



## **Manual - Part 2 - Materials**





## Part Two: Materials

### **Chapter 1. Building Sewer**

The building sewer must be constructed with materials in conformance to building sewer standards identified in the California Plumbing Code. The building sewer pipe must have a minimum diameter of three (3) inches.

### **Chapter 2. Septic Tank**

#### **A. General criteria for septic tanks**

1. Tanks must be constructed of precast reinforced concrete or other material approved by the LEA. Wood and metal tanks are prohibited. Cast-in-place, and fiberglass may be considered on a case-by-case basis provided there is adequate engineering justification and provided they meet the requirements outlined in this Manual. Polyethylene and polypropylene tanks that meet the International Association of Plumbing and Mechanical Officials (IAPMO) standard IAPMO/ANSI Z1000 (standard for design, material, performance testing, and marking) are approved by the LEA, unless otherwise noted.
2. Tanks must have the manufacturer's name and tank capacity in gallons permanently displayed on the uppermost portion of the tank. If the tank is constructed of fiberglass, polyethylene, or polypropylene then the model number must also be displayed.
3. Tanks must be protected against flotation under high ground water conditions.
4. Tanks must be approved by the International Association of Plumbing and Mechanical Officials (IAPMO) or meet IAPMO minimum standards as demonstrated to the LEA by a certification program equivalent to that provided by IAPMO with the following program elements:
  - a. Evaluation and certification by an engineering firm, approved by the LEA, with expertise and experience related to septic tank design and construction, to verify substantial equivalency with IAPMO standards and compliance with the requirements of this Manual as pertaining to:
    - (1) Structural design of the tank;
    - (2) Quality of materials used in construction of the tank;
    - (3) Acceptable construction methods and practices;
    - (4) Quality control and quality assurance plan proposed by the manufacturer;
  - b. Unannounced inspection of manufacturer's facilities and observation of construction methodology by a qualified third party approved by the LEA to assure compliance with the items listed above;



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- c. Reciprocity:
    - (1) A certification program of tanks by another oversight agency in a manner substantially equivalent to that which is outlined in this Manual may be accepted by reciprocity;
    - (2) Reports generated from unannounced inspections conducted by a qualified independent third party on behalf of another oversight agency may be accepted by the LEA provided the certification requirements of the other oversight agency are substantially equivalent to that which is specified in this Manual.
  - d. All associated costs shall be borne by the manufacturer requesting the alternative certification process.
5. Tanks must be accompanied by a Manufacturer's Guarantee for a minimum period of one year and be installed in strict accordance with the manufacturer's instructions.
  6. Tanks must be constructed and installed so as to be watertight. Septic tanks for new construction must be verified as watertight through manufacturer certification and insitu testing. Testing methods are described in Part 1 of this Manual.
- B. Configuration
1. The tank must be designed to ensure removal of settleable solids. To accomplish this, the tank must provide:
    - a. Liquid volume as specified in Part 3 of this Manual. This is to allow sufficient retention time for treatment and sufficient sludge storage space to prevent the discharge of sludge or scum into the drainfield.
    - b. Inlet and outlet sanitary "T"s to prevent the discharge of sludge or scum in the effluent.
    - c. Venting provisions to allow for the escape of accumulated methane and hydrogen sulfide gases.
    - d. Inlet sanitary "T" must be extended to penetrate at least 12 inches into the liquid from the inlet flow line. If the submerged scum depth is expected to be greater than 12 inches, the inlet fixture should be extended into the liquid two inches below the expected lowest scum depth.
  2. Septic tanks must have a minimum of two compartments. Installation of multiple single compartment tanks in a series is not acceptable, unless approved by the LEA prior to installation. The first compartment must have a liquid capacity of two-thirds (2/3) of the total required liquid capacity, as measured from the invert of the outlet fitting.
  3. Each compartment must have access provided by a manhole having not less than eighteen (18) inches across its shortest dimension unless otherwise approved by the LEA.



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4. At least ten (10) percent of the inside volume of the tank must be above liquid level to provide scum storage.

### C. Structural Integrity

All treatment units and tanks, regardless of material or method of construction shall:

1. Be designed and constructed to withstand all potential lateral earth pressures under saturated soil conditions with the tank empty.
2. Pass Top Load = 300 psf (the tank shall be capable of supporting long-term unsaturated soil loading in addition to the lateral hydrostatic load.)
3. Pass Lateral Load = 62.5 pcf (the tank shall be capable of withstanding long term hydrostatic loading with the water table maintained at ground surface.)
4. Have a minimum live load at the surface of 300 pounds per square foot with twelve (12) inches of cover unless heavier loads are expected. For heavier loads, (i.e. vehicles), proof of traffic rating is required.
5. Successfully withstand an above ground static hydraulic test if the tank is 2,000 gallons or smaller.
6. Precast concrete tanks must have a minimum wall, compartment and bottom thickness of three (3) inches, and must be adequately reinforced. The top must be at least four (4) inches thick.
7. Tanks must be built such that all construction joints are sealed watertight and bonded together in a structurally sufficient manner to prevent separation as certified by the manufacturer's registered engineer.

### D. Risers

1. Each compartment must be provided with a concrete (or other material approved by the LEA) watertight riser, extending to the finished grade or above, with a minimum inside horizontal measurement equal to or greater than the access manhole.
2. All joints must be properly sealed with a sealant and/or an interlocking mechanism approved by the LEA. Cement grout sealing alone is not an acceptable method of sealing joints.
3. Surface water must be diverted away from the riser cover by creating a sloping surface away from the riser, or extending the riser two (2) inches above finished grade.
4. The cover must be securely fastened with stainless steel or other corrosion resistant fasteners to make the riser vandal, tamper, and child resistant. No cover may exceed seventy-five (75) pounds.
5. Risers must have a minimum inside horizontal diameter of twenty-four (24) inches.

## Chapter 3. Fittings

- A. The inlet and outlet fittings must be of Schedule 40 PVC, Schedule 40 ABS, or other materials approved by the LEA, with a minimum diameter of three (3) inches.



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- B. All fittings must be secured with a sealant approved by the LEA and must be constructed so as to be watertight. Tank fitting locations must be properly engineered to ensure the structural integrity of the tank.
- C. The inlet fitting must be a sanitary "T" with minimum pipe diameter not less than the connecting building sewer or less than three (3) inches. It must extend at least four (4) inches above and twelve (12) inches below the liquid level.
- D. The outlet fitting must be a sanitary "T" with minimum pipe diameter no less than the connecting influent sewer pipe and not less than four (4) inches in order to accommodate an effluent filter. The outlet fitting must extend at least four (4) inches above liquid level, and below liquid level a distance approximately equal to the flow level through the baffle separating the two compartments of the tank. The diameter of the vertical leg extending below the liquid level must not be less in size than the building sewer nor less than four (4) inches.
- E. An effluent filter is recommended prior to discharge of the effluent to the effluent sewer. It must be commercially designed and manufactured, intended for effluent filtration, and be readily accessible for inspection and cleaning.
- F. The invert of the inlet fitting must not be less than one (1) inch and preferably three (3) inches above the invert of the outlet fitting.
- G. Sanitary "T"s must be accessible and directly below the manhole access riser.
- H. Baffles must be a three (3) inch or larger diameter "T" fitting or baffle slot (with the same opening area as the fitting) that is located in the shared compartment wall, using the same material specifications as required for the outlet fitting. The invert of the "T" fitting or baffle slot must be located approximately at fifty (50) percent of the liquid depth. There must be a minimum two-inch vent opening in the baffle above the liquid level. The baffle must be constructed of the same material as the tank and extend a minimum of four (4) inches above the liquid level.

### Chapter 4. Distribution Box

- A. Distribution boxes must be constructed of concrete or other materials acceptable to the LEA.
- B. Distribution boxes must be designed to accommodate the necessary distribution laterals and expected flows. The top, walls, and bottom of concrete distribution boxes must be at least one and one-half (1-1/2) inches thick.
- C. Distribution boxes must be installed for equal distribution to the drainfield trenches.
- D. Each distribution box must be provided with a sump extending at least one (1) inch below the invert of the outlets.
- E. For initial use of a manufacturer's distribution box design proposed for use in Butte County, or when a revised box design is proposed for same, the commercial manufacturer of the prefabricated box must provide the LEA with written documentation that the box design, materials and construction comply with all requirements of the California Plumbing Code.



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- F. All distribution boxes must be installed level on LEA-approved bedding material and as described in Part 3 of this Manual.

### Chapter 5. Diversion Valve

- A. Diversion valves must be constructed of durable material and be of a design approved by the LEA. They must be corrosion resistant, watertight, and designed to accommodate the inlet and outlet pipes.
- B. Each diversion valve must have a positive stop.
- C. For initial use of a manufacturer's diversion valve design proposed for use in Butte County, or when a revised valve design is proposed for same, the commercial manufacturer of the prefabricated valves must provide the LEA with written documentation verifying that the valve design, materials and construction comply with all requirements of the California Plumbing Code.

### Chapter 6. Dosing and Pump Tanks

- A. The tank may be:
  - 1. The second compartment of a two compartment septic tank provided:
    - a. The septic tank is a minimum of 1,500 gallons;
    - b. The wall separating the two compartments of the tank is equipped with a properly placed sanitary "T" to prevent the discharge of sludge or scum into the second compartment that is utilized as the pump chamber, or with a flow-through port. If a sanitary "T" is utilized, the tank must have an access lid over the "T" to allow servicing;
    - c. The wall separating the two compartments has the structural integrity to allow the first compartment to remain full while the second compartment is empty.
  - 2. A separate tank meeting the requirements specified in this manual.
- B. Each dosing tank employing one (1) or more pumps must have a liquid capacity sufficient to deliver the design dose, and have a minimum additional capacity of one day's design flow between the high level alarm and the tank's "soffit" (inner ceiling).
- C. Each dosing tank must be marked on the uppermost surface with the liquid capacity and manufacturer's business name, or a number assigned by the LEA.
- D. When a revised tank design is proposed, the manufacturer of the tank must provide the LEA with written documentation that the tank design, materials and construction comply with all requirements of the California Plumbing Code. The manufacturer must provide a set of plans and specifications prepared by a registered professional engineer for each tank design and a set reflecting any subsequent revisions. The appropriate fee must accompany plans.
- E. Any pump tank transporting effluent or solids to a septic tank must have its own penetration into the tank with a 3-inch minimum diameter sanitary "T." Because effluent entering the septic tanks should not do so under pressure that could cause turbulence in the septic tank,



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the pressure line from the dosing/pump tank needs to connect to the larger diameter pipe at least 10 feet before entering the septic tank.

### Chapter 7. Pumps, Controls, and Alarms

Electrical components used in systems must comply with the Uniform Electrical Code, and the following provisions:

- A. Motors must be continuous-duty, with overload protection.
- B. Pumps must have durable impellers of bronze, cast iron, or other materials approved by the LEA.
- C. Submersible pumps must be provided with an easy, readily accessible means of electrical and plumbing disconnect, and a noncorrosive lifting device as a means of removal for servicing.
- D. Pumps must be automatically controlled with mechanical switches designed for use with pumps and control panels.
- E. Pumps must have automatically resetting audible and visual high water level alarm with manual silence switch that is located in or near the building served by the pump. Only the audible alarm may be user cancelable. The electrical box for the pump and alarm system must not be located in an environment that may damage the components.
- F. Wiring must be of proper construction and gauge and permanently fixed to a supporting structure under permit from the local Administrative Authority.
- G. The pump and alarm must be connected to separate circuits.
- H. There must be a non-resettable digital pump cycle counter in the electrical box.
- I. There must be a manual override switch in the electrical box to facilitate dosing control during inspections.

### Chapter 8. Pipe

- A. All pipe throughout the wastewater system must be clearly labeled and installed so that the labeling can be readily identified by LEA inspectors. Labeling, consisting of durable ink, must cover at least 50% of the length of the pipe. Labeling may consist of a solid line, letters, or a combination of the two. Intervals between markings must not exceed 12 inches.
- B. Schedule 40 ABS must be used from the house to the septic tank
- C. Schedule 40 ABS or SDR 35 (ASTM D 3034) must be used as follows:
  1. From the septic tank to the distribution box (if applicable)
  2. From the distribution box outlet for a minimum of 5 feet
  3. From the septic tank to the pump chamber (if applicable)
- D. Gravity Distribution (leachline) Dispersal
  1. One of the following grades of 4-inch perforated pipe must be used:
    - a. SDR 35 (ASTM D 3034) 4-inch diameter
    - b. Triple Wall ASTM F810





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- 2. Gravelless chambers, may be used provided the products meet IAPMO standard PS-63.
- 3. The pipe described in subsection D.1. of this section must have 2 rows of holes spaced 120 degrees apart and 60 degrees on either side of a centerline. The holes of each row must not be more than 5 inches on-center and must have a minimum diameter of one-half inch.
- E. Pressure transport pipe, pressure distribution manifolds, and pressure distribution laterals (piping and fittings), must meet the most current requirements for schedule 40 PVC pressure pipe as identified in ASTM Specifications D-1785, or other material approved by the LEA. All pressure distribution laterals and all pressure transport and manifold piping must be adequately sized for the design flow.
- F. Curtain drain pipe must meet the requirements specified in the Manual for gravity drainfield pipe. Other types of pipe may be approved by the LEA, provided it can be demonstrated that the selected pipe has the structural strength for the application proposed.

**Chapter 9. Drainrock**

- A. Gravel used for drainrock must be ¾ inch to 2½ inches in diameter. Uniformly graded material is recommended to maximize pore space. Drainrock must be clean, washed, non-deteriorating gravel, with the percent by weight passing the U.S. No. 200 sieve no greater than 0.5%. Alternatives to drainrock, as described in this Chapter, may be accepted on a case-by-case basis.
- B. Gravelless systems are allowed provided the requirements for such systems as described in Part Three of this Manual are followed.

**Chapter 10. Barrier Material**

- A. Untreated building paper or two inches of compacted straw may be used for standard gravity systems.
- B. Filter fabric must be used for non-standard gravity systems and must meet or exceed the specifications described in the following table:

Property	Requirement	Test Method
Grab Strength	80 lbs.	ASTM D4632
Puncture Strength	25 lbs.	ASTM D4833
Trapezoid Tear	25 lbs.	ASTM D4533
Apparent Opening Size	AOS < 0.297 mm, or > #50 US Standard Sieve	ASTM D4751
Permeability	0.4 cm/sec for Soil Types 1,2 0.004 cm/sec for Soil Types >2	ASTM D4491

<sup>1</sup> Examples of filter fabrics meeting this specification include: Mirafi 140 NSL.

**Chapter 11. Bundled EPS Synthetic Aggregate**

- A. As substitute for pipe, drainrock, and barrier material, Bundled Expanded Polystyrene (EPS) Synthetic aggregate meeting IAPMO standard IGC 276 may be used for wastewater dispersal.



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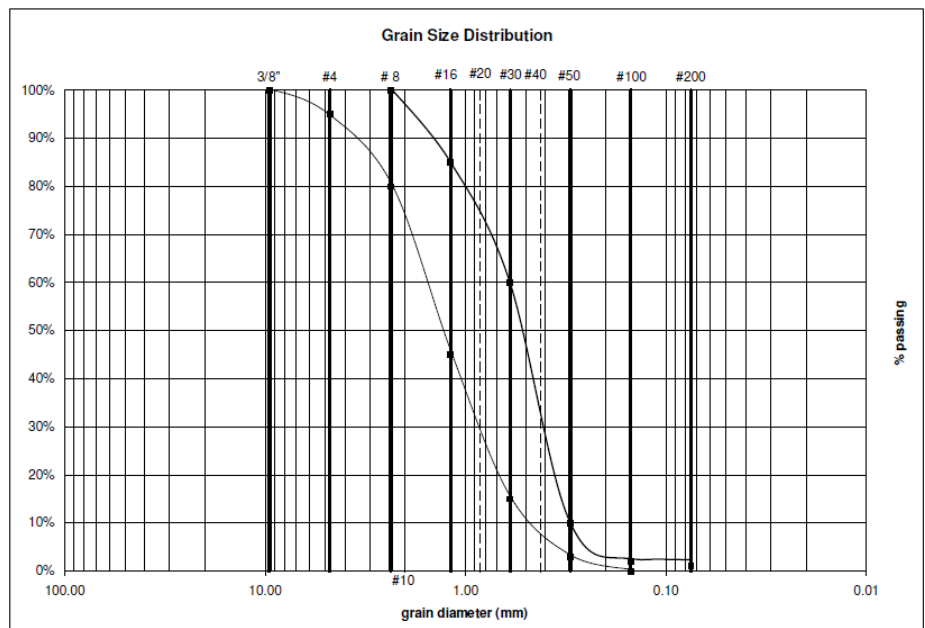
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Units are cylindrically shaped; having a seamless external permeable netting that contains EPS synthetic aggregate. A geotextile is pre-inserted between the EPS synthetic aggregate and netting as a barrier material to overlying soil. At least one bundled EPS synthetic aggregate unit in the configuration shall include an internal 4-inch pipe. The internal pipe shall comply with ASTM F405.

- B. Bundled EPS synthetic aggregate shall be H-10 rated. Units may contain a plastic pipe for longitudinal conveyance of water.
- C. EPS synthetic aggregate particles shall be relatively uniform in shape and size. The aggregate particle size may range from 0.5 inches to 2.0 inches along any axis. EPS synthetic aggregate must provide a minimum porosity of 30%.

### Chapter 12. Single-Pass Sand Filter and Mound System Filter Material

- A. All filter materials used in single-pass sand filters and mound systems must fall within the limits of the specifications shown in the following graph for the amounts of material retained/passing (by weight). This specification closely follows the ASTM C-133 concrete sand specification.
- B. The material must also have a uniformity coefficient of 4 or less.



The uniformity coefficient is calculated by dividing D60 (the size of screen opening where 60 percent of a sample passes and 40 percent is retained) by D10 (the size of screen opening where 10 percent of a sample passes and 90 percent is retained). For sands with a D10 less than 0.3 mm, the designer should consider a loading of no greater than 1.0 gallon/square foot-day, and specify frequent dosing. A sieve analysis, (done in accordance with ASTM D 136 for dry product, or ASTM C-117 for wet product), of the material is required prior to transport to the construction site.

- C. A report of the sieve analysis and on-site analysis results must be available for the LEA prior to system approval and for inclusion in the system's permanent file.

### Chapter 13. Containment Vessel for Intermittent Sand Filter



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A. Lined Pit: when a sand filter is constructed in an excavated pit the following criteria are to be met.

B. Unsupported polyvinyl chloride (PVC) shall have the following properties:

Property	Test Method	
Thickness	ASTM D1593 Para 9.1.3	30 mil minimum
Specific Gravity (Minimum)	ASTM D792 Method A	
Minimum Tensile Properties (each direction)	ASTM D882	
A) Breaking Factor (pounds/inch width)	Method A or B (1 inch wide)	69
B) Elongation at Break (percent)	Method A or B	300
C) Modulus (force) at 100% Elongation (pounds/inch width)	Method A or B	27
Tear Resistance (pounds, minimum)	ASTM D1004 Die C	8
Low Temperature	ASTM D1790	-20°F
Dimensional Stability (each direction, percent change maximum)	ASTM D1204 212°F, 15 min.	± 5
Water Extraction	ASTM D1239	-0.35% max.
Volatile Loss	ASTM D1203 Method A	0.7% max.
Resistance to Soil Burial (percent change maximum in original value)	ASTM D3083	
A) Breaking Factor		-5
B) Elongation at Break		-20
C) Modulus at 100% Elongation		±10
Welded Seam Strength (factory seam, breaking factor, ppi width)	ASTM D3083	55.2
Hydrostatic Resistance	ASTM D751 Method A	82

C. Concrete Containment Vessel: to be designed and/or approved by a qualified professional engineer if the following conditions are not met.

1. Above ground tank

a. Walls

- (1) At least 6 inches thick
- (2) 4 feet or less in height
- (3) Rebar reinforcement: 3/8 inch diameter rebar on 2-foot centers horizontally and vertically, with continuous lengths wrapped around the corners.

b. Floor

- (1) At least 3 1/2 inches thick
- (2) Reinforced with steel mesh (CRSI standard #6-1010) to prevent cracking and to maintain water-tightness



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- c. Tank is to be designed, constructed, and sealed to be water-tight.
2. Below ground tank
  - Any below ground concrete tank must be watertight. The design of any such tank is to be approved by a qualified professional engineer and meet the specifications of this Manual.

### Chapter 14. Observation Port Design

