

Chapter 40 - Sewage Pumping Stations

General Design Information

31 Flood Protection

25 Year Flood Elevation _____

100 Year Flood Elevation _____

32 Location _____

33 _____

Type of pumping station Wet well/Dry well Submersible
 Package Built-in-place

Number of pumps _____

Maximum flow expected _____

| <u>Capacity of each pump</u> | <u>Rated Head</u> | <u>Computed Head</u> |
|------------------------------|-------------------|----------------------|
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| 31 | General | | | | |
| 31.1 | Structures and electrical and mechanical equipment protected from physical damage by 100 yr. flood and will remain fully operational and accessible during the 25 yr. flood? | Yes | | | |
| 31.2 | Pumping station is readily accessible by maintenance vehicles during all weather conditions? | Yes | | | |
| 31.3 | Special consideration given to design of the wet well and piping to avoid operational problems from the accumulation of grit? | Yes | | | |
| 32 | Design | Wet Well or Dry Well | | | |
| 32.1 | Type of sewage pumping station? | | | | |
| 32.21 | Dry wells, including their superstructure, are completely separated from the wet well? | Yes | | --- | |
| 32.22 | Provisions made to facilitate removal of pumps, motors, and other mechanical and electrical equipment? | Yes | | --- | |
| 32.23 | Suitable and safe means of access provided to dry wells, and to wet wells containing either bar screens or mechanical equipment? | Yes | | | |
| | For built-in place pump stations, a stairway with rest landings provided at vertical intervals not to exceed 12 ft.? | Yes | | --- | |
| | For factory built pump stations over 15 ft. deep, a rigidly fixed landing provided at vertical intervals not to exceed 10 ft.? | Yes | | --- | |
| | Where landing is used, a suitable and rigidly fixed barrier | Yes | | --- | |

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| | provided to prevent an individual from falling past the intermediate landing? | | | | |
| | If manlift or elevator used, emergency access included in design? | Yes | | -- | |
| | Stairways designed to meet the provisions of 46.5? | Yes | | --- | |
| 32.24 | Selection of materials - Consideration given to the presence of hydrogen sulfide and other corrosive gases, greases, oils, and other constituents frequently present in sewage? | Yes | | --- | |
| 32.3 | Pumps and Pneumatic Ejections | Yes | | | |
| 32.31 | At least 2 pumps or pneumatic ejectors provided? | | | | |
| | Minimum of 3 pumps provided for flows >1 mgd? | Yes | | | |
| | If only 2 units provided, both have same capacity and each is capable of handling flows in excess of expected maximum flow? | Yes | | | |
| | If 3 or more provided, units designed to fit actual flow conditions and of such capacity that with any one unit out of service the remaining units will have capacity to handle maximum sewage flow? | Yes | | | |
| 32.32 | Pumps handling combined sewage preceded by rapidly accessible bar racks? | Yes | | | |

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| 32.33 | Max. bar rack spacing? | 2 ½" | | --- | |
| | Mechanical hoist provided with bar rack? | Yes | | | |
| | Where warranted, mechanically cleaned and/or duplicate bar racks provided? | Yes | | | |
| | Pumps handling separate sanitary sewage from 30" or larger diameter sewers protected by bar racks? | Yes | | | |
| | For small pumping stations, protection from clogging considered? | Yes | | --- | |
| | Sphers size that can be passed by pumps (except grinder pumps)? | 3" min. | | | |
| | Diameter of pump suction piping (except grinder pumps)? | 4" min. | | | |
| | Diameter of pump discharge piping (except grinder pumps)? | 4" min. | | | |
| 32.34 | Under normal operating conditions, pump will operate under a positive suction head? | Yes | | --- | |
| 32.35 | Electrical systems and components in raw sewage wet wells, or in enclosed or partially enclosed spaces where flammable gases may be present, comply with NEC requirements for Class 1, Group D, Div. 1 locations (explosion-proof)? | Yes | | --- | |
| | Equipment in wet well suitable for use under corrosive conditions? | Yes | | --- | |
| | Each flexible cable provided with watertight seal and separate strain relief? | Yes | | --- | |

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| 32.36 | Fused disconnect switch provided above ground, and weatherproof (NEMA 3 R)? | Yes | | --- | |
| | Each pump has an individual intake? | Yes | | --- | |
| | Wet well design avoids turbulence near intake, with intake piping as straight and short as possible? | Yes | | --- | |
| 32.37 | For dry wells, a separate sump pump with dual check valves provided, with discharge located as high as possible? | Yes | | --- | |
| | Floor and walkway surfaces sloped to point of drainage? | Yes | | --- | |
| | Pump seal water piped to sump? | Yes | | --- | |
| 32.4 | Controls | | | | |
| 32.41 | Type of control system: (a) air bubbler, (b) encapsulated float, or (c) flow measuring? | a, b, or c | | --- | |
| 32.42 | Control system electrical equipment complies with NEC requirements for Class 1, Group D, Division 1 location? | Yes | | --- | |
| | Control system located away from turbulence of incoming flow and pump suction? | Yes | | --- | |
| 32.43 | Provisions included to automatically alternate the pumps in use? | Yes | | | |
| 32.5 | Valves | Yes | | --- | |

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| 32.51 | Suitable shutoff valves on suction line of each pump, except submersible and vacuum primed? | | | | |
| 32.52 | Suitable shutoff and check valves on discharge line of each pump? | Yes | | --- | |
| | Check valves suitable for material being handled? | Yes | | --- | |
| | Check valve location acceptable (not on vertical piping)? | Yes | | --- | |
| | All valves capable of withstanding normal pressure and water hammer? | Yes | | --- | |
| 32.53 | Valves located outside of wet well? | Yes | | --- | |
| 32.6 | Wet Wells | Yes | | | |
| 32.61 | Is wet well divided into multiple sections, properly interconnected, to facilitate repairs and cleaning? | Desire-able | | --- | |
| 32.62 | Size adequate to avoid heat buildup in pump motor and to avoid septic conditions due to excessive detention time? | Yes | | --- | |
| 32.63 | Slope of wet well floor to hopper bottom? | 1:1 min. | | --- | |
| 32.7 | Ventilation | Yes | | | |
| | Adequate ventilation provided? | Yes | | | |
| | If below ground, has mechanical ventilation been provided and so arranged as to independently ventilate the dry well and the wet well, with no interconnection, if equipment requiring maintenance or inspection is located in wet well? | Yes | | | |

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| 32.71 | Fan wheel for mechanical ventilation fabricated from non-sparking material? | Yes | | --- | |
| | If continuous, minimum air turnover rate per hour? | 12 | | --- | |
| | If intermittent, minimum air turnover rate per hour? | 30 | | | |
| 32.72 | If continuous, minimum air turnover rate per hour? | 6 | | | |
| | If intermittent, minimum air turnover rate per hour? | 30 | | --- | |
| 32.8 | Suitable devices provided for measuring sewage flow? | | | | |
| 32.9 (TIP #14) | Potable water supply complies with Section 42.62 and TIP #14? (No Physical connection with pumping station.) | Yes | | | |
| 33 | Suction Lift Pumps | | | | |
| | Type of suction lift pumps provided: (a) self-priming, or (b) vacuum-priming? | a or b | | --- | |
| | Pump stations using dynamic suction lifts exceeding the limits outlined in sections 33.1 and 33.2 have factory certification of pump performance and detailed calculations submitted for review? | Yes | | --- | |
| | Pump equipment compartment above grade or offset and effectively isolated from wet well? | Yes | | --- | |
| | Wet well access other than through equipment compartment? | Yes | | --- | |
| | Valving located outside wet well? | Yes | | --- | |

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| 33.1 | Self-Priming Pumps | Yes | | --- | |
| | Pumps capable of rapid priming and repriming at the “lead pump on” elevation, automatically, under design operating conditions? | | | | |
| | Suction piping not exceeding pump suction size and not exceeding 25 ft. in total length? | Yes | | --- | |
| 33.2 | Priming lift at “lead pump on” elevation includes safety factor of at least 4 ft. from max. allow. priming lift at design operating conditions? | Yes | | --- | |
| | Combined total maximum dynamic suction lift at “pump off” elevation and required NPSH at design operating conditions? | 22 ft. | | | |
| | Vacuum - Priming Pump | Yes | | --- | |
| | Dual vacuum pumps provided capable of automatically and completely removing air from suction list pump? | | | | |
| | Combined total maximum dynamic suction list at “pump off” elevation and required NPSH at design operating conditions? | 22 ft. | | --- | |
| 34 | Submersible Pump Stations | Yes | | --- | |
| | Provisions under Section 32 being met? | | | | |
| 34.1 | Pumps and motors designed specifically for raw sewage use, including totally submerged operation during a portion of each pumping cycle? | Yes | | --- | |
| | Effective method provided to detect shaft seal failure or potential seal failure? | Yes | | --- | |

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| 34.2 | Motor of squirrel-cage type design without brushes or other arc producing mechanisms? | Yes | | --- | |
| | Pumps readily removable and replaceable without dewatering wet well or disconnecting any wet well piping? | Yes | | | |
| 34.31 | Strain relief and disconnection from outside wet well provided for electrical supply, control and alarm circuits? | Yes | | --- | |
| | Terminals and connectors - located outside wet well or use water-tight seals. If outside, use weather proof equipment. | Yes | | --- | |
| 34.32 | MCC located outside wet well and protected by conduit seal or other appropriate measures meeting NEC requirements, with seal located so that motor may be removed and electrically disconnected without disturbing seal? | Yes | | --- | |
| 34.33 | Pump motor power cords meet requirements of Mine Safety and Health Administration for trailing cables? | Yes | | --- | |
| | Ground Fault Interruption protection provided to deenergize the circuit in event of failure in cable electrical integrity? | Yes | | --- | |
| | Power cord terminal fittings corrosion-resistant, constructed to prevent entry of moisture into cable, provided with strain relief, and designated to facilitate field connecting? | Yes | | --- | |
| 34.4 | Valves required under 32.5 located in a separate valve pit, drain to the wet well, or to the soil? | Yes | | --- | |
| 35 | Alarm Systems | Yes | | --- | |
| | Alarm system provided to activate in cases of power failure, pump failure, use of lag pump, unauthorized entry, or any cause of pump | | | | |

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| | station malfunction? | | | | |
| 36 | Alarms telemetered to a remote location or audio-visual alarm system provided? | Yes | | --- | |
| | Emergency Operation Suitable controlled high-level wet well overflow and/or use of storage/detention tanks or basins provided to supplement alarm systems and emergency power generation for times of flood, power failure or other reasons? | Yes Desire- able | | --- | |
| 36.1 | Which of the following methods utilized to prevent or minimize overflows? (a) Storage capacity of system (b) In-place or portable pump driven by an internal combustion engine. (c) Two independent public utility sources or engine-driven generating equipment. | a,b, or c | | | |
| 36.211 | Engine protection equipment capable of shutting down and activating an alarm on site as provided in Section 35? | Yes | | --- | |
| | Engine protective equipment monitors conditions of low oil pressure and overheating, except for engines with splash lubrication? | Yes | | --- | |
| 36.212 | Engine of adequate rated power to start and continuously operate all connected loads? | Yes | | --- | |

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| 36.213 | Type of fuel adequate for cold weather conditions expected? | Yes | | --- | |
| 36.214 | Engine located above grade with adequate ventilation of fuel vapors and exhaust gases? | Yes | | --- | |
| 36.215 | Instructions provided for all emergency equipment indicating need for regular starting and running at full loads? | Yes | | --- | |
| 36.216 | Emergency equipment protected from damage at the restoration of regular electrical power? | Yes | | --- | |
| 36.221 | Engine-driven pumps meet design pumping requirements unless storage capacity is available for excess flows, with pumps designed for anticipated operating conditions? | Yes | | | |
| 36.222 | Engine and pump equipment to provide automatic start-up and operation? | Yes | | --- | |
| | Manual start-up also provided? | Yes | | --- | |
| | Where manual start-up and operation justified, storage capacity, and alarm system meet 36.223? | Yes | | --- | |
| 36.223 | Where engine-driven pumping equipment is portable, sufficient storage capacity is provided? | Yes | | --- | |
| 36.231 | Generating unit size adequate for pump motor starting current and for lighting, ventilation, and other auxiliary equipment? | Yes | | --- | |
| | Operation of only one pump during periods of auxiliary power supply adequately justified? | Yes | | --- | |
| | Special sequencing controls provided to start pump motors, unless generating capacity available to start all pumps simultaneously? | Yes | | --- | |

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| 36.232 | Automatic and manual start-up and load transfer provided? | Yes | | --- | |
| | Generator protected from damaging operating conditions? | Yes | | --- | |
| | Where manual start-up and transfer justified, storage capacity and alarm system meet 30.233? | Yes | | --- | |
| 36.233 | Where portable generating equipment or manual transfer provided, sufficient storage capacity is provided? | Yes | | | |
| | Special electrical connections and double-throw switches provided for connecting portable generating equipment? | Yes | | --- | |
| 37 | Instructions and Equipment | | | | |
| | Complete set of operational instructions provided? (to be included in O&M manual) | Yes | | --- | |
| 38 | Force Main | 2.0 fps | | 3.6 | --- |
| 38.1 | Min. velocity at design average flow? | | | | |
| 38.2 | Automatic air relief valves at high points? | Yes | | --- | --- |
| 38.3 | When entering gravity sewer, force mains at a point not more than 2.0 ft. above flow line of receiving manhole? | Yes | | --- | --- |
| 38.4 | Force main and fittings designed to withstand normal pressure and pressure surges? | Yes | | --- | --- |
| 38.5 | Force main near streams or for serial crossings meet requirements of Sections 27 and 28? | Yes | | --- | --- |
| 38.6 | Design valve used for "C" in Hazen-Williams formula? | 120* | | --- | --- |

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| 38.7 | (*100 for unlined iron or steel) | | | | |
| | Min. horizontal separation between water mains and san. sewer force mains? | 10 ft. | | | --- |
| | Min. vertical separation between outside of force main and outside of water main when crossing water mains? | 18 in. | | --- | --- |
| | At crossings of water mains, one full length of water pipe located so both joints as far from the force main as possible? | Yes | | --- | --- |
| 38.8 | Force main properly identified where necessary? | Yes | | --- | --- |

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| | Remarks - Explanations/Justifications for Departures from Standards |
|--|---|
| | |