprene, Neoprene, Rubber	34	35	Disintegrated	38	34
Buna-N, Nitrile, Rubber	31	20	Disintegrated	25	23

TEST SAMPLE	CONTROL	CONTACTOR	OFF-GAS	SIDE STREAM	FINISHED WATER
Red Silicone Rubber	59	62	64	58	59
Hypalon Rubber	65	56	62	45	46
Viton "A" Rubber	75	83	80	67	67
Ethylene propylene dimonomer (EPDM) Rubber	74	75	70	70	73
Natural Gum Rubber	44	45	Disintegrated	45	43
#2 Natural Gum Rubber	44	Disintegrated	Disintegrated	42	37
Polychloroprene, Neoprene, Rubber	63	58	Disintegrated	55	56
Buna-N, Nitrile, Rubber	59	59	Disintegrated	57	57

MATERIAL	CONTROL	CONTACTOR	OFF-GAS	SIDE STREAM	FINISHED WATER
Acrylonitrile-butadiene-styrene (ABS) Thermoplastic	136	127	134	139	142
Polyvinylchloride (PVC) Thermoplastic	150	140	151	156	149
Chlorinated Polyvinylchloride (CPVC) Thermoplastic	306	282	292	301	293
Low Density Polyethylene (LDPE) Thermoplastic	47	45	43	50	54
High Density Polyethylene (HDPE) Thermoplastic	180	150	158	163	171
Ultra High Molecular Weight Polyethylene (UHMWPE), Tivar, Thermoplastic	197	183	190	190	203
Polypropylene (PP) Thermoplastic	161	131	161	161	165
Polytetrafluoroethylene (PTFE), Teflon, Thermoplastic	69	64	67	69	79
Durlon 9000	59	57	59	64	64
Clear Vinyl Thermoplastic	83	72	78	75	80

TEST SAMPLE	CONTROL	CONTACTOR	OFF-GAS	SIDE STREAM	FINISHED WATER
Acrylonitrile-butadiene-styrene (ABS) Thermoplastic	69	67	70	70	70
Polyvinylchloride (PVC) Thermoplastic	82	81	80	84	72
Chlorinated Polyvinylchloride (CPVC) Thermoplastic	81	79	83	80	82
Low Density Polyethylene (LDPE) Thermoplastic	50	50	52	52	52
High Density Polyethylene (HDPE) Thermoplastic	75	75	75	76	75
Ultra High Molecular Weight Polyethylene (UHMWPE), Tivar, Thermoplastic	68	68	69	70	64
Polypropylene (PP) Thermoplastic	77	79	77	77	78
Polytetrafluoroethylene (PTFE), Teflon, Thermoplastic	60	58	58	61	61
Durlon 9000	61	58	59	60	64
Clear Vinyl Thermoplastic	95	93	95	95	96

**TABLE 8
PROTECTIVE COATINGS FOR STEEL STRUCTURES**

COATING (Type & Manufacturer)	CONTACTOR	OFF GAS	SIDE STREAM	FINISHED WATER
3M - Scotchkote 306, High Solids Amine Epoxy (Self Priming, Green)	Heavy fade, material wipes off, moderate rust on edges	Moderate to heavy fading, tiny to small blisters; all samples material is damp and wipes off, very light rust on a couple of spots on the coupons radii.	Moderate fading with heavy chalking.	Slight fading.
Themic - Series 20 Pota-pox Polyamide Epoxy over Themic Series 66-1211 Polyamide Epoxy Primer (White)	Very heavy chalking, coating wipes off.	Material is deteriorating, damp and wipes off, light rust on coupons radii, very heavy chalking, several tiny blisters.	Very heavy chalking, coating is deteriorating and wipes off.	Good condition.
Pittsburgh Paints - (97-640) Coal Tar Epoxy Paint (Black)	Heavy fading, light to moderate rust on coupon radii.	Heavy fading, rough surface and material wipes off, heavy chalking.	Heavy fading with very light chalking.	Good condition.
3M - Scotchkote 309, 100% Solids Amine Cured Epoxy (No Primer, Lt. Green)	Moderate to heavy fading, moderate chalking.	Material deteriorating, rough surface, material is damp and rubs off, light chalking.	Moderate fading with heavy chalking.	Slight fading.
Devcon - Brushable Ceramic Repair System (Ruddy Brown)	Very heavy fading, very rough surface, moderate to heavy rust on coupon radii.	Heavy fading, material is soft and wipes off, moderate to heavy rust on coupon radii.	Heavy fading with a very rough surface, pinholes over entire surface with moderate to heavy rust tubercles along edges.	Good condition.
Durall Plastics Inc - #47 Aqua Vinyl Ester (No Primer, Aqua Blue)	Slight fading, moderate rust on coupon radii.	Very heavy chalking, slight discoloration on surface.	Moderate fading.	Moderate fading.
Durall Plastics Inc - #47 Polyester (Aqua Blue)	Slight fading.	Very heavy chalking, couple of rust spots on corners of one coupon.	Slight to moderate fading.	Good condition.

**TABLE 9
PROTECTIVE COATINGS FOR CONCRETE STRUCTURES**

COATING (Type & Manufacturer)	CONTACTOR	OFF GAS	SIDE STREAM	FINISHED WATER
3M - Scotchkote 306, High Solids Amine Epoxy (Self Priming, Green)	Heavy fading, heavy chalking, few pinholes.	Heavy fading, pinholes, material damp and wipes off with heavy chalking.	Heavy fading, light chalking and pinholes.	Slight to moderate white film.
Pittsburgh Paints - (97-640) Coal Tar Epoxy Paint (Black)	Very heavy fading with very light chalking.	Very heavy fading and material wipes off.	Very heavy fading, light chalking and few pinholes.	Very slight fading.
3M - Scotchkote 309, 100% Solids Amine Cured Epoxy (No Primer, Lt. Green)	Heavy fading with heavy chalking and pinholes over most of the surface.	Heavy fading, material deteriorating, pinholes on all test blocks, material wipes off.	Heavy fading, pinholes over most of the sample and light chalking.	Good condition.
Devcon - Brushable Ceramic Repair System (Ruddy Brown)	Very heavy fading, very rough surface (gritty), several pinholes.	Heavy fading, material deteriorating, material wipes off, discoloration and pinholes.	Very heavy fading and very rough surface.	Slight white film.
Durall Plastics Inc - #47 Aqua Vinyl Ester 406.006 (No Primer, Aqua Blue)	Light to moderate fading with pinholes over most of the surface.	Very heavy chalking with several pinholes.	slight to moderate fading.	Slight white film.
Durall Plastics Inc - #47 Polyester (Aqua Blue)	Slight fading.	Heavy chalking.	Slight to moderate fading with a few pinholes.	Good condition.

TABLE 10 SHEAR STRENGTH OF STRUCTURAL ADHESIVES Compressive Load (Lbs)			
Test Location	Manufacturer & Product		
	Select Products GP3000	Select Products Select Bond Polyester	Sika Corporation Sikadur 52
Control	19000	33600	31400
	17000	26600	24600
	17400	26800	21800
Contactor	12800	13200	10000
	11400	14600	9600
	12400	9200	10000
Off Gas	11600	6600	10200
	9000	14600	7800
	10200	11200	9200
Side Stream	9400	18200	10400
	8800	16800	6800
	11600	20600	14000
Finished Water	10400	15600	7800
	12000	18000	6800
	10200	13200	9000

TABLE 11 BREAKING STRENGTH OF STRUCTURAL ADHESIVES Tensile Load (Lbs)			
Test Location	Manufacturer & Product		
	Select Products GP3000	Select Products Select Bond Polyester	Sika Corporation Sikadur 52
Control	1678	1087	1435
	1218	1672	1169
	1570	1033	1143
Contactor	1468	1335	1376
	1099	1380	1408
	1428	1571	1595
Off Gas	1695	620	1419
	1769	1335	1061
	1622	780	1769
Side Stream	1545	1346	1317
	1193	474	1053
	1459	1637	1042
Finished Water	1826	691	1957
	1164	977	1903
	1762	1262	1563

TABLE 12 EXPANSION JOINT SEALANTS				
SEALANT (Type & Manufacturer)	CONTACTOR	OFF GAS	SIDE STREAM	FINISHED WATER
Select Products - Select Seal T-227, Two Component Polysulfide Sealant (Pourable Grade, Gray)	Slight to moderate darkening with good adhesion, pinholes on all of each sample.	Sealant deteriorated, crumbles when touched.	Heavy darkening, sealant soft and sticky, rubs off.	Good condition with good adhesion.
Dow Corning - 100% Silicone Bathtub Caulk & Sealant (White)	Good condition with good adhesion. Hardening and disbonding observed one month after removal.	Slight discoloration and good adhesion. Hardening and disbonding observed one month after removal.	Good condition with good adhesion. Hardening and disbonding observed one month after removal.	Good condition with good adhesion.
Select Products - Select Seal U-227 Type II Polyurethane Sealant (Gray)	Heavy white film, good adhesion.	Sealant deteriorated, heavy surface cracking, disintegrates when touched.	Moderate darkening and good adhesion.	Good condition with good adhesion.