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**Greenville
Technical College**

GREENVILLE - BLDG. 112 AIR COOLED CHILLER ADDITION

Project No.: H59-N054-FW

**SUBMITTED FOR:
CONSTRUCTION
JANUARY 15, 2021**

**OWNER:
GREENVILLE TECHNICAL COLLEGE
506 S. PLEASANTBURG DRIVE
GREENVILLE, SOUTH CAROLINA 29607**

**ARCHITECT:
CRAIG GAULDEN DAVIS, INC.
19 WASHINGTON PARK
GREENVILLE, SOUTH CAROLINA 29601**

**CIVIL ENGINEER:
SEAMON WHITESIDE
508 RHETT STREET, #101
GREENVILLE, SOUTH CAROLINA 29601**

**HVAC, PLUMBING ENGINEER:
CAVINESS LAMBERT ENGINEERING
508 E. NORTH STREET
GREENVILLE, SOUTH CAROLINA 29601**

**ELECTRICAL ENGINEER:
CAVINESS LAMBERT ENGINEERING
508 E. NORTH STREET
GREENVILLE, SOUTH CAROLINA 29601**

SCOPE OF WORK

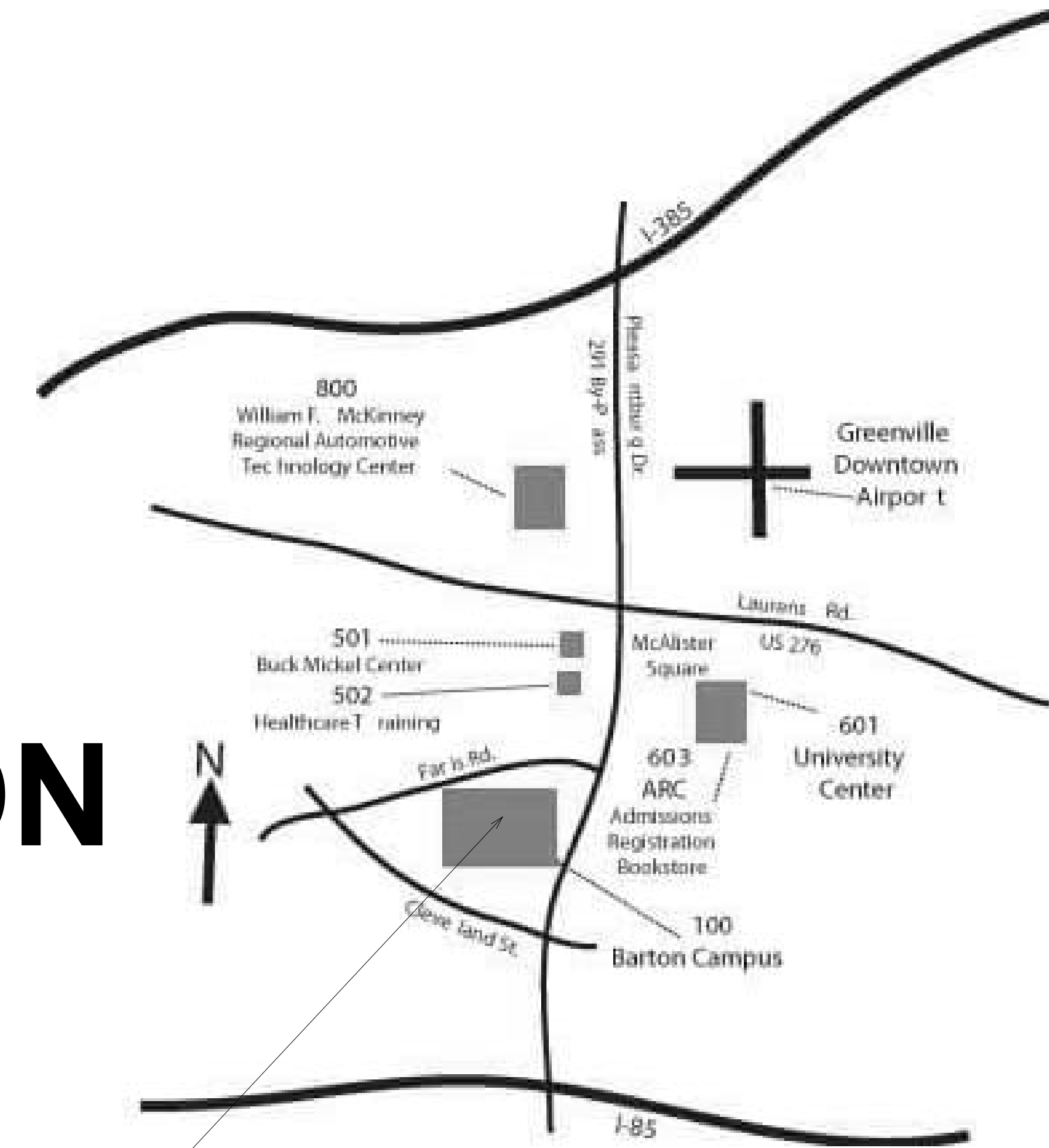
1. THE COLLEGE PLANS TO TAKE BUILDING 112 OFF THE LOOP FROM THEIR CENTRAL ENERGY PLANT. A BOILER WAS PREVIOUSLY ADDED TO THE BUILDING. THE PURPOSE OF THIS PROJECT IS TO ADD A CHILLER TO SERVE BUILDING 112. THE CHILLER WILL BE PLACED IN A NEARBY PARKING LOT. THE WATER PIPING WILL ENTER THE BUILDING WHERE THE CURRENT CHILLED WATER LINE ENTERS. EXISTING PIPING INSIDE THE BUILDING WILL BE REUSED.
2. SINCE THE BUILDING IS NOT BEING EXPANDED AND NO ARCHITECTURAL WORK IS BEING DONE, THE WORK FALLS UNDER LEVEL 1 ALTERATIONS OF THE 2018 INTERNATIONAL EXISTING BUILDING CODE (IEBC). ALL WORK WILL MEET WITH REQUIREMENTS OF THE FOLLOWING CODES:

INTERNATIONAL MECHANICAL CODE, 2018 EDITION
INTERNATIONAL PLUMBING CODE, 2018 EDITION
NATIONAL ELECTRICAL CODE, 2017 EDITION

DRAWING LIST

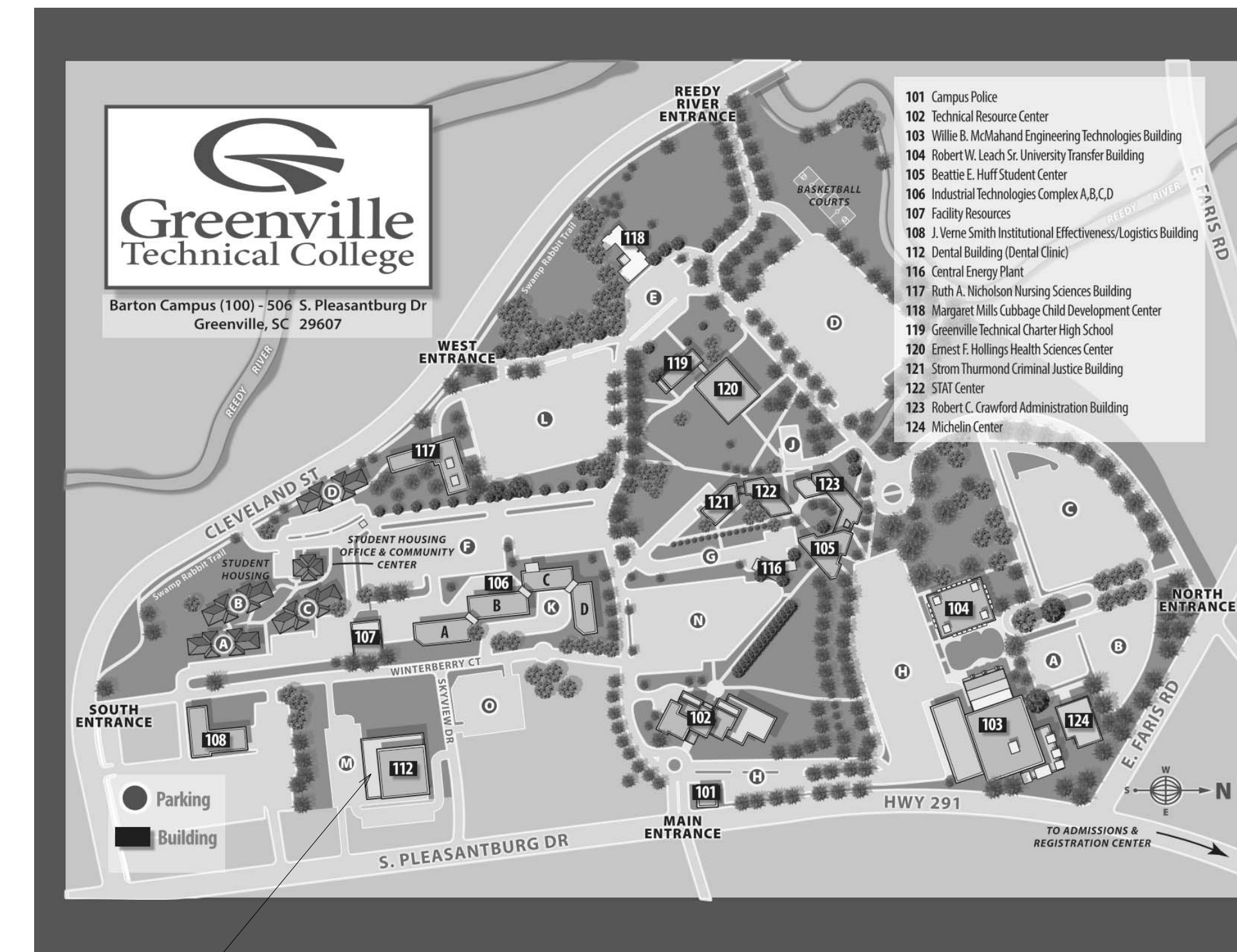
T100. TITLE SHEET

| | |
|-------------------|---------------------------------------|
| CIVIL | |
| C1.1 | NOTES & LEGEND |
| C2.0 | EXISTING CONDITIONS & DEMOLITION PLAN |
| C3.0 | EROSION & SEDIMENT CONTROL PLAN |
| C4.0 | SITE PLAN |
| MECHANICAL | |
| MP001 | MECHANICAL PIPING SCHEDULES & NOTES |
| MP002 | MECHANICAL SPECIFICATIONS |
| MP003 | MECHANICAL SPECIFICATIONS |
| MP004 | MECHANICAL SPECIFICATIONS |
| MP101 | CHILLER AREA PLAN |
| MP102 | MECHANICAL PIPING PLAN |
| ELECTRICAL | |
| E001 | ELECTRICAL PLAN, SCHEDULES & DETAILS |
| E002 | ELECTRICAL SPECIFICATIONS |



PROJECT CAMPUS

AREA MAP



BUILDING 112

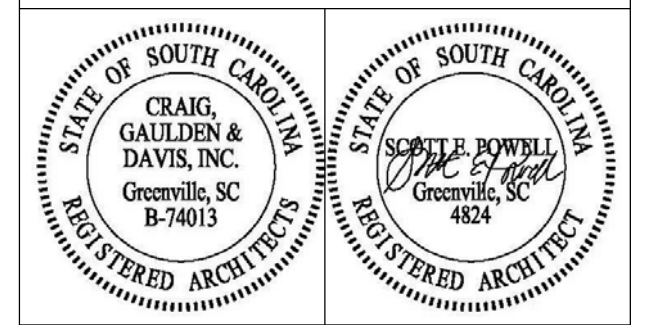
CAMPUS MAP

**CRAIG
GAULDEN
DAVIS**

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Planning
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CONSULTANT



506 S. PLEASANTBURG DRIVE, GREENVILLE, SC 29607

GREENVILLE - BLDG. 112 AIR COOLED CHILLER ADDITION

Project No.: H59-N054-FW

| DATE | MARK | DESCRIPTION |
|------|------|-------------|
| | | |

ISSUE: CONSTRUCTION
DATE: 1/15/2021
PROJECT NO: 20033
DRAWN BY: HED
CHECKED BY: SEP

TITLE SHEET

T100

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GENERAL NOTES

- ALL ELEVATIONS ARE BASED ON THE TOPOGRAPHIC SURVEY PROVIDED BY OWNER COMPLETED BY FREELAND & ASSOCIATES, INC. DATED JUNE 12, 2019. THE VERTICAL ELEVATION DATUM IS NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88) AND THE HORIZONTAL DATUM IS NAD83.
- THE LOCATIONS OF EXISTING UTILITIES ARE SHOWN IN AN APPROXIMATE WAY ONLY AND HAVE NOT BEEN INDEPENDENTLY VERIFIED BY THE OWNER OR HIS REPRESENTATIVES. EXISTING UTILITIES SHOWN DO NOT INCLUDE ALL UTILITIES THAT MAY EXIST.
- THE CONTRACTOR SHALL BE RESPONSIBLE FOR HAVING ALL EXISTING UNDERGROUND UTILITIES LOCATED WITHIN THIS SITE AND AROUND THE PERIMETER OF THIS SITE WHERE SUCH UTILITIES MIGHT BE OCCASIONED BY ANY ACTIVITY INVOLVED WITH THESE PLANS. ALL UTILITY LOCATION WORK SHALL BE DONE PRIOR TO CONSTRUCTION ACTIVITY. THE CONTRACTOR AGREES TO BE RESPONSIBLE FOR ANY AND ALL DAMAGES WHICH MIGHT BE OCCASIONED BY THE CONTRACTOR'S FAILURE TO LOCATE AND PRESERVE ANY UNDERGROUND UTILITIES THAT MAY EXIST.
- THE CONTRACTOR SHALL VERIFY THE EXISTING TOPOGRAPHY AND EXISTING UTILITY LINE LOCATIONS AND ELEVATIONS PRIOR TO BEGINNING WORK. SHOULD THE CONTRACTOR FIND ANY DISCREPANCIES ON THE DRAWING PRIOR TO BEGINNING WORK OR DURING CONSTRUCTION, HE SHALL NOTIFY THE ENGINEER IMMEDIATELY COMMENCING LAND DISTURBING ACTIVITIES CONSTITUTES ACCEPTANCE OF THE SITE CONDITIONS AS INDICATED ON THE CONSTRUCTION DRAWINGS.
- ALL CONTRACTORS MUST HAVE APPROPRIATE BUSINESS LICENSE(S) PRIOR TO BEGINNING WORK.
- THE PROPERTY IS LOCATED IN THE CITY OF GREENVILLE, GREENVILLE COUNTY, SOUTH CAROLINA.
- PARCEL MAP NUMBERS ARE 0269000101102 & 026900010280.
- TOTAL DISTURBED AREA IS ±0.15 ACRES. TOTAL PROPERTY AREA IS ±1.41 ACRES.
- THE CONTRACTOR SHALL VERIFY ALL DIMENSIONS PRIOR TO CONSTRUCTION. AN AUTOCAD FILE OF THIS DRAWING CAN BE PROVIDED TO THE CONTRACTOR FOR CONSTRUCTION LAYOUT PURPOSES. SWM PROVIDES NO WARRANTY REGARDING USE OF ELECTRONIC FILES. ALL MEASUREMENTS ARE CALCULATED AND NOT SURVEYED UNLESS NOTED OTHERWISE. ALL DIMENSIONS ARE TO FACE OF CURB OR EDGE OF PAVEMENT UNLESS OTHERWISE NOTED.
- THE CONTRACTOR IS RESPONSIBLE FOR SITE SAFETY.
- THIS PROPERTY IS LOCATED IN ZONE X AS SCALED FROM FEMA FIRM 45045C0403E.
- CLEARING OUTSIDE OF WHAT IS DEPICTED ON THESE PLANS TO BE CLEARED IS PROHIBITED. CONTRACTOR SHALL BE HELD RESPONSIBLE FOR LAND DISTURBANCES BEYOND THE LIMITS OF DISTURBANCE INDICATED ON THE CONSTRUCTION DOCUMENTS AT THE CONTRACTOR'S EXPENSE.
- THE OWNER SHALL BE RESPONSIBLE FOR ANY SOIL OR MATERIAL TESTING REQUIRED TO MEET SPECIFICATIONS.
- PROVIDE SILT FENCE ALONG THE TOE OF ANY SLOPES OR LOCATIONS WHERE SEDIMENT SHALL DISCHARGE FROM THE SITE. SEE SEDIMENT AND EROSION CONTROL PLAN FOR SPECIFIC LOCATIONS.
- THE RECEIVING WATER IS THE REDDY RIVER.
- THE EXISTING SOILS ARE CARTECY (C8), CECIL-URBAN LAND COMPLEX, 2 TO 10 PERCENT SLOPES (CUG) & CECIL-URBAN LAND COMPLEX, 10 TO 25 PERCENT SLOPES (CUE).
- THE OWNER IS GREENVILLE TECHNICAL COLLEGE THE NATURE OF CONSTRUCTION IS ADDITION OF A COLD WATER CHILLER AND TRANSFORMER.
- ALL SLOPES TO BE STABILIZED BEFORE CITY OF GREENVILLE FINAL ACCEPTANCE.
- ALL RETAINING WALLS FOUR (4) FEET AND GREATER IN HEIGHT, WHEN MEASURED FROM THE BOTTOM OF THE FOOTING TO THE TOP OF THE WALL AT ANY POINT, AND ALL RETAINING WALLS SUPPORTING A SURCHARGE OR IMPOUNDING CLASS I, II OR III LIQUIDS MUST BE ENGINEERED BY A REGISTERED SOUTH CAROLINA PROFESSIONAL ENGINEER AND SUBMITTED TO THE CITY OF GREENVILLE'S BUILDING CODES DEPARTMENT FOR REVIEW AND APPROVAL PRIOR TO INSTALLATION.
- ANY REVIEW/ACCEPTANCE BY THE CITY OF GREENVILLE DOES NOT RELIEVE THE CONTRACTOR OR SUBCONTRACTORS FROM MEETING CODE/ORDINANCE REQUIREMENTS (SOUTH CAROLINA CODE OF LAWS SECTION 40-11-110 AND 40-59-90).
- THE CONTRACTOR MUST NOTIFY THE CITY OF GREENVILLE'S CONSTRUCTION INSPECTION BUREAU (864) 467-8890 A MINIMUM OF 72 HOURS PRIOR TO BEGINNING DEMOLITION AND CONSTRUCTION.
- ANY ENCROACHMENT PERMIT FROM THE SCDOT FOR STATE ROADS OR FROM THE CITY OF GREENVILLE FOR CITY ROADS (CONTACT THE CONSTRUCTION INSPECTION BUREAU, (864) 467-8890) IS REQUIRED FOR ANY WORK PERFORMED WITHIN THE PUBLIC RIGHT-OF-WAY. CONTRACTOR IS RESPONSIBLE FOR OBTAINING ENCROACHMENT PERMITS AS NEEDED FOR CONSTRUCTION.
- THE CONTRACTOR SHALL COORDINATE WITH THE ENGINEER OF RECORD FOR A DIGITAL STAKING PLAN TO ESTABLISH COMPLETE HORIZONTAL AND VERTICAL CONTROL. THE CONTRACTOR IS RESPONSIBLE FOR SURVEY STAKEOUT OF ALL IMPROVEMENTS. DISCREPANCIES BETWEEN THE PLANS, CONSTRUCTION STAKES, AND FIELD CONDITIONS SHALL BE REPORTED TO THE ENGINEER OF RECORD IMMEDIATELY FOR RESOLUTION PRIOR TO INSTALLATION OF PROPOSED IMPROVEMENTS.

DEMOLITION NOTES

- THE CONTRACTOR SHALL VERIFY ALL ITEMS TO BE DEMOLISHED AND REMOVED FROM THE PROJECT SITE. THE DEMOLITION PROCESS SHALL INCLUDE WAITING AND WALKING THE SITE. ALL ITEMS REQUIRING DEMOLITION/REMOVAL, WHETHER SHOWN ON THIS PLAN OR NOT, SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR.
- THERE SHALL BE NO BURNING ON THE SITE UNLESS THE CITY OF GREENVILLE APPROVES AND PERMITS BURNING. IT IS THE CONTRACTOR'S RESPONSIBILITY TO OBTAIN PERMIT IF NECESSARY.
- ALL EXISTING STRUCTURES (IF ENCOUNTERED) AND RELATED FOOTINGS, FOUNDATIONS, STEPS, ETC. ARE TO BE REMOVED FROM THE SITE AND DISPOSED OF ACCORDING TO APPLICABLE CODES.
- THE CONTRACTOR IS RESPONSIBLE FOR COORDINATING THE REMOVAL AND/OR RELOCATION OF ALL UTILITIES (ABOVE AND BELOW GROUND LEVEL) AS NECESSARY TO FACILITATE CONSTRUCTION. SEE THE UTILITY PLANS FOR SPECIFIC DIRECTION.
- EXISTING SEPTIC TANKS, GREASE TRAPS AND/OR UNDERGROUND TANKS, IF ENCOUNTERED, ARE TO BE REMOVED FROM THE SITE AND DISPOSED OF ACCORDING TO APPLICABLE CODES. THE LOCATION OF ANY TANKS SHALL BE RECORDED AND THE ENGINEER SHALL BE NOTIFIED AT ONCE.
- WELLS, IF ENCOUNTERED, SHALL BE ACCURATELY LOCATED BY THE CONTRACTOR, PROTECTED AND SURROUNDING GRADES MAINTAINED SUCH THAT SURFACE RUNOFF CANNOT ENTER THE WELL OPENING. THE CONTRACTOR SHALL NOTIFY THE ENGINEER AT ONCE.
- THE CONTRACTOR SHALL CONSULT THE OWNER REGARDING SALVAGE, ANY ITEMS NOT RETAINED BY THE OWNER SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO DEMOLISH AND/OR LEGALLY DISPOSE OF.
- EROSION AND SEDIMENT CONTROL MEASURES SHALL BE IN PLACE PRIOR TO DEMOLITION AND REMAIN IN PLACE UNTIL FINAL STABILIZATION AND COMPLETION OF CONSTRUCTION ACTIVITIES.
- IF ANY HAZARDOUS MATERIAL IS ENCOUNTERED DURING DEMOLITION, THE CONTRACTOR SHALL COORDINATE WITH THE OWNER AND APPROPRIATE AGENCIES FOR PROPER REMOVAL AND DISPOSAL.
- DEMOLITION SHALL MEET ALL APPLICABLE STATE, LOCAL AND FEDERAL REGULATIONS. THE CONTRACTOR SHALL BE RESPONSIBLE FOR OBTAINING APPLICABLE PERMITS.

I HAVE PLACED MY SIGNATURE AND SEAL ON THE DESIGN DOCUMENTS SUBMITTED SIGNIFYING THAT I ACCEPT RESPONSIBILITY FOR THE DESIGN OF THE SYSTEM. FURTHER, I CERTIFY TO THE BEST OF MY KNOWLEDGE AND BELIEF THAT THE DESIGN IS CONSISTENT WITH THE REQUIREMENTS OF TITLE 48, CHAPTER 14 OF THE CODE OF LAWS OF SC, 1976 AS AMENDED, PURSUANT TO REGULATION 72-300 ET SEQ. (IF APPLICABLE), AND IN ACCORDANCE WITH THE TERMS AND CONDITIONS OF SCRI100000.

CONTRACTOR IS RESPONSIBLE FOR PREPARATION, INSTALLATION, AND MAINTENANCE OF TRAFFIC CONTROL PLAN & DEVICES

CONTRACTOR IS TO CONFIRM ANY FILL DIRT OR WASTE DIRT MUST BE FROM OR TO A PERMITTED SITE



Know what's below. Call before you dig.

CITY OF GREENVILLE EROSION PREVENTION & SEDIMENT CONTROL NOTES

- THE CITY OF GREENVILLE CONSTRUCTION INSPECTION BUREAU SHALL BE NOTIFIED BY THE PERMIT HOLDER AT (864) 467-8890 A MINIMUM OF 72 HOURS PRIOR TO BEGINNING CONSTRUCTION. A PRE-CONSTRUCTION CONFERENCE MUST BE HELD FOR EACH CONSTRUCTION SITE WITH AN APPROVED ON-SITE SWPPP PRIOR TO THE IMPLEMENTATION OF CONSTRUCTION ACTIVITIES.
- SEDIMENT AND EROSION CONTROL DEVICES SHALL BE INSTALLED AND FUNCTIONING PRIOR TO BEGINNING ANY PROJECT EROSION CONTROL ACTIVITIES.
- ALL SEDIMENT AND EROSION CONTROLS SHALL BE INSPECTED UNTIL CONSTRUCTION IS COMPLETE, THE SITE IS PERMANENTLY STABILIZED, AND THE NOTICE OF TERMINATION (NOT) IS FILED WITH SCHEC.
- ALL EROSION CONTROL DEVICES SHALL BE PROPERLY MAINTAINED DURING CONSTRUCTION UNTIL THE COMPLETION OF ALL CONSTRUCTION ACTIVITIES AND ALL DISTURBED AREAS HAVE BEEN PERMANENTLY STABILIZED. ADDITIONAL CONTROL DEVICES MAY BE REQUIRED DURING CONSTRUCTION IN ORDER TO CONTROL EROSION AND/OR OFFSITE SEDIMENTATION. ALL TEMPORARY CONTROL DEVICES SHALL BE REMOVED ONCE CONSTRUCTION IS COMPLETE AND THE SITE IS PERMANENTLY STABILIZED.
- ALL SEDIMENT AND EROSION CONTROL DEVICES SHALL BE INSPECTED ONCE EVERY SEVEN (7) CALENDAR DAYS. DAMAGED, INEFFECTIVE, OR INCORRECTLY INSTALLED DEVICES SHALL BE REPAIRED OR REPLACED, AS NECESSARY, WITHIN 48 HOURS OF IDENTIFICATION FENCING.
- ALL INSPECTION RECORDS SHALL BE DOCUMENTED IN WRITTEN FORM AND CATALOGUED IN A RECORD KEEPING BINDER FOR THE PROJECT (SWPPP BOOK). THE CITY MAY REQUIRE ELECTRONIC SUBMISSION OF WEEKLY INSPECTION RECORDS.
- A RAIN GAUGE SHALL BE INSTALLED AT THE PROJECT AREA, AND CUMULATIVE PRECIPITATION DEPTH SHALL BE RECORDED WITH WEEKLY INSPECTION DOCUMENTATION. ALL RAINFALL EVENTS 0.5" AND GREATER, AS RECORDED ON-SITE OR BY A WEATHER STATION IN REASONABLE PROXIMITY TO THE PROJECT, SHALL ALSO BE DOCUMENTED WITH THE WEEKLY INSPECTION REPORTS.
- ALL EROSION PREVENTION AND SEDIMENT CONTROL PLANS AND INSPECTION DOCUMENTATION (E.G., SWPPP BOOK, CERTIFICATION STATEMENTS, INSPECTION RECORDS, MAINTENANCE RECORDS, AND RAINFALL DATA) SHALL BE RETAINED AT THE CONSTRUCTION SITE OR, IF APPROVED BY THE CITY, AT A NEARBY LOCATION EASILY ACCESSIBLE DURING NORMAL BUSINESS HOURS FROM THE DATE OF COMMENCEMENT OF CONSTRUCTION ACTIVITIES TO THE DATE THAT FINAL STABILIZATION IS REACHED. ALL PLANS AND DOCUMENTS SHALL BE UPDATED AS NECESSARY TO REFLECT GENERAL PERMIT SCRI100000.
- IF EXISTING BMPs NEED TO BE MODIFIED OR IF ADDITIONAL BMPs ARE NECESSARY TO COMPLY WITH THE REQUIREMENTS OF THIS PERMIT AND/OR SC'S WATER QUALITY STANDARDS, IMPLEMENTATION MUST BE COMPLETED BEFORE THE NEXT STORM EVENT WHENEVER PRACTICABLE. IF IMPLEMENTATION BEFORE THE NEXT STORM EVENT IS IMPRACTICABLE, THE SITUATION MUST BE DOCUMENTED IN THE SWPPP AND ALTERNATIVE BMPs MUST BE IMPLEMENTED AS SOON AS REASONABLY POSSIBLE.
- STABILIZATION MEASURES SHALL BE INITIATED AS SOON AS PRACTICABLE IN PORTIONS OF THE SITE WHERE CONSTRUCTION ACTIVITIES HAVE TEMPORARILY OR PERMANENTLY CEASED, BUT IN NO CASE MORE THAN FOURTEEN (14) DAYS AFTER WORK HAS CEASED, EXCEPT AS STATED BELOW:
 - WHERE STABILIZATION BY THE 14TH DAY IS PRECLUDED BY SNOW COVER OR FROZEN GROUND CONDITIONS STABILIZATION MEASURES MUST BE INITIATED AS SOON AS PRACTICABLE.
 - WHERE CONSTRUCTION ACTIVITY ON A PORTION OF THE SITE IS TEMPORARILY CEASED AND EARTH DISTURBING ACTIVITIES WILL BE RESUMED WITHIN 14 DAYS, TEMPORARY STABILIZATION MEASURES DO NOT HAVE TO BE INITIATED ON THAT PORTION OF THE SITE.
 - THE SITE SHALL BE CONSIDERED PERMANENTLY STABILIZED WHEN ALL SURFACE DISTURBING ACTIVITIES ARE COMPLETE AND EITHER OF THE TWO FOLLOWING CRITERIA IS MET:
 - A UNIFORM (E.G., EVENLY DISTURBED, WITHOUT LARGE BARE AREAS) PERENNIAL VEGETATIVE COVER WITH A DENSITY OF 70% OF THE NATIVE BACKGROUND VEGETATIVE COVER FOR THE AREA HAS BEEN ESTABLISHED ON ALL UNPAVED AREAS AND AREAS NOT COVERED BY PERMANENT STRUCTURES, OR
 - EQUIVALENT PERMANENT STABILIZATION MEASURES (SUCH AS RIPRAP, GABIONS, OR GEOTEXTILES) HAVE BEEN EMPLOYED.
- A STABILIZED CONSTRUCTION ENTRANCE SHALL BE INSTALLED AND MAINTAINED ON THE PROJECT SITE. STORM WATER INLET PROTECTION SHALL BE PROVIDED FOR ALL INLETS (UPSTREAM AND DOWNSTREAM) WITHIN 50 FT. OF THE CONSTRUCTION ENTRANCE OR DISTURBANCE ON BOTH SIDES OF THE PUBLIC ROADWAY.
- ALL EXISTING AND NEW STORM WATER STRUCTURES, AFFECTED BY THIS PROJECT, SHALL BE INSPECTED AND MAINTAINED CLEAN OF ACCUMULATED DEMOLITION DEBRIS OR SEDIMENTS.
- DISPOSAL OF ALL RECOVERED SEDIMENTS AND CONSTRUCTION DEBRIS SHALL BE IN ACCORDANCE WITH ALL APPLICABLE CITY, STATE AND FEDERAL REGULATIONS. NO SEDIMENT OR CONSTRUCTION DEBRIS SHALL BE FLUSHED DOWN THE STORM WATER SYSTEM.
- DURING THE COURSE OF CONSTRUCTION ACTIVITIES, EROSION AND SEDIMENT CONTROLS SHALL BE USED TO PREVENT TRACKING OF MUD AND/OR SEDIMENT ACCUMULATION ON PUBLIC ROADWAYS (INCLUDING STREET GUTTERS) AND ACCESS DRIVE. SEDIMENT LADEN RUNOFF FROM ENTERING EXISTING STORM WATER SYSTEM INLETS AND DEPOSITING ON ADJACENT PUBLIC ROADWAYS SHALL BE PROHIBITED. THE CONTRACTOR SHALL DAILY REMOVE MUD/SOIL FROM PAVEMENT, BY SWEEPING OR VACUUMING, AS MAY BE REQUIRED.
- TO SECURE THE PROJECT SITE, LOCATE LIMITS OF CONSTRUCTION, PROTECT AREAS THAT ARE TO REMAIN UNDISTURBED, AND PREVENT MIGRATION OF CONSTRUCTION DEBRIS, 6" CHAIN LINK FENCING SHALL BE INSTALLED AROUND AND ABOUT ALL UNPAVED AREAS AND AREAS NOT COVERED BY PERMANENT STRUCTURES, OR ON PUBLIC ROADWAYS OR ADJACENT PROPERTIES SHALL BE REMOVED WITHIN 24 HOURS. CARE SHALL BE TAKEN WHEN INSTALLING CONSTRUCTION FENCING TO NOT OBSCURE ONGOING TRAFFIC AT INTERSECTIONS, ADJACENT DRIVEWAYS AND THE PROJECT CONSTRUCTION ENTRANCE.
- PROVIDE SILT FENCE AND/OR OTHER CONTROL DEVICES, AS MAY BE REQUIRED, TO CONTROL SOIL EROSION DURING UTILITY CONSTRUCTION. ALL DISTURBED AREAS SHALL BE CLEANED, GRADED, AND STABILIZED IMMEDIATELY AFTER THE UTILITY INSTALLATION.
- SILT FENCE SHALL BE INSTALLED ALONG LINES OF EQUAL ELEVATION. SILT FENCING SHALL BE INSTALLED NO CLOSER THAN 5 FT. TO THE PROPERTY LINE OR CONSTRUCTION ENTRANCE.
- ALL WATERS OF THE STATE (WQS), INCLUDING WETLANDS, ARE TO BE FLAGGED OR OTHERWISE CLEARLY MARKED IN THE FIELD. ALL WQS SHALL BE CLEARLY DELINEATED ON THE EROSION PREVENTION AND SEDIMENT CONTROL PLANS.
- PROJECT SETBACK BUFFERS SHALL BE LOCATED A MINIMUM OF 30 FT. MEASURED FROM THE TOP OF STREAM BANK OR EDGE OF WETLAND, UNLESS OTHERWISE APPROVED BY THE CITY ENGINEER. ALL SETBACKS SHALL BE CLEARLY DELINEATED ON THE EROSION PREVENTION AND SEDIMENT CONTROL PLANS.
- A SINGLE ROW OF SILT FENCING SHALL BE INSTALLED ALONG ALL SETBACK BUFFERS THAT MEET THE MINIMUM REQUIREMENTS.
- A DOUBLE ROW OF SILT FENCING SHALL BE INSTALLED IN ALL AREAS WHERE A MINIMUM SETBACK BUFFER CANNOT BE MAINTAINED BETWEEN THE DISTURBED AREA AND THE WATER BODY OR WETLAND. DOUBLE ROW OF SILT FENCING SHALL BE PLACED NO CLOSER THAN 5 FT. DOWNHILL FROM THE TOE OF ANY FILL AREA AND A MINIMUM 5 FT. SPACING SHALL BE MAINTAINED BETWEEN SILT FENCE ROWS. A MINIMUM 5 FT. BUFFER SHOULD BE MAINTAINED BETWEEN THE LAST ROW OF SILT FENCE AND ALL WATER BODIES AND WETLANDS.
- STOCKPILES OF USEABLE OR WASTE MATERIALS SHALL BE SURROUNDED BY A ROW OF SILT FENCE AT ALL TIMES. STOCKPILES THAT ARE UNDISTURBED FOR MORE THAN FOURTEEN (14) DAYS SHALL HAVE APPROPRIATE STABILIZATION MEASURES INSTALLED. STOCKPILES SHALL BE PLACED A MINIMUM OF 50 FEET AWAY FROM STORMWATER FLOWS, STORMWATER INLET STRUCTURES, DRAINAGE COURSES, ADJACENT PROPERTY AND PUBLIC ROADWAYS.
- LITTER, CONSTRUCTION DEBRIS, OILS, FUELS, BUILDING PRODUCTS WITH SIGNIFICANT POTENTIAL FOR IMPACT (SUCH AS STOCKPILES OF FRESHLY TREATED LUMBER), AND CONSTRUCTION CHEMICALS THAT COULD BE EXPOSED TO STORM WATER MUST BE PREVENTED FROM BECOMING A POLLUTANT SOURCE IN STORMWATER DISCHARGES.
- TEMPORARY DIVERSION BERMS, DITCHES, OR SLOPE DRAINS SHALL BE PROVIDED FOR ALL SLOPES 3:1 OR STEEPER AND AS OTHERWISE NEEDED DURING CONSTRUCTION TO PROTECT AREAS FROM UPSLOPE RUNOFF AND/OR TO DIVERT SEDIMENT LADEN WATER TO APPROPRIATE TRAPS OR STABLE OUTLETS.
- SLOPES 3:1 OR STEEPER AND/OR EXCEEDING EIGHT (8) VERTICAL FEET SHALL BE STABILIZED WITH STAKED SYNTHETIC/VEGETATIVE MATS IN ADDITION TO HYDRO SEEDING AS SOON AS PRACTICAL BUT NO MORE THAN 7 CALENDAR DAYS AFTER LAND DISTURBING ACTIVITIES ON THE SLOPE HAVE PERMANENTLY OR TEMPORARILY CEASED.
- CAT TRACK OR SURFACE ROUGHENING IS REQUIRED FOR ALL SLOPES 3:1 OR STEEPER PRIOR TO SEEDING AND LAYING OF SYNTHETIC OR VEGETATIVE MATS. CAT TRACKING OR SURFACE ROUGHENING SHALL PRODUCE A SURFACE WITH FURROWS RUNNING CROSS SLOPE, PARALLEL WITH SLOPE CONTOURS, AND PERPENDICULAR TO SURFACE RUNOFF.
- PORTABLE TOILET FACILITIES SHALL NOT BE LOCATED WITHIN 20 FEET OF ANY STORM WATER STRUCTURE AND/OR 50 FEET OF ANY WATER COURSE, WETLAND AREA, STREAM, FLOODPLAIN, OR LAKE.
- THE FOLLOWING DISCHARGES ARE PROHIBITED:
 - WASTEWATER FROM WASHOUT OF CONCRETE, UNLESS MANAGED BY AN APPROPRIATE CONTROL.
 - WASTEWATER FROM WASHOUT AND CLEANOUT OF STUCCO, PAINT, FORM RELEASE OILS, CURING COMPOUNDS AND OTHER CONSTRUCTION MATERIALS.
 - FUELS, OILS, OR OTHER POLLUTANTS USED IN VEHICLE AND EQUIPMENT OPERATION AND MAINTENANCE.
 - SOAPS OR SOLVENTS USED IN VEHICLE AND EQUIPMENT WASHING DURING CONSTRUCTION.
- MINIMIZE THE DISCHARGE OF POLLUTANTS FROM EQUIPMENT AND VEHICLE WASHING, WHEEL WASH WATER, AND OTHER WASH WATERS. WASH WATERS MUST BE TREATED IN A SEDIMENT BASIN OR ALTERNATIVE CONTROL THAT PROVIDES EQUIVALENT TREATMENT PRIOR TO DISCHARGE.
- MINIMIZE THE DISCHARGES OF POLLUTANTS FROM DEWATERING OF TRENCHES AND EXCAVATED AREAS. THESE DISCHARGES ARE TO BE ROUTED THROUGH APPROPRIATE BMPs (SEDIMENT BASIN, FILTER BAG, ETC.).
- RESIDENTIAL SUBDIVISIONS REQUIRE EROSION CONTROL FEATURES FOR INFRASTRUCTURE AS WELL AS FOR INDIVIDUAL LOT CONSTRUCTION. INDIVIDUAL PROPERTY OWNERS SHALL FOLLOW THESE PLANS DURING CONSTRUCTION OR PROVIDE AN INDIVIDUAL PLAN IN ACCORDANCE WITH S.C. REG. 72-300 ET SEQ. AND SCRI00000.
- PROPERLY SIGNED AND SEALED AS-BUILT DRAWINGS OF THE STORMWATER PLAN AND A SIGNED AND SEALED DETENTION BASIN AS-BUILT SHALL BE SUBMITTED TO THE CITY WITHIN 30 DAYS OF PERMANENT STABILIZATION AND PRIOR TO ISSUANCE OF PROJECT ACCEPTANCE BY THE CITY.

DRAWING LEGEND

| OBJECTS AND SYMBOLS | EXISTING | NEW | OBJECTS AND SYMBOLS | EXISTING | NEW |
|------------------------------------|----------------------|--------------------|--|----------|-------|
| Adjoining Property Line | --- | N/A | Benchmark | ⊕ | N/A |
| Centerline | --- | (Same as Existing) | Sanitary Sewer Manhole | ⊕ | N/A |
| Easement | --- | (Same as Existing) | Sanitary Sewer Manhole ID # | N/A | ⊕ |
| Setback | --- | (Same as Existing) | Sanitary Sewer Cleanout | ⊕ | ⊕ |
| Sanitary Sewer (Gravity) | —ES—ES— | —S—S— | Double Sanitary Sewer Service (Residential Only) | ⊕ | ⊕ |
| Sanitary Sewer (Force Main) | —EFM—EFM— | —FM—FM— | Single Sanitary Sewer Service (Residential Only) | ⊕ | ⊕ |
| Water Line | —EW—EW— | —W—W— | TYPE 1 Storm Drainage Structure | ⊕ | ⊕ |
| Curb & Gutter (Straight) | ==== | ==== | TYPE 16 Storm Drainage Structure | ⊕ | ⊕ |
| Curb & Gutter (R&L) | ==== | ==== | TYPE 17 Storm Drainage Structure (Right) | ⊕ | ⊕ |
| Storm Drain | —ED—ED— | —RD—RD— | TYPE 18 Storm Drainage Structure (Left) | ⊕ | ⊕ |
| Road Drain | —ERD—ERD— | —RD—RD— | Catch Basin | ⊕ | ⊕ |
| Subsurface Drainage | —EUD—EUD— | —UD—UD— | Isolation Box | ⊕ | ⊕ |
| Silt Fence, Standard | —ESF—ESF— | —SF—SF— | Storm Drainage Junction Structure | ⊕ | ⊕ |
| Silt Fence, Reinforced | —ERSF—ERSF— | —RSF—RSF— | Yard Inlet | ⊕ | ⊕ |
| Phase Line | N/A | --- | Storm Drainage Structure ID # | N/A | N/A |
| Watershed Limit | N/A | --- | Telephone Box | N/A | N/A |
| Flood Zone | —ZONE 'X' ZONE 'AE'— | N/A | Telephone Manhole | ⊕ | N/A |
| Conduit | —EC—EC— | —C—C— | Electrical Box | ⊕ | N/A |
| Natural Gas | —EG—EG— | —G—G— | Electrical Manhole | ⊕ | N/A |
| Overhead Electrical | —EP—EP— | —P—P— | Power Pole | ⊕ | ⊕ |
| Underground Electrical | —EUP—EUP— | —UP—UP— | Light Pole | ⊕ | ⊕ |
| Underground Telephone | —ET—ET— | —T—T— | Fire Hydrant Assembly | ⊕ | ⊕ |
| Underground Cable | —ETV—ETV— | —TV—TV— | Water Blowoff | ⊕ | ⊕ |
| Underground Fiber Optic | —EFO—EFO— | —FO—FO— | Water Line Bends, Angle Vanes | N/A | N/A |
| Fence | —X—X— | —O—O— | Water Line Valve | ⊕ | ⊕ |
| Elevation Contour | --- | --- | Water Line Reducer | ⊕ | ⊕ |
| Revision Cloud (Encloses Revision) | N/A | --- | Single Water Service (Residential Only) | ⊕ | ⊕ |
| | | | Double Water Service (Residential Only) | ⊕ | ⊕ |
| | | | Sign | ⊕ | ⊕ |
| | | | ADA Accessible Parking Space | ⊕ | ⊕ |
| | | | Spot Elevation | ⊕ | ⊕ |
| | | | Watershed Area | N/A | XXXAC |
| | | | Detail ID # | N/A | ⊕ |
| | | | Keynote | N/A | ⊕ |
| | | | Parking Count ID # | N/A | ⊕ |
| | | | Lot # | N/A | # |
| | | | Revision ID # | N/A | ⊕ |

SEEDING SPECIFICATIONS

USE THIS SEEDING TABLE ONLY WHERE NOT INDICATED OTHERWISE ON THE LANDSCAPE PLANS

| SPECIES | LBS./AC. | PERMANENT SEEDING - UPSTATE | | | | | | | | | | | | |
|---|----------|-----------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|----|
| | | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC | |
| BAHIA GRASS (ALONE) | 40 | | | | ██ | ██ | ██ | ██ | | | | | | |
| BAHIA GRASS (MIX) | 30 | | | | ██ | ██ | ██ | ██ | | | | | | |
| BERMUDA GRASS (HULLED) (ALONE) | 8-12 | | | | | | | ██ | ██ | ██ | | | | |
| BERMUDA GRASS (HULLED) (MIX) | 4-6 | | | | | | | ██ | ██ | ██ | | | | |
| FESCUE, TALL (KY31) ALONE | 40 | | | | | | | | | | ██ | ██ | ██ | |
| FESCUE, TALL (KY31) MIX | 20 | | | | | | | | | | ██ | ██ | ██ | |
| SERICEA LESPEDEZA (SCARIFIED) ALONE OR MIX (INOCULATED WITH EL INOCULANT) | 40 | | | | | | | | | | | | ██ | ██ |

FOR STEEP SLOPES / CUT SLOPES

| SPECIES | LBS./AC. | TEMPORARY SEEDING - UPSTATE | | | | | | | | | | | | |
|---------------------------|----------|-----------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|--|
| | | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC | |
| BROWNSTONE MILLET (ALONE) | 40 | | | | | ██ | ██ | ██ | | | | | | |
| BROWNTOP MILLET (MIX) | 10 | | | | | ██ | ██ | ██ | | | | | | |
| RYE GRAIN (ALONE) | 56 | | | ██ | ██ | ██ | ██ | ██ | | | | | | |
| RYE GRAIN (MIX) | 10 | | | ██ | ██ | ██ | ██ | ██ | | | | | | |
| RYE GRASS (ALONE) | 50 | | | | | | | | | | ██ | ██ | ██ | |
| RYE GRASS (MIX) | 8 | | | | | | | | | | ██ | ██ | ██ | |

FOR STEEP SLOPES / CUT SLOPES

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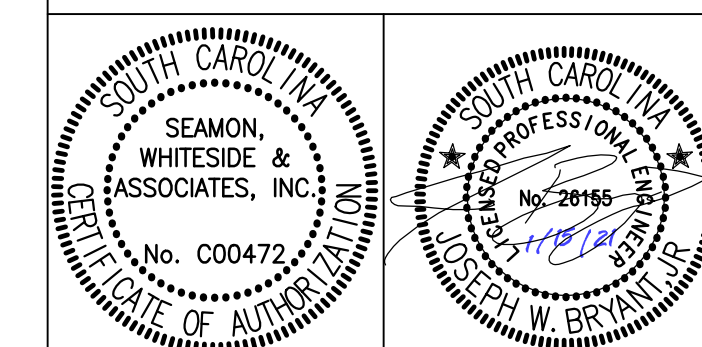
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506 S. PLEASANTBURG DRIVE, GREENVILLE, SC 29607

GREENVILLE - BLDG. 112 AIR COOLED CHILLER ADDITION

Project No.: H59-N054-FW

| DATE | MARK | DESCRIPTION |
|------|------|-------------|
| | | |

ISSUE: CONSTRUCTION

01/15/2021

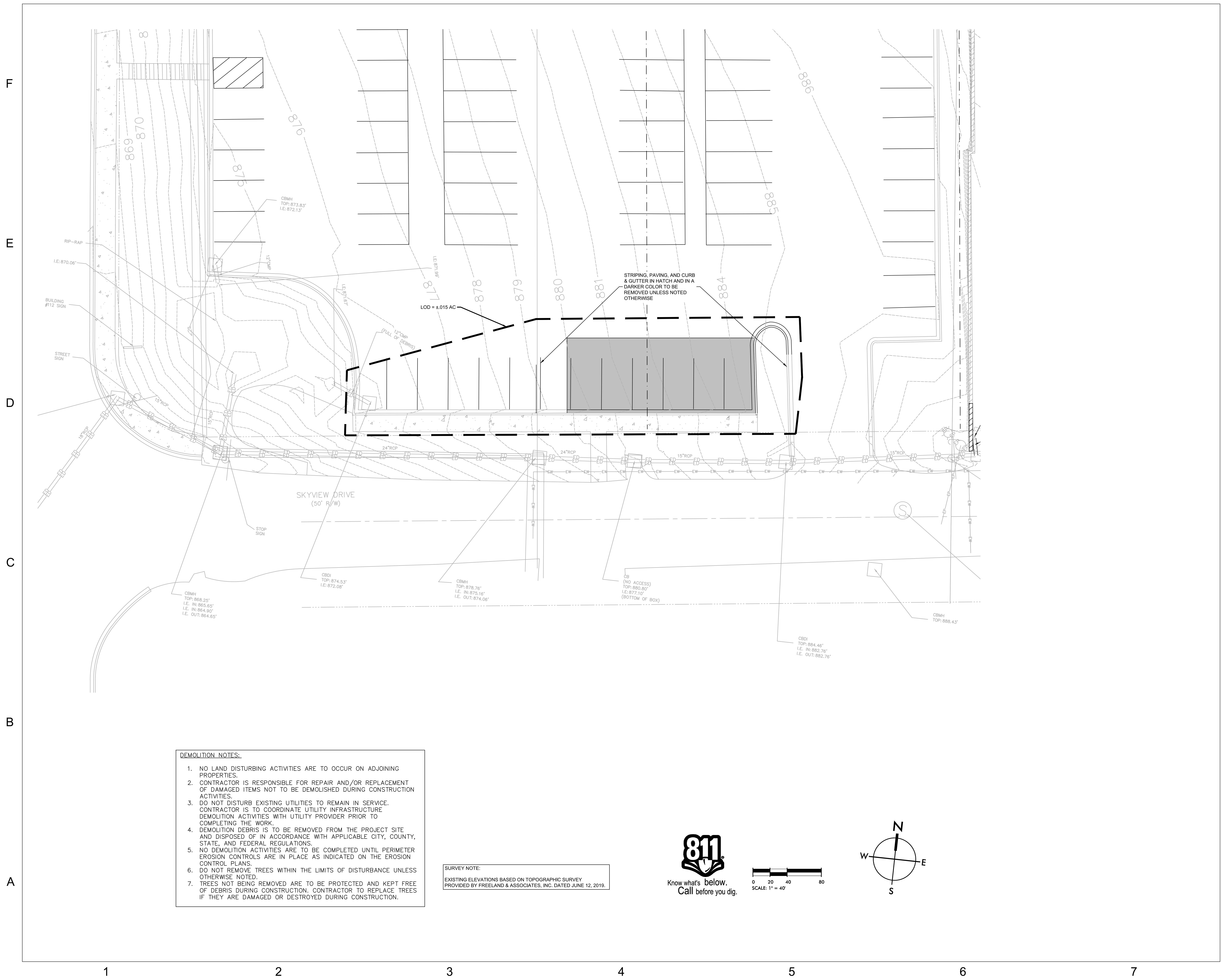
PROJECT NO: 20033

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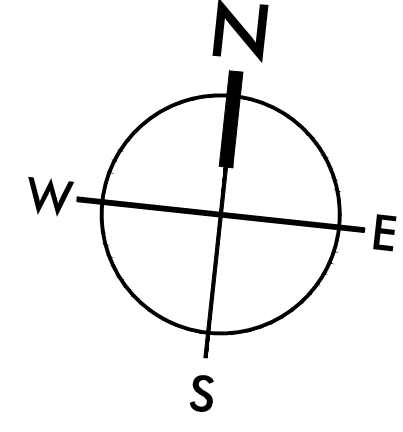
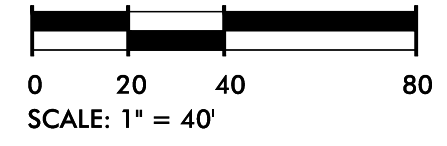
NOTES & LEGEND

C1.1



- DEMOLITION NOTES:**
1. NO LAND DISTURBING ACTIVITIES ARE TO OCCUR ON ADJOINING PROPERTIES.
 2. CONTRACTOR IS RESPONSIBLE FOR REPAIR AND/OR REPLACEMENT OF DAMAGED ITEMS NOT TO BE DEMOLISHED DURING CONSTRUCTION ACTIVITIES.
 3. DO NOT DISTURB EXISTING UTILITIES TO REMAIN IN SERVICE. CONTRACTOR IS TO COORDINATE UTILITY INFRASTRUCTURE DEMOLITION ACTIVITIES WITH UTILITY PROVIDER PRIOR TO COMPLETING THE WORK.
 4. DEMOLITION DEBRIS IS TO BE REMOVED FROM THE PROJECT SITE AND DISPOSED OF IN ACCORDANCE WITH APPLICABLE CITY, COUNTY, STATE, AND FEDERAL REGULATIONS.
 5. NO DEMOLITION ACTIVITIES ARE TO BE COMPLETED UNTIL PERIMETER EROSION CONTROLS ARE IN PLACE AS INDICATED ON THE EROSION CONTROL PLANS.
 6. DO NOT REMOVE TREES WITHIN THE LIMITS OF DISTURBANCE UNLESS OTHERWISE NOTED.
 7. TREES NOT BEING REMOVED ARE TO BE PROTECTED AND KEPT FREE OF DEBRIS DURING CONSTRUCTION. CONTRACTOR TO REPLACE TREES IF THEY ARE DAMAGED OR DESTROYED DURING CONSTRUCTION.

SURVEY NOTE:
 EXISTING ELEVATIONS BASED ON TOPOGRAPHIC SURVEY PROVIDED BY FREELAND & ASSOCIATES, INC. DATED JUNE 12, 2019.

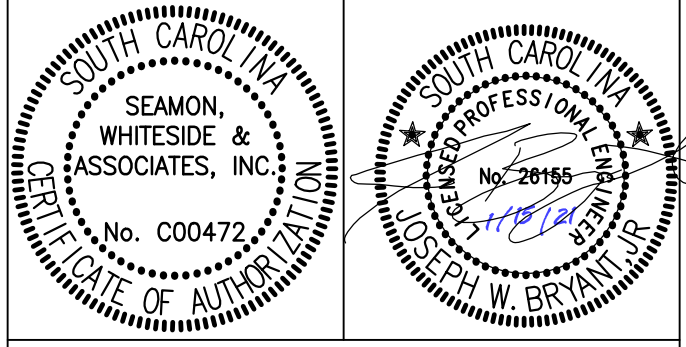


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506 S. PLEASANTBURG DRIVE, GREENVILLE, SC 29607

GREENVILLE - BLDG. 112 AIR COOLED CHILLER ADDITION

Project No.: H59-N054-FW

| DATE | MARK | DESCRIPTION |
|------|------|-------------|
| | | |

| | |
|-------------|--------------|
| ISSUE: | CONSTRUCTION |
| PROJECT NO: | 01/15/2021 |
| DRAWN BY: | 20033 |
| CHECKED BY: | HED |
| | SEP |

EXISTING CONDITIONS & DEMOLITION PLAN

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F

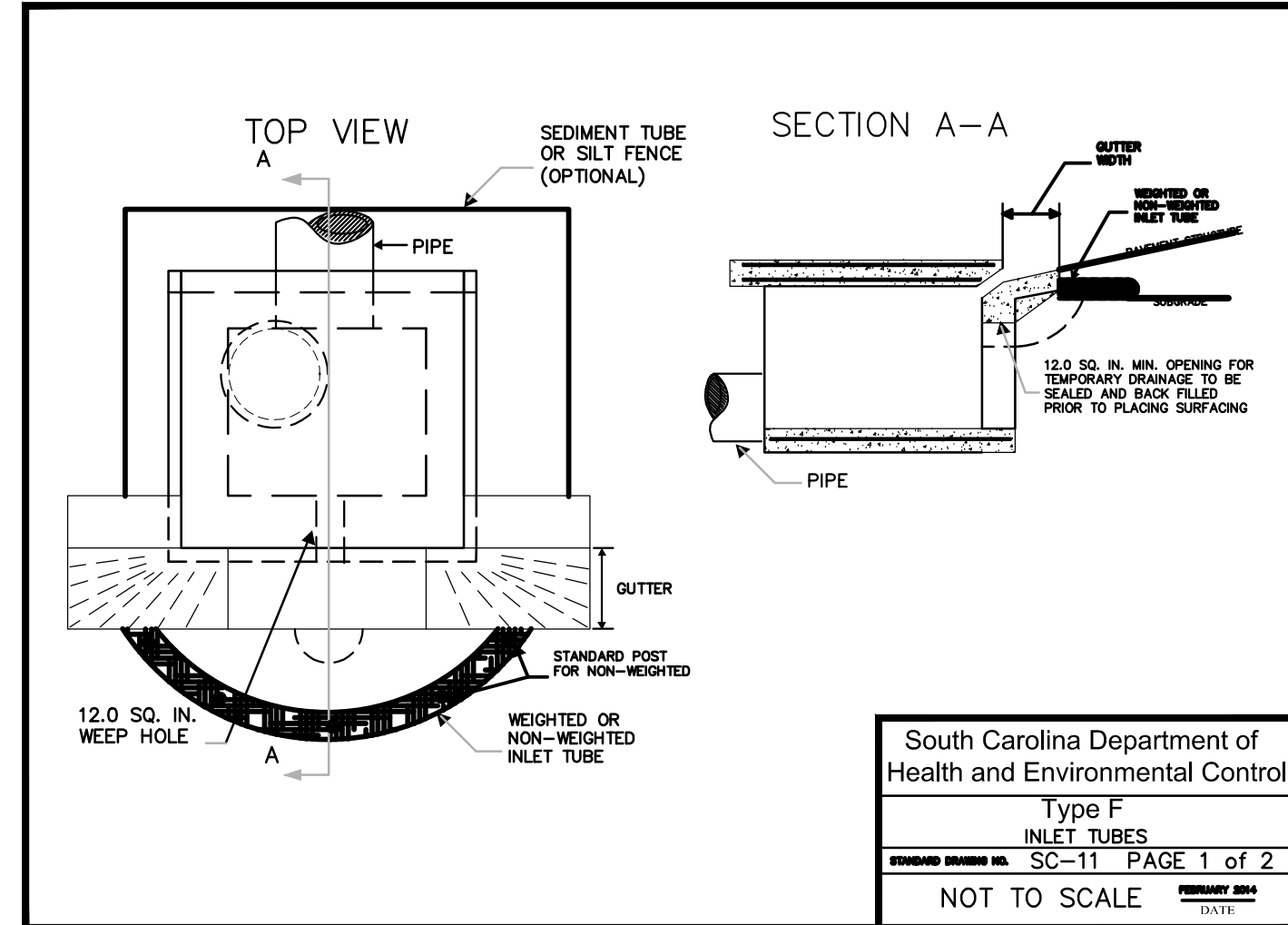
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South Carolina Department of Health and Environmental Control
 Type F
 INLET TUBES
 SC-11 PAGE 1 of 2
 NOT TO SCALE

TYPE F - INLET TUBES INLET PROTECTION

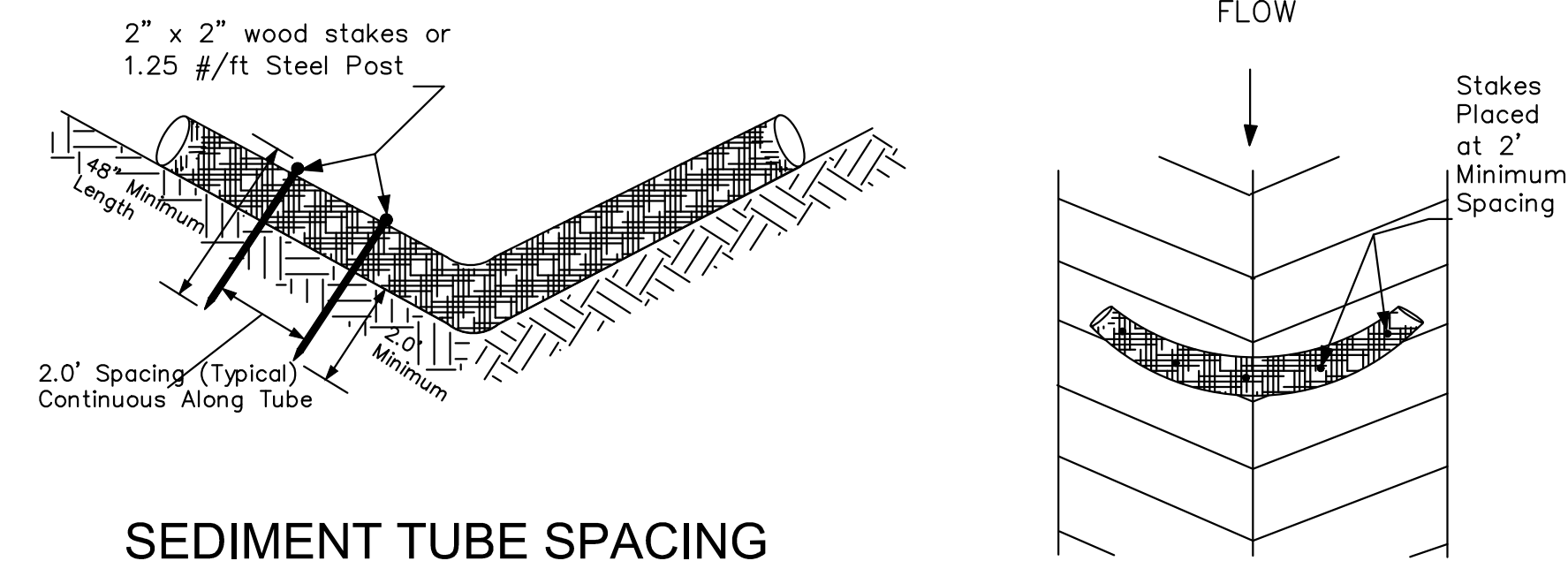
GENERAL NOTES

- Inlet tubes should be composed of compacted geotextiles, curled excelsior wood, natural coconut fibers, a hardwood mulch, or a mix of these materials enclosed by a flexible netting material.
- Inlet tubes should utilize an outer netting that consists of seamless, high-density polyethylene photodegradable materials treated with ultraviolet stabilizers or a seamless, high-density polyethylene non-degradable material. Curled wood excelsior fiber, or natural coconut fiber rolled erosion control products rolled up to create an inlet tube device are not allowed.
- Do not use straw, straw fiber, straw bales, pine needles, or leaf mulch as fill material within inlet tubes.
- Weighted inlet tubes must be capable of staying in place without external stabilization measures and may have a weighted inner core or other weighted mechanism to keep them in place.
- Install weighted tubes lying flat on the ground, with no gaps between the underlying surface and the inlet tube. Do not stock inlet tubes. Do not completely block inlet with tube.
- Non-weighted inlet tubes require staking or other stabilization methods to keep them safely in place.
- Overflow or overtopping of inlet tubes must be allowed to flow into inlet unobstructed.
- To avoid possible flooding, two or three concrete cinder blocks may be placed between the tube and the inlet.

INSPECTION AND MAINTENANCE

- The key to functional inlet protection is weekly inspection, routine maintenance, and regular sediment removal.
- Regular inspections of all inlet protection shall be conducted once every calendar week and, as recommended, within 24-hours after each rainfall event that produces 1/2-inch or more of precipitation.
- Attention to sediment accumulations in front of the inlet protection is extremely important. Accumulated sediment should be continuously monitored and removed when necessary.
- Remove accumulated sediment when it reaches 1/3 the height of the blocks. If a pump is used, sediment should be removed when it fills approximately 1/3 the depth of the hole.
- Removed sediment shall be placed in stockpile storage areas or spread thinly across disturbed area. Stabilize the removed sediment after it is relocated.
- Large debris, trash, and leaves should be removed from in front of tubes when found.
- Replace inlet tube when damaged or as recommended by manufacturer's specifications.
- Inlet protection structures should be removed after the disturbed areas are permanently stabilized. Remove all construction material and sediment, and dispose of them properly. Grade the disturbed area to the elevation of the drop inlet structure crest. Stabilize all bare areas immediately.
- To avoid possible flooding, two or three concrete cinder blocks may be placed between the tube and the inlet.

South Carolina Department of Health and Environmental Control
 Type F
 INLET TUBES
 SC-11 PAGE 2 of 2
 GENERAL NOTES



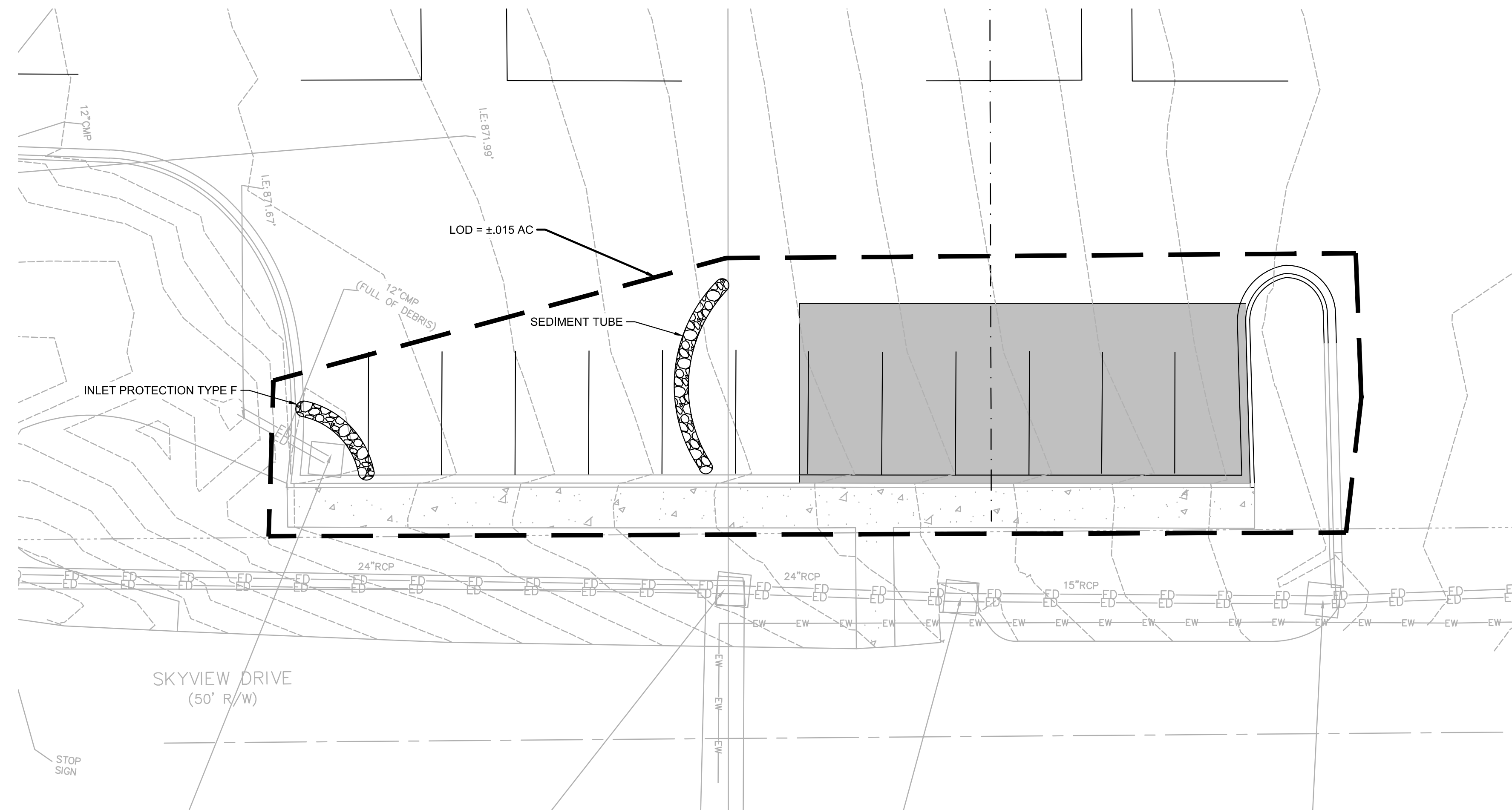
| SLOPE | MAX. SEDIMENT TUBE SPACING |
|-----------------|----------------------------|
| LESS THAN 2% | 150-FEET |
| 2% | 100-FEET |
| 3% | 75-FEET |
| 4% | 50-FEET |
| 5% | 40-FEET |
| 6% | 30-FEET |
| GREATER THAN 6% | 25-FEET |

SEDIMENT TUBES - GENERAL NOTES

- Sediment tubes may be installed along contours, in drainage conveyance channels, and around inlets to help prevent off-site discharge of sediment-laden stormwater runoff.
- Sediment tubes are elongated tubes of compacted geotextiles, curled excelsior wood, natural coconut fiber, or hardwood mulch. Straw, pine needles, and leaf mulch-filled sediment tubes are not permitted.
- The outer netting of the sediment tube should consist of seamless, high-density polyethylene photodegradable materials treated with ultraviolet stabilizers or a seamless, high-density polyethylene non-degradable material.
- Sediment tubes, when used as checks within channels, should range between 18-inches and 24-inches depending on channel dimensions. Diameters outside this range may be allowed where necessary when approved.
- Curled excelsior wood, or natural coconut products that are rolled up to create a sediment tube are not allowed.
- Sediment tubes should be staked using wooden stakes (2-inch X 2-inch) or steel posts (standard "U" or "T" sections with a minimum weight of 1.25 pounds per foot) at a minimum of 48-inches in length placed on 2-foot centers.
- Install all sediment tubes to ensure that no gaps exist between the soil and the bottom of the tube. Manufacturer's recommendations should always be consulted before installation.
- The ends of adjacent sediment tubes should be overlapped 6-inches to prevent flow and sediment from passing through the field joint.
- Sediment tubes should not be stacked on top of one another, unless recommended by manufacturer.
- Each sediment tube should be installed in a trench with a depth equal to 1/5 the diameter of the sediment tube.
- Sediment tubes should continue up the side slopes a minimum of 1-foot above the design flow depth of the channel.
- Install stakes at a diagonal facing incoming runoff.

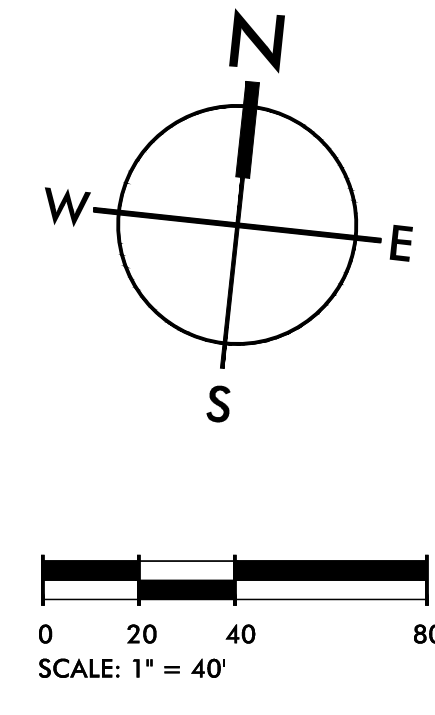
SEDIMENT TUBES - INSPECTION & MAINTENANCE

- The key to functional sediment tubes is weekly inspections, routine maintenance, and regular sediment removal.
- Regular inspections of sediment tubes shall be conducted once every calendar week and, as recommended, within 24-hours after each rainfall event that produces 1/2-inch or more of precipitation.
- Attention to sediment accumulations in front of the sediment tube is extremely important. Accumulated sediment should be continuously monitored and removed when necessary.
- Remove accumulated sediment when it reaches 1/3 the height of the sediment tube.
- Removed sediment shall be placed in stockpile storage areas or spread thinly across disturbed area. Stabilize the removed sediment after it is relocated.
- Large debris, trash, and leaves should be removed from in front of tubes when found.
- If erosion causes the edges to fall to a height equal to or below the height of the sediment tube, repairs should be made immediately to prevent runoff from bypassing tube.
- Sediment tubes should be removed after the contributing drainage area has been completely stabilized. Permanent vegetation should replace areas from which sediment tubes have been removed.



- SEDIMENT AND EROSION CONTROL PHASE 1 SEQUENCE OF CONSTRUCTION:**
- OBTAIN ALL NECESSARY PERMITS AND APPROVAL FROM THE CITY OF GREENVILLE AND SCDHEC. AFTER RECEIVING PLAN AND PERMIT APPROVAL, SCHEDULE AN ONSITE PRE-CONSTRUCTION MEETING WITH THE ENGINEER, OWNER, CONTRACTOR, AND CITY OF GREENVILLE INSPECTOR BEFORE ANY MOBILIZATION OR WORK IS PERFORMED.
 - INSTALL CONCRETE WASHOUT BASIN. CONTRACTOR TO COORDINATE LOCATION OF THE CONCRETE WASHOUT BASIN, AS NECESSARY, WITHIN LIMITS OF DISTURBANCE.
 - INSTALL SEDIMENT TUBES AS SHOWN. DO NOT REMOVE VEGETATION OR TREES OUTSIDE OF THE LIMITS OF DISTURBANCE.
 - INSTALL TEMPORARY LAVATORY AND CONSTRUCTION DEBRIS ENCLOSURE. CONTRACTOR TO COORDINATE EXACT LOCATIONS AS SITE CONDITIONS ALLOW.
 - INSTALL TYPE F INLET PROTECTION ON EXISTING INLETS WHERE SHOWN.
 - AFTER INSTALLATION OF PERIMETER SEDIMENT TUBES AND INLET PROTECTION, CONTRACTOR MAY BEGIN DEMOLITION ACTIVITIES PER THE DEMOLITION PLAN. CONTRACTOR TO REMOVE ALL DEMOLITION DEBRIS FROM THE SITE PER ALL LOCAL, STATE, AND FEDERAL REGULATIONS.
 - BEGIN PAVING OPERATIONS.
 - INSTALL PERMANENT SEEDING AND LANDSCAPING ON THE SITE.
 - CONTACT ENGINEER TO BEGIN CLOSE OUT PROCEDURES FOR THE PROJECT NO LATER THAN 30 DAYS BEFORE PROJECT COMPLETION. SET UP INITIAL CLOSE OUT INSPECTION WITH THE ENGINEER AND CITY ENGINEER INSPECTOR.
 - COMPLETE CORRECTION LIST FROM INITIAL CLOSE OUT INSPECTION. SCHEDULE FINAL CLOSE OUT INSPECTION WITH ENGINEER AND CITY ENGINEER INSPECTOR.
 - REMOVE (FLUSH) ALL SEDIMENT FROM STORM DRAIN PIPES AND STRUCTURES, AS NECESSARY.
 - REMOVE ALL TEMPORARY EROSION AND SEDIMENT CONTROL DEVICES ONCE SITE IS COMPLETELY STABILIZED.
 - PERFORM GENERAL CLEANUP OF THE SITE.
 - SUBMIT NOTICE OF TERMINATION TO CITY OF GREENVILLE AND SCDHEC.

SURVEY NOTE:
 EXISTING ELEVATIONS BASED ON TOPOGRAPHIC SURVEY PROVIDED BY FREELAND & ASSOCIATES, INC. DATED JUNE 12, 2019.

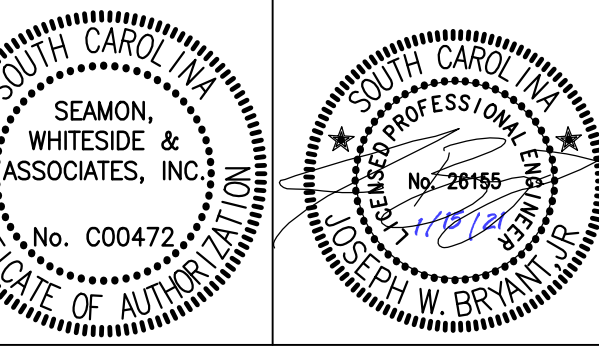


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506 S. PLEASANTBURG DRIVE, GREENVILLE, SC 29607

GREENVILLE - BLDG. 112 AIR COOLED CHILLER ADDITION

Project No.: H59-N054-FW

| DATE | MARK | DESCRIPTION |
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| ISSUE: | CONSTRUCTION |
| PROJECT NO: | 20033 |
| DRAWN BY: | HED |
| CHECKED BY: | SEP |

EROSION & SEDIMENT CONTROL PLAN

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AIR COOLED CHILLER SCHEDULE

| MARK | LOCATION | AREA SERVED | MANUFACTURER | MODEL NUMBER | EVAPORATOR | | | | REFRIGERANT | MOTOR | | | REMARKS | |
|------|-------------|-------------|--------------|-------------------|-----------------|-----------------|----------------|----------------|-------------|--------------|-----|------|----------|------------|
| | | | | | TEMP °F ENT/LVG | DESIGN FLOW GPM | DESIGN DP (FT) | FOULING FACTOR | | MIN FLOW GPM | MCA | MOCP | | VOLT/PH/Hz |
| CH-1 | SEE DRAWING | - | YORK | YWA0195A0V468AWX0 | 54/44 | 382.9 | 10.1 | 0.0001 | 200 | R134a | 316 | 400 | 460/3/60 | 1,2,3,4 |

NOTES:
 1. SEE SPECIFICATION ON SHEET MPO02 FOR ADDITIONAL INFORMATION.
 2. INCLUDE AN INTEGRAL AND FACTORY WIRED FLOW SWITCH.
 3. BACNET INTERFACE MODULE FOR CONNECTION TO EXISTING BACNET BUS IN BUILDING 112 VIA OWNER PROVIDED FIBER OPTIC CABLE WITH S.I. TECH MODEL 2110 FIBER DRIVERS.
 4. ONE (1) YEAR PLANNED SERVICE AGREEMENT.
 5. UNIT WARRANTY: 5 YEARS PARTS, LABOR AND REFRIGERANT WARRANTY.
 6. ALTERNATES SHALL BE PRE-APPROVED.

WATER CIRCULATING PUMP SCHEDULE

| MARK | SERVICE | MANUFACTURER | MODEL NO. | INLET INCH | DISCH INCH | PUMP TYPE | FLOW GPM | HEAD FT | MOTOR HP | RPM | V/PH/Hz | REMARKS |
|--------|---------------|--------------|--------------|------------|------------|--------------|----------|---------|----------|------|----------|-----------|
| CHWP-1 | CHILLED WATER | B&G | E-1510 2.58B | 3 | 2.5 | BASE MOUNTED | 196 | 80 | 7.5 | 1800 | 460/3/60 | 1,2,3,4,5 |
| CHWP-2 | CHILLED WATER | B&G | E-1510 2.58B | 3 | 2.5 | BASE MOUNTED | 196 | 80 | 7.5 | 1800 | 460/3/60 | 1,2,3,4,5 |

NOTES:
 1. VARIABLE PRIMARY PUMPS RUNNING IN PARALLEL.
 2. VFD PROVIDED AND INSTALLED BY GREENVILLE TECHNICAL COLLEGE.
 3. ALL MOTORS TO BE TEFC, PREMIUM EFFICIENCY.
 4. PUMP MOTOR HP SHALL BE SELECTED FOR NOT-OVERLOADING OPERATION.
 5. SEE ACCESSORIES FOR ADDITIONAL ITEMS.

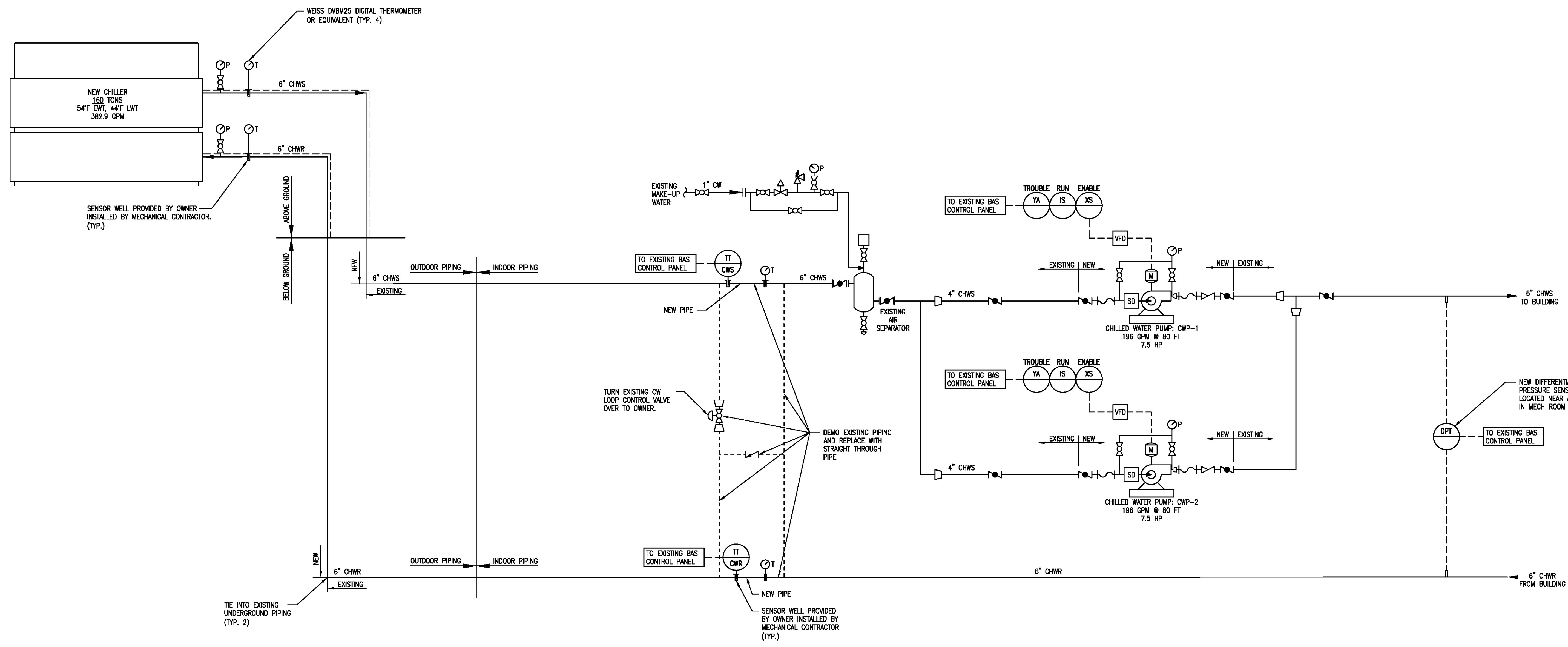
ACCESSORIES:
 1. B&G SUCTION DIFFUSER PLUS
 2. TRIPLE DUTY VALVE
 3. FLEX CONNECTORS
 4. GAUGE KITS

SYMBOL LEGEND

- TEMPERATURE GAUGE (WEISS DVM225 DIGITAL THERMOMETER OR EQUIVALENT)
- PRESSURE GAUGE
- MANUALLY OPERATED BALL VALVE
- 2-POSITION ACTUATED BALL VALVE
- MANUALLY OPERATED BUTTERFLY VALVE
- 2-POSITION ACTUATED BUTTERFLY VALVE
- 2-WAY ACTUATED CONTROL VALVE
- 3-WAY ACTUATED CONTROL VALVE
- TRIPLE DUTY VALVE
- PRESSURE REGULATOR VALVE
- CHECK VALVE
- STRAINER
- FLOW METER
- FLEXIBLE CONNECTOR
- THERMOWELL
- COOLING TOWER WATER - SUPPLY
- COOLING TOWER WATER - RETURN
- CHILLED WATER - SUPPLY
- CHILLED WATER - RETURN
- MAKE UP WATER
- CONTROL INSTRUMENT OR FUNCTION
- CONTROL FUNCTION PROVIDED BY THE BMS
- ELECTRIC MOTOR
- PUMP SUCTION DIFFUSER (WITH STRAINER)
- VARIABLE FREQUENCY DRIVE
- EXISTING PIPING
- NEW PIPING
- HEAT TRACED PIPING

CONTROL LEGEND

- HS: HAND SWITCH
- HQA: HAND-OFF-AUTO
- FCV: FLOW CONTROL VALVE
- FXV: TWO-POSITION ISOLATION VALVE
- TT: TEMPERATURE TRANSMITTER
- FT: FLOW TRANSMITTER
- LT: LEVEL TRANSMITTER
- SC: SPEED CONTROL
- PDT: PRESSURE DIFFERENTIAL TRANSMITTER
- IS: CURRENT SWITCH (RUN INDICATION)
- YA: STATUS INDICATION FROM EQUIPMENT TO BMS
- XS: ENABLE SIGNAL FROM BMS TO EQUIPMENT
- LV: LEVEL CONTROL VALVE



CHILLED WATER FLOW DIAGRAM
SCALE: NONE

PROJECT NOTES

- THE PROJECT IS ADDING A DEDICATED CHILLER TO BUILDING 112.
- THE MAIN EQUIPMENT INCLUDES A NEW CHILLER AND PUMPS.
- ALL WORK SHALL COMPLY WITH THE 2018 INTERNATIONAL MECHANICAL PLUMBING (WITH INSERTIONS) AND BUILDING CODE, 2020 EDITION OF CSE PROJECT MANUAL, AND ALL LOCAL CODES.
- THE ENTIRE BUILDING CHILLED WATER SYSTEM SHALL BE TESTED, ADJUSTED AND BALANCED BY AN INDEPENDENT CONTRACTOR PER INDUSTRY STANDARDS. BALANCE REPORTS SHALL BE SUBMITTED TO ENGINEER AND OWNER FOR REVIEW. THE WORK SHALL BE COMPLETED AFTER ALL INSTALLATION IS COMPLETE INCLUDING OWNER SCOPE.

CONTROLS AND CW PUMP VFDs WILL BE FURNISHED AND INSTALLED BY OWNER

- GREENVILLE TECHNICAL COLLEGE (OWNER) WILL SELF-PERFORM ALL CONTROL WORK AND INTERLOCK WIRING NOT SPECIFICALLY NOTED TO BE PERFORMED BY THE CONTRACTOR. OWNER WILL PROVIDE ALL CONTROL DEVICES AND WILL BE RESPONSIBLE FOR ALL CONTROL AND INTERLOCK WIRING FOR CHILLED WATER (CW) SYSTEM INCLUDING FIBER OPTIC COMMUNICATIONS CABLE FROM BUILDING TO REQUIRED BACNET INTERFACE MODULE PROVIDED BY THE CHILLER MANUFACTURER. CHILLER COMMUNICATION WIRING WILL BE TERMINATED PER DIAGRAMS PROVIDED BY THE CHILLER MANUFACTURER. FIBER OPTIC CABLE WILL BE INTERFACED TO BACNET BUS USING S.I. TECH MODEL 2110 FIBER DRIVERS. CHILLER TO BE FURNISHED WITH FACTORY WIRED INTEGRAL FLOW SWITCH.
- THE CHILLED WATER PUMP VFDs WILL BE FURNISHED, INSTALLED, AND WIRED (POWER AND CONTROLS) BY OWNER.
- OWNER WILL REMOVE ANY EXISTING CONTROL DEVICES FROM ALL SECTIONS OF CW PIPE TO BE REMOVED IN MECHANICAL EQUIPMENT ROOM 013 PRIOR TO DEMOLITION.

CHILLED WATER SYSTEM SEQUENCE OF OPERATION

- GENERAL:
- ENABLE/DISABLE (START/STOP) CONTROL OF CHILLER AND CHILLED WATER PUMPS WILL BE PROVIDED THROUGH THE EXISTING JCI METASYS BUILDING AUTOMATION SYSTEM (BAS).
 - THE BAS WILL PROVIDE STATUS AND ALARM MONITORING FOR EACH CHILLED WATER SYSTEM COMPONENT INCLUDING CHILLER STATUS AND DIAGNOSTICS PROVIDED BY THE CCP THROUGH THE REQUIRED BACNET INTERFACE.
 - THE CHILLER MANUFACTURER CONTROL PANEL (CCP) WILL CONTROL THE CHILLER AND ITS INTEGRAL START/STOP/SAFETY AND CHILLED WATER TEMPERATURE CONTROL FUNCTIONS.
- CW SYSTEM ENABLE/DISABLE:
- THE CW SYSTEM WILL BE ENABLED WHEN ANY BUILDING AHU IS IN OPERATION AND THE OUTDOOR AIR TEMPERATURE (OAT) IS ABOVE 55°F (ADJ.). CW SYSTEM ENABLE WILL INITIATE STARTUP OF CHILLER AND LEAD CHILLED WATER PUMP.
 - ALL CHILLER SAFETY CONDITIONS MUST BE SATISFIED FOR CW SYSTEM STARTUP TO PROCEED. IF ANY SYSTEM CONDITIONS ARE NOT NORMAL OR CHILLER DIAGNOSTICS ARE INDICATED BY THE CCP, AN ALARM MESSAGE WILL BE GENERATED INDICATING THE SPECIFIC STARTUP PROBLEM. IF THERE ARE NO ALARM CONDITIONS BOTH THE CHILLER WILL BE ENABLED AND THE LEAD CW PUMP WILL BE ENABLED.
- CHILLER CONTROL AND SEQUENCING:
- CHILLER INTEGRAL FLOW SWITCH WILL BE INTERLOCKED WITH CHILLER CCP. CHILLER WILL START WHEN CW FLOW THROUGH THE CHILLER IS PROVEN. THE CCP WILL CONTROL ALL CHILLER FUNCTIONS TO MAINTAIN THE CHILLED WATER SUPPLY TEMPERATURE SET POINT AT 44°F (ADJ.) AS SEEN BY THE INTEGRAL SUPPLY TEMPERATURE SENSOR.

CW PUMP CONTROL AND SEQUENCING:

- ON CW SYSTEM STARTUP, THE LEAD PUMP WILL RAMP UP TO A MINIMUM SPEED (ADJ.) DETERMINED BY T&B CONTRACTOR TO PROVIDE THE CHILLER MANUFACTURER'S PUBLISHED MINIMUM CW FLOW.
- LEAD CW PUMP SPEED WILL BE CONTROLLED TO MAINTAIN THE BUILDING CW SYSTEM DIFFERENTIAL PRESSURE SET POINT (ADJ.) AS SEEN BY THE CW DIFFERENTIAL PRESSURE TRANSMITTER INSTALLED AT AC-6. THE CW SYSTEM DIFFERENTIAL PRESSURE SET POINT WILL BE DETERMINED BY T&B CONTRACTOR AS MINIMUM E.O.L. SYSTEM PRESSURE REQUIRED TO PROVIDE DESIGN CW FLOW TO BUILDING AHUs.
- ON A DROP IN DIFFERENTIAL PRESSURE BELOW THE SET POINT, THE LEAD CHILLED WATER LOOP PUMP SPEED WILL BE INCREASED TO MAINTAIN THE SYSTEM DIFFERENTIAL PRESSURE SET POINT.
- ON A CONTINUED DROP IN SYSTEM DIFFERENTIAL PRESSURE, WITH THE LEAD CW PUMP OPERATING AT 80%, THE CONTROL SYSTEM WILL ENABLE THE LAG CW PUMP. CW PUMPS WILL THEN BE OPERATED TOGETHER AT THE SAME SPEED TO MAINTAIN THE SYSTEM DIFFERENTIAL PRESSURE SET POINT.
- WITH BOTH LEAD AND LAG CW PUMPS OPERATING, ON A RISE IN SYSTEM DIFFERENTIAL PRESSURE AND PUMP SPEEDS REDUCED TO 45%, THE LAG CW PUMP WILL BE DISABLED. THE LEAD CW PUMP SPEED WILL THEN BE INCREASED TO MAINTAIN THE SYSTEM DIFFERENTIAL PRESSURE SET POINT.
- THE DESIGNATED LEAD CW PUMP WILL BE ROTATED BY THE BAS TO EQUALIZE PUMP RUN TIMES (ADJ.). LEAD PUMP CAN BE MANUALLY SELECTED AND LAG PUMP DISABLED FOR MAINTENANCE.

ALARMS AND FAILURE MODES:

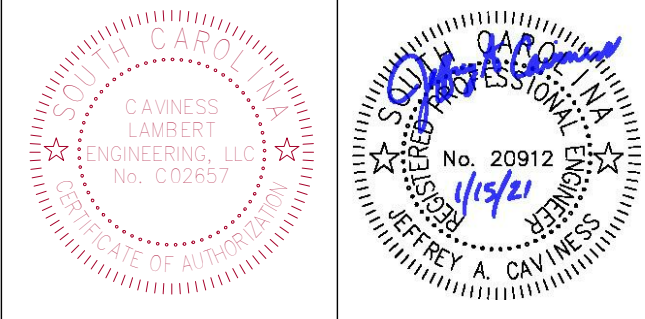
- ALL CHILLER SAFETY CONDITIONS MUST BE SATISFIED FOR CW SYSTEM STARTUP TO OCCUR. IF ANY SYSTEM CONDITIONS ARE NOT NORMAL OR CHILLER DIAGNOSTICS ARE INDICATED BY THE CCP, AN ALARM MESSAGE WILL BE GENERATED INDICATING THE SPECIFIC STARTUP PROBLEM.
- THE BAS WILL PROVIDE ENUNCIATION OF CHILLER DIAGNOSTIC ALARMS PROVIDED BY THE CCP THROUGH THE REQUIRED BACNET INTERFACE AND ADJUSTABLE ALARM LIMITS ON ALL CW SYSTEM SENSORS.
- UPON A FAILURE OF THE LEAD CW PUMP TO OPERATE, AN ALARM MESSAGE WILL BE GENERATED, THE LEAD CW PUMP DISABLED AND THE LAG CW PUMP ENABLED.

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CAVINESS LAMBERT ENGINEERING



Greenville Technical College

GREENVILLE - BLDG. 112 AIR COOLED CHILLER ADDITION

Project No.: H59-N054-FW

| DATE | MARK | DESCRIPTION |
|------------|------|-------------------|
| 09/02/2020 | A | ISSUED FOR REVIEW |
| 10/02/2020 | B | ISSUED FOR REVIEW |
| 1/15/2021 | C | CONSTRUCTION |

| | |
|--------------|--------------|
| ISSUE: | CONSTRUCTION |
| DATE: | 1/15/2021 |
| PROJECT NO.: | 120047.015 |
| DRAWN BY: | CTL |
| CHECKED BY: | JAC |

MECHANICAL PIPING SCHEDULES & NOTES
MP001

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SECTION 23 05 13 COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

1.1 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
1.2 SUMMARY
A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on alternating-current power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.
1.3 COORDINATION
A. Coordinate features and installed units, and accessory devices to be compatible with the following:
1. Motor controls.
2. Torque and speed requirements of the load.
3. Ratings and characteristics of supply circuit and required control sequence.
4. Ambient and environmental conditions of installation location.
PART 2 - PRODUCTS
2.1 GENERAL MOTOR REQUIREMENTS
A. Comply with NEMA MG 1 unless otherwise indicated.
B. Comply with IEEE 841 for seven-speed motors.
2.2 MOTOR CHARACTERISTICS
A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet above sea level.
B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or conserving service factor.
2.3 POLYPHASE MOTORS
A. Description: NEMA MG 1, Design B, medium induction motor.
B. Efficiency: Premium efficient, as defined in NEMA MG 1.
C. Service Factor: 1.15.
D. Motor Nameplate: Variable torque.
1. For motors with 2:1 speed ratio, consequent pole, single winding.
2. For motors with other than 2:1 speed ratio, separate winding for each speed.
E. Multiphased Motors: Separate winding for each speed.
F. Rotor: Random-wound, squirrel cage.
G. Bearings: Regreased, shielded, anti-friction ball bearings suitable for radial and thrust loading.
H. Temperature: Match insulation rating.
I. Insulation: Class F.
J. Code Letter Designation:
1. Motors 15 HP and Larger: NEMA Starting Code F or Code G.
2. Motors Smaller Than 15 HP: Manufacturer's standard starting characteristic.
K. Enclosure Material: Cast iron for motor frame sizes 324 and larger; rolled steel for motor frame sizes smaller than 324.
2.4 ADDITIONAL REQUIREMENTS FOR POLYPHASE MOTORS
A. Motors Used with Reduced-Voltage and Multi-Speed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control methods.
B. Motor: Inverter-Driven Motors: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.
1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time fire pulse produced by pulse-width-modulated inverters.
2. Premium-Efficient Motors: Class B temperature rise, Class F insulation.
3. Inverter-Duty Motors: Comply with NEMA MG 1 insulation.
4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.
C. Inverter-Duty Motors: Comply with IEEE 841, with 1.15 minimum service factor.
2.5 SINGLE-PHASE MOTORS
A. Motors larger than 100 hp shall be able to start, to full starting torque and requirements of specific motor application:
1. Permanent split capacitor.
2. Split phase.
3. Capacitor start, inductor run.
4. Capacitor start, capacitor run.
B. Multiphased Motors: Variable-torque, permanent-split-capacitor type.
C. Bearings: Pre-lubricated, anti-friction ball bearings or sleeve bearings suitable for radial and thrust loading.
D. Motor: HP and Smaller: Squirrel-cage type.
E. Thermal Protection: Internal protection to automatically open supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

SECTION 23 05 29 HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

1.1 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
1.2 SUMMARY
A. Section Includes:
1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Fiberglass pipe hangers.
4. Metal framing systems.
5. Fiberglass strut systems.
6. Thermal-hanger shield inserts.
7. Fastener systems.
8. Pipe stands.
9. Equipment supports.
1.3 ACTION SUBMITTALS
A. Product Data: For each type of product.
B. Shop Drawings: Show fabrication and installation details and include calculations for the following: include Product Data for components:
1. Trapeze pipe hangers.
2. Fiberglass pipe hangers.
3. Metal framing systems.
4. Fiberglass strut systems.
5. Pipe stands.
6. Thermal-hanger shield inserts.
7. Fastener systems.
8. Height: 12 inches above roof.
9. Equipment supports.
C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
D. Detail fabrication and assembly of trapeze hangers.
2.2 STACK-SLEEVE FITTINGS
A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Advance Products & Systems, Inc.
2. CALPICO, Inc.
3. GPT, an EnPro Industries company
4. Other approved manufacturers.
B. Cast-Iron Pipe Sleeves: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral weldshop collar.
C. Steel Pipe Sleeves: ASTM A 53A S3M, Type E, Grade B, Schedule 40, anti-corrosion coated or galvanized, with plain ends and integral welded waterproof collar.
D. Galvanized-Steel Sheet Sleeves: 0.023-inch minimum thickness, round tube closed with welded longitudinal joint.
E. PVC Pipe Sleeves: ASTM D 1785, Schedule 40.
F. Molded-PVC Sleeves: With ralling flange for attaching to wooden forms.
G. Molded-PE or -PP Sleeves: Reinforced, tapered-end cap, and smooth outer surface with ralling flange for attaching to wooden forms.
PART 2 - PRODUCTS
2.1 SLEEVES
A. Subject to compliance with requirements, provide products by one of the following:
1. Advance Products & Systems, Inc.
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A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Advance Products & Systems, Inc.
2. CALPICO, Inc.
3. GPT, an EnPro Industries company
4. Other approved manufacturers.
B. Description:
1. Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
2. Designed to form a hydrostatic seal of 20 pig minimum.
3. Features Elements: EPDM rubber, high-temperature silicone, or Nitrile (Buna N) interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size and pipe.
4. Pressure Plates: Carbon steel, Composite plastic, Stainless steel, or Stainless steel, Type 316.
5. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, ASTM B 633 Stainless steel or Stainless steel, Type 316 of length required to secure pipe sleeve to sealing elements.
2.3 SLEEVE-FITTING SYSTEMS
A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Advance Products & Systems, Inc.
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5. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, ASTM B 633 Stainless steel or Stainless steel, Type 316 of length required to secure pipe sleeve to sealing elements.
2.5 GROUT
A. Description: Non-shrink, for interior and exterior sealing operations in non-reinforced walls or floors.
B. Standard: ASTM C 1107/1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
C. Design Mix: 500-psi, 28-day compressive strength.
D. Packaging: Premixed and factory packaged.
2.6 SILICONE SEALANTS
A. Silicone, S, NS, 25, NT: Single-component, non-sag, plus 25 percent and minus 25 percent movement capability, nontraffice-use, neutral-curing silicone joint sealant, ASTM D 993, Type S, Grade NS, Class 25, Use NT.
B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Dow Corning Corporation.
2. GE Construction Sealants, Homometric Performance Materials Inc.
3. Polysar, Inc.
4. Schone-Montebel, Inc., an ITW company.
5. Sherwin-Williams Company (Titebond).
B. Silicone, P, 25, NT: Single-component, non-sag, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffice-use, neutral-curing silicone joint sealant, ASTM D 993, Type S, Grade P, Class 25, Uses T and NT, Grade P Pourable (self-leveling) formulation for use in opening floors and other horizontal surfaces that are not for rail.
C. Manufacturers: Subject to compliance with requirements, provide products by the following:
1. May National Associates, Inc., a subsidiary of Sikka Corporation.
D. Other approved manufacturers.
E. Silicone Foam: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, non-shrinking foam.
F. Manufacturers: Subject to compliance with requirements, provide products by the following:
1. Smooth-On.
2. Other approved manufacturers.

SECTION 23 05 29 HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

1.1 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
1.2 SUMMARY
A. Section Includes:
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2. Trapeze pipe hangers.
3. Fiberglass pipe hangers.
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5. Fiberglass strut systems.
6. Thermal-hanger shield inserts.
7. Fastener systems.
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A. Product Data: For each type of product.
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7. Fastener systems.
8. Height: 12 inches above roof.
9. Equipment supports.
C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
D. Detail fabrication and assembly of trapeze hangers.
2.2 STACK-SLEEVE FITTINGS
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D. Galvanized-Steel Sheet Sleeves: 0.023-inch minimum thickness, round tube closed with welded longitudinal joint.
E. PVC Pipe Sleeves: ASTM D 1785, Schedule 40.
F. Molded-PVC Sleeves: With ralling flange for attaching to wooden forms.
G. Molded-PE or -PP Sleeves: Reinforced, tapered-end cap, and smooth outer surface with ralling flange for attaching to wooden forms.
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C. Design Mix: 500-psi, 28-day compressive strength.
D. Packaging: Premixed and factory packaged.
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3. Polysar, Inc.
4. Schone-Montebel, Inc., an ITW company.
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SECTION 23 05 29 HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

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E. PVC Pipe Sleeves: ASTM D 1785, Schedule 40.
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PART 2 - PRODUCTS
2.1 SLEEVES
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B. Description:
1. Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
2. Designed to form a hydrostatic seal of 20 pig minimum.
3. Features Elements: EPDM rubber, high-temperature silicone, or Nitrile (Buna N) interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size and pipe.
4. Pressure Plates: Carbon steel, Composite plastic, Stainless steel, or Stainless steel, Type 316.
5. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, ASTM B 633 Stainless steel or Stainless steel, Type 316 of length required to secure pipe sleeve to sealing elements.
2.3 SLEEVE-FITTING SYSTEMS
A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Advance Products & Systems, Inc.
2. CALPICO, Inc.
3. GPT, an EnPro Industries company
4. Other approved manufacturers.
B. Description:
1. Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
2. Designed to form a hydrostatic seal of 20 pig minimum.
3. Features Elements: EPDM rubber, high-temperature silicone, or Nitrile (Buna N) interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size and pipe.
4. Pressure Plates: Carbon steel, Composite plastic, Stainless steel, or Stainless steel, Type 316.
5. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, ASTM B 633 Stainless steel or Stainless steel, Type 316 of length required to secure pipe sleeve to sealing elements.
2.4 SLEEVE-FITTING SYSTEMS
A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Advance Products & Systems, Inc.
2. CALPICO, Inc.
3. GPT, an EnPro Industries company
4. Other approved manufacturers.
B. Description:
1. Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
2. Designed to form a hydrostatic seal of 20 pig minimum.
3. Features Elements: EPDM rubber, high-temperature silicone, or Nitrile (Buna N) interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size and pipe.
4. Pressure Plates: Carbon steel, Composite plastic, Stainless steel, or Stainless steel, Type 316.
5. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, ASTM B 633 Stainless steel or Stainless steel, Type 316 of length required to secure pipe sleeve to sealing elements.
2.5 GROUT
A. Description: Non-shrink, for interior and exterior sealing operations in non-reinforced walls or floors.
B. Standard: ASTM C 1107/1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
C. Design Mix: 500-psi, 28-day compressive strength.
D. Packaging: Premixed and factory packaged.
2.6 SILICONE SEALANTS
A. Silicone, S, NS, 25, NT: Single-component, non-sag, plus 25 percent and minus 25 percent movement capability, nontraffice-use, neutral-curing silicone joint sealant, ASTM D 993, Type S, Grade NS, Class 25, Use NT.
B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Dow Corning Corporation.
2. GE Construction Sealants, Homometric Performance Materials Inc.
3. Polysar, Inc.
4. Schone-Montebel, Inc., an ITW company.
5. Sherwin-Williams Company (Titebond).
B. Silicone, P, 25, NT: Single-component, non-sag, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffice-use, neutral-curing silicone joint sealant, ASTM D 993, Type S, Grade P, Class 25, Uses T and NT, Grade P Pourable (self-leveling) formulation for use in opening floors and other horizontal surfaces that are not for rail.
C. Manufacturers: Subject to compliance with requirements, provide products by the following:
1. May National Associates, Inc., a subsidiary of Sikka Corporation.
D. Other approved manufacturers.
E. Silicone Foam: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, non-shrinking foam.
F. Manufacturers: Subject to compliance with requirements, provide products by the following:
1. Smooth-On.
2. Other approved manufacturers.

SECTION 23 05 29 HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

1.1 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
1.2 SUMMARY
A. Section Includes:
1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Fiberglass pipe hangers.
4. Metal framing systems.
5. Fiberglass strut systems.
6. Thermal-hanger shield inserts.
7. Fastener systems.
8. Pipe stands.
9. Equipment supports.
1.3 ACTION SUBMITTALS
A. Product Data: For each type of product.
B. Shop Drawings: Show fabrication and installation details and include calculations for the following: include Product Data for components:
1. Trapeze pipe hangers.
2. Fiberglass pipe hangers.
3. Metal framing systems.
4. Fiberglass strut systems.
5. Pipe stands.
6. Thermal-hanger shield inserts.
7. Fastener systems.
8. Height: 12 inches above roof.
9. Equipment supports.
C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
D. Detail fabrication and assembly of trapeze hangers.
2.2 STACK-SLEEVE FITTINGS
A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Advance Products & Systems, Inc.
2. CALPICO, Inc.
3. GPT, an EnPro Industries company
4. Other approved manufacturers.
B. Cast-Iron Pipe Sleeves: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral weldshop collar.
C. Steel Pipe Sleeves: ASTM A 53A S3M, Type E, Grade B, Schedule 40, anti-corrosion coated or galvanized, with plain ends and integral welded waterproof collar.
D. Galvanized-Steel Sheet Sleeves: 0.023-inch minimum thickness, round tube closed with welded longitudinal joint.
E. PVC Pipe Sleeves: ASTM D 1785, Schedule 40.
F. Molded-PVC Sleeves: With ralling flange for attaching to wooden forms.
G. Molded-PE or -PP Sleeves: Reinforced, tapered-end cap, and smooth outer surface with ralling flange for attaching to wooden forms.
PART 2 - PRODUCTS
2.1 SLEEVES
A. Subject to compliance with requirements, provide products by one of the following:
1. Advance Products & Systems, Inc.
2. CALPICO, Inc.
3. GPT, an EnPro Industries company
4. Other approved manufacturers.
B. Cast-Iron Pipe Sleeves: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral weldshop collar.
C. Steel Pipe Sleeves: ASTM A 53A S3M, Type E, Grade B, Schedule 40, anti-corrosion coated or galvanized, with plain ends and integral welded waterproof collar.
D. Galvanized-Steel Sheet Sleeves: 0.023-inch minimum thickness, round tube closed with welded longitudinal joint.
E. PVC Pipe Sleeves: ASTM D 1785, Schedule 40.
F. Molded-PVC Sleeves: With ralling flange for attaching to wooden forms.
G. Molded-PE or -PP Sleeves: Reinforced, tapered-end cap, and smooth outer surface with ralling flange for attaching to wooden forms.
2.2 STACK-SLEEVE FITTINGS
A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Advance Products & Systems, Inc.
2. CALPICO, Inc.
3. GPT, an EnPro Industries company
4. Other approved manufacturers.
B. Description:
1. Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
2. Designed to form a hydrostatic seal of 20 pig minimum.
3. Features Elements: EPDM rubber, high-temperature silicone, or Nitrile (Buna N) interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size and pipe.
4. Pressure Plates: Carbon steel, Composite plastic, Stainless steel, or Stainless steel, Type 316.
5. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, ASTM B 633 Stainless steel or Stainless steel, Type 316 of length required to secure pipe sleeve to sealing elements.
2.3 SLEEVE-FITTING SYSTEMS
A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Advance Products & Systems, Inc.
2. CALPICO, Inc.
3. GPT, an EnPro Industries company
4. Other approved manufacturers.
B. Description:
1. Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
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4. Pressure Plates: Carbon steel, Composite plastic, Stainless steel, or Stainless steel, Type 316.
5. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, ASTM B 633 Stainless steel or Stainless steel, Type 316 of length required to secure pipe sleeve to sealing elements.
2.4 SLEEVE-FITTING SYSTEMS
A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Advance Products & Systems, Inc.
2. CALPICO, Inc.
3. GPT, an EnPro Industries company
4. Other approved manufacturers.
B. Description:
1. Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
2. Designed to form a hydrostatic seal of 20 pig minimum.
3. Features Elements: EPDM rubber, high-temperature silicone, or Nitrile (Buna N) interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size and pipe.
4. Pressure Plates: Carbon steel, Composite plastic, Stainless steel, or Stainless steel, Type 316.
5. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, ASTM B 633 Stainless steel or Stainless steel, Type 316 of length required to secure pipe sleeve to sealing elements.
2.5 GROUT
A. Description: Non-shrink, for interior and exterior sealing operations in non-reinforced walls or floors.
B. Standard: ASTM C 1107/1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
C. Design Mix: 500-psi, 28-day compressive strength.
D. Packaging: Premixed and factory packaged.
2.6 SILICONE SEALANTS
A. Silicone, S, NS, 25, NT: Single-component, non-sag, plus 25 percent and minus 25 percent movement capability, nontraffice-use, neutral-curing silicone joint sealant, ASTM D 993, Type S, Grade NS, Class 25, Use NT.
B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Dow Corning Corporation.
2. GE Construction Sealants, Homometric Performance Materials Inc.
3. Polysar, Inc.
4. Schone-Montebel, Inc., an ITW company.
5. Sherwin-Williams Company (Titebond).
B. Silicone, P, 25, NT: Single-component, non-sag, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffice-use, neutral-curing silicone joint sealant, ASTM D 993, Type S, Grade P, Class 25, Uses T and NT, Grade P Pourable (self-leveling) formulation for use in opening floors and other horizontal surfaces that are not for rail.
C. Manufacturers: Subject to compliance with requirements, provide products by the following:
1. May National Associates, Inc., a subsidiary of Sikka Corporation.
D. Other approved manufacturers.
E. Silicone Foam: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, non-shrinking foam.
F. Manufacturers: Subject to compliance with requirements, provide products by the following:
1. Smooth-On.
2. Other approved manufacturers.

SECTION 23 05 29 HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

1.1 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
1.2 SUMMARY
A. Section Includes:
1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Fiberglass pipe hangers.
4. Metal framing systems.
5. Fiberglass strut systems.
6. Thermal-hanger shield inserts.
7. Fastener systems.
8. Pipe stands.
9. Equipment supports.
1.3 ACTION SUBMITTALS
A. Product Data: For each type of product.
B. Shop Drawings: Show fabrication and installation details and include calculations for the following: include Product Data for components:
1. Trapeze pipe hangers.
2. Fiberglass pipe hangers.
3. Metal framing systems.
4. Fiberglass strut systems.
5. Pipe stands.
6. Thermal-hanger shield inserts.
7. Fastener systems.
8. Height: 12 inches above roof.
9. Equipment supports.
C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
D. Detail fabrication and assembly of trapeze hangers.
2.2 STACK-SLEEVE FITTINGS
A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Advance Products & Systems, Inc.
2. CALPICO, Inc.
3. GPT, an EnPro Industries company
4. Other approved manufacturers.
B. Cast-Iron Pipe Sleeves: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral weldshop collar.
C. Steel Pipe Sleeves: ASTM A 53A S3M, Type E, Grade B, Schedule 40, anti-corrosion coated or galvanized, with plain ends and integral welded waterproof collar.
D. Galvanized-Steel Sheet Sleeves: 0.023-inch minimum thickness, round tube closed with welded longitudinal joint.
E. PVC Pipe Sleeves: ASTM D 1785, Schedule 40.
F. Molded-PVC Sleeves: With ralling flange for attaching to wooden forms.
G. Molded-PE or -PP Sleeves: Reinforced, tapered-end cap, and smooth outer surface with ralling flange for attaching to wooden forms.
PART 2 - PRODUCTS
2.1 SLEEVES
A. Subject to compliance with requirements, provide products by one of the following:
1. Advance Products & Systems, Inc.
2. CALPICO, Inc.
3. GPT, an EnPro Industries company
4. Other approved manufacturers.
B. Cast-Iron Pipe Sleeves: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral weldshop collar.
C. Steel Pipe Sleeves: ASTM A 53A S3M, Type E, Grade B, Schedule 40, anti-corrosion coated or galvanized, with plain ends and integral welded waterproof collar.
D. Galvanized-Steel Sheet Sleeves: 0.023-inch minimum thickness, round tube closed with welded longitudinal joint.
E. PVC Pipe Sleeves: ASTM D 1785, Schedule 40.
F. Molded-PVC Sleeves: With ralling flange for attaching to wooden forms.
G. Molded-PE or -PP Sleeves: Reinforced, tapered-end cap, and smooth outer surface with ralling flange for attaching to wooden forms.
2.2 STACK-SLEEVE FITTINGS
A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Advance Products & Systems, Inc.
2. CALPICO, Inc.
3. GPT, an EnPro Industries company
4. Other approved manufacturers.
B. Description:
1. Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
2. Designed to form a hydrostatic seal of 20 pig minimum.
3. Features Elements: EPDM rubber, high-temperature silicone, or Nitrile (Buna N) interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size and pipe.
4. Pressure Plates: Carbon steel, Composite plastic, Stainless steel, or Stainless steel, Type 316.
5. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, ASTM B 633 Stainless steel or Stainless steel, Type 316 of length required to secure pipe sleeve to sealing elements.
2.3 SLEEVE-FITTING SYSTEMS
A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Advance Products & Systems, Inc.
2. CALPICO, Inc.
3. GPT, an EnPro Industries company
4. Other approved manufacturers.
B. Description:
1. Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
2. Designed to form a hydrostatic seal of 20 pig minimum.
3. Features Elements: EPDM rubber, high-temperature silicone, or Nitrile (Buna N) interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size and pipe.
4. Pressure Plates: Carbon steel, Composite plastic, Stainless steel, or Stainless steel, Type 316.
5. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, ASTM B 633 Stainless steel or Stainless steel, Type 316 of length required to secure pipe sleeve to sealing elements.
2.4 SLEEVE-FITTING SYSTEMS
A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Advance Products & Systems, Inc.
2. CALPICO, Inc.
3. GPT, an EnPro Industries company
4. Other approved manufacturers.
B. Description:
1. Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
2. Designed to form a hydrostatic seal of 20 pig minimum.
3. Features Elements: EPDM rubber, high-temperature silicone, or Nitrile (Buna N) interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size and pipe.
4. Pressure Plates: Carbon steel, Composite plastic, Stainless steel, or Stainless steel, Type 316.
5. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, ASTM B 633 Stainless steel or Stainless steel, Type 316 of length required to secure pipe sleeve to sealing elements.
2.5 GROUT
A. Description: Non-shrink, for interior and exterior sealing operations in non-reinforced walls or floors.
B. Standard: ASTM C 1107/1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
C. Design Mix: 500-psi, 28-day compressive strength.
D. Packaging: Premixed and factory packaged.
2.6 SILICONE SEALANTS
A. Silicone, S, NS, 25, NT: Single-component, non-sag, plus 25 percent and minus 25 percent movement capability, nontraffice-use, neutral-curing silicone joint sealant, ASTM D 993, Type S, Grade NS, Class 25, Use NT.
B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Dow Corning Corporation.
2. GE Construction Sealants, Homometric Performance Materials Inc.
3. Polysar, Inc.
4. Schone-Montebel, Inc., an ITW company.
5. Sherwin-Williams Company (Titebond).
B. Silicone, P, 25, NT: Single-component, non-sag, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffice-use, neutral-curing silicone joint sealant, ASTM D 993, Type S, Grade P, Class 25, Uses T and NT, Grade P Pourable (self-leveling) formulation for use in opening floors and other horizontal surfaces that are not for rail.
C. Manufacturers: Subject to compliance with requirements, provide products by the following:
1. May National Associates, Inc., a subsidiary of Sikka Corporation.
D. Other approved manufacturers.
E. Silicone Foam: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, non-shrinking foam.
F. Manufacturers: Subject to compliance with requirements, provide products by the following:
1. Smooth-On.
2. Other approved manufacturers.

SECTION 23 05 29 (CONT.) HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

2.7 FIBERGLASS STRUT SYSTEMS
A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
1. Champion Fiberglass, Inc.
2. Fibroc Plastics, Wholesale Limited
3. G-Steel
4. Unifast, Part of Alcoa International
B. Description: Structural-grade, factory-formed, glass-fiber-reinforced channels and angles for supporting multiple parallel pipes.
1. Standard: Comply with MFMA 4 factory-fabricated components for field assembly.
2. Channels: Continuous slotted fiberglass-reinforced plastic channel with intumed lips.
3. Channel Width: Selected for applicable load criteria.
4. Fillings and Accessories: Products provided by channel and angle manufacturer and designed for use with those items.
5. Fittings and Accessory Materials: Same as those for channels and angles, except metal items may be stainless steel.
6. Rated Strength: Selected to suit applicable load criteria.
7. Protect Finishes on exposed surfaces from damage by applying a suitable, temporary protective covering before shipping.
2.8 THERMAL-HANGER SHIELD INSERTS
A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
1. Backus, Inc.
2. Carpenter & Peterson, Inc.
3. ERICO International Corporation
4. National Pipe Hanger Corporation
5. Pipe Shields, Inc.
6. Value Engineered Products, Inc.
B. Insulation-Insert Material for Cold Piping: ASTM C 552, Type I cellular glass with 100-psi ASTM E 591, Type VI, Grade 1 polyisocyanurate with 125-psi minimum compressive strength and vapor barrier.
C. Insulation-Insert Material for Hot Piping: Water-repellent-treated, ASTM C 533, Type I calcium silicate with 100-psi, ASTM C 552, Type II cellular glass with 100-psi ASTM E 591, Type VI, Grade 1 polyisocyanurate with 125-psi minimum compressive strength and vapor barrier.
D. For Trapeze or Clamped Systems: Insert and shield shall cover 180 degrees of pipe.
E. For Clevis or Band Hangers: Insert and shield shall cover 180 degree of pipe.
F. Insert Length: Extend 2 inches beyond steel member shield for piping operating below ambient air temperature.
2.9 FASTENER SYSTEMS
A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
a. Hill, Inc.
b. ITW Rammed/Ret Head, Illinois Tool Works, Inc.
c. MKT Fastening, LLC
d. Simpson Strong-Tie Co., Inc.
B. Mechanical-Expansion Anchors: Insert-wedge-type anchors for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
a. Bim, an Eaton business
b. Hill, Inc.
c. MKT Fastening, LLC
D. Indoor Applications: Zinc-coated or stainless-steel.
E. Outdoor Applications: Stainless steel.
2.10 PIPE STANDS
A. General Requirements for Pipe Stands: Shop- or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.
B. Compact Pipe Stand:
1. Description: Single base unit with integral-rof roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.
2. Base: Single, vulcanized rubber, molded polypropylene, or polycarbonate.
3. Hardware: Galvanized steel or polycarbonate.
4. Accessories: Protection

SECTION 23 05 33 (CONT.) HEAT TRACING FOR HVAC PIPING

H. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

I. Capacities and Characteristics:

- Maximum Heat Output: 5 W/ft.
- Piping Diameter: Per manufacturer's requirements.
- Number of Parallel Cables: Per manufacturer's requirements.
- Spiral Wrap Pitch: Per manufacturer's requirements.
- Electrical Characteristics for Single-Circuit Connection:
 - Volts: 120.
 - Phase: 1.
 - Herz: 60.
 - Full-Load Amperes: Per design.
 - Minimum Circuit Ampacity: Per design.
 - Maximum Overcurrent Protection: Per design.

2.3 CONSTANT-WATTAGE HEATING CABLES

A. **Manufacturers:** Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

- Chromalox, Inc.
- Raychem, Inc./Thermal Controls

B. Comply with IEEE 515.1.

C. Heating Element: Pair of parallel No. 12 AWG, inner or nickel-coated, stranded copper bus wires with single-stranded resistor wire connected between bus wires. Terminate with waterproof, factory-assembled, nonheating leads with connectors at one end, and seal the opposite end and wiretight.

D. Electrical Insulating Jacket: Flame-retardant fluoropolymer.

E. Cable Cover: Tinned-copper or stainless-steel braid and polyolefin outer jacket with ultraviolet inhibitor.

F. Maximum Operating Temperature (Power On): 332 deg F.

G. Maximum Exposure Temperature (Power Off): 185 deg F.

H. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

I. Capacities and Characteristics:

- Maximum Heat Output: 4 W/ft.
- Electrical Characteristics for Single-Circuit Connection:
 - Volts: 120.
 - Phase: 1.
 - Herz: 60.
 - Full-Load Amperes: Per design.
 - Minimum Circuit Ampacity: Per design.
 - Maximum Overcurrent Protection: Per design.

2.4 CONTROLS

A. Pipe-Mounted Thermostats for Freeze Protection:

- Remove bulb unit with adjustable temperature range from 30 to 55 deg F.
- Snap action, open-circuit, single-pole switch with minimum current rating adequate for connected cable.
- Remove bulb on capillary, resistance temperature device, or thermostat for directly sensing pipe wall-temperature.
- Corrosion-resistant, waterproof contact enclosure.

B. Thermostatic and Temperature Sensor for Snow Melting on Roofs and in Gutters:

- Automatic control with manual on, automatic, and standby/reset switch.
- Precipitation and temperature sensors shall sense the surface conditions of roof and gutters and shall be programmed to energize the cable as follows:
 - Temperature Span: 34 to 44 deg F.
 - Adjustable Delay-Off Span: 30 to 90 minutes.
 - Energize Cables: Following two-minute delay if ambient temperature is below set point and precipitation is detected.
 - De-Energize Cables: On detection of a dry surface plus time delay.
 - Corrosion- and waterproof enclosures suitable for outdoor, rooftop, for controls and precipitation and temperature sensors.
 - Minimum 50A contactor for energize cable or closer contactors.
 - Precipitation sensor shall be freeze-drying, on or off, for interface with central HVAC control-system workstation.
 - Provide relay with contacts to indicate operational status, on or off, for interface with central HVAC control-system workstation.
 - Programmable Time for Domestic Hot Water Temperature Maintenance:
 - Microprocessor based.
 - Minimum of four separate schedules.
 - Minimum 24-hour battery capacity.
 - On-off-audible switch.
 - 355-day calendar with 20 programmable holidays.
 - Relays with contacts to indicate operational status, on or off, and for interface with central HVAC control-system workstation.

2.5 ACCESSORIES

A. Cable Installation Accessories: Fiberglass tape, heat-conductive putty, cable ties, silicone end seals and splice kits, and installation clips all furnished by manufacturer, or as recommended in writing by manufacturer.

B. Warning Labels: Refer to Section 22 05 53 "Identification for Plumbing Piping and Equipment."

C. Warning Tape: Continuously printed "Electrical Tracing" vinyl, at least 3 mils thick, and with pressure-sensitive, permanent, waterproof, self-adhesive.

- Width for Markers on Pipes with OD, Including Insulation, Less Than 6 Inches: 3/4 inch minimum.
- Width for Markers on Pipes with OD, Including Insulation, 6 inches or Larger: 1-1/2 inches minimum.

SECTION 23 05 53 IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

- Equipment labels.
- Warning signs and labels.
- Pipe labels.
- Duct labels.
- Stencils.
- Valve tags.
- Warning tags.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For color, letter style, and graphic representation required for each identification material and device.

C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

D. Valve numbering systems.

E. Valve Schedules: For each piping system to include in maintenance manuals.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Metal Labels for Equipment:

- Manufacturers:** Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - Brady Corporation
 - Champion America
 - Chromalox Pipe Markers
 - emisco
 - Kobli Pipe Marker Co.
 - Seton Identification Products
- Material and Thickness: Brass, 0.032-inch or stainless steel, 0.025-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
- Letter Color: TBD.
- Background Color: TBD.
- Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
- Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
- Fasteners: Stainless-steel rivets or self-tapping screws.
- Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Plastic Labels for Equipment:

- Manufacturers:** Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - Brady Corporation
 - Champion America
 - Chromalox Pipe Markers
 - emisco
 - Kobli Pipe Marker Co.
 - Seton Identification Products
- Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
- Letter Color: Black.
- Background Color: White.
- Maximum Temperature: Able to withstand temperatures up to 160 deg F.
- Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
- Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.

SECTION 23 05 53 (CONT.) IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

B. Fasteners: Stainless-steel rivets or self-tapping screws.

C. Label Content: Include equipment's Drawing designation or unique equipment number. Drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section and title where equipment is specified.

D. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify drawing numbers where equipment is indicated (plans, details, and schedules) and the Specification Section and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

A. **Manufacturers:** Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

- Brady Corporation
- Champion America
- Chromalox Pipe Markers
- emisco
- Seton Identification Products

B. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.

C. Letter Color: White.

D. Background Color: Red or Yellow as appropriate.

E. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

F. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

G. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.

H. Fasteners: Stainless-steel rivets or self-tapping screws.

I. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

J. Label Content: Include caution and warning information plus emergency notification instructions.

2.3 PIPE LABELS

A. **Manufacturers:** Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

- Brady Corporation
- Carlton Industries, LP
- Champion America
- Chromalox Pipe Markers
- emisco

B. HYPERLINK: <http://www.spacogent.com/lookup?uid=1245694342> 6. Kobli Pipe Marker Co.

C. **Seton Identification Products:**

D. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

E. Preinsulated Pipe Labels: Precoiled, semirigid plastic formed to partially cover or cover full circumference of pipe and to attach to pipe without fasteners or adhesive.

F. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

G. Pipe Label Contents: Include identification of piping service using some designations or abbreviations as used on Drawings; also include pipe size and an arrow indicating flow direction.

H. Flow-Direction Arrows: Integral with piping-system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.

2.4 DUCT LABELS

A. **Manufacturers:** Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

- Brady Corporation
- Carlton Industries, LP
- Champion America
- Kobli Pipe Marker Co.
- LSM Products Inc.
- Seton Identification Products

B. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.

C. Letter Color: Black.

D. Background Color: Yellow.

E. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

F. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

G. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.

H. Fasteners: Stainless-steel rivets or self-tapping screws.

I. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

J. Duct Label Contents: Include identification of duct service using some designations or abbreviations as used on Drawings; also include duct size and an arrow indicating flow direction.

K. Flow-Direction Arrows: Integral with duct system service lettering to accommodate both directions or as separate unit on each duct label to indicate flow direction.

2.5 STENCILS

A. Stencils for Piping:

- Manufacturers:** Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - Carlton Industries, LP
 - Champion America
 - Chromalox Pipe Markers
 - Kobli Pipe Marker Co.
- Lettering Size: Size letters according to ASME A13.1 for piping.
- Stencil Material: Fiberglass or metal.
- Stencil Paint: Exterior, gloss, alkyl enamel in colors complying with recommendations in ASME A13.1 unless otherwise indicated. Paint may be in pressurized spray-can form.
- Identification Paint: Exterior, alkyl enamel in colors according to ASME A13.1 unless otherwise indicated. Paint may be in pressurized spray-can form.

B. Stencils for Ducts:

- Manufacturers:** Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - Carlton Industries, LP
 - Champion America
 - Chromalox Pipe Markers
 - Kobli Pipe Marker Co.
- Lettering Size: Minimum letter height of 1-1/4 inches for viewing distances up to 15 feet and proportionately larger lettering for greater viewing distances.
- Stencil Material: Fiberglass or metal.
- Stencil Paint: Exterior, gloss, alkyl enamel. Paint may be in pressurized spray-can form.
- Identification Paint: Exterior, alkyl enamel. Paint may be in pressurized spray-can form.

C. Stencils for Access Panels and Door Labels, Equipment Labels, and Similar Operational Instructions:

- Manufacturers:** Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - Carlton Industries, LP
 - Champion America
 - Chromalox Pipe Markers
 - Kobli Pipe Marker Co.
- Lettering Size: Size letters according to ASME A13.1 for piping.
- Stencil Material: Fiberglass or metal.
- Stencil Paint: Exterior, gloss, alkyl enamel in colors complying with recommendations in ASME A13.1 unless otherwise indicated. Paint may be in pressurized spray-can form.
- Identification Paint: Exterior, alkyl enamel in colors according to ASME A13.1 unless otherwise indicated. Paint may be in pressurized spray-can form.

D. **Manufacturers:** Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

- Brady Corporation
- Carlton Industries, LP
- Champion America
- Chromalox Pipe Markers
- emisco
- Kobli Pipe Marker Co.
- Seton Identification Products

E. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.

F. Tag Material: Brass, 0.020-inch or stainless steel, 0.025-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.

G. Fasteners: Brass wire-ink chain, beaded chain, or S-hook.

F. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

2.6 WARNING TAGS

A. **Manufacturers:** Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

- Brady Corporation
- Carlton Industries, LP
- Champion America
- Chromalox Pipe Markers
- emisco
- Kobli Pipe Marker Co.
- Seton Identification Products

B. Description: Preprinted or partially preprinted accident-prevention tags of plasticized card stock with matte finish suitable for writing.

- Size: 3 by 5-1/4 inches minimum.
- Fasteners: Brass grommet and wire.
- Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
- Color: Safety yellow background with black lettering.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

3.3 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.4 PIPE LABEL INSTALLATION

A. Piping Color Coding: Painting of piping is specified in Section 91 23 "Interior Painting."

B. Stenciled Pipe Label Option: Stenciled labels may be provided instead of manufactured pipe labels, at installer's option. Install stenciled pipe labels, complying with ASME A13.1, with painted, color-coded bands or rectangles on each piping system.

- Identification Paint: Use for contrasting background.
- Stencil Paint: Use for pipe marking.

C. Locate label labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

- Near each branch and control device.
- Near each branch outlet, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
- Near penetrations and on both sides of through walls, floors, ceilings, and inaccessible enclosures.
- At access doors, manholes, and similar access points that permit view of concealed piping.
- Near major equipment items and other points of origination and termination.
- Spaced at minimum intervals of 60 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
- On piping above removable acoustical ceilings. Omit immediately stacked labels.

D. Directional Flow Arrows: Arrows shall be used in indicate direction of flow in pipes, including pipes where flow is allowed in both directions.

E. Pipe Label Color Schedule:

- Chilled-Water Piping: White letters on a safety-yellow background.
- Condenser-Water Piping: White letters on a safety-yellow background.
- Refrigerant Piping: White letters on a safety-purple background.

3.5 DUCT LABEL INSTALLATION

A. Install self-adhesive duct labels with permanent adhesive on air ducts in the following color codes:

- Blue: For cold-air supply ducts.
- Yellow: For hot-air supply ducts.
- Green: For exhaust, outside, return, return, and mixed-air ducts.

B. Stenciled Duct Label Option: Stenciled labels showing service and flow direction may be provided instead of plastic-laminated duct labels, at installer's option.

C. Locate labels near ceiling units and exit from concealed spaces and at maximum intervals of 50 feet in each space where ducts are exposed or concealed by removable ceiling system.

SECTION 23 05 53 (CONT.) IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

3.6 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in piping systems, except check valves, valves within factory-fabricated equipment units, shutoff valves, faucets, convenience and law-watering hose connections, and HVAC terminal devices and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:

- Valve-Tag Size and Shape:
 - Chilled Water: 2 inches, round.
 - Condenser Water: 2 inches, round.
 - Refrigerant: 2 inches, round.
 - Gas: 2 inches, round.
- Valve-Tag Colors:
 - Toxic and Corrosive Fluids: Black letters on a safety-orange background.
 - Flammable Fluids: Black letters on a safety-yellow background.
 - Combustible Fluids: White letters on a safety-brown background.
 - Possible or Other Water: White letters on a safety-green background.
 - Compressed Air: White letters on a safety-blue background.
 - Defined by User: White letters on a safety-purple background, black letters on a safety-white background, white letters on a safety-gray background, and white letters on a safety-black background.

3.7 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION

SECTION 23 21 13 HYDRONIC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes pipe and fitting materials and joining methods for the following:

- Copper tube and fittings.
- Steel pipe and fittings.
- Plastic pipe and fittings.
- Joining materials.
- Transition fittings.
- Dielectric fittings.
- Bypass chemical feeder.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of the following:

- Pipe.
- Fittings.
- Joining materials.
- Bypass chemical feeder.

B. Delegated-Design Submittal:

- Design calculations and detailed fabrication and assembly of pipe anchors and alignment guides, hangers and supports for multiple pipes, expansion joints and loops, and attachments of the same to the building structure.
- Locations of pipe anchors and alignment guides and expansion joints and loops.
- Locations and details for penetrations, including sleeves and sleeve seals for exterior walls, floors, basement, and foundation walls.
- Locations of and details for penetration and freestopping for fire- and smoke-rated wall and floor and ceiling assemblies.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Piping layout, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

- Suggested ceiling components.
- Other building services.
- Structural members.
- Qualification data: For installer.
- Welding certificate.
- Field quality-control reports.

E. Preconstruction Test Reports:

- Water Analysis: Submit a copy of the water analysis to illustrate water quality available at Project site.

1.5 QUALITY ASSURANCE

A. Installer Qualifications:

- Installers of Pressure-Sealed Joints: Installers shall be certified by pressure-seal joint manufacturer as having been trained and qualified to join piping with pressure-seal pipe couplings and fittings.
- Fiberglass Pipe and Fitting Installers: Installers of RTRP and RTRP shall be certified by manufacturer of pipes and fittings as having been trained and qualified to join fiberglass piping with manufacturer-recommended adhesive.

B. Steel Support Welding: Quality procedures and personnel according to AWS D1.101.1M, "Structural Welding Code - Steel."

C. Pipe Welding: Quality procedures and operators according to ASME Boiler and Pressure Vessel Code, Section IX.

D. Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation.

E. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

1.6 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Owner will engage a qualified testing agency to perform preconstruction testing on water quality.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Hydroneic piping components and installation shall be capable of withstanding the following minimum working pressure and temperature unless otherwise indicated:

- Chilled-Water Piping: 150 psig at 73 deg F.
- Cooling-Water Piping: 150 psig at 73 deg F.
- Makeup-Water Piping: 80 psig at 73 deg F.
- Condensate Water Piping: 150 deg F.
- Safety-Valve-Inlet and -Outlet Piping: Equal to the pressure of the piping system to which it is attached.

2.2 COPPER TUBE AND FITTINGS

A. Draw-Temper Copper Tubing: ASTM B 88, Type L.

B. Annealed Temper Copper Tubing: ASTM B 88, Type K.

C. DWV Copper Tubing: ASTM B 36, Type D.

D. Grooved, Mechanical-Joint, Wrought-Copper Fittings: ASME B16.22.

1. **Manufacturers:** Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

- Arrol International
- Star Pipe Products
- Victaulic Company

- Grooved-End Copper Fittings: ASTM B 75, copper tube or ASTM B 884, bronze casting.
- Grooved-End Tube Couplings: Rigid pattern unless otherwise indicated, galvanized fitting. Ductile-iron housing with keys matching pipe and fitting grooves, predrilled EPDM gasket installed, minimum 230 deg F for use with housing, and steel bolts and nuts.

E. Copper or Bronze Pressure-Seal Fittings:

- Manufacturers:** Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - Elkhart Products Corporation
 - Muller Industries, Inc.
 - NBCO, Inc.
 - Victaulic Company
- Housing: Copper.
- O-Rings and Pipe Stops: EPDM.
- Tools: Manufacturer's special tools.
- Minimum 200-psig working-pressure rating at 250 deg F.

F. Copper, Mechanically Formed Tee Option: For forming T-branch on copper water tube.

G. **Manufacturers:** Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

- Victaulic Company

2.3 STEEL PIPE AND FITTINGS

A. Steel Pipe: ASTM A 53A, SM, black steel with plain ends; welded and seamless, Grade B, and wall thickness as indicated in "Piping Applications" Article.

B. Cast-Iron Threaded Fittings: ASME B16.4, Classes 125 and 250 as indicated in "Piping Applications" Article.

C. Malleable-Iron Threaded Fittings: ASME B16.3, Classes 150 and 300 as indicated in "Piping Applications" Article.

D. Malleable-Iron Unions: ASME B16.39; Classes 150, 250, and 300 as indicated in "Piping Applications" Article.

E. Cast-Iron Pipe Flanges and Flanged Fittings: ASME B16.5, including bolts, nuts, and gaskets of the following material group, end connections, and facing:

- Material Group: 1.1.
- End Connections: But welding.
- Facing: Raised face.
- Grooved Mechanical Fittings and Couplings:

H. **Manufacturers:** Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

- Victaulic Company
- Welding: Steel.
- O-Rings and Pipe Stop: EPDM.
- Tools: Manufacturer's special tool.
- Minimum 300-psig working-pressure rating at 230 deg F.

K. Steel Pipe Nipples: ASTM A 753, made of same materials and wall thickness as pipe in which they are installed.

2.4 PLASTIC PIPE AND FITTINGS

A. CPVC Plastic Pipe: ASTM F 441F/441F, with wall thickness as indicated in "Piping Applications" Article.

C. CPVC Plastic Pipe Fittings: Socket-type pipe fittings, ASTM F 439 for Schedule 40 pipe, ASTM F 438 for Schedule 80 pipe.

PVC Plastic Pipe Fittings: Socket-type pipe fittings, ASTM A 2465 for Schedule 40 pipe; ASTM D 2467 for Schedule 80 pipe.

2.5 FIBERGLASS PIPE AND FITTINGS

A. RTRP: ASTM D 2966, flange-wound pipe with tapered bond and adhesion prep for adhesive joints.

B. RTRF: Compression or spray-applied mold of same material, pressure class, and joining method as A.

C. Flanges: ASTM D 4024, Full-face gaskets suitable for the service, minimum 1/8-inch thick, 60-70 durometer, ASTM A 307, Grade B, hex head bolts with washers.

SECTION 23 21 13 (CONT.) HYDRONIC PIPING

2.6 JOINING MATERIALS

A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

- ASME B16.25, normal-face, flat, asbestos-free, 1/8-inch maximum thickness unless otherwise indicated.
 - Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
 - Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
- Flange Bolts and Nuts: ASME B16.3.1, carbon steel, unless otherwise indicated.
- Plastic Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer unless otherwise indicated.
- Solder: Pipe Flange: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- Brazing Filler Metals: AWS AS-BM.BM, BCuP Series, copper-phosphorus alloys for joining copper with copper; or BAq-1, silver alloy for joining copper with bronze or steel.
- Welding Filler Metals: Comply with AWS D10.12M/D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- Solvent Cements for CPVC Piping: ASTM F 493.
- Solvent Cements for PVC Piping: ASTM D 2564, include primer according to ASTM F 666.
- Fiberglass Pipe Adhesive: As furnished or recommended by pipe manufacturer.

2.7 TRANSITION FITTINGS

A. Plastic-to-Metal Transition Fittings:

- Manufacturers:** Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - Charlotte Pipe and Foundry Company
 - IPC USA, LLC
 - Victaulic LLC
- One-piece fitting with one threaded brass or copper insert and one solvent-cement-joint end of material and wall thickness to match plastic pipe material.

B. Plastic-to-Metal Transition Unions:

- Manufacturers:** Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - Charlotte Pipe and Foundry Company
 - IPC USA, LLC
 - Victaulic LLC
- Brass or copper end, solvent-cement-joint end of material and wall thickness to match plastic pipe material, rubber gasket, and threaded union.

2.8 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

B. Dielectric Unions:

- Manufacturers:** Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - A.V. McDonald Mfg. Co.
 - Ormet Mechanical Products
 - HART Industrial Unions, LLC
 - D. WATTS
 - Zam Industries, LLC
- Description:
 - Standard ASSE 1079.
 - Factory-abricated, bolted, companion-flange assembly.
 - Pressure Rating: 150 psig.
 - End Connections: Solder-joint copper alloy and threaded ferrous.

C. Dielectric Flanges:

- Manufacturers:** Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - Watts
 - Ormet Mechanical Products
 - Watts
 - Zam Industries, LLC
- Description:
 - Standard ASSE 1079.
 - Factory-abricated, bolted, companion-flange assembly.
 - Pressure Rating: 150 psig.
 - End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

D. Dielectric-Fitting Insulating Kits:

- Manufacturers:** Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - Advance Products & Systems, Inc.
 - Carlton, Inc.
 - Pipeline Seal and Insulator, Inc.
- Description:
 - Nonconducting materials for field assembly of companion flanges.
 - Pressure Rating: 150 psig.
 - Gasket: Neoprene or phenolic.
 - Bolt Sleeves: Phenolic or polyethylene.
 - Washers: Phenolic with steel backing washers.

E. Dielectric Nipples:

- Manufacturers:** Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - Elbex Perfection Corporation
 - Ormet Mechanical Products
 - Precision Plumbing Products
 - Victaulic Company
- Description:
 - Standard: IPMOM PS 66.
 - Electropolished steel nipple, complying with ASTM F 1545.
 - Pressure Rating: 300 psig at 225 deg F.
 - End Connections: Male threaded or grooved.
 - Lining: Inert and nonconductive, proprietary.

2.9 BYPASS CHEMICAL FEEDERS

A. Description: Welded steel construction; 125-psig working pressure, 5-gal. capacity, with fill funnel and inlet, outlet, and drain valves.

- Chemicals: Specifically formulated, based on analysis of makeup water, to prevent accumulation of scale and corrosion in piping and connected equipment.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Chilled-water piping, aboveground, NPS 2 and smaller, shall be the following:

- Schedule 40 steel pipe, Class 125, cast-iron fittings, cast-iron flanges and flange fittings, and threaded joints.
- Chilled-water piping, aboveground, NPS 2-1/2 and larger, shall be any of the following:
 - Schedule 40 steel pipe, wrought-steel fittings and wrought-cast or forged-steel flanges and flange fittings, and welded and flanged joints.
 - Schedule 40 steel pipe, grooved, mechanical joint coupling and fittings, and grooved, mechanical joints.
 - Schedule 40 steel pipe, plain-end mechanical-coupled joints.

C. Chilled-water piping installed belowground and within slabs shall be either of the following:

- Type K, annealed-temper copper tubing, wrought-copper fittings, and brazed joints. Use the fewest possible joints.
- RTRP and RTRF with adhesive or flanged joints.

D. Cooling-water piping, aboveground, NPS 2 and smaller, shall be the following:

- Schedule 40 steel pipe, Class 125, cast-iron fittings, cast-iron flanges and flange fittings, and threaded joints.
- Cooling-water piping, aboveground, NPS 2-1/2 and larger, shall be any of the following:
 - Schedule 40 steel pipe, wrought-steel fittings and wrought-cast or forged-steel flanges and flange fittings, and welded and flanged joints.
 - Schedule 40 steel pipe, grooved, mechanical joint coupling and fittings, and grooved, mechanical joints.
 - Schedule 40 steel pipe, plain-end mechanical-coupled joints.

F. Cooling-water piping installed belowground and within slabs shall be either of the following:

- Type K, annealed-temper copper tubing, wrought-copper fittings, and soldered or brazed joints.
- RTRP and RTRF with adhesive or flanged joints.

G. Makeup-water piping installed aboveground shall be the following:

- Type L, draw-temper copper tubing, wrought-copper fittings, and soldered or brazed joints.

H. Makeup-Water Piping Installed Belowground and within Slabs: Type K, annealed-temper copper tubing, wrought-copper fittings, and soldered joints. Use the fewest possible joints.

I. Condensate-Drain Piping: Type DWV, draw-temper copper tubing, wrought-copper fittings, and soldered joints or Schedule 40 PVC plastic pipe and fittings and solvent-welded joints.

J. Condensate-Drain Piping: 40 PVC plastic pipe and fittings and solvent-welded joints.

K. Blowdown-Drain Piping: Same materials and joining methods as for piping specified for the service in which blowdown drain is installed.

L. Air-Vent Piping:

- Inlet: Same as service where installed with metal-to-plastic transition fittings for plastic piping systems according to piping manufacturer's written instructions.
- Outlet: Type K, annealed-temper copper tubing with soldered or flared joints.

M. Safety-Valve-Inlet and -Outlet Piping for Hot-Water: Same materials and joining methods as for piping specified for the service in which safety valve is installed with metal-to-plastic transition fittings for plastic piping systems according to piping manufacturer's written instructions.

3.2 PIPING INSTALLATIONS

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping to permit valve servicing.

F. Install piping at indicated slopes.

G. Install piping free of sag and bends.

H. Install fittings for changes in direction and branch connections.

I. Install piping to allow application of insulation.

J. Select system components with pressure rating equal to or greater than system operating pressure.

K. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.

L. Install drains, consisting of a free fitting, NPS 3/4 ball valve, and short NPS 3/4 threaded nipple with cap, at low points in piping system mains and enclosures as required for system drainage.

M. Install piping at a uniform grade of 0.2 percent upward in direction of flow.

N. Reduce pipe sizes using eccentric reducer fitting installed with level side up.

O. Install branch connections to mains using mechanically formed tee fittings in main pipe, with the branch connected to the bottom of the main pipe. For up-fed sizes, connect the branch to the top of the main pipe.

P. Install valves according to the following:

- Section 23 05 23.11 "Shoe Valve for HVAC Piping."
- Section 23 05 23.12 "Ball Valves for HVAC Piping."
- Section 23 05 23.13 "Butterfly Valves for HVAC Piping."
- Section 23 05 23.14 "Shoe Valve for HVAC Piping."
- Section 23 05 23.15 "Gate Valves for HVAC Piping."

- Install unions in piping, NPS 2 and smaller, adjacent to valves, at final connections of equipment, and elsewhere as indicated.
- Install flanges in piping, NPS 2-1/2 and larger, at final connections of equipment and elsewhere as indicated.
- Install shut-off valve immediately upstream of each dielectric fitting.
- Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- Comply with requirements in Section 23 05 16 "Expansion Fittings and Loops for HVAC Piping" for installation of expansion joints, expansion joints, anchors, and pipe alignment guides.
- Comply with requirements in Section 23 05 53 "Identification for HVAC Piping and Equipment" for identifying piping.
- Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 23 05 17 "Sleeves and Sleeve Seals for HVAC Piping."
- Install sleeves for piping penetrations of concrete walls and slabs. Comply with requirements for sleeves seals specified in Section 23 05 17 "Sleeves and Sleeve Seals for HVAC Piping."
- Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for acoustichous specified in Section 23 05 18 "Acoustichous for HVAC Piping."

| SECTION 23 21 13 (CONT.) HYDRONIC PIPING | |
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| D. | Install hangers for steel piping with the following maximum spacing and minimum rod sizes: 1. NPS 3/4: Maximum span, 7 feet. 2. NPS 1: Maximum span, 7 feet. 3. NPS 1-1/2: Maximum span, 9 feet. 4. NPS 2: Maximum span, 10 feet. 5. NPS 2-1/2: Maximum span, 11 feet. 6. NPS 3 and Larger: Maximum span, 12 feet. |
| E. | Install hangers for draw-embed copper piping with the following maximum spacing and minimum rod sizes: 1. NPS 3/4: Maximum span, 5 feet; minimum rod size, 1/4 inch. 2. NPS 1: Maximum span, 5 feet; minimum rod size, 1/4 inch. 3. NPS 1-1/4: Maximum span, 7 feet; minimum rod size, 3/8 inch. 4. NPS 1-1/2: Maximum span, 8 feet; minimum rod size, 3/8 inch. 5. NPS 2: Maximum span, 9 feet; minimum rod size, 3/8 inch. 6. NPS 2-1/2: Maximum span, 9 feet; minimum rod size, 3/8 inch. 7. NPS 3 and Larger: Maximum span, 10 feet; minimum rod size, 3/8 inch. |
| F. | Flexing Hanger Spacing: Space hangers according to pipe manufacturer's written instructions for service conditions. Avoid point loading. Space and install hangers with the lowest practical rigid anchor points. G. Fiberglass Piping Hanger Spacing: Space hangers according to pipe manufacturer's written instructions for service conditions. Avoid point loading. Space and install hangers with the lowest practical rigid anchor points. H. Support vertical runs at roof, at each floor, and at a 10-foot interval between floors. |
| 3.5 | PIPE JOINT CONSTRUCTION A. Remove ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe. B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly. C. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 332. D. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.85 A5.85 BM. E. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows: 1. Apply appropriate tape or thread compound to external pipe threads unless dry thread is specified. 2. Demarcate pipe or pipe fittings with "hydes" that are unqualified or damaged. Do not use pipe fittings that have cracked or open welds. F. Welded Joints: Construct joints according to AWS D10.12M/D10.12, using qualified processes and welding operators. Certify that each welder has passed AWS qualification tests for welding processes. G. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on both threads. H. Flexible Piping: Select piping material and fittings, apply adhesive, and join according to pipe manufacturer's written instructions. I. Grooved Joints: Assemble joints with coupling and gasket, lubricant, and bolts. Cut or roll grooves in ends of pipe based on pipe and coupling manufacturer's written instructions for pipe wall thickness. Use grooved-end fittings and rigid, grooved-end pipe couplings. K. Flare-End Mechanical Couplings: Prepare, assemble, and test joints in accordance with manufacturer's written installation instructions. L. Mechanically Formed, Copper-Tube-Outlet Joints: Use manufacturer-recommended tool and procedure, and brazed joints. M. Pressure-Sealed Joints: Use manufacturer-recommended tool and procedure. Leave insertion marks on pipe after assembly. |
| 3.6 | TERMINAL EQUIPMENT CONNECTIONS A. Sizes for supply and return piping connections shall be the same as or larger than equipment connections. B. Install control valves in accessible locations close to connected equipment. C. Install bypass piping with globe valve around control valve. If parallel control valves are installed, only one bypass is required. D. Install ports for pressure gauges and thermometers at coil inlet and outlet connections. Comply with requirements in Section 23 05 19 "Meters and Gages for HVAC Piping." |
| 3.7 | CHEMICAL TREATMENT A. Install bypass chemical feeders in each hydronic system where indicated. 1. Install in upright position with top of tank not more than 48 inches above the floor. 2. Install feeder in minimum NPS 3/4 bypass line, from main with full-port, ball valve in the main between bypass connections. 3. Install NPS 3/4 pipe from chemical feeder drain to nearest equipment drain and include a full-size, full-port, ball valve. B. Fill system with fresh water and add liquid alkaline compound with emulsifying agents and detergents to remove grease and petroleum products from piping. Circulate solution for a minimum of 24 hours, clean, clean strainer screens, and refill with fresh water. C. Add initial chemical treatment and maintain water quality in ranges allowed for the first year of operation. |
| 3.8 | FIELD QUALITY CONTROL A. Prepare hydraulic piping according to ASME B31.9 and as follows: 1. Leave joints, including welds, unexposed until approved for examination during test. 2. Provide temporary restraints for unrestrained joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing. 3. Flush hydronic piping systems with clean water, then remove and clean or replace strainer screens. 4. Isolate equipment from piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve, install valves in flanged joints to isolate equipment. 5. Install safety valve, set at a pressure no more than one-third higher than test pressure, to protect against damage by expanding liquid or other source of overpressure during test. B. Perform tests on hydronic piping: 1. Use ambient temperature water as a testing medium unless there is risk of damage to freezing. Another liquid that is safe for workers and compatible with piping may be used. 2. While filling system, use vents installed at high points of system to release air. Use drains installed at low points for complete draining of test liquid. 3. Isolate expansion tanks and determine that hydronic system is full of water. 4. Products shall be tested at a pressure that is not less than 1.5 times the system's working pressure. Test pressure shall not exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure is present at location of vertical runs that do not exceed 90 percent of specified minimum yield strength of 1.7 times the "SE" value in Appendix A in ASME B31.9, "Building Services Piping." 5. After hydrostatic test pressure has been applied for at least 10 minutes, examine piping, joints, and connectors for leakage. Eliminate leaks by tightening, repairing, or replacing components, and repeat hydrostatic test until there are no leaks. 6. Prepare written report of testing. C. Perform the following before operating the system: 1. Open manual valves fully. 2. Inspect valves for proper rotation. 3. Set makeup pressure-reducing valves for required system pressure. 4. Inspect air vents at high points of system and determine if all are installed and operating fully (automatic type), or bleed air completely (manual type). 5. Set temperature controls on all coils are calling for full flow. 6. Inspect and set operating temperatures of hydronic equipment, such as boilers, chillers, cooling towers, to specified values. 7. Verify lubrication of motors and bearings. |

END OF SECTION

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| SECTION 23 21 23 HYDRONIC PUMPS | |
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| PART 1 - GENERAL | |
| 1.1 | RELATED DOCUMENTS Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section. |
| 1.2 | SUMMARY A. Section Includes: 1. Close-coupled, in-line centrifugal pumps. 2. Close-coupled, end-suction centrifugal pumps. 3. Separately coupled, horizontally mounted, in-line centrifugal pumps. 4. Separately coupled, vertically mounted, in-line centrifugal pumps. 5. Separately coupled, base-mounted, end-suction centrifugal pumps. 6. Separately coupled, base-mounted, double-suction centrifugal pumps. 7. Separately coupled, vertically mounted, double-suction centrifugal pumps. 8. Automatic condensate pump units. B. Operation and Maintenance Data: For pumps to include in emergency, operation, and maintenance manuals. 1. Mechanical Seals: One mechanical seal(s) for each pump. |
| 1.3 | DEFINITIONS A. Buna-N: Nitrile rubber. B. EPDM: Ethylene propylene terpolymer. |
| 1.4 | ACTION SUBMITTALS A. Product Data: For each type of pump, include certified performance curves and rated capacities, operating characteristics, furnished specialties, final impeller dimensions, and accessories for each type of product indicated. Include pump's operating point on curves. B. Shop Drawings: For each pump: 1. Show pump layout and connections. 2. Include setting drawings with templates for installing foundation and anchor bolts and other anchorages. 3. Include diagrams for power, signal, and control wiring. |
| 1.5 | CLOSEOUT SUBMITTALS A. Operation and Maintenance Data: For pumps to include in emergency, operation, and maintenance manuals. |
| 1.6 | MAINTENANCE MATERIAL SUBMITTALS A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents: 1. Mechanical Seals: One mechanical seal(s) for each pump. |

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| PART 2 - PRODUCTS | |
| 2.1 | CLOSE-COUPLED, IN-LINE CENTRIFUGAL PUMPS A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following: 1. Armstrong Pumps, Inc. 2. Grundfos Pumps Corporation 3. ITT Corporation 4. Patterson Pump Company a Gorman-Rupp company B. Description: Factory-assembled and -tested, centrifugal, overhung-impeller, close-coupled, in-line pump as defined in HI 1.1-1.2 and HI 1.3, designed for installation with pump and motor shafts mounted horizontally or vertically. C. Capacities and Characteristics: 1. See pump schedules on drawings. D. Pump Construction: 1. Casting: Radially split, cast iron, with threaded gage tappings at inlet and outlet, replaceable bronze wear rings, and threaded companion-flange connections. 2. Impeller: ASTM B 584, cast bronze, statically and dynamically balanced, keyed to shaft, and secured with a locking cap screw. For constant-speed pumps, trim impeller to match specified performance. 3. Pump Shaft: Steel, with copper-alloy shaft sleeve or Stainless steel. 4. Seal: Mechanical seal consisting of carbon rotating ring against a ceramic seat held by a stainless-steel spring, and Buna-N, EPDM or Viton bellows and gasket. Include water slinger on shaft between motor and seal. 5. Seal: Packing seal consisting of stuffing box with a minimum of four rings of graphite-impregnated braided yarn with bronze lantern ring between center two graphite rings, and bronze packing gland. 6. Pump Bearings: Permanently lubricated ball bearings or Oil lubricated, bronze-journal or thrust type. E. Shaft Coupling: Molded-rubber insert and interlocking spider capable of absorbing vibration. Couplings shall be drop-out type to allow disassembly and removal without removing pump shaft or motor. EPDM coupling sleeve for variable-speed applications. F. Coupling Guard: Dual rated; ANSI B15.1, Section 8, OSHA 1910.219 approved; steel removable; attached to mounting frame. G. Mounting Frame: Welded-steel frame and cross members, factory fabricated from ASTM A36M 36M channels and angles. Fabricate to mount pump casing, coupling guard, and motor. H. Motor: Single speed, secured to mounting frame, with adjustable alignment. 1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application. 2. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 23 05 13 "Common Motor Requirements for HVAC Equipment." |
| 2.2 | CLOSE-COUPLED, END-SUCTION CENTRIFUGAL PUMPS A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following: 1. Armstrong Pumps, Inc. 2. ITT Corporation 3. Patterson Pump Company a Gorman-Rupp company B. Description: Factory-assembled and -tested, centrifugal, overhung-impeller, close-coupled, end-suction pump as defined in HI 1.1-1.2 and HI 1.3, designed for installation with pump and motor shafts mounted horizontally. C. Capacities and Characteristics: 1. See pump schedules on drawings. D. Pump Construction: 1. Casting: Radially split, cast iron, with replaceable bronze wear rings, drain plug at bottom and air vent at top of volute, threaded gage tappings at inlet and outlet, and threaded companion-flange connections. 2. Impeller: ASTM B 584, cast bronze, statically and dynamically balanced, keyed to shaft, and secured with a locking cap screw. For constant-speed pumps, trim impeller to match specified performance. 3. Pump Shaft: Stainless steel. 4. Seal: Mechanical seal consisting of carbon rotating ring against a ceramic seat held by a stainless-steel spring, and Buna-N, EPDM or Viton bellows and gasket. Include water slinger on shaft between motor and seal. 5. Seal: Packing seal consisting of stuffing box with a minimum of four rings of graphite-impregnated braided yarn with bronze lantern ring between center two graphite rings, and bronze packing gland. 6. Pump Bearings: Grease-lubricated ball bearings in cast-iron housing with grease fittings. E. Shaft Coupling: Molded-rubber insert and interlocking spider capable of absorbing vibration. F. Motor: Single speed and secured to casing. 1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application. 2. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 23 05 13 "Common Motor Requirements for HVAC Equipment." |
| 2.3 | SEPARATELY COUPLED, VERTICALLY MOUNTED, DOUBLE-SUCTION CENTRIFUGAL PUMPS A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following: 1. Armstrong Pumps, Inc. 2. ITT Corporation 3. Grundfos Pumps Corporation, USA 4. Patterson Pump Company a Gorman-Rupp company B. Description: Factory-assembled and -tested, centrifugal, overhung-impeller, separately coupled, double-suction pump as defined in HI 1.1-1.2 and HI 1.3, designed for installation with pump and motor shafts mounted horizontally. C. Capacities and Characteristics: 1. See pump schedules on drawings. D. Pump Construction: 1. Casting: Radially split, cast iron, with replaceable bronze wear rings, threaded gage tappings at inlet and outlet, drain plug at bottom and air vent at top of volute, and ASME B16.1, Class 125 flanges. Castings support shafts and allow removal and replacement of impeller without disconnecting piping. 2. Impeller: ASTM B 584, cast bronze, statically and dynamically balanced, and keyed to shaft. For pumps not frequency-drive controlled, trim impeller to match specified performance. 3. Pump Shaft: Stainless steel. 4. Seal: Mechanical seal consisting of carbon rotating ring against a ceramic seat held by a stainless-steel spring, and Buna-N, EPDM or Viton bellows and gasket. 5. Seal: Packing seal consisting of stuffing box with a minimum of four rings of graphite-impregnated braided yarn with bronze lantern ring between center two graphite rings, and bronze packing gland. 6. Pump Bearings: Grease-lubricated ball bearings in cast-iron housing with grease fittings. E. Shaft Coupling: Molded-rubber insert and interlocking spider capable of absorbing vibration. Couplings shall be drop-out type to allow disassembly and removal without removing pump shaft or motor. EPDM coupling sleeve for variable-speed applications. F. Coupling Guard: Dual rated; ANSI B15.1, Section 8, OSHA 1910.219 approved; steel removable; attached to mounting frame. G. Mounting Frame: Welded-steel frame and cross members, factory fabricated from ASTM A36M 36M channels and angles. Fabricate to mount pump casing, coupling guard, and motor. H. Motor: Single speed, secured to mounting frame, with adjustable alignment. 1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application. 2. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 23 05 13 "Common Motor Requirements for HVAC Equipment." |
| 2.4 | SEPARATELY COUPLED, VERTICALLY MOUNTED, DOUBLE-SUCTION CENTRIFUGAL PUMPS A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following: 1. Armstrong Pumps, Inc. 2. Grundfos Pumps Corporation, USA 3. ITT Corporation 4. Patterson Pump Company a Gorman-Rupp company B. Description: Factory-assembled and -tested, centrifugal, overhung-impeller, separately coupled, double-suction pump as defined in HI 1.1-1.2 and HI 1.3, designed for installation with pump and motor shafts mounted vertically. C. Capacities and Characteristics: 1. See pump schedules on drawings. D. Pump Construction: 1. Casting: Radially split, cast iron, with replaceable bronze wear rings, threaded gage tappings at inlet and outlet, drain plug at bottom and air vent at top of volute, and ASME B16.1, Class 125 flanges. Castings support shafts and allow removal and replacement of impeller without disconnecting piping. 2. Impeller: ASTM B 584, cast bronze, statically and dynamically balanced, and keyed to shaft. For pumps not frequency-drive controlled, trim impeller to match specified performance. 3. Pump Shaft: Stainless steel. 4. Seal: Mechanical seal consisting of carbon rotating ring against a ceramic seat held by a stainless-steel spring, and Buna-N, EPDM or Viton bellows and gasket. 5. Seal: Packing seal consisting of stuffing box with a minimum of four rings of graphite-impregnated braided yarn with bronze lantern ring between center two graphite rings, and bronze packing gland. 6. Pump Bearings: Grease-lubricated ball bearings in cast-iron housing with grease fittings. E. Shaft Coupling: Molded-rubber insert and interlocking spider capable of absorbing vibration. F. Motor: Single speed and secured to casing. 1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application. 2. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 23 05 13 "Common Motor Requirements for HVAC Equipment." |
| 2.5 | SEPARATELY COUPLED, VERTICALLY MOUNTED, DOUBLE-SUCTION CENTRIFUGAL PUMPS A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following: 1. Armstrong Pumps, Inc. 2. Grundfos Pumps Corporation, USA 3. ITT Corporation 4. Patterson Pump Company a Gorman-Rupp company B. Description: Factory-assembled and -tested, centrifugal, overhung-impeller, separately coupled, double-suction pump as defined in HI 1.1-1.2 and HI 1.3, designed for installation with pump and motor shafts horizontal. C. Capacities and Characteristics: 1. See pump schedules on drawings. D. Pump Construction: 1. Casting: Radially split, cast iron, with replaceable bronze wear rings, threaded gage tappings at inlet and outlet, drain plug at bottom and air vent at top of volute, and ASME B16.1, Class 125 flanges. Castings support shafts and allow removal and replacement of impeller without disconnecting piping. 2. Impeller: ASTM B 584, cast bronze, statically and dynamically balanced, and keyed to shaft. For pumps not frequency-drive controlled, trim impeller to match specified performance. 3. Pump Shaft: Stainless steel. 4. Seal: Mechanical seal consisting of carbon rotating ring against a ceramic seat held by a stainless-steel spring, and Buna-N, EPDM or Viton bellows and gasket. 5. Seal: Packing seal consisting of stuffing box with a minimum of four rings of graphite-impregnated braided yarn with bronze lantern ring between center two graphite rings, and bronze packing gland. 6. Pump Bearings: Grease-lubricated ball bearings in cast-iron housing with grease fittings. E. Shaft Coupling: Molded-rubber insert and interlocking spider capable of absorbing vibration. F. Motor: Single speed, secured to mounting frame, with adjustable alignment. 1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application. 2. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 23 05 13 "Common Motor Requirements for HVAC Equipment." |
| 2.6 | SEPARATELY COUPLED, VERTICALLY MOUNTED, DOUBLE-SUCTION CENTRIFUGAL PUMPS A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following: 1. Armstrong Pumps, Inc. 2. Grundfos Pumps Corporation, USA 3. ITT Corporation 4. Patterson Pump Company a Gorman-Rupp company B. Description: Factory-assembled and -tested, centrifugal, overhung-impeller, separately coupled, double-suction pump as defined in HI 1.1-1.2 and HI 1.3, designed for installation with pump and motor shafts horizontal. C. Capacities and Characteristics: 1. See pump schedules on drawings. D. Pump Construction: 1. Casting: Radially split, cast iron, with replaceable bronze wear rings, threaded gage tappings at inlet and outlet, drain plug at bottom and air vent at top of volute, and ASME B16.1, Class 125 flanges. Castings support shafts and allow removal and replacement of impeller without disconnecting piping. 2. Impeller: ASTM B 584, cast bronze, statically and dynamically balanced, and keyed to shaft. For pumps not frequency-drive controlled, trim impeller to match specified performance. 3. Pump Shaft: Stainless steel. 4. Seal: Mechanical seal consisting of carbon rotating ring against a ceramic seat held by a stainless-steel spring, and Buna-N, EPDM or Viton bellows and gasket. 5. Seal: Packing seal consisting of stuffing box with a minimum of four rings of graphite-impregnated braided yarn with bronze lantern ring between center two graphite rings, and bronze packing gland. 6. Pump Bearings: Grease-lubricated ball bearings in cast-iron housing with grease fittings. E. Shaft Coupling: Molded-rubber insert and interlocking spider capable of absorbing vibration. F. Motor: Single speed and secured to casing. 1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application. 2. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 23 05 13 "Common Motor Requirements for HVAC Equipment." |
| 2.7 | SEPARATELY COUPLED, VERTICALLY MOUNTED, DOUBLE-SUCTION CENTRIFUGAL PUMPS A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following: 1. Armstrong Pumps, Inc. 2. ITT Corporation 3. Grundfos Pumps Corporation, USA 4. Patterson Pump Company a Gorman-Rupp company B. Description: Factory-assembled and -tested, centrifugal, overhung-impeller, separately coupled, double-suction pump as defined in HI 1.1-1.2 and HI 1.3, designed for installation with pump and motor shafts horizontal. C. Capacities and Characteristics: 1. See pump schedules on drawings. D. Pump Construction: 1. Casting: Radially split, cast iron, with replaceable bronze wear rings, threaded gage tappings at inlet and outlet, drain plug at bottom and air vent at top of volute, and ASME B16.1, Class 125 flanges. Castings support shafts and allow removal and replacement of impeller without disconnecting piping. 2. Impeller: ASTM B 584, cast bronze, statically and dynamically balanced, and keyed to shaft. For pumps not frequency-drive controlled, trim impeller to match specified performance. 3. Pump Shaft: Stainless steel. 4. Seal: Mechanical seal consisting of carbon rotating ring against a ceramic seat held by a stainless-steel spring, and Buna-N, EPDM or Viton bellows and gasket. 5. Seal: Packing seal consisting of stuffing box with a minimum of four rings of graphite-impregnated braided yarn with bronze lantern ring between center two graphite rings, and bronze packing gland. 6. Pump Bearings: Grease-lubricated ball bearings in cast-iron housing with grease fittings. E. Shaft Coupling: Molded-rubber insert and interlocking spider capable of absorbing vibration. F. Motor: Single speed and secured to casing. 1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application. 2. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 23 05 13 "Common Motor Requirements for HVAC Equipment." |
| 2.8 | AUTOMATIC CONDENSATE PUMP UNITS A. Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following: 1. Beckert Corporation 2. Harsco Pumps, Milton Roy 3. Little Giant Pump Co. 4. Mingo, LLC B. Description: Packaged units with corrosion-resistant pump, plastic tank with cover, and automatic controls. Include factory- or field-installed check valve and a 72-inch-minimum, electrical power cord with plug. C. Capacities and Characteristics: 1. Size per AHJ condensate requirements. D. PUMP SPECIALTY FITTINGS A. Suction Diffuser: 1. Angle pattern. 2. 175-psig or 300-psig pressure rating, cast or ductile-iron body, pump-discharge fitting. 3. Bronze start-up and bronze or stainless-steel permanent ends. 4. Bronze or stainless-steel straining vanes. 5. Drain plug. 6. Factory-lubricated support. B. Triple-Drain Valve: 1. Angle or straight pattern. 2. 175-psig or 300-psig pressure rating, cast or ductile-iron body, pump-discharge fitting. 3. Drain plug and bronze-filter strainer, ball check valve feature. 4. Brass gage ports with integral check valve for flow measurement. |

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| SECTION 23 21 23 (CONT.) HYDRONIC PUMPS | |
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| 3. | Pump Shaft: Steel, with copper-alloy shaft sleeve or Stainless steel. 4. Mechanical Seal: Carbon rotating ring against a ceramic seat held by a stainless-steel spring, and Buna-N or EPDM bellows and gasket. Include water slinger on shaft between motor and seal. 5. Pump Bearings: Permanently lubricated ball bearings or Oil lubricated, bronze-journal or thrust type. |
| E. | Motor: Single speed and rigidly mounted to pump casing with integral pump support. 1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application. 2. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 23 05 13 "Common Motor Requirements for HVAC Equipment." |
| 2.3 | SEPARATELY COUPLED, HORIZONTALLY MOUNTED, IN-LINE CENTRIFUGAL PUMPS A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following: 1. Armstrong Pumps, Inc. 2. Grundfos Pumps Corporation 3. ITT Corporation 4. Patterson Pump Company a Gorman-Rupp company B. Description: Factory-assembled and -tested, centrifugal, overhung-impeller, separately coupled, in-line pump as defined in HI 1.1-1.2 and HI 1.3, designed for installation with pump and motor shafts mounted horizontally. C. Capacities and Characteristics: 1. See pump schedules on drawings. D. Pump Construction: 1. Casting: Radially split, cast iron, with threaded gage tappings at inlet and outlet, and threaded companion-flange connections. 2. Impeller: ASTM B 584, cast bronze, statically and dynamically balanced, and keyed to shaft. For pumps not frequency-drive controlled, trim impeller to match specified performance. 3. Pump Shaft: Steel, with copper-alloy shaft sleeve or Stainless steel. 4. Mechanical Seal: Carbon rotating ring against a ceramic seat held by a stainless-steel spring, and Buna-N, EPDM or Viton bellows and gasket. Include water slinger on shaft between motor and seal. 5. Pump Bearings: Permanently lubricated ball bearings or Oil lubricated, bronze-journal or thrust type. E. Shaft Coupling: Molded-rubber insert and interlocking spider or interlocking frame with interconnecting spindles capable of absorbing vibration. F. Motor: Single speed and rigidly mounted to pump casing. 1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application. 2. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 23 05 13 "Common Motor Requirements for HVAC Equipment." |
| 2.4 | SEPARATELY COUPLED, VERTICALLY MOUNTED, IN-LINE CENTRIFUGAL PUMPS A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following: 1. Armstrong Pumps, Inc. 2. Grundfos Pumps Corporation, USA 3. ITT Corporation 4. Patterson Pump Company a Gorman-Rupp company B. Description: Factory-assembled and -tested, centrifugal, overhung-impeller, separately coupled, in-line pump as defined in HI 1.1-1.2 and HI 1.3, designed for installation with pump and motor shafts mounted vertically. C. Capacities and Characteristics: 1. See pump schedules on drawings. D. Pump Construction: 1. Casting: Radially split, cast iron, with threaded gage tappings at inlet and outlet, replaceable bronze wear rings, and threaded companion-flange connections. 2. Impeller: ASTM B 584, cast bronze, statically and dynamically balanced, keyed to shaft, and secured with a locking cap screw. For pumps not frequency-drive controlled, trim impeller to match specified performance. 3. Pump Shaft: Steel, with copper-alloy shaft sleeve or Stainless steel. 4. Seal: Mechanical seal consisting of carbon rotating ring against a ceramic seat held by a stainless-steel spring, and Buna-N, EPDM or Viton bellows and gasket. Include water slinger on shaft between motor and seal. 5. Seal: Packing seal consisting of stuffing box with a minimum of four rings of graphite-impregnated braided yarn with bronze lantern ring between center two graphite rings, and bronze packing gland. 6. Pump Bearings: Permanently lubricated ball bearings or Oil lubricated, bronze-journal or thrust type. E. Shaft Coupling: Molded-rubber insert and interlocking spider capable of absorbing vibration. F. Motor: Single speed and rigidly mounted to pump casing with lifting eyebolt and supporting lugs in motor enclosure. 1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application. 2. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 23 05 13 "Common Motor Requirements for HVAC Equipment." |
| 2.5 | SEPARATELY COUPLED, VERTICALLY MOUNTED, DOUBLE-SUCTION CENTRIFUGAL PUMPS A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following: 1. Armstrong Pumps, Inc. 2. Grundfos Pumps Corporation, USA 3. ITT Corporation 4. Patterson Pump Company a Gorman-Rupp company B. Description: Factory-assembled and -tested, centrifugal, overhung-impeller, separately coupled, end-suction pump as defined in HI 1.1-1.2 and HI 1.3, designed for installation with pump and motor shafts horizontal. C. Capacities and Characteristics: 1. See pump schedules on drawings. D. Pump Construction: 1. Casting: Radially split, cast iron, with replaceable bronze wear rings, threaded gage tappings at inlet and outlet, drain plug at bottom and air vent at top of volute, and threaded companion-flange connections. 2. Impeller: ASTM B 584, cast bronze, statically and dynamically balanced, keyed to shaft, and secured with a locking cap screw. For pumps not frequency-drive controlled, trim impeller to match specified performance. 3. Pump Shaft: Steel, with copper-alloy shaft sleeve or Stainless steel. 4. Seal: Mechanical seal consisting of carbon rotating ring against a ceramic seat held by a stainless-steel spring, and Buna-N, EPDM or Viton bellows and gasket. Include water slinger on shaft between motor and seal. 5. Seal: Packing seal consisting of stuffing box with a minimum of four rings of graphite-impregnated braided yarn with bronze lantern ring between center two graphite rings, and bronze packing gland. 6. Pump Bearings: Permanently lubricated ball bearings or Oil lubricated, bronze-journal or thrust type. E. Shaft Coupling: Molded-rubber insert and interlocking spider capable of absorbing vibration. Couplings shall be drop-out type to allow disassembly and removal without disconnecting piping. F. Coupling Guard: Dual rated; ANSI B15.1, Section 8, OSHA 1910.219 approved; steel removable; attached to mounting frame. G. Mounting Frame: Welded-steel frame and cross members, factory fabricated from ASTM A36M 36M channels and angles. Fabricate to mount pump casing, coupling guard, and motor. H. Motor: Single speed, secured to mounting frame, with adjustable alignment. 1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application. 2. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 23 05 13 "Common Motor Requirements for HVAC Equipment." |
| 2.6 | SEPARATELY COUPLED, VERTICALLY MOUNTED, DOUBLE-SUCTION CENTRIFUGAL PUMPS A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following: 1. Armstrong Pumps, Inc. 2. Grundfos Pumps Corporation, USA 3. ITT Corporation 4. Patterson Pump Company a Gorman-Rupp company B. Description: Factory-assembled and -tested, centrifugal, overhung-impeller, separately coupled, double-suction pump as defined in HI 1.1-1.2 and HI 1.3, designed for installation with pump and motor shafts horizontal. C. Capacities and Characteristics: 1. See pump schedules on drawings. D. Pump Construction: 1. Casting: Radially split, cast iron, with replaceable bronze wear rings, threaded gage tappings at inlet and outlet, drain plug at bottom and air vent at top of volute, and ASME B16.1, Class 125 flanges. Castings support shafts and allow removal and replacement of impeller without disconnecting piping. 2. Impeller: ASTM B 584, cast bronze, statically and dynamically balanced, and keyed to shaft. For pumps not frequency-drive controlled, trim impeller to match specified performance. 3. Pump Shaft: Stainless steel. 4. Seal: Mechanical seal consisting of carbon rotating ring against a ceramic seat held by a stainless-steel spring, and Buna-N, EPDM or Viton bellows and gasket. 5. Seal: Packing seal consisting of stuffing box with a minimum of four rings of graphite-impregnated braided yarn with bronze lantern ring between center two graphite rings, and bronze packing gland. 6. Pump Bearings: Grease-lubricated ball bearings in cast-iron housing with grease fittings. E. Shaft Coupling: Molded-rubber insert and interlocking spider capable of absorbing vibration. F. Motor: Single speed, secured to mounting frame, with adjustable alignment. 1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application. 2. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 23 05 13 "Common Motor Requirements for HVAC Equipment." |
| 2.7 | SEPARATELY COUPLED, VERTICALLY MOUNTED, DOUBLE-SUCTION CENTRIFUGAL PUMPS A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following: 1. Armstrong Pumps, Inc. 2. Grundfos Pumps Corporation, USA 3. ITT Corporation 4. Patterson Pump Company a Gorman-Rupp company B. Description: Factory-assembled and -tested, centrifugal, overhung-impeller, separately coupled, double-suction pump as defined in HI 1.1-1.2 and HI 1.3, designed for installation with pump and motor shafts horizontal. C. Capacities and Characteristics: 1. See pump schedules on drawings. D. Pump Construction: 1. Casting: Radially split, cast iron, with replaceable bronze wear rings, threaded gage tappings at inlet and outlet, drain plug at bottom and air vent at top of volute, and ASME B16.1, Class 125 flanges. Castings support shafts and allow removal and replacement of impeller without disconnecting piping. 2. Impeller: ASTM B 584, cast bronze, statically and dynamically balanced, and keyed to shaft. For pumps not frequency-drive controlled, trim impeller to match specified performance. 3. Pump Shaft: Stainless steel. 4. Seal: Mechanical seal consisting of carbon rotating ring against a ceramic seat held by a stainless-steel spring, and Buna-N, EPDM or Viton bellows and gasket. 5. Seal: Packing seal consisting of stuffing box with a minimum of four rings of graphite-impregnated braided yarn with bronze lantern ring between center two graphite rings, and bronze packing gland. 6. Pump Bearings: Grease-lubricated ball bearings in cast-iron housing with grease fittings. E. Shaft Coupling: Molded-rubber insert and interlocking spider capable of absorbing vibration. F. Motor: Single speed and secured to casing. 1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application. 2. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 23 05 13 "Common Motor Requirements for HVAC Equipment." |
| 2.8 | AUTOMATIC CONDENSATE PUMP UNITS A. Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following: 1. Beckert Corporation 2. Harsco Pumps, Milton Roy 3. Little Giant Pump Co. 4. Mingo, LLC B. Description: Packaged units with corrosion-resistant pump, plastic tank with cover, and automatic controls. Include factory- or field-installed check valve and a 72-inch-minimum, electrical power cord with plug. C. Capacities and Characteristics: 1. Size per AHJ condensate requirements. D. PUMP SPECIALTY FITTINGS A. Suction Diffuser: 1. Angle or straight pattern. 2. 175-psig or 300-psig pressure rating, cast or ductile-iron body, pump-discharge fitting. 3. Bronze start-up and bronze or stainless-steel permanent ends. 4. Bronze or stainless-steel straining vanes. 5. Drain plug. 6. Factory-lubricated support. B. Triple-Drain Valve: 1. Angle or straight pattern. 2. 175-psig or 300-psig pressure rating, cast or ductile-iron body, pump-discharge fitting. 3. Drain plug and bronze-filter strainer, ball check valve feature. 4. Brass gage ports with integral check valve for flow measurement. |

4

| SECTION 23 21 23 (CONT.) HYDRONIC PUMPS | |
|--|--|
| PART 3 - EXECUTION | |
| 3.1 | EXAMINATION A. Examine equipment foundations and anchor-bolt locations for compliance with requirements for installation tolerances and other conditions affecting performance of the Work. B. Examine roughing-in for piping systems to verify actual locations of piping connections before pump installation. C. Examine foundations and inertia bases for suitable conditions where pumps are to be installed. D. Proceed with installation only after unsatisfactory conditions have been corrected. |
| 3.2 | PUMP INSTALLATION A. Comply with HI 1.4 and HI 2.4. B. Install pumps to provide access for periodic maintenance including removing motors, impellers, couplings, and accessories. C. Independently support pumps to support weight of piping is not supported by pumps and weight of piping is not supported by piping. D. Automatic Condensate Pump Units: Install units for collecting condensate and extend to open drain. E. Equipment Mounting: 1. Install base-mounted pumps on cast-in-place concrete grade beams. Comply with requirements for equipment bases and foundations specified in Section 03 30 00 "Cast-in-Place Concrete." 2. Comply with requirements for vibration isolation and seismic device specified in Section 23 05 48 "Vibration and Seismic Controls for HVAC." 3. Comply with requirements for vibration isolation devices specified in Section 23 05 48.13 "Vibration Controls for HVAC." F. Equipment Mounting: Install in-line pumps with continuous-thread hanger rods and spring hangers with vertical-limit stop of size required to support weight of in-line pumps. 1. Comply with requirements for seismic-restraint devices specified in Section 23 05 48 "Vibration and Seismic Controls for HVAC." 2. Comply with requirements for hangers and supports specified in Section 23 05 29 "Hangers and Supports for HVAC Piping and Equipment." |
| 3.3 | ALIGNMENT A. Perform alignment service. B. Comply with requirements in Hydraulics Institute standards for alignment of pump and motor shaft. Add shims to the motor feet and bolt motor to base frame. C. Comply with pump and coupling manufacturer's written instructions. D. After alignment is correct, tighten foundation bolts evenly but not too firmly. Completely fill basepate with nonshrink, nonmetallic grout while metal bolts and nuts or wedges are in place. After grout has cured, fully tighten foundation bolts. E. Comply with requirements for piping specified in Section 23 22 13 "Steam and Condensate Heating Piping" and Section 23 22 16 "Steam and Condensate Piping Specialties." Drawings indicate general arrangement of piping, fittings, and specialties. F. Where installing piping adjacent to pumps, allow space for service and maintenance. G. Connect piping to pumps. Install valves that are same size as piping connected to pumps. D. Install suction and discharge pipe size equal or to greater than diameter of pump nozzles. E. Install check valve and throttling valve with memory stop or triple-drain type with memory stop on discharge side of pumps. F. Install Y-type strainer |

F

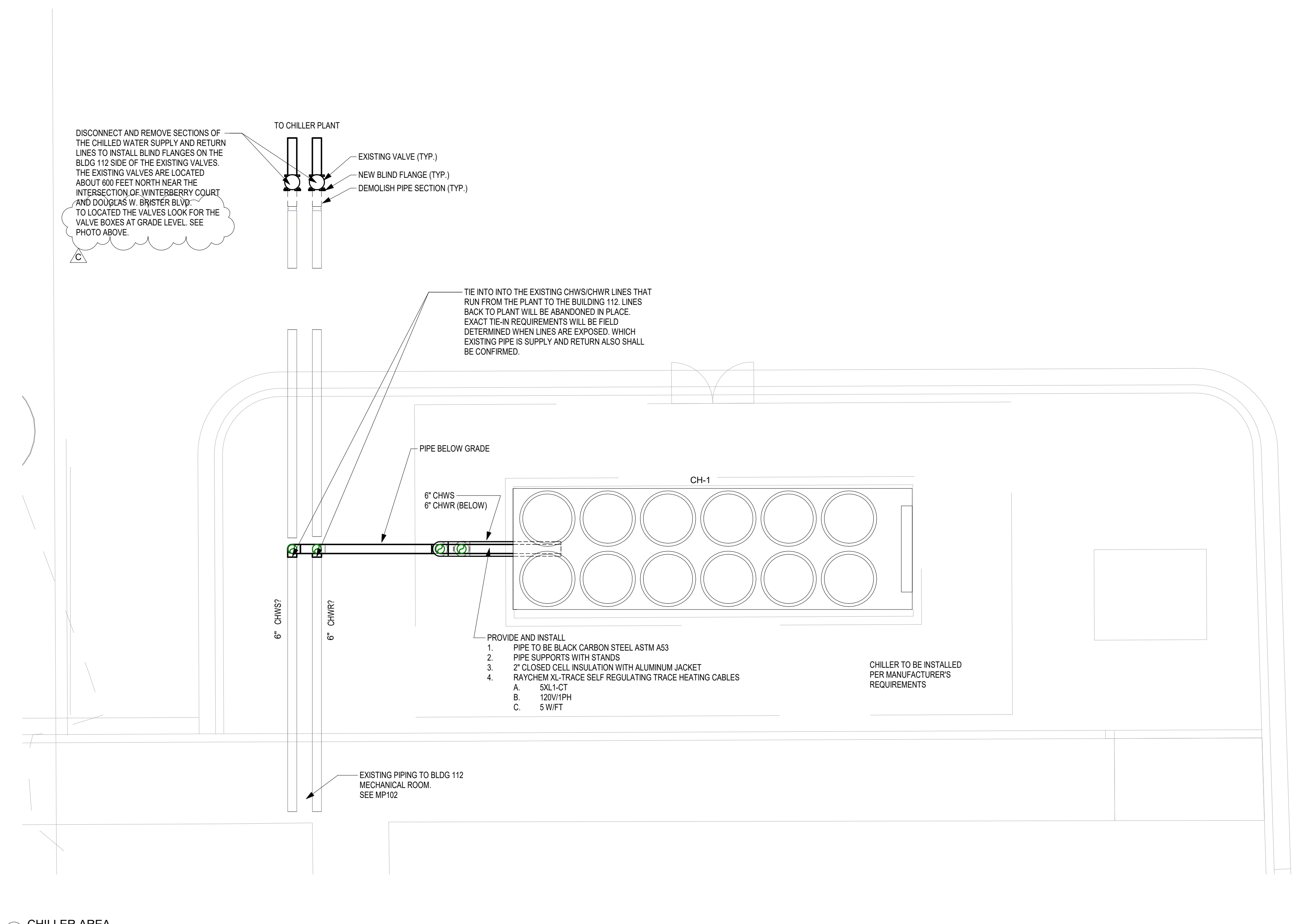
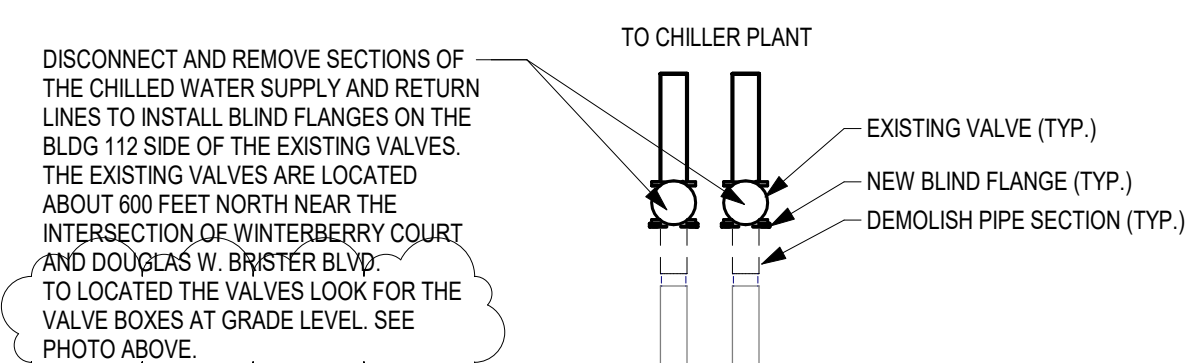
E

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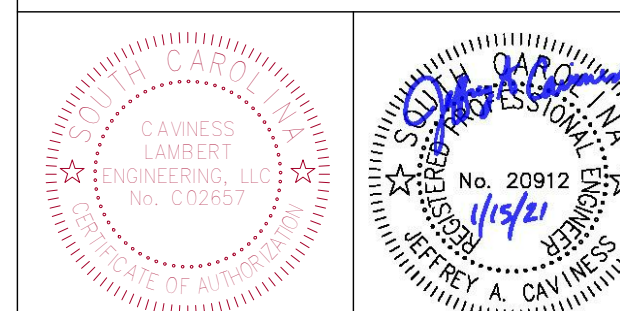
1 CHILLER AREA
1/4" = 1'-0"

CRAIG GAULDEN DAVIS

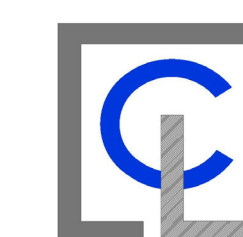
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GREENVILLE - BLDG. 112 AIR COOLED CHILLER ADDITION

Project No.: H59-N054-FW

| DATE | MARK | DESCRIPTION |
|------------|------|-------------------|
| 09/02/2020 | A | ISSUED FOR REVIEW |
| 10/02/2020 | B | ISSUED FOR REVIEW |
| 1/15/2021 | C | CONSTRUCTION |

| | |
|--------------|--------------|
| ISSUE: | CONSTRUCTION |
| DATE: | 1/15/2021 |
| PROJECT NO.: | 120047.015 |
| DRAWN BY: | CTL |
| CHECKED BY: | JAC |

CHILLER AREA
PLAN

MP101

1

2

3

4

5

6

7

F

DEMO SUPPLY LINE FROM AND INCLUDING THE STRAINER TO THE EXISTING AIR SEPARATOR. SEE PHOTO 2 & 3.



DEMO THROUGH STRAINER ON SUPPLY LINE

DEMO BYPASS

REMOVE EXISTING CONTROL VALVE AND TURN OVER TO OWNER. REPLACE WITH SPOOL PIECE.



PICTURE 2: STRAINER

DEMO SUPPLY LINE TO EXISTING AIR SEPARATOR



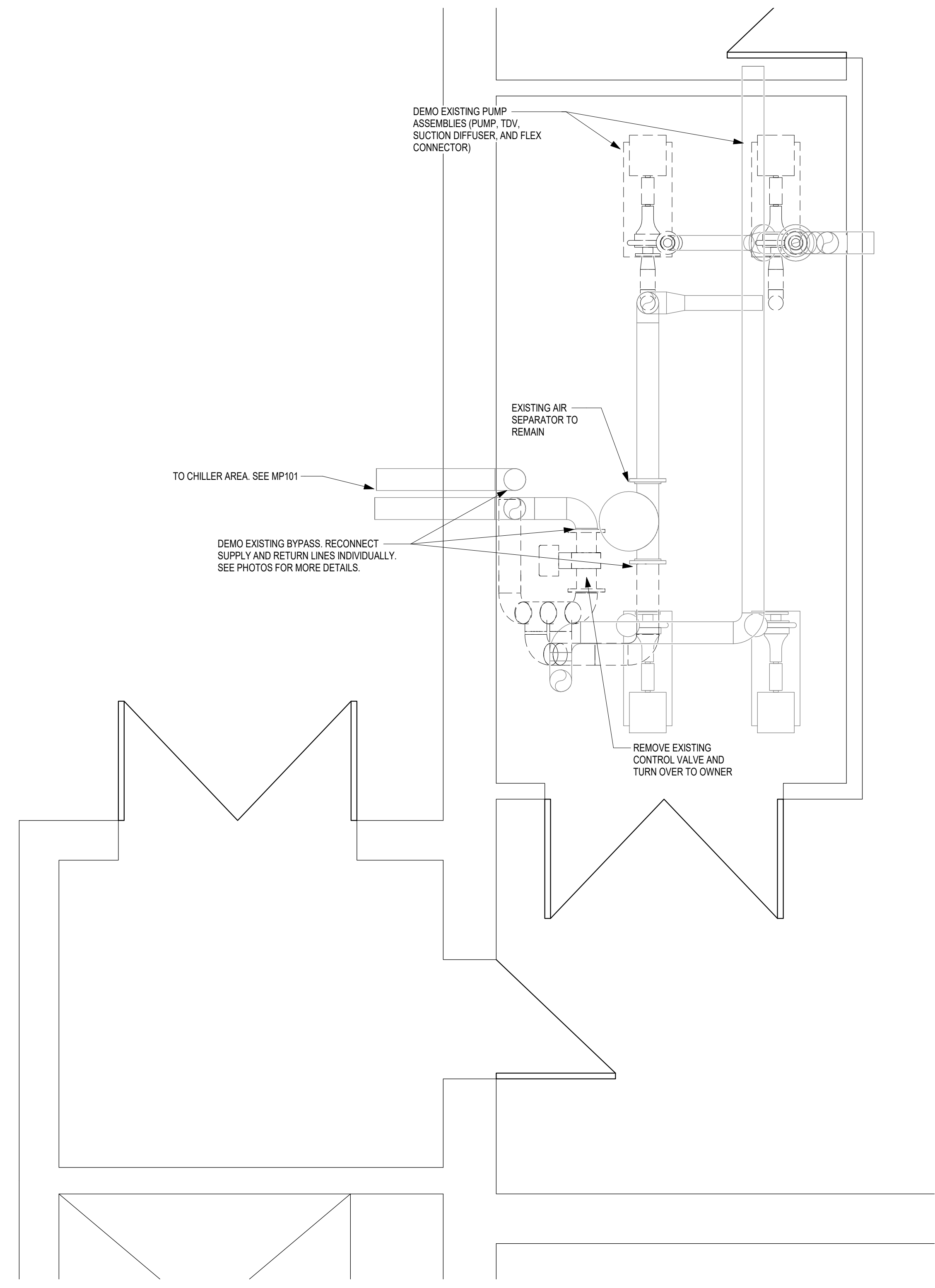
PICTURE 3: AIR SEPARATOR

E

DEMO RETURN LINE AS REQUIRED TO RECONNECT BEFORE BYPASS.

PICTURE 1: BYPASS

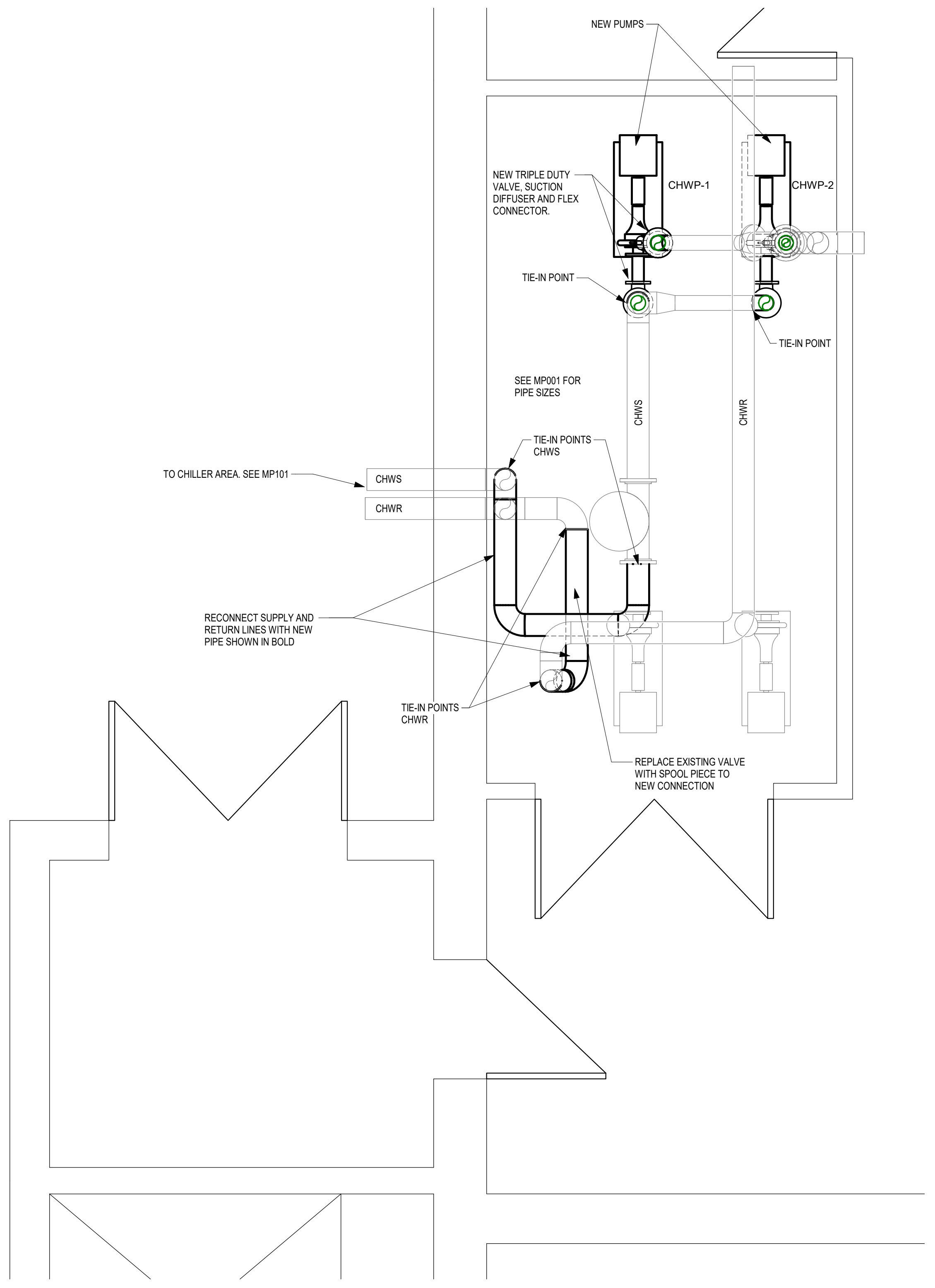
D



2 MECHANICAL ROOM DEMO PLAN
1/2" = 1'-0"

ADDED NOTES TO PLANS NO CHANGES IN SCOPE

C



1 MECHANICAL ROOM PLAN
1/2" = 1'-0"

B

A

1

2

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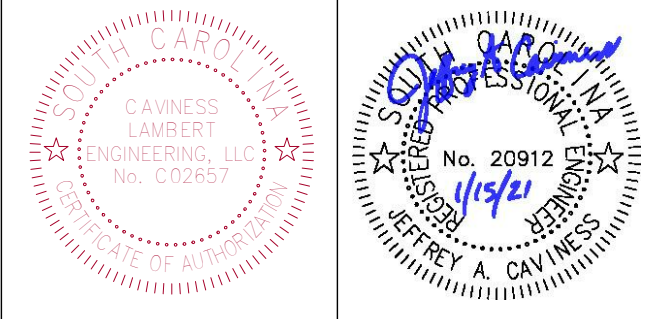
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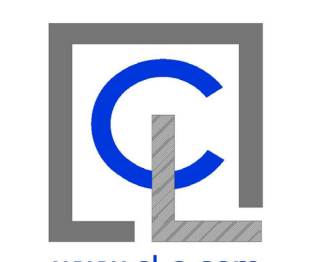
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CAVINESS LAMBERT ENGINEERING



MECHANICAL/ELECTRICAL/PLUMBING
508 East North Street
Greenville, SC 29601



GREENVILLE - BLDG. 112 AIR COOLED CHILLER ADDITION

Project No.: H59-N054-FW

| DATE | MARK | DESCRIPTION |
|------------|------|-------------------|
| 10/02/2020 | B | ISSUED FOR REVIEW |
| 1/15/2021 | C | CONSTRUCTION |

| | |
|--------------|--------------|
| ISSUE: | CONSTRUCTION |
| DATE: | 1/15/2021 |
| PROJECT NO.: | 120047.015 |
| DRAWN BY: | CTL |
| CHECKED BY: | JAC |

MECHANICAL PIPING PLAN

MP102

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ELECTRICAL SPECIFICATIONS

| | | | |
|---|---|---|---|
| <p>F</p> <p>1. GENERAL REQUIREMENTS</p> <p>A. REFER TO ONE LINE DIAGRAM AND SCHEDULES FOR CONDUCTOR SIZES AND ADDITIONAL INFORMATION.</p> <p>B. THE CONTRACTOR SHALL MAKE A PERSONAL INSPECTION OF THE PROJECT SITE TO BECOME FAMILIAR WITH THE SCOPE OF WORK PRIOR TO BID AND SHALL PROVIDE ALL WORK NECESSARY TO COMPLETE THE SCOPE OF WORK AS INDICATED IN THE CONSTRUCTION DOCUMENTS. NOTIFY CAVINESS LAMBERT ENGINEERING, LLC OF ANY INCONSISTENCIES FOUND BETWEEN THE CONSTRUCTION DOCUMENTS AND ACTUAL CONDITIONS.</p> <p>C. SCHEDULE WORK WITH THE OWNER SO THAT WORK IS DONE AT TIMES WHICH CAUSE MINIMUM INTERFERENCE WITH BUILDING PERSONNEL, ACTIVITIES, AND OPERATIONS, INCLUDING NIGHT WORK, AS REQUIRED FOR CONVENIENCE OF PLANT OPERATIONS AND CONTRACTOR.</p> <p>D. ALL WORK SHALL COMPLY WITH ALL FEDERAL, STATE, AND LOCAL CODES AND REGULATORY AUTHORITIES HAVING JURISDICTION.</p> <p>E. ALL NEW PANELBOARDS, CIRCUIT BREAKERS, TRANSFORMERS, AND OTHER ELECTRICAL EQUIPMENT SHALL BE BY THE SAME MANUFACTURER.</p> <p>F. WHERE CONDUIT AND WIRING HAS NOT BEEN SHOWN ON THE DRAWINGS, THE ARRANGEMENT AND ROUTING OF CIRCUITS WILL BE AT THE CONTRACTOR'S DISCRETION IN ACCORDANCE WITH GENERALLY ACCEPTED GOOD PRACTICE AND NEC REQUIREMENTS.</p> <p>G. ELECTRICAL LAYOUT DRAWINGS ARE PARTIALLY DIAGRAMMATIC. REFER TO MECHANICAL, ARCHITECTURAL, AND STRUCTURAL DRAWINGS (WHERE APPLICABLE) FOR GUIDANCE ON DIMENSIONS, DUCTS, PIPES, AND STEEL LOCATIONS, ETC. INSTALL ELECTRICAL SYSTEMS WITHOUT INTERFERING WITH OTHER SYSTEMS.</p> <p>H. PROVIDE IN A WORKMANLIKE MANNER A COMPLETE AND OPERABLE SYSTEM. OUTLINE DESCRIPTION AND DIAGRAMMATIC REPRESENTATION OF SYSTEM OPERATION AND EQUIPMENT DOES NOT LIMIT CONTRACTOR RESPONSIBILITY FOR THE INSTALLATION OF A COMPLETE AND OPERABLE SYSTEM.</p> | <p>W. PROVIDE AN INSULATED EQUIPMENT GROUNDING CONDUCTOR IN EACH RACEWAY/CONDUIT AND BOND TO EQUIPMENT/RACEWAYS. EQUIPMENT GROUNDING CONDUCTOR SIZES SHALL BE IN ACCORDANCE WITH NEC.</p> <p>X. SECURELY AND ELECTRICALLY BOND ALL NON-CURRENT CARRYING METALLIC PARTS OF STRUCTURES, ELECTRICAL EQUIPMENT AND RACEWAYS TO THE GROUNDING SYSTEMS INDICATED.</p> <p>Y. CLEAN AND POLISH FIXTURES, EQUIPMENT, AND MATERIALS THOROUGHLY, AND RETURN TO "AS NEW" CONDITION. REMOVE EXCESS PAINT, MATERIAL AND DEBRIS. PLACE ELECTRICAL SYSTEMS IN COMPLETE WORKING ORDER BEFORE REQUEST FOR FINAL REVIEW. BROOM CLEAN AREAS.</p> <p>Z. THE ELECTRICAL CONTRACTOR SHALL BE RESPONSIBLE FOR ALL PERMITS, FEES, AND LICENSES REQUIRED FOR THE ELECTRICAL INSTALLATION.</p> <p>2. SHUTDOWNS OF ELECTRICAL SERVICES</p> <p>A. ESTABLISH A SCHEDULE OF SHUTDOWN(S) COMPLETE WITH STARTING TIME AND DURATION. PRESENT SCHEDULE TO OWNER FOR APPROVAL. REVISE SCHEDULE AS NECESSARY TO COORDINATE WITH OWNER. BEYOND ANY SCHEDULED SHUTDOWNS, MAINTAIN CONTINUITY OF ELECTRICAL SERVICE TO ALL EXISTING FACILITIES.</p> <p>3. PENETRATIONS</p> <p>A. PENETRATIONS THROUGH FLOORS OR FIRE WALLS SHALL BE SEALED TO MAINTAIN THE FIRE RATING INTEGRITY OF THE WALLS AND FLOORS UTILIZING MATERIALS/METHODS APPROVED BY UL.</p> <p>B. COORDINATE FLOOR, WALL AND ROOF PENETRATIONS WITH FIELD CONDITIONS, OTHER TRADES, AND ARCHITECTURAL/STRUCTURAL WORK. LOCATE PENETRATIONS SO AS NOT TO AFFECT STRUCTURAL INTEGRITY OR WEATHER-TIGHTNESS.</p> <p>4. SUPPORTING DEVICES</p> <p>A. PROPERLY SUPPORT AND ANCHOR ELECTRICAL EQUIPMENT IN ACCORDANCE WITH SPECIFICATION AND MANUFACTURER'S INSTRUCTIONS. ANCHOR FLOOR MOUNTED EQUIPMENT TO FLOOR. MOUNT EQUIPMENT DESIGNED FOR WALL MOUNTING TO WALL OR STEEL STRUT SUPPORT ASSEMBLY, SUITABLE FOR THE EQUIPMENT TO BE SUPPORTED. REINFORCE WALLS AND STEEL STRUT WHERE REQUIRED FOR THE EQUIPMENT PROVIDED. PROVIDE SEISMIC BRACING IN ACCORDANCE WITH ALL APPLICABLE CODES.</p> <p>B. CLEAN EACH RACEWAY WITH MANDREL FOLLOWED BY CLEAN MOPPING. REWORK EXISTING RACEWAYS WHERE REQUIRED.</p> <p>5. GENERAL CONDUCTOR REQUIREMENTS</p> <p>A. COORDINATE EQUIPMENT PROVISIONS FOR CONDUCTOR TERMINATION WITH THE TYPE, SIZE, AND QUANTITIES OF CONDUCTORS INDICATED OR SPECIFIED. PROVIDE LUGS SUITABLE FOR THE INSTALLATION. SPLICES AT CONDUCTOR TERMINATIONS MAY BE USED ONLY WHERE APPROVED BY THE OWNER.</p> <p>B. ALL CONDUCTOR TERMINATIONS OF CIRCUIT BREAKERS AND ALL PANEL ENCLOSURES SHALL BE 75°C RATED FOR USE WITH 75°C WIRE.</p> <p>C. WHITE/NEUTRAL, GREEN/GROUND SHALL BE MAINTAINED THROUGHOUT THE SITE ELECTRICAL SYSTEM (TAPE WILL NOT BE ACCEPTABLE ON CONDUCTOR SIZES 6 AWG AND SMALLER).</p> <p>6. WIRE AND CABLE</p> <p>A. FEEDERS AND BRANCH CIRCUITS LARGER THAN NO. 6 AWG SHALL USE COPPER, STRANDED CONDUCTOR WITH 600 VOLT INSULATION, THW, THHN/THWN, XHHW, RHW IN ACCORDANCE WITH NEMA WC5 AND NEMA WC3.</p> <p>B. FEEDERS AND BRANCH CIRCUITS NO. 6 AWG AND SMALLER SHALL USE COPPER CONDUCTOR, 600 VOLT INSULATION, THW, THHN/THWN; SMALLER THAN NO. 8 AWG, SOLID CONDUCTOR IN ACCORDANCE WITH NEMA WC5.</p> <p>C. CONTROL CIRCUITS SHALL USE COPPER, STRANDED CONDUCTOR WITH 600 VOLT INSULATION, THW, THHN/THWN.</p> <p>7. WIRING CONNECTIONS AND SPLICES</p> <p>A. SPLICES ARE NOT ALLOWED ON NEW CIRCUITS AND WILL ONLY BE PERMITTED WHEN RELOCATING AN EXISTING CIRCUIT, UNDER THE FOLLOWING CONDITIONS "B" THROUGH "E".</p> <p>B. SPLICES MUST BE APPROVED BY OWNER'S REPRESENTATIVE AND ENGINEER.</p> <p>C. CONNECT AND SPlice WIRE NO. 8 AWG AND SMALLER WITH SELF-INSULATING, WIRE NUT CONNECTORS.</p> <p>D. SPlice ALL NO. 6 AWG AND LARGER COPPER CONDUCTORS WITH HIGH CONDUCTIVITY, WROUGHT COPPER, COLOR-KEYED COMPRESSION CONNECTOR SIMILAR TO T & B.</p> <p>E. SET SCREW TYPE CONNECTORS ARE ONLY ACCEPTABLE ON THE LOAD SIDE LUGS OF CLASS I AND II SWITCHBOARDS, PANELBOARDS, CIRCUIT BREAKERS, FUSIBLE SWITCHES, AND ON INDIVIDUAL MOTOR CONTROLLERS.</p> | <p>8. GENERAL WIRING METHODS</p> <p>A. USE NO WIRE SMALLER THAN NO. 12 AWG FOR POWER AND LIGHTING CIRCUITS, AND NO SMALLER THAN NO. 14 AWG FOR CONTROL WIRING. PROVIDE MINIMUM OF NO. 12 AWG FOR ALL SWITCH LEGS. PROVIDE NEUTRAL CONDUCTOR OF THE SAME SIZE AS THE PHASE CONDUCTORS TO WHICH IT IS ASSOCIATED.</p> <p>B. USE NO. 10 AWG CONDUCTOR MINIMUM FOR 20 AMPERE, 120 VOLT BRANCH CIRCUITS LONGER THAN 100 FEET, AND FOR 20 AMPERE, 277 VOLT BRANCH CIRCUITS LONGER THAN 200 FEET.</p> <p>C. INSTALL ALL WIRING IN CONDUIT.</p> <p>D. NEATLY TRAIN AND LACE WIRING INSIDE BOXES, PANELBOARDS, SWITCHGEAR, MOTOR CONTROL CENTERS, WIRING GUTTERS, AND OTHER EQUIPMENT USING THOMAS & BETTS "TY-WRAPS."</p> <p>E. A COMMON NEUTRAL MAY ONLY BE USED FOR CIRCUITS SCHEDULED FOR DIFFERENT PHASES.</p> <p>F. TAG EACH CIRCUIT IN AN OUTLET BOX WHERE TWO OR MORE CIRCUITS RUN TO A SINGLE OUTLET.</p> <p>9. WIRING INSTALLATION IN RACEWAYS</p> <p>A. PULL ALL CONDUCTORS INTO A RACEWAY AT THE SAME TIME. USE UL LISTED WIRE-PULLING LUBRICANT. DO NOT EXCEED MANUFACTURER'S RECOMMENDED TENSION.</p> <p>B. INSTALL WIRE IN RACEWAY AFTER INTERIOR OF BUILDING HAS BEEN PHYSICALLY PROTECTED FROM THE WEATHER AND ALL MECHANICAL WORK LIKELY TO INJURE CONDUCTORS HAS BEEN COMPLETED.</p> <p>C. COMPLETELY AND THOROUGHLY SWAB RACEWAY SYSTEM BEFORE INSTALLING CONDUCTORS.</p> <p>D. REMOVE AND DISCARD CONDUCTORS CUT TOO SHORT OR INSTALLED IN WRONG RACEWAY. DO NOT INSTALL CONDUCTORS WHICH HAVE BEEN REMOVED FROM A RACEWAY.</p> <p>E. DO NOT INSTALL CONDUCTORS IN CONDUIT WHICH CONTAINS WIRES ALREADY IN PLACE.</p> <p>10. ELECTRICAL IDENTIFICATION</p> <p>A. PROVIDE ENGRAVED THREE-LAYER LAMINATED PLASTIC NAMEPLATES WITH WHITE LETTERS ON A BLACK BACKGROUND ON EACH PIECE OF NEW AND EXISTING EQUIPMENT AFFECTED BY THESE DRAWINGS INCLUDING PANELS AND DISCONNECT SWITCHES.</p> <p>B. PROVIDE VINYL CLOTH WIRE AND CABLE MARKERS WITH SPLIT SLEEVE OR TUBING TYPE.</p> <p>C. PROVIDE A TYPEWRITTEN CIRCUIT DIRECTORY FOR EACH PANELBOARD AFFECTED BY THESE DRAWINGS. MOUNT CIRCUIT DIRECTORY IN A PERMANENT, CLEAR LEXAN CARD HOLDER LOCATED ON INSIDE OF DOOR ON PANELBOARD.</p> <p>11. ELECTRICAL TESTING</p> <p>A. FIELD VERIFY VOLTAGE AND ADEQUACY OF EXISTING CIRCUITS TO BE USED FOR NEW EQUIPMENT, PRIOR TO INSTALLATION OF EQUIPMENT (IF APPLICABLE).</p> <p>B. TEST INSULATION RESISTANCE OF INSTALLED CONDUCTORS USING BIDDLE MEGGER OR EQUIVALENT. MEASURE RESISTANCE FROM PHASE-TO-PHASE AND PHASE-TO-GROUND. IN CIRCUITS WHERE INSULATION TEST VALUE IS LOWER THAN 1 MEGOHM, REMOVE AND REPLACE CONDUCTOR AND RETEST.</p> <p>C. ENSURE THAT GROUNDING CONDUCTOR IS ELECTRICALLY CONTINUOUS.</p> <p>D. TEST BRANCH CIRCUITS AGAINST GROUNDS, SHORTS, OR OTHER FAULTS.</p> <p>E. AFTER ENERGIZATION, VERIFY PROPER VOLTAGE WITH SYSTEM OPERATING AT LOAD CONDITIONS.</p> <p>F. VERIFY PROPER OPERATION IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS.</p> <p>G. OPERATE EVERY CIRCUIT BREAKER, SWITCH, AND CONTACTOR.</p> <p>H. MODIFY CIRCUIT BREAKER AND RELAY SETTINGS AS REQUIRED.</p> <p>12. CONDUIT MATERIALS</p> <p>A. PROVIDE RIGID METAL CONDUIT AND FITTINGS IN ACCORDANCE WITH ANSI C80.1: HOT-DIPPED GALVANIZED.</p> <p>B. PROVIDE PVC SCHEDULE 40 FOR ALL UNDERGROUND OR UNDER SLAB INSTALLATIONS.</p> | <p>13. CONDUIT SIZING, ARRANGEMENT, AND SUPPORT</p> <p>A. MINIMUM SIZE OF CONDUIT IS 3/4 INCH. INDICATED SIZES ARE MINIMUM BASED ON THWN COPPER WIRE AND LARGER SIZES MAY BE USED FOR CONVENIENCE OF WIRE PULLING. CONCEAL CONDUIT IN CEILING OF ALL FINISHED AREAS. NEATLY ROUTE CONDUIT IN A COMMON RUN WHERE POSSIBLE.</p> <p>B. MAINTAIN MINIMUM 6-INCH CLEARANCE BETWEEN CONDUIT AND PIPING. MAINTAIN 12-INCH CLEARANCE BETWEEN CONDUIT AND HEAT SOURCES SUCH AS FLUES, STEAM PIPES, AND HEATING APPLIANCES. ROUTE CONDUIT TO ALLOW FOR EQUIPMENT ACCESS AND MAINTENANCE.</p> <p>C. ARRANGE CONDUIT SUPPORTS TO PREVENT DISTORTION OF ALIGNMENT BY WIRE PULLING OPERATIONS. FASTEN CONDUIT SECURELY TO STRUCTURE USING SUITABLE CLAMPS. ROUTE CONDUIT TO ALLOW FOR EQUIPMENT ACCESS AND MAINTENANCE.</p> <p>14. EXTERIOR CONDUIT INSTALLATION</p> <p>A. EXTERIOR EXPOSED CONDUIT SHALL BE RIGID METAL CONDUIT.</p> <p>B. LIQUIDTIGHT FLEXIBLE METAL CONDUIT SHALL BE USED FOR CONNECTION TO VIBRATING EQUIPMENT INCLUDING MOTORS, TRANSFORMERS, AND CONTROL DEVICES.</p> <p>C. LIQUIDTIGHT FLEXIBLE METAL CONDUIT MAY BE USED WHERE MAKING CONNECTION TO UTILIZATION EQUIPMENT.</p> <p>D. PVC CONDUIT MAY BE USED UNDERGROUND OR UNDERSLAB IN LIMITED APPLICATIONS AS SPECIFICALLY NOTED ON THE DRAWINGS.</p> <p>17. SERVICE AND POWER DISTRIBUTION</p> <p>A. ELECTRICAL CONTRACTOR SHALL COORDINATE WITH THE LOCAL UTILITY FOR PROVIDING THE ELECTRICAL SERVICE AS INDICATED ON THE DRAWINGS. THE ELECTRICAL CONTRACTOR SHALL PROVIDE ALL REQUIREMENTS BY THE LOCAL UTILITY (INCLUDING NEW TRANSFORMER PAD AND METERING) AND SHALL PAY ALL ASSOCIATED COSTS AND FEES REQUIRED.</p> <p>B. PROVIDE ALL PRIMARY AND SECONDARY CONDUITS AS REQUIRED BY THE LOCAL UTILITY.</p> <p>C. ALL POWER DISTRIBUTION EQUIPMENT SHALL BE UL LISTED AND LABELED.</p> <p>D. DISCONNECT SWITCHES SHALL BE HEAVY DUTY TYPE, FUSIBLE AND NON-FUSIBLE AS INDICATED ON THE DRAWINGS, WITH QUICK-MAKE AND QUICK-BREAK OPERATION. CONSTRUCTION SHALL CONSIST OF SILVER-PLATED OPERATING PARTS WITH SAFETY INTERLOCK ON DOOR TO PREVENT ACCESS WHEN SWITCH IS IN "ON" POSITION. FUSE CLIPS SHALL BE FOR TYPE RK-1 CURRENT LIMITING FUSES.</p> <p>E. ALL ELECTRICAL EQUIPMENT, PANELBOARDS, SWITCHES, ETC. SHALL BE TAGGED WITH WHITE PLASTIC NAMEPLATES WITH 1/4" ENGRAVED BLACK LETTERS. NAMEPLATES SHALL SHOW EQUIPMENT DESIGNATION AND OPERATING VOLTAGE. NAMEPLATES SHALL BE SECURED TO EQUIPMENT WITH SCREWS.</p> <p>F. ALL POWER DISTRIBUTION EQUIPMENT SHALL BE AS MANUFACTURED BY SQUARE D, SIEMENS, OR GENERAL ELECTRIC.</p> <p>18. WIRING DEVICES AND BOXES</p> <p>A. WIRING DEVICES SHALL BE AS MANUFACTURED BY HUBBELL, BRYANT, LEVITON, OR PASS & SEYMOUR.</p> <p>B. LIGHT SWITCHES SHALL BE QUIET TOGGLE TYPE, HUBBELL #1221 (SINGLE POLE) OR HUBBELL #1223 (3-WAY) AND SHALL BE RATED 20A FOR 120/277V.</p> <p>C. DUPLEX RECEPTACLES SHALL BE RATED 20A, HUBBELL #5352, THREE-WIRE GROUNDING TYPE WITH GROUND INSTALLED. PROVIDE GFI RECEPTACLES WHERE INDICATED ON THE DRAWINGS OR WHERE REQUIRED BY NEC, HUBBELL #GF5352.</p> <p>D. WIRING DEVICES AND PLATE COLOR SHALL BE AS DIRECTED BY ARCHITECT.</p> <p>E. ALL OUTLET, LIGHTING AND SWITCH BOXES SHALL BE PRESSED STEEL WHERE INSTALLED ABOVE CEILING OR CONCEALED WITHIN WALLS. EXPOSED BOXES SHALL BE FERROUS ALLOY OR CAST ALUMINUM BOXES WITH APPROPRIATE SHEET STEEL COVERS.</p> <p>19. SUBSTITUTIONS</p> <p>A. EQUIPMENT SUBSTITUTIONS SHALL BE REQUESTED IN WRITING TEN (10) DAYS PRIOR TO THE BID DATE. UNLESS NOTIFIED OF APPROVED EQUAL EQUIPMENT, FURNISH AND INSTALL ONLY THE EQUIPMENT OF MANUFACTURERS SPECIFIED HEREIN OR ON THE DRAWINGS.</p> <p>20. WARRANTY</p> <p>A. ALL ELECTRICAL WORK SHALL BE WARRANTED BY THE ELECTRICAL CONTRACTOR FOR A PERIOD OF ONE (1) YEAR FROM THE DATE OF FINAL ACCEPTANCE BY THE OWNER OR OWNER'S REPRESENTATIVE.</p> |
| <p>E</p> <p>I. EQUIPMENT SHALL FIT INTO THE SPACE ALLOTTED AND SHALL ALLOW ADEQUATE CLEARANCE FOR ENTRY, INSTALLATION, REPLACEMENT, SERVICING, AND MAINTENANCE. COORDINATE ALL EQUIPMENT WITH WORK BY OTHER TRADES. FIELD VERIFY DIMENSIONS AND FIELD CONDITIONS. INSTALLATION SHALL COMPLY WITH MANUFACTURER'S INSTRUCTIONS AND ALL APPLICABLE CODES, DIMENSIONS ON THE DRAWINGS, AND SPECIFICATION REQUIREMENTS. CLEARANCES SHALL COMPLY WITH NEC. ALL ADDITIONAL WORK REQUIRED FOR EQUIPMENT PROPOSED BY THE CONTRACTOR SHALL BE IDENTIFIED ON EQUIPMENT SUBMITTALS AND COORDINATION DRAWINGS FOR APPROVAL, AND SHALL BE PROVIDED AT NO ADDITIONAL COST.</p> <p>J. BEFORE BEGINNING WORK, LAY OUT AND MARK ALL EQUIPMENT LOCATIONS FOR APPROVAL BY THE OWNER.</p> <p>K. AS APPROVED BY THE OWNER, PROVIDE ALL WORK REQUIRED TO ACHIEVE COMPLIANCE WITH ALL EQUIPMENT MANUFACTURER INSTRUCTIONS AND RECOMMENDATIONS AT NO ADDITIONAL COST TO THE OWNER.</p> <p>L. LOCATIONS SHOWN FOR EQUIPMENT AND WIRING ARE APPROXIMATE. VERIFY LOCATIONS AND SIZES OF NEW AND EXISTING WORK BEFORE PURCHASING OR FABRICATING NEW WORK. FOR ALL NEW WORK PROVIDE ADDITIONAL HORIZONTAL OR VERTICAL ELBOWS, DROPS, RISES, OFFSETS, SUPPORTS, ACCESSORIES, AND REROUTING REQUIRED FOR A COMPLETE INSTALLATION. COORDINATE EXACT ROUTING OF WORK AND EQUIPMENT INSTALLATION WITH OTHER TRADES AND FIELD CONDITIONS.</p> <p>M. MAINTAIN SEPARATION OF POWER WIRING AND LOW VOLTAGE WIRING PER NEC REQUIREMENTS.</p> <p>N. WHERE REQUIREMENTS FOR WORK VARY BETWEEN DRAWINGS, SPECIFICATIONS, APPLICABLE CODES, REFERENCED STANDARDS, AND EQUIPMENT MANUFACTURER INSTRUCTIONS AND RECOMMENDATIONS, WORK SHALL CONFORM TO THE MOST STRINGENT REQUIREMENTS FROM ALL OF THE DOCUMENTS ABOVE.</p> <p>O. PROVIDE LABOR, MATERIALS, APPARATUS, AND APPLIANCES ESSENTIAL TO THE COMPLETE FUNCTIONING OF THE SYSTEMS DESCRIBED OR INDICATED HEREIN, OR WHICH MAY BE REASONABLY IMPLIED AS ESSENTIAL WHETHER MENTIONED IN THE CONTRACT DOCUMENTS OR NOT.</p> <p>P. PROVIDE OPERATING SYSTEM COMPONENTS FREE OF OBJECTIONABLE NOISE OR VIBRATION. STATICALLY AND DYNAMICALLY BALANCE ROTATING EQUIPMENT, AND MOUNT OR FASTEN SO THAT NO EQUIPMENT VIBRATION WILL BE TRANSMITTED TO THE BUILDING. RECTIFY OBJECTIONABLE CONDITIONS AT NO ADDITIONAL COMPENSATION.</p> <p>Q. PROVIDE CIRCUIT BREAKERS AND FUSES FOR EQUIPMENT IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS. VALUES SHOWN ARE NOMINAL.</p> <p>R. PROVIDE CIRCUIT BREAKERS, FUSES, AND DISCONNECT SWITCHES OF THE TYPES AND RATINGS REQUIRED.</p> <p>S. NOTIFY CAVINESS LAMBERT ENGINEERING, LLC PRIOR TO ADJUSTING THE RATINGS AND TYPES OF CIRCUIT BREAKERS, FUSES, AND DISCONNECT SWITCHES INDICATED, WHERE REQUIRED.</p> <p>T. NOTIFY CAVINESS LAMBERT ENGINEERING, LLC PRIOR TO ADJUSTING THE SIZES OF FEEDERS/CIRCUITS TO EQUIPMENT PROVIDED, WHERE REQUIRED.</p> <p>U. IDENTIFY PROPOSED REVISIONS AND ADDITIONAL WORK IN WRITING TO THE OWNER, FOR APPROVAL PRIOR TO PROCEEDING WITH WORK.</p> <p>V. BRANCH CIRCUIT WIRING CONDUCTOR QUANTITY REQUIREMENTS SHALL BE AS INDICATED ON DRAWINGS.</p> | <p>2. SHUTDOWNS OF ELECTRICAL SERVICES</p> <p>A. ESTABLISH A SCHEDULE OF SHUTDOWN(S) COMPLETE WITH STARTING TIME AND DURATION. PRESENT SCHEDULE TO OWNER FOR APPROVAL. REVISE SCHEDULE AS NECESSARY TO COORDINATE WITH OWNER. BEYOND ANY SCHEDULED SHUTDOWNS, MAINTAIN CONTINUITY OF ELECTRICAL SERVICE TO ALL EXISTING FACILITIES.</p> <p>3. PENETRATIONS</p> <p>A. PENETRATIONS THROUGH FLOORS OR FIRE WALLS SHALL BE SEALED TO MAINTAIN THE FIRE RATING INTEGRITY OF THE WALLS AND FLOORS UTILIZING MATERIALS/METHODS APPROVED BY UL.</p> <p>B. COORDINATE FLOOR, WALL AND ROOF PENETRATIONS WITH FIELD CONDITIONS, OTHER TRADES, AND ARCHITECTURAL/STRUCTURAL WORK. LOCATE PENETRATIONS SO AS NOT TO AFFECT STRUCTURAL INTEGRITY OR WEATHER-TIGHTNESS.</p> <p>4. SUPPORTING DEVICES</p> <p>A. PROPERLY SUPPORT AND ANCHOR ELECTRICAL EQUIPMENT IN ACCORDANCE WITH SPECIFICATION AND MANUFACTURER'S INSTRUCTIONS. ANCHOR FLOOR MOUNTED EQUIPMENT TO FLOOR. MOUNT EQUIPMENT DESIGNED FOR WALL MOUNTING TO WALL OR STEEL STRUT SUPPORT ASSEMBLY, SUITABLE FOR THE EQUIPMENT TO BE SUPPORTED. REINFORCE WALLS AND STEEL STRUT WHERE REQUIRED FOR THE EQUIPMENT PROVIDED. PROVIDE SEISMIC BRACING IN ACCORDANCE WITH ALL APPLICABLE CODES.</p> <p>B. CLEAN EACH RACEWAY WITH MANDREL FOLLOWED BY CLEAN MOPPING. REWORK EXISTING RACEWAYS WHERE REQUIRED.</p> <p>5. GENERAL CONDUCTOR REQUIREMENTS</p> <p>A. COORDINATE EQUIPMENT PROVISIONS FOR CONDUCTOR TERMINATION WITH THE TYPE, SIZE, AND QUANTITIES OF CONDUCTORS INDICATED OR SPECIFIED. PROVIDE LUGS SUITABLE FOR THE INSTALLATION. SPLICES AT CONDUCTOR TERMINATIONS MAY BE USED ONLY WHERE APPROVED BY THE OWNER.</p> <p>B. ALL CONDUCTOR TERMINATIONS OF CIRCUIT BREAKERS AND ALL PANEL ENCLOSURES SHALL BE 75°C RATED FOR USE WITH 75°C WIRE.</p> <p>C. WHITE/NEUTRAL, GREEN/GROUND SHALL BE MAINTAINED THROUGHOUT THE SITE ELECTRICAL SYSTEM (TAPE WILL NOT BE ACCEPTABLE ON CONDUCTOR SIZES 6 AWG AND SMALLER).</p> <p>6. WIRE AND CABLE</p> <p>A. FEEDERS AND BRANCH CIRCUITS LARGER THAN NO. 6 AWG SHALL USE COPPER, STRANDED CONDUCTOR WITH 600 VOLT INSULATION, THW, THHN/THWN, XHHW, RHW IN ACCORDANCE WITH NEMA WC5 AND NEMA WC3.</p> <p>B. FEEDERS AND BRANCH CIRCUITS NO. 6 AWG AND SMALLER SHALL USE COPPER CONDUCTOR, 600 VOLT INSULATION, THW, THHN/THWN; SMALLER THAN NO. 8 AWG, SOLID CONDUCTOR IN ACCORDANCE WITH NEMA WC5.</p> <p>C. CONTROL CIRCUITS SHALL USE COPPER, STRANDED CONDUCTOR WITH 600 VOLT INSULATION, THW, THHN/THWN.</p> <p>7. WIRING CONNECTIONS AND SPLICES</p> <p>A. SPLICES ARE NOT ALLOWED ON NEW CIRCUITS AND WILL ONLY BE PERMITTED WHEN RELOCATING AN EXISTING CIRCUIT, UNDER THE FOLLOWING CONDITIONS "B" THROUGH "E".</p> <p>B. SPLICES MUST BE APPROVED BY OWNER'S REPRESENTATIVE AND ENGINEER.</p> <p>C. CONNECT AND SPlice WIRE NO. 8 AWG AND SMALLER WITH SELF-INSULATING, WIRE NUT CONNECTORS.</p> <p>D. SPlice ALL NO. 6 AWG AND LARGER COPPER CONDUCTORS WITH HIGH CONDUCTIVITY, WROUGHT COPPER, COLOR-KEYED COMPRESSION CONNECTOR SIMILAR TO T & B.</p> <p>E. SET SCREW TYPE CONNECTORS ARE ONLY ACCEPTABLE ON THE LOAD SIDE LUGS OF CLASS I AND II SWITCHBOARDS, PANELBOARDS, CIRCUIT BREAKERS, FUSIBLE SWITCHES, AND ON INDIVIDUAL MOTOR CONTROLLERS.</p> | <p>13. CONDUIT SIZING, ARRANGEMENT, AND SUPPORT</p> <p>A. MINIMUM SIZE OF CONDUIT IS 3/4 INCH. INDICATED SIZES ARE MINIMUM BASED ON THWN COPPER WIRE AND LARGER SIZES MAY BE USED FOR CONVENIENCE OF WIRE PULLING. CONCEAL CONDUIT IN CEILING OF ALL FINISHED AREAS. NEATLY ROUTE CONDUIT IN A COMMON RUN WHERE POSSIBLE.</p> <p>B. MAINTAIN MINIMUM 6-INCH CLEARANCE BETWEEN CONDUIT AND PIPING. MAINTAIN 12-INCH CLEARANCE BETWEEN CONDUIT AND HEAT SOURCES SUCH AS FLUES, STEAM PIPES, AND HEATING APPLIANCES. 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EQUIPMENT SUBSTITUTIONS SHALL BE REQUESTED IN WRITING TEN (10) DAYS PRIOR TO THE BID DATE. UNLESS NOTIFIED OF APPROVED EQUAL EQUIPMENT, FURNISH AND INSTALL ONLY THE EQUIPMENT OF MANUFACTURERS SPECIFIED HEREIN OR ON THE DRAWINGS.</p> <p>20. WARRANTY</p> <p>A. ALL ELECTRICAL WORK SHALL BE WARRANTED BY THE ELECTRICAL CONTRACTOR FOR A PERIOD OF ONE (1) YEAR FROM THE DATE OF FINAL ACCEPTANCE BY THE OWNER OR OWNER'S REPRESENTATIVE.</p> |
| <p>D</p> <p>J. BEFORE BEGINNING WORK, LAY OUT AND MARK ALL EQUIPMENT LOCATIONS FOR APPROVAL BY THE OWNER.</p> <p>K. AS APPROVED BY THE OWNER, PROVIDE ALL WORK REQUIRED TO ACHIEVE COMPLIANCE WITH ALL EQUIPMENT MANUFACTURER INSTRUCTIONS AND RECOMMENDATIONS AT NO ADDITIONAL COST TO THE OWNER.</p> <p>L. LOCATIONS SHOWN FOR EQUIPMENT AND WIRING ARE APPROXIMATE. VERIFY LOCATIONS AND SIZES OF NEW AND EXISTING WORK BEFORE PURCHASING OR FABRICATING NEW WORK. FOR ALL NEW WORK PROVIDE ADDITIONAL HORIZONTAL OR VERTICAL ELBOWS, DROPS, RISES, OFFSETS, SUPPORTS, ACCESSORIES, AND REROUTING REQUIRED FOR A COMPLETE INSTALLATION. COORDINATE EXACT ROUTING OF WORK AND EQUIPMENT INSTALLATION WITH OTHER TRADES AND FIELD CONDITIONS.</p> <p>M. MAINTAIN SEPARATION OF POWER WIRING AND LOW VOLTAGE WIRING PER NEC REQUIREMENTS.</p> <p>N. WHERE REQUIREMENTS FOR WORK VARY BETWEEN DRAWINGS, SPECIFICATIONS, APPLICABLE CODES, REFERENCED STANDARDS, AND EQUIPMENT MANUFACTURER INSTRUCTIONS AND RECOMMENDATIONS, WORK SHALL CONFORM TO THE MOST STRINGENT REQUIREMENTS FROM ALL OF THE DOCUMENTS ABOVE.</p> <p>O. PROVIDE LABOR, MATERIALS, APPARATUS, AND APPLIANCES ESSENTIAL TO THE COMPLETE FUNCTIONING OF THE SYSTEMS DESCRIBED OR INDICATED HEREIN, OR WHICH MAY BE REASONABLY IMPLIED AS ESSENTIAL WHETHER MENTIONED IN THE CONTRACT DOCUMENTS OR NOT.</p> <p>P. PROVIDE OPERATING SYSTEM COMPONENTS FREE OF OBJECTIONABLE NOISE OR VIBRATION. STATICALLY AND DYNAMICALLY BALANCE ROTATING EQUIPMENT, AND MOUNT OR FASTEN SO THAT NO EQUIPMENT VIBRATION WILL BE TRANSMITTED TO THE BUILDING. RECTIFY OBJECTIONABLE CONDITIONS AT NO ADDITIONAL COMPENSATION.</p> <p>Q. PROVIDE CIRCUIT BREAKERS AND FUSES FOR EQUIPMENT IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS. VALUES SHOWN ARE NOMINAL.</p> <p>R. PROVIDE CIRCUIT BREAKERS, FUSES, AND DISCONNECT SWITCHES OF THE TYPES AND RATINGS REQUIRED.</p> <p>S. NOTIFY CAVINESS LAMBERT ENGINEERING, LLC PRIOR TO ADJUSTING THE RATINGS AND TYPES OF CIRCUIT BREAKERS, FUSES, AND DISCONNECT SWITCHES INDICATED, WHERE REQUIRED.</p> <p>T. NOTIFY CAVINESS LAMBERT ENGINEERING, LLC PRIOR TO ADJUSTING THE SIZES OF FEEDERS/CIRCUITS TO EQUIPMENT PROVIDED, WHERE REQUIRED.</p> <p>U. IDENTIFY PROPOSED REVISIONS AND ADDITIONAL WORK IN WRITING TO THE OWNER, FOR APPROVAL PRIOR TO PROCEEDING WITH WORK.</p> <p>V. BRANCH CIRCUIT WIRING CONDUCTOR QUANTITY REQUIREMENTS SHALL BE AS INDICATED ON DRAWINGS.</p> | <p>2. SHUTDOWNS OF ELECTRICAL SERVICES</p> <p>A. ESTABLISH A SCHEDULE OF SHUTDOWN(S) COMPLETE WITH STARTING TIME AND DURATION. PRESENT SCHEDULE TO OWNER FOR APPROVAL. REVISE SCHEDULE AS NECESSARY TO COORDINATE WITH OWNER. BEYOND ANY SCHEDULED SHUTDOWNS, MAINTAIN CONTINUITY OF ELECTRICAL SERVICE TO ALL EXISTING FACILITIES.</p> <p>3. PENETRATIONS</p> <p>A. PENETRATIONS THROUGH FLOORS OR FIRE WALLS SHALL BE SEALED TO MAINTAIN THE FIRE RATING INTEGRITY OF THE WALLS AND FLOORS UTILIZING MATERIALS/METHODS APPROVED BY UL.</p> <p>B. COORDINATE FLOOR, WALL AND ROOF PENETRATIONS WITH FIELD CONDITIONS, OTHER TRADES, AND ARCHITECTURAL/STRUCTURAL WORK. LOCATE PENETRATIONS SO AS NOT TO AFFECT STRUCTURAL INTEGRITY OR WEATHER-TIGHTNESS.</p> <p>4. SUPPORTING DEVICES</p> <p>A. PROPERLY SUPPORT AND ANCHOR ELECTRICAL EQUIPMENT IN ACCORDANCE WITH SPECIFICATION AND MANUFACTURER'S INSTRUCTIONS. ANCHOR FLOOR MOUNTED EQUIPMENT TO FLOOR. MOUNT EQUIPMENT DESIGNED FOR WALL MOUNTING TO WALL OR STEEL STRUT SUPPORT ASSEMBLY, SUITABLE FOR THE EQUIPMENT TO BE SUPPORTED. REINFORCE WALLS AND STEEL STRUT WHERE REQUIRED FOR THE EQUIPMENT PROVIDED. PROVIDE SEISMIC BRACING IN ACCORDANCE WITH ALL APPLICABLE CODES.</p> <p>B. CLEAN EACH RACEWAY WITH MANDREL FOLLOWED BY CLEAN MOPPING. REWORK EXISTING RACEWAYS WHERE REQUIRED.</p> <p>5. GENERAL CONDUCTOR REQUIREMENTS</p> <p>A. COORDINATE EQUIPMENT PROVISIONS FOR CONDUCTOR TERMINATION WITH THE TYPE, SIZE, AND QUANTITIES OF CONDUCTORS INDICATED OR SPECIFIED. PROVIDE LUGS SUITABLE FOR THE INSTALLATION. SPLICES AT CONDUCTOR TERMINATIONS MAY BE USED ONLY WHERE APPROVED BY THE OWNER.</p> <p>B. ALL CONDUCTOR TERMINATIONS OF CIRCUIT BREAKERS AND ALL PANEL ENCLOSURES SHALL BE 75°C RATED FOR USE WITH 75°C WIRE.</p> <p>C. WHITE/NEUTRAL, GREEN/GROUND SHALL BE MAINTAINED THROUGHOUT THE SITE ELECTRICAL SYSTEM (TAPE WILL NOT BE ACCEPTABLE ON CONDUCTOR SIZES 6 AWG AND SMALLER).</p> <p>6. WIRE AND CABLE</p> <p>A. FEEDERS AND BRANCH CIRCUITS LARGER THAN NO. 6 AWG SHALL USE COPPER, STRANDED CONDUCTOR WITH 600 VOLT INSULATION, THW, THHN/THWN, XHHW, RHW IN ACCORDANCE WITH NEMA WC5 AND NEMA WC3.</p> <p>B. FEEDERS AND BRANCH CIRCUITS NO. 6 AWG AND SMALLER SHALL USE COPPER CONDUCTOR, 600 VOLT INSULATION, THW, THHN/THWN; SMALLER THAN NO. 8 AWG, SOLID CONDUCTOR IN ACCORDANCE WITH NEMA WC5.</p> <p>C. CONTROL CIRCUITS SHALL USE COPPER, STRANDED CONDUCTOR WITH 600 VOLT INSULATION, THW, THHN/THWN.</p> <p>7. WIRING CONNECTIONS AND SPLICES</p> <p>A. SPLICES ARE NOT ALLOWED ON NEW CIRCUITS AND WILL ONLY BE PERMITTED WHEN RELOCATING AN EXISTING CIRCUIT, UNDER THE FOLLOWING CONDITIONS "B" THROUGH "E".</p> <p>B. SPLICES MUST BE APPROVED BY OWNER'S REPRESENTATIVE AND ENGINEER.</p> <p>C. CONNECT AND SPlice WIRE NO. 8 AWG AND SMALLER WITH SELF-INSULATING, WIRE NUT CONNECTORS.</p> <p>D. SPlice ALL NO. 6 AWG AND LARGER COPPER CONDUCTORS WITH HIGH CONDUCTIVITY, WROUGHT COPPER, COLOR-KEYED COMPRESSION CONNECTOR SIMILAR TO T & B.</p> <p>E. SET SCREW TYPE CONNECTORS ARE ONLY ACCEPTABLE ON THE LOAD SIDE LUGS OF CLASS I AND II SWITCHBOARDS, PANELBOARDS, CIRCUIT BREAKERS, FUSIBLE SWITCHES, AND ON INDIVIDUAL MOTOR CONTROLLERS.</p> | <p>13. CONDUIT SIZING, ARRANGEMENT, AND SUPPORT</p> <p>A. MINIMUM SIZE OF CONDUIT IS 3/4 INCH. INDICATED SIZES ARE MINIMUM BASED ON THWN COPPER WIRE AND LARGER SIZES MAY BE USED FOR CONVENIENCE OF WIRE PULLING. CONCEAL CONDUIT IN CEILING OF ALL FINISHED AREAS. NEATLY ROUTE CONDUIT IN A COMMON RUN WHERE POSSIBLE.</p> <p>B. MAINTAIN MINIMUM 6-INCH CLEARANCE BETWEEN CONDUIT AND PIPING. MAINTAIN 12-INCH CLEARANCE BETWEEN CONDUIT AND HEAT SOURCES SUCH AS FLUES, STEAM PIPES, AND HEATING APPLIANCES. ROUTE CONDUIT TO ALLOW FOR EQUIPMENT ACCESS AND MAINTENANCE.</p> <p>C. ARRANGE CONDUIT SUPPORTS TO PREVENT DISTORTION OF ALIGNMENT BY WIRE PULLING OPERATIONS. FASTEN CONDUIT SECURELY TO STRUCTURE USING SUITABLE CLAMPS. ROUTE CONDUIT TO ALLOW FOR EQUIPMENT ACCESS AND MAINTENANCE.</p> <p>14. EXTERIOR CONDUIT INSTALLATION</p> <p>A. EXTERIOR EXPOSED CONDUIT SHALL BE RIGID METAL CONDUIT.</p> <p>B. LIQUIDTIGHT FLEXIBLE METAL CONDUIT SHALL BE USED FOR CONNECTION TO VIBRATING EQUIPMENT INCLUDING MOTORS, TRANSFORMERS, AND CONTROL DEVICES.</p> <p>C. LIQUIDTIGHT FLEXIBLE METAL CONDUIT MAY BE USED WHERE MAKING CONNECTION TO UTILIZATION EQUIPMENT.</p> <p>D. PVC CONDUIT MAY BE USED UNDERGROUND OR UNDERSLAB IN LIMITED APPLICATIONS AS SPECIFICALLY NOTED ON THE DRAWINGS.</p> <p>17. SERVICE AND POWER DISTRIBUTION</p> <p>A. ELECTRICAL CONTRACTOR SHALL COORDINATE WITH THE LOCAL UTILITY FOR PROVIDING THE ELECTRICAL SERVICE AS INDICATED ON THE DRAWINGS. THE ELECTRICAL CONTRACTOR SHALL PROVIDE ALL REQUIREMENTS BY THE LOCAL UTILITY (INCLUDING NEW TRANSFORMER PAD AND METERING) AND SHALL PAY ALL ASSOCIATED COSTS AND FEES REQUIRED.</p> <p>B. PROVIDE ALL PRIMARY AND SECONDARY CONDUITS AS REQUIRED BY THE LOCAL UTILITY.</p> <p>C. ALL POWER DISTRIBUTION EQUIPMENT SHALL BE UL LISTED AND LABELED.</p> <p>D. DISCONNECT SWITCHES SHALL BE HEAVY DUTY TYPE, FUSIBLE AND NON-FUSIBLE AS INDICATED ON THE DRAWINGS, WITH QUICK-MAKE AND QUICK-BREAK OPERATION. CONSTRUCTION SHALL CONSIST OF SILVER-PLATED OPERATING PARTS WITH SAFETY INTERLOCK ON DOOR TO PREVENT ACCESS WHEN SWITCH IS IN "ON" POSITION. FUSE CLIPS SHALL BE FOR TYPE RK-1 CURRENT LIMITING FUSES.</p> <p>E. ALL ELECTRICAL EQUIPMENT, PANELBOARDS, SWITCHES, ETC. SHALL BE TAGGED WITH WHITE PLASTIC NAMEPLATES WITH 1/4" ENGRAVED BLACK LETTERS. NAMEPLATES SHALL SHOW EQUIPMENT DESIGNATION AND OPERATING VOLTAGE. NAMEPLATES SHALL BE SECURED TO EQUIPMENT WITH SCREWS.</p> <p>F. ALL POWER DISTRIBUTION EQUIPMENT SHALL BE AS MANUFACTURED BY SQUARE D, SIEMENS, OR GENERAL ELECTRIC.</p> <p>18. WIRING DEVICES AND BOXES</p> <p>A. WIRING DEVICES SHALL BE AS MANUFACTURED BY HUBBELL, BRYANT, LEVITON, OR PASS & SEYMOUR.</p> <p>B. LIGHT SWITCHES SHALL BE QUIET TOGGLE TYPE, HUBBELL #1221 (SINGLE POLE) OR HUBBELL #1223 (3-WAY) AND SHALL BE RATED 20A FOR 120/277V.</p> <p>C. DUPLEX RECEPTACLES SHALL BE RATED 20A, HUBBELL #5352, THREE-WIRE GROUNDING TYPE WITH GROUND INSTALLED. 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