

TABLE OF CONTENTS

TECHNICAL SPECIFICATIONS

(Addendum 5)

Page

DIVISION 1. GENERAL REQUIREMENTS

SECTION	01010	SUMMARY OF WORK	01010-1 – 01010-11
	01170	GENERAL PROJECT PROVISIONS	01170-1 – 01170-2
	01300	SUBMITTALS	01300-1 – 01300-7
	01311	CONSTRUCTION SCHEDULING	01311-1 – 01311-2
	01560	ENVIRONMENTAL PROTECTION	01560-1 – 01560-2
	01600	DELIVERY, STORAGE, AND HANDLING	01600-1 – 01600-3
	01700	CONTRACT CLOSEOUT	01700-1 – 01700-2
	01720	QUALITY CONTROL	01720-1 – 01720-3
	01730	OPERATION AND MAINTENANCE DATA	01730-1 – 01730-5
	01740	WARRANTIES AND BONDS	01740-1 – 01740-3

DIVISION 2. SITE WORK

SECTION	02100	SITE PREPARATION	02100-1 – 02100-4
	02200	EARTHWORK	02200-1 – 02200-7
	02221	EXCAVATION, BACKFILLING, AND COMPACTING FOR STRUCTURES	02221-1 – 02221-5
	02222	EXCAVATION, BACKFILLING, AND COMPACTING FOR UTILITIES (SITEWORK)	02222-1 – 02222-6
	02223	EXCAVATION, BACKFILLING, AND COMPACTING FOR PAVEMENT	02223-1 – 02223-4
	02227	AGGREGATE MATERIALS	02227-1 – 02227-3
	02270	SLOPE PROTECTION AND EROSION CONTROL	02270-1 – 02270-7
	02505	PAVING BASE COURSE	02505-1 – 02505-3
	02511	ASPHALTIC CONCRETE PAVING	02511-1 – 02511-6
	02525	CONCRETE CURBS, DRIVEWAYS AND WALKS	02525-1 – 02525-2
	02584	PAVEMENT MARKINGS	02584-1 – 02584-2
	02605	SEWER MANHOLES	02605-1 – 02605-3
	02660	WATER DISTRIBUTION SYSTEM	02660-1 – 02660-7
	02730	SANITARY SEWER SYSTEM	02730-1 – 02730-5
	02830	CHAIN-LINK FENCE AND GATES	02830-1 – 02830-2
	02890	TRAFFIC SIGNAGE	02890-1 – 02890-2

TABLE OF CONTENTS
(Continued)

TECHNICAL SPECIFICATIONS (Continued)	<u>Page</u>
 <u>DIVISION 3. CONCRETE</u>	
SECTION 03100 CONCRETE FORMWORK	03100-1 – 03100-4
03200 CONCRETE REINFORCEMENT	03200-1 – 03200-3
03300 CAST-IN-PLACE CONCRETE	03300-1 – 03300-28
03420 PRECAST CONCRETE PRODUCTS FOR BELOW GRADE CONSTRUCTION	03420-1 – 03420-12
 <u>DIVISION 4. MASONRY</u>	
SECTION 04230 CEMENT RUBBLE MASONRY	04230-1 – 04230-2
SECTION 04810 UNIT MASONRY ASSEMBLIES	04810-1 – 04810-14
 <u>DIVISION 5. METALS</u>	
SECTION 05500 FABRICATED METAL	05500-1 – 05500-4
 <u>DIVISION 6. WOOD AND PLASTICS</u>	
SECTION 06900 FRP GRATING	06900-1 – 06900-2
 <u>DIVISION 7. THERMAL AND MOISTURE PROTECTION</u>	
NOT USED	
 <u>DIVISION 8. DOORS AND WINDOWS</u>	
NOT USED	
 <u>DIVISION 9. FINISHES</u>	
SECTION 09900 PAINTING	09900-1 – 09900-4
09910 EPOXY COATING	09910-1 – 09910-3
 <u>DIVISION 10. SPECIALTIES</u>	
NOT USED	
 <u>DIVISION 11. EQUIPMENT</u>	
SECTION 11000 GENERAL EQUIPMENT REQUIREMENTS	11000-1 – 11000-10
11052 AUTOMATIC REFRIGERATED SAMPLERS	11052-1 – 11052-6

TABLE OF CONTENTS

(Continued)

TECHNICAL SPECIFICATIONS (Continued)	<u>Page</u>
11210 PUMPS (GENERAL)	11210-1 – 11210-11
11211 OXYGEN PROBES	11211-1 – 11211-4
11212 TURBIDITY METER	11212-1 – 11212-3
11213 LEVEL ELEMENTS	11213-1 – 11213-3
11217 ROTARY LOBE PUMPS	11217-1 – 11217-4
11221 SUBMERSIBLE NON-CLOG PUMPS	11221-1 – 11221-14
11231 AIR DIFFUSERS	11231-1 – 11231-7
11250 MAGNETIC FLOW METER	11250-1 – 11250-2
11261 STATIONARY DAVIT CRANE	11261-1 – 11261-3
11262 POLYMER FEED SYSTEMS	11262-1 – 11262-5
11270 STATIC MIXER	11270-1 – 11270-3
11293 SLIDE GATES	11293-1 – 11293-3
11300 MEMBRANE BIOREACTOR SYSTEM	11300-1 – 11300-29
11332 TANK MOUNTED CYLINDRICAL PERORATED PLATE SCREEN W/ INTEGRATED SCREENINGS WASHING	11332-1 – 11332-16
11334 SLUDGE DEWATERING SCREW PRESS	11334-1 – 11334-13
11346 ULTRAVIOLET DISINFECTION EQUIPMENT	11346-1 – 11346-12
11375 JET AERATOR	11375-1 – 11375-3
11544 PACKAGED BOOSTER PUMPS	11544-1 – 11544-10
11860 BLOWERS, POSITIVE DISPLACEMENT	11860-1 – 11860-10

DIVISION 12. FURNISHINGS

NOT USED

DIVISION 13. SPECIAL CONSTRUCTION

13120 PORTABLE BUILDINGS	13120-1 – 13120-15
13210 FACTORY POWDER COATED BOLTED STEEL TANK	13120-1 – 13120-5
13441 CONTROL LOOP DESCRIPTIONS	13441-1 – 13441-24
13601 PRE-ENGINEERED METAL BUILDING	13601-1 – 13601-15

DIVISION 14. CONVEYING SYSTEMS

NOT USED

TABLE OF CONTENTS
(Continued)

TECHNICAL SPECIFICATIONS (Continued)	<u>Page</u>
DIVISION 15. MECHANICAL	
SECTION 15020 TESTING AND DISINFECTING	15020-1 – 15020-3
15050 VALVES AND APPURTENANCES	15050-1 – 15050-12
15054 HORIZONTAL DIRECTIONAL DRILLING	15054-1 – 15054-11
15060 PIPING	15060-1 – 15060-6
15064 FUSIBLE POLYVINYLCHLORIDE PIPE (Addendum No. 5)	15064-1 – 15064-9
15112 ELECTRIC VALVE OPERATORS	15112-1 – 15112-3
15115 PROCESS PIPING	15115-1 – 15115-4
<u>DIVISION 16. ELECTRICAL</u>	
SECTION 16000 GENERAL REQUIREMENTS FOR ELECTRICAL WORK	16000-1 – 16000-8
16110 RACEWAYS, BOXES, AND SUPPORTS	16110-1 – 16110-4
16120 600 VOLT CONDUCTORS, WIRE, AND CABLE	16120-1 – 16120-3
16235 EMERGENCY/STANDBY POWER SYSTEMS GENERATOR SET	16235-1 – 16235-16
16413 AUTOMATIC TRANSFER SWITCH	16413-1 – 16413-13
16483 VARIABLE FREQUENCY DRIVES	16483-1 – 16483-14
16510 INTERIOR LIGHTING	16510-1 – 16510-3
16975 SUPERVISORY CONTROLS AND DATA ACQUISITION (SCADA) AND PROGRAMMABLE LOGIC CONTROLS (PLC)	16975-1 – 16975-6

DIVISION 17. INSTRUMENTATION

NOT USED

ATTACHMENTS

Geotechnical Engineering Exploration, DHHL Pulehunui Wastewater System,
Pulehunui, Maui, Hawaii, November 25, 2019

Amendment to Geotechnical Report: Corrected Field Infiltration Test Results DHHL
Pulehunui Wastewater System, Pulehunui, Maui, Hawaii, Dated December 4, 2019

SECTION 15064 – FUSIBLE POLYVINYLCHLORIDE PIPE

PART I - GENERAL

1.1 DESCRIPTION

This section specifies fusible polyvinylchloride pipe for horizontal directional drilling, including standards for dimensionality, testing, quality, acceptable fusion practice, safe handling and storage.

1.2 PIPE DESCRIPTION

Pipe supplier shall furnish fusible polyvinylchloride pipe conforming to all standards and procedures, and meeting all testing and material properties as described in this specification.

1.3 SPECIFIED PIPE SUPPLIERS

A. Fusible polyvinylchloride pipe shall be used as manufactured under the trade names Fusible C-900®, Fusible C-905®, and FPVC®, for Underground Solutions, Inc., Poway, CA, (858) 679-9551. Fusion process shall be as patented by Underground Solutions, Inc., Poway, CA, Patent No. 6,982,051. Owner and engineer are aware of no other supplier of fusible polyvinylchloride pipe that is an equal to this specified pipe supplier and products.

B. The pipe shall be warranted for one year per the pipe supplier's standard terms.

C. In addition to the standard pipe warranty, the fusion services shall be warranted for one year per the fusion service provider's standard terms.

1.4 PRE-CONSTRUCTION SUBMITTALS

A. The following PRODUCT DATA is required from the pipe supplier and/or fusion provider:

- i. Pipe Size
- ii. Dimensionality
- iii. Pressure Class per applicable standard
- iv. Color
- v. Recommended Minimum Bending Radius
- vi. Recommended Maximum Safe Pull Force
- vii. Fusion technician qualification indicating conformance with this specification
- viii. Experience of pipe supplier by years and number of projects
- ix. Warranty information

B. POST-CONSTRUCTION SUBMITTALS

The following AS-RECORDED DATA is required from the contractor and/or Fusion provider to the owner or pipe supplier upon request:

- i. Approved datalogger device reports
- ii. Fusion joint documentation containing the following information:
 - 1. Pipe Size and Thickness
 - 2. Machine Size
 - 3. Fusion Technician Identification
 - 4. Job Identification
 - 5. Fusion Joint Number
 - 6. Fusion, Heating, and Drag Pressure Settings
 - 7. Heat Plate Temperature
 - 8. Time Stamp
 - 9. Heating and Cool Down Time of Fusion
 - 10. Ambient Temperature

PART 2 - PRODUCTS

2.1 FUSIBLE POLYVINYLCHLORIDE NON-PRESSURE PIPE FOR WASTEWATER

- A. Fusible polyvinylchloride pipe shall conform to AWWA C905 for standard dimensionality, as applicable.
- B. Fusible polyvinylchloride pipe shall be extruded with plain ends. The ends shall be square to the pipe and free of any bevel or chamfer. There shall be no bell or gasket of any kind incorporated into the pipe.
- C. Fusible polyvinylchloride pipe shall be manufactured in a standard 40' nominal length, or custom lengths as specified.
- D. Fusible polyvinylchloride pipe shall be green in color for wastewater use.
- E. Pipe shall be marked as follows:
 - 1. Nominal pipe size
 - 2. PVC
 - 3. Dimension Ratio, Standard Dimension Ratio, or Schedule
 - 4. Pressure class or standard pressure rating
 - 5. Standard designation number or pipe type
 - 6. Extrusion production-record code
 - 7. Trademark or trade name
 - 8. Cell Classification 12454 and/or PVC material code 1120 may also be included
- F. Pipe shall be homogeneous throughout and be free of visible cracks, holes, foreign material, blisters, or other visible deleterious faults.

2.2 FUSION JOINTS

Fusible PVC pipe lengths shall be assembled in the field with butt-fused joints. The Contractor shall follow the pipe supplier's written instructions for this procedure. Joint strength shall be equal to the pipe as demonstrated by testing requirements. All fusion joints shall be completed as described in this specification.

PART 3 - EXECUTION

3.1 DELIVERY AND OFF-LOADING

All pipes shall be bundled or packaged in such a manner as to provide adequate protection of the ends during transportation to the site. Any pipe damaged in shipment shall be replaced as directed by the Construction Manager. Each pipe shipment should be inspected prior to unloading to see if the load has shifted or otherwise been damaged. Notify the Construction Manager immediately if more than immaterial damage is found.

Each pipe shipment should be checked for quantity and proper pipe size, color and type. Pipe should be loaded, off-loaded, and otherwise handled in accordance with AWWA M23.

A forklift with chisel forks shall be used to off-load the pipe. The fork chisel should be checked to be sure it is not thicker than the gap between the units of pipe strapped together for shipping and handling purposes. Extend forks to remove each top unit from the truck. When unloading 20' lengths, remove back units first. Do not run forks too far under the units, as fork ends striking adjacent units may cause damage. Insure that the forks are fully engaged. The 30' and 40' lengths are shipped in single length units. Because these are longer, the packages will flex or bend more than the 20' length units. If left bundled in units, unloading can be done with a single forklift so long as it is of sufficient capacity to handle the load. If the sag exceeds recommendation (see table below as to allowable sag), then each piece of pipe should be unloaded individually. The forks should be placed as far apart as possible to provide support to the unit. When unloading individual pieces of pipe, the pipe should be supported at approximately the 1/3 point measured from each end of the pipe.

Sag in Pipe Lengths during Unloading and Moving

Nom. Pipe Size (DIPS)	Segment Height (Sag)	
	30' Length (inches)	40' Length (inches)
	4	13
6	9	16 ½
8	7	12 ½
10	5 ½	10
12	4 ½	8 ½
14	4	7 ½
16	3 ½	6 ½
18	3	5 ½
20	2 ½	5
24	2 ½	4
30	2	3 ½
36	1 ½	3
42	1	2 ½
48	1	2

Nom. Pipe Size (IPS)	Segment Height (Sag)	
	30' Length (inches)	40' Length (inches)
	3	18
4	14	25 ½
6	9 ½	17
8	7 ½	13
10	6	10 ½
12	5	9
14	4 ½	8
16	4	7
18	3 ½	6
20	3	5 ½
24	2 ½	4 ½
30	2	3 ½
36	1 ½	3
42	1 ½	2 ½
48	1	2

Sag is the measurement of the pipe ends relative to the pipe center. With a pipe raised on the forklift, a string line can be pulled from the bottom of one end of the pipe to the bottom of the other end of the pipe. The distance in the center from the string to the bottom of the pipe is the sag.

If a forklift is not available, a spreader bar with fabric straps capable of handling the load should be used. Recommended lift points when using fabric slings are at the point approximately 1/3 of the length measured from each end of the unit.

Off-loading devices such as chains, wire rope, chokers, or other pipe handling implements that may scratch, nick, cut, or gouge the pipe are strictly prohibited. If appropriate unloading equipment is not available, pipe may be unloaded by removing individual pieces. Care should be taken to insure that pipe is not dropped or damaged.

In preparation for pipe installation, placement of pipe should be as close to the fusion area as practical.

3.2 HANDLING AND STORAGE

Any length of pipe showing a crack or which has received a blow that may have caused an incident fracture, even though no such fracture can be seen, shall be marked as rejected and removed at once from the work. Damaged areas, or possible areas of damage may be removed by cutting out and removing the suspected incident fracture area. Limits of the acceptable length of pipe shall be determined by the Construction Manager.

Any scratch or gouge greater than 10% of the wall thickness will be considered significant and can be rejected unless determined acceptable by the Construction Manager.

Pipe lengths should be stored and placed on level ground. Pipe should be stored at the job site in the unit packaging provided by the manufacturer. Caution should be exercised to avoid compression, damage, or deformation to the ends of the pipe. The interior of the pipe, as well as all end surfaces, should be kept free from dirt and foreign matter.

Pipe shall be handled and supported with the use of woven fiber pipe slings or approved equal. Care shall be exercised when handling the pipe to not cut, gouge, scratch or otherwise abrade the piping in any way. Use of hooks, chains, wire rope or any other handling device which creates the opportunity to damage the surface of the pipe is strictly prohibited.

After delivery to the project site, fusible PVC pipe shall be stored at ambient temperature and protected from ultraviolet light degradation. If pipe is to be stored for periods of 6 months or longer, the pipe must be shaded or otherwise shielded from direct sunlight. Covering of the pipe which allows for temperature build-up is strictly prohibited. Pipe should be covered with an opaque material while permitting adequate air circulation above and around the pipe as required to prevent excess heat accumulation.

Racks or dunnage to prevent damage to the bottom of the pipe during storage should support the pipe lengths. Supports should be spaced to prevent pipe bending and deformation. The pipe shall be stored in stacks no higher than that given in the following table:

<u>Pipe Diameter (inches)</u>	<u>Max. No. of Rows Stacked</u>
8 or less	5
12 to 21	4

3.3 FUSION PROCESS

A. GENERAL

1. Fusible PVC pipe will be handled in a safe and non-destructive manner before, during, and after the fusion process and in accordance with this specification and pipe supplier's recommendations.
2. Fusible PVC pipe will be fused by qualified fusion technicians, as documented by the pipe supplier. Training records for qualified fusion technicians shall be available to Construction Manager upon request.
3. Each joint fusion shall be recorded and logged by an electronic monitoring device (data logger) affixed to the fusion machine. Joint data shall be submitted as part of the As-Recorded information, in accordance with this specification.
4. The fusible PVC pipe will be installed in a manner so as not to exceed the recommended bending radius.
5. Where fusible PVC pipe is installed by pulling in tension, the recommended Safe Pulling Force, according to the pipe supplier, will not be exceeded.
6. Only appropriately sized, and outfitted fusion machines that have been approved by the pipe supplier shall be used for the fusion process. Fusion machines must incorporate the following properties, including the following elements:
 - a. HEAT PLATE - Heat plates shall be in good condition with no deep gouges or scratches within the pipe circle being fused. Plates shall be clean and free of any contamination. Heater controls shall properly function, and cord and plug shall be in good condition. The appropriately sized heat plate shall be capable of maintaining a uniform and consistent heat profile and temperature for the size of pipe being fused, per the pipe supplier's recommendations.
 - b. CARRIAGE - Carriage shall travel smoothly with no binding at less than 50 psi. Jaws shall be in good condition with proper inserts for the pipe size being fused. Insert pins shall be installed with no interference to carriage travel.

- c. GENERAL MACHINE - Overview of machine body shall yield no obvious defects, missing parts, or potential safety issues during fusion.
 - d. DATALOGGER - The current version of the pipe supplier's recommended and compatible software shall be used. Protective case shall be utilized for the hand held wireless portion of the unit. Datalogger operations and maintenance manual shall be with the unit at all times. If fusing for extended periods of time, an independent 11 OV power source shall be available to extend battery life.
7. Other equipment specifically required for the fusion process shall include the following:
- a. Pipe rollers shall be used for support of pipe to either side of the machine
 - b. A weather protection canopy that allows full machine motion of the heat plate, fusion assembly and carriage shall be provided for fusion in inclement and/or windy weather.
 - c. Fusion machine operations and maintenance manual shall be kept with the fusion machine at all times.
 - d. Facing blades specifically designed for cutting fusible PVC pipe.

B. JOINT RECORDING

A fusion report is required from the Contractor and/or fusion provider for each fusion joint performed on the project, including joints that were rejected. Each fusion joint shall be recorded and logged by an electronic monitoring device (data logger) connected to the fusion machine. The fusion data logging and joint report shall be generated by software developed specifically for the butt-fusion of thermoplastic pipe. The software shall register and/or record the parameters required by the manufacturer and these specifications. Data not logged by the data logger shall be logged manually and be included in the Fusion Technician's joint report.

Submittals of the Fusion Technician's joint reports are required as requested by the Construction Manager. Specific requirements of the Fusion Technician's joint report shall include:

- 1. Pipe Size and Dimensions
- 2. Machine Size
- 3. Fusion Technician Identification

4. Job Identification Number
5. Fusion Number
6. Fusion, Heating, and Drag Pressure Settings
7. Heat Plate Temperature
8. Time Stamp
9. Heating and Cool Down Time of Fusion
10. Ambient Temperature

3.4 INSTALLATION

A. FUSIBLE PVC LAYOUT

All fusion of the pipe shall occur at surface level. No fusion will be completed in the excavated area or trench. Pipe lengths shall be fused in their entirety and staged prior to installation in the trench. Fused pipe lengths shall be determined by Contractor preference, manufacturer's recommendations and site constraints. The allowable length and width of open trench or excavation shall adhere to all applicable jurisdictional standards and these specifications.

B. FUSIBLE PVC PIPE INSTALLATION

Fused lengths of pipe shall be installed by lowering into the trench or excavation, using approved strapping per these specifications. The lowering operation, once initiated shall proceed until the entire length of the fused section of pipe is installed.

Coordination of lifting equipment shall ensure that the fused pipe does not exceed the bending and buckling limitations of the pipe, per the manufacturer's recommendations. Three pick points shall be utilized at all times and shall be staged per the manufacturer's recommendations. Under no circumstances will the pipe be "dropped" or "rolled" into the trench or excavation.

If the length of the fused pipe is longer than what the available equipment can lower into the trench or excavation at one time, equipment shall be staged so that lowering shall begin at one end of the installation, and proceed along the trench or excavation, so that the entire fused length is installed without exceeding the bending limitations of the fused pipe.

Pipe may also be installed by dragging it into the end of the trench via a sloped section that is constructed so as not to exceed the bending radius of the pipe. Pipe may be pulled by the use of a pull head and winch or piece of construction machinery as recommended by the pipe supplier.

Fused pipe shall be bedded and backfilled per the drawings, these specifications and all applicable jurisdictional standards. Lengths of fused PVC pipe shall be bedded and removed from direct sunlight for a period of at least two minutes per inch-diameter before any connections are made. This period of thermal equalization of the pipe is to assure proper connections may be installed.

D. PVC PIPE CARE

PVC pipe shall be handled with care to minimize the possibility of it being cut, kinked, gouged, or otherwise damaged. The use of cables or hooks will not be permitted.

Sections of PVC pipe damaged, cut, or gouged shall be repaired by cutting out the section of damaged pipe and then rejoining.

3.5 TESTING

A DEFLECTION TESTING

1. After completion, a deflection test be performed.
2. Deflection tests should be conducted using a go/no-go mandrel. The mandrel's outside dimension shall be sized to permit no more than 7.5 percent deflection. The percent deflection shall be established from the base inside diameter of the pipe. If the internal beading of the fused joints for the pipe is not required to be removed, the mandrel shall account for this clearance as well. The mandrel shall be approved by the owner or engineer prior to use. Lines that permit safe entry may allow other deflection test options, such as direct measurements.

- B Air Testing of Fusible polyvinylchloride pipe: Refer to Section 625-Sewer System of the Hawaii Standard Specifications.

END OF SECTION