BRUNSWICK REGIONAL WATER AND SEWER H2GO

WASTEWATER SYSTEM STANDARDS & SPECIFICATIONS

Revised 3.2025

Standards and Specifications contained herein are approved only for sewer collection systems.

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1 WASTEWATER TRANSMISSION PIPELINE INSTALLATION

1.1 SCOPE: Wastewater pipelines and appurtenances shall be provided as shown on the plans and as specified herein. Clearing, grubbing, trench excavation and backfill, pipe material, valves, cutting and replacing pavement, and removing and replacing sidewalk shall be as specified in other sections. All applicable provisions shall be binding upon work covered in this section.

1.2 GENERAL

1.2.1 Low Pressure Sewer Systems and On-site Lift Stations

If the Developer desires to install a low pressure sewer system or on-site lift station in lieu of a gravity collection system, the Developer must have their Engineer prepare and submit an engineering alternatives cost analysis to BRWS H2GO for review and consideration. The cost analysis shall compare the following:

A. gravity sewer system at depths to connect to nearby existing collection systems;

B. on-site duplex lift station with appurtenances and tributary gravity sewers; and

C. low pressure sewer system with grinder pumps and appurtenances.

The threshold selection criteria for BRWS H2GO to approve low pressure sewer systems or on-site lift stations will be as follows:

D. The gravity system at depth must be at least 1.5 times more expensive than an on-site duplex lift station with appurtenances and tributary gravity sewers.

E. The gravity system at depth must be at least 2.5 times more expensive than low pressure sewer systems.

F. The on-site duplex lift station with appurtenances and tributary gravity sewers must be 2.5 times more expensive than low pressure sewer systems.

G. All new grinder connections to force mains-not part of a permitted low-pressure system-should be progressive -cavity grinder pump to ensure the grinder will pump against existing/future flows and pressures from upstream lift stations.

*Even if threshold criteria are met, BRWS H2GO's Executive Director has the right to deny approval at their discretion.

1.3 MATERIAL

All materials and products shall meet Made in America Criteria.

1.3.1 Piping: Pipe and fitting material shall be as specified in sections as follows:

A. PVC Pipe: Section 2.1.

B. Ductile Iron Pipe: Section 2.2.

C. Polyethylene Pipe: Section 2.3.

D. Valves: Section 2.4.

E. Fittings, Misc Appurtenances and Specialties: Section 2.5.

F. Manholes and Associated Appurtenances: Section 2.6.

G. Sewer Pump Stations and Appurtenances: Section 3.

H. Service Connections: Section 1.4.3.

I. General Electrical: Section 3.

1.4 PIPELINE INSTALLATION

Piping and appurtenances shall be installed in accordance with the best practice, manufacturer's instructions. Where the pipeline crosses under or is installed on highway or railroad right-of-way, the work shall be done in accordance with such requirements specified in other sections.

1.4.1 Locations: Piping and appurtenances shall be installed at the locations shown on the plans and to the position, alignment and grade shown thereon. Prior to beginning work at any location, the Contractor shall consult with BRWS H2GO to determine that all rights-of-way, permits, and other legalities are in order. Contractor shall familiarize themself with all conditions and/or limitations of such rights-of-way or permits and shall fully comply with all such requirements. All work shall be confined to rights-of-way or permit limits and any encroachment beyond such limits shall be the Contractor's liability.

1.4.2 Installation of Pipe and Appurtenances: Clearing and Grubbing along pipelines shall be as specified in the General Provisions. Trench Excavation shall be as specified in the General Provisions. Trenches for water lines shall generally follow the contour of the ground to provide a minimum cover of 36 inches and a maximum cover of 60 inches, unless otherwise noted. Pipe and appurtenances shall be hauled to the work site and distributed neatly along the trench prior to laying. Pipe shall be carefully handled to prevent damage by using mechanical hoists or other approved methods. All damaged pipe and appurtenances shall be rejected and removed from the work site. Installation shall proceed as follows:

A. Pipe and appurtenances shall be kept clean and open ends securely plugged when pipe laying is not in progress. The inside of pipe, bells and spigots shall be thoroughly inspected and cleaned prior to lowering into the ditch. Care shall be exercised after the pipe is in place to prevent dirt or other extraneous material from getting into the pipe, bells, and spigots.

B. Spigots shall be fully seated in bells, and the pipe shall be uniformly bedded on the bottom of the trench for its entire length, with bells laying in previously dug bell holes sufficiently large to allow for proper bedding and jointing. Pipe shall be cut where necessary. After jointing, a reasonable amount of deflection may be made in the joint. Such deflection shall not exceed the maximum allowable amount recommended by the manufacturer for each size of pipe.

C. Pipe on piers or supported from bridge shall be ductile iron unless otherwise noted and shall be properly installed in accordance with the details shown on the plans. Pipe shall be carefully placed in position to the required line and grade. Joints shall be restrained mechanical joints unless otherwise noted and shall be watertight and trouble-free. All fittings and connections, including transition pieces, shall be provided as required for a complete installation. All hangers, supports, straps, bracing, anchors, and other appurtenances shall be provided as detailed or required for proper alignment and support of the pipe.

D. River crossing pipe shall be laid as shown on the plans. Trenching shall be as shown and shall produce a suitable bearing surface for the pipe throughout the length of the trench. After pipe

laying has been completed the trench shall be backfilled. Installation of river crossing pipe shall proceed as follows:

1. Concrete anchor collars shall be constructed in accordance with the plans.
2. Appropriate end of the run fittings shall be provided at each end of the river crossing run to mate with the pipe approaching and leaving the river.
3. A minimum cover of two feet shall be provided over the pipe. When crossing water courses which are greater than 15 feet in width, the following shall be provided.
    a. The pipe shall be ductile iron of special construction, having flexible watertight joints or of fuse butt welded polyethylene with concrete anti-flotation collars.
    b. Valves shall be provided at both ends of the water crossing so that the section can be isolated for testing or repair. The valves shall be easily accessible and not subject to flooding. The valves shall be installed in a watertight manhole or vault.
    c. Permanent taps shall be made on each side of the valve on the source side to allow insertion of a small meter to determine leakage and for sampling purposes.

E. Fittings, valves, and other appurtenances shall be installed where shown on the plans or as directed by BRWS H2GO. Valves shall be installed every 1000 feet along force mains. Valves shall be installed on both sides of all horizontal directional drills. BRWS H2GO shall have full discretion on the style of these valves and will address during the technical review. Fittings shall be well restrained as specified on the plans.

F. Use of dog-house manholes shall not be allowed in the gravity sewer system. The use of interference boxes shall not be allowed in the gravity sewer system. When connecting a new sewer main to an existing main, Contractor shall cut the existing gravity main and install a new manhole and reattach to existing sewer with approved mechanical joint fittings. Connections will be subject to CCTV inspection and/or mandrel testing as specified in the testing section.

G. Air release valves shall be provided where shown on the plans or directed by BRWS H2GO and shall be carefully installed in accordance with applicable portions of these specifications. Valves shall be installed in a watertight vault.

H. Connections to Existing Facilities shall be made where shown on the plans or where directed by BRWS H2GO. Romac type CB sewer saddle acceptable for connection of new lateral to existing gravity sewer; however, use and installation method shall be at the discretion of BRWS H2GO field inspectors. All connections to the existing system shall be performed in the presence of BRWS H2GO Inspector. Pressure sewer connections shall be made with tapping sleeves and valves, except where other type connections are specifically shown.

I. All replacement of sewer pipe shall be performed in a manner to cause the least interference with the operation of existing pipelines. Contractor shall take measures to ensure that at no time will raw sewage be discharged on the premises.

J. Water lines shall be laid at least 10 feet horizontally from any sanitary sewer, storm sewer or sewer manhole. The distance shall be measured edge-to-edge. Where it is impossible to maintain the prescribed 10 feet of separation, BRWS H2GO may at its discretion allow deviation from the

10-foot requirement provided both the water and sewer line shall be constructed to water system standards and pressure tested to a minimum of 150 psi in accordance with the Ten State Standards. Prior approval must be obtained from BRWS H2GO before proceeding.

K. Water lines crossing house sewers, storm sewers or sanitary sewers shall be laid to provide a separation of at least 18 inches between the bottom of the water line and the top of the sewer. Where it is impossible to maintain the prescribed 18 inches of vertical separation, both the water and sewer line shall be pressure tested to water system standards in accordance with the Ten State Standards.

L. High points in the force mains shall be marked and air release valves installed at these points. If obstructions are encountered which would require a change in the grade of the work, BRWS H2GO shall be notified immediately.

M. On force mains where angular deflections from a straight line or grade are made necessary by vertical or horizontal curves or offsets in ductile iron pipe, the deflection shall not exceed six (6) divided by the nominal diameter (in inches), per lineal foot for pipe less than 14 inches in diameter, nor four and one-half (4.5) divided by the nominal diameter (in inches) per lineal foot for pipe 14 inches or more in diameter, except for river crossings. The deflection is to be measured between the center lines, extended, of any two connecting joints of pipe. Where deflections in excess of such limits are necessary, special bends shall be provided, or, if authorized by BRWS H2GO, shorter lengths shall be used in sufficient number to provide the angular deflection required.

N. Except where necessary to make connections with other lines, pipes shall be laid with the bell facing the direction of laying. For lines of appreciable grade, the joints shall be facing upgrade.

O. Mechanical thrust restraints shall be applied on all pressure pipelines four (4) inches in diameter or larger at all bends, tees, valves, and plugs. Concrete blocking shall also be used.

P. Manholes, pits, or vaults containing valves, air release valves, or other appurtenances in the collection system shall be sealed watertight and shall be located where they are not subject to flooding by surface water. Any sealed top manhole shall be vented if located within one thousand (1,000) feet of a lift station. Placement will be called out during BRWS H2GO plan review. Under no circumstances are drains to be connected to any storm or sanitary sewer system. All hardware inside vaults (including but not limited to bolts, nuts, anchors, and washers) shall be stainless steel.

Q. Transmission mains that exceed 1000 linear feet will require wire tracing stations for locating purposes. These are to be installed at a maximum of 500 linear feet with approved markers or surface level access points. Test station shall be as manufactured by Promark Supply, item PM TS3, or approved equal. BRWS H2GO shall approve selected test station prior to installation. BRWS H2GO shall test and approve tracer wire installation during the final walkthrough.

R. Backfilling of Trenches shall be as specified in the General Provisions.

S. Cutting and Replacing Pavement shall be as specified in the General Provisions.

1.4.3 Service Connections: Sewer Service Lateral Inspection procedures: The intent of these specifications is to ensure that every service lateral connected to BRWS H2GO's sewer collection system will perform

properly for the life of the building it serves. Inspections will emphasize the following criteria: quality of materials used, grade maintained along the full length of the pipe, access to the pipe in the event service is needed, conformance to all applicable county codes, and construction techniques.

A. If a preexisting sewer lateral is stubbed out at a lot property line, the Contractor must connect to this pipe at an approved grade. No other taps to the gravity main or manholes shall be made without the approval of BRWS H2GO. The Contractor must verify location and elevation of this lateral before laying out the plumbing plans. BRWS H2GO reserves the right to determine the size of the service lateral to any property. BRWS H2GO shall also determine the extent of piping that is to be deeded to BRWS H2GO for operation and maintenance.

B. The lateral must be constructed of 4-inch or 6-inch Sch. 40, ASTM-3034 pvc, gasketed sewer pipe to ensure pipe flexibility. All pipe fittings must be pvc, gasketed fittings made specifically for Sch. 40 sewer pipe. No petroleum-based pipe lube can be used.

C. The finished grade of the lateral must be 1/4-inch per foot where possible. BRWS H2GO will determine if this grade can be modified. A minimum 1-foot earth cover is required for all lateral piping. Bedding may be required depending on soil conditions. Sewer services shall have a minimum horizontal separation of 5 feet from the water service.

D. A dual sweep tee with a cleanout plug must be installed at the building for cleaning in both directions and a cast iron cleanout cover with a concrete ring is required at the property line nearest the main. The lateral must be constructed in such a way to reduce the number of bends from the building to the street connection. 90-degree bends will not be allowed. If it is determined that an excessive number of bends has been used, BRWS H2GO will require cleanouts to be installed at each bend. All required cleanouts must be turned toward the sewer main and stubbed up to ground level. Maximum distance between cleanout will not exceed 100 feet. All sanitary sewer cleanouts are to be left at a minimum of 3’ above grade after testing and final walkthrough are completed. The cast iron box and concrete collar are to be slid over the cleanout.

E. When laying pipe, the Contractor must start at the lowest point, establish his grade, and lay the pipe uphill. Run the pipe as straight as possible with the bell end uphill. No more than 5% deflection on pipe will be allowed. The start and finish point of the proposed lateral must be verified with a leveling instrument before laying any pipe. The plumber will be responsible for barricading or for marking any open ditches.

F. Should the potential exist for commercial properties to need a grease trap facility, the Owner/Developer must incorporate the space requirements in the original site plan. The site must be located in line with the building discharge lateral and shall be sized according to Federal, State, and Local guidelines. Plans and sizing calculations for the installation of any grease trap must be submitted to the applicable agency by a licensed engineer and approved prior to initiating construction. A cleanout will be installed in the lateral on the discharge side of the grease trap turned toward the manhole.

G. The Contractor must call the Operations and Maintenance office at 371-9949 48-hours before the day of inspection on sewer tap inspections for completed taps. BRWS H2GO cannot guarantee a specific time for an inspection. The entire lateral from the building to the street connection must be exposed for the inspection; however, in the case of rain, you may cover short sections of pipe

to keep it from floating up, provided the bells are not covered. If an inspection fails or is not complete, the plumber is responsible for correcting the problem(s) and calling the Operation and Maintenance office for a re-inspection. The inspection form will be left in the Contractor's plan tube or at the cleanout at the street. A copy of the approved inspection form will be placed on file for the location in order to have the meter set at the location. Suggestions: Avoid laying pipe shallow in areas where future vehicular traffic is likely. Install cleanout plugs 4 inches above finish grade to allow for sod. It can always be shortened to match the grade of the established lawn.

H. No in-line pressure sewer service boxes will be allowed in driveway, landscaping, or concrete/asphalt. In-line pressure sewer service boxes shall be placed at utility right-of-way. SDR-9 piping will be accepted for pressure sewer taps from the mainline to the force main service box.

1.4.4 INSPECTION AND ACCEPTANCE

All work shall be subject to inspection and approval prior to final acceptance and payment.

A. Pressure and Leakage Tests shall be as specified in Section 4.

B. Cleanup and site restoration shall be as specified in the General Provisions.

C. Closeout documentation, as-built drawings shall be furnished by the Engineer to BRWS H2GO.

2 PIPELINE MATERIALS AND APPURTENANCES

2.1 POLYVINYL CHLORIDE (PVC) PIPE for utilities shall be provided as shown on the plans and as specified herein.

2.1.1 Shop Drawings: Catalog cuts and related data for all pipe and fitting material shall be submitted to BRWS H2GO for review and approval.

2.1.2 Materials: All material under this section shall meet Made in America Criteria. PVC Pressure Pipe shall be as specified below. Standard laying lengths shall be 20 feet maximum. Fittings and adapters shall conform to the same requirements as for pipe, and shall be compatible with pipe.

A. Pipe for sewer force mains 4 inches through 12 inches in diameter shall conform to AWWA C900, SDR 18 (150 psi), with pipe made to cast iron outside diameters. Pipe 14 inches and larger shall conform to AWWA C905, DR 21 (200 psi). Pipe shall have integral bell and spigot joints with rubber ring or gasket. Pipes 2 inches and 3 inches in diameter shall conform to ASTM D2241, SDR 21 (Class 200), with pipe made from PVC 1120 material. Pipe shall have integral bell and spigot joints with rubber ring or gasket. Contractor shall request the most recent list of approved manufacturers from BRWS H2GO.

B. Pipe shall be marked as to the Type, Class or nominal thickness, weight, manufacturer, and date of production.

C. Force main pipe shall be factory dyed industry standard green to aid in identification. Effluent transmission pipe shall be factory dyed industry standard purple.

D. Pipe fittings 4 inches and larger shall be mechanical joint type utilizing synthetic rubber ring gasket and shall conform to the requirements of ANSI/AWWA C110/A21.10. Schedule 80 glue joint PVC fittings may be used on 2-inch pipe. Contractor shall request the most recent list of approved manufacturers from BRWS H2GO.

E. PVC Gravity Sewer Pipe, 4 to 15 inches in diameter, shall be Type PSM pipe conforming to ASTM D3034, with integral bell and spigot rubber O-ring gasket joints. C900 shall be used for depths greater than 8 feet. Standard laying lengths shall be 13 feet maximum. Gasket fittings and accessories shall be compatible with pipe. Contractor shall request the most recent list of approved manufacturers from BRWS H2GO.

2.1.3 Material Testing: Each joint of pressure pipe shall be subjected to and successfully meet a hydrostatic proof test at the factory in accordance with the requirements for each type. Certified test results shall be furnished to BRWS H2GO for each shipment of pipe. Pipe Fittings shall be subject to inspection and testing in accordance with standard manufacturing practice.

A. PVC Gravity Sewer Pipe, 4 to 15 inches in diameter, shall be tested by the manufacturer for pipe flattening, impact resistance, pipe stiffness, joint tightness, and extrusion quality (acetone immersion) in accordance with ASTM D3034. Test certificates showing the pipe conforms to these specifications shall be furnished to the Engineer for each shipment of pipe. PVC Gravity Sewer Pipe shall be installed with all pipe sections assembled in accordance with the manufacturer's instructions to form tight joints. All pipe shall pass the deflection test as specified below.

2.1.4 Installation: Pipe and fittings shall be installed in accordance with the requirements specified in other sections and the manufacturer's instructions. Pipeline marking tape and tracer wire, as specified in the Pipeline Identification and Marking paragraph of the General Provisions, shall be installed on all pipelines.

A. PVC Pressure Pipe shall be installed in strict accordance with the manufacturer's instructions. Adapters shall be provided as required when connections are made to other types of pipe.

B. Deflection Test: All PVC gravity sewer pipe, 4-inch diameter and larger, shall be tested after installation and backfill by the Contractor using methods and equipment approved in writing by the Engineer.

C. Air Testing: Air testing as specified in Section 4.4 shall not occur until all dry utilities have been installed. All horizontal directional drill installations are to be air tested at 5 psi for a duration of no less than 5 minutes. The contractors will be responsible for the testing. H2Go staff will need to be present to witness the tests. Test caps and plugs shall be provided by the Contractor/Developer and installed once air testing is complete.

2.2 DUCTILE IRON (DIP) PIPE: Ductile iron pipe and fittings shall be provided as shown on the plans and as specified herein.

2.2.1 Shop Drawings: Catalog cuts and related data for all pipe and fittings shall be submitted to BRWS H2GO for review.

2.2.2 Material: All material under this section shall meet Made in America Criteria. Ductile Iron Pipe shall conform to ANSI/AWWA C151/A21.51, and shall be designed for thickness Class 50 unless otherwise noted. Ductile iron pressure pipe shall conform to ASTM A377. Pipe shall have push-on or mechanical joint ends conforming to ANSI/AWWA C111/A21.11, except where flanged or other type ends are shown or specified.

A. Pipe shall be coated on the outside with a standard bituminous coating.

B. Interior surface of pipe shall be Class 50 ceramic epoxy lining, such as Protecto 401 or equal. DIP gravity sewer piping shall be factory lined with a hydrogen sulfide resistant coating specifically designed for sanitary sewer service.

C. Pipe shall be marked as Type, Class or nominal thickness, weight, manufacturer, and date of production.

2.2.3 Material Testing: Each joint of ductile iron pipe, prior to lining, shall be subjected to and successfully meet a hydrostatic test at the factory in accordance with ANSI/AWWA C151/A21.51. Certified test results shall be furnished to BRWS H2GO for each shipment of pipe.

2.2.4 Installation: Pipe and fittings shall be installed in accordance with the manufacturer's instructions and the requirements specified in other sections. Ductile iron pressure pipe shall be installed in accordance with all applicable requirements of ANSI/AWWA C600. Underground pipe and fittings shall be installed using push-on joints or mechanical joints, except where other type joints are specifically noted. Exposed pipe and fittings shall have Class 125 flanged joints except where Class 250 is specifically noted, or other type joints as shown or specified. All adapters necessary for the proper jointing of pipe and fittings shall be provided. Connections to other types of pipe shall be made as detailed on the plans. Underground fittings shall be well restrained as detailed on the plans. Pipe supports, hangers and anchors shall be provided as required for a complete installation. Pipeline marking tape and tracer wire, as specified in the Pipeline Identification and Marking paragraph of the General Provisions, shall be installed on all pipelines.

2.3 POLYETHYLENE (PE) PIPE

2.3.1 General: The pipe supplied under this specification shall be SDR 9 high performance, high molecular weight, high density polyethylene pipe (PE 4710), and shall conform to ASTM D3350. Minimum cell classifications values shall be 445574C as referenced in ASTM D 3350 - latest edition. All pipe resin shall be manufactured by the same company that manufactures the pipe itself in accordance with these specifications to ensure complete resin compatibility and total product accountability. The fittings supplied in this specification shall be molded or manufactured from a polyethylene compound having a cell classification equal to or exceeding the compound used in the pipe. To ensure compatibility of polyethylene resins, all fittings supplied under this specification shall be of the same manufacture as the pipe being supplied.

2.3.2 Physical Properties: The pipe shall conform to the physical properties as described herein.

A. Typical Pipe Physical Properties

Class	Property	Test Method	Value
4	Density	ASTM D1505	0.941 – 0.955 g/cm^3
4	Melt Index	ASTM D1238	<0.15 g/10 min
5	Flexural Modulus	ASTM D790	>110,000 <160,000 psi
5	Tensile strength at yield	ASTM D638	>3,500 psi <4,000 psi
7	SCG (PENT)	ASTM F1473	>500 hours
4	HDB @ 73.4°F (23°C)	ASTM D2837	1,600 psi
C	Color; UV Stabilizer	ASTM D3350	Black with minimum 2% carbon black

B. Quality Control: The resin used for manufacturer of the pipe shall be manufactured by the pipe manufacturer, thus maintaining complete control of the pipe quality. The pipe shall contain no recycled compound except that generated in the manufacturer's own plant from resin of the same specification from the same raw material. The pipe shall be homogenous throughout and free of visible cracks, holes, foreign inclusions, or other deleterious defects and shall be identical in color, density, melt index, and other physical properties. The polyethylene resin used shall have all ingredients pre-compound prior to extrusion of pipe, in plant blending is not acceptable. BRWS H2GO may request, as part of the quality control records submittal, certification that the pipe produced is represented by the quality assurance testing. Additionally, test results from manufacturer's testing or random sampling by BRWS H2GO that do not meet appropriate ASTM standards or manufacturer's representation, may be cause for rejection of pipe represented by the testing. These tests may include density and flow rate measurements from samples taken at selected locations within the pipe wall and thermal stability determinations according to ASTM D 3350, 10.1.9. BRWS H2GO may request certified lab data to verify the physical properties of the materials supplied under this specification or may take random samples and have them tested by an independent laboratory.

C. Rejection: BRWS H2GO reserves the right to reject any polyethylene pipe and fittings failing to meet any of the requirements of this specification.

D. Pipe Dimensions: Pipe supplied under this specification shall have a nominal IPS (Iron Pipe Size) O.D. unless otherwise specified. The SDR (Standard Dimension Ratio) of the pipe supplied shall be as specified by BRWS H2GO.

2.3.3 Construction Practices:

A. Handling of Pipe: Pipe shall be stored on clean, level ground to prevent undue scratching or gouging of the pipe. If the pipe must be stacked for storage, such stacking should be done in accordance with the pipe manufacturer's recommendations. The handling of the pipe should be done in such a manner that it is not damaged by dragging over sharp objects or cut by chokers or lifting equipment.

B. Repair of Damaged Sections: Segments of pipe having cuts or gouges in excess of 10% of the wall thickness of the pipe should be cut and removed. The undamaged portions of the pipe shall be rejoined using the butt fashion joining method as specified below.

C. Pipe Joining: Sections of polyethylene pipe should be joined into continuous lengths on the job site above ground. The joining method shall be the butt fusion method and shall be performed by the manufacturer's recommendations. The butt fusion equipment used in the joining procedures should be capable of meeting all conditions recommended by the pipe manufacturer, including, but not limited to, temperature requirements, alignment, and fusion pressures. Prior approval of equipment and personnel shall be obtained from BRWS H2GO before fusion begins. The completed pipe joints shall be guaranteed for five years in writing to BRWS H2GO and its Contractor.

D. End Connections: Special flanged stub ends will be required for each approximate 500 feet line length. The price as quoted shall include any special end configuration and polyethylene ring to

hold a standard slip-on ANSI flange. BRWS H2GO and its Contractor will determine the final number and condition required.

E. Handling of Fused Pipe: Fused segments of pipe shall be handled so to avoid damage to the pipe. When lifting fused sections of pipe, chains or cable type chokers should be avoided. Nylon slings are preferred. Spreader bars should be used when lifting long fused sections. Care should be exercised to avoid cutting or gouging the pipe.

F. Installation: Trenching, installation, backfill and testing shall be in accordance with BRWS H2GO specifications and drawings and special method of installation developed for a specific project. Where specified, pipeline marking tape and tracer wire, as specified in the Pipeline Identification and Marking paragraph of the General Provisions, shall be installed over all pipelines.

2.3.4 Final Testing: After polyethylene piping is installed, backfilled and all air removed, the Contractor shall apply a hydrostatic pressure of 150 psi min. to the pipe. The test pressure shall be allowed to stand without make-up pressure for a period of time as required by the pipe manufacturer and approved by BRWS H2GO to allow for diameter expansion or pipe stretching to stabilize. After the required equilibrium period the test section shall be returned to the original test pressure. All final testing shall be in conformance with BRWS H2GO specifications.

2.4 VALVES

2.4.1 General: Eccentric plug valves shall be used exclusively on sewer force main projects unless specifically authorized by BRWS H2GO. Plug valves shall be used for all sizes two (2) inches and larger. All valves shall open left (counterclockwise). All plug valves six (6) inches and larger shall have a 450 foot-lbs. gear driven actuator minimum. All buried service valves shall have a 2-inch square operating nut located at a depth not to exceed 3 feet. Valves with operating nuts greater than 3 feet deep shall have valve nut extenders provided by the valve manufacturer bringing the operating nut within 2 feet of finished grade. Valves installed in concrete vaults or manholes shall be provided with hand wheel actuators. All valves shall have a cast iron screw type valve box and a four (4) inch thick concrete collar. All valves are to be designed for a minimum working pressure of not less than 150 psi. Contractor shall request the most recent list of approved manufacturers from BRWS H2GO.

2.4.2 Plug Valves: Plug valves shall be of the non-lubricated eccentric plug type with a resilient seat seal unless otherwise specified and shall be furnished with mechanical joint ends in accordance with ANSI Standard A21.11, unless specified otherwise on the plans. Port area for all valves shall be a minimum of 80% of the full pipe area. Valve bodies shall be of ASTM A-126 Class B cast iron. All exposed nuts, bolts, washers, springs, etc. shall be zinc plated. Resilient seat seals shall be of Buna-N or Neoprene, suitable for use in sewage service. Seats shall be non-metallic with seat coating thermally bonded and in full conformance to AWWA Standard C550. Valves shall be furnished with permanent corrosion resistant bearing surfaces in the upper and lower journals designated to withstand full rated bearing loads and provide long life in sewage service. Valves furnished shall have their internal wetted surfaced protected by nonmetallic coatings factory applied, thermally bonded and in full conformance to AWWA Standard C550. Nominal valve pressure ratings, body flanges and wall thicknesses shall be in full conformance to ANSI B16.1-1975. Valves shall seal leak-tight against full rated pressure in both directions. Valve seats shall be tested and provide leak-tight shut-off to 175 psi for valves 14 inches and larger, with pressure in each direction. A hydrostatic shell test at twice rating shall be performed with plug open to demonstrate overall pressure envelope integrity. Valves on lines 4 to 6 inches shall

be ¼ turn. Valves 6 inches and larger for direct bury shall have gear actuators with 2-inch square operating nut and shall be capable of opening valve at rated pressure of 150 psi. All gearing shall be fully enclosed in a suitable housing and be suitable for running in a lubricant with seals provided on all shafts to prevent entry of dirt and water into the actuator. A suitable stop shall be set to provide watertight shut off in the closed position at full rated pressure. All exposed nuts, bolts and washers shall be zinc plated. Plug valves for installation in valve pits shall have a 2-inch square operating nut and all above ground shall have hand wheel operators. Valve actuators for buried or submerged service shall have seals on all shafts and gaskets on the valve and actuator covers to prevent the entry of water. Actuator mounting brackets for buried or submerged service shall be totally enclosed and shall have gasket seals. All exposed nuts, bolts, springs, and washer used in buried service shall be electro plated steel. Valves shall be fitted with cast iron valve boxes and cover with fully adjustable tops for all buried valves.

2.4.3 Gate valves: All Resilient Wedge Gate Valves shall comply with all requirements of AWWA C509, latest revision, and with the below listed requirements. All resilient Wedge Gate Valves shall be designed for 250 PSIG working pressure, shall be factory seat tested at 250 PSIG with no leakage past the seat from either side of the disc, and shall be shell tested at 500 PSIG. Minimum body and bonnet wall thickness shall be as set forth in Table 2, Section 4.3.1 of AWWA C509. Body and bonnet wall thicknesses less than the minimum thickness as specified in table 2 shall not be acceptable. Bonnet to body seal shall be affected by a flat neoprene gasket. Bonnet and body flanges shall be fully machined to assure proper sealing of the gasket. End connections shall be flanged in accordance with Class 125, ANSI B16.1 for above ground installation, and for underground installation shall be mechanical joint in accordance with AWWA C110/111 or slip-on for use with cast iron OD pipe. All gate valves shall be of the non-rising stem (N.R.S.) design and shall open left (counterclockwise). Valves installed above ground shall be furnished with hand wheels. All buried valves shall be furnished with 2-inch square operating nuts. All gate valves shall have O-Ring sealed stems with one O-Ring located below the thrust collar and with two O-Rings located above the thrust collar. The thrust collar area between the two lower O-Rings shall be factory filled with a lubricant to provide permanent lubrication of the thrust collar area. Gate valve stems shall be of bronze rolled bar stock and shall have a forged thrust collar. The stem material shall provide 70,000 PSI tensile strength with 15% elongation and a yield strength of 30,000 PSI. Cast stems shall not be acceptable. Stems shall have acme form threads for strength and efficiency. An anti-friction thrust washer shall be provided both above and below the thrust collar for ease of operation. The resilient-seated disc wedge shall be of the resilient wedge fully-supported type. Solid guide lugs shall travel within channels in the body of the valve. The disc and guide lugs shall be fully (100%) encapsulated in SBR (styrene butadiene) rubber. Contractor shall request the most recent list of approved manufacturers from BRWS H2GO.

2.4.4 Air Release Valves: Air Release Valves (ARV's) shall be designed to operate under a working pressure of 150 psi, and shall have been tested at a pressure of not less than 300 psi. ARV's shall have a stainless steel body and cover and shall have IPS inlet threads. Float guides, bushings, lever pins, and all internal moving parts shall be stainless steel. ARV's shall be rated for raw sewer use and shall be H-TEC brand or approved equal. Contractor shall request the most recent list of approved manufacturers from BRWS H2GO.

2.4.5 Swing Check Valves: The Contractor will furnish and install swing check valves as shown on the plans and in accordance with these specifications. For valves four (4) inches and larger, bodies and bonnets

will consist of cast iron or cast steel and will be designed to allow removal of the clapper arm and disc assembly through the bonnet opening without requiring removal of the valve from the line. Disc will be of cast iron or cast steel with bronze or alloy disc rings machined into the disc. The seat ring will be bronze or stainless steel and will be threaded for removal with the valve body in line. Clapper arms will be bronze bushed ductile iron. Clapper arm shafts will be manufactured of bronze or high tensile aluminum bronze will be extended through the body for attachment of the weight or spring and will be capable of being field adjusted. Flanged ends will be faced and drilled in accordance with ANSI B 16.1, Class 125. Valves twelve inches and smaller will have a minimum working pressure rating of 175 psi and 350 psi hydrostatic test pressure and valves larger than twelve will have a corresponding pressure of 150 psi and 300 psi. The valves may be operated by lever and weight. Contractor shall request the most recent list of approved manufacturers from BRWS H2GO.

2.4.6 Ball Check Valves. Installation of ball check valves must receive prior approval from BRWS H2GO. Ball Check Valves shall consist of a gray cast iron class 35 body and cover containing a hollow steel ball with a vulcanized nitrile rubber exterior. The ball check valve shall have one moving part. The valve shall be designed as such that solids, stringy material, grit, rags etc. will not clog valve or require back flushing. The ball shall clear the waterway providing “full flow” equal to the nominal size. The ball shall be resistant to grease, petroleum products, animal and vegetable fats, diluted concentrations of acids and alkalis (pH 4-10), tearing, and abrasion. Flange drilling shall be according to ANSI B 16.1, Class 125. The ball check valve shall be a sinking ball type capable of installation in a horizontal or vertical position. Full access to the ball shall be provided thru a flanged opening. Contractor shall request the most recent list of approved manufacturers from BRWS H2GO.

2.4.7 Gear reduction valves are required for all valves that are 12-inch in size or greater.

2.5 FITTINGS, MISCELLANEOUS APPURTENANCES AND SPECIALTIES

2.5.1 Pipe Fittings: Pipe Fittings four (4) inches and larger shall be gray cast iron or ductile iron conforming to ANSI A21.10. Cast iron fittings shall be Class 250 for 12 inch and under, and Class 150 for larger than 12-inch. Ductile iron fittings shall be Class 350 for 24 inch and under, and Class 250 for larger than 24-inch. Ductile iron shall conform to ASTM A536, minimum grade 70-50-05. Fittings shall have mechanical joints conforming to ANSI/AWWA C111/A21.11, except where flanged or other type ends are shown or specified. Fittings shall be cement mortar lined in accordance with ANSI 21.4. An exterior coating of bituminous coal tar epoxy shall be applied to a minimum thickness of 5 mil. Fittings for pipe less than four (4) inches in diameter shall be in accordance with ASTM D-2467 for Schedule Fittings.

2.5.2 Flanges: Flanges for pipe and fittings shall be Class 125, except where Class 250 is specifically noted, and shall conform to ANSI/AWWA C110/A21.10. Drilling and facing of flanges shall be in accordance with ANSI B16.1.

2.5.3 Mechanical Restraints: Restrained Joints for pipe and fittings shall be the ductile iron mechanical joint type, designed for a working pressure of 350 psi for 24 inch and under and 250 psi for 30-inch and larger. Restrained joint pipe and fittings shall be capable of being deflected after assembly. Contractor shall request the most recent list of approved manufacturers from BRWS H2GO.

2.5.4 Tapping Sleeves: Tapping sleeves four (4) inches and larger shall be fabricated stainless steel with stainless steel bolts or fabricated steel with fusion bonded epoxy or nylon coating with stainless steel bolts. Tapping sleeves shall have outlet flange counter bored to accept a mating tapping valve per MSS SP-60 for true alignment of tapping valve and tapping machine. Sleeve shall have a stepped

stainless steel valve flange complying with AWWA C207 class D, ANSI 316.5, 150 lb. drilling. Contractor shall request the most recent list of approved manufacturers from BRWS H2GO.

2.5.5 Miscellaneous Appurtenances and Specialties: All material and products under this section shall meet Made in America Criteria. Miscellaneous piping appurtenances and specialties shall be provided where shown on the plans and as required for a complete installation. Shop drawings shall be submitted to BRWS H2GO for review.

A. Yard Hydrants: Yard Hydrants shall be ¾ inch in size and have locking capability and installed with an approved vacuum breaker. Provide a gate valve and valve box in the water line prior to the yard hydrant at the supply main. Inlet line should be buried 12 inches deep at a location to be determined by BRWS H2GO for the installation of a water meter. Contractor shall request the most recent list of approved manufacturers from BRWS H2GO.

B. Gaskets: Gaskets for Water Pipe and Fittings shall be vulcanized synthetic virgin rubber free of porous areas, foreign material, and visible defects. Gaskets shall be designed to provide a permanent watertight seal at all joints. Rubber gaskets shall conform to all applicable provisions of AWWA/ASTM C111/A21.11. Gasket Lubricant shall be non-toxic, shall not support growth of bacteria, shall not impart taste or odor to water, and shall have no deteriorating effects on gaskets. Lubricant shall be suitable for the intended use and shall remain in a usable stage throughout the range of temperature in which the pipe is normally installed. Lubricant shall be delivered to the job site in unopened containers bearing the manufacturer's name and trade name or trademark.

C. Mechanical Couplings and Adapters: Mechanical Couplings and Adapters shall be the type and size as shown on the plans, complete with rings, followers, gaskets, bolts, nuts and other items necessary for a complete installation. Couplings and adapters shall be installed in accordance with the manufacturer's instructions to provide permanently tight joints under all reasonable conditions of expansion, contraction, shifting and settlement.

2.6 MANHOLES AND ASSOCIATED APPURTENANCES:

2.6.1 Scope: This section covers the construction of manholes, including frames, and covers, as shown on the plans and as specified herein.

2.6.2 Materials: All materials in this section shall meet Made in America Criteria. Shop drawings and related data for manhole material, frames, and covers shall be submitted to BRWS H2GO for review.

A. Manhole material shall be precast reinforced concrete sections with tongue and groove joints and shall conform to ASTM Specification C478, latest revision. The riser sections for manholes shall be made as long as practical to minimize the number of manhole joints. Manhole sections shall be scored or stamped with the date of castings and the date shall appear on the inside of the cone section. Concrete use in their manufacture shall be manufactured with granite stone with a concrete alkalinity of not less than 0.35 and shall have a 28-day compressive strength to not less than 5,000 pounds per square inch and the absorption shall not exceed four percent (4%). Calcium chloride or admixtures of calcium chloride shall not be used.

The minimum wall thickness of the manhole riser section shall be:

MH Diameter (ft)	Min. Wall Thickness (in.)
4'	5"

5’	6”
6’	7”
7’	7”
8’	8”

Base riser sections shall be monolithically cast and have minimum bottom thickness of:

MH Diameter (ft)	Min. Bottom Thickness (in.)
4’	5”
5’	8”
6’	8”
7’	8”
8’	10”

1. All manholes 16’ in depth or greater are to be 5’ in diameter manholes. All manholes with a 12” diameter pipe or greater are to be 5’ diameter manholes.
2. Manhole interior and riser joints shall be evenly coated with two coats of a factory applied coal tar epoxy coating to a minimum film thickness of 20 mils. Conforming to U.S. Corps of Engineers specification C-200. All manholes shall have a tar coating applied on site to all manhole seams after concrete has cured. The first 3 manholes downstream of a force main receiving manhole shall be epoxy coated. The first 3 manholes immediately upstream of a lift station shall be epoxy coated. Refer to Section 2 for manhole interior protective coatings.
3. Cone sections shall be eccentric and have a minimum wall thickness of eight (8) inches at the top. Manhole sections shall be scored or stamped with date of casting and the cone section shall show date on the inside.
4. The tongue and grove joints shall not be less than the wall thickness and shall be evenly coated with a factory applied coal tar epoxy coating. Refer to Section 2 for manhole interior protective coatings.
5. Entire exterior surface of manhole shall be wrapped with a 12-inch butyl-tite joint wrap that meets or exceeds the requirements of ASTM C877-01 Type III & C990-o1a. Contractor shall request the most recent list of approved manufacturers from BRWS H2GO.

B. Frames and Covers: Manhole frames and covers shall be gray cast iron conforming to minimum requirements ASTM A48, Class 35, and shall conform in general to the details for each type shown on the plans. Castings shall be of uniform quality, and free from blowholes, porosity, hard spots, shrinkage distortion and other defects. Frames and covers shall be smooth, well-cleaned by shot blasting and shall remain unpainted. All castings shall be manufactured true to pattern, and component parts shall fit together in a satisfactory manner. Frames shall have a clear opening of 23 and ¾ inch. There shall be no holes or perforations in the cover. The frame and cover shall have a rubber gasket that is fitted in a machined groove manufactured in the bottom of the cover. Contractor shall request the most recent list of approved manufacturers from BRWS H2GO.

C. Resilient Pipe Connections: Resilient pipe connections will be provided in manholes. Such connections shall have a minimum thickness of 3/8 inch and conform to ASTM C923, and shall consist of a natural or synthetic rubber connector complete with stainless steel mechanical devices designed to provide a positive flexible watertight connection. New pipe connections to existing manholes shall be made using Kor-N-Seal boots, or approved equal.

D. Rain Guards shall be placed under every manhole lid; vinyl guards for manholes outside of paved areas, stainless steel guards for manholes inside of paved areas.

2.6.3 Installation:

A. Precast Concrete Manholes: Each section shall be handled and installed in such a manner and by such means as to prevent damage. All manhole sections damaged during handling and installation will be rejected as directed by BRWS H2GO, and replaced at no additional cost to the Owner. All lifting holes shall be plugged and sealed watertight as recommended by the manufacturer.

1. Base sections shall be installed on a 12-inch firm stabilized foundation of compacted stone embedment so prepared to prevent settlement and misalignment. Pipe openings shall be placed at the exact elevation and location to receive entering pipes. All inlets and outlets shall be cast in or core drilled.

2. Riser and top sections shall be installed level and plumb. Joint sealant shall be of the type specified above. Joints shall be made in accordance with the manufacturer's recommendations, and to ensure a watertight installation. Exterior shall receive a four (4) inch wide butyl rubber wrap over the grout area.

3. Entering pipes shall be secured in the resilient pipe connectors, properly aligned, and set to grade. Pipe shall be firmly held in place, and the annular space between the pipe and opening sealed watertight with a non-shrink catalyzed metallic aggregate mortar.

4. Leveling and final grading of manhole frames and covers shall be accomplished by using a maximum of two (2) concrete grade rings. Concrete grade rings shall not exceed four (4) inches in thickness. Grade rings shall be laid in a full bed of non-shrink grout and covered after laying with a smooth coating of non-shrink grout or hydraulic cement a minimum of ½ inch thick. Deviation from this requirement shall require prior approval from BRWS H2GO.

B. Invert Construction: Bottoms inverts shall be accurately and properly installed as required for each location. Inverts shall be constructed of cement grout and shall have the same cross-section as the invert of the sewer which they connect. The manhole invert shall be carefully formed to the required size and grade by gradual and even changes in sections. Changes in direction of flow through the sewer shall be made to a true curve with as large a radius as the size of the manhole will permit. Inverts shall be "U" design with top of the "U" even with the crown of the pipe. Invert piping shall not extend inside of the manhole any further than two (2) inches. Slope of inside of invert bench shall be a minimum of two (2) inches higher than the crown of the pipe. When dissimilar pipe sizes occur, the elevation of the crown of the pipe shall be the same.

C. Mortar Mix: Mortar used in manhole construction shall consist of 1 part Portland cement and 2 parts clean washed sand, with the required amount of potable water added to produce a workable mixture. Sand shall be uniformly graded from fine to coarse, and when dry shall pass a

screen having 8 meshes per inch. Mortar shall be used before initial set has occurred. Re-tempering of mortar will not be permitted.

D. Drop Manholes: Manhole drops shall be internal to the manhole sections. All inside drop manholes shall have a 5 foot minimum inside diameter, except where approved by BRWS H2GO. Drop piping shall be constructed of sewer grade HDPE or PVC, properly supported as detailed, and the backfill thoroughly compacted. Receiving manholes that are 5 feet in diameter with internal drops will be allowed to use the RELINER inside drop bowl. A similar style can be used if approved by BRWS H2GO during the review process. All new sewer pipes, 4 inches or less, that connect to an existing 4 foot diameter manhole higher than 30 inches above the shelf shall have the Intra Flow brand low profile inside drop system, Reliner drop bowl and associated drop pipe, or approved equal.

E. Manhole Top Grade: Manhole tops shall be set to the proper elevation as required by the location, or as directed by BRWS H2GO.

1. Where manholes are located in streets, roads, drives or parking areas, tops shall be set to conform to the finished grade of the pavement or surfacing and installed to prevent storm water runoff from entering the system.

2. Where manholes are placed in unpaved roads, the tops shall be 4-inches below grade of the road.

3. In cultivated fields, wooded areas and along outfall sewers, manhole tops shall be set approximately 1-foot above ground elevation, unless the line is subject to flooding or other hazards. In such instances, manhole tops shall be set to elevations given by BRWS H2GO.

F. Manhole Interior Protective Coatings: Protective coating shall be applied to all manhole interiors and joints between sections. Interior coating shall consist of two coatings of epoxy conforming to U.S. Corps of Engineers Specification C-200, and shall be manufactured by Raven, Duromar, Sherwin Williams, or approved equal. Coating shall be applied according to manufacturer's recommendations to a minimum film thickness of 20 mils.. Thinners, solvents and cleaning compounds shall be types as recommended by the coating manufacturer.

2.6.4 Inspection and Acceptance: Manholes shall be true circles of acceptable concrete work with properly corbelled tops, satisfactory inverts, complete interior coatings, and properly placed frames and covers. All leaks in manholes shall be repaired to the satisfaction of BRWS H2GO, prior to acceptance.

2.7 Sand, Oil & Grease Interceptors: Sand, oil, grease interceptors shall be provided when, in the opinion of BRWS H2GO, they are necessary for the proper handling of liquid waste containing sand, oil, grease or other harmful ingredients in excessive amounts. All interceptors shall be of a type approved by the applicable agency and shall be located so as to be readily and easily accessible for cleaning and inspecting. All interceptors shall be supplied and properly maintained continuously in satisfactory and effective operation by the property owner at their expense. Chemical additives shall not be added to the interceptor system for removal or cleaning of the system without prior approval of BRWS H2GO.

3 SEWER LIFT STATIONS AND APPURTENANCES:

3.1 This section of Specifications is provided for the purpose of outlining items required in lift stations but is not intended to cover all special conditions or BRWS H2GO special requirements.

3.1.1 Station Requirements:

A. Any Developers who wish to install lift stations must study the effects on upstream and downstream pumping capabilities. After review and flow tracking, if new designs are found to dead head smaller stations or decrease pumping performance greater than 50 %, Developer shall explore options to eliminate this from happening. Additionally, new developments who will convey significant wastewater to an existing lift station may be required to submit an upgrade proposal for the station(s) impacted at the discretion of BRWS H2GO. These could range from line extensions, force main reroutes, to upgrades of surrounding stations. This will go through the same review process already in place. (See H2GO rules and regulations)

B. Fencing of Lift Station Site

1. Minimum site dimensions (in feet) shall be as follows:

Wet Well Diameter	Site Dimension	Minimum Fenced Area
6’ to 8’	40’ x 40’	37’ x 37’
10’ and larger	50’ x 50’	47’ x 47’

2. Fence Materials:

   a. All material shall be Class I Hot-dipped Galvanized Coated. Green Vinyl coated fencing shall be installed for aesthetic purposes.

   b. Fabric shall be six (6) feet high, ends barbed, commercial grade nine (9) gauge, two (2) inch mesh installed 3 inches above finished grade.

   c. End, corner, and pull post shall be 3-inch O.D. sch 40 hot-dipped galvanized steel pipe. Provide watertight closure caps on all posts.

   d. Line posts shall be 2 and 1/2 inch O.D. sch 40 hot-dipped galvanized steel pipe. Provide watertight closure caps on all post. Top posts shall be 1 and 5/8 inch O.D. sch 40 hotdipped galvanized steel pipe.

   e. Bottom tension wire shall be 7-gauge spring coil wire.

3. Gate post shall be 3-inch O.D. sch. 40 hot-dipped galvanized steel pipe. Provide watertight closure caps on all post.

4. Gate shall be a pair of 6 feet long (12-foot total width) 6 feet high sections constructed of 2-inch O.D. pipe. Gate shall be equipped with a prop post center latch and hasp assembly. A ground anchor cast in concrete shall be provided. Gates shall be factory fabricated, coated, and equipped with gate holders. Duck bill backstops shall be provided for swing side of both gate sections.

C. The site shall be graded to drain and direct stormwater runoff away from the lift station, and to remove stormwater runoff from the site in a non-erosive manner.

D. The entire site shall be covered with MIRAFIX 600X filter fabric covered with 4 inches of crusher run and 2 inches of clean # 57 stone. This covering should extend a minimum of one (1) foot outside the fenced area. Stone shall be clean No. 57 with no soil or foreign material present.

E. Lift station electric meter base shall be located inside the fenced area.

F. All power lines within the site shall be underground. No overhead power line will be allowed to cross the site.

G. Provide a minimum 12-foot-wide paved access drive and adequate turn around areas for BRWS H2GO service vehicles at sites with high traffic areas. Access drive shall have positive drainage and the elevation shall be set above the twenty-five (25) year flood elevation. Road and site drainage shall be approved by appropriate agency. Final site layout and dimensions to be approved by BRWS H2GO. Lift station access slope cannot exceed elevations that impede access for cleaning crews. H2GO plan reviewers reserve the right to reconfigure the design to meet these criteria.

H. A ¾ inch yard hydrant shall be supplied in accordance with Section 2.5.5 with locking capability. An approved R.P.Z. with insulated enclosure shall be installed on water supply line to yard hydrant. Inlet line should be buried 12 inches deep at a location determined by BRWS H2GO for the installation of a water meter.

I. A receiving manhole must be located in the fenced area of each lift station for by-pass pumping.

J. A SCADA monitoring system shall be installed at each lift station. Contractor shall request the most recent list of approved manufacturers from BRWS H2GO.

K. A 3-inch quick connect shall be placed on force main line inside of check valve vault with an optional location just outside of the vault.

L. Area light to be provided inside fenced site and shall be located in a manner to provide light for control panels and generator.

M. A standby generator shall be situated on site with a properly sized automatic transfer switch. Where natural gas is available, install natural gas generator in lieu of diesel generator. See Section 5 for Generator Specifications.

N. Safety placards shall be plastic laminated and placed for lift stations and equipment as required by OSHA and be readily visible. Signage is to be provided by installing contractor as part of the closeout process. See pump station details for sign requirements.

O. KHRONE Tidal Flux 2000 flow meters are required at all lift stations and shall be installed in a separate pre-cast vault or manhole with drain to wet well. The sensing unit shall be mounted at least six (6) feet away from any fittings on the force main. The read-out portion should be mounted on an aboveground control panel backboard. Contractor shall request the most recent list of approved manufacturers from BRWS H2GO.

P. Main interceptor/regional stations with pumps 50hp or greater shall have, at a minimum and at the discretion of BRWS H2GO, an approved concrete pad and all electrical conduit installed for future odor control systems.

Q. All lift stations designed for a 3-pump configuration shall have the rails and piping associated with the third pump installed in the wet well at the time of construction. A third pump or the monies associated with the purchase of the same brand and horsepower pump shall be provided to BRWS H2GO.

R. All 3-pump configured station control cabinets are to have all the wire and conduit associated with the third pump installed at the time of construction. This includes breakers, contactors, and VFD's.

S. The first joint leaving the lift station shall be ductile iron unless 95 percent compaction can be achieved.

T. VFD or soft starts shall be determined by BRWS H2GO during the review process.

3.1.2 Design Considerations:

A. The following design considerations should be submitted to BRWS H2GO for review:

1. Loading calculations indicating lift station service area ultimate flows.

2. Buoyancy calculations (weight of station without pumps vs. uplift).

3. Cycle time calculation shall be a maximum ten (2-8) cycles/hour and a minimum run time of 1 min. at zero inflow.

4. Provide certification the motor and control circuit will provide 2-8 cycles/hour.

3.1.3 Wet well Design and Construction:

A. Minimum allowable wet well diameter shall be 6 feet 0 inches. Concrete shall meet the requirements as specified for manholes in Section 2.6. Interior surface of wet well shall be coated with approved epoxy coating. Refer to Section 2 for manhole interior protective coatings.

B. The bottom slab of the wet well shall be set on a 12-inch base made of crushed stone. All over-excavated area below the wet well bottom shall be filled with angular material or flowable fill as directed by the Engineer or BRWS H2GO.

C. Wet well bottom shall be constructed to provide a hopper or fillet bottom. Concrete bricks may be used as filler to form hopper bottom provided minimum of 6-inch grout cover is maintained.

D. Top of slab shall be two (2) feet above the 100-year flood elevation and shall have a Standard Brass Benchmark set into the slab with elevation stamped on the face of the benchmark.

E. Guide rails shall be 316 Stainless Steel. Guide rails shall be compatible with Flygt guide rail system. All metal parts associated with the wet well shall be 316 stainless steel, including guide rail top brackets and intermediate guide rail brackets.

F. Wet well hatches shall be of heavy gauge aluminum with aluminum or 316 stainless steel support bracing. Minimum hatch size shall be 36 inches by 48 inches double door clamshell style. Larger size hatches may be specified as directed to support larger pumps to meet future demands of other design consideration by BRWS H2GO. All hatch support bracing should incorporate a self-locking hinge mechanism to lock in the open position. All hatches shall have a pad-lockable recessed locking mechanism. Aluminum grates shall be required for fall protection. Contractor shall request the most recent list of approved manufacturers from BRWS H2GO.

G. Vent pipe shall be a minimum four (4) inches diameter Schedule 80 piping and shall contain 1/8 inch 316 stainless steel bug screen. All vents shall be a minimum of 12" above the cast lid.

H. All bolts, nuts, anchors, washers, and other hardware utilized in the wet well shall be 316 stainless steel.

I. Each lift station is to be equipped with a U.S.F Fabrication Inc. or equal 2000 lb. minimum stainless steel pump hoist and 2 sockets. The sockets shall be cast into the wet well top aligned with each pump per manufacturer's instruction and shall be located per BRWS H2GO's instructions. Stainless steel socket caps shall be provided for each socket. Locking chains shall be supplied on winch sockets.

J. All lift station and valve vault discharge piping shall be a minimum of 4 inches in diameter.

K. The pump discharge shall be equipped with a pressure gauge assembly within the valve vault consisting of a stainless steel pressure isolator with a 50% mixture of ethylene glycol/water sensing liquid and Buna-N diaphragm, 316 stainless steel fittings and gauge cock, and a 4-inch glycerin filled phenolic cased pressure gauge. The gauge assembly shall be mounted on either discharge line downstream of the check valves and positioned at a 45-degree angle so as to be easily read from ground level. Gauges shall have a full scale reading in feet of water not to exceed 120% of the shut-off head of the pumps selected. Final location for pressure gauge(s) shall be determined during review process. Gauges shall read from 0-200 psi and be manufactured of stainless steel. At the discretion of BRWS H2GO, a pressure transmitter may be required at the pressure gauge(s). Transmitter shall be 4-20 mA transmitter as manufactured by Wika, Druck, or approved equal. Gauges shall have ability to read 0-200 psi in 2-pound increments.

L. Influent pipe shall terminate a minimum of ½ inch and a maximum of 3 inches inside the basin.

M. All ductile iron piping and fittings within the wet well and valve vault shall be flanged and be Protecto 401 lined. Exterior of piping shall be TNEMEC red primer with topcoat TNEMEC hi-build epoxoline series 66, color black. Lift stations with a 4- to 6-inch discharge that are less than 15 feet deep may use schedule 80 PVC or fusible PVC pipe in wet well.

N. Diverter plates shall be installed in lieu of trash baskets on all lift station influent pipes. Diverter plates and associated mounting shall have 316 stainless steel bodies and hardware.

3.1.4 Pumps and motors (Submersible Stations)

A. A list of acceptable manufacturers for submersible pumps may be requested from BRWS H2GO.

B. Pump motors shall have a five (5) year written manufacturer's Warranty.

C. Lift station pumps shall be a minimum of 5hp. Approved brand will be discussed during the technical review process.

D. Pumps shall be designed to handle peak flow with the largest pump out of service. Minimum design peaking factor shall be 2.5.

E. All motors operated with VFD configuration must be VFD rated and have synchronous motors.

F. Motors shall be non-overloading over entire pumping range and have a 1.15 or higher service factor per Minimum Design Criteria for Pump Stations section 2T.

G. Motors shall have Class F (155 degree C) insulation and withstand Class B (130 degree C) temperature rise with a service factor of 1.0.

H. Motors shall not exceed 1800 rpm's unless recommended by the manufacturer and approved by BRWS H2GO.

I. Three phase power shall be required on all motors (3 phase 460 or 230 volts) as recommended by the manufacturer. Add - a -Phase units are not allowed.

J. Unbalanced voltages on motors under load shall not exceed 1.0% when measured at the motor disconnect terminals. Voltage measurements shall be read with an accurate digital volt meter; and readings shall be recorded as part of the final inspection. Systems will not be accepted until unbalance has been corrected.

K. Systems that are metered with a KVA meter supplied by the power company shall have power factor correction to 85%.

L. Approved lightning arresters mounted below the main disconnect are required for all services. Contractor shall request the most recent list of approved manufacturers from BRWS H2GO.

M. Pump and motor shall have a minimum of 400 series stainless steel shaft on motors under 10 HP, on motors over 10 HP the shaft may be chrome plated steel.

N. Impeller shall be keyed to shaft and shall be the single vane non-clogging design. The impeller shall be gray cast iron capable of passing a 3-inch sphere. Impellers shall be trimmed to the design flow and TDH; they shall be dynamically balanced to the manufacturers design specification for the pump supplied.

O. Pump volute shall have replaceable stainless steel wear rings or plates.

P. Seals shall be tungsten carbide to silicon carbide or tungsten carbide.

Q. B-10 bearing life shall be a minimum of 50,000 hours.

R. Pump and motor shall have adequately sized stainless steel chain, the length shall reach the top of station plus an additional six (6) feet. Loops at both ends of cables shall be secured with SS clamps.

S. Depth of wet well shall be set to accommodate the following parameters:

    1. Float Control System:

        a. OFF: Set above the pump impeller

        b. LEAD-LAG: Differential minimum of one foot (1').

        c. ALARM: Set one foot (1') above the lag setting.

        d. INFLUENT PIPE: Set a minimum of six (6) inches above the alarm setting.

T. Pump housing shall be equipped with moisture detection probe and have moisture detection lamp mounted on the control panel. Moisture detection shall cause the motor to shut down and activate the ALARM light. Flygt pumps shall be supplied with two spare Meniscus units for moisture detection and temperature overload.

U. Each pump shall be supplied with a 3/16" SS cable, 18" - 1/4" SS chain, 5/16" SS screw pin shackle, SS thimble, and Nicro press sleeve to fit Grip Eye System by Flygt.

V. Pumps shall mount on dual stainless steel guide rail system compatible to Flygt pumps.

W. Spare parts: Provide monies for (1) additional pump of equal size and design criteria for the sewer pump station.

3.1.5 Grinder Pumps and motors:

A. Allowed usage: It is not the policy of BRWS H2GO to allow grinder lift stations. However, under unusual conditions that arise, where normal installation of the standard lift station cannot be implemented, BRWS H2GO's management staff will consider such installations after all other possibilities have been exhausted. When approved, the following criteria will be used.

1. Simplex station only – using the approved Zoeller E-6840-C Grinder pump 230volts 1 Phase.
2. No motors smaller than 2 HP.
3. Basin shall be fiberglass in construction and be the approved AK Industries Model Number GB-60-201.
4. Residential simplex lift station basins shall be no less than five (5) feet, but no more than eight (8) feet from the dwelling.
5. Pump cord length shall be minimized, and pump cord splicing is expressly disallowed.
6. All fees and permits shall be paid by the Developer.
7. Control panel shall be CSI Controls RK Series Pressure Activated. Model Number RKSP230CBGDDCSL1MB-28
8. Spare parts: Provide one (1) additional grinder pumps with electrical cables and control box for inventory.
9. Force main lines shall be tracer taped and wrapped as specified in the Pipeline Identification and Marking paragraph of the General Provisions section from basin to saddle on existing sewer line.
10. Force main lines shall have a check valve and ¼ turn ball valve placed on them inside a plastic valve box to be located in right-of-way. Contractor shall request the most recent list of approved manufacturers from BRWS H2GO.
11. All forced sewer connections for grinder systems shall have a brass C.T.S. compression fitting and shut off valve at the main tap. The service is to be the appropriate size C.T.S. with no coupled fittings ran to the residential service connection.

3.1.6 Testing and startup:

A. Simplex draw-down test shall be performed by the Engineer prior to final acceptance of the lift station. Specifications to include completion of lift station start-up procedures in the presence of BRWS H2GO's representative.

B. Final basin level and control setup will be performed by BRWS H2GO’s representative.

C. The Engineer shall provide a Certification that the work has been completed in accordance with BRWS H2GO's approved plans, specifications, and good engineering practice. The Contractor shall

provide a Certification that all material, suppliers and Subcontractors have been paid and that no lien is in force against the work.

D. Contractor shall supply a one (1) year written warranty on all work and material except pumps and controls.

E. The Developer shall provide BRWS H2GO with an easement for the length of the force main to include the basin for access to pumps and force main. See General Provisions for easement requirements.

3.1.7 Valve vault:

A. Lift stations, where shown on the plans, shall be equipped with a valve vault. Valve vault shall have minimum interior dimensions of six foot by six foot (6' x 6'). Larger discharge sizes shall be provided with a valve vault sized to allow proper maintenance on all installed appurtenances.

B. Each pump discharge line shall have a weighted arm, cushioned check valve within the valve vault. One check valve shall be a mirror of the other to facilitate the removal of the shaft. Check valve shall be of the full waterway design for quiet operation and with the flow area through the valve equal to or exceeding the flow area of the pipe to which it is installed, a flanged lever operated plug valves for valves four (4) inches and smaller, and gear actuated, hand wheel operated plug valves for valves six (6) inches and larger and a locking flanged adapter on the discharge side. All valves shall be resilient seat plug valves open left (counter-clockwise) valve stem operation. Valves located within valve pits shall be square nut actuated. All other valve vault piping shall be flanged. Dresser coupling or uniflange fitting shall not be used. Contractor shall request the most recent list of approved manufacturers from BRWS H2GO.

C. The force main shall have plug valves located on either side of the emergency connection to prevent force main backflow when making repairs in the valve vault and to provide bypass pumping. Plug valves shall have a 2-inch square operating nut and all bolting on the valve shall be stainless steel. Contractor shall request the most recent list of approved manufacturers from BRWS H2GO. The emergency bypass connection shall consist of a tee with the tee turned up and with a plug valve, 90 degree bend centered three (3) feet above finish grade, 4-inch aluminum female quick disconnect w/ 4-inch plug.

D. All hardware, including but not limited to bolts, nuts, and washers, shall be stainless steel within the valve vault.

E. Access covers shall be a minimum of 48 inches x 48 inches or larger to provide working clearance. Covers shall be a clam shell double door constructed of heavy gauge aluminum with stainless steel or aluminum hardware and accessories. Contractor shall request the most recent list of approved manufacturers from BRWS H2GO.

F. The bottom of the valve vault shall be sloped to drain to the wet well. Drain from the valve vault to the wet well shall have a trap and a Red Valve “duckbill” style check valve or approved equal. Contractor shall request the most recent list of approved manufacturers from BRWS H2GO.

G. All expansion anchors shall be type 316 stainless steel.

3.1.8 General Electrical and Control panel:

A. General electrical requirements. All electrical work must be done in accordance with Section 3.2. *NOTE: Electrical schematic shall be plastic laminated and affixed inside the control panel door.

1. Pump and motor shall be shipped with non-wicking electrical power cable, over-heat cable, and seal-failure cable, factory installed and tested. Cut ends are to be factory sealed and tagged for shipping. A single power cable is required.

2. Conduits that leave the wet well shall terminate a minimum of 6-inches below connecting enclosures to allow venting. Conductors shall enter enclosures through compression fittings.

3. Wet well level sensor float hangers shall be a DORS-3 located at the edge of the hatch away from inlet piping. Contractor shall request the most recent list of approved manufacturers from BRWS H2GO. Kellum grips cable supports shall be provided on power cables for pumps 10 HP and larger.

4. Electrical control panels shall be 316 stainless steel NEMA 4X with drip shield rated with minimum 0.080 inches thick aluminum inner door with ¾ inch break around perimeter and aluminum or stainless steel back component panel. Panel shall be of sufficient size to house all control equipment. All panel penetrations for conduit shall be from the bottom only. NO side entries shall be allowed.

5. Electrical control panel bracket shall be slotted stainless steel unistrut with end caps, with 316 stainless steel hardware and shall be adequately grounded.

6. Concrete pad shall be provided for electrical control panels with hoods and incorporate the wet well and valve vault. There shall be a minimum of 3 feet of separation from the back of the wet well to the electrical control panel. Concrete pad shall be a minimum of 4 inches thick and shall be integral with the wet well and valve vault top. Electrical panels without hoods shall be set in sono tubes, poured in place, with all approved unistrut and poles noted in this section and do not require a concrete pad.

7. Underground conduit from junction boxes shall be PVC minimum 2-inches schedule 40. Above ground conduit shall be schedule 80 PVC. Separate conduit shall be provided for each pump power cable and one conduit for all float wires. All panel penetrations shall be thru the bottom of the panel.

8. Lightning arrester shall be mounted in a NEMA 4x stainless steel enclosure under the main disconnect for each phase of incoming service. Lightning arrester shall be protected from over current per manufacturers recommendations.

9. Electrical grounding shall consist of 3 - 5/8 inch diameter, 10 foot long copper clad ground rods, set in a 6 foot triangular spacing. Ground wires shall be exothermically welded to the ground rods with a viewing box at each connection.

B. Main Control Panel.

1. Enclosure shall be NEMA 4X stainless steel with drip shield and a single handled three point latch system with padlocking provisions. Screw-type latches will not be accepted.

2. A minimum of the following components shall be installed on a separate hinged aluminum inner door:

a. Pump motor circuit protective breakers with pad lockable lock-out device for each motor.

b. Hand-Off-Automatic (HOA) selector switches shall be non-spring loaded and oil tight.

c. Lead 1-Lead 2-Automatic alternator selector switch.

d. 6 digit elapse time meter without reset for each motor.

e. Single Ammeter with appropriate scale ranges, PUMP1- PUMP2 selector switch and Off-L1-L2-L3 selector switches,

f. 35 HP and larger motors shall have one voltmeter with Off-L1-L2-L3 selector switches.

g. The following indicating lamps:

    1. Pump running (green)

    2. Seal failure (red)

    3. Overheat failure (red)

    4. High level Alarm (red)

    5. Phase failure (red)

    6. Float levels (yellow)

h. Pushbuttons for:

    1. Alarm horn silence (externally mounted)

    2. Reset motor over temperature

    3. Test seal alarm

    4. Reset seal alarm

    5. Float test for each float

i. 15 amp, 110 volt GFI Duplex Receptacle mounted outside the control panel with a rainproof cover capable of allowing a plug to be inserted and still maintaining it rainproof.

3. A minimum of the following components shall be mounted on the back plate:

    a. Fuseless NEMA rated combination motor starters with instantaneous short circuit protection, heavy duty industrial contactors (Definite Purpose contactors are not acceptable), 3 phase adjustable bimetallic overload protection manufacturer shall be Square D.

    b. Control circuit transformers 120 VAC (not required on 230 v, 3-wire systems) with primary circuit breaker and secondary circuit breaker for:

        1. Control

        2. 15 amp duplex receptacle and yard light

    c. Automatic electrical alternation

    d. Control relays, plug in 3 pole pin type with indicator lights.

e. Surge suppressor

f. Power terminals and control terminals, each shall be Allen-Bradley or equal with ¼ inch flat head set screws.

g. Condensation protective space heater with adjustable thermostat

h. Phase failure relay with 2-second delay trip and 60-second delay on time manufactured by Sycom - model 102A which will monitor:

1. Phase failure

2. Phase reversal

3. Low voltage (Brown Outs)

4. A weather proof alarm horn, 115 volt ac single projector, vibrating type and flashing alarm light, vapor tight with a housing guard, with a minimum of 40 watt light bulb shall be shipped loose and installed remotely or on the side of the panel visible from the entrance drive and 360 degrees. All installations requiring penetration of the control panel shall be made in such a manner and with approved devices that will maintain the panel's NEMA 4X rating. No time delay shutoff of alarm horn or light shall be allowed. Panels shall be factory assembled and shall bear a UL approval label certifying this rating.

   Alarm Light shall be on at:

   High water level

   Alarm light shall flash at:

   Seal failure alarm

   Overheat alarm

   Pump breaker tripped

   Phase failure alarm

   High water level

   Horn shall be on at:

   High water level

5. Control sequence shall be designed that panel function is automatically restored after a power failure and manual reset is not necessary.

6. Control wire to be MTW 90 degree C, #14 AWG. Color code and number all wiring as indicated on the factory wiring diagram. All wiring shall be neatly grouped in plastic wire troughs except wiring from bookplate to the door shall be done in separate bundled harnesses. All wires shall have a wrap-around wire identification number at both ends of the wire as shown in the wiring diagram. All components shall be identified with the same number as shown in the wiring diagram. All door mounted components shall have engraved nameplates fastened to the door with stainless steel rivets. Electrically ground all components to a common ground screw mounted on the removable back panel.

7. All conduits entering the control panels or other enclosures shall be sealed with gas-tight fittings and enter from the panel bottoms. (Meyers type hubs). Three junction boxes shall be located below the gas-tight seals for the pump and control conduits. Contractor shall request the most recent list of approved manufacturers from BRWS H2GO.

8. All electrical work shall be performed by licensed personnel in accordance with the National Electric Code.

9. Electrical permit shall be applied for at the Brunswick County Building Codes.

10. A time delay relay to prevent the pumps (duplex) to start simultaneously after power failure.

11. In consultation with BRWS H2GO's management, soft starting is required on all motors 20 HP and larger shall have a soft start motor controller. The controller is to reduce high inrush currents, reduce excessive starting torques and reduce peak demand surges. The controller shall be capable of ramping to full speed from 10 to 90 seconds. The controller shall be Allen Bradley model SMC or approved equal.

12. All installations shall be in accordance with the National Electric Codes.

13. Electric supply, control, and alarm circuits shall be designed to provide strain relief and to allow disconnection from outside of the wet well. Terminals and connectors shall be protected from corrosion by location outside the wet well or through use of watertight seals. If located outside, weatherproof equipment shall be used.

14. The motor control center shall be located outside and facing toward the wet well with an adequate distance from the wet well to avoid accidental fall.

15. Pump motor power cables shall be designed for flexibility and serviceability under conditions of extra hard usage and shall meet the requirements of the Mine Safety and Health Administration for trailing cables. Power cable terminal fittings shall be corrosive REV. resistant and constructed in a manner to prevent the entry of moisture into the cable, shall be provided with strain relief appurtenances and shall be designed to facilitate field connection.

16. Provide power and control cables of adequate length to reach the junction box without splicing.

17. Slope conduit from the control panel to the wet well.

18. Lift Station SCADA System shall be provided and mounted to the backboard and be wired into the system so that backup power will be available at all times. Contractor shall request the most recent list of approved manufacturers from BRWS H2GO.

3.1.9 Spare parts for submersible lift stations:

A. Contractor shall furnish on or before final inspection each of the following:

1. Two (2) complete sets of record drawings for wet well, electrical, electronic schematics, O&M manuals with factory certified pump curves (20 Hp and larger), copies of all certified test and inspection data.

2. A completed start-up report by the pump manufacturer.

3. One box (2 min) of fuses for each size that is in control panel.
4. One complete set of motor starter contactor kit.
5. One box (4 min) of spare bulbs of each size used in the control panel.
6. Motor starter coil.
7. One spare relay and timer of each type used.
8. A spare parts kit for each pump. Spare parts kit shall contain, at a minimum, seal kits, wear rings, and impellers.

3.2 GENERAL ELECTRICAL:

3.2.1 Scope:

A. Electrical Work: As indicated on the Drawings, including all items which may be reasonable implied in order to provide a complete and operational system.

B. Permits: Obtain necessary permits and pay associated fees.

C. Utilities: Contractor shall make all necessary arrangements with the utility for power service and arrange for temporary power, as required.

3.2.2 Quality Assurance:

A. Perform all work using licensed electricians.

B. Comply with the requirements of the National Electrical Code and with local codes and ordinances.

3.2.3 Submittals:

A. Submit shop drawings and manufacturer's data on all products.

B. No equipment may be installed prior to submittal approval by BRWS H2GO or their representative.

3.2.4 Products/Materials:

A. Standards: Use only new materials conforming to the standards of Underwriting Laboratories.

B. Wiring: Copper, #12 AWG minimum, type THWN. For runs over 100 feet, use #10 AWG in lieu of #12.

C. Support Channel: Stainless steel with stainless steel hardware.

3.2.5 Installation:

A. Install all wiring in conduit. Use schedule 80 PVC for all exposed runs and schedule 40 PVC for underground conduits embedded in concrete. Use flexible metal conduit for connections to transformers and other vibrating equipment.

B. Provide a separate ground conductor where indicated on the Drawings; the raceway may not be used for grounding.

4 TESTING PROCEDURES

4.1 SCOPE: All liquid-retaining structures, pressure piping, gravity sewer piping, and manholes shall be tested by the Contractor as specified herein and as directed by BRWS H2GO. The Contractor shall furnish all materials, labor, and equipment needed to perform all testing. Testing shall be conducted in the presence of BRWS H2GO and the Engineers representative in a manner to minimize interference with the progress of the work. All testing (low-pressure, hydraulic, etc.) shall not be performed until all surrounding utilities have been installed and the pipe being tested is set to its final grade.

4.2 TESTS OF STRUCTURES:

4.2.1 Concrete Structures: Prior to backfill, each cast-in-place or pre-stressed concrete tank, basin or other liquid retaining structure shall be tested by filling the structure with clear water to its intended operating level or a greater level as directed by BRWS H2GO, and letting it stand for at least 24 hours. All wall castings, sleeves and other openings shall be plugged temporarily during the test period.

A. During cold weather, the Contractor shall take measures to ensure ice does not form; such method shall be submitted, before testing, to BRWS H2GO for approval.

B. All exterior surfaces shall be examined for leakage. Leakage will be considered to be within the allowable limits where there is no visible sign of leakage and where water loss does deviate from the original volume during the 24-hour test period. If leakage exceeds the allowable limits, the work shall be repaired by draining the structure and removing and replacing the defective areas, or by other methods as approved by BRWS H2GO, and then performing a second leakage test.

1. In cast-in-place structures, hairline cracks that leak shall be enlarged to a V-shaped groove, 1-inch wide at the surface by 1-inch deep, and repaired to the satisfaction of BRWS H2GO. Cracks may also be pre grouted if required by BRWS H2GO.

2. All repairs to pre-stressed tanks shall be made in strict accordance with the recommendations of the tank constructor.

C. Disposal of water after testing shall be satisfactory to BRWS H2GO.

D. Repair and retesting of the structure shall continue until leakage is within the allowable limits and all leaks are repaired to the satisfaction of BRWS H2GO.

E. Unless otherwise specified, all expenses of the leakage test, including measuring devices, temporary plugs, repairs and retesting, shall be paid for by the Contractor at no additional cost to the Owner. Water for the first leakage test will be furnished by the Owner at no cost to the Contractor; water used in retesting shall be paid for by the Contractor at current utility rates.

F. If any structure fails to pass the leakage test after five times, the entire structure shall be removed and rebuilt at no additional cost to the Owner; such rebuilt structure shall be subject to all leakage test requirements as specified herein.

4.3 HYDROSTATIC TESTING OF PRESSURE PIPELINES

Each pressure pipeline or valved section thereof shall be subjected to hydrostatic testing in accordance with all applicable provisions of AWWA C600, Section 4, latest edition. Contractor to notify BRWS H2GO field inspectors via email and/or phone a minimum of 48 hours prior to any scheduled pressure testing. All testing shall be performed only in the presence of BRWS H2GO staff or authorized representative(s). Any testing

performed without BRWS H2GO staff, or authorized representative, being present shall be considered a failed test and shall be retested.

4.3.1 Pressure Test: Unless otherwise specified, pressure lines shall be tested to the working pressure but not less than 100 psi or greater than pressure rating of pipe based on the lowest point of the section under pressure. Any lines to be tested above 100 psi shall be done with the use of a graph gauge reading technology. Before applying the test pressure, all air, dirt and foreign material shall be expelled completely from the line through air valves, flushing and other means. The test shall be maintained at full pressure for at least two hours. Pressure gauges on test apparatus shall be a minimum of 4 inches in diameter and read in 2-pound increments. All damaged or defective pipe, fittings, joints, valves, and appurtenances discovered after the pressure test shall be repaired or replaced with sound material, and the pressure test repeated until satisfactory to the Engineer and BRWS H2GO.

A. Pressure lines shall be tested to 2.5 times the working pressure but not less than 100 psi, not to exceed 150 psi, for a period of 2 consecutive hours. A Leakage Test for pipelines shall be conducted concurrently with the pressure test. No allowable leakage. No air test shall be allowed. If the test discloses leakage, the Contractor shall, at his own expense, locate and repair all defects until leakage is fixed. All visible leaks shall be repaired regardless of the amount of leakage.

B. BRWS H2GO may provide water for testing if the ability to fill directly from a tapped line is in place. If water is needed from a hydrant meter, the Contractor will remain responsible for usage. In areas without a tapped line, water shall be furnished by the Contractor. The Contractor shall furnish the test pump, measuring devices and all necessary pipe or hose extensions or transportation to the point of use, and shall exercise care in the use of water.

C. If large amounts of water are needed for flushing, the Contractor must make arrangements with BRWS H2GO or other appropriate water system owner to install a meter.

D. All valves within the test section shall be completely opened and closed several times during the test period.

4.4 GRAVITY SEWER TESTING

4.4.1 Air Testing: Air testing of gravity sewer pipelines shall be done in accordance with applicable provisions of ASTM C828. All lines shall pass the air test before they will be accepted by BRWS H2GO. Lines not passing the test shall be repaired and retested as required. Air testing shall not occur until all underground dry and wet utilities have been installed and roads have been subgraded.

A. Air test shall be conducted in strict accordance with the testing equipment manufacturer's instructions, including all recommended safety precautions. No one will be allowed in manholes during testing. Equipment used for air testing shall be specifically designed for this type of test, and is subject to approval of BRWS H2GO.

B. The Contractor shall furnish an air compressor which will provide at least three hundred cubic feet of air per minute at one hundred pounds per square inch along with all necessary plugs, valves, air hoses, connections and other equipment necessary to conduct the air test. Pressure gauges on test apparatus shall be a minimum of 4 inches in diameter with a minimum of 1 psi graduations and a maximum range of 0-10 psi. Plugs in sewer 18 inches in size and larger shall be connected by cable for thrust reaction.

C. The sewer section shall be plugged at both ends and air pressure shall be applied until the pressure inside the pipe reaches 5.5 PSIG. When a stable condition has been reached, the pressure shall be bled back to 5.0 PSIG. above the average back pressure of any ground water above the pipe's invert. At this starting pressure, the time and pressure shall be observed and recorded. A minimum of three (3) readings shall be required for each test.

1. For a pipe to be presumed free of defects, pipe must maintain an air pressure of 5 psi for a minimum test duration of 5 minutes. If the test pressure cannot be maintained for the duration of the test, then the cause of failure must be determined and corrected. After repairs have been made, the sewer sections shall be retested. This process shall be repeated until all sewer sections pass the air test.

4.4.2 Pipe Deflection Test: All PVC gravity sewer pipe, 4-inch diameter and larger, shall be tested after installation and backfill by the Contractor. Testing shall be performed at the Contractor's expense using a 5% mandrel acceptable to BRWS H2GO to ensure initial deflection of pipe does not exceed 5.0%. All deflection testing shall be performed after a settling period of no less than 30 days and in the presence of the Engineer and BRWS H2GO. Contractor shall notify the Engineer and BRWS H2GO in sufficient time to ensure both will be present during deflection tests. Deflection test records shall identify the location and deflection amount at all points where deflection exceeds the specified limit. Such records shall be certified by the Contractor and shall be furnished to the Engineer prior to acceptance and payment. Pipe with initial deflection exceeding the specified limit will be unacceptable, and shall be re-bedded to the correct deflection and retested for deflection, at the Contractor's expense. Additional mandrel testing may be required as part of the 11 months warranty walk through.

4.4.3 Visual inspection: All gravity sewer manholes and pipelines shall be visually inspected by BRWS H2GO's Inspector prior to acceptance. Gravity sewer manholes shall be to final grade, have no visible infiltration, contain properly formed and sloped inverts, and be properly coated as outlined in previous sections. Gravity sewer pipelines shall be of uniform slope with no portion holding water. Repairs to gravity sewer pipelines shall be performed in manner equivalent to new construction. Fernco style couplings or repair bands shall not be used. If BRWS H2GO's Inspector suspects that the gravity sewer pipeline does not meet the above stated criteria, a video inspection, at the Contractor’s expense, may be required.

4.4.4 Video Inspection: All gravity sewer manholes and pipelines shall be video inspected at the Contractor’s expense. Video inspection shall only be performed after a settling period of no less than 30 days. A copy of the inspection video shall be provided to BRWS H2GO for their records. No submission of C.C.T.V. footage will be accepted via flash drive. Contractors and their engineers will need to submit through an H2GO supplied shared folder. Before the end of the one year warranty, another video inspection shall be performed on the previously videoed lines and manholes at the Contractor’s expense and a copy of these video inspections shall be provided to BRWS H2GO. Additional video inspection may be required as part of the 11 months warranty walk through. All C.C.T.V work is to be completed and reviewed before any pressure testing is performed.

4.4.5 Soil Compaction Test: All trenches suspected of not meeting the compaction requirements stated previously shall be tested for conformance by a BRWS H2GO approved testing laboratory and at the locations and depths requested by BRWS H2GO.

4.5 MANHOLE TESTING

4.5.1 All newly installed manholes shall pass a vacuum test in accordance with ASTM C 1244. Manholes requiring testing to be determined at pre-construction meeting.

4.5.2 No person shall be allowed in manhole during testing.

4.5.3 A vacuum of 10-inches of mercury shall be drawn with an approved vacuum testing unit. Testing time shall not be measured until after the vacuum pump has been shut off.

4.5.4 Measure time for vacuum to drop from 10-inches to 9-inches of mercury. Manhole shall pass if time meets or exceeds the values listed in the following table:

Depth (ft)	Diameter (inches)		
	48	60	72
	Time (seconds)		
8	20	26	33
10	25	33	41
12	30	39	49
14	35	46	57
16	40	52	67
18	45	59	73
20	50	65	81
22	55	72	89
24	59	78	97
26	64	85	105
28	69	91	113
30	74	98	121

4.5.5 If manhole fails test, make necessary repairs to the satisfaction of BRWS H2GO and the Engineer, at no additional cost to the Owner, and repeat test until manhole passes.

5 TECHNICAL SPECIFICATION SECTION FOR SEWAGE LIFT STATION GENERATOR SET/ATS

5.1 GENERAL

5.1.1 It is the intent of the specification to secure an emergency system that has been prototype tested, factory built, production tested, site tested, of the latest commercial design, together with all accessories necessary for a complete installation as specified herein.

5.1.2 The equipment supplied and installed shall meet the requirements of the National Electric Code and all applicable local codes and regulations.

5.1.3 All equipment shall be new, unused and of current production by a firm that has its final assembly located in the continental United States. The generating set manufacturer shall have at least twenty-five (25) years of experience assembling generating sets.

5.1.4 The engine, generator, controls, transfer switch, and disconnect shall be completely assembled and wired by the generator manufacturer and locally authorized dealer to ensure one-source responsibility for warranty, parts, and service through factory-trained service personnel.

5.1.5 Generator pads shall be designed, by the Engineer, to accommodate the generator size and weight.

5.1.6 Generators must be approved by BRWS H2GO before purchase or installation.

5.2 SYSTEM DESCRIPTION

5.2.1 Description: NFPA 110, UL 2200 listed engine generator system to provide source of power for Level 2 applications.

5.2.2 Generator shall deliver its rating continuously for the duration of any normal power failure. System shall be rated for standby duty; 85% load factor.

Units that cannot meet the 85% load factor, without any change to engine warranty, must increase kW to allow for the 15% lesser load factor. Manufacturer's standard engine/generator set warranty and Time Before Overhaul (TBO) cannot be affected by increased load factor.

5.2.3 Generator system shall be sized as indicated on the Drawings for the following requirements:

A. Rating: As indicated on the Drawings.
B. Power factor: 0.8
C. Load factor: 85%
D. Operating fuel: Diesel
E. Fuel tank size: Size for 48-hour operation at 100% load.

5.2.4 Generator system shall comply with all current Environmental Protection Agency (EPA) emission regulations including the New Source Performance Standards (NSPS) for stationary and non-road generator sets; Tier 2.

5.2.5 Provide automatic operation from automatic transfer switch to allow generator system to come online automatically on normal power loss. On restoration of normal power transfer switch automatically transfers load to normal power, shuts down generator, and returns generator to readiness for another operating cycle.

5.3 SUBMITTAL

5.3.1 Submit the following in accordance with Division 1.

A. Certificate of Compliance: Certify that Products meet or exceed specified requirements.
B. Catalog Data: The catalog data shall show the following information as a minimum:
    1. Show plan and elevation views with overall dimensions and connection point requirements for electrical and fuel lines.
    2. Provide weight of unit.
    3. Indicate electrical characteristics.
    4. Wiring diagrams for engine, generator, and control panel.
    5. Label major components of system.
    6. Listing and description of system components and accessories.
    7. Technical data and requirements for engine and fuel, lubricating, and cooling system.
C. Test and Start Up Reports: Upon testing of the installed system, field test reports shall be submitted showing field tests performed to adjust each component and field tests performed to prove compliance with the specified performance criteria. Each test report shall indicate the final position of controls.

D. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of Product.

E. Operation and Maintenance Instructions: Submit complete manufacturer's operation and maintenance manual for the total system. The parts list shall include schedule of type and quantity of parts recommended for stock. Submit sufficient copies to allow the Engineer and Owner to retain five copies. Submit three copies – one for the Engineer and two for the Owner.

5.3.2 In addition to the submittal requirements of Division 1, provide a copy of submittals in CD format.

5.4 QUALITY ASSURANCE

5.4.1 Manufacturer: Company specializing in manufacturing generator sets with a minimum of 25 years' experience.

5.4.2 Supplier: Authorized distributor of a specified manufacturer with a minimum of 10 years' experience. Suppliers shall maintain a parts and service facility within 75 miles of the project (Brunswick County).

5.5 DELIVERY, STORAGE, AND HANDLING

5.5.1 Accept unit on site on skids. Inspect for damage.

5.5.2 Protect equipment from dirt and moisture by securely wrapping in a heavy plastic shipping bag.

5.6 WARRANTY

5.6.1 The manufacturer shall warrant the generating set against all manufacturing defects for a period of five years or 3000 hours, whichever occurs first, from the date of system start-up. The warranty period shall commence from the date of the system start-up but no later than six months from the date of shipment from the manufacturer.

5.7 RATINGS

5.7.1 The standby generator set shall be rated as standby power (defined as continuous operation for the duration of any power outage). Kilowatt ratings for three-phase voltages are based on a 0.8 power factor and single-phase voltages are based on a 1.0 power factor. Ratings are established on 150 feet altitude and 110º Fahrenheit.

5.7.2 In all applications in sewage lift stations the generator shall be capable of starting both sewage pump motors at the same time. Refer to BRWS H2GO or the Engineer for sizing generator applications.

5.8 ENGINE

The prime mover shall be a liquid-cooled, 2 diesel-fueled engine of 4-cycle design, and shall be equipped with the following:

5.8.1 Mechanical or electric fuel transfer pump, primary and secondary fuel filters, water separator, and electric fuel shut-off valve.

5.8.2 Electronic governor capable of regulating the no load to full load frequency to a 0.25% maximum, steady state regulation shall be .25%.

5.8.3 12-volt positive engagement solenoid shift-starting motor.

5.8.4 12-volt belt-driven battery charging alternator with solid-state voltage regulation.

5.8.5 Positive displacement full pressure lubrication oil pump, cartridge oil filters, dipstick, and crankcase oil drain.

5.8.6 Dry replaceable, dual element “heavy duty type” air cleaner. Provide a restriction indicator on the air filter.

5.8.7 Unit-mounted radiator, pusher type cooling fan, water pump, thermostat and radiator duct flange (non-enclosed units) shall properly cool the engine and be designed for operation at a minimum ambient temperature of 120º F.

5.8.8 Vibration isolators shall be provided between the engine generator/alternator and the steel sub-base, fuel tank or directly to mounting pad. ¼ inch thick elastomeric pad in square shape placed under the base frame at each of the pre-drilled isolator mounting holes.

5.9 ALTERNATOR

5.9.1 The alternator shall be a 4-pole revolving field type with 12 reconnectable leads, self-ventilated and of drip-proof construction. The insulation material shall meet the NEMA standard (MGI-22.40 and 16.40) for Class H insulation. The excitation system shall be of brushless construction controlled by a solid-state voltage regulator with adjustable volts per-hertz tracking. PMG/DVR2400 by Marathon, or equal.

5.9.2 On application of any load up to the full rated load the voltage dip shall not exceed 12.5% and shall recover to stable operation within two seconds. The alternator shall be capable of sustaining at least 250% of rated current for at least 10 seconds under a 3 phase symmetrical short by inherent design or by the addition of an optional current boost system. The alternator shall be capable of accepting the loads and instantaneous voltage dip when loads are started as specified.

5.9.3 The generator shall be directly connected to the flywheel housing and by means of a shaft through a flexible drive plate coupled between the alternators rotating mass and the engine flywheel for permanent alignment. A ground cable will be installed between the alternator foot and the support crossmember.

5.10 GENERATOR/CONTROLLER

5.10.1 Generator controller shall be an integral part of the overall weather enclosure and shall have three points of interface so that panel can be removed and replaced quickly as and if required. A separate D/C twist lock receptacle shall be provided for all D/C interfaces to the generator control panel from the generator set. A separate A/C twist lock receptacle shall be provided for all A/C interfaces to the generator control panel from the generator set. A RS 232 connector shall be provided and installed through the control panel box to allow access to the controller without having to remove the controller from the box. This plug-in device will be capable of allowing maintenance personnel to test controller performance without operating the engine. All wire shall be rated for peak A/C voltage and shall be number stamped as indicated in the electrical schematic. The enclosure shall be constructed of .090-gauge aluminum. The microprocessor control board shall be moisture proof and capable of operation from -40° to 85º Celsius. The digital generating set controller shall be provided utilizing microprocessor-based technology and provide:

A. CAN Bus option to connect to standard SAE J1939 engine management systems. Error codes will be displayed in numerical and text format.

B. Comprehensives remote communications via optional RS232 port. Full 2 way communication and panel supports GSM SMS messaging system.

C. Engine instruments: Oil pressure, water temperature, actual engine hours run, charging voltage, battery volts and engine rpm.

D. Generator Instruments: Volts, Hz, Amps, kW, kVA, Power factor.

E. 16 bit micro processor control

F. Optional RS 485 'Modbus' output.

G. LCD 4 line text based backlit display

H. PC configuration and status monitoring using 5xxx PC software

I. PIN number front panel programming protection for selected trip points and timers to allow in field adjustments.

J. Built in exerciser times

K. Sleep mode to conserve battery life

L. Automatic and manual operation modes

M. Six configurable auxiliary inputs for connection to external fault detection equipment-expandable to 14 auxiliary inputs along with three configurable outputs.

N. Integral load switch control capability

O. Able to survive 0V for 50mS without internal batteries

P. Ability to be configured for use with a 16 light remote annunciator. Range is 1000 meters over standard wires (NFPA 110)

Q. Optional 8 light remote annunciator and 8 dry relay contacts-Fully programmable.

R. Ability to communicate with Thompson Technologies automatic switch

S. Enclosure protection IP55 with gasket

T. Multiple display languages

U. Auto scroll display

V. Integral load switch capability

W. Pre-alarms and shutdowns for generator voltage, frequency and amps.

X. Adjustable high current shutdown alarm-IDMT curves.

Y. 4 configurable LEDs on front panel-Warnings, shutdowns or Status indicators

Z. Event log

AA. Fuel level input with transfer pump control

BB. Multiple wiring topologies supported-Front panel configurable

CC. UL, CE and CUL approved

DD. Generator available LED

EE. Close generator output LED

5.11 ACCESSORIES

5.11.1 The following accessories, as required, shall be installed, and completely wired to ensure that no site installation is required.

A. Batteries: Heavy duty, diesel starting type lead-acid storage batteries of sufficient capacity to provide a minimum of five full cycle starts for ten seconds crank with ten second rest periods between cranks. Match battery voltage to starting system. Include necessary cables and clamps.

B. Battery racks. Battery cables. 12-volt or 24-volt battery(s) capable of delivering the minimum cold cranking amps required at zero degrees Fahrenheit ~ SAE Standard 1-537 for each particular kW rating. The battery rack shall be welded to the sub-base or fuel tank and shall have two hold down bolts with one cross over strap.

C. Oil and water drain lines shall be installed and extended to the outside of the weather protective enclosure through bulkhead fittings. Each drain line shall include but not be limited to a brass ball valve and flexible lines. The ball valves shall be located on the interior of the package.

D. Engine exhaust silencer shall be coated to be temperature and rust resistant and rated for critical applications. Exhaust noise shall be limited to 85 dba as measured at 10 feet in a free-field environment. Silencer is mounted within the structure of the weather protective enclosure. The silencer is connected to the engine by a stainless steel flexible pipe.

E. The block heater shall be sized properly to carry the correct wattage and voltage for the engine chosen by the generator supplier; 1500 W minimum. This block heater shall also be thermostatically controlled to maintain engine coolant at 90º F (32 degrees Celsius) to meet the start-up requirement of NFPA-99 or NFPA-110 regulations. If the line voltages do match the required voltages, the manufacturer shall furnish and install the necessary transformer in the transfer switch compartment to convert the primary power source voltage to the voltage and current level required.

F. Automatic float and equalize battery charger with constant voltage constant from no load to full load. Current limited during engine cranking and short circuit conditions. Temperature compensated for ambient from -40 degrees C to +60 degree C, voltmeter and ammeter fused, reverse polarity and transient protected. Optional alarm circuit board to meet the requirements of NFPA-110 for low battery voltage, high battery voltage and battery charger malfunction. MicroGenius2, model 180 by SENS, or equal; rated for 12VDC, 10A. Mounted and wired to the enclosure panelboard.

G. A duplex receptacle, GFCI type, is made available to route power from the normal source to the float charger and block heater. The float charger and block heater are connected to the receptacle.

H. Electrical Distribution Panelboard: NEMA PB 1, rated 208/120VAC, 100A tin-plated copper bus with 60A main circuit breaker, 10 kA interrupt rating. Include branch circuit breakers for jacket water heater, battery charger, alternator strip heater, and convenience outlet circuits. Circuits shall be pre-wired at the factory.

I. LED Lighting: Provide 30 footcandles of lighting inside the enclosure with a timer prewired to a circuit of the internal panelboard.

J. Weather-protective enclosure constructed of marine grade aluminum with powder coat paint finish. The enclosure shall have removable and hinged side panels to allow inspection and maintenance access on both sides of the enclosure. This enclosure shall be constructed from minimum-.090-gauge aluminum for units up to and including 35kW. Enclosures housing gensets larger than 35kW are constructed of 1/8 inch thick marine grade aluminum. All enclosures shall have stainless hardware throughout. Doors shall include restraints. The enclosure shall have a removable panel at the radiator end to allow access to the interior mounted exhaust silencer and for cleaning of the radiator cooling fins. The sound level of the enclosure without additional material added shall not exceed 70 dBa at a distance of 7 meters; Level III 190 MPH Wind Rating.

K. Sound attenuation material added to the enclosure will be constructed of 1-inch adhesive backed foam.

L. The generator set will be fitted with a mainline circuit breaker(s), unless otherwise specified, sized a minimum of 15% above the rated amperage. NEMA AB 1, molded case circuit breaker on generator output with integral solid-state long, short, and instantaneous trip in each pole, 100% rated, with shunt trip. This breaker will be mounted on the side of the alternator conduit box with rubber anti-vibration mounts.

M. A double walled steel sub-base mounted fuel tank shall be provided, adhering to UL code 142 requirements. A fuel level gauge, 4-20mA analog level transmitter and low-level alarm contact shall be provided to annunciate the fuel level on the generator control panel. In addition, there shall be a leak detection switch located in the outer tank to indicate any occurrence on the generator control panel. The fuel tank shall have a lifting eye on each corner constructed of 3/8 structural steel plate. 48 hour run time tank. The tank will be fitted with a fuel drain fitting to remove the diesel fuel from the tank. The fuel tank shall be provided with a lockable fuel fill cap, suction and return pipes. Consideration shall be given to the upper plate design to ensure free and easy access to the hardware that holds the vibration mounts to the top of the fuel tank. At the rear of the tank there shall be an area to allow electrical stub up. Pressure tested by the manufacturer before shipment.

N. Genset is fitted with a fuel/water separator.

5.12 AUTOMATIC TRANSFER SWITCH

5.12.1 SCOPE

This Specification covers the supply of a complete operational automatic transfer switch rated ____Amps, ____Volts,

_3__Phase, and _60_Hz, _3 Pole, for installation by others. Three phase systems must be multi-voltage capable. The actual size will be by pump and or amp requirement.

List of Accepted Transfer Switch Manufacturers:

A. All transfer switches shall be ASCO 300.

5.12.2 GENERAL REQUIREMENTS

The unit shall be manufactured in accordance with this specification and applicable UL, CSA, IEC, NEMA, and ANSI standards. The unit shall be manufactured in a facility which is registered to an ISO 9001:2000 quality system. Supplier shall be responsible for ensuring the compatibility of all components of the unit. The unit shall be free of defects in material and workmanship.

5.12.3 RELATED INDUSTRY STANDARDS

UL 1008 Automatic Transfer Switches for Use in Emergency Systems

5.12.4 ENGINEERING SUBMITTALS

The following documentation shall be made available for submission to the project Engineer for review/approval purposes on the automatic transfer switch:

A. Physical layout drawing with outline dimensions, cable entry/exit locations, interior/exterior component layouts, and connection data.

B. Electrical schematic to include internal wiring, customer connection terminals, optional components, and controller settings.

C. Product Data Sheets with Equipment Ratings.

5.12.5 RATINGS & CONSTRUCTION

A. The automatic transfer switch must be listed or certified to the following safety standards:

UL 1008 Automatic Transfer Switches For Use in Emergency Systems

B. The completed assembly shall be mounted in a NEMA 4X enclosure suitable for outdoor application.

C. All materials and parts used in the unit shall be new, of current manufacture, of the best industrial grade, and free from defects and imperfections.

D. The transfer switch mechanism shall provide a simple means of manual operation using only components, which are permanently affixed, in the operating position.

E. Transfer switch must be capable of being switched under load in a manual configuration.

F. The unit shall permit manual operation of the transfer switch while the system is energized and carrying rated load.

G. All internal control devices used in the automatic transfer switch shall be cable of being de-energized and isolated from the system by use of an accessible isolation plug for servicing procedures as required.

H. The automatic transfer switch design shall provide front accessible components and wiring for easy serviceability. Power or control connections, which are not readily serviceable while the transfer switch is mounted in its enclosure, are not acceptable.

I. All power contacts used shall operate in a quick-make / quick-break manner, the speed of which shall be independent of supply voltage and / or speed of operation by manual means.

J. Rating of the automatic transfer switch shall be _____AMP, _____VAC, _60__Hz, _3_ PHASE, _3_WIRE.

K. The transfer switch shall comprise of _3__ switching poles plus a solid neutral. Fault withstand current rating of the complete assembly shall be ____Kamps RMS. The interrupting and closing rating shall be equal to or exceed the required withstand rating. This rating shall be obtained with standard upstream over current protection devices.

5.12.6 FUNCTIONAL REQUIREMENTS

A. The automatic transfer switch shall automatically transfer the load to the generator supply in the event of a utility supply failure and return the load to the utility supply upon restoration of normal utility power. The automatic transfer switch power switching devices shall be mechanically and electrically interlocked to prevent the utility and generator power supplies from being interconnected.

5.12.7 "AUTOMATIC SEQUENCE OF OPERATION"

Note: For specific device settings refer to Section 5.13.8 "STANDARD CONTROL FEATURES."

A. When the voltage on any phase of the utility supply is below preset levels of rated voltage for a preset time delay, a contact shall close to initiate starting of the generator set.

B. The load shall transfer to the generator supply when the generator voltage and frequency have stabilized and reached acceptable preset levels and the warm-up time delay has expired.

C. When the utility supply is restored to above preset levels of rated voltage on all phases, load transfer from generator to utility supply shall be initiated following expiry of the utility return timer.

D. Once the transfer mechanism operates and opens the generator power switching device, the transfer mechanism shall stop in the neutral position (i.e. with both power switching devices open) for the duration of the neutral delay timer setting to allow load voltage to decay prior to re-connecting the utility supply.

E. The load shall be re-connected to the utility supply once the neutral delay timer expires, and the transfer mechanism continues operation and closes the utility power switching device.

F. The load shall immediately retransfer to the utility supply (if within acceptable limits) should the generator supply fail prior to expiry of the utility transfer delay.

G. The generator set shall continue to operate following a load transfer for a cool down delay period, and then a contact shall open to stop the generator set.

H. An "on load" test mode may be initiated which shall cause a simulated utility failure condition and transfer the load to the generator set. The transfer sequence shall be the same as for a utility power failure except a neutral delay sequence shall occur when transferring from utility to a generator source.

I. The load shall immediately retransfer to the utility supply (if within acceptable limits) should the generator supply fail during an “on load” test mode.

5.12.8 STANDARD CONTROL FEATURES

A. The transfer switch shall be rated for use on multiple system voltages.

B. The transfer switch shall be field configurable to operate on the following nominal system voltages; 208V, 240V, 380V, 480V, 600V. Field selectable single or three phase.

C. Transfer switch control power must be obtained from the source being transferred to. The controls shall not require any connection to external power sources. Transfer switches requiring power from the engine starting (or other battery) are not acceptable.

D. A control circuit isolation plug shall be provided to isolate all control circuitry inside the transfer switch to facilitate maintenance procedures. When isolated, there shall be no voltage present on the control circuitry.

E. The transfer switch controller shall be microprocessor based and shall contain all voltage, frequency sensing and timing functions.

F. Three phase under voltage sensing shall be provided for the utility supply. The under voltage sensor shall be user adjustable from 70-95% of nominal and shall be based on a falling (i.e. drop-out) voltage. The under voltage sensor shall be factory set at 85% nominal voltage. The under voltage sensor shall reset (i.e. pickup) 5% above the dropout setting. The under voltage sensor shall include a transient time delay feature set at 1 second.

G. Three phase under voltage sensing shall be provided for the generator supply. The under voltage sensor shall be user adjustable from 70-95% of nominal and shall be based on a falling (i.e. drop-out) voltage. The under voltage sensor shall be factory set at 85% nominal voltage. The under voltage sensor shall reset (i.e. pick-up) 5% above the dropout setting. The under voltage sensor shall include a transient time delay feature set at 5 seconds.

H. Under frequency sensing shall be provided for the generator supply to permit load transfer to the generator supply if within nominal limits. The frequency sensing function shall contain a user adjustable set-point with a range of 70-90%. The factory setting shall be set at 90% of nominal frequency.

I. An engine start contact shall be provided which shall close to initiate starting of the engine. The engine start contact shall be rated 5A, 120/240VAC, 5A, 28Vdc resistive.

J. The following time delay functions shall be provided:

1. Engine Start-A time delay on engine start shall be provided to delay the engine start signal after failure of the utility source. The time delay shall be user adjustable 0 – 60 seconds, factory set at 3 seconds.

2. Engine Warm-up- A time delay for engine warm-up shall be provided which permits transfer to the generator supply after generator voltage and frequency exceed acceptable limits. The time delay shall be user adjustable 0 – 60 seconds, factory set at 2 seconds. Utility Return- A time delay for return to utility shall be provided which permits transfer to the utility supply

only after stable voltage conditions exist for the specified time period. The time delay shall be user adjustable 0 – 30 minutes, factory set at 2 minutes.

3. Engine Cool down- A time delay for engine cool down shall be provided which delays the engine stop signal after load has retransferred to the utility source until the time delay period expires. The time delay shall be user adjustable 0 – 30 minutes, factory set at 2 minutes.

4. Neutral Delay- A time delay for neutral position shall be provided to minimize the effect of out-of-phase transfer due to connected motor load. The time delay shall be user adjustable 0 – 60 seconds, factory set at 3 seconds.

K. Provision for local and remote operator-initiated system test modes shall be provided. Test modes shall allow "on load" testing of the generator set.

L. An automatic plant exercise time function shall be provided for generator testing. A fixed timer shall provide a 7 day off mode and a 20-minute run period. The exercise mode shall be enabled by a door mounted push-button.

M. Control logic shall be provided for immediate transfer to the utility supply (if within acceptable limits) should the generator set fail during any activated test mode.

N. Control logic shall be provided for sensing a Transfer Switch Failure condition, and if the alarm condition is activated, the transfer controller shall automatically force a transfer to the alternate source if available.

O. Required Pilot Lights (must be long life LED type):

1. Green light – load on Normal Utility Source

2. Red light – load on Generator Source

3. Green light – Normal Utility Source Available

4. Green light – Generator Source Available

P. Pilot light shall be provided to indicate energized load voltage status of the transfer switch. Pilot light to be long life LED type.

Q. The transfer switch controller shall provide a lamp test function to test all LED lights.

R. The transfer controller shall provide a user-initiated timer bypass feature to allow temporary bypassing of any active timer to reduce unnecessary delays in testing or trouble shooting procedures.

S. Utility Supply Auxiliary Contact (AUX-U)

1. An auxiliary contact (qty 1) shall be provided which operates when the utility source is on load. The auxiliary contact shall be supplied with a rating of 10A, 120/240VAC, 5A, 28Vdc resistive, Form C.

T. Generator Supply Auxiliary Contact (AUX-G)

1. An auxiliary contact (qty 1) shall be provided which operates when the generator is on load. The auxiliary contact shall be supplied with a rating of 10A, 120/240VAC, 5A, 28Vdc resistive, Form C.

5.12.9 OPTIONAL CONTROL FEATURES

A. 4.3.1.0 FTS4 -Four function Test Switch (Auto, Off, Engine Start Test).

B. Option 11BE:

1. Serial RS-485 Modbus communications

2. Multi-schedule engine exerciser

3. 300 entry event log

4. Common alarm output function

C. When applied on 3-phase systems it also enables:

1. 3 phase emergency source VLL sensing

2. Phase rotation monitoring

3. Emergency source VLL unbalance monitoring

D. Option 44G, space heater prewired to load side of ATS

5.13 PLANT TESTING / START UP SERVICES:

5.13.1 Provide the services of manufacturer's representative to check the equipment installation, supervise initial start-up, and instruct Owner's personnel in proper operation and maintenance of the equipment. A minimum of one trip to the site will be required, consisting of a minimum of one 8-hour working day. Regardless of the time spent at the site, services will not be considered complete until the system operates as intended for a minimum of one (1) month of operation.

5.13.2 Provide a four-hour full load test utilizing portable test bank. Simulate power failure including operation of transfer switch, automatic starting cycle, automatic shutdown, and return to normal. Each generator set shall be tested under varying loads with guards and exhaust system in place. Testing shall be performed to nameplate ratings and shall include:

A. Load steps of 25, 50, 75 and 100%

B. Block load from no load to 75% and 100%

C. Transient and steady state governing

D. Safety shutdown device testing

E. Voltage regulation

F. Rated power

G. Maximum power

H. Arrangements to witness performance tests or a certified test record shall be available at the request of the purchaser.

5.14 EXECUTION

The Owner in accordance with the manufacturer's recommendations and all applicable codes shall install the equipment.

Site tests: An installation check. The manufacturer's local representative shall perform start-up and load test. The time and date of the site tests shall be coordinated with the Owner. The tests shall include:

5.14.1 Fuel, lubricating oil, and engine coolant shall be checked for conformity to the manufacturer's recommendations under the present and anticipated environmental conditions.

5.14.2 Accessories that normally function while the set is in standby mode shall be checked prior to cranking the engine. These shall include: engine heaters, solid-state battery charger, generator strip heaters, remote annunciator, etc.

5.14.3 Start-up under test mode to check for exhaust leaks and cooling air flow. Test for movement during starting and stopping, vibration during running normal and emergency along with line-to-line voltage and phase rotation while running a known test load.

5.14.4 Automatic start-up by means of simulated power outage to test remote-automatic starting, transfer of the load, and automatic shutdown. Test unit under actual load by starting all pumps sequentially along with all additional miscellaneous loads. Engine temperature, oil pressure, and battery charge level along with generator voltage, amperes, and frequency shall be monitored throughout the test. Prior to this test, all transfer switch timers shall be adjusted for proper systems coordination.