

USD 320 Wamego-Phase 2-Bid Package 3- Wamego Middle School Science Addition

Addendum 4

Issue Date: 12-14-17

Architect: BBN Architects Inc.

MEP: Orazem & Scalora Engineering, P.A.

Civil Engineer: SMH Consultants

Construction Manager: Coonrod & Associates Construction Co., Inc.

Owner: USD 320 Wamego

The attached documents and / or items below shall hereby become part of the Construction Documents for the referenced project above.

4-1: Add Sheets M401, M402, M403, M405, and M406 for test and balance of existing building.

4-2: Reference Sheet ME101 – Add additional notes to gas service about regulator.

4-3: Reference Sheet ME102 – Add removal and replacement of existing hot water heaters in existing boiler room.

4-4: Reference Sheet M101 – Changed routing of ductwork in two locations.

4-5: Reference Sheet E101 – Reworked panel location to accommodate water softeners and added GFI to two exterior receptacles.

4-6: Reference Sheet E201 – Added some additional GFI breakers in panel.

4-7: Reference Sheet P101 – Water softeners have been added to the project.



4-8: Reference Sheet P102 – Water softeners were added to the project, and the water heater detail was changed. The MXV model number has been changed due to a typo in the previous schedule. Other changes have been made to the plumbing fixture schedule including water heater sizes and type, and information regarding the P-traps on lab sinks.

4-9: Specification Section 115313 Laboratory Fume Hoods – Changed description at beginning of section.

4-10: Specification Section 220000 Plumbing Systems – Add information for water softeners.

4-11: Lithonia lighting and Light lighting control will be accepted as substitutions, however all fixtures and control devices will still be subject to the submittal process and will be reviewed to ensure products meet the requirements of the schedule and specifications.

4-12: Please use the attached bid form when submitting your bid.

END OF ADDENDUM

SECTION 115313 – LABORATORY FUME HOODS AND RELATED PRODUCTS

Labconco Protector Premiere fume hood 100400040-27338 4 ft fume hood with guardian monitor and GFCI duplex factory installed flush mount, with worksurface 9500400, and base stand 3746702.

PART 1 - GENERAL**1.1 SUMMARY****A. Section Includes:**

1. Bench-top High-Performance Laboratory Fume Hoods with Integral Blower.
2. Service fixtures (ie. water, gas, etc.) and electrical service fittings in fume hoods.
3. Piping and wiring within service fittings, light fixtures, switches, and other electrical devices.
4. Fume hood base support.
5. Work Surfaces within fume hoods.
6. Laboratory sinks and cup sinks in fume hoods.
7. Filler panels and ceiling enclosures for fume hoods.

B. Related Sections:

1. Section 238500: Furnishing and installation of exhaust duct work and equipment, and final connection of hoods.
2. Section 260100: Furnishing and installation of electrical utilities and final connections to hoods.

1.2 SCOPE AND CLASSIFICATION

- A. This specification covers the requirements for the purchase of bench-mounted fiberglass-lined laboratory fume hoods with integral blower systems.
- B. Bench-mounted laboratory fume hoods in 4, 5, and 6-foot widths, internal depth of 23.3" and external depth of 31.7" is required.
- C. This specification sets the intent for quality, performance and appearance.

1.3 REFERENCES**A. The laboratory hoods must conform to the following regulations and standards.**

1. SEFA 1-2010, Scientific Equipment and Furniture Association , Recommended Practices for Laboratory Fume Hoods
2. SEFA 8-2010, Recommended Practices for Laboratory Grade Metal Casework, 8.0 Cabinet Surface Finish Tests
3. NFPA 45-2011, National Fire Protection Association, Fire Protection for Laboratories Using Chemicals
4. ASTM E84-09C, ANSI 2.5, NFPA 255, UL 723, UBC 8-1 (42-1), Standard Test method for Surface Burning Characteristics of Building Materials
5. ASHRAE 110-2016, American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Method of Testing Performance of Laboratory Fume Hoods
6. OSHA, Federal Register 29 CFR Part 1910, Occupational Safety & Health Administration, U.S. Department of Labor, Occupational exposures to hazardous chemicals in laboratories.

B. The laboratory fume hoods must carry the ETL listed mark for the following.

1. UL 61010-1 (formerly 3101-1), Underwriters Laboratories Inc., Electrical Equipment for Laboratory Use

2. CAN/CSA C22.2 No. 61010-1, Canadian Standards Association, Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use
3. UL 1805, Underwriters Laboratories Inc., Standard for Laboratory Hoods and Cabinets

1.4 PERFORMANCE REQUIREMENTS

A. General Design Requirements (See Part 2 for details)

1. Fume hoods shall function as ventilated, enclosed workspaces, designed to capture, contain and exhaust fumes, vapors and particulate matter produced or generated within the enclosure.
2. Fume hood shall be factory designed to function as a by-pass, constant volume fume hood.
3. Structure and Materials of construction
 - a. Hoods are of double-wall construction
 - b. Powder-coated, cold rolled steel exterior
 - c. Galvanized steel support members
 - d. One-piece, monolithic, molded polyester resin liner
4. Baffles
 - a. One-piece, monolithic, molded polyester resin
 - b. Moving or adjustable baffles are not acceptable
5. Sash
 - a. Maximum opening is 28".
 - b. Unobstructed viewing height is 37.5".
 - c. Hood incorporates a perforated sash handle to bleed air into the hood chamber directing fume concentrations away from the user's breathing zone.
6. Airfoil:
 - a. Hoods are provided with an air foil across the bottom of the sash area to allow airflow into the hood regardless of user's position.
7. Besides the exhaust blower, no additional blowers are required for specified containment.
8. Access for maintenance is from both the front and exterior sides of the hood, as lift off panels with no tool / fastener removal required.
9. Services:
 - a. Factory install all electrical receptacle, airflow monitor, and switches, as listed in these specifications, equipment schedules or as shown on drawings.
 - b. Plumbing fittings mounted on the fume hood superstructures shall be pre-plumbed per section 2.03.
 - c. Final plumbing and electrical connections are the responsibility of those contractors fulfilling requirements of Divisions 230000 and 260000.
120 V, 20 amp GFCI electrical services and air flow alarm monitor are pre-wired to a single point internal junction box at the top right of the hood (on vapor proof models only).
10. Hoods without service fixtures pass through a 33" opening without disassembly.
11. Exhaust Blower
 - a. Integral blower shall be belt-driven, corrosion resistant with adjustable sheave, molded thermoplastic housing and non-sparking, coated aluminum impeller.

B. Containment

1. The purpose of this section is to set a standard of performance for the bidder's laboratory fume hood before award of contract, and may not necessarily represent the operating conditions of the hoods after installation. Before or after award of contract, owners may require representative witness to said testing at their option, with failure to meet passing criteria as grounds for rejection of the bidder. Test data shall be provided at no cost to the owner.
2. Evaluation of manufacturer's standard product shall take place in manufacturer's test facility meeting the following criteria.

- a. Lab to be located at manufacturer's place of business for the testing of bench-mounted laboratory hoods in accordance with ASHRAE Standard 110.
- b. Room shall accommodate hoods up to 16' wide, while maintaining sufficient area so that a minimum of 15 feet of clear space is available in front of and 5' on both sides of hoods for viewing tests.
- c. The facility's ventilation system shall have adequate heating and air conditioning so that room air temperatures can be maintained within the desired ranges.
- d. One hundred percent non-recirculated air to be both carbon and HEPA filtered to ensure removal of contaminants that could interfere with containment testing before entering the lab.
- e. Make-up air to the test room shall be ceiling-supplied through any combination of multiple diffusers to either minimize adverse airflow, or increase it depending on test objectives.
- f. Exhaust volumes shall be computer controlled and measured via AMCA calibrated orifices and flow station at each exhaust trunk.
- g. Room pressurization must be digitally monitored, and variable depending on test objectives.
- h. All equipment must be properly calibrated.
- i. Qualified personnel familiar with the laboratory and its operation shall be available to perform the test.
- j. Include the following instrumentation and test equipment:
 - 1) Properly calibrated hot wire thermal anemometer capable of measuring air velocities from 10 to 600 ft/minute; correlate with computer data acquisition format to provide simultaneous readings at all points.
 - 2) Theatrical smoke generator or other source of high volume smoke.
 - 3) Smoke tubes or other source of localized smoke.
 - 4) Leakmeter with traceable calibration, calibrated just before test, to indicated concentration of sulfur hexafluoride.
 - 5) Tracer gas: Sulfur hexafluoride supplied from a cylinder with two stage regulator.
 - 6) Adjustable mannequin, 5' 0" to 5'8" in height, with reasonable human proportions, clothed in a smock
 - 7) Inclined manometer with graduations no greater than 0.2 inch of water.
 - 8) Ejector system: Tracer gas ejector built to specific ASHRAE-110 requirements.
 - 9) Critical orifice: Sized to provide tracer gas at four or eight liters per minute at an upstream pressure sufficient to maintain release rate.
 - 10) Data acquisition software to include HoodPro™ and LabMeasurePro™ from Exposure Control Technologies, Inc.
3. Hood shall be tested to ASHRAE 110 modified test method as detailed below.
4. Some fume hoods may use face velocity controls, motorized baffles, integral auxiliary make up, or supply fans. Because all of these devices are subject to failure, containment testing shall show both operational containment and product containment with these systems off.
5. Fume hood sashes shall be placed in their full open position, at least 28" from the work surface, unless noted otherwise.
6. Ambient Temperature: 68 to 74 degrees F
7. **Average Face Velocity:** Face velocity average shall be 60 fpm, as noted below in subsection 8.d, parts 1 and 2, plus or minus 5%.
 - a. An imaginary grid is formed comprised of equal 12" by 12" squares, or smaller, across the face opening of the laboratory hood. Airflow velocity readings are taken at the intersections of these grids with calibrated hot wire anemometer over a twenty second period of time. Probes shall communicate readings to a computer data acquisition package, which will provide an average of each reading over the one-minute period and also an overall average

- upon completion of data acquisition. Face velocity shall be determined by averaging readings at the hood face.
- b. Average face velocity must be achieved without exceeding the CFM noted in part C.
8. **Tracer Gas Detection:** Hood shall achieve a rating of 4.0AM0.00 maximum average and 4.0AM0.01 maximum spike (unless specifically otherwise noted), wherein:
- a. 4.0 = tracer gas release in liters/minute, AM = as manufactured, 0.01 = tracer gas in parts per million (PPM)
 - b. With the ejector body 6" from the rear of the sash plane, the test shall be conducted for each ejector position noted.
 - 1) Left position with ejector 12" from the left interior wall.
 - 2) Center position with ejector equidistant from the sidewalls.
 - 3) Right position with ejector 12" from the right interior wall.
 - c. Install mannequin positioned in front of the hood, centered on the ejector.
 - d. Detector probes shall be placed 3" in front of the sash plane. The test shall be conducted for each detector probe position and corresponding face velocity.
 - 1) Detector probe in the region of the **nose and mouth of the mannequin**. Test with average face velocity of **60 fpm**.
 - 2) With the mannequin height reduced 4", place detector probe in the **chest of the mannequin**, and even with the height of the ejector. Test with average face velocity of **60 fpm**.
 - e. Open tracer gas valve, and collect readings with a computer data acquisition package, which is capable of monitoring and visually recording a minimum of one reading per second for a minimal five minute time period for each position.
 - f. The single control rating of the fume hood shall be the results of the test position yielding the highest average levels of tracer gas in any of the six mannequin/ejector configurations.
 - g. With the ejector and mannequin in the center position, detector probe in the region of the **nose and mouth of the mannequin**, average face velocity of **60 fpm**, tracer gas released, and concentration recorded, open and close the sash in a smooth motion. Test to be repeated three times, with peak values of 0.01 PPM or less.
 - h. With the mannequin removed, the periphery of the hood is traversed by the probe at 1" in front of the hood opening at a rate of 3 inches per second. The hood shall have a maximum perimeter reading of 0.03 PPM or less.
9. Flow Visualization:
- a. Test the operation of the lower air bypass airflow opening and hood periphery by introducing light smoke under the air foil, and around the perimeter of the sash opening. If any smoke that enters the hood reverses directions and escapes from any of these locations, the hood fails this portion of the test and receives no rating.
 - b. Introduce smoke along both walls and the hood floor in a line parallel to the hood face and 6 inches (152 mm) back into the hood. Define air movement toward the face of the hood as reverse airflow and define lack of movement as dead air space. All smoke should be carried to the back of the hood and out.
 - c. Introduce a large volume of smoke at the work surface in the center of the hood, and 6" inside the plane of the sash. Define air movement toward the face of the hood as reverse airflow and define lack of movement as dead air space. All smoke should be carried to the back of the hood and out.
 - d. All data on the above, including instrumentation and equipment, and test conditions shall be provided on a report, including the average face velocities, and a separate graph-type performance curve on all tracer gas tests for all required fume hood widths. Performance test data for a 6' representative hood shall be conducted by an independent testing agency and by

a specific individual certified to perform such tests by the National Environmental Balancing Bureau (NEBB).

- C. Efficiencies
 - 1. The fume hood shall maintain constant volumetric rate (+/- 5 CFM) and static pressure losses (+/- 0.01" H₂O) across all sash positions.
 - 2. The fume hood shall demonstrate a minimization of the volumetric rate of air (CFM) requirement at any given face velocity.
 - 3. The fume hood shall demonstrate a minimization of static pressure loss (inches of H₂O) at any given CFM.
- D. Noise Criterion: The hood shall have a Noise Criterion (NC) rating of less than 50; measured 36" in front of the hood with full open sash, at 100 fpm face velocity. NC is a factor of sound pressure level (dB) and frequency.
- E. Illumination: Shall be a minimum average of 80 foot-candles inside the work area. Work area is defined as the area inside the lined portion of the fume hood, from the face of baffle to sash plane, from interior left to interior right, and from the work surface to a height of 28 inches.
- F. Materials of Construction: Interior and Exterior materials of construction and finishes shall meet the requirements in Part 2 of this specification.

1.5 QUALITY ASSURANCE

- A. Fume hoods shall be designed, including comprehensive engineering analysis, by a qualified, licensed Professional Engineer.
- B. Manufacturer's Qualifications
 - 1. ISO 9001 Certified manufacturing plant and processes.
 - 2. Ten installations of equal or larger size and requirements. Provide contact at each.
 - 3. Only hood manufacturers who have had fume hoods as a principal product for 30 years are considered.
- C. Fume hoods shall be Made in America
 - 1. 95% or more of raw material and component suppliers shall be United States based.
 - 2. Stainless and cold rolled steel used in manufacturing shall be sourced from United States steel mills.
 - 3. Final product must be fabricated and assembled within the United States of America.
 - 4. Owner reserves the right to evaluate Made in America claims for compliance with the Bureau of Consumer Protection.
- D. Supply all equipment in accordance with this specification. Offering a product differing in materials, construction, or performance from this specification requires written approval obtained seven days or more before the proposal deadline.
- E. The owner/architect reserves the right to reject qualified or alternate proposals and to award based on product value where such action assures the owner greater integrity of product.
- F. Manufacturer's warranty against defects in material or workmanship on its fume hoods will be for 1 year from date of installation or 2 years from date of purchase, whichever is sooner, and includes replacement of parts (except lamps) and labor.

1.6 SUBMITTALS

- A. Action Submittals
 - 1. Laboratory hood specification sheets and product manuals shall be submitted by the hood manufacturer upon request, and include safe and proper operation and maintenance information.
 - 2. Shop Drawings: Include plans, elevations, sections, and details.

- a. Indicate details for anchoring fume hoods to permanent building construction including locations of blocking and other supports.
 - b. Indicate locations and types of service fittings together with associated service supply connection required.
 - c. Indicate duct connections, electrical connections, and locations of access panels.
 - d. Include roughing-in information for mechanical, plumbing, and electrical connections.
 - e. Provide face opening, volumetric rates, and static pressure drop data.
3. Submit a document detailing the information supplied on the Hood Safety Practices Label to verify compliance to specifications.
- B. Informational Submittals
1. Product Test Reports: Showing compliance with specified performance requirements, including NEBB representative test report as defined previously.
 2. Independent validation:
 - a. Written verification that the laboratory fume hoods carry the ETL listed mark for the following.
 - 1) UL 61010-1 (formerly 3101-1), Underwriters Laboratories Inc., Electrical Equipment for Laboratory Use
 - 2) CAN/CSA C22.2 No. 61010-1, Canadian Standards Association, Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use
 - 3) UL 1805, Underwriters Laboratories Inc., Standard for Laboratory Hoods and Cabinets
 - b. Written verification that 230 volt model fume hoods carry the CE conformity marking as required by the Council of European Communities.
 - c. Written verification from an outside testing agency confirming coating compliance to SEFA 8-2010, Recommended Practices for Laboratory Grade Metal Casework, 8.0 Cabinet Surface Finish Tests
 3. Documentation of ISO 9001 Certified manufacturing plant and processes.
 4. List of five installations (of equal or larger size and requirements) is available upon request. Provide contact at each.
 5. Declaration of Made in America. Owner reserves the right to evaluate Made in America claims for compliance with the Bureau of Consumer Protection.
- C. Material Submittals
1. Samples for Verification: of the hood exterior wall material, interior liner and baffle material, epoxy work surface material, and color selection chips are available from the hood manufacturer upon request.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Protect finished surfaces during handling and installation with protective covering of polyethylene film or another suitable material.
- B. Schedule delivery of equipment so that spaces are sufficiently complete that equipment can be installed immediately following delivery.

1.8 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install fume hoods until building is enclosed, wet work and utility roughing-in are complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturer: Labconco Corporation, 8811 Prospect Avenue, Kansas City, Missouri 64132
- B. Basis-of-Design Product: Labconco Protector Premier; for use with integral blower

2.2 MATERIALS

- A. Hood Interior Liner and Baffle
 - 1. Liner material must comply with UL 1805, and be listed within NRTL test report as proof of compliance.
 - 2. General Material Properties
 - a. Nonflammable, corrosion and chemical-resistant
 - b. Fiberglass reinforced polyester resin
 - c. Minimum thickness is 3/16"
 - d. Smooth, white finish
 - 3. Method of Construction
 - a. Liner shall be one continuous molded component, and of monolithic construction, including the left and right side walls, rear, ceiling, and duct collar. Liners that are bonded together, do not include the duct collar within the continuous structure, or are of panelized construction are not acceptable.
 - 4. Flame and Smoke Characteristics
 - a. Flame retardant, self-extinguishing, with a flame spread rating of 25 or less in accordance with ASTM-E84
 - 5. Chemical Resistance
 - a. Splash and Spill Resistance:
 - 1) Suspend sample panel in a vertical plane
 - 2) Apply five drops of each reagent listed with an eyedropper
 - 3) Apply liquid reagents at top of panel and allow to flow down full panel height
 - b. Fume Resistance:
 - 1) Place 25 milliliters of reagent into 100 milliliters beakers and position panel over beaker tops in the proper sequence. Ensure beaker pouring lip permits air to enter the interior atmosphere.
 - 2) After 24 hours remove panel, flush with water, clean with detergent, rinse, wipe dry and evaluate
 - c. Evaluation ratings: Change in surface finish and function shall be described by the following ratings
 - 1) E: Excellent for intended service with expected long and economic life.
 - 2) G: Some staining may result with prolonged usage. Satisfactory for limited service. Tests under actual conditions suggested.
 - 3) F: Surface deterioration may be experienced with prolonged usage. Test under actual conditions.
 - 4) NR: Not Recommended
 - d. Required minimum results for each reagent (Reagent, Rating)

Acetic Acid	G
Acrylic Acid	G
Aluminum Sulfate	E
Ammonium Bicarbonate	E

Acetone	G
Aluminum Fluoride	E
Ammonia	E
Ammonium Carbonate	G

Ammonium Chloride	E	Ammonium Fluoride	F
Ammonium Hydroxide	G	Ammonium Nitrate	E
Ammonium Persulfate	E	Ammonium Sulfate	E
Ammonium Thiocyanate	E	Amyl Acetate	E
Amyl Alcohol	E	Aniline	F
Aniline Sulfate	E	Antimony Pentachloride	E
Antimony Trichloride	E	Aqua Regia (HNO ₃ -HCl) Aromatic Hydrocarbon	E
Arsenious Acid	E	Barium Carbonate	E
Barium Chloride	E	Barium Hydroxide	F
Benzaldehyde	F	Benzene	G
Benzene Sulfonic Acid	E	Benzoic Acid	E
Bleach - Hypochlorite	E	Bromine, liquid	F
Butyl Acetate	E	Butyl Alcohol E	E
Butyric Acid	E	Calcium Chlorate	E
Calcium Chloride	E	Calcium Hydroxide	E
Calcium Hypochlorite	E	Calcium Sulfate	E
Caprylic Acid(n-Octanoic Acid)	E	Carbon Dioxide	E
Carbon Disulfide Vapor	F	Hydrocyanic Acid	E
Hydrofluoric Acid	G	Hydrofluorosilic Acid	F
Hydrogen	E	Hydrogen Chloride, Anhydrous	E
Hydrogen Fluoride, Wet	F	Hydrogen Peroxide	E
Hydrogen Sulfide	E	Hypochlorous Acid	E
Kerosene	E	Lactic Acid	E
Lead Acetate	E	Lime Slurry	E
Linseed Oil	E	Lithium Chloride	E
Magnesium Carbonate	E	Magnesium Chloride	E
Magnesium Sulfate	E	Malic Acid	E
Mercaptan, Organic, H ₂ S, H ₂ O, Butanol	E	Mercuric Chloride	E
Mercurous Chloride	E	Mercury	E
Alcohol	E	Methyl Chloride	F
Methyl Ethyl Ketone	G	Methyl Isobutyl Ketone	E
Moisture	E	Naptha	E
Napthalene	E	Nickel Chloride	E
Nickel Nitrate	E	Nickel Sulfate	E
Nitric Acid	E	Nitrobenzene	G
Nitrogen	E	Nitrous Acid	E
Oleic Acid	E	Oxalic Acid	E
Perchloric Acid	NR	Phenol	F
Phosphate Salts	E	Phosphonitrilic Chloride, Cl ₂ , HCl, benzene, H ₂ O Vapors	E
Phosphoric Acid	E	Phosphoric Vapor & Condensate	E
Phosphoric: Nitric Vapor	E	Phosphoric: HCl, Saturated with phosphorous	E
Phosphoric: HCl, Sat. with	E	Phosphorous Oxychloride, CHl, Cl ₂ , H ₂ O Vapors	E

Cl2	
Phosphorous Trichloride, HCl, Cl2, H2O Vapors	E
Phthalic Anhydride	E
Potassium Bicarbonate	E
Potassium Chloride	E
Potassium Ferrocyanide	E
Potassium Nitrate	E
Potassium Persulfate	E
Propylene Glycol	E
Pyridine	F
Sodium Acetate	G
Sodium Bicarbonate	E
Sodium Borate	E
Sodium Carbonate	E
Sodium Cyanide	F
Sodium Hydroxide	G
Sodium Nitrate	E
Sodium Sulfide	E
Sodium Tetraborate	E
Stannic Chloride	E
Stearic Acid	E
Sulfite Liquors	E
Sulfur Chloride	E
Sulfonated Aliphatics, HCl, H2S, Butanol vapors	E
Sulfur Dioxide: SO3 wet vapor	F
Sulfuric Acid	G
Sulfuric + Chromic	G
Sulfuric-Nitric Acids	G
Sulfurous Acid	G
Tartaric Acid	E
Toluene	G
Trichloroacetic Acid	E
Trichloroethylene, HCl, Cl2, H2O vapors	G
Trisodium Phosphate	F
Water	E
Zinc Sulfate	E

Phosphorous Sesquisulfide	E
Picric Acid in Alcohol	E
Potassium Carbonate	E
Potassium Dichromate	E
Potassium Hydroxide	F
Potassium Permanganate	G
Potassium Sulfate	E
PVA Emulsion	E
Silver Nitrate	E
Benzoate	E
Sodium Bisulfate	E
Sodium Bromide	E
Sodium Chloride	E
Sodium Ferricyanide	E
Sodium Hypochlorite	E
Sodium Sulfate	E
Sodium Sulfite	E
Sodium Xylene Sulfonate	E
Stannous Chloride	E
Styrene	G
Sulfur, molten, vapors	E
Sulfur Dioxide	E
Sulfur Dioxide Saturated H2O; trace HF, H2SO4, H2S, F2	E
Sulfur Trioxide	E
Sulfuric Acid + Dichromate	G
Sulfuric Acid vapor	G
Sulfuric - HCl	G
Tannic Acid	E
Tetrapotassium Pyrophosphate	E
Toluene Diisocyanate	E
Trichloroethylene	G
Trichlorophenol	F
Waste, Organic, H2O, HCl, Cl2, vapors	E
Zinc Chloride	E

B. Sheet Steel

1. Side panels and access panels 20-gauge (or heavier) sheet steel.
2. Hood corner posts are 16-gauge sheet steel.
3. Ceiling enclosure panels are 18 gauge sheet steel.
4. Cold-rolled, commercial steel (CS) sheet, complying with ASTM A 1008/A 1008M.

C. Chemical Resistant Finish

1. General: Prepare, treat, and finish welded assemblies after welding. Prepare, treat, and finish components that are to be assembled with mechanical fasteners before assembling.
2. Chemical and Physical Resistance of Finish System: Finish complies with acceptance levels of cabinet surface finish tests in SEFA 8. Third party validation required.
3. Powder-coat process required. Paint processes that release Volatile Organic Compounds (VOC) are not acceptable
4. Color for Fume Hood Finish:
 - a. Glacier White

D. Safety Glass

1. Tempered
 - a. Clarity and temper test to be as specified in latest edition of Glass Tempering Association, *Engineering Standards Manual*, Section 8.1.
 - b. Surface and interior visible quality to be as specified per ASTM C 1036, *Standard Specification for Flat Glass*, Table 4, Quality level Q3.

2.3 CONSTRUCTION

A. Superstructure:

1. Self-supporting, rigid structural assembly, to support inner wall consisting of fume hood liner and outer wall of sheet metal exterior.
2. Fabricated from galvanized steel.
3. Space shall accommodate fume hood wiring and plumbing components for service fixtures.
4. Access to fixture valves concealed in wall provided by exterior removable access panels or through removable access panels on the front posts.

B. Exterior

1. Fabricate from steel sheet with component parts screwed together.
2. Apply chemical-resistant finish to interior and exterior surfaces of component parts before assembly.
3. Interchangeable side panels shall lift off without the use of tools to allow access to plumbing lines, service fittings, electrical wiring, counterbalance sash weights, and light fixtures. Exposed fasteners or hardware, and Velcro type fasteners, are not acceptable.
4. Corner posts
 - a. Pre-punched and plugged to accommodate up to 4 service fixtures per side
 - b. All services are accessible from the front of the hood.
 - c. Aerodynamic shape
 - d. Accommodate two electrical duplexes per side.
 - e. Right hand corner post includes electrical switches and pre-cut for Airflow monitor installation.
 - f. Un-used penetrations shall be plugged.
5. Top and sides of face opening to provide an aerodynamic shape to ensure smooth, even flow of air into fume hood.
6. Panel above header shall be removable without the use of tools to allow access to mechanical connection, electrical wiring, counterbalance sash weights, and light fixtures. Exposed fasteners or hardware, and "hook-and-loop" type fasteners, are not acceptable.

C. Dimensions

1. Overall exterior dimensions are as follows:
 - a. 4 foot nominal width: 48" w x 66" h x 31.7"d

- b. 5 foot nominal width: 60" w x 66" h x 31.7"d
- c. 6 foot nominal width: 72" w x 66" h x 31.7"d
- 2. Overall interior dimensions are as follows:
 - a. 4 foot nominal width: 38.1" w x 48" h x 23.3"d
 - b. 5 foot nominal width: 50.1" w x 48" h x 23.3"d
 - c. 6 foot nominal width: 62.1" w x 48" h x 23.3"d

D. Hood Liner

- 1. Adhere interior liner components to superstructure.
- 2. Stainless steel fasteners shall be used on the interior ceiling for structural integrity.
- 3. Fasteners exposed to chemical environment are not acceptable.
- 4. Punch fume hood lining side panels to receive four service fittings, for use with remote controls, per side. Provide removable plug buttons for holes not used for indicated fittings.

E. Hood Baffle

- 1. Baffle system shall be designed to capture a wide range of gaseous densities without adjustment or moving components.
- 2. Shall provide a continuous horizontal slot at the work surface, vertical openings running the interior height of the hood on the left and right sides, and an opening at the ceiling running left to right.
- 3. The baffle system shall be constructed with the same material as the fume hood liner.
- 4. The baffles shall be removable for cleaning.
- 5. Exposed components to be non-metallic. Metal components exposed to chemical environment are not acceptable.
- 6. Moving parts or adjustment of any kind is not acceptable.

F. Exhaust Connection

- 1. Hood shall have a continuous component of fume hood liner, fiberglass reinforced polyester resin exhaust collar to connect with blower inlet.
- 2. Outlet of blower shall have a PVC adaptor for a round duct connection. 4-foot hood shall have a 10.8" ID duct connection, 5-foot and 6-foot hoods shall have a 12.8" ID duct connection.
- 3. Integral blower shall be capable of overcoming a maximum external static pressure and equivalent resistance in feet of straight duct per the chart below:

Hood Width	Max external static pressure in inches H2O	Duct Connection diameter	Equivalent Resistance in feet of straight duct
4-foot hoods	0.17 inches	10 inch	75 feet
5-foot hoods	0.12 inches	12 inch	75 feet
6-foot hoods	0.17 inches	12 inch	70 feet

G. Integral Blower

- 1. Hood shall have an integral blower mounted directly to the top of the fume hood
- 2. Blower housing shall be special purpose rigid PVC sheet extrusion compound designated for reduced smoke emission properties
- 3. Impeller wheel shall be a forward curved centrifugal aluminum wheel with heresite coating
- 4. The wheel and fan inlet shall be matched and shall have precise running tolerances for maximum performance and operating efficiency
- 5. Blower motor shall be belt-driven with an adjustable sheave
- 6. Blower motor shall be 1/3 HP or 1/2 HP based upon the following chart:

1/3 HP	100400040, 100400042, 100400060, 100400061
1/2 HP	100400050, 100400051, 100400070*, 100400071*, 100500040, 100500042, 100500050, 100500051, 100500060, 100500061, 100500070*, 100500071*,

100600040, 100600042, 100600050, 100600051, 100600060, 100600061, 100600070*, 100600071*

*Explosion Proof model

H. Airfoil

1. Cold Rolled Steel with Chemical-Resistant Finish.
2. Airfoil shall have an aerodynamic radius to sweep the air into the hood with minimal turbulence. Airfoil directs airflow across work top to remove heavier-than-air gases.
3. Must have 5 rows of perforations to allow the air to bypass underneath and through the foil and sweep across the work surface to prevent any back flow of fumes escaping from the front of the hood opening. This airflow continues even if blocked by the presence of the operator.
4. Foil must extend back under the sash to prevent closure of the lower by-pass opening when the sash is in the fully closed position, directly on top of the airfoil.

I. Sash Assembly

1. Glass: Fully tempered safety glass with unobstructed, side-to-side view of fume hood interior and service fixture connections.
2. Dimensions: The full sash opening height is 28", the total unobstructed viewing height is 37.5" measured from the work surface.
3. Sash Tracks: Steel with Chemical Resistant Finish. Shall include bump stops for opening and closing.
4. Sash Handle: extruded aluminum with Chemical Resistant Finish. Sash handle includes a perforated air passage directly atop the handle to bleed air into the hood chamber and direct chemical fumes away from the user's breathing zone. The handle is ergonomic in design and is easy to grasp when operating
5. Sash guides: Corrosion resistant extruded poly-vinyl chloride.
6. Sash System
 - a. Vertical Sash (Cable and Pulley)
 - 1) Hoods have a single vertical sash counterbalanced by a single weight.
 - 2) Sash and weight to be connected via aircraft cable meeting MIL-W-83420 Military Specification.
 - 3) Rear pulleys shall be connected via timing shaft to prevent sash tilting and permit one finger operation at any point along full width sash handle. Maximum 7 pounds pull required to raise or lower sash throughout its full length of travel.
 - 4) Design system to hold sash at any position without creep and to prevent sash drop in the event of cable failure.
 - 5) Include a defeatable, and automatically resetting sash stop positioned for an 18" sash height.

J. Electrical Components

1. Lighting
 - a. Provide UL Listed, high-efficiency, quick-start, T8 fluorescent lighting systems, including bulbs.
 - 1) 4 Foot Hoods - 2 each, 3-foot 25-watt fluorescent lamps
 - 2) 5 Foot Hoods - 2 each, 4-foot 32-watt fluorescent lamps
 - 3) 6 Foot Hoods - 2 each, 4-foot 32-watt fluorescent lamps
 - b. Vapor-Proof: all electrical components shall be outside of the contaminated air space. Lighting shall be located behind a laminated safety glass shield, sealed to the top of the hood liner.
 - c. The fluorescent light assemblies shall be serviceable from outside the fume hood cavity, without the use of tools.

- d. Light switch to be included on the lower right corner post, at heights compliant with the Americans with Disabilities Act (ADA).
2. Blower Switch
 - a. Hoods shall be provided with blower switch, on the lower right corner post, at heights compliant with the Americans with Disabilities Act (ADA).
3. Electrical Receptacles
 - a. The hoods shall accommodate up to four (two per corner post) electrical receptacles as indicated in schedule or drawings. Options to include:
 - 1) 115 volt, 60 Hz, three-wire polarized and grounded electrical duplex, with Ground Fault Circuit Interruption (GFCI)
 - b. Receptacles shall be individually wired to field wiring box, and each rated at 20 Amperes.
 - c. Cover plates shall be acid resistant thermoplastic.
4. Wiring
 - a. Every electrical component shall be individually wired to a single point internal field wiring box (including individual duplexes/receptacles).
 - b. Field wiring box to be 7" x 4" x 2.5", grounded, and have (12) 7/8" diameter knock out penetrations.
 - c. Final wiring and circuit dedication is to be by others.
 - d. Each receptacle circuit shall accommodate being wired to a dedicated building circuit rated at 20A, or the receptacles ganged together on a building circuit with the total load not exceeding 20 Amperes.
5. Fume hood to have third party validation of compliance to UL 1805 and UL 61010-1 by a Nationally Recognized Testing Laboratory (NRTL)

K. By-Pass Opening

1. The size of the by-pass opening is controlled by sash position for use with a constant volume mechanical system. The hood shall not have a change in static pressure or exhaust volume across all sash positions.

L. Hood Safety Practices Label: Corrosion resistant plate attached to the corner post of the fume hood with the following Hood Safety Practices:

1. For use with substances that produce hazardous levels of airborne chemicals: gas, fumes, vapors, dust
2. Do not put your head in the hood.
3. Minimize drafts and sudden movements in front of the hood.
4. Work a minimum of six inches inside the hood.
5. Elevate equipment above the work surface.
6. Keep sill and baffle unobstructed.
7. Do not use the hood for storage.
8. Adjust the sash to smallest opening possible when in use.
9. Close sash when unattended.
10. Do not remove any of the hood components.
11. Do not place flammable solvents near heat, flame or sparks.
12. Do not evaporate large amounts of flammable liquids.
13. Wipe up spills immediately.
14. Routinely validate airflow.
15. If the ventilation system malfunctions, or airflow alarm indicates unsafe condition, close sash and discontinue hood operation immediately-call for help.
16. Do not use with Biohazards or Perchloric Acid

M. Fume Hood Accessories

1. Tissue Screen: Provide epoxy-coated, stainless-steel screen at bottom baffle opening to prevent paper from being drawn into the exhaust plenum behind baffles.
2. Rear Finish Panel: Shall be the same materials and coating as the hood exterior.
3. Ceiling Enclosure Panels:
 - a. Provide filler panels matching fume hood exterior to enclose space above fume hoods at front and sides of fume hoods and extending from tops of fume hoods to ceiling.
 - b. Exposed fasteners are not acceptable.
 - c. Height adjustment to be within the following ranges as specified in the schedule.
 - 1) 11.0 - 14.0"
 - 2) 14.0 - 18.6"
 - 3) 18.6 - 24.4"
4. Distillation Grid: Include stainless steel rods and connectors for field installation, and factory drilled liner.
5. Fire Suppression System: An ABC dry powder fire suppression system, with 165 degree Fahrenheit fusible link, shall be factory supplied and prepped, and field installed through the ceiling of the fume hood.
6. Face Velocity Monitor/Alarm
 - a. Audio/Visual Airflow Monitor
 - 1) Provide audible and visual alarm in the event of an unsafe face velocity.
 - 2) Alarm must sit flush with the fume hood corner post.
 - 3) Based on a thermally compensated thermistor in the alarm module, and air passing through a separate airstream into the hood interior.
 - 4) LED lights display red for alarm and green for normal operation.
 - 5) Must include external alarm and night setback functions.
 - 6) Alarm mute shall be accessible from the front of the monitor; visual alarm must remain activated until alarm condition is corrected.
 - 7) UL Listed electrical components
 - 8) Calibration shall be through a front located potentiometer.
 - 9) Calibration is the responsibility of the owner, following a complete balancing of the mechanical system, and concurrently with As-Installed testing.

N. Work Surface

1. 1.25" thick, molded from solid modified epoxy resin, with smooth, non-specular, black finish.
2. One inch radius front edge for optimal fume hood performance.
3. 3/8" dished area to match the fume hood interior work space and form a water tight pan for spill containment.
4. Include a 2.5" diameter hole on each side for service pass-through and piping. Hole to be covered by hood superstructure upon installation.
5. Include two 1.5" diameter penetrations to accommodate base cabinet venting. Holes to be located outside of dished area and under the fume hood baffles. Include plugs.
6. Physical Properties:
 - a. Flexural Strength: Not less than 10,000 psi (70 MPa).
 - b. Modulus of Elasticity: Not less than 2,000,000 psi (1400 MPa).
 - c. Hardness (Rockwell M): Not less than 100.
 - d. Water Absorption (24 Hours): Not more than 0.02 percent.
 - e. Heat Distortion Point: Not less than 260 deg F (127 deg C).
 - f. Flame-Spread Index: 25 or less per ASTM E 84.
 - 1) 1

O. Supporting Base Cabinets

1. Base cabinets shall be in depths of 22", widths, quantities, and types called out in the equipment schedule, and meet the requirements of this specification.
2. Construction requirements for all cabinets
 - a. Exterior construction is 18 gauge (or heavier) cold rolled sheet steel with Chemical Resistant Finish.
 - b. Hinges are 10 gauge (or heavier) plate with self-clinching pilot pin. Knuckle, bullet, or piano type hinges are not accepted.
 - c. The rear panel will feature a 12" x 8" removable plumbing access panel.
 - d. Units 24" wide or less have only one door.
 - e. Each cabinet includes four leveling feet.
 - f. Capable of supporting up to 800 pounds.
 - g. An 8" filler panel is required to increase the cabinet depth to 30".
3. Standard Storage
 - a. Overall exterior dimensions:
 - 1) 48" 48" w x 22" d x 35.5"-36.75"
 - 2) 36" 36" w x 22" d x 35.5"-36.75"
 - 3) 30" 30" w x 22" d x 35.5"-36.75"
 - 4) 24" 24" w x 22" d x 35.5"-36.75" h or 31.5"-32.75" for ADA cabinet
 - 5) 18" 18" w x 22" d x 35.5"-36.75" h or 31.5"-32.75" for ADA cabinet
 - 6) 12" 12" w x 22" d x 35.5"-36.75" h or 31.5"-32.75" for ADA cabinet
 - b. Flush pull handles are ABS, low gloss black.
4. Acid Storage
 - a. Overall exterior dimensions:
 - 1) 48" 48" w x 22" d x 35.5"-36.75"
 - 2) 36" 36" w x 22" d x 35.5"-36.75"
 - 3) 30" 30" w x 22" d x 35.5"-36.75"
 - 4) 24" 24" w x 22" d x 35.5"-36.75" h or 31.5"-32.75" for ADA cabinet
 - 5) 18" 18" w x 22" d x 35.5"-36.75" h or 31.5"-32.75" for ADA cabinet
 - b. Completely lined with a polyethylene corrosion resistant liner. The liner is 3/16" thick, with a vacuum formed PVC liner pan at the bottom to contain spills. Each door has a 3/16" sheet polyethylene liner.
 - c. The cabinet is labeled: "ACID".
 - d. Flush pull handles are ABS, low gloss black.
 - e. Each cabinet is vented into the fume hood with a 1-1/2" vent pipe. It should provide a positive airflow directly into the fume hood exhaust system.
 - f. Supply an epoxy coated steel shelf with PVC liner pan if indicated in the schedule.
 - g. Acid cabinets with louvers are not acceptable
5. Solvent Storage
 - a. Overall exterior dimensions:
 - 1) 48" 48" w x 22" d x 35.5"-36.75"
 - 2) 36" 36" w x 22" d x 35.5"-36.75"
 - 3) 30" 30" w x 22" d x 35.5"-36.75"
 - 4) 24" 24" w x 22" d x 35.5"-36.75" h or 31.5"-32.75" for ADA cabinet
 - b. Solvent storage cabinets are specifically designed for the storage of flammable and combustible liquids.
 - c. Solvent Storage Cabinet must be compliant with NFPA 30 "Flammability and Combustible Liquids Code."
 - d. Cabinets 30" wide and greater shall be tested and approved by Factory Mutual to meet Factory Mutual Approval Standard 6050.

- e. The bottoms, top, sides, and doors are fabricated of 18 gauge steel and are all double panel construction with a 1-1/2" air space between panels.
- f. All joints are welded or screwed to provide a rigid enclosure. A 2" deep liquid tight pan that covers the entire bottom of the cabinet is furnished to contain liquid leaks and spills.
- g. A full-depth, 18 gauge steel, adjustable shelf is also provided. Shelves are sealed leak tight.
- h. Two diametrically opposed flame arrestor vents with spark screens are provided in the back of the cabinet, as well as a grounding screw.
- i. The cabinet has an interior finish same as the exterior.
- j. The cabinet is labeled: "FLAMMABLE - KEEP FIRE AWAY".
- k. The right hand door shall have a three point latching device.
- l. Door handles include a key lock. Solvent storage handles are locking lever handles with bright chrome finish.
- m. If noted on the schedule, self-closing/self-latching models shall be provided with a fusible-link feature to ensure the doors will close if the temperature outside the cabinet exceeds 165 degrees Fahrenheit. The doors are synchronized so that both doors will fully close.

PART 3 - EXECUTION**3.1 EXAMINATION**

- A. Examine areas, with installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of fume hoods.
- B. Coordinate with other trades for the proper and correct installation of plumbing and electrical rough-in and for rough opening dimensions required for the installation of the hood.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install fume hoods according to shop drawings and manufacturer's written instructions.
- B. Install level, plumb, and true; shim as required, using concealed shims, and securely anchor to building and adjacent laboratory casework.
- C. Securely attach access panels, but provide for easy removal and secure reattachment. Where fume hoods abut other finished work, apply filler strips and scribe for accurate fit, with fasteners concealed where practical.
- D. Neighboring splash blocks shall not be attached directly to the hood.
- E. Install according to standards required by authority having jurisdiction.
- F. Sequence installations to ensure utility connections are achieved in an orderly and expeditious manner.
- G. Touch up minor damaged surfaces caused by installation. Replace damaged components as directed by Architect.

3.3 FIELD QUALITY CONTROL

- A. NFPA 45 requires that fume hoods be field tested when installed.
- B. Field test installed fume hoods according to ASHRAE 110 to verify compliance with performance requirements.
 - 1. Adjust fume hoods, hood exhaust fans, building's HVAC system, and make other corrections until tested hoods perform as specified in fume hood schedule.
 - 2. After making corrections, retest fume hoods that failed to perform as specified.

3.4 ADJUSTING AND CLEANING

- A. Adjust moving parts for smooth, near silent, accurate sash operation with one hand. Adjust sashes for uniform contact of rubber bumpers. Verify that counterbalances operate without interference.
- B. Clean finished surfaces, including both sides of glass; touch up as required; and remove or refinish damaged or soiled areas to match original factory finish, as approved by Architect.
- C. Clean adjacent construction and surfaces that may have been soiled in the course of installation of work in this section.
- D. Provide all necessary protective measures to prevent exposure of equipment and surfaces from exposure to other construction activity.
- E. Advise contractor of procedures and precautions for protection of material and installed equipment and casework from damage by work of other trades.

SECTION 22 00 00 - PLUMBING**PART 1 - GENERAL****1.1 WORK INCLUDED:**

- A. This Section of the Specification includes the furnishing and installation of complete drainage, water supply, plumbing fixtures and other equipment as described herein and as indicated on the Drawings.

1.2 SUBMITTALS:

- A. Submit complete printed catalog and descriptive data for each major piece of equipment, clearly indicating exactly what features, options and accessories are being provided.
- B. See Section 23 01 00.

1.3 SEWER AND WATER CONNECTIONS:

- A. Connections to on site water, sewer and gas services shall be in accordance with the requirements of the 2012 International Plumbing Code and the respective Utility Company. Pay all associated tap and meter fees and costs.
- B. Before any new sewer work is done, the Contractor shall uncover the sewer line where connection is to be made and shall determine the actual elevation. If the actual elevation of the sewer at the point of connection is such that the new drainage line cannot be installed with the required slope to the new fixtures, the matter shall be referred to the Architect as soon as possible.

PART 2 - PRODUCTS**2.1 DRAINAGE AND VENT PIPING:**

- A. Hub-and-Spigot Pipe: Hub-and-spigot cast-iron pipe not larger than 15-inch size shall be service weight ASTM A74, coated. All changes in pipe size of soil, waste, and drain lines shall be made with reduction fittings or reducers. Changes in direction, where space permits, shall be made with long sweep bends, Y-fittings and 1/8 or 1/16-bends, or combination Y and 1/8-bends. Sanitary tee branches and 1/4-bends may be used for connections of branch lines to fixtures and on vertical runs of pipe. Hub-and-spigot cast-iron pipe larger than 15-inch size shall be Type II or III; Grade C, cast-iron pressure pipe.
 - 1. Gasketed Joints: Molded neoprene elastic compression type gaskets. Gaskets shall conform to ASTM C 564, and pipe, fittings, and gaskets shall bear the symbol of the Cast Iron Soil Pipe Institute. Pipe and fittings shall be manufactured with the spigot ends plain and beveled, and the bells shall be modified to receive the gaskets. Service weight soil pipe and fittings shall be joined with service weight gaskets. Service weight gaskets shall be clearly designated and identified. A lubricant shall be used in making the joints. When the joint is completed, a tight seal shall be formed between the external face of the pipe and the internal face of the bell. Gaskets shall be capable of making and maintaining a tight seal with a deflection not to exceed 5 degrees.

Deflection of pipe will not be allowed to avoid the use of a fitting. Joints shall be assembled by the tools and as recommended by the pipe, fittings, and gasket manufacturers.

- B. "NO-Hub" Cast-Iron Pipe: "No-Hub" cast-iron soil pipe and fittings shall conform to Cast Iron Soil Pipe Institute Specification 301 and ASTM A-888. Pipe, fittings, and couplings shall bear the symbol of the Cast Iron Soil Pipe Institute. "No-Hub" piping systems shall be installed in accordance with the manufacturer's recommendations.
- C. Threaded Steel Pipe: Threaded steel pipe shall be galvanized, Schedule 40 conforming to ASTM A 53.
- D. Threaded Copper Nickel Steel Pipe: Threaded copper nickel steel pipe shall conform to ASTM A 714, Grade V, galvanized.
- E. Threaded Cast Iron Pipe: Threaded cast iron pipe shall comply with ASTM A-74.
1. Fittings on threaded ferrous soil, waste, and drain piping, including storm drainage piping and couplings on pipes 6- inches and smaller, shall comply with ANSI B 16.12. Short tee branches and short turn elbows may, except for wall hung water closets, be used for connections of branch lines to fixture and on vertical runs of pipe; long turn fittings shall be used in all other locations where space permits. Fittings may be galvanized or black, coated or uncoated. Couplings on pipes 8- inches and larger shall be standard weight steel, zinc-coated (galvanized) and need not be recessed; steel couplings shall not be used on piping 6- inches and smaller.
 2. Fittings on threaded ferrous vent pipes shall comply with ANSI B 16.3, B16.4, or B 16.12. Couplings shall be as specified above for soil, waste, and drain piping.
- F. Copper Tubing: Copper tubings shall be Type M, in accordance with ASTM B-88, or Type DWV in accordance with ASTM B 306. Ends of tubing shall be cut square and shall be reamed before being made up. Tubing ends shall enter the full depth of the fitting recesses without binding.
1. Fittings for copper tubing shall be solder type, recessed drainage pattern, of wrought copper or cast brass. Recesses shall be smooth and correctly sized to provide proper clearance over the tubing. Solder shall be composition 95/5 tin-antimony or Brigit. Flux shall be noncorrosive. Tubing ends and fitting recesses shall be thoroughly cleaned. Solder shall penetrate fully and shall fill the joint completely.
- G. Plastic Pipe and Fittings:
1. Schedule 40 PVC, ASTM D-1784 with solvent welded joints.
 2. Schedule 40 chlorinated polyvinyl chloride (CPVC) Type IV Grade I compounds with a minimum cell classification of 23447. Pipe and Fittings shall conform to ASTM F 2618. One-Step solvent cement shall be specially formulated for chemical waste applications and conform to ASTM F493. All pipe, fittings and cement shall be supplied as a system by a single manufacturer and shall be certified by NSF International for use in corrosive waste drainage systems and shall bear the mark "NSF-cw". Flame spread rating not over 25 and a smoke developed rating not higher than 50 per ULC S102.2.
 - a. Acceptable Manufacturers: Charlotte Pipe "ChemDrain", Spears.
- H. Acid Resistant Piping and Fittings shall be:
1. Schedule 40 polyvinylidene (PVDF), ASTM F1673, ASTM D3222 and meeting ASTM E84 25/50 for flame spread and smoke development and UL-723 requirements for flame propagation and smoke density in environmental spaces. Pipe shall be factory and/or field grooved for mechanical joint systems; or field heat-fused using the manufacturer-recommended joining system. Fittings shall meet or exceed schedule 40 dimensions. The joint system shall have a corrosion resistance equal to the pipe and fittings.

- a. Acceptable Manufacturers: GSR Sloan, Labline Enfield, Orion, Zurn.

2.2 UNDERGROUND WATER PIPING:

- A. Underground domestic water piping beyond five feet outside the building shall be as specified by the Civil Engineer.
- B. Underground water piping beneath the building to a point five feet outside the building shall be:
 1. Cross-linked polyethylene (PEX).
 - a. Material Standard: Manufactured in accordance with ASTM F876 and ASTM F877 and tested for compliance by an independent third party agency.
 - 1) Standard grade hydrostatic design and pressure ratings from Plastic Pipe Institute.
 - 2) Minimum Bend Radius (cold bending): No less than 6 times the outside diameter. Use a bend support as supplied by the PEX tubing manufacturer for tubing with a bend radius less than stated.
 - 3) Nominal Inside Diameter: Provide tubing with nominal inside diameter, in accordance with ASTM F876.
 - b. Fittings:
 - 1) Joints below grade shall be avoided if possible.
 - 2) Fittings shall be of a type approved by the piping manufacturer for the application, and shall be supplied by piping manufacturer.
 - 3) Material: Fittings shall be suitable for direct burial in earth, and shall be manufactured from one of the following –
 - 4) Same material as piping.
 - 5) Pollyalloy (ASTM 2359).
 - 6) Bronze (w/ stainless steel sleeve) (ASTM 877).
 - 7) Dezincified brass (ASTM 1807).
 - 8) Material Standard: Comply with ASTM F1960.
 - c. Accessories
 - 1) Bend supports designed for maintaining tight radius bends shall be supplied by the PEX tubing manufacturer.
 - 2) Tools required to install the piping fittings shall be supplied by the PEX tubing manufacturer.
 - 3) The tubing manufacturer will provide clips and/or PEX rails for supporting tubing runs.
 - d. Warranty:
 - 1) Warranty Period for PEX piping and fitting system shall be 25-year, non-prorated warranty against failure due to defect in material or workmanship, beginning with date of substantial completion.
 - e. Acceptable Manufacturers – Mr. Pex, Uponor, Viega.

2.3 ABOVEGROUND WATER PIPING:

- A. Aboveground domestic water piping 3-inches in size and smaller, shall be copper tubing, Type L, hard drawn, ASTM B-88. Fittings shall be one of the following:
1. Recessed solder-joint type of either wrought copper or cast brass. Adapters for connection to threaded valves, fittings, meters and other equipment shall be cast brass. Recesses shall be smooth and correctly sized to provide proper clearance over the tubing. Solder shall be composition 95/5 tin-antimony or Brigit. Flux shall be noncorrosive. The solder shall contain no lead.
 2. Mechanical grooved joint pipe couplings may be used for connecting equipment to the piping system, headers, and distribution piping in lieu of soldered tube or fitting connections for water piping with NSF-61 rated temperatures to +180°F. System shall meet the low lead requirements of NSF-372.
 - a. Coupling housing clamps shall consist of two ductile iron castings complying with ASTM A-536, cast with offsetting angle-pattern bolt pads. Housing clamps shall hold in place an elastomer water sealing gasket of a FlushSeal® pressure responsive design. Clamps and gaskets shall be manufactured to copper-tube dimensions. (Flaring of tube or fitting ends to accommodate alternate sized couplings is not permitted.)
 - 1) Victaulic Style 607H ‘Quick-Vic’ installation ready coupling, for direct stab installation without field disassembly.
 - b. Fittings shall be manufactured to copper-tube dimensions, ASME B16.22 or ASME B16.18 Victaulic Copper-Connection.
 - c. Flange Adapter: Flat face, ductile iron housings with elastomer pressure responsive gasket, for direct connection to ANSI Class 125 or 150 flanged components. For use with copper-tube dimensioned grooved ends. Victaulic Style 641.
 3. Victaulic Installation-Ready™ fittings for grooved end copper tubing shall be manufactured to copper-tube dimensions. Fittings shall be ductile iron conforming to ASTM A-536, Grade 65-45-12, with Installation-Ready™ ends, complete with PVDF (Poly Vinylidene Fluoride) and Grade “EHP” EPDM-HP [Grade ‘T’ Nitrile] gasket; and ASTM A449 electroplated steel bolts and nuts. System shall be rated to 300 psi (2065 kPa) with Type K or L Copper Tubing.
 4. Viega ProPress Fitting: Copper and copper alloy press fittings shall conform to material requirements of ASME B16.18 or ASME B16.22 and performance criteria of IAPMO PS 117. Sealing elements for press fittings shall be EPDM. Sealing elements shall be factory installed or an alternative supplied by fitting manufacturer. Press end shall have SC (Smart Connect) feature design (leakage path). Smart Connect™ (SC Feature) In ProPress ½” to 4" dimensions the Smart Connect Feature assures leakage of liquids and/or gases from inside the system past the sealing element of an unpressed connection (when testing from ½ to 85 psi). The function of this feature is to provide the installer quick and easy identification of connections which have not been pressed prior to putting the system into operation.
- B. At contractor’s option, and where noted on drawings, branch piping serving toilet rooms and downstream of toilet room isolation valves, and piping serving individual fixtures shall be PEX piping as specified for underground water piping.

2.4 UNDERGROUND SOIL, WASTE, VENT AND DRAIN PIPING:

- A. Underground soil, waste, vent and storm drainage piping shall be as follows (unless otherwise indicated on Drawings):

1. Underground sanitary and storm drain lines shall be hub- and-spigot cast-iron, or plastic pipe.

2.5 ABOVEGROUND SOIL, WASTE, VENT AND DRAIN PIPING (includes condensate drain piping):

- A. Aboveground soil, waste, vent and storm drainage piping:
 1. Where exposed in rooms or where located in return air plenums, piping may be hub- and-spigot cast iron, or "No-Hub" cast iron, threaded galvanized steel, threaded copper nickel steel, threaded cast iron, copper tubing, or CPVC pipe. **PVC piping shall not be used where exposed or located in return air plenums.**
 2. Where installed inside walls or above ceilings that are not return air plenums, piping may be hub-and-spigot cast iron, or "No-Hub" cast iron, threaded galvanized steel, threaded copper nickel steel, threaded cast iron, copper tubing, PVC or CPVC pipe.
 3. Exposed waste piping and fittings in toilet rooms, and in finished areas, shall be chromium plated brass. Pipe shall be red brass, standard weight, iron pipe size and thickness, ASTM B-43, and fittings shall be threaded cast-brass of the recessed drainage pattern. Chromium plated piping shall be carefully measured and cut so that no more than one full turn of thread shall be exposed beyond any fittings. Joints between brass and ferrous pipes shall be threaded.
 4. Aboveground acid waste and vent piping shall be schedule 40 polyvinylidene (PVDF).

2.6 TRAPS:

- A. Provide deep seal traps on all floor drains.

2.7 CLEANOUTS AND FERRULES:

- A. Cleanouts shall be installed as shown on Drawings and where required by the building code.
- B. Cleanout plugs for threaded fittings shall be in accordance with Table 52 of CS 188. Except for test openings, where size must be sufficient to admit test plug, bushings will be permitted on pipes 5-inches and larger to reduce plug size to 4-inches; cleanout plugs for piping 4-inches and smaller shall be the same size as the pipe.
- C. Cleanout plugs for hub-and-spigot fittings shall be screwed into ferrules caulked into the fitting. Ferrules and plugs shall be in accordance with Table 54 of CS 188.
- D. Cleanout plugs on copper drainage lines shall be installed in solder-joint fittings having threaded openings provided for the cleanout, or in solder-joint fittings with threaded adapters.
- E. Acceptable Manufacturer - Josam, Smith, Zurn, Wade.

2.8 FLASHING:

- A. Openings in roof for waste vent pipes shall be provided with flexible rubber boots clamped to vent pipe and flashed into roofing. Products and installation shall be watertight and shall be approved by the National Roofing Contractor's Association.

2.9 DIELECTRIC ISOLATORS:

- A. Provide a dielectric isolator at all points of connection between ferrous and nonferrous piping. Isolators shall be made of Teflon or nylon made up in the form of screwed type unions or insulating gaskets and bolt sleeves and washers for standard flanged connection.
- B. Connections may be made with Schedule 80 CPVC nipples, nylon or Teflon bushings selected for the temperatures and pressures of the system.

2.10 VALVES:

- A. All valves shall be designed for 125 psi minimum water working pressure, but in no case less than 150% of the system operating pressure, whichever is greater.
- B. Provide valves with extended necks in insulated piping.
- C. All valves installed in potable systems shall be lead-free in accordance with Federal Government S.3874.
- D. Ball Valves:
 - 1. For size 4- inch and smaller shall be 2 piece, full port brass ball valves with RPTFE seats and packing, blow out proof stem, and sweated or threaded ends.
 - a. Equivalent to Apollo 77FLF.
- E. Check Valves:
 - 1. Check valves 2-inch in size and smaller shall be soldered bronze body, horizontal swing check type with regrindable seat and Buna-N disc.
 - a. Equivalent to Nibco S-413.
 - 2. Check valves 2 1/2-inch in size and larger shall be flanged, cast iron, spring actuated, , horizontal swing check type with stainless steel spring, aluminum bronze bushing, Buna-N bonded to bronze seat, and bronze disc.
 - a. Equivalent to Nibco F-910-B-LF.
- F. Butterfly Valves:
 - 1. 2 through 6-inch, 300 psi (2065 kPa) maximum pressure rating, with copper tubing sized grooved ends. Cast brass body to UNS C87850. Aluminum bronze disc to UNS C95500, with pressure responsive elastomer seat. Stem shall be offset from the disc centerline to provide complete 360-degree circumferential seating. Certified to the low lead requirements of NSF-372. Victaulic Series 608N.
- G. Acceptable Manufacturers – Apollo, DeZurik, Milwaukee, Nibco, Victaulic, Watts.
- H. Automatic Balancing Valves:
 - 1. Automatic flow control valves shall be factory set to a rated flow, and shall automatically control the flow to within $\pm 10\%$ of the rated value over a 40 to 1 differential pressure, operating range, (2 to 80 psid). Valves shall have the capabilities and pressure ratings as indicated and conform to this specification.
 - 2. Automatic balance assembly shall include one or more precision sculptured brass or polyphenylsulfone orifi with an elastomeric diaphragm. Each automatic balancing valve shall

automatically control the flow rate to within $\pm 10\%$ of its rated flow, over a temperature range of 32 to 225°F, and a pressure differential range of 2 to 80 psid.

3. Inline copper sweat valves 1/2, 3/4, 1, & 1 1/4 inch shall consist of a wrought copper (ASTM B88-83a) housing. Valve bodies shall be suitable for 522 psig working pressure rating per ASME B31.9 Building Services Piping. Flow rates from 0.5 to 25 gpm shall have a differential pressure operating range of 2 to 80 psid.
4. Equivalent to Hays Model 2511, or Victaulic ICSS TA Series 76X.

2.11 WALL HYDRANTS:

- A. Wall hydrants shall be cast bronze, chrome plated nonfreeze type with 3/4-inch inlet and 1-inch copper casing of sufficient length to extend through walls as required to place valve inside the building. Valve rod and seat washer shall be removable through the face of the hydrant. Hydrants shall be furnished complete with adjustment locknuts, union elbows, detachable T-handles, and integral vacuum breaker.
- B. Acceptable Manufacturers - Josam, MiFab, Prier, Smith, Wade, Watts, Woodford, Zurn.

2.12 GAS PIPING:

- A. Underground distribution piping shall be polyethylene piping conforming to applicable State and Federal Standards. The installation shall be completed by personnel meeting the requirements of applicable State and Federal Standards. Risers to above grade shall be anodeless. Joints shall be fusion butt welded. Provide #12 copperclad steel tracer wire equivalent to Copperhead 1230-HS, with wire manufacturer's standard connectors, magnesium anodes and accessories.
 1. Underground gas pipe and tubing shall meet or exceed the specifications for ASTM D 2513 and Department of Transportation (DOT) CFR Title 49 Part 192. Material shall Type II Grade P24 as defined by ASTM standard D 1248 and Cell Classification as defined by ASTM standard D 3350. PE gas pipe shall be colored yellow or black with yellow stripe.
- B. Aboveground distribution piping 2-inches and smaller shall be Schedule 40 black steel using malleable iron threaded fittings, wrought steel butt welding fittings or pressed fittings.
 1. Pressed fittings shall be Viega MegaPress Gas Press Fittings. MegaPress Fittings: 1/2-inch through 2-inch shall conform to ASME B31.1, ASME B31.3, or ASME B31.9 MegaPress fittings with zinc and nickel coating for use with IPS carbon steel pipe conforming to ASTM A53, ASTM A106, ASTM A135, or ASTM A795. MegaPress fittings shall have an HNBR sealing element, 420 stainless steel grip ring, separator ring, and an un-pressed fitting leak identification feature. Sealing elements shall be verified for the intended use. Installation must be in accordance to manufacturer's instructions and specifications.
- C. Aboveground distribution piping 2 1/2-inches and larger, and concealed piping of any size shall be Schedule 40 black steel with wrought steel butt welding fittings, or pressed fittings as specified above.
- D. Valves:
 1. For sizes 1-inch and smaller, provide ball valves, 125 psig WOG.
 2. For sizes larger than 1-inch, provide gas cocks, 125 psi WOG, bronze straight way cocks, flat or square head, threaded ends for 2-inches and smaller, flanged ends for 2 1/2-inches and larger.

2.13 GAS PRESSURE REGULATORS:

- A. Regulators shall be single stage, steel jacketed, corrosion resistant, with vent line extended to atmosphere, threaded ends for 2-inches and smaller, flanged ends for 2 1/2-inches and larger.
- B. Acceptable Manufacturers - Fischer, Maxitrol.

2.14 FIXTURE SUPPLY PIPING SUPPORTS:

- A. Support and position fixture rough-in piping in plumbing chases, shafts, fixture walls or batteries, at each fixture with metal strut framing system or angle iron supports and U- bolt clamps or high impact polystyrene or ABS anchoring channels designed for the purpose. Anchors shall effect positive electrolytic isolation, noise dampening, solid support, and rough-in positioning. See Section 23 20 00 for additional requirements.
- B. Acceptable Manufacturers - Sumner, Pipefix, Channel.

2.15 BACK-TO-BACK FIXTURE MANIFOLD:

- A. Wherever fixtures utilizing both hot and cold water are installed back-to-back on a partition, the hot water shall be on the left and the cold water shall be on the right on both sides of the partition. Cast bronze manifold fittings designed for the purpose, and to offset around stack may be used.
- B. Acceptable Manufacturers - Precision Plumbing Products "BAC 2 BAC", or approved equal.

2.16 SHOCK ABSORBER:

- A. Shock absorbers shall be factory fabricated stainless steel casing and bellows with working pressure of 250 psi, bellows precharged with nitrogen. Construction shall be in accordance with Plumbing and Drainage Institute Standard PDI-WH201, ANSI A-11, 2.26.1, and ASSE 1010.
- B. Acceptable Manufacturers - Josam, MiFab, Smith, Wade, Watts, Zurn.

2.17 PLUMBING FIXTURES, GENERAL:

- A. Provide plumbing fixtures scheduled, at locations and mounting heights indicated on architectural drawings.
- B. Provide fixture, trim and equipment specified or of similar quality, design, capacity, appearance and function by acceptable manufacturer listed.
- C. Provide required trim for each fixture including faucets, stops, drains, tail pieces, traps and escutcheons.
- D. Fixtures fitted to walls shall have backs ground square and true. Caulk juncture of fixture with wall or floor as directed by the Architect.
- E. Exposed Pipe - Exposed flush, waste and supply pipes at fixtures shall be chromium plated brass pipe, iron pipe size.
- F. Vandalproofing - Provide vandalproof fittings for all fixtures.

- G. Acceptable Manufacturers -
1. Fixtures - American Standard, Crane, Gerber, Kohler, Sloan, Toto, Zurn.
 2. Stainless Steel Sinks (self-rimming) - Elkay, Just, Kohler, Kindred.
 3. Faucets and Drains - American Standard, Bradley, Chicago, Delta, Eljer, Elkay, Gerber, Kohler, Powers, Sloan, Speakman, Symmons, Zurn.
 4. Supplies, Stops and Traps - Central, Crane, Dearborn, Eljer, McGuire.
 5. Closet Seats - Church, Beneke, Olsonite, Sperzel.
 6. Carriers - Josam, MiFab, Smith, Wade, Watts, Zurn.
 7. Service Sinks - Florestone, Fiat, Stern-Williams.
 8. Floor Drains - Josam, MiFab, Smith, Wade, Watts, Zurn.

2.18 PIPE HANGERS AND SUPPORTS:

- A. See Section 23 01 00.

2.19 WATER HEATER - POWER DIRECT-VENT, GAS FIRED, STORAGE TYPE:

- A. Provide AGA approved storage water heater as scheduled, with welded steel tank, polyurethane closed cell insulation, protective sheet metal jacket with baked enamel finish, fully submerged glass-lined condensing heat exchanger, controls, non-sacrificial powered anode rod(s) and temperature and pressure relief valve. Provide water heater with ASME rating when scheduled and for all models with an input rating of 200,000 BTUH or greater.
- B. The heater shall be suitable for sealed combustion direct vertical or sidewall venting using PVC air intake and exhaust pipe for a total of 120 equivalent feet of intake pipe, and 120 equivalent feet of vent pipe.
- C. The tank shall be fully glass or phenolic epoxy plastic lined after assembly and welding of tank. The tank shall be approved for a working pressure of 160 psi minimum. A hand hole cleanout and a drain valve shall be located near the bottom of the tank. The tank assembly shall be covered by a three year limited warranty against failure due to corrosion, metal fatigue or overheating caused by the buildup of scale, film or sediment.
- D. The heat exchanger shall be fully submerged, condensing, spiral shaped, and glass-lined on both water and vent sides to protect against corrosive flue gasses and condensate inside the coil.
- E. The heater shall operate at a minimum of 96% thermal efficiency when tested to ANSI Z21.10.3 "Gas Water Heaters". The heaters standby losses shall satisfy ASHRAE 90.1 standards.
- F. A microprocessor shall control all heater functions including ignition and temperature regulation. Precise temperature control shall be adjustable from 90 to 180 degrees F. A LCD display shall provide detailed operational and diagnostic information in plain English.
- G. The heater shall be completely packaged, requiring only field connection for gas, electrical power, plumbing, and combustion air intake and venting. Provide a thermal expansion tank for the hot water system. Additionally, provide all accessories required to complete water heater installation as scheduled, as indicated on Drawings and as recommended by equipment manufacturer.
- H. Provide a thermometer at the outlet of each water heater.
- I. Acceptable Manufacturers - A.O. Smith, Lochinvar, PVI, State.

2.20 TEMPERATURE AND PRESSURE RELIEF VALVES:

- A. Provide combination temperature and pressure relief valves on each domestic water heater and fired pressure vessel. Valves shall be constructed and rated in accordance with ASME standards, with cast iron bodies, shall be of the diaphragm type, with stainless steel spring, field adjustable, set to relieve above the operating pressure or temperature, but lower than the design pressure of the vessel. Pipe blowoff line full size to 6" above finished floor.
- B. Acceptable Manufacturers - Amtrol, Bell & Gossett, Taco, Watts.

2.21 WATER SOFTENER:

- A. Water softener shall be complete with two resin tanks and one brine tank and shall remove hardness, (expressed as CaCO₂), to the extent that the effluent from the water softener shall contain not more than 5 grains per gallon (0.08 grams per liter) of hardness, determined by an accepted soap hardness test method.
- B. The resin tanks shall be designed for a working pressure of 125 psi and hydrostatically tested for 150% of working pressure. Tank shall be constructed from fiberglass reinforced polyester with PVC internal water distribution. Each resin tank shall hold 7 cubic feet of exchange resin. Each cubic foot of resin shall be capable of removing 30,000 grains of hardness as calcium carbonate when regenerated with 15 pounds of salt.
- C. The main control valve shall be top mounted, brass construction with a factory fabricated copper manifold joining the second resin tank. An integral water meter shall record volume and initiate a regeneration based on water usage. The system shall be furnished with a pre-wired 8-foot long grounded electrical cord to plug into a standard 120 VAC power receptacle.
- D. The system rated service flow rate shall not be less than 60 GPM with a pressure loss not exceeding 15 psi.
- E. A complete water testing kit shall be furnished suitable for wall mounting.
- F. Three complete sets of instructions covering the installation, operation and servicing of the water softener shall be provided in booklet form.
- G. Install water softening equipment in strict accordance with manufacturer's recommendations.
- H. Provide a minimum of 200 pounds of high purity pellet or solar salt for start-up.
- I. Provide a minimum of two hours of instruction of the Owner's personnel and initial start-up of water softener system by a factory authorized service representative.
- J. Acceptable Manufacturers - Bruner, Culligan, Lakeside Water Treatment, Northstar.

PART 3 - EXECUTION**3.1 PIPING INSTALLATION:**

- A. Do not route piping above electrical distribution equipment, per National Electric Code.

3.2 SOIL, WASTE AND VENT SYSTEMS:

- A. Pitch lines at 1/8-inch per foot minimum and 1/4-inch per foot where possible.
- B. Below Grade - Install immediately after excavation, lay pipe so that entire length bears on firm soil, excavate for hubs, do not backfill until installation has been observed.
- C. Above Grade - Install in structure as high as possible. Independently support each length of cast iron. Support steel pipe according to hanger schedule. Support vertical lines at each floor, both horizontally and laterally.
- D. Joints and Fittings for CPVC and PVC plastic piping shall be prepared and solvent welded according to manufacturer's recommendations.
- E. Joints and Fittings for acid waste piping shall be installed according to manufacturer's recommendations.
- F. Vents - Slope up to high point. Support each length of vent pipe independently within structure.
- G. Sanitary Waste Cleanouts - Install cleanouts where required by code and as shown on Drawings. Set floor cleanout covers flush with adjacent finished surface.
- H. Floor Drains, Waste Receptors - Install as shown and connect to cast-iron, deep seal "P" trap. Where a water proof membrane is used, anchor membrane to flange with clamping collar and rustproof bolts.
- I. Drain Lines - Install drain lines from air conditioning equipment, tanks and other items of equipment requiring regular drainage, to waste receptors. Terminate above receptors with elbow turned down when piping is run horizontal to receptor.
- J. Plumbing Fixtures - Rough-in and install plumbing fixtures at height as recommended by the manufacturer unless otherwise indicated on architectural drawings. Caulk perimeter of wall or floor mounted fixture where it meets wall or floor. caulking shall be of type and color as selected by Architect.

3.3 DOMESTIC WATER SYSTEMS:

- A. Below Grade - Install immediately after excavation, do not backfill until installation has been observed, and lay pipe so that entire length bears of firm soil.
 - 1. Site Verification of Conditions:
 - a. Verify that site conditions are acceptable for installation of the PEX potable water system.
 - 2. PEX Piping Installation:
 - a. Do not proceed with installation of the PEX potable water system until unacceptable conditions are corrected.
 - b. Install PEX tubing in accordance with the tubing manufacturer's recommendations and as indicated in the 2006 Plastic Pipe Institute/Plastic Pipe and Fitting Association/NAHB/PATH Design Guide.
 - c. Joints below grade shall be limited to those required for tees and connection to valves at connections to buildings.
 - d. Minimum horizontal supports are to be installed not less than 32 inches between hangers in accordance with model plumbing codes and the installation handbook.
 - e. Do not expose PEX tubing to direct sunlight for more than 30 days.

- f. Ensure no glues, solvents, sealants or chemicals come in contact with the tubing without prior permission from the tubing manufacturer.
 - g. Protect PEX tubing with sleeves where abrasion may occur.
 - h. Use tubing manufacturer supplied bend supports where bends are less than six times the outside pipe diameter.
 - i. Pressurize tubing with air in accordance with applicable codes or in the absence of applicable codes to a pressure of 25 psi (173 kPa) above normal working pressure of the system.
 - j. Comply with safety precautions when pressure testing, including use of compressed air, where applicable. Do not use water to pressurize the system if ambient air temperature has the possibility of dropping below 32 degrees F (0 degrees C).
 - k. Field Quality Control:
 - 1) Manufacturer's Field Services: Provide manufacturer's field service consisting of product use recommendations and one site visit for inspection of product installation in accordance with manufacturer's instructions.
- B. Above Grade - Run level as high as possible in building structure, install hangers per schedule, allow for expansion and contraction, and anchor where required. Separate hot and cold pipes, with 6-inch minimum clear space between piping. Install 3/4-inch hose end drain valve at low points. Install ball valve at each plumbing fixture or group of fixtures, and at each point of connection to equipment. Allow access to equipment, for removal and servicing of pumps or equipment without draining system.
- 1. PEX Piping Installation:
 - a. Install PEX tubing in accordance with the tubing manufacturer's recommendations and as indicated in the 2006 Plastic Pipe Institute/Plastic Pipe and Fitting Association/NAHB/PATH Design Guide.
 - b. Exposed PEX piping shall be neatly installed plumb and parallel to building surfaces, and supported to eliminate sags and deflections.
 - 2. Copper Piping Installation:
 - a. For slabs on grade, copper pipe shall be separated from sand fill beneath poured concrete by a minimum of 6 inches of soil backfill.
 - b. Isolate copper pipe from concrete at all locations where piping penetrates concrete or masonry construction.
- C. Grooved joints shall be installed in accordance with the manufacturer's latest published installation instructions. Grooved ends shall be clean and free from indentations, projections, and roll marks in the area from pipe end to groove. Gaskets shall be of an elastomer grade suitable for the intended service, and shall be molded and produced by the coupling manufacturer. The grooved coupling manufacturer's factory trained representative shall provide on-site training for contractor's field personnel in the use of grooving tools and installation of grooved joint products. The representative shall periodically visit the jobsite and review contractor is following best recommended practices in grooved product installation. (A distributor's representative is not considered qualified to conduct the training or jobsite visit(s).)
- D. Viega ProPress connections: Copper press fitting joints shall be made in accordance with the manufacturer's installation instructions. Pipe shall be approved by manufacturer for use with fittings. Piping shall be square cut, properly deburred, and cleaned. The tubing shall be fully inserted into the fitting and the tubing marked at the shoulder of the fitting. The fitting alignment shall be checked against the mark on the tubing to assure the tubing is fully engaged (inserted) in the fitting. The joints shall be pressed using the tool approved by the manufacturer.

- E. Connections to equipment:
1. Connect to each plumbing fixture.
 2. Connect to each hydrant.
 3. Provide valved connections to each piece of kitchen equipment or owner-provided equipment requiring water connection. Provide pressure regulators, pressure reducing valves, vacuum breakers, shock arrestors and other accessories as required for equipment supplied.
 4. Provide unions or flanged connections at each piece of equipment connected.
 5. Install supply connections to fixtures through wall as high under fixtures as possible.

3.4 WATER HEATER INSPECTION CERTIFICATE:

- A. When required by the Kansas Boiler Safety Act for the storage capacity and/or firing rate of the installed water heater, the Contractor shall be responsible for obtaining an inspection and acceptance certificate from the State Boiler Inspector. The Contractor shall schedule and pay for the inspection, and shall post the certificate(s) in the room containing the water heater.

3.5 SHOCK ABSORBERS:

- A. Install in accessible locations, see drawings. Provide access panels where required.

3.6 DISINFECTION OF WATER SYSTEMS:

- A. General - Disinfect all domestic water systems. Disinfection shall not start until water systems are complete, connections made, and system is flushed out. Upon completion of disinfection, submit certificate and certified bacteriological test report for approval.
- B. Follow the method prescribed by the local Health Department, Building Code Department or water purveyor. In the absence of a prescribed method, follow the procedure outlined in either AWWA C651 or AWWA C652.

3.7 GAS PIPING SYSTEM:

- A. Above Grade - Run level and as high as possible. Install hangers per schedule. Allow for expansion and contraction. Anchor where required. Install Schedule 10 carbon steel welded gas tight pipe casing around piping in concealed vented areas. Pipe casings to be vented to atmosphere. Pipe casings not required in exposed areas.
- B. Below Grade –
1. Use PE pipe, PE fittings, and heat-fusion joints.
 2. Installation shall meet the requirements of applicable State and Federal Standards.
 3. Install buried gas distribution piping with a minimum cover of 36 inches.
 4. Install underground, plastic, gas distribution piping according to ASTM D 2774.
- C. Above Roof - Support piping at no more than 8 feet on center, with manufactured pipe supports: Miro Industries Model 3-R or approved equivalent. The pipe supports shall be a roller-bearing type designed to support piping or conduit, and to absorb thermal expansion and contraction of piping or conduit thus preventing damage to roof membrane. The pipe or conduit shall rest on a polycarbonate resin roller and a glass-filled nylon rod situated in a polycarbonate resin seat.

- D. Connections to equipment - Connect at each appliance or gas using device and provide gas cock unions, and dirt leg.
- E. Tracer Wire Installation:
 - 1. Ground tracer wire at each end of pipe and at all dead ends/stubs per wire manufacturer's instructions.
 - a. Grounding of trace wire shall be achieved by use of a drive-in magnesium grounding anode rod with a minimum of 20ft of #14 red HDPE insulated copper clad steel wire connected to anode (minimum 0.5 lb.) specifically manufactured for this purpose, and buried at the same elevation as the utility.
 - 2. All new trace wire installations shall be located using typical low frequency (512Hz) line tracing equipment, witnessed by the contractor, engineer and facility owner as applicable, prior to acceptance of ownership.
 - a. This verification shall be performed upon completion of rough grading and again prior to final acceptance of the project.
 - b. Continuity testing in lieu of actual line tracing shall not be accepted.

3.8 TESTING:

- A. Systems shall be tested in accordance with the 2012 International Plumbing Code prior to insulating, covering or concealing this work.
- B. Plug or cap lines for testing and disconnect equipment and devices which may be damaged by excessive test pressures.
- C. Before final connections are made to site sewer and connection of fixtures, all underground drainage piping shall be hydrostatically tested. All openings shall be capped or plugged and the system filled with water to the top of a vertical section of pipe 10 feet high, temporarily connected to the highest point of the underground system. The water shall be allowed to stand in the system for at least 30 minutes prior to inspection. If the water level remains constant and no leaks are found during the period of inspection, the water shall be drained from the system. Final connections shall then be made to the site sewer and the trenches backfilled.
- D. Before any fixtures are connected, all sanitary drain and vent systems, and storm drainage systems above ground, shall be hydrostatically tested. All opening shall be capped or plugged and the systems filled with water. The water shall be allowed to stand in the systems for at least 30 minutes prior to inspection. If the water level remains constant and no leaks are found during the period of inspection, the water shall be drawn off and fixtures, etc., connected. No parts of a system shall be tested with less than 10-foot head of water. No parts of a system using cast iron bell-and-spigot pipe shall be tested with more than a 40-foot head of water, and no parts of a system using screwed piping shall be tested with more than 200-foot head of water. The Contractor shall be responsible for determining the amount of piping he wishes to test at one time, but the above conditions shall not be exceeded.
- E. Before final connections are made to a water supply system, all underground water piping shall be hydrostatically tested and proven tight at a pressure of not less than 100 psi or 50 psi in excess of the working pressure, whichever is greater, at the lowest point in the system. The pressure shall be maintained for at least 1 hour for inspection, the water shall be drained from the system. Final connections shall then be made to the water supply system, and the trenches backfilled.
- F. Before any fixtures or equipment are connected, all domestic water and compressed air systems connected thereto above ground shall be hydrostatically tested and proven tight at a pressure of not less

than 100 psi or 50 psi in excess of the working pressure, whichever is greater, at the lowest point in the system. The pressure shall be maintained for at least 2 hours for inspection. If the pressure remains constant and no leaks are found during the period of inspection, the water shall be drained from the systems and final connections shall then be made to the fixtures, etc.

- G. All tests shall be made when there is no danger of freezing, prior to enclosure of any parts of the systems by furrings, suspended ceilings, etc.
- H. Test to demonstrate the capacities and general operating characteristics of all equipment, such as water heating outfits, pumps, water coolers, etc., shall be made under the direction of the Architect at the time of final inspection and under conditions imposed by him. Water heaters having steam or water coils shall be tested with the main heating system in operation.
- I. Gas piping shall be tested in accordance with the requirements of the local building code and the 2012 International Fuel Gas Code.
- J. All tests shall be made in the presence of and results approved by the Architect.
- K. Should any leaks, flaws, or defective materials or equipment be found during the testing operations, such leaks or flaws shall be corrected, and defective materials and equipment replaced. All defective joints shall be remade, and calking or threaded joints will not be acceptable. After corrections have been made, tests shall be repeated until all systems are proven tight and satisfactory. All corrections and retests shall be made at Contractor's expense.

3.9 CLEANING:

- A. See Section 23 01 00.

3.10 COMPLETION:

- A. Complete each piping system in its entirety. Properly support the system, clean the interior surfaces of the pipe by flushing, and disinfecting domestic water piping as specified. Leave systems filled and free from air, and ready for operation and testing.

END OF SECTION 22 00 00

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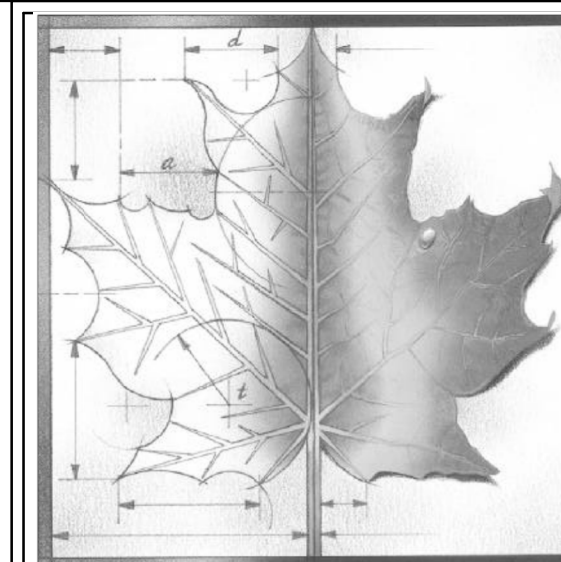
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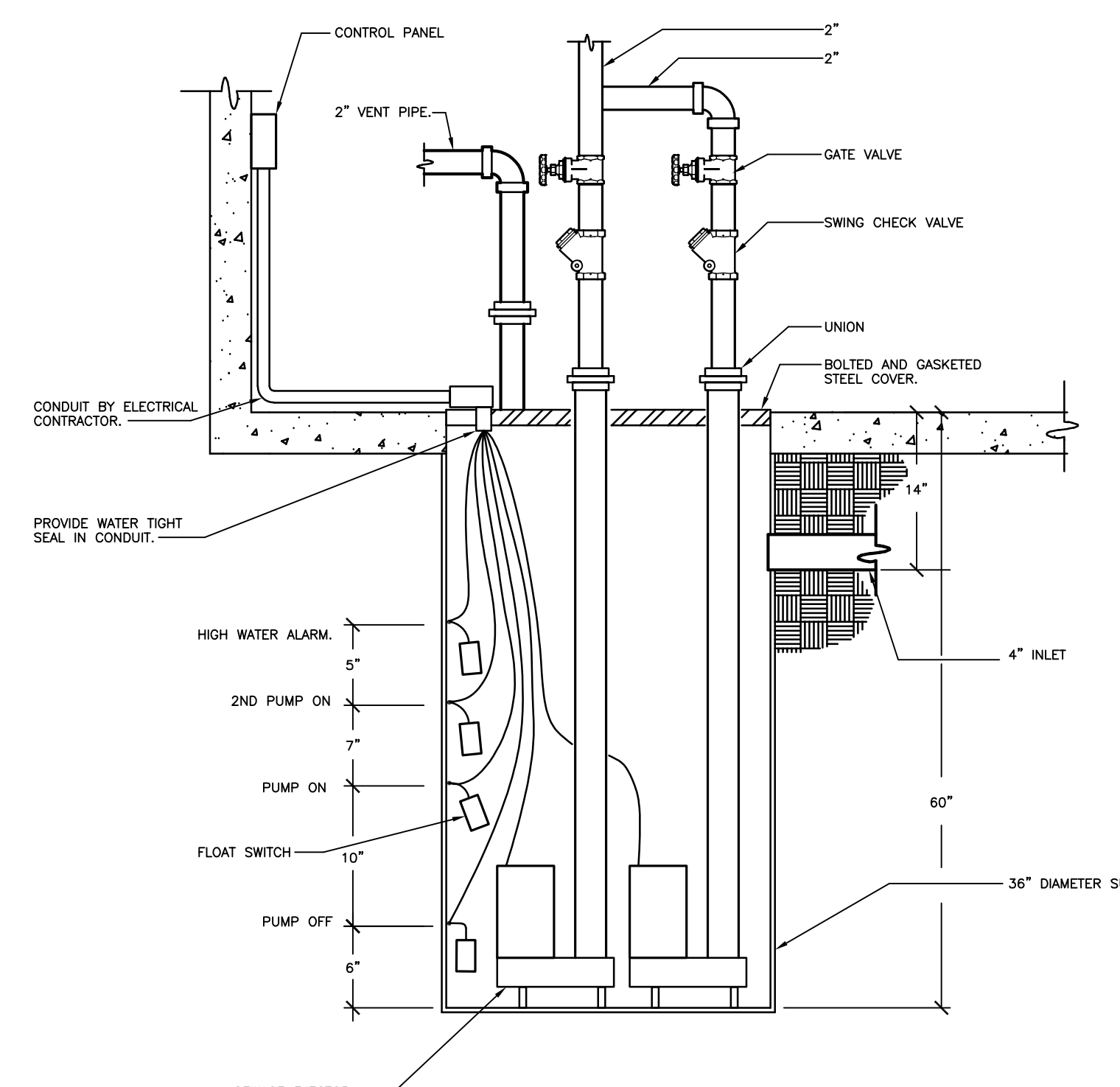
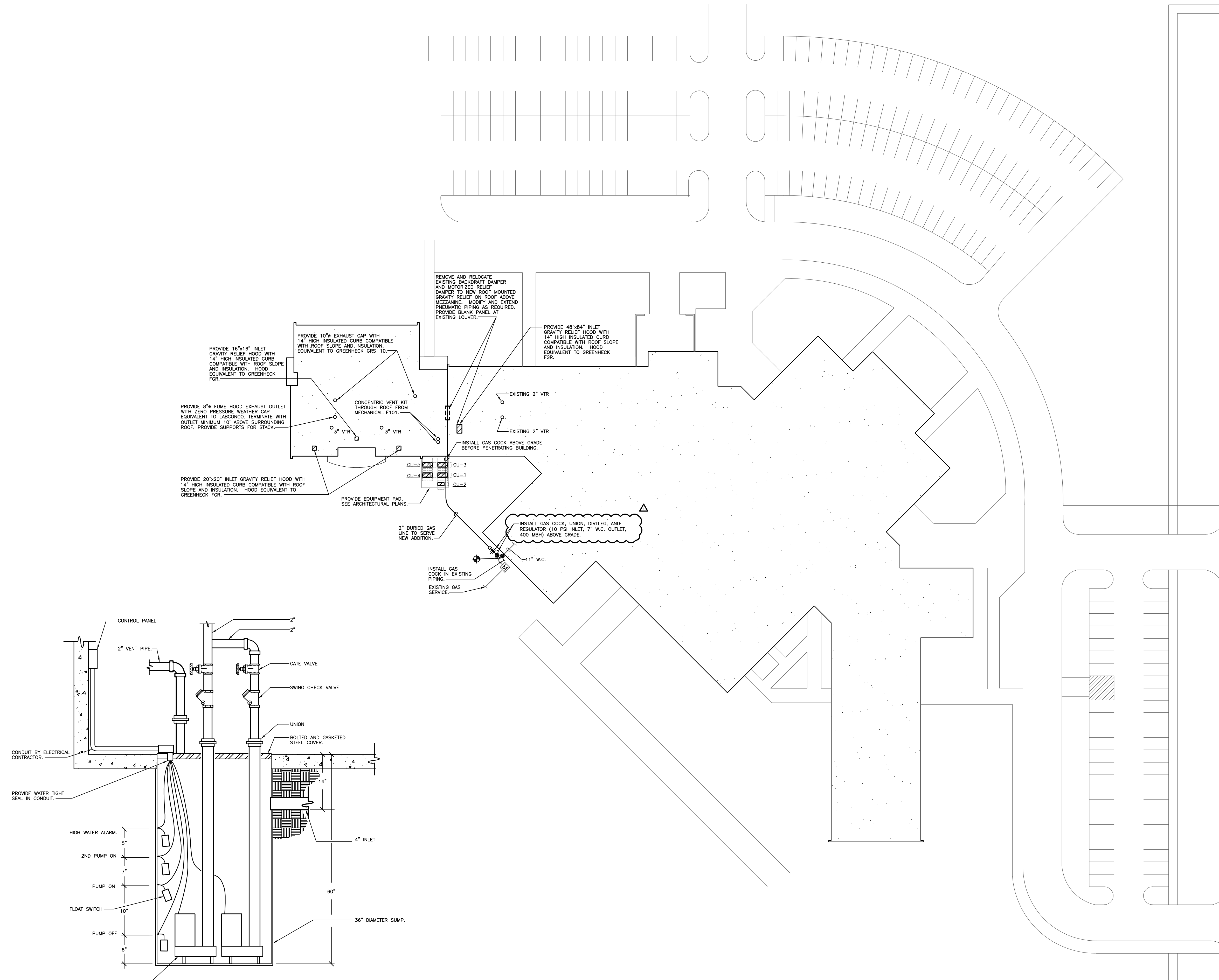
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A SEWAGE EJECTOR DETAIL
NO SCALE

SITE PLAN - MEP
1" = 40'-0"

Job No. 15011-1

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Manhattan, Kansas

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REVISIONS:
▲ 12/14/2017
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Project Number: **16036**

Date: **11/28/17**

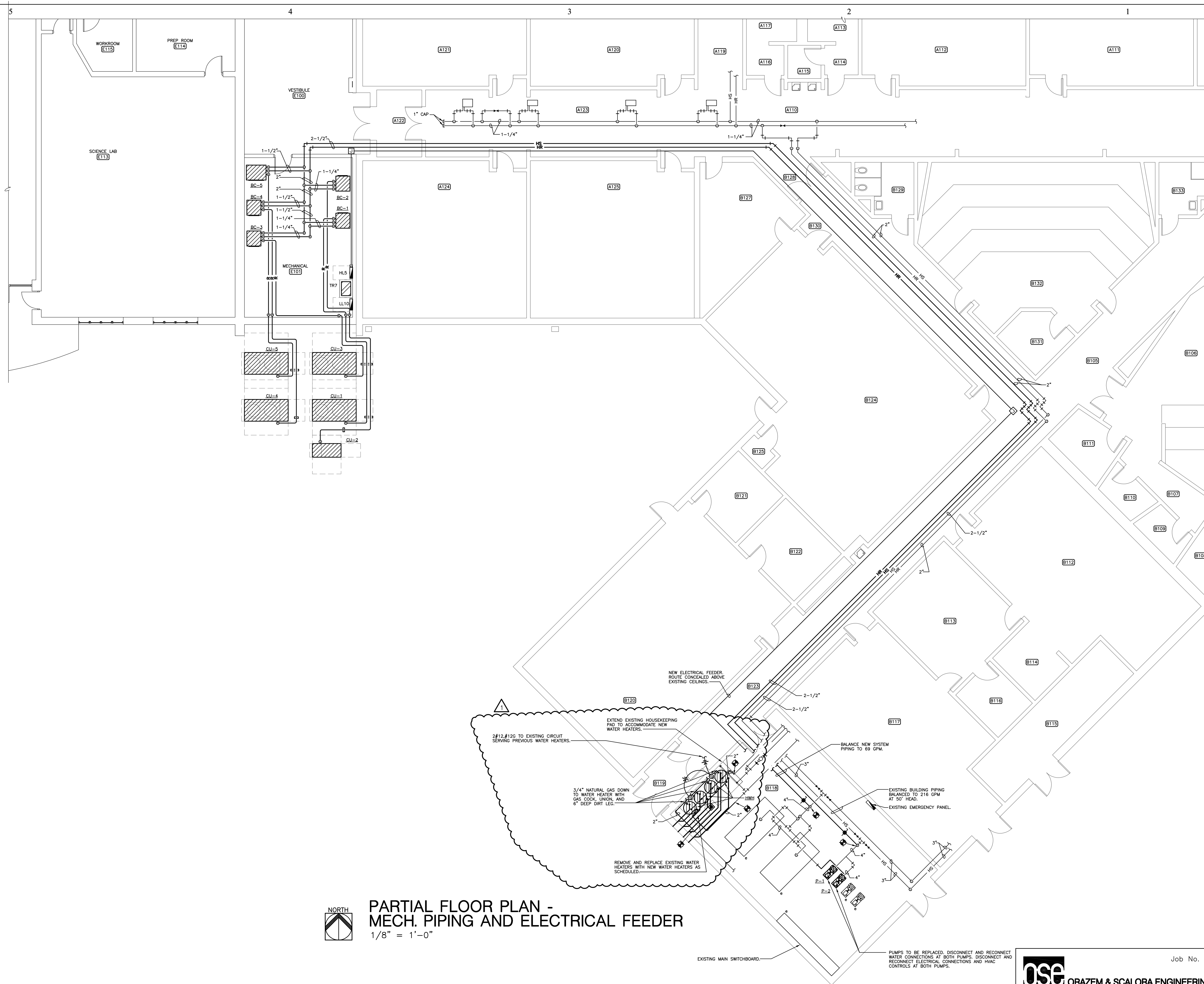
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USD 320 WAMEGO MIDDLE SCHOOL SCIENCE ROOM ADDITION

Project Address:
**1701 KAW VALLEY ROAD
Wamego, KS 66547**

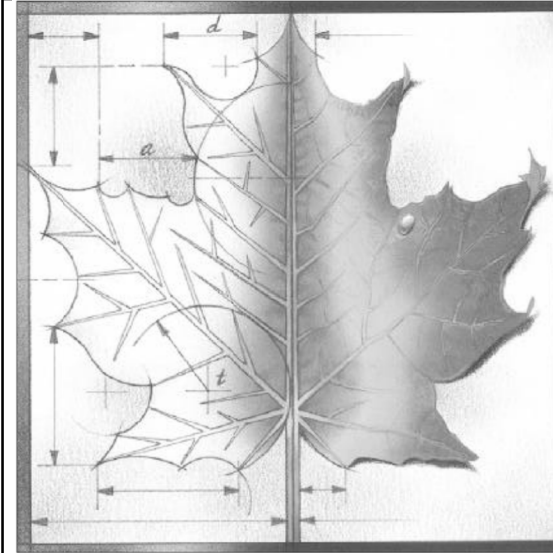
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MEP SITE PLAN

Sheet:
ME101

OF: **16**



**PARTIAL FLOOR PLAN -
MECH. PIPING AND ELECTRICAL FEEDER**
1/8" = 1'-0"



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Project Number: **16036**

Date: **11/28/17**

Project Name:
**USD 320 WAMEGO MIDDLE
SCHOOL SCIENCE ROOM
ADDITION**

Project Address:
**1701 KAW VALLEY ROAD
Wamego, KS 66547**

Sheet Title:
**PARTIAL
MECH./ELEC.
PLAN**

Sheet:
ME102

OF: **16**

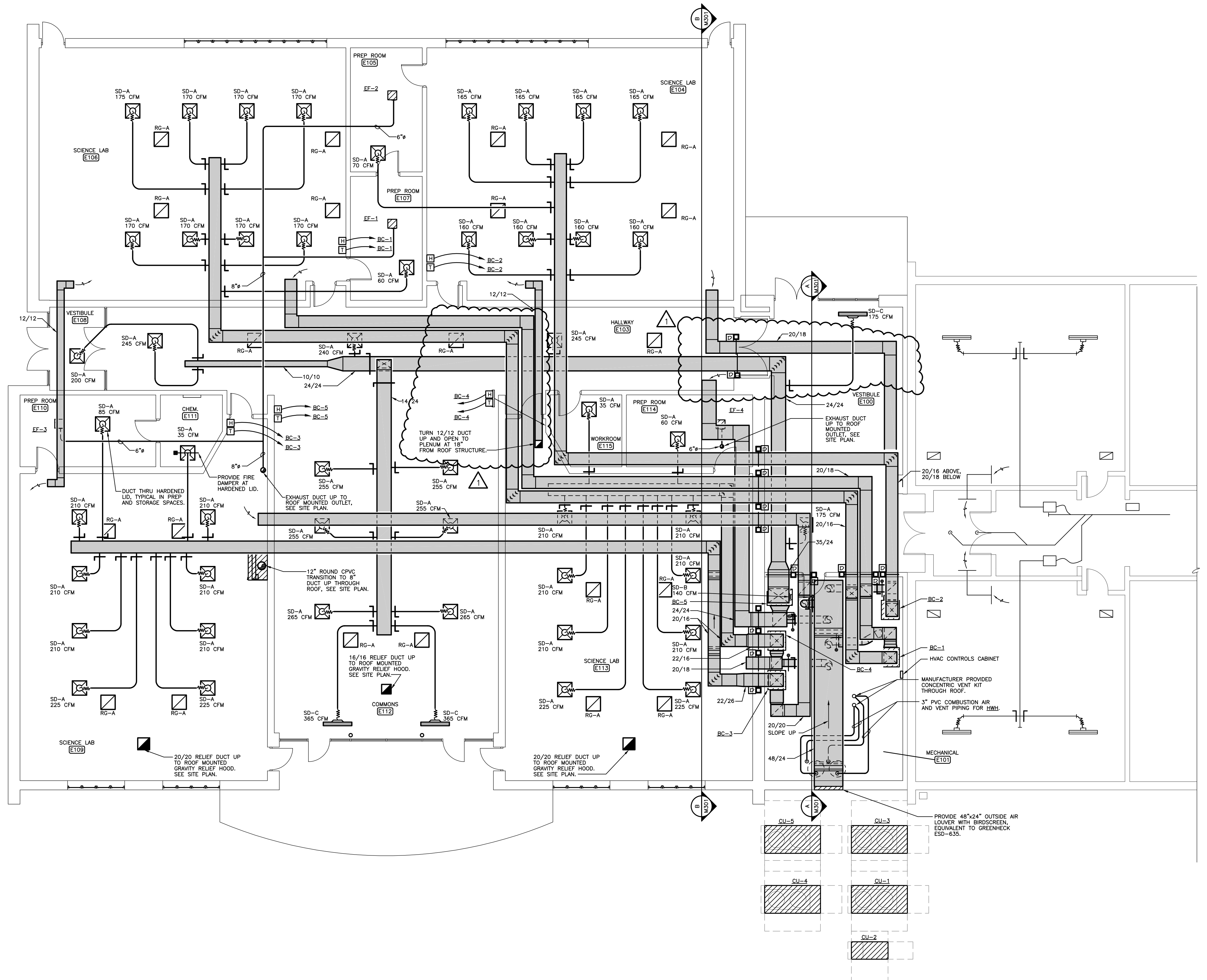
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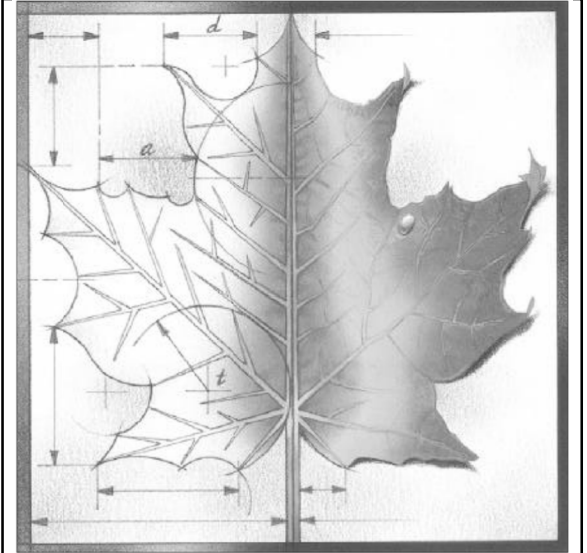
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MECHANICAL SYMBOLS LEGEND

	Thermostat
	90° Elbow down, round duct
	90° Elbow up, round duct
	Round duct offset
	Radius elbow
	90° Elbow down, rectangular supply duct
	90° Elbow up, rectangular supply duct
	90° Elbow down, rectangular return duct
	90° Elbow up, rectangular return duct
	Rectangular elbow with turning vanes
	Flexible duct
	Manual balancing damper
	Motorized damper
	Fire damper
	Smoke damper
	Combination fire/smoke damper
	Ceiling supply air diffuser
	Ceiling return air grille
	Sidewall supply air diffuser
	Sidewall return air grille
	Supply air slot diffuser
	Round tap in bottom of duct
	Rectangular tap in bottom of duct
	Condensate drain
	Cold water
	Hot water
	Tempered water
	Recirculated water
	Recirculated tempered water
	Natural gas
	Sanitary waste above grade
	Sanitary waste below grade
	Sanitary vent
	VTR Vent through roof
	Plumbing trap
	Pipe turning down
	Pipe turning up
	Shock arrestor
	Gas cock
	Union
	Temperature/pressure relief valve
	Strainer
	Aquastat
	Thermometer in well
	Temperature sensor in well
	Connection of new to existing
	Existing device
TYP	Typical
A.F.F.	Above finished floor
U.N.O.	Unless noted otherwise
N.I.C.	Not in contract
G.C.	General Contractor



ADDITION FLOOR PLAN - MECHANICAL DUCTWORK
1/8" = 1'-0"



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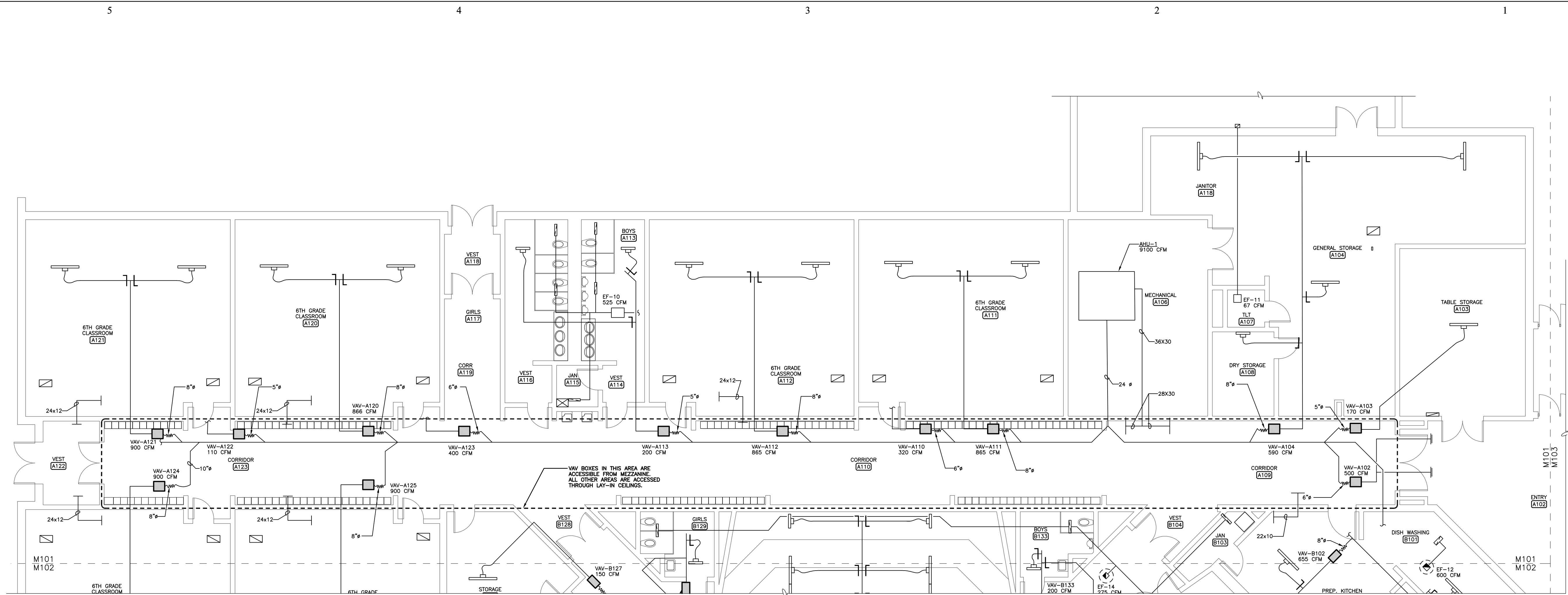
Project Name:
USD 320 WAMEGO MIDDLE SCHOOL SCIENCE ROOM ADDITION

Project Address:
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Wamego, KS 66547**

Sheet Title:
MECHANICAL DUCTWORK PLAN

Sheet:
M101
OF: **16**

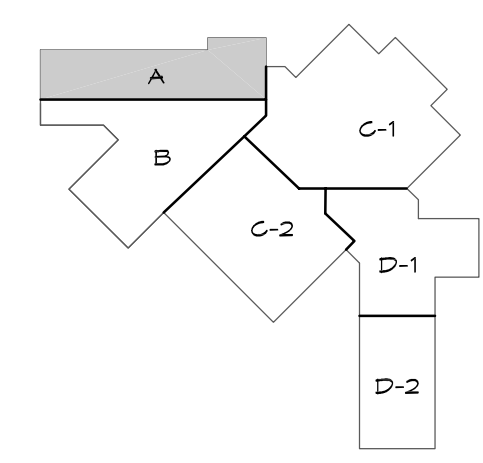
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MECHANICAL TEST AND BALANCE - AREA A
 1/8" = 1'-0"

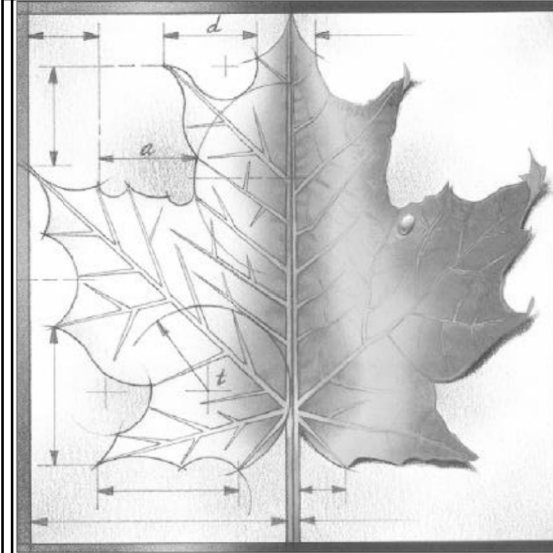
TEST AND BALANCE NOTES:

1. Balance existing air supply and exhaust systems, after noted improvements are completed to original design air volumes shown on these plans.
2. See section 239900 for Test and Balance qualifications and requirements.
3. Field verify all equipment and air device locations.



KEY PLAN
 NTS

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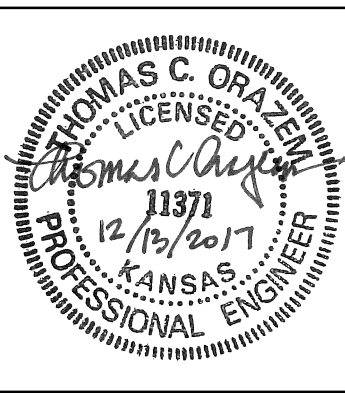


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Project Name:
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Project Address:
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Sheet Title:
MECHANICAL TEST AND BAL. AREA A

Sheet:
M401

OF: **16**

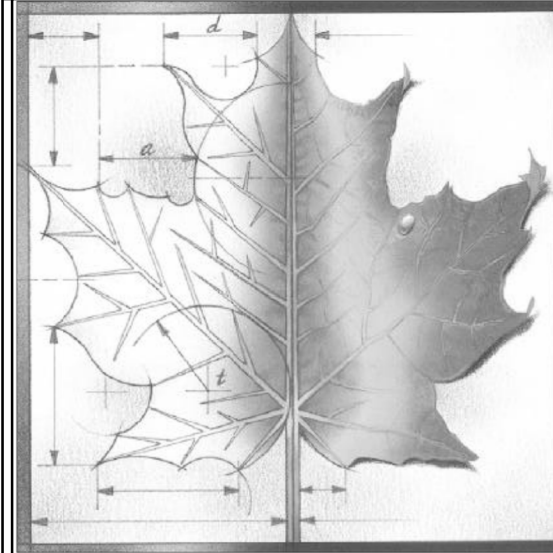


MECHANICAL TEST AND BALANCE - AREA B
 1/8" = 1'-0"



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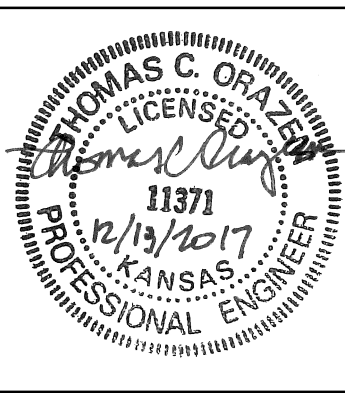
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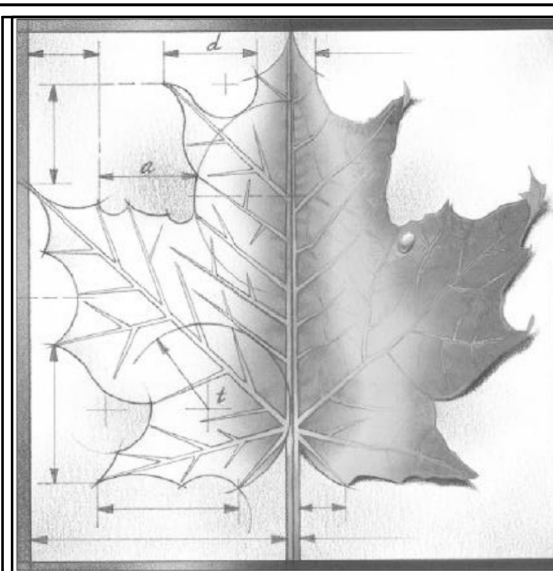
Project Name:
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Sheet Title:
MECHANICAL TEST AND BAL. AREA B

Sheet:
M402

OF: **16**



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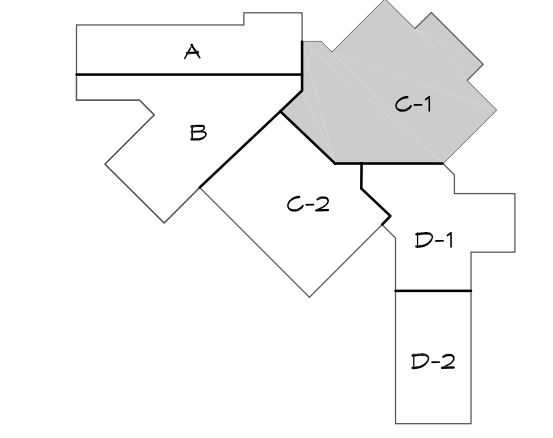
Project Name:
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Project Address:
**1701 KAW VALLEY ROAD
Wamego, KS 66547**

Sheet Title:
MECHANICAL TEST AND BAL. AREA C1

Sheet:
M403

OF: **16**



KEY PLAN
NTS



MECHANICAL TEST AND BALANCE - AREA C1
1/8" = 1'-0"

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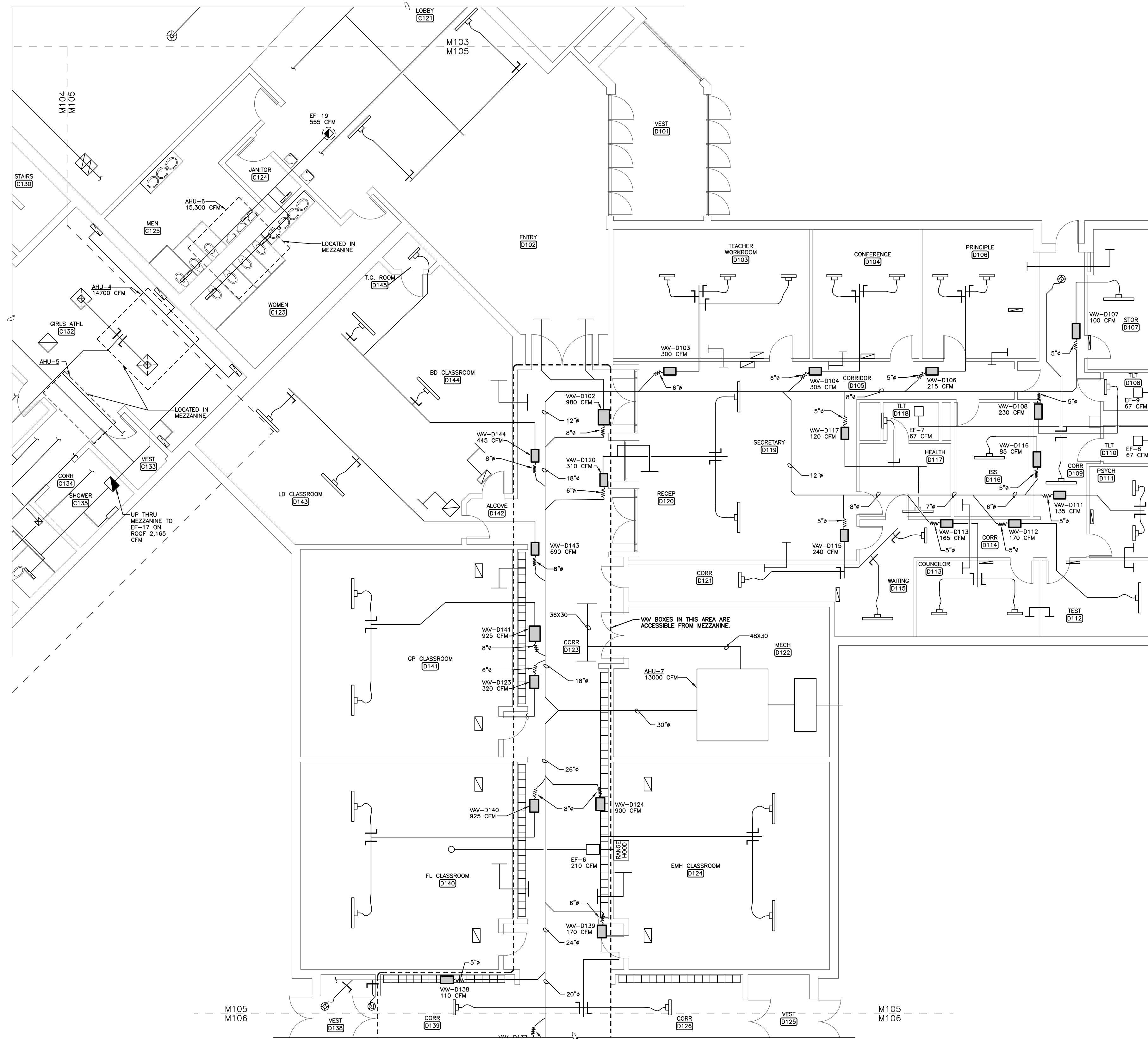
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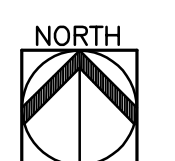
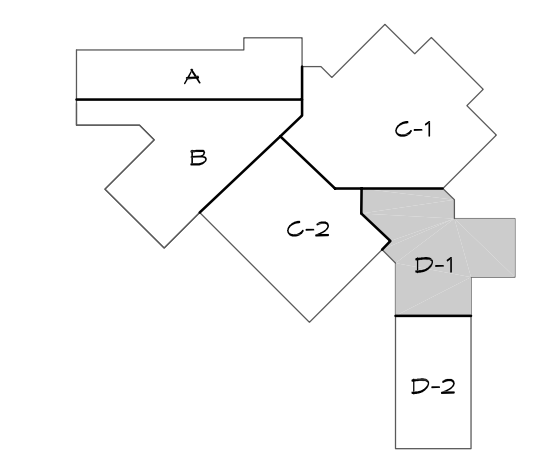
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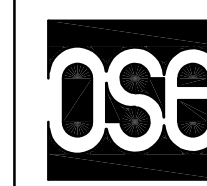
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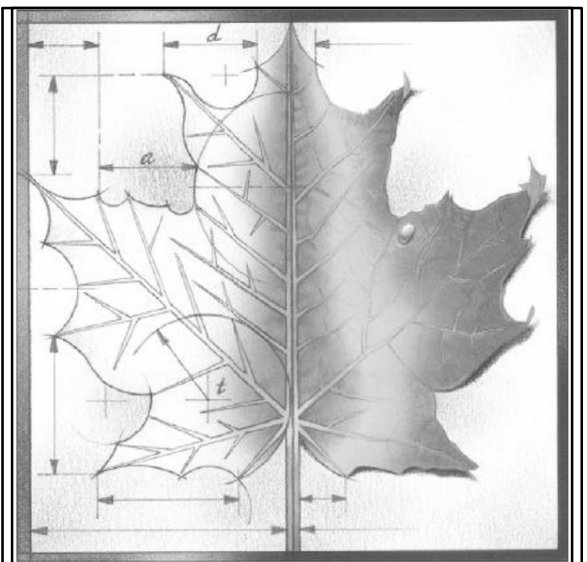


MECHANICAL TEST AND BALANCE - AREA D1
1/8" = 1'-0"



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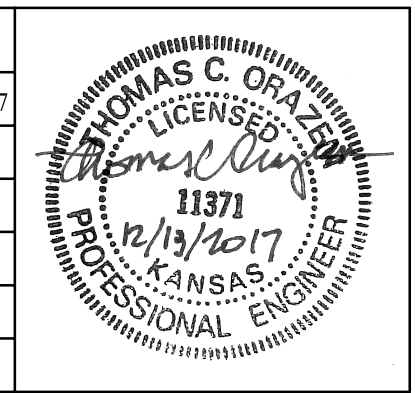


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Sheet Title:
MECHANICAL TEST AND BAL. AREA D1

Sheet:
M405

Of: **16**

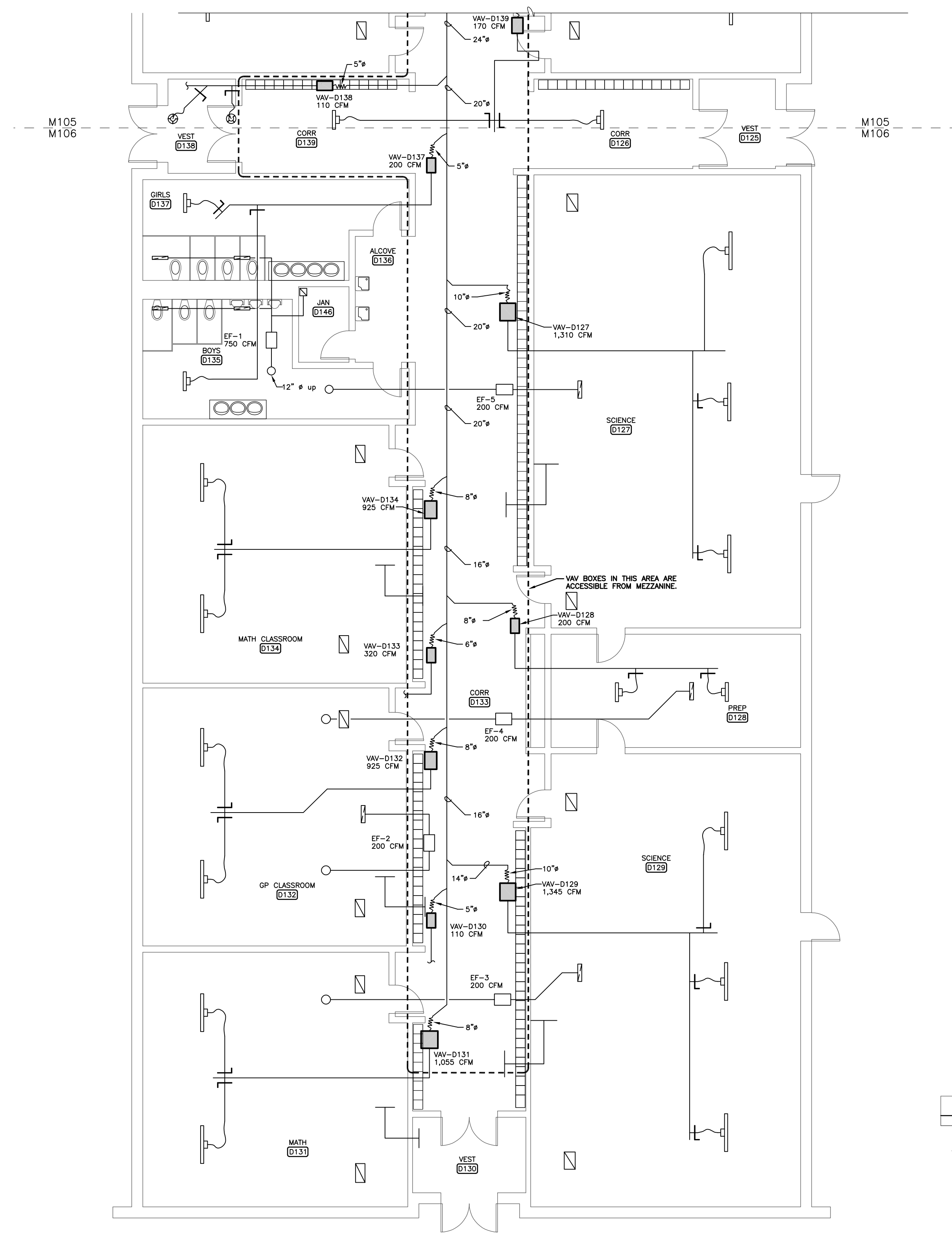
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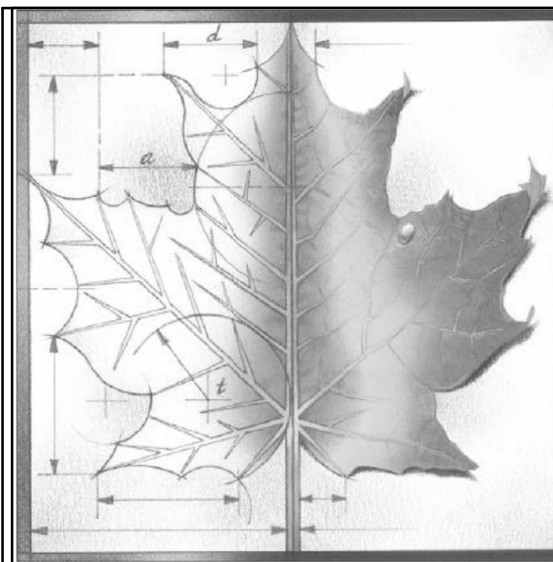


MECHANICAL TEST AND BALANCE - AREA D2
1/8" = 1'-0"



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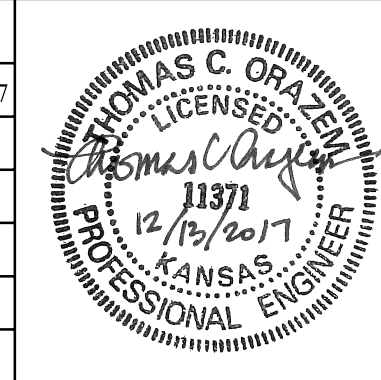
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Date: **11/28/17**

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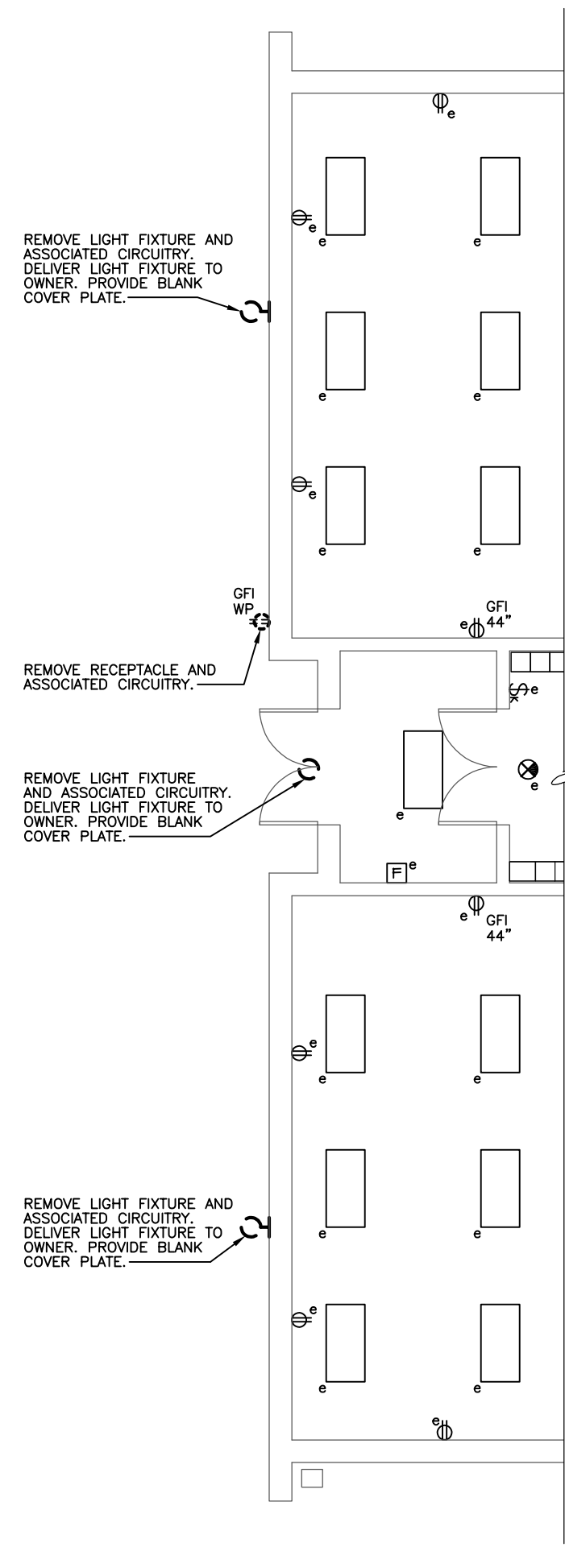
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M406

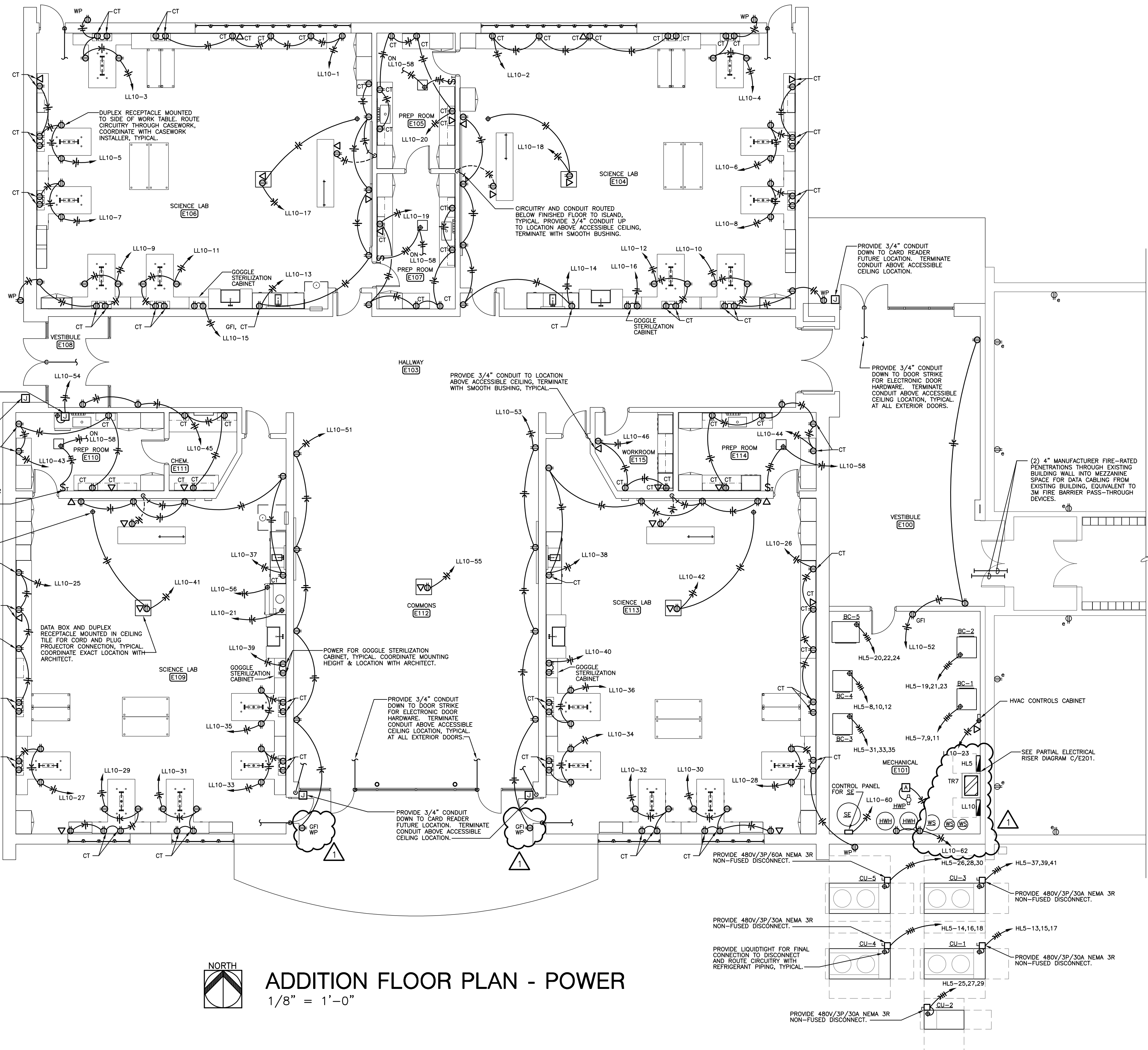
OF: **16**

ELECTRICAL SYMBOLS LEGEND

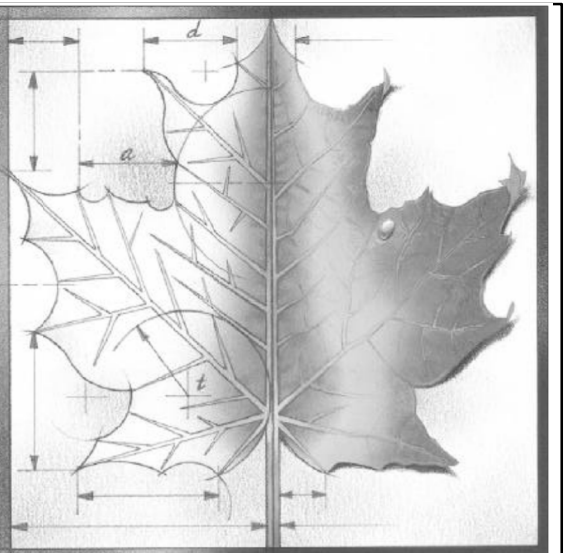
	Duplex receptacle
	Ground fault interrupting duplex receptacle
	Countertop duplex receptacle
	Weatherproof duplex receptacle
	Four-plex receptacle
	Special receptacle as noted
	Data box
	Countertop data box
	Flush junction box
	Surface or concealed junction box
	Electrical connection to equipment
	Single pole switch
	Three-way switch
	Four-way switch
	Manual motor starter
	Relay switch
	Test switch
	Electrical disconnect switch
	Motor starter
	Electrical motor
	Conduit concealed in wall or ceiling
	In-floor conduit
	Homerrun to panelboard with conductors as indicated. Do not share neutrals unless noted otherwise.
	Panelboard
	Transformer
	Electrical meter
	Fire alarm horn/strobe
	Fire alarm pull station
	Fire alarm duct smoke detector
	Fire alarm test switch
	Fire alarm relay/addressable control module
	Fire alarm addressable monitor module
	Fire alarm strobe
	Fire alarm control panel
	Light fixture on emergency circuit
	Existing device
	Circuit breaker
	Unless noted otherwise
	Above finished floor
	Not in contract
	Typical
	General Contractor



PARTIAL FLOOR PLAN - ELECTRICAL DEMOLITION
 1/8" = 1'-0"



ADDITION FLOOR PLAN - POWER
 1/8" = 1'-0"



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Sheet Title:

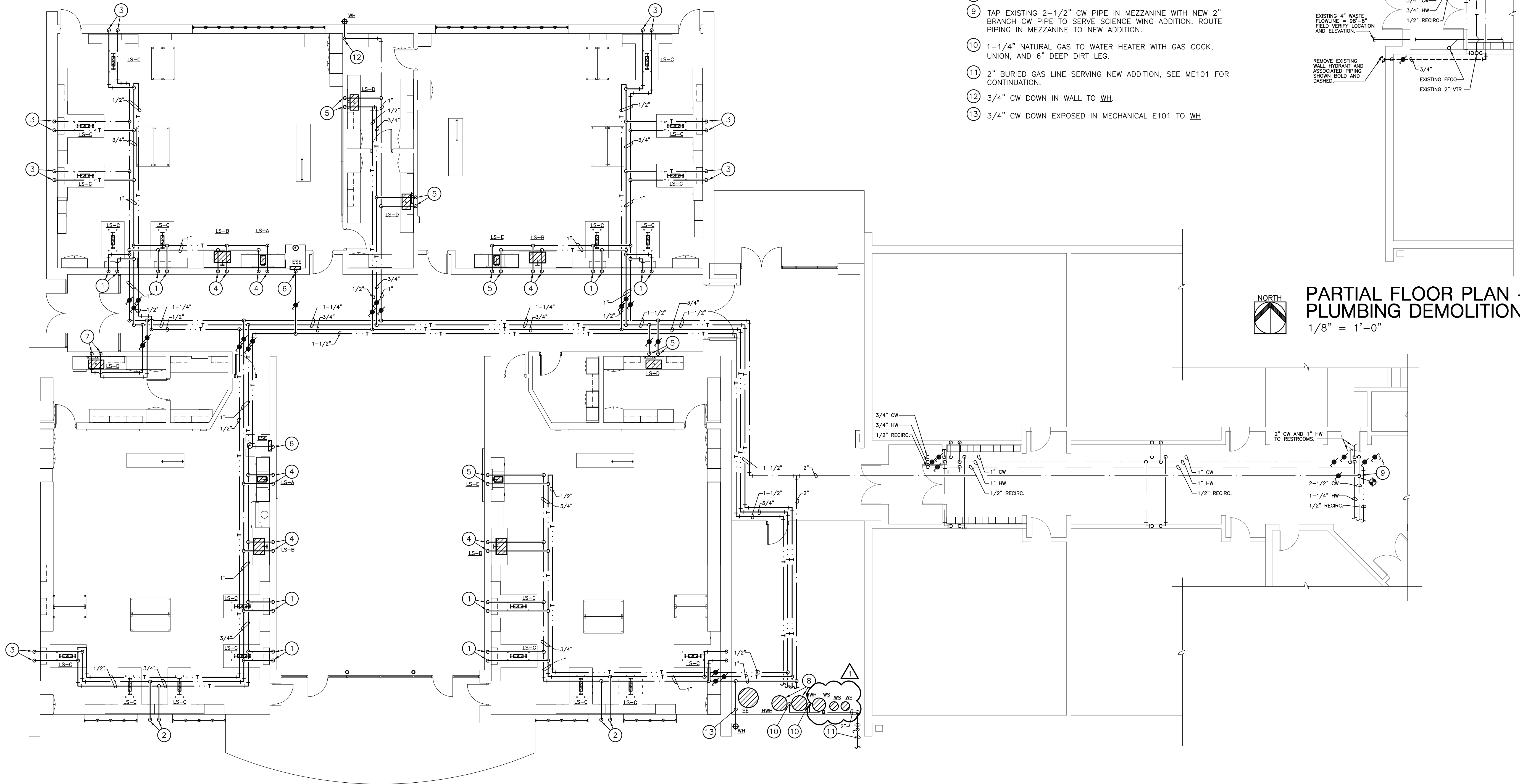
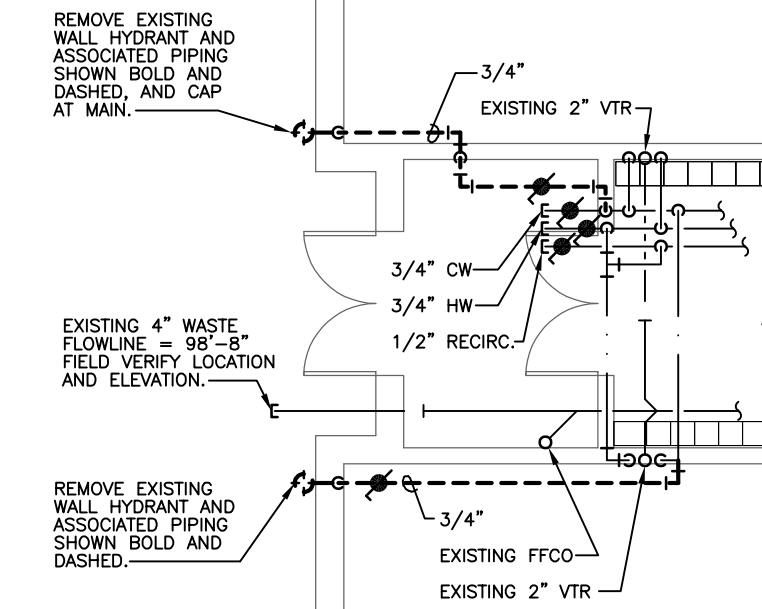
ELECTRICAL PLAN

Sheet: **E101**

OF: **16**

NOTES BY SYMBOLS

- ① ROUTE 1/2" CW AND 1/2" HW PIPING DOWN IN WALL AND CONCEALED IN CASEWORK TO LS-C. COORDINATE WITH CASEWORK SUPPLIER.
- ② 3/4" CW AND 3/4" HW PIPING DOWN IN WALL ON INTERIOR SIDE OF INSULATION TO (2) LS-C. ROUTE 1/2" CW AND 1/2" HW PIPING CONCEALED IN CASEWORK TO EACH LS-C. COORDINATE WITH CASEWORK SUPPLIER. FINAL BRANCH RUNOUTS SHALL BE PEX PIPING WITH 1/2" FIBERGLASS PIPE COVERING TO PROVIDE 25/50 FLAME/SMOKE SPREAD RATING TO MEET ASTM E84.
- ③ 1/2" CW AND 1/2" HW PIPING DOWN IN WALL ON INTERIOR SIDE OF INSULATION. ROUTE PIPING CONCEALED IN CASEWORK TO LS-C. COORDINATE WITH CASEWORK SUPPLIER. FINAL BRANCH RUNOUTS SHALL BE PEX PIPING WITH 1/2" FIBERGLASS PIPE COVERING TO PROVIDE 25/50 FLAME/SMOKE SPREAD RATING TO MEET ASTM E84.
- ④ 1/2" CW AND 1/2" HW DOWN TO LAB SINK.
- ⑤ 3/4" CW AND 3/4" HW DOWN TO LAB SINK WITH EMERGENCY EYEWASH DRENCH HOSE.
- ⑥ 1-1/2" TEMPERED HOT WATER DOWN TO EMERGENCY SHOWER.
- ⑦ 3/4" CW AND 3/4" HW DOWN TO LAB SINK, EMERGENCY EYEWASH DRENCH HOSE, AND UNDERCOUNTER FLASK SCRUBBER.
- ⑧ SEE HOT WATER HEATER DETAIL ON P102 FOR PIPING.
- ⑨ TAP EXISTING 2-1/2" CW PIPE IN MEZZANINE WITH NEW 2" BRANCH CW PIPE TO SERVE SCIENCE WING ADDITION. ROUTE PIPING IN MEZZANINE TO NEW ADDITION.
- ⑩ 1-1/4" NATURAL GAS TO WATER HEATER WITH GAS COCK, UNION, AND 6" DEEP DIRT LEG.
- ⑪ 2" BURIED GAS LINE SERVING NEW ADDITION, SEE ME101 FOR CONTINUATION.
- ⑫ 3/4" CW DOWN IN WALL TO WH.
- ⑬ 3/4" CW DOWN EXPOSED IN MECHANICAL E101 TO WH.



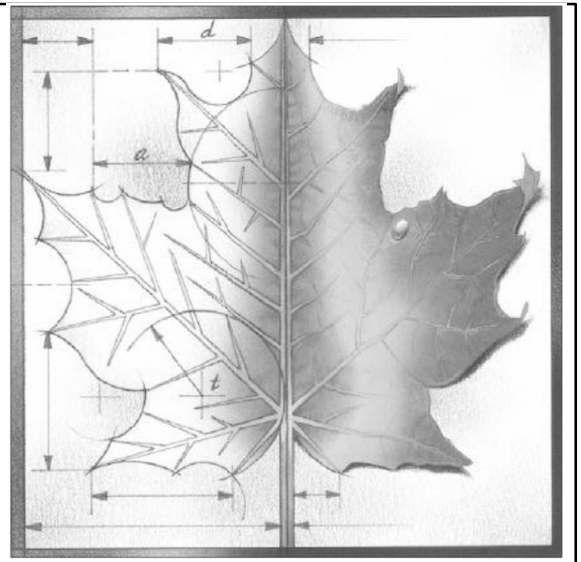
PARTIAL FLOOR PLAN - PLUMBING DEMOLITION
1/8" = 1'-0"



ADDITION FLOOR PLAN - WATER AND GAS
1/8" = 1'-0"

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Sheet Title:
PLUMBING PLANS

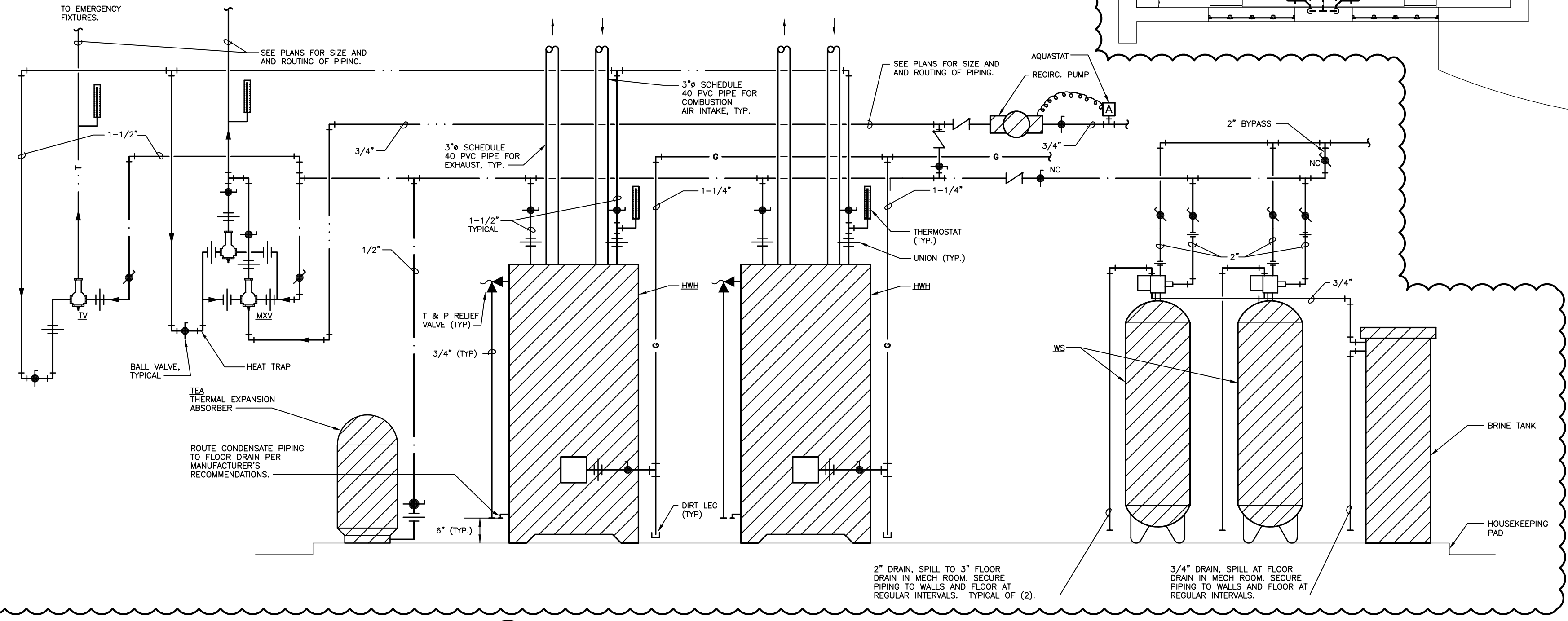
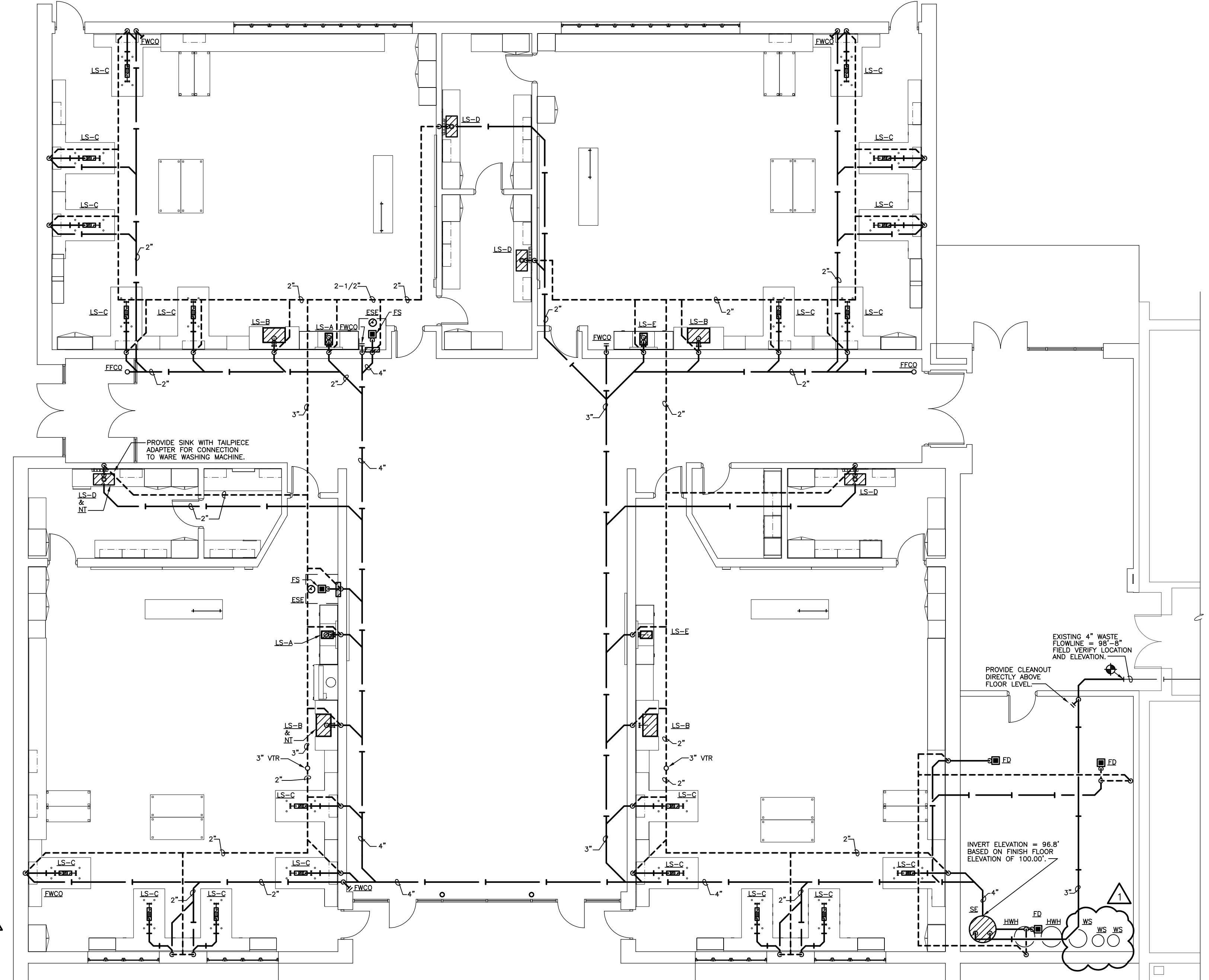
Sheet:
P101

OF: **16**

PLUMBING EQUIPMENT SCHEDULE

General Notes:
 1. For fixtures marked (ADA), fixture, trim, mounting dimensions and installation shall meet the requirements of the 2010 Americans With Disabilities Act.
 2. Coordinate fixture locations with Architectural plans and elevations prior to rough-in.
 3. All fixtures shall be provided with vandal resistant trim.

LS-A (ADA)	Lab sink and faucet by others. Provide Dearborn supplies with stops and escutcheon plate, and Enfield Labline W511 1-1/2" polypropylene P-trap with transparent base. Insulate water and waste piping below sink with manufactured piping covers consisting of flexible vinyl insulation with white finish and access to piping, equivalent to Handi-Lav Guard manufactured by Trubro Inc.	FWCO	Wade 8560-E cleanout tee with brass threaded plug and 8480-R round stainless steel coverplate secured to plug by countersunk screw.
LS-B	Lab sink and faucet by others. Provide Dearborn supplies with stops and escutcheon plate, and Enfield Labline W511 1-1/2" polypropylene P-trap with transparent base.	FECO	Finished floor cleanout, Wade 6000-Z-1 cast iron finished floor cleanout with spigot outlet, threaded adjustable housing, flanged ferrule with bronze threaded plug and vandal proof round secured nickel bronze scoriated top.
LS-C	Lab sink and faucet by others. Provide Dearborn supplies with stops and escutcheon plate, and Enfield Labline W511 1-1/2" polypropylene P-trap with transparent base. Two faucets provided at each sink location.	HWH	Rheem BTH-199 gas fired direct vent water heater, 80 gallon storage, 199 MBH natural gas input, 258 gallon per hour recovery at 90 degrees F rise.
LS-D	Lab sink and faucet by others. Provide Dearborn supplies with stops and escutcheon plate, and Enfield Labline W511 1-1/2" polypropylene P-trap with transparent base. Provide with undercounter mounted tempering valve for deck mounted drench hose, equivalent to Guardian G3600LF tempering valve, 1/2" nominal hot and cold water inlet pipe tap, 1/2" mixed outlet pipe tap. Valve shall be capable of providing 2.7 gpm of tempered water at 10 psi pressure drop. The valve shall be constructed of bronze and non-ferrous materials. The unit shall include a built-in cold water by-pass, solid bimetal thermostat, locking temperature regulator with limit stop factory set for 90 degrees, internal check stops, and dial thermometer.	SE	Vertical centrifugal sewage ejector pump, Weil series 2100, model 2103, duplex arrangement. 30 gpm @ 20 feet head (each pump), 2 drip-proof motors, 1/2 hp, 120 volt/1 phase, 1150 rpm, 36 in. dia. x 60 in. deep fiberglass basin. Provide pump with cover panel, automatic alternator, capacity doubler, float switches, high water alarm, basin cover and 3" NPT threaded discharge elbow & check valves.
LS-E (ADA)	Lab sink and faucet by others. Provide Dearborn supplies with stops and escutcheon plate, and Enfield Labline W511 1-1/2" polypropylene P-trap with transparent base. Provide with undercounter mounted tempering valve for deck mounted drench hose, equivalent to Guardian G3600LF tempering valve, 1/2" nominal hot and cold water inlet pipe tap, 1/2" mixed outlet pipe tap. Valve shall be capable of providing 2.7 gpm of tempered water at 10 psi pressure drop. The valve shall be constructed of bronze and non-ferrous materials. The unit shall include a built-in cold water by-pass, solid bimetal thermostat, locking temperature regulator with limit stop factory set for 90 degrees, internal check stops, and dial thermometer. Insulate water and waste piping below sink with manufactured piping covers consisting of flexible vinyl insulation with white finish and access to piping, equivalent to Handi-Lav Guard manufactured by Trubro Inc.	MXV	Leonard #TM-520B-LF-DT-IT high-low thermostatic water mixing valve assembly for exposed piping with Type TM Thermostatic Water Mixing Valve with solid bimetal thermostat directly linked to valve porting, adjustable limit stops, color coded scale, wall support, inlet union angle strainer checkstops, outlet volume control/shutoff, pressure regulating valve with pressure gauges, Type TM Thermostatic Water Mixing Valve with solid bimetal thermostat directly linked to valve porting, assembly shall be capable of providing 29 gpm of tempered water at 10 psi pressure drop, 1.0 gpm minimum flow rate, adjustable limit stops, color coded scale, outlet volume control/shutoff, dial thermometer (range: 0 degrees F to 140 degrees F), and rough bronze finish.
NI	Striem model LB-2 neutralization tank with 2 gallon capacity, 4-1/2" gasketed top access port with captive hand-thread hardware, 2" pipe inlet and outlet, and built-in sewer gas trap. Unit molded from high density polyethylene with 1/4" uniform wall thickness, and 25 lb limestone capacity. See plans for installation location. Provide complete with fully supported base. Install in a manner that unit remains serviceable.	IV	Emergency mixing valve Haws 9202E with factory set point of 85 deg. F, 60-90 deg. F outlet temperature adjustment range, 1 gpm minimum flow rate, 45 gpm flow rate at 10 PSI pressure drop, cold water bypass upon failure of hot water, hot water shutdown upon failure of cold water, paraffin filled thermostat, inlet check stops, 1-1/4" inlets, 1-1/4" outlet.
WH-A	Wade W-8600 non-freeze wall hydrant, cast bronze with satin bronze face, 3/4" inlet and brass casing of sufficient length to extend through walls as required to place valve inside building. Valve rod and seat washer shall be removable through the face of the hydrant. Hydrant shall be furnished complete with detachable T-handle and integral vacuum breaker.	HWP	Hot water circulation pump, Taco #005-BF, in-line, 4GPM @ 9 ft. head, 1/35 HP, bronze body, 3250 RPM, 120 volt, 1 phase, 3/4" flanges. Provide bronze companion flanges and aquastat control.
ES	Floor sink - Wade 9140 12" square, 8" deep, cast iron with smooth porcelain acid resisting interior, double drainage flange, bottom outlet, acid resisting nickel brass grate with openings as required for indirect drains, and sediment bucket. Omit grate where not required. Use acid resistant porcelain coated cast iron where not subjected to foot traffic. Provide with ProSet Systems trap guard T25630-F. Floor sink installed in recessed floor slab, see Architectural plans.	TEA	Thermal Expansion Absorber, Amtral ST-30W-C precharged hydropneumatic steel expansion tank with internal butyl diaphragm, 14.0 gallons total volume, 8.9 gal minimum expansion volume, 150 psig maximum working pressure.
		ESE (ADA)	Guardian GBF2150 recessed barrier-free eye/face wash and shower safety station with ceiling mounted exposed shower head, stainless steel bar actuator with brass stay-open ball valve, pulldown eye/face wash to automatically open valve for operation. Furnished with ANSI-compliant identification sign.
		FD	Floor drain for mechanical rooms - Wade 2350-27 cast iron with bottom outlet, 8" square top, square loose set grate, and removable sediment bucket. Provide with ProSet Systems trap guard T25630-F.
		WS	Mario MGT-120-2 twin fully automatic water softener with two resin tanks and one brine tank, 80,000 grain exchange capacity in each resin tank at a salt dosage of 6lb/cu.ft., demand regeneration based on meter, each valve/resin tank rated for 47 gpm at a maximum pressure drop of 15 psi. Low voltage transformers to plug into 15 Amp 120 volt receptacle.

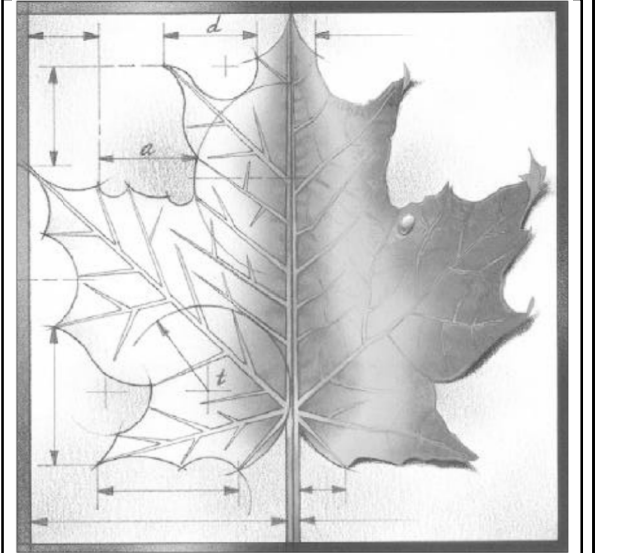


A WATER HEATER DETAIL
NO SCALE

ADDITION FLOOR PLAN - WASTE AND VENT
1/8" = 1'-0"

FIXTURE/DESIGNATION	WASTE	VENT	COLD WTR.	TEMP. HOT WTR.
LAB SINK/LS-A,B,C	2"	2"	1/2"	1/2"
LAB SINK WITH EYEWASH/LS-D,E	2"	2"	3/4"	3/4"
EMERGENCY SHOWER/ESE	---	2"	---	1-1/2"
WALL HYDRANT/WH-A	---	---	3/4"	---
FLOOR SINK/FS	4"	2"	---	---
FLOOR DRAIN/FD	2"	2"	---	---

ose ORAZEM & SCALORA ENGINEERING, P.A.
 Manhattan, Kansas
 Job No. 15011-1
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BBN

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Information provided on the drawings regarding existing conditions has been obtained from the best sources available, but cannot be guaranteed in all respects. Contractor shall verify all such information prior to proceeding with any new work that may be affected. Include as part of the contract all work required to produce the indicated result. All drawings and written material appearing herein constitute the original and unpublished work of the Architect, and same may not be duplicated, used or disclosed without the written consent of the Architect.
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REVISIONS:

12/14/2017	

Project Number: **16036**
 Date: **11/28/17**
 Project Name:
USD 320 WAMEGO MIDDLE SCHOOL SCIENCE ROOM ADDITION
 Project Address:
1701 KAW VALLEY ROAD Wamego, KS 66547

Sheet Title:
PLUMBING PLANS
 Sheet:
P102
 OF: **16**

Sub-Contract / Material Supplier Bid Form

**USD 320 Wamego-Phase 2-Bid Package 3-
Wamego Middle School Science Addition**
Project: Wamego, KS

Architect: BBN Architects Inc.
MEP Engineer: Orazem & Scalora Engineering, P.A.
Civil Engineer: SMH Consultants
Owner: USD 320 Wamego
Construction Manager: Coonrod & Associates Construction Co., Inc.

Date: _____

Bidder Company Name: _____

Bidder Address: _____

Bidder Contact Name: _____

Bidder Contact Phone Number: _____

Bidder Contact Email: _____

Scope of Work / Bid Scope (Reference Bid Scopes issued by CM):
Scope clarifications may be attached to this bid form.

Base Bid:

In compliance with the Instructions to Bidders, plans, specifications / project manual and any and all addenda for this project, the undersigned agrees to fully furnish all material and equipment and perform all labor for above scope of work and/or bid package designated, for the lump sum of

_____ Dollars

(\$ _____)

Unit Prices:

_____	\$ _____ \$ /
_____	\$ _____ \$ /
_____	\$ _____ \$ /

Bid Alternates:

In compliance with the Instructions to Bidders, plans, specifications and any and all addenda for this project, the undersigned agrees to fully furnish all material and equipment and perform all labor for above scope of work and/or bid package designated as it pertains to the alternates, for the lump sum of

<u>IF ADDED BY ADDENDUM</u>		ADD	DEDUCT
Alternate	# _____	\$ _____	\$< _____ >
Alternate	# _____	\$ _____	\$< _____ >
Alternate	# _____	\$ _____	\$< _____ >
Alternate	# _____	\$ _____	\$< _____ >