

Published Bollard Pull Comparison															
Vessel	Owner	Propellers	Screws	# of	engine	# of	Power	Power	Trial	Bollard	Bollard	Lb/HP	Astern	Bollard	Source Publication
		type	dia	blades		prop	BHP	density	speed	pull	Efficiency		pull	Efficiency	
			in					HP/R2	knots	lb			lb		
Niigata Z-Drives with modified 19a Nozzles															
Seaspan Discovery	Seaspan International	Niigata ZP-2A	82.68	4	Detroit 149TI-DEC	2	1600	42.91	12.3	87940	1.44	27.48	84,000	1.37	World Book Yearbook 1994 p22
Vancouver	Shafer Transportation	Niigata ZP-2A	82.68	4	Detroit 149TI-DDEC	2	1500	40.23	12.4	82000	1.40	27.33	80,700	1.38	World Book Yearbook 1994 p24
Ocean Intrepide	Le Groupe Ocean	Niigata ZP21 19a	82.68		Mitsubishi S16R-MPTA	2	2,038	54.66	12.5	106,700	1.48	26.18			Tug & Salvage Sep/Oct 98 p31
Point Valiant	Eastern Canada Towing	Niigata ZP-21	79.00		Mitsubishi S16R-MPTA	2	2,038	59.87		90000	1.29	22.08			Marine News May 31, 99 p24
Ocean Intrepide	Le Groupe Ocean RAL	Niigata ZP21 19a	82.68		Mitsubishi S16R-MPTA	2	2,038	54.66	12.8	106,000	1.47	26.01			West Coast Mariner Feb 1999 p37
Point Valiant	Eastern Canada Towing	Niigata ZP-21	79.00	4	Mitsubishi S16R-MPTA	2	2,038	59.87	13.5	101,190	1.45	24.83			American Tugboat review 99 p63
Ocean Intrepide	Le Groupe Ocean	Niigata ZP21 19a	82.68		Mitsubishi S16R-MPTA	2	2,038	54.66	13	100,000	1.39	24.53			American Tugboat review 99 p75
Ulstein Z-Drives with 19a Nozzles															
Silex, Thrax	Torksey Ltd.	Ulstein/Liaaen TCN 92/68-250	98.43		Wartsila 6V28	2	2500	47.31	14	132280	1.43	26.46	125,660	1.36	World Book Yearbook 1994 p50
Z-three, Z-four, Z-five	Tugz International	Ulstein 1650H Kort	86.00	4	Cat 3516 B	2	2,000	49.58	12	99,270	1.36	24.82			Tug & Salvage Jan/Feb 99 p23
Fort Bragg	Cape Fear Towing	Ulstein 1650H Kort	90.00	4	Cat 3616 B	2	2,200	49.80	13	119,050	1.49	27.06			Tug & Salvage Jan/Feb 99 p27
Point Clear	Crescent Towing Co.	Ulstein 1650 Kort	85.00		GE 7FDM12A16	2	2,500	63.44		143,300	1.71	28.66			Tug & Salvage Sep/Oct 99 p14
Atlantic Hemlock	Atlantic Towing	Ulstein Z-Drives	86.00		16-645-E2 EMD	2	2,145	53.17		108,000	1.41	25.17	95,400	1.25	American Tugboat review 96 p6
Gyrfalcon	Alaska Marine Charters	Z-dr Ulstien	86.00		Caterpillar 3516-B	2	2,000	49.58	14	112,000	1.53	28.00			American Tugboat review 96 p18
James Dunlap	Dunlap Towing	Ulstein 1650H z-dr	86.00	4	EMD 16-645E2	2	1,950	48.34		108,000	1.51	27.69			American Tugboat review 96 p42
Z-One & Z-two	Tugz International	Ulstein 1650 Kort	86.00	4	Cat 3516 BTA	2	2,200	54.54	14	112,000	1.44	25.45			American Tugboat review 97 p68
Mamo	Hawaiian Tug & Barge	Ulstein 1650 Kort	90.00	4	Cat 3512B	2	1,600	36.22	13	90,000	1.39	28.13			American Tugboat review 97 p63
SDM New River	Hvide Marine	Ulstein 1650 Kort	86.00	4	Cat 3516B	2	2,000	49.58	12.5	105,000	1.44	26.25			American Tugboat review 98 p58
Fort Bragg	Cape Fear Towing	Ulstein 1650H Kort	90.00	4	Cat 3616 B	2	2,200	49.80	14	120,000	1.50	27.27			American Tugboat review 99 p25
Point Clear	Crescent Towing Co.	Ulstein Kort	85.00		GE 7FDM12A16	2	3,000	76.13		145,000	1.53	24.17			American Tugboat review 99 p33
Z-Three, Z-Four, Z-Five	Great lake Towing	Ulstein 1650 Kort	86.00	4	Cat 3516B	2	2,000	49.58	14	110,000	1.51	27.50	102,000	1.40	American Tugboat review 99 p56
SDM Suwannee River	Hvide Marine	Ulstein 1650 Kort	94.00	4	Wartsila-Vasa 9L20	2	2,000	41.50	12.5	110,000	1.42	27.50	110,000	1.42	American Tugboat review 99 p63
Tira Lani	Sause Bros Ocean Towing	Ulstein 1650H Kort	86.00	4	Cat 3516B	2	2,050	50.82		109,000	1.47	26.59			American Tugboat review 99 p88
Tira Lani	Sause Bros Ocean Towing	Ulstein 1650H Kort	86.00	4	Cat 3516B	2	2,100	52.06	13	120,000	1.59	28.57	100,000	1.33	Work Boat July 99 p34
Aquamaster Z-Drives with modified 19a Nozzles															
Impulse	UK Ministry of Defence	Aquamaster US1401	78.74	4	W.H. Allen 8S12	2	1700	50.27	12.75	85100	1.38	25.03	79,145	1.28	World Book Yearbook 1994 p42
Sanergy Tujuh, Lapen, Sembilan	President Marine Pte Ltd	Aquamaster US1701/3000	84.65		Wartsila 6R25	2	2000	51.17	13.8	103610	1.43	25.90			World Book Yearbook 1994 p45
Elizabeth Turecamo	White Stack Marine Corp.	Aquamaster 3001 z-dr	106.30	4	EMD 16-645 E7B	2	3,070	49.81	14	149,900	1.34	24.41			Tug & Salvage Sep/Oct 98 p21
Michel	Peterson & Alpers	Aquamaster US2001	84.65		MaK 8M20	2	2,038	52.15	12.2	112,430	1.54	27.58			Tug & Salvage Nov/Dec 98 p19
Sea Salvor	civil Protection Department - Malta	Aquamaster US2001	90.55	4	MWM Deutz SBV 8M	2	2,253	50.38	12.5	121,250	1.48	26.91			Tug & Salvage Jan/Feb 99 p25
Hasik / Rakhyut	Cory Towage	Aquamaster US 2001	94.50		Caterpillar 3606 TA	2	2,414	49.56	13	121,250	1.38	25.11	113,540	1.29	Tug & Salvage Mar/April 99 p20
Smit Mississippi/ Mersey	Smit International	Aquamaster US 3001 z-drive	102.36	4	Wartsila 6L26	2	2,454	42.94	13.6	134,920	1.44	27.49	124,340	1.32	Tug & Salvage May/June 99 p11
Frigga, Freja, Fenja	Em Z Svitzer	Aquamaster CP US 3001	94.50		MaK 6M25	2	2,446	50.22	14	136,685	1.54	27.94			Tug & Salvage Jul/Aug 99 p18
Cecilia B Slatten	Bisso Towboat Co.	Aquamaster US 2001	90.00	4	EMD 16-645 E6	2	2,150	48.67	14	117,000	1.48	27.21			Tug & Salvage Jul/Aug 99 p21
Smit Ahoada	Smit International	Aquamaster US 2001	94.50		Cat 3516B	2	2,100	43.11		115,960	1.44	27.61			Tug & Salvage Jul/Aug 99 p21
BC Dutt, Tarafdar	Indian Navy	Aquamaster US1201	70.87		Cummins KT3067	2	1,250	45.63	12.3	61,730	1.32	24.69			Tug & Salvage Nov/Dec 99 p19
Persada Jaya, Enny Jaya	Java Marine Lines	Aquamaster US901	63.00	4	Cat 3508BTA	2	1,000	46.19	12	52,910	1.42	26.46			Tug & Salvage Nov/Dec 99 p27
Aventureeaux	Les Abeille	Aquamaster US 1401	78.50	4	ABC 6MDZC	2	1,776	52.84	12	89,300	1.41	25.14			Ship & Boat International Nov 99 p23
Smit Yerwa	Smit International	Aquamaster US 2001	94.50		Cat 3516B TA	2	2,000	41.06	12.7	110,230	1.42	27.56	99,200	1.28	Ship & Boat International Nov 99 p27
Smit Missouri	Smit International	Aquamaster US 3001	106.30		Wartsila 6L26	2	2,454	39.82	13.2	134,480	1.40	27.40	123,457	1.28	Ship & Boat International Nov 99 p27
Spruce & Fir & Hemlock	Atlantic Towing	Aquamaster US 1701 z-dr	83.00		Caterpillar 3516TA	2	2,000	53.23	13.5	112,000	1.57	28.00			American Tugboat review 96 p22
Kinsman Hawk & Condor	Bay Transportation corp.	Aquamaster 3001/3600 z-dr	110.00	4	Wartsila 6R32E	2	3,350	50.76	14	172,000	1.42	25.67			American Tugboat review 96 p25
Eddie C.	Wilmington Transportation	Aquamaster 1701z-drive	86.00		Caterpillar 3516	2	1,600	39.66	14	111,000	1.77	34.69			American Tugboat review 96 p37
Broward	Hvide Marine	Aquamaster 2001/3250 z-drive	75.00		Twin EMD 12-645F7B	2	2,550	83.12	14	120,000	1.53	23.53			American Tugboat review 96 p48
Kinsman Eagle II	Bay Transportation corp.	Aquamaster 3001/3600 z-drive	110.00		Wartsila 6R32E	2	3,350	50.76	14	172,000	1.42	25.67			American Tugboat review 97 p31
Kinsman Venture/Relient	Bay Transportation corp.	Aquamaster 2001/3150 z-drive	91.00		EMD 15-645 E2	2	2,150	47.60	14	110,000	1.38	25.58			American Tugboat review 97 p33
Spruce & Fir & Hemlock	Atlantic Towing	Aquamaster US 1701 z-dr	83.00		Caterpillar 3516TA	2	2,000	53.23	13.5	112,000	1.57	28.00			American Tugboat review 98 p22
Delta Linda & Delta Carey	Baydelta Maritime	Aquamaster z-drives	94.50	4	Cat 3516 B	2	2,200	45.17	14.3	118,000	1.43	26.82			American Tugboat review 98 p32
Elizabeth Turecamo	White Stack Marine Corp.	Aquamaster 3001 z-dr	106.30	4	EMD 16-645 E7B	2	3,070	49.81	14	160,000	1.43	26.06			American Tugboat review 98 p85
Cecilia B Slatten	Bisso Towboat Co.	Aquamaster US 2001	90.00	4	EMD 16-645 E6	2	2,150	48.67	14	117,000	1.48	27.21			American Tugboat review 99 p20
Atlantic Willow	Atlantic Towing Ltd.	Aquamaster US 1701 z-dr	84.00	4	Cat 3516 TA	2	2,002	52.02	12.5	98,000	1.36	24.48			Workboat Dec 98 p66
Cecilia B Slatten 3.422:1	Bisso Towboat Co.	Aquamaster US 2001	90.00	4	EMD 16-645 E6	2	2,150	48.67	14	117,000	1.48	27.21			Work Boat July 99 p46
Willamette	Shaver Transportation Co.	Aquamaster US 2001 PV-Duct	90.55	4	Detroit Diesel 16V149-TI	2	1,800	40.25		105,000	1.49	29.17			Workboat Dec 99 p100
Willamette	Shaver Transportation Co.	Aquamaster US 2001 PV-Duct	90.55	4	Detroit Diesel 16V149-TI	2	1,800	40.25		105,000	1.49	29.17			Harbour & Shipping Nov 99 p34
Rivtow Spirit	Rivtow Marine	Aquamaster 1401	78.74	4	Detroit 16V149TIB	2	1,515	44.80	12.3	85,980	1.50	28.38			ITS Report Aug 96 p35
Van de Giesen Nozzles															
El Oriental	Venecia Ship Service	Van de Giesen Nozzles	104.33	4	Cat 3606 TA	2	2,310	38.91	12.6	145,500	1.59	31.49			Tug & Salvage Sep/Oct 98 p25
Teign	Teignmouth Harbour Commision	Van de Giesen Nozzles	39.37		Cummins NT855-M/CR	2	304	35.96	9.5	17,636	1.43	29.01			ITS Report July 97 p15
Fixed Conventional ("Kort") Nozzles															
Manutara II	Sudamericana Agencias	Nozzles	86.61		Yanmar T240A-ET	2	1400	34.22	12	80000	1.38	28.57			World Book Yearbook 1994 p26
Koyo Maru	Nippon Salvage Company	Kamome CPP in Kort Nozzles	137.80		Daihatsu 8DLM-40A	2	5,500	53.11	18.34	265,000	1.35	24.09			Tug & Salvage Sep/Oct 98 p26
Walvis 9-11	Mobile Oil	FP in Nozzles	74.80		Cat 3512 DITA	2	1,280	41.94	12.9	77,160	1.56	30.14			Tug & Salvage Sep/Oct 98 p29
Lamalcol Pelican, Petrel, Puffin	Mobile Oil	Lips CP in Nozzles	92.52		Cat 3516 DITA	2	1,710	36.63		106,900	1.55	31.26			Tug & Salvage Sep/Oct 98 p29
Tiger Wolf	Tiger Tugz	Fixed Nozzles	68.00	4	GM 12V149	2	900	35.69		50,700	1.38	28.17			Tug & Salvage Sep/Oct 98 p33
Maersk Blazer	AP Moller	Kemava CP Nozzles	169.25		MAK 8M32	2	10,010	64.07	17	529,100	1.58	26.43			Tug & Salvage Sep/Oct 98 p33
Secor Vanguard	Seacor	Berg CP Nozzle	140.15		NREC	2	7,000	65.34	16	352,740	1.51	25.20			Tug & Salvage Nov/Dec 98 p23
Assanhado & Abusado	Tranship Venzuela	Nozzles	66.93	4	Cat 3412B	3	720	29.47	10.2	68,340	1.46	31.64			Tug & Salvage Jan/Feb 99 p27
Neeltje P	Terminales Maracaibo	Rice Nozzle	102.36		Detroit 12V-4000	2	2,300	40.25	13.6	132,280	1.47	28.76	90,390	1.00	Tug & Salvage Mar/April 99 p19
Sall	Bahwan-Lamalcol	Promarin Nozzle	80.71		Cat 3512DITA/B	2	1,360	38.28	12.7	83,770	1.55	30.80			Tug & Salvage May/June 99 p13
Vera Bisso	Bisso Towboat Co.	Kort Nozzles	138.00	4	EMD 16-645-E6	2	2,100	20.22	13	145,500	1.41	34.64			Tug & Salvage Nov/Dec 99 p17
Jaya Mariner	Java Marine Lines	CP Kort Nozzle	106.30	4	Wartsila 6L26	2	2,650	43.00		147,700	1.46	27.87			Tug & Salvage Nov/Dec 99 p25
Tiger Wolf	Tiger Tugz	Fixed Nozzles	68.00	4	GM 12V149	2	900	35.69							