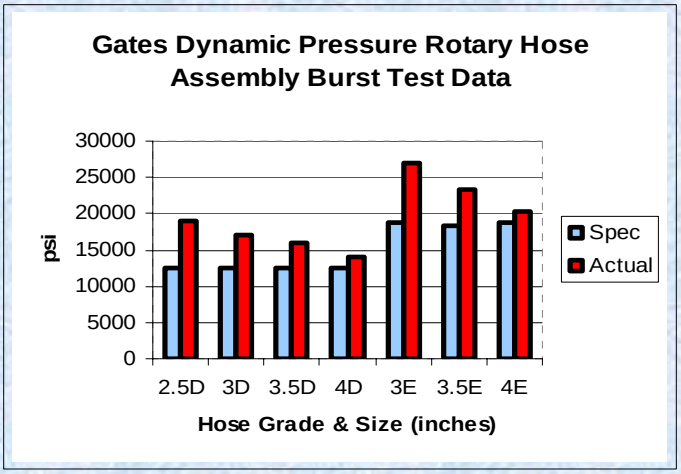
OFFSHORE LAND RIG

Gates Dynamic Pressure Rated Rotary Hose Assembly Burst Test Data

To keep pace with rapidly advancing drilling technology involving directional drilling and down-linking with negative pressure pulses, Gates offers a high performance API 7K rated rotary hose assembly that far exceeds minimum standards. In addition to a high quality hose construction, the Gates system has a swage attached coupling with no seals to leak and no set screws to loosen with operation vibrations or epoxy to weaken with working temperatures above 180 degrees F. Burst test results significantly exceed the API 7K minimum standards as shown in the chart below.



Important: The statements and data on this page are *not* intended as an implied warranty. The test data is obtained with new, unused hose assemblies under controlled conditions. Results in actual use of products may be different from the test data due to many factors including, but not limited to: conditions of use, care given the assembly, temperature and pressure, material passing through the assembly, frequency of use, and wear and tear of the assembly.

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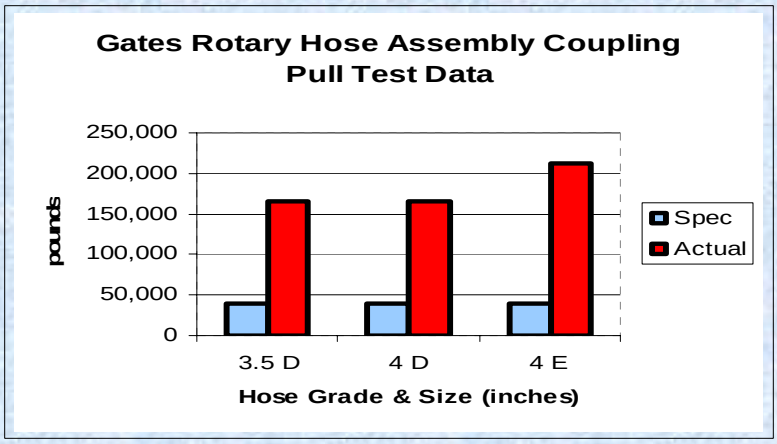
Gates Rotary Hose Assembly Coupling Pull Test Data

Coupling pull tests on hose assemblies show outstanding coupling retention capabilities as shown in the chart below. The Grade D hose assemblies were pressurized to 5,000 psi and then pulled. The 3 1/2" Grade D stretched 15" and the 4" Grade D stretched 12 5/8" before pressure loss. The Grade E test assembly pressurized to 7500 psi stretched 16" before pressure loss. None of the test assemblies exhibited coupling separation. This is important for the safety of operators in the vicinity of such heavy, high pressure hose assemblies that could come crashing down if coupling separation were to occur.



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Gates Oilfield Hose Flow Rate Limits

On some oil rigs, the flow rate of mud to the drill pipe has been increased significantly. Flow rates as high as 3100 GPM have been reported. Three pumps aligned to work together can be set up to produce the higher flow rate.

There are factors that need to be considered to safely and cost effectively provide such a high flow rate. As flow rate (GPM) increases, velocity of that fluid through a conduit such as a hose or a pipe will also increase. As velocity increases, the turbulence of the moving fluid increases. Excessive turbulence produces erosive friction, heat, and vibration. This can have a damaging effect on hose, pipe, pumps, and other components in the system, significantly reducing their length of service life. Things will not last nearly as long under increasingly severe conditions. Replacing these expensive components more frequently is compounded with the additional service downtime.

To maximize the length of service time from hoses, etc., and reduce damaging effects of excessive velocity, Gates recommends limiting the fluid velocity to a maximum of 30 fps (feet per second). Higher flow rates will require larger bore hoses and in some cases multiple hose lines. The table below summarizes the relationship of hose size, flow rates and velocity. To avoid costly, frequent replacements and downtime, stay out of the high velocity shaded area in this table.

Flow Rates

(*Velocity for various pumping rates)

Hose I.D. (In.)	*Velocity, ft/sec (fluids) gpm																			
	100	150	200	250	300	350	400	450	500	550	600	650	700	750	1000	1500	2000	2500	3000	3500
2 1/2	6.5	9.8	13.1	16.3	19.6	22.8	26.1	29.4	32.6	35.9	39.2	42.4	45.7	49	65.3	97.9	130.6	163.2	195.8	228.5
3	—	6.8	9.1	11.3	13.6	15.9	18.1	20.4	22.7	24.9	27.2	29.5	31.7	34	45.3	68	90.7	113.3	136	158.7
3 1/2	—	5	6.7	8.3	10	11.7	13.3	15	16.6	18.3	20	21.6	23.3	25	33.3	50	66.6	83.3	99.9	116.6
4	—	3.8	5.1	6.4	7.7	8.9	10.2	11.5	12.8	14	15.3	16.6	17.9	19.1	25.5	38.3	51	63.8	76.5	89.3
4+4 (Two hoses; velocities shown per hose)															12.8	19.1	25.5	31.9	38.3	44.6
4+4+4 (Three hoses; velocities shown per hose)															8.5	12.8	17	21.2	25.5	29.7

Calculations based on the equation below:

$$*V = \frac{0.408 \times gpm}{d^2}$$

*V= Velocity, ft./sec.

Gpm = gallons per minute

d = hose I.D., inches

Note: For Optimum performance, maximum velocity should not exceed 30 feet per second.