STANDARD OPERATING PROCEDURE

Proof of Structural Design Test for Precast Septic Tanks by the Negative Air Pressure (Vacuum) Method

1.0 PURPOSE

1.1 The purpose of the procedure is to establish the means by which to verify the structural capacity of a precast concrete septic tank due to external forces.

2.0 REFERENCES

2.1 ASTM C1227, "Standard Specification for Precast Concrete Septic Tanks"

2.2 "Quality Control Manual for Precast Plants – 5th Edition; National Precast Concrete Association.

3.0 EQUIPMENT REQUIRED

3.1 Air supply (compressor or vacuum) capable of drawing a vacuum pressure of at least 10" of mercury (Hg).

3.2 A vacuum measuring device is required and may be a vacuum gauge or mercury manometer accurate to within 0.5"Hg.

3.2.1. Vacuum gauges should be calibrated annually to ensure the accuracy of the test.

4.0 SEQUENCE OF OPERATIONS

4.1 The tank to be tested should be selected from inventory and is intended to be representative of tanks made on the same size mold and made from the same materials and methods. In other words, tanks represented by the proof test shall be made from the same mix design, use the same reinforcing, and have the same dimensions and member thicknesses.

4.2 The tank shall be inspected prior to testing for compliance with the shop drawing and for signs of cracking or other defects. Tanks found to be defective shall be repaired or rejected.

4.3 Pipe seal pockets may be filled with grout if it is suspected that they will not withstand the maximum vacuum pressure to be applied.

4.3.1. A target vacuum pressure may be determined from the attached "Uniform Load Comparison for Vacuum Load Test".

4.3.2. The tank shall rest on a yielding foundation (i.e. sand bed) in order to assure that the tank dead load does not control the bottom slab design.

4.3.3. The top and bottom slab may have a greater structural capacity than the side walls. Since vacuum pressure is equally applied to all surfaces, additional uniform load may be applied to the top slab, if desired, in order to increase the allowable capacity of the top and bottom slabs over and above the capacity of the side walls.

4.4 Once the tank has been inspected and is properly sealed and prepared for testing, the tank shall be subjected to a gradually increasing vacuum pressure until the target value is reached.

4.4.1. Watertightness may be evaluated during the proof test by applying a vacuum level of 4"Hg and holding it for 5 minutes. This test is passing if the tank holds 90% of the vacuum during the 5" minute duration. *Note: This criteria exceeds the vacuum test requirements of ASTM C1227 but is consistent with the NPCA "Best Practices Manual for Precast Concrete On-Site Wastewater Tanks.*

4.5 If the target vacuum pressure is achieved without collapse, then the vacuum should be held for approximately one minute, after which the pressure may be gradually released. *Note: some tests have shown that dropping the pressure too fast may result in the formation of cracks in the tank.*

4.6 Once the vacuum source is removed, all interior and exterior surfaces of the tank shall be inspected for the presence of cracks or spalls. Minor cracks, less than .006" that DO NOT pass through the wall or slab, are considered acceptable.

4.7 Test results shall be evaluated by a Licensed Professional Engineer to determine the allowable live loads and placement depth of the tank under various soil conditions. A minimum safety factor of 1.5 shall be used to evaluate the structural capacity of the tank.

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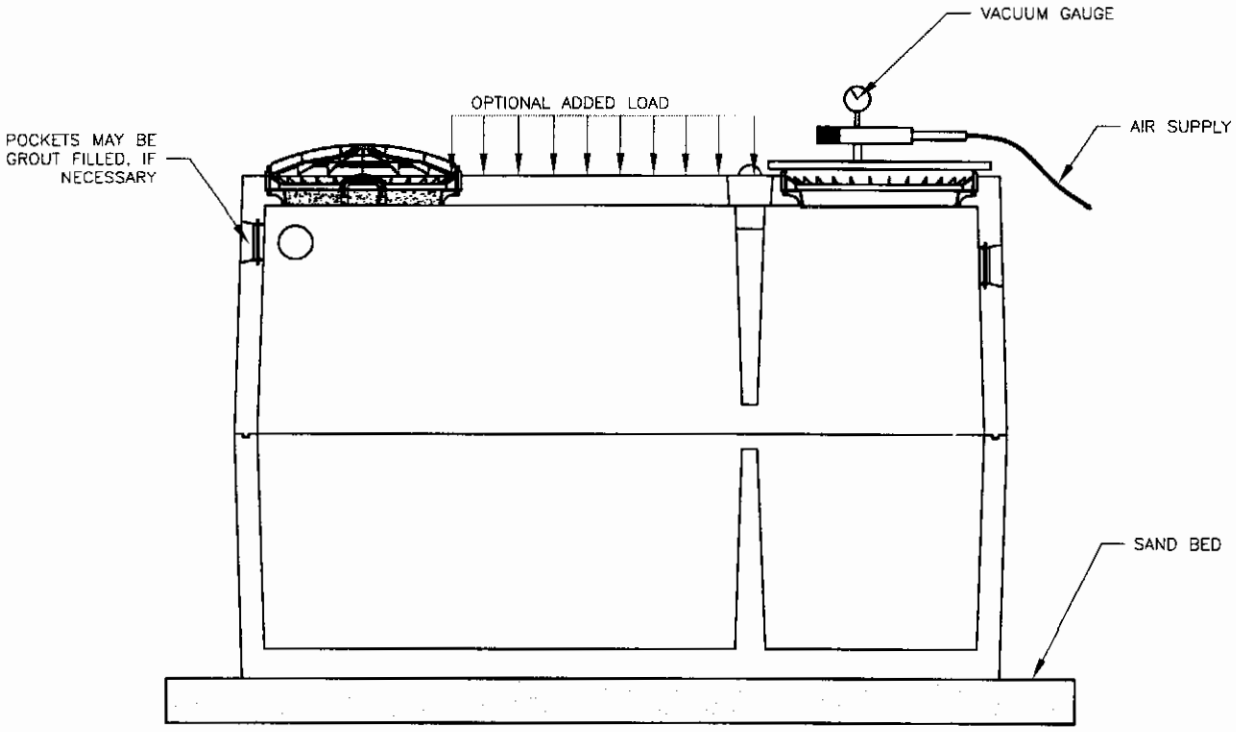
5.0 RECORDS

5.1 The results of each vacuum test performed shall be documented on the Septic Tank Vacuum Test Report. Supporting documentation shall include:

5.1.1. Detailed shop drawing of the tank showing all dimensions and reinforcing. (required)

5.1.2. Photographs of the test set-up and performance. (Recommended but not required)

5.2 Records shall be maintained for a minimum of three (3) years in accordance with NPCA Quality Control Manual for Precast Plants.



REV.NO.	DATE	REVISION

PREPARED FOR:

PREPARED BY:

DELTA ENGINEERS
164 COURT STREET, BINGHAMTON, NY 13901
TEL: (607) 231-6600 FAX: (607) 231-6650

DATE: 3/1/06 | SHEET TITLE: | DRWN BY: RET

SCALE: N.T.S. | CKD BY:

PROJECT: VACUUM LOAD TEST FOR PRECAST SEPTIC TANK

CONTRACTOR: | DWG. I.D. SK-01

DELTA PROJ. NO.: | SHT. NO. 1 OF 1

UNIFORM LOAD COMPARISON FOR VACUUM LOAD TEST

	Convert inches of mercury from test to allowable uniform load							
Vacuum Pressure (inches Hg)	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**
Equivalent Uniform Load (psf)	430	501	573	644	716	788	859	931
Allowable Load (psf)	286	334	382	430	477	525	573	621

Earth Fill (ft)	Allowable live load adjusted for soil depth (psf)							
0.0	286	334	382	430	477	525	573	621
1.0	166	214	262	310	357	405	453	501
1.5	106	154	202	250	297	345	393	441
2.0	46	94	142	190	237	285	333	381
2.5		34	82	130	177	225	273	321
3.0			22	70	117	165	213	261

Earth Load

Effective Pressure (Dry)	40 pcf
Effective Pressure (Saturated)	80 pcf

Water Table Depth	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**Dry**
Soil Depth Below Grade	Lateral earth pressure based on water table depth (psf)							
4.0	320	280	240	200	160			160
4.5	360	320	280	240	200			180
5.0	400	360	320	280	240	200		200
5.5	440	400	360	320	280	240		220
6.0	480	440	400	360	320	280	240	240
6.5	520	480	440	400	360	320	280	260
7.0	560	520	480	440	400	360	320	280
7.5	600	560	520	480	440	400	360	300

SEPTIC TANK VACUUM TEST REPORT

Manufacturer: _____ Test Date: _____

Address _____ Report By: _____

_____

City, State Zip _____

TANK DESCIPTION (Attach detailed drawings)

Model No: _____ Volume and/or working capacity: _____ Mfg Date: _____

Outside Dimensions: Length_____ Width _____ Height _____

Member Thickness: Top Slab_____ Base Slab _____ Walls _____

Compartments: ____Dual ____Single

Seam: ____Mid ____Top

If top seam; does cover slab interlock with top of wall? ____Yes ____No

Joint Sealant Brand/Size: _____

Pipe Seals Brand/Type: _____No. of Inlet Seals: _____ No. of Outlet Seals: _____

MIX DESIGN

Mix No: _____ W/C Ratio _____

Fibers: ___No ___Yes Brand/Type _____ Dosage _____/cy

REINFORCING STEEL

Rebar: ___Grade 40 ___Grade 60 ___None

Wire Fabric: ___Smooth (ASTM A185) ___Deformed (ASTM A497) ___None

CONCRETE TEST RESULTS

Slump: _____ %Air: _____ Temp: _____ Unit Weight: _____

Compressive Strength: _____ psi @ _____ Days

WATERTIGHTNESS TEST

Tank withheld 4" of mercury for 2 minutes without loss of vacuum: ___Yes ___No

STRUCTURAL TEST

Vacuum measuring device: ____Manometer ____Gauge: Date of last gauge calibration _____

Tank tested to failure: ___Yes ___No

Maximum vacuum pressure tested: _____ inches Hg. Additional load applied to top slab _____ psf

Tank was inspected after the load was applied and there were no signs of cracks: yes no (describe below)

_____

_____

_____

DELTA ENGINEERS