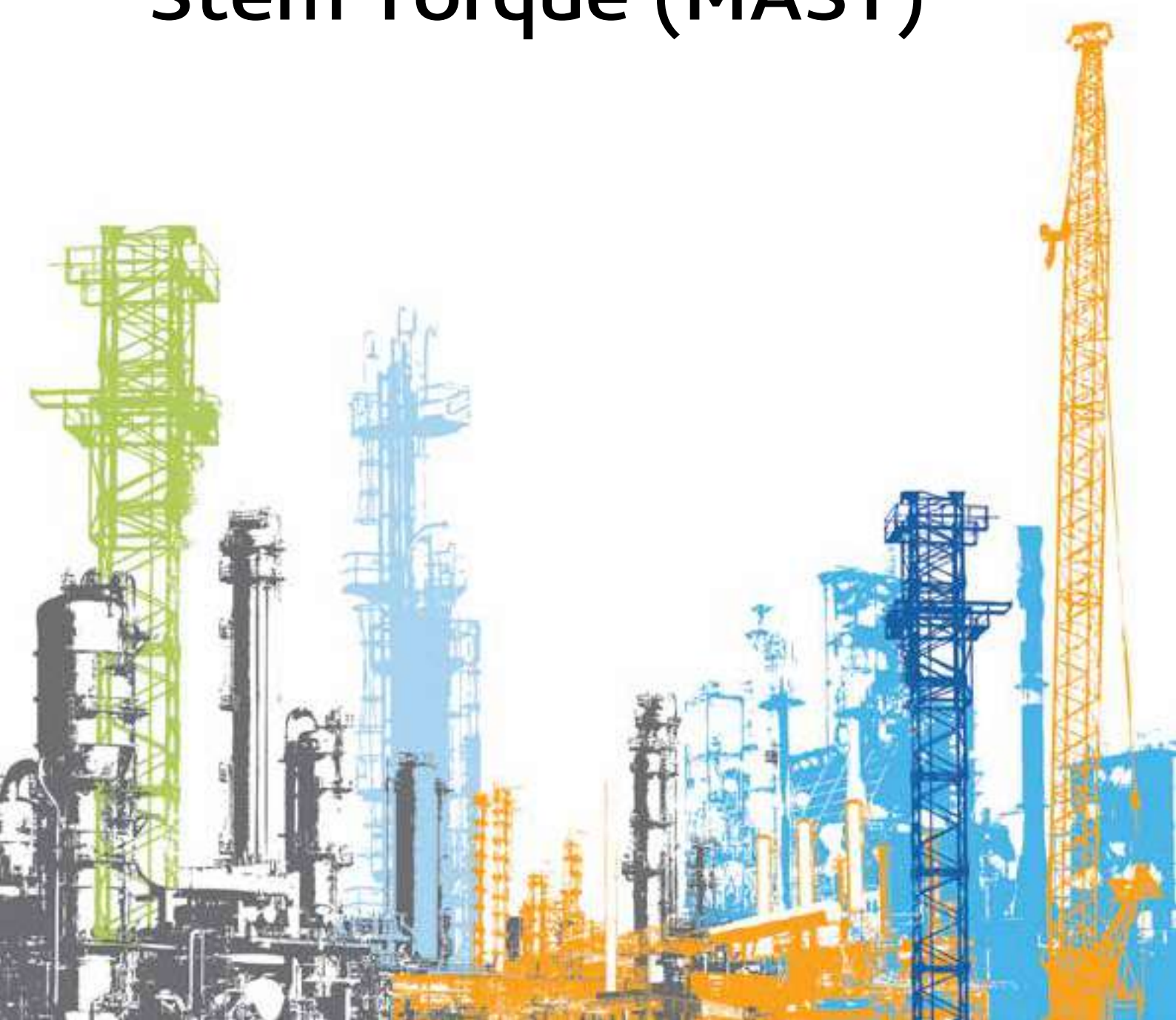


Technical information Maximum Allowable Stem Torque (MAST)



Maximum Allowable Stem Torque (MAST)

Introduction

MAST is the Maximum Allowable Stem Torque to which a quarter-turn valve stem can be subjected during operation without mechanical failure.

The MAST values shown in Table A are based on a laboratory test conducted by Habonim engineers at ambient temperature. The test included severe cycle operation under the maximum load shown in Table A, followed by a dimensional check and a die penetrant test to verify that the valve stem is in operable condition and within the elastic boundaries.

Table B represents the theoretical maximum allowable torque figures according to the Roark formula for stress and strain.

The yield strength values used for calculating the maximum allowable torque are in accordance with the technical specifications provided by Habonim to its stem material suppliers. These figures exceed the values required by the ASTM standards.

Habonim recommends the use of the data in Table B for severe service applications such as high cycle and modulating, as well as when sizing requires a larger safety factor such as valves complying with API6D and SIL certified packages.

Tables C, D and E are a detailed map of stem sizes designed by Habonim, sorted according to the various valve series at ambient temperature, cryogenic temperature and elevated temperature.

Example:

- Select the valve size and series, and search for the stem size according to Tables C-E.
- Use the stem size and stem material to obtain the MAST from Table A or Table B.
- Use the valve torque graphs and verify that the MAST does not exceed the valve's maximum torque at the application maximum differential pressure.

Important notes:

- For valves complying with API6D and SIL certified packages, the valve maximum torque must not exceed 50% of the MAST figures shown in Table B.
- In accordance with API6DX / ISO 12490, the actuator maximum torque must not exceed the valve MAST.

Table A - based on experimental results (Exist)

Stem	Unit	316/316L A479 S31600/ S31603	17-4PH A564 S17400	Alloy C22 B574 N06022	Alloy 20 B473 N08020	Monel 400 A164 N04400	Duplex A479 S31803	Super Duplex A479 S32750	254 SMO A479 S31254	Titanium Gr.2 B348 R50400	Inconel 718 B637 N07718
Min. Working temp	°C	-264	-196	-196	-196	-196	-60	-60	-196	-60	-196
	°F	-443	-320	-320	-320	-320	-76	-76	-320	-76	-320
½"	Nm	13.20	38.28	17.16	15.58	15.44	21.12	22.44	14.52	15.84	47.52
	inch*lbs	116.83	338.81	151.88	137.86	136.69	186.93	198.61	128.51	140.20	420.59
1"	Nm	24.40	70.76	31.72	28.79	28.55	39.04	41.48	26.84	29.28	87.84
	inch*lbs	215.96	626.28	280.75	254.83	252.67	345.53	367.13	237.55	259.15	777.45
1½"	Nm	48.60	140.94	63.18	57.35	56.86	77.76	82.62	53.46	58.32	174.96
	inch*lbs	430.15	1247.42	559.19	507.57	503.27	688.23	731.25	473.16	516.18	1548.53
2½"	Nm	192.00	556.80	249.60	226.56	224.64	307.20	326.40	211.20	230.40	691.20
	inch*lbs	1699.34	4928.10	2209.15	2005.23	1988.23	2718.95	2888.88	1869.28	2039.21	6117.64
3"	Nm	385.00	1116.50	500.50	454.30	450.45	616.00	654.50	423.50	462.00	1386.00
	inch*lbs	3407.54	9881.86	4429.80	4020.90	3986.82	5452.06	5792.82	3748.29	4089.05	12267.14
3" DD	Nm	364.60	1057.33	473.97	430.22	426.58	583.35	619.81	401.05	437.51	1312.54
	inch*lbs	3226.94	9358.12	4195.02	3807.79	3775.52	5163.10	5485.80	3549.63	3872.33	11616.98
6"	Nm	1138.00	3300.20	1479.40	1342.84	1331.46	1820.80	1934.60	1251.80	1365.60	4096.80
	inch*lbs	10072.15	29209.25	13093.80	11885.14	11784.42	16115.45	17122.66	11079.37	12086.58	36259.75
6" DD	Nm	1105.00	3204.49	1436.50	1303.90	1292.85	1768.00	1878.50	1215.50	1326.00	3977.99
	inch*lbs	9780.06	28362.18	12714.08	11540.47	11442.67	15648.10	16626.10	10758.07	11736.07	35208.22
10"	Nm	2006.00	5215.60	2306.90	2367.08	2347.02	2908.70	3009.00	2006.00	2206.60	6519.50
	inch*lbs	17754.60	46161.97	20417.80	20950.43	20772.89	25744.18	26631.91	17754.60	19530.06	57702.46
10" DD	Nm	2647.92	6884.59	3045.11	3124.55	3098.07	3839.48	3971.88	2647.92	2912.71	8605.74
	inch*lbs	23436.08	60933.80	26951.49	27654.57	27420.21	33982.31	35154.12	23436.08	25779.69	76167.25
12"	Nm	4363.05	11343.93	5017.51	5148.40	5104.77	6326.42	6544.58	4363.05	4799.36	14179.91
	inch*lbs	38616.26	100402.29	44408.70	45567.19	45181.03	55993.58	57924.40	38616.26	42477.89	125502.86

Maximum Allowable Stem Torque (MAST)

Table B - Analytical calculations based on Roark formulas

Stem	Unit	316/316L A479 S31600/ S31603	17-4PH A564 H1150D S17400	Alloy C22 B574 N06022	Alloy 20 B473 N08020	Monel 400 A164 N04400	Duplex A479 S31803	Super Duplex A479 S32750	254 SMO A479 S31254	Titanium Gr.2 B348 R50400	Inconel 718 B637 N07718
1/2"	Nm	9.90	29.02	12.98	8.20	8.20	15.37	17.59	10.41	9.39	35.34
	inch*lbs	87.64	256.89	114.84	72.53	72.53	136.00	155.64	92.18	83.11	312.80
1"	Nm	22.63	66.34	29.66	18.73	18.73	35.12	40.20	23.80	21.46	80.78
	inch*lbs	200.33	587.17	262.50	165.79	165.79	310.86	355.76	210.69	189.97	714.97
1 1/2"	Nm	39.61	116.10	51.90	32.78	32.78	61.46	70.34	41.66	37.56	141.37
	inch*lbs	350.58	1027.55	459.38	290.13	290.13	544.00	622.57	368.71	332.44	1251.19
2 1/2"	Nm	137.22	402.20	179.80	113.56	113.56	212.93	243.68	144.32	130.12	489.73
	inch*lbs	1214.50	3559.73	1591.41	1005.10	1005.10	1884.56	2156.78	1277.31	1151.68	4334.49
3"	Nm	230.59	675.85	302.15	190.83	190.83	357.80	409.49	242.51	218.66	822.95
	inch*lbs	2040.85	5981.81	2674.22	1688.98	1688.98	3166.84	3624.27	2146.41	1935.29	7283.74
3" DD	Nm	202.29	592.93	265.07	167.41	167.41	313.90	359.24	212.76	191.83	721.98
	inch*lbs	1790.44	5247.85	2346.10	1481.75	1481.75	2778.27	3179.58	1883.05	1697.83	6390.03
6"	Nm	792.20	2321.95	1038.05	655.61	655.61	1229.27	1406.83	833.17	751.22	2827.32
	inch*lbs	7011.52	20551.01	9187.51	5802.64	5802.64	10879.95	12451.49	7374.19	6648.86	25023.88
6" DD	Nm	714.39	2093.90	936.10	591.22	591.22	1108.54	1268.66	751.34	677.44	2549.63
	inch*lbs	6322.89	18532.61	8285.17	5232.74	5232.74	9811.38	11228.58	6649.94	5995.84	22566.17
10"	Nm	1584.39	4643.90	2076.10	1311.22	1311.22	2458.54	2813.66	1666.34	1502.44	5654.63
	inch*lbs	14023.04	41102.02	18375.02	11605.28	11605.28	21759.89	24902.99	14748.37	13297.71	50047.75
10" DD	Nm	2037.07	5970.73	2669.27	1685.85	1685.85	3160.98	3617.56	2142.44	1931.71	7270.24
	inch*lbs	18029.63	52845.45	23625.03	14921.07	14921.07	27977.00	32018.13	18962.19	17097.06	64347.11
12"	Nm	3352.68	9826.83	4393.17	2774.63	2774.63	5202.44	5953.90	3526.10	3179.27	11965.61
	inch*lbs	29673.76	86974.81	38882.86	24557.59	24557.59	46045.49	52696.50	31208.61	28138.91	105904.62

Habonim valve series - Table C

Valve Size		Temperature range: -60 °C ÷ +260 °C (-76 °F ÷ +500 °F)									
Std. Port	Full Port	47	26 ⁽¹⁾	48	31/32	73 ⁽¹⁾ /74 ⁽¹⁾	77 ⁽¹⁾	78 ⁽¹⁾	24	27	28
DN10	DN8-DN10	½"	-	-	-	-	-	-	½"	½"	½"
¾"	¼"-¾"										
DN15	DN8-DN10	½"	-	½"	½"	-	-	-	½"	½"	½"
½"	¼"-¾"										
DN20	DN15	½"	-	½"	½"	½"	-	½"	½"	½"	1"
¾"	½"										
DN25	DN20	1"	-	1"	1"	1"	-	1"	1"	1"	1½"
1"	¾"										
DN32	DN25	1"	-	1"	-	1"	-	1"	1"	1"	1½"
1¼"	1"										
DN40	DN32	1½"	-	1½"	1½"	-	-	-	-	1½"	2½"
1½"	1¼"										
DN50	DN40	1½"	-	2½"	1½"	1½"	-	1½"	-	1½"	2½"
2"	1½"										
DN65	DN50	1½"	3"	3"	-	1½"	-	1½"	-	2½"	3"
2½"	2"										
DN80	DN65	3"	-	3"	3"	-	-	-	-	3"	6"
3"	2½"										
DN100	DN80	3"	6"	3"	3"	3"	3"	-	-	3"	6"
4"	3"										
-	DN100	3"	6"	3"	-	3"	3"	-	-	3"	6"
-	4"										
DN150	-	6"	-	6"	6"	-	-	-	-	6"	10"
6"	-										
DN200	DN150	-	10"	-	6"	6"	6"	-	-	10"	12"
8"	6"										
-	DN200	-	12"	-	-	6"	6"	-	-	10"	12"
-	8"										

Maximum Allowable Stem Torque (MAST)

Cryogenic valve series - Table D

Valve Size		Temperature range: -269 °C ÷ +200 °C (-452 °F ÷ +392 °F)						
Std. Port	Full Port	C47	C26	C31/C32	C73/C74	C77	C78	C28
DN10 3/8"	DN8-DN10 1/4"-3/8"	1/2"	-	-	-	-	-	1/2"
DN15 1/2"	DN8-DN10 1/4"-3/8"	1/2"	-	-	-	-	-	1/2"
DN20 3/4"	DN15 1/2"	1/2"	-	1/2"	1/2"	-	1/2"	1"
DN25 1"	DN20 3/4"	1"	-	1/2"	1"	-	1"	1 1/2"
DN32 1 1/4"	DN25 1"	1"	-	-	1"	-	1"	1 1/2"
DN40 1 1/2"	DN32 1 1/4"	1 1/2"	-	1 1/2"	-	-	-	2 1/2"
DN50 2"	DN40 1 1/2"	1 1/2"	-	1 1/2"	1 1/2"	-	1 1/2"	2 1/2"
DN65 2 1/2"	DN50 2"	2 1/2"	3"	-	2 1/2"	-	2 1/2"	3"
DN80 3"	DN65 2 1/2"	3"	-	3"	-	-	-	6"
DN100 4"	DN80 3"	3"	6"	3"	3"	3"	-	6"
-	DN100 4"	3"	6"	-	3"	3"	-	6"
DN150 6"	-	6"	-	6"	-	-	-	10"
DN200 8"	DN150 6"	-	10"	6"	6"	6"	-	12"
-	DN200 8"	-	12"	-	6"	6"	-	-

Metal seated valve series - Table E

Valve Size		Temperature range: -60 °C ÷ +650 °C (-76 °F ÷ +1200 °F)				
Std. Port	Full Port	Z47	Z73/Z74	Z77	Z78	Z28
DN10	DN8-DN10	½"	-	-	-	½"
¾"	¼"-¾"					
DN15	DN8-DN10	½"	-	-	-	½"
½"	¼"-¾"					
DN20	DN15	½"	½"	-	½"	1"
¾"	½"					
DN25	DN20	1"	1"	-	1"	1½"
1"	¾"					
DN32	DN25	1"	1"	-	1"	1½"
1¼"	1"					
DN40	DN32	1½"	-	-	-	2½"
1½"	1¼"					
DN50	DN40	1½"	1½"	-	1½"	2½"
2"	1½"					
DN65	DN50	3"	2½"	-	2½"	3"
2½"	2"					
DN80	DN65	3"	-	-	-	6"
3"	2½"					
DN100	DN80	6"	3"	3"	-	6"
4"	3"					
-	DN100	6"	6"	6"	-	10"
-	4"					
DN150	-	-	-	-	-	10"
6"	-					
DN200	DN150	10"	6"	6"	-	-
8"	6"					
-	DN200	12"	10"	-	-	-
-	8"					



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