

SECTION 02997

VACUUM SEWER COLLECTION SYSTEM - REVISED

PART 1 GENERAL

1.01 WORK INCLUDED

- A. This section covers all work required to furnish and install, complete, the vacuum sewer collection system specified herein.
- B. Like items of equipment provided hereunder shall be the end products of one manufacturer in order to achieve standardization for appearance, operation and maintenance, and manufacturer's service.
- C. See Division 1, GENERAL REQUIREMENTS, which contain information and requirements that apply to the Work specified herein and are mandatory for this project.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. None

1.03 SUBMITTALS

- A. Submittals of all materials required to establish compliance with the specifications shall be submitted in accordance with Section 01300 - Submittals.
- B. Submittals for establishing specification compliance shall include but not be limited to the following items:
 - 1. Descriptive literature, bulletins, and/or catalog cuts of the equipment or materials. Include complete manufacturer's specifications including materials descriptions.
 - 2. Submit manufacturer's recommended vacuum main line flushing procedure for ENGINEER's approval. Submit manufacturer's recommended installation, assembly and testing instructions for vacuum pit assembly.
 - 3. Special handling instructions and requirements for storage and protection prior to installation.
 - 4. Vacuum pit assembly drawings.
 - 5. Complete project schedule including, but not limited to, shop drawing preparation and approval, material/equipment procurement, shop manufacturing, shop testing and final checkout, shipping, field erection, testing, and closeout.
 - 6. Coordination drawings for CONTRACTOR's work.
- C. Complete Operation and Maintenance Manuals shall be submitted in accordance with Section 01730 - Operation and Maintenance Data. O&M Manuals shall be provided prior to startup.

- D. Warranty information shall be submitted in accordance with the Operation and Maintenance Manuals.
- E. Provide all additional submittal information as specified in the related specifications sections, as applicable.
- F. Startup/field test reports and documentation as specified herein.

1.04 DELIVERY, STORAGE AND HANDLING

- A. Valve pit cones, collection sumps, valve pit bottoms, cast iron rings and covers and fiberglass flotation collars shall be stored per manufacturer's requirements.
- B. Suction pipes, sensor pipes and flexible service laterals shall be stored in a manner that will keep them at ambient outdoor temperatures and out of the sunlight. Temporary shading as required to meet this requirement shall be provided. Simple covering of the pipe and fittings, which allows temperature buildup or direct or indirect sunlight, is not permitted.
- C. Boxes of nuts, bolts, washers, grommets, valve pit O-ring seals shall be kept in a dry area.
- D. 3" vacuum valves with controllers, sump breathers, and installation parts bags shall be kept in a dry area. For safe storage, the individual cartons are to remain intact while in storage. Temperature surrounding the boxes while in storage shall not exceed 110 degrees.
- E. Valve pit cones: Stored as instructed by manufacturer.
- F. Collection sumps: Stored as instructed by manufacturer.
- G. Valve pit bottoms: Stored as instructed by manufacturer.
- H. Cast iron rings and covers shall be stacked on separate pallets.
- I. CONTRACTOR shall store vacuum pits and components as recommended by manufacturer. CONTRACTOR shall be responsible for any lost or damaged vacuum pits or related components.

1.05 WARRANTY

- A. The vacuum system manufacturer and CONTRACTOR shall warrant the vacuum sewer installation being supplied to the OWNER against all defects in workmanship and materials for a minimum period of two (2) years. Warranty period shall commence on Substantial Completion date as outlined in the General Conditions. Warranties for all materials installed under this contract shall run concurrently.
- B. The MANUFACTURER's warranty period shall run concurrently with the CONTRACTOR's warranty period. No exception to this provision shall be allowed. If the equipment remains in storage at the jobsite for longer than six (6) months, before installation, the CONTRACTOR shall notify stored material's manufacturer and/or product representative to conduct a complete inspection of the equipment.

Any work necessary to restore the equipment to an "as shipped" condition will be the responsibility of the CONTRACTOR.

1.06 DEFINITIONS

- A. Vacuum sanitary collection system = The collective of all vacuum sub-systems inclusive of the vacuum valve pits, and vacuum collection main(s).
- B. Vacuum System Manufacturer/Supplier = Single manufacturer/supplier for the vacuum valve pit assemblies complete in accordance with this specification inclusive of factory and field testing, system startup/commissioning, operation and maintenance training and warranty.

PART 2 PRODUCTS

2.01 VACUUM MAIN LINES AND LATERALS (PVC)

- A. All buried vacuum mainlines, branch lines and vacuum service laterals shall be gasketed SDR 21 and 26 200 psi rated PVC pipe, or as approved by manufacturer as specified herein. Pipe must meet the requirements of ASTM D2241.
- B. PVC vacuum pipe shall conform to the requirements of ASTM D3139 latest revision. PVC pressure pipe shall be made from Class 12454-B virgin compounds as defined in ASTM D1784.
- C. PVC pipe for vacuum sewers shall be color coded, green for sewer and marked with green metallic marker tape at least 4" wide and not more than 18" below finish grade. All fittings and change in direction shall be marked with a green locator ball (3M or equal).
- D. Pipe shall be provided in standard laying lengths not to exceed 20 feet.
- E. Joints for PVC pressure pipe shall be accomplished by a factory fabricated, continuous, flexible rubber compression gasket permanently attached to the bell of the pipe. Gasket shall be Rieber type (locked in).
- F. Joint gaskets shall meet the requirements of ASTM D-3139. Pipe must be certified by manufacturer that pipe and gasket will operate at 22 inches of mercury vacuum and withstand a vacuum test at 22 inches of mercury with no leakage over a one hour period per ASTM D-3139, paragraph 6.1.2.
- G. PVC pipe shall be as manufactured by National, JM Eagle, North American, Charlotte or equal.

2.02 VACUUM FITTINGS ALTERNATE (3-INCH DIAMETER AND SMALLER)

- A. Fittings shall be PVC Schedule 40 pipe fittings (for solvent cement joints) manufactured from a PVC compound having a cell classification of 12454 conforming to ASTM D-1784. All PVC Schedule 40 fittings shall be injection molded in accordance with ASTM D-2466 with the exception of wye fittings. These wye fittings may be fabricated on the condition that fitting dimensions shall not

deviate significantly from fitting dimensions shown on the standard details. Wye fitting sockets shall be made in accordance with ASTM D-2466.

- B. Solvent cement: ASTM E-2564, primer and cement shall not be same color.
- C. A written certification is required from the manufacturer that these fittings are suitable for operation in a vacuum of 24 inches of mercury and that the fittings have been tested at a minimum of 24 inches of mercury vacuum with a leak rate not exceeding 1% per hour for (4) four tests.
- D. Fittings shall be as manufactured by Spears Manufacturing Company, or equal.

2.03 VACUUM FITTINGS (3-INCH DIAMETER AND LARGER)

- A. All fittings for 3" through 12" IPS pipe shall be one-piece injection molded or fabricated from a PVC compound that meets the requirements of ASTM D1784. Fittings shall be Class 200 and conform to the requirements of DR21. Solvent weld or gasket-end fittings are option of user. Solvent weld bells shall meet the requirements of ASTM D212 and ASTM D2241. Gasket bells shall conform to ASTM D3139 with gaskets conforming to ASTM F477. Gaskets shall be lock-in Reiber style. All fittings shall be made from NSF-approved material.
- B. Gasketed fittings shall be factory tested to a vacuum pressure of 28 inches of mercury.
- C. A written certification is required from the manufacturer that these fittings are suitable for operation in a vacuum of 24 inches of mercury and that the fittings have been tested at a minimum of 24 inches of mercury vacuum with a leak rate not exceeding 1% per hour for (4) four tests.
- D. Fittings shall be as manufactured by Specific Fittings, Inc., Harco Fittings or equal.

2.04 VACUUM LINE DIVISION VALVES (DV)

- A. Resilient-seated gate valves must be wedge type conforming to ANSI/AWWA C509 and UL262 for 3-inch and larger buried service. Resilient-seated gate valves, wedge-type, shall have a cast or ductile iron body and bonnet, rubber-coated cast iron disc, mechanical joint ends, non-rising stem, O-ring seals, bronze stem nut, flanged bonnet and 2-inch square operating nut. All ferrous surfaces, interior and exterior, shall receive a minimum 8 mil fusion-bonded epoxy coating conforming to AWWA C550.
- B. Two (2) tee keys shall be provide for each valve size required.
- C. All valves must be UL Listed and FM approved. AWWA, UL-FM designation must be cast into valve body.
- D. Buried valves shall be provided with valve boxes and the operating nut shall be extended to within 9", plus or minus 6", of the finish

graded. The valve box shall have the words "sewer" and "open" with a directional arrow cast on it. Provide concrete collar around each division calve and gage tap.

- E. Valves shall be as manufactured by American/Darling, Mueller, Clow, or equal.

2.05 VALVE BOXES

- A. Valve boxes shall be of the two piece adjustable screw type, cast iron, with 5 1/4 inch shaft of appropriate length for the installation. Extension pieces, if required, shall be the manufacturer's standard type. Valve box tops shall have raised letters saying "SEWER". Valve boxes shall be as manufactured by Tyler/Union Pipe, or equal.

2.06 VALVE PITS - GENERAL

- A. Valve pit types: Valve pits shall be provided in the following types and depths as shown by location in the ENGINEER's plans.

AIRVAC Pits

One (1) Piece Valve Pits			
AIRVAC Model No.	Pit Description	Overall Depth	Depth to invert of gravity inlet
VP3030P1	1-piece	5.00 feet	3.71 feet
VP4830P1	1-piece	6.50 feet	5.21 feet

Flovac Pits

One (1) Piece Valve Pits		
Flovac Model No.	Overall Depth	Depth to invert of gravity inlet
FP01	6.00 feet	5.00 feet
FP02	8.00 feet	6.50 feet

- B. Separating barrier: All valve pits shall incorporate a physical barrier that separates the valve chamber from the collection sump.
- C. Traffic rated: All valve pits shall be H20 traffic rated or 32,000 lbs-force rated. An independent laboratory certification shall be provided that the entire valve pit assembly is rated for H20 traffic wheel loads and/or 32,000 lbs-force. Calculated data is not acceptable.

- D. Breather: All valve pits shall include an internal breather. No external breather piping or tubing will be acceptable.
- E. Manufacturer: Valve pits and accessories as manufactured by AIRVAC or Flovac, Inc.

2.07 VALVE PITS

- A. Type: Valve pit shall have components including the valve pit assembly and the collection sump as well as associated pipes, connectors, seals and grommets.
- B. Valve pit: The valve pit assembly shall be manufactured by the designated manufacturers.
- C. Collection sump: The collection sump shall be manufactured using the PE with a minimum wall thickness of 3/16". It shall be tapered with the top diameter the same as the valve pit bottom and having a 30" deep sump with a 55 gallon capacity (min). The collection sump shall be designed to allow up to (4) homes to be connected with either 4" or 6" Sch 40 or SDR 21 PVC pipe.
- D. Suction and Sensor Pipes: Suction and sensor pipes shall be Sch 40 PVC or PE.
- E. Anti-buoyancy collar: Anti-buoyancy collars shall be manufactured from polyethylene and shall be designed to prevent floatation of the valve pit assembly when ground water is present.
- F. Grommets: Holes for the house gravity line connections into the collection sump shall be field located and cut. Rubber grommets shall be used to make a watertight seal.
- G. Manufacturer: Valve pit assembly manufactured by AIRVAC or Flovac.

2.08 FLEXIBLE VACUUM PIT CONNECTOR

- A. Flexible connector: Flexible connector shall be 3" in diameter with an overall length per manufacturer's recommendations. The flexible connector shall incorporate a section of flexible pipe that is specially manufactured for AIRVAC or Flovac. The flexible pipe shall have the proper outside diameter for solvent welding into PVC fittings. One end of the flexible pipe shall be joined to a piece of 3" Sch. 40 PVC pipe with a 3" Sch. 40 PVC coupling. The opposite end of the flexible pipe shall be fitted with a 3" Sch. 40 PVC coupling.
- B. Manufacturer: Flexible vacuum pit connectors as manufactured by vacuum pit manufacturer/supplier.

2.09 VALVE PIT COVERS

- A. Valve pit covers: Valve pit covers shall be designed for H-20 loading. Castings shall meet ASTM A-48, Class 30 gray cast iron. Valve pit covers shall have elastomer seals and a concealed pick hole, or hinged lid with t-seal and lock.

- C. Identification markings: The words " SEWER" shall appear on top of cover in 1" tall lettering.
- D. All valve pit rings shall be supported by a concrete collar as shown in the drawings.
- C. Manufacturer: US Foundry 1116 ring/cover, Neenah Foundry Model R5900, East Jordan Ergo Hinged Lid with t-seal and lock or equal.

2.10 DEDICATED AIR-INTAKE/VENT PILLAR

- A. Dedicated air-intake/vent pillar: Assembly as shown on the standard details and provided by valve pit assembly manufacturer. Assembly shall be connected to each valve pit per manufacturer's instructions.
- B. Field assembly: Contractor shall field construct complete assembly as shown on the standard details.
- C. Height: The top of the finished assembly shall be as noted on the drawings.
- D. Piping: Pressure rated SDR 21 or 26 PVC pipe and fittings.
- E. Support: Assembly shall be fastened as shown on the drawings.

2.11 GRAVITY SEWER PIPE (STUB-OUT PIPES AND HOUSE LATERALS)

- A. All valve pit stub-out pipes and gravity laterals installed in the public right-of-way shall be pressure rated pipe: ASTM D3034 SDR 21 or 26 as indicated on the drawing.
- B. Stub outs: Stub-outs shall be 4" or 6" in diameter and a minimum 72" in length. PVC cap shall be solvent bonded around the gravity line as shown in the standard details.

2.12 TRAILER MOUNTED VACUUM PUMP (TMVP)

- A. Portable pumping system for testing as specified herein shall be provided by the selected vacuum system manufacturer. Trailer mounted vacuum pump shall remain the property of the vacuum system manufacturer at the completion of the project.

2.13 SPARE PARTS

- A. Furnish the manufacturer's recommended spare parts including at least the following:
 - 1. None.

2.14 ACCEPTABLE VACUUM SYSTEM MANUFACTURERS/SUPPLIERS

- A. The vacuum sewer system equipment and accessories specified herein shall be manufactured and/or provided by AIRVAC-Aqseptence Group,

Inc., 4217 N. Old US Highway 31, Rochester, In, 46975 or Flovac Inc, 15 Utility Drive, Suite A Palm Coast, FL 32137, meeting all requirements of this specification.

PART 3 EXECUTION

3.01 VACUUM MAIN INSTALLATION

- A. All vacuum sewers shall be laid to the line and grade with the use of construction laser beam equipment. All pipe which has been designed to slope downward, shall be installed to slope continuously downward. There shall be no abrupt sags or bellies in the line. The maximum deviation from planned elevations shall not exceed 0.05 feet in any 100 feet of length. The +/- tolerance applies to all main sizes.
- B. Installation by the horizontal directional drilling (HDD) method is not acceptable, unless prior, written approval is obtained from the ENGINEER. Approval would be on a case-by-case basis. Request to use HDD is a major deviation requiring different pipe materials, joints, etc. Should ENGINEER approve the use of HDD, the same installation tolerances specified in Article 3.01, A for open-cut would apply, no abrupt sags or bellies would be allowed and the CONTRACTOR would be required to verify such through electronic means while the pipe is being installed.
- C. Proper tools and equipment shall be used for handling and laying of pipe and fittings.
- D. Prevent entrance of dirt or foreign matter or damage to pipe. Plug pipe any time work progress has stopped.
- E. No defective pieces shall be permitted. Defective pieces discovered after use shall be removed and replaced with a sound piece.
- F. Lay and join pipe in accordance with manufacturer's instructions to insure pipe thermal expansion and contraction. Lay pipe with spigot end downstream.
- G. Compacted fill shall be placed in entire space between the fitting and the trench walls. Temporary plugs shall be used in end of pipes when work is not in progress.
- H. Provide pipe through casing with support skids to hold pipe to center of casing as shown on Detail Drawings.
- I. Verify pipe grade and elevation at each change in grade and record in notebook in a manner acceptable to the ENGINEER.

3.02 DIVISION VALVE(S) , GAGE TAP(S) AND ACCESS POINTS

- A. Installation at locations as noted on the Drawings.

3.03 VALVE PIT INSTALLATION

- A. Valve pit and valve pit internals shall be assembled, installed and tested in accordance with manufacturer's instructions.

3.04 VALVE PIT SUMP TESTING

- A. Valve pit and valve pit internals shall be assembled, installed and tested in accordance with manufacturer's instructions.

3.05 VACUUM LINE TESTING - DAILY TESTING

- A. A two (2) hour vacuum tightness test of all sewer mains and lateral connections shall be conducted daily as follows:
 - 1. Plug all open connections with rubber stoppers or temporary caps, fitted to the pipe by "no-hub" couplings.
 - 2. Apply a vacuum to 22 inches Hg to the pipes and allow the pressure to stabilize for 15 minutes.
 - 3. There shall be no loss of vacuum in excess of 1% per hour for a two-hour test period.
 - 4. There shall be absolutely no water allowed to be admitted into the piping network during this test.
 - 5. As pipe is laid the new section shall be tested in addition to the previously laid pipe on that main.
- B. If the CONTRACTOR successfully passes the daily 2-hour test for seven (7) consecutive working days or two thousand (2,000) feet of pipe, a request to modify the test procedures may be made to the ENGINEER. If so approved by the ENGINEER, the daily two (2) hour vacuum test procedure may be modified as follows:
 - 1. The procedure may be altered to allow the trench to be covered as work progresses rather than being kept open all day as is the norm with the daily 2-hour test.
 - 2. Should a line fail the vacuum test while utilizing this test modification, the CONTRACTOR shall take whatever action necessary at his own expense to successfully pass the test including the re-excavation of the trench, leak detection, line repair, and additional cleanup as required by the ENGINEER.
 - 3. After a failure, the CONTRACTOR must return to the standard testing procedures in order to "re-qualify" for the modified testing again.
 - 4. This test modification is optional, and as such, the CONTRACTOR assumes all liability in its use, even if approved by the ENGINEER.

3.06 VACUUM LINE TESTING - FINAL ACCEPTANCE TEST

- A. A four (4) hour vacuum tightness test of the complete vacuum piping network, including all sewer mains and lateral connections shall be conducted as follows:

1. Subject the entire sewerage system to a vacuum of 22 inches Hg, allow to stabilize for 15 minutes.
 2. There shall be no loss greater than 1% per hour over a four (4) hour test period.
 3. There shall be absolutely no water allowed to enter the piping system or the vacuum station during this test.
- B. CONTRACTOR to provide 48 hours notice to ENGINEER prior to test.
- C. CONTRACTOR to assure all division valves are open prior to beginning of Final Acceptance Test.
- D. Final Acceptance Test shall be recorded on approved data logger. The data logger will not be considered valid unless verified by ENGINEER and/or representative on test equipment at beginning and the end of vacuum test period.
- E. ENGINEER and/or representative will sign and date test to verify witness of test. This signature does not indicate acceptance of the system.

3.7 LINE FLUSHING

- A. After successful final four (4) hour acceptance testing, flush lines to remove debris and foreign materials that accumulated during construction.
- B. Alternate flushing procedure subject to ENGINEER's review and approval.

3.8 MANUFACTURER'S FIELD REPRESENTATIVE - ROLE & DUTIES

- A. The Manufacturer's Field Representative role shall be to supplement the OWNER and/or ENGINEER's inspector with efforts directed toward insuring proper installation of the vacuum system by the INSTALLATION CONTRACTOR. The presence of the Manufacturer's Field Representative shall not, in any way, constitute the acceptance of work nor shall it relieve the INSTALLATION CONTRACTOR of their responsibility to comply fully with all requirements of the contract documents.
- B. Duties relating to vacuum main installation shall include:
1. Check type of pipe, fittings and division valves to insure they are suitable for vacuum service.
 2. Confirm that vacuum lines are installed as indicated on the construction plans by spot-checking grades, distances and elevations.
 3. Observe trench conditions to insure adequate soil conditions exist, and that proper bedding and compaction are carried out in accordance with the contract documents.
 4. Observe branch and service lateral installations to insure compliance with contract documents.

5. Maintain a neat, legible and accurate set of "Hydraulic Drawings" and field notes (for manufacturer's internal use only). If on-site full time, manufacturer shall provide OWNER with a copy of this information upon completion of the project.
 6. Provide on site training on use of the Trailer Mounted Vacuum Pump (TMVP).
 7. Observe the daily vacuum testing of vacuum sewers to insure compliance with the contract documents.
 8. Provide supervision of the final 4-hour vacuum main test and line flushing.
- C. Duties relating to valve pit installation shall include:
1. Sump testing is conducted in accordance with the contract documents.
 2. Storage and handling procedures are followed to avoid loss or damage to vacuum sewer products used at the project site.
 3. Insure all field penetrations to vacuum sewer products are neatly cut, reasonably circular and are located properly.
 4. Valve pit assembly is placed in accordance with construction drawings or as otherwise directed.
 5. Three-inch service lateral is properly aligned with the 3" suction pipe.
 6. Depth is in accordance with contract documents as well as within vacuum manufacturer limits.
 7. Pit assembly is plumb and reasonably level.
 8. Compile and maintain a complete and accurate set of valve pit installation forms (for manufacturer's internal use only).
 9. Observe testing and installation of gravity sewers to ensure no infiltration exists.
- D. Manufacturer's Representative shall not be responsible for keeping construction as-built drawings. This shall be the responsibility of the INSTALLATION CONTRACTOR or other party so designated elsewhere in the Contract Documents.
- E. Manufacturer's Representative shall not be responsible for compiling and maintaining the Valve Pit Installation Forms. This shall be the responsibility of the INSTALLATION CONTRACTOR.

3.9 MANUFACTURER'S CERTIFICATION

- A. Provide certification from vacuum system manufacturer stating that the vacuum valves, pits and accessories have been installed in

accordance with the manufacturer's stated recommendations and that the vacuum valves, pits and accessories meet the specified performance requirements.

- B. Certification to be submitted in accordance with the requirements of Section 01300 - Submittals.

END OF SECTION