LEE'S SUMMIT MISSOURI

FINAL DEVELOPMENT PLAN APPLICATION

1. PROJECT NAME: Mid-Continent Public Library: East Lee's Summit Branch

2. PROPERTY ADDRESS: 2240 SE Blue Parkway, Lee's Summit, MO 64063

3. ZONING OF PROPERTY: CP-2

4. LEGAL DESCRIPTION (attach if description is metes and bounds description): Lot 2A except the East 81.81 Feet, Magnolia Place at Charleston Park, Second Plat, Lots 2A-3, A Subdivision in the Northeast quarter of section 10,Township 47 N, Range 31 W, Lee's Summit, Jackson Co., Mo.

5. Size of Building(s) (sq. ft): 18,531 SF Lot Area: 3.8008 Acres

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6. APPLICANT Mid-Continent Public Library PHONE 916-521-7286
   CONTACT PERSON Jake Wimmer FAX
   ADDRESS 15616 E. Highway 24 CITY/STATE/ZIP Independence, MO 64050
   E-MAIL JWimmer@mymcpl.org
7. PROPERTY OWNER Mid-Continent Public Library PHONE 816-836-5200
   CONTACT PERSON Mr. Steve Potter, Director FAX
   ADDRESS 15616 East US Highway 24 CITY/STATE/ZIP Independence, Mo, 64050
   E-MAIL spotter@mymcpl.org
8. ENGINEER/SURVEYOR Olsson Associates PHONE 913-634-0903
   CONTACT PERSON Terry Parsons FAX
   ADDRESS 7301 W. 133rd St. #200 CITY/STATE/ZIP Overland Park, KS 66213
   E-MAIL tparsons@olssonassociates.com
9. OTHER CONTACTS Sapp Design Architects PHONE 417-877-9600
   CONTACT PERSON Jim Stufflebeam FAX 417-877-9696
   ADDRESS 3750 S. Fremont CITY/STATE/ZIP Springfield, MO 65804
   E-MAIL stufflebeam@sdaarchitects.com

All applications require the signature of the owner on the application and on the ownership affidavit. Applications without the proper signatures will be deemed incomplete and will not be processed.

PROPERTY OWNER

Print name: Steven V. Potter

APPLICANT

Jacob V. Wimmer

Receipt #: _____ Date Filed: _____ Processed by: _____ Application#: _____

LEE'S SUMMIT
MISSOURI

OWNERSHIP AFFIDAVIT

STATE OF MISSOURI)
ss.
COUNTY OF JACKSON)

Comes now Steven V. Potter (owner) who being duly sworn upon his/her oath, does state that he/she is the owner of the property legally described as Lot 2A except the East 81.81 Feet Magnolia Place at Charleston Park, Second Plat, Lots 2A-3, A Subdivision in the Northeast quarter of section 10, Township 37 N, Range 31 W, Lee's Summit, Jackson County, Missouri

in the application for Final Development Plan
(type of application, e.g., rezoning, preliminary or final development plan, etc.).

Owner acknowledges the submission of said application and understands that upon approval of the application the proposed use specified in the application will be a permitted use upon the subject property under the City of Lee's Summit Unified Development Ordinance.

Dated this 18th day of January, 2019

Signature of Owner

Steven V. Potter

Printed Name

Subscribed and sworn to before me this 18 day of January, 2019

NOTARY PUBLIC NOTARY SEAL STATE OF MISSOURI

TERESA JOHNSON
My Commission Expires
June 12, 2021
Jackson County
Commission #13474387

Teresa Johnson

Notary Public

June 12, 2021

My Commission Expires

REVISED FEBRUARY 2014

LEE'S SUMMIT
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FINAL DEVELOPMENT PLAN CHECKLIST

Submittal Requirements	Yes	No*
Completed application form with signatures	X	
Ownership affidavit form	X	
Legal description	X	
Technical Studies, if required (2) sets of Structural Analysis Report		X
Filing fee – **$600 (0-5 acres) $1000 (over 5 acres)**	X	
Number of folded sets of final development plans – **Initial submittal (4), resubmittal (7)** (including site plan, landscape plan, building elevations, civil engineering), collated, stapled (seals required for engineering plans)	X	
Checklist for Plan Submission Requirements	X	
Checklist for Final Development Plan	X	
Checklist for Zoning District Regulations – **Separate document**		X
Checklist for Design Standards (See Article 7) – **Separate document**		X
Checklist for Other Ordinance Requirements		X

*** Applications missing any required item above will be deemed incomplete.**

Table 1. General Application Requirements Plan Submission Requirements				
UDO Article 4., Sec. 4.040	**Ordinance Requirement**	**Met**	**Not Met**	**N/A**
B.1. Date Prepared	Date prepared	X		
B.2. Name & address	Name, address and telephone number of the person who prepared, or person responsible for preparing, the plan;	X		
B.3. Scale	Graphic, engineering scale not to exceed 1:100. All plans shall be drawn to a standard engineer's scale of 1:50 or 1:100', unless a different scale is specifically approved by the Director. (MATCHES PDP)		X	
B.4. Plan Size	Plan size maximum of 11X17 inches	X		
B.5. North Arrow	North Arrow; plan shall be oriented so north is to the top or to the right side of the sheet.	X		
B.6. Vicinity Map	Vicinity map with north arrow indicating the location of the property within the City.	X		

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FINAL DEVELOPMENT PLAN CHECKLIST

Table 3. Final Development Plan				
UDO Article 4, Sec. 4.360.	**Ordinance Requirement**	**Met**	**Not Met**	**N/A**
C.1. Legal Description	A legal description which accurately describes the limits of the property.	X		
C.2. Land Area	Area of land in square feet and acres.	X		
C.3. Floodplain	Location and limits of the 1% Annual Chance Flood, as set forth on the current FEMA maps with reference to the panel number. Elevations shall be provided if shown on the FEMA map.			X
C.4. Lot Area	Layout, number and approximate dimensions of lots and approximate lot areas.			X
C.5. Streets	Name, location, width, radii, centerline, and grade of streets and alleys, both public and private;	X		
C.6. Sidewalks	Location, width and limits of all existing and proposed sidewalks and public walkways;	X		
C.7. Easements	Location and width of proposed easements;	X		
C.8. Building Setback	Building setback lines from streets with dimensions.	X		
C.9. Culverts	Location and approximate dimensions of culverts and bridges;	X		
C.10. Driveways	Location of existing and proposed driveways, curb cuts, median breaks and turn lanes;	X		
C.11. Utilities	The location and size of all utility lines, including water, storm water, and sanitary sewers.	X		
C.12. Sanitary Sewer	Final analysis of the capacity of the existing sanitary sewer receiving system.	X		
C.13. Water & Sanitary Plans	Final water and sanitary sewer plans.	X		
C.14. Water Demand	Appropriate water service demand data (including, but not limited to, planned land usage, densities of proposed development, pipe sizes, contours and fire hydrant layout) to allow for the preliminary analysis of the demand for water service if required by the City Engineer.	X		
C.15. Storm Water	Final storm water collection, detention and erosion control plans.	X		
C.16. Storm Water Management	Information (proposed size, nature and general location) on all proposed storm water management facilities and detention facilities. A final storm water report shall be submitted unless the stormwater report requirement was waived by the City Engineer or there are no required revisions to the preliminary storm water report. All storm water reports shall include:			
C.16.a.	Current and proposed land use assumptions,	X		
C.16.b.	Identification of the watershed in which the project is located,	X		
C.16.c.	Identification of offsite drainage areas,	X		

LEE'S SUMMIT MISSOURI

FINAL DEVELOPMENT PLAN CHECKLIST

Table 3. Final Development Plan				
UDO Article 4, Sec. 4.360.	**Ordinance Requirement**	**Met**	**Not Met**	**N/A**
C.16.d.	Surrounding property information,	X		
C.16.e.	Any other pertinent information about the site which may influence storm water runoff,			X
C.16.f.	Proposed storm water facilities,	X		
C.16.g.	The downstream effects of the development	X		
C.16.h.	Calculations for the 100%, 10%, and 1% storms. All calculations must be submitted with the report; a summary table is not acceptable.	X		
C.16.i.	If the storm water report indicates that detention is not required, supporting calculations evaluating the downstream effects must be provided.			X
C.16.j.	All reports shall be signed and sealed by a Professional Engineer registered in the State of Missouri.	X		
C.17. Open Space	Location and size of proposed open space for public use proposed to be dedicated or reserved and any conditions of such dedication or reservation; parks, playgrounds, churches, or school sites or other special uses of land to be considered for public use, or to be reserved by deed or covenant for the use of all property owners in the subdivision.	X		
C.18. Parking	Location and dimensions of all parking spaces, accessible spaces, drive aisles, driveways, and curbs.	X		
C.19. Contours	Finished grades showing 1-foot contours for the entire site (2-foot contour intervals may be allowed by the Director, depending on the site).	X		
C.20. Right-of-Way	All proposed and existing adjacent public street rights-of-way with centerline location.	X		
C.21. Streets	All proposed and existing adjacent public street and public drive locations, widths, curb cuts and radii.	X		
C.22. Dimensions	Sufficient dimensions to indicate relationship between buildings, property lines, parking areas and other elements of the plan.	X		
C.23. Setbacks	Location of all required building and parking setbacks.	X		
C.24. Building Dimensions	Location, dimensions, number of stories and area in square feet of all proposed buildings.	X		
C.25. Oil & Gas Wells	The location of all oil and/or gas wells within the subject property. NOTE ON FDP	X		
C.26. Retaining Walls	Limits, location, size and material to be used in all proposed retaining walls.			X
C.27. Driveways	Location and dimensions of all driveways, parking lots, parking stalls, aisles, loading and service areas and docks.	X		
C.28. Lighting	Location, height, intensity and type of outside lighting fixtures for buildings and parking lots.	X		

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FINAL DEVELOPMENT PLAN CHECKLIST

Table 3. Final Development Plan				
UDO Article 4, Sec. 4.360.	**Ordinance Requirement**	**Met**	**Not Met**	**N/A**
C.29. Photometric Diagram	Photometric diagram indicating the foot candle levels throughout the site and at the property lines.	X		
C.30. Lighting Spec Sheets	The manufacturer's specification sheets for proposed exterior lighting to include both parking lot pole mounted and wall mounted fixtures. The specification sheets shall indicate the exact fixture to be used.	X		
C.31. Mechanical Screening	Location, size, and type of material to be used in all screening of ground mounted mechanical equipment.	X		
C.32. Equipment Spec Sheets	The manufacturer's specification sheets for proposed mechanical equipment to be used.	X		
C.33. Signs	Location, size, and type of material of all proposed monument or freestanding signs.			X
C.34. Adjacent Developments	The location of adjacent developments, alignment and location of existing public and private driveways and streets, medians, and public and semi-public easements.	X		
C.35. Fire Hydrants	Locations of existing and proposed fire hydrants.	X		
C.36. Sight Triangles	Sight triangles (See Article 7)	X		
D.1. Building Elevations	Elevations of all sides of proposed buildings including notation indicating building materials to be used on exteriors and roofs.	X		
D.2. Screening Materials	Location, size and materials to be used in all screening of rooftop mechanical equipment.	X		
D.3. Roof Line	A dashed line indicating the roof line and rooftop mechanical equipment.	X		
E. Floor Plan	Floor plan showing dimensions and areas of all floors within proposed buildings and structures.	X		
F. Landscape Plan	Landscaping plans shall be submitted in accordance with Article 14.	X		
G. Land Use Schedule	A land use schedule shall include the following:			
G.1.	Total floor area	X		
G.2.	Number of dwelling units			X
G.3.	Land area	X		
G.4.	Number of required and proposed parking spaces	X		
G.5.	Impervious coverage	X		
G.6.	Floor Area Ratio (FAR)	X		

LEE'S SUMMIT
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FINAL DEVELOPMENT PLAN CHECKLIST

Table 3. Final Development Plan				
UDO Article 4, Sec. 4.360.	**Ordinance Requirement**	**Met**	**Not Met**	**N/A**
H.	The following shall be submitted in support of the application for final development plan approval:			
H.1. Deeds	Deeds of dedication for all rights-of-way or easements required as a result of preliminary development plan approval, if conveyance thereof is not to be made by plat. WILL BE INCLUDED ON PLAT			
H.2. Covenants	A copy of all proposed covenants and restrictions applicable to the development.			X
H.3. POA Bylaws	A copy of the property owners association bylaws as evidence of the establishment of the agency for the ownership and maintenance of any common open space and all assurances of the financial and administrative ability of such agency.			X
H.4. Conditions	Evidence of satisfaction of any conditions of the preliminary development plan approval that were conditions precedent to consideration of the final development plan.			X
H.5. Engineering Plans	An application for engineering approval pursuant to the Design and Construction Manual. All applications for engineering approval shall be accompanied by the number of copies of the following as required by the City Engineer:			
H.5.a.	Engineering drawings with the information required in the Design and Construction Manual	X		
H.5.b.	Plans, profiles and details for streets, curb and gutters, sidewalks, storm and sanitary sewers, and water lines	X		
H.5.c.	A written benchmark description and elevation	X		
H.5.d.	A storm water Master Drainage Plan that contains detailed plans for storm drainage, storm water detention, and grading plans, as specified in the Design and Construction Manual.	X		

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FINAL DEVELOPMENT PLAN CHECKLIST

Table 4. Other Requirements				
	Ordinance Requirement	**Met**	**Not Met**	**N/A**
UDO Art. 14 Landscaping, Buffers & Tree Protection				
Sec. 14.020. Landscaping & buffer plans	Landscaping and buffer plans shall be submitted, and shall include information as listed in the ordinance.	**L500** **L510**		
Sec. 14.050. Acceptable plant material	Acceptable plant materials and sizes for landscaping, buffers and tree replacement shall meet the ordinance requirements.	**L500** **L510**		
Sec. 14.090.A.1. Street frontage trees	1 tree shall be planted for each 30 feet of street frontage. Such trees may be clustered or arranged within the setback if approved as part of the landscape plan. A minimum 20-foot landscape strip shall be provided along the full length of any street frontage, except where the building setback is less than 20 feet.	**L500**		
Sec. 14.090.A.2. Front parking setback	In commercial and industrial districts, any parking or loading area visible from a street shall be separated from the street right-of way with a landscape strip at least 20 feet wide.	**L510**		
Sec. 14.090.A.3. Street frontage shrubs	1 shrub shall be provided for each 20 feet of street frontage, or portion thereof, with in the landscaped setback abutting such frontage. Such shrubs may be clustered or arranged within the setback.	**L510**		
Sec. 14.090.B.1 Open yard shrub reqt.	The minimum of 2 shrubs per 5,000 square feet of total lot area, excludes single family and duplex developments. For schools, large sports/play fields and other areas specifically open to the public for use, i.e., tennis courts, paved play areas, paved parking lots etc. may be excluded in the calculation of this requirement.	**L510**		
Sec. 14.090.B.2. Ground cover	Open areas not covered with other materials shall be covered with sod. Some areas of the site are seeded instead of sodded.		**L500**	
Sec. 14.090.B.3. Open yard tree reqt.	In addition to the trees required based upon street frontage, additional trees shall be required at a ratio of 1 tree for every 5,000 square feet of total landscaped open space. For schools, large open sports/play fields may be excluded in the calculation of total landscaped open space. The remaining open space shall be applied to the ratio for tree planting as stated herein.	**L500**		
Sec. 14.090.C. Trash enclosures	A detailed drawing of enclosure and screening methods to be used in connection with trash storage containers on the property shall be included with the landscaping plan. ***(See Article 7 for requirements)***	**L500** **C10.1**		
Sec. 14.110.A. Parking lot landscape islands	Landscape islands, strips or other planting areas shall be located within the parking lot and shall constitute at least 5% of the entire area devoted to parking spaces, aisles and driveways. *Every four rows of parking shall include a landscape island of at least ten feet in width.*	**L500**		
Sec. 14.110.B. Landscape island placement	A landscaping island shall be located at the end of every parking bay between the last parking space and an adjacent travel aisle or driveway. The island shall be no less than 9 feet wide for at least one-half the length of the adjacent parking space. The island shall be planted in trees, shrubs, grass, or ground cover, except for those areas that are mulched.	**L500**		

LEE'S SUMMIT MISSOURI

FINAL DEVELOPMENT PLAN CHECKLIST

Table 4. Other Requirements				
	Ordinance Requirement	**Met**	**Not Met**	**N/A**
Sec. 14.110.C. Island width	Tree planting areas shall be no less than 10 feet in width. No tree shall be located less than 4 feet from the back of curb. All parking lot landscape islands, strips or other planting areas shall be curbed with minimum 6 inch high curbs.	**L500**		
Sec. 14.120 Parking lot screening	Screening to a height of 2.5 feet must be provided along the edge of the parking lot or loading area closest to and parallel to the street. (See Sec. 14.120 for requirements).	**L510**		
Sec. 14.170. Buffer/screen requirements	Buffer/screen between developments of differing land uses adjoining one another or separated from one another by only a street or alley shall comply with ***Table 14.1*** Typical buffers. Variance for wall granted at PDP	**L500 L510**		
UDO Art. 12 Vehicle Parking				
Sec. 12.030 Number of Parking spaces	See Table 12-1 for minimum required.	**X**		
Sec. 12.120.A. Head-in parking	All areas devoted to vehicle parking shall be so designed and be of such size that no vehicle is required to back into a public street to obtain access.	**X**		
Sec. 12.120.B.1. Parking setback	Parking lots shall be set back a minimum 20 feet from any public right-of-way or private street edge of pavement.	**X**		
Sec. 12.120.B.2- Parking setback	Parking lots shall be set back a minimum 20 feet from any residential use or district.			**X**
Sec. 12.120.B.3. Parking setback	Parking lots shall be set back a minimum 6 feet from the side or rear property line when not part of shared parking and/or cross access.	**X**		
Sec. 12.120.C.1. Parking dimensions	9' wide x 19' deep, placed at the prescribed angle so that it lies between the curb and the aisle. 9' wide x 17' deep parking spaces shall be permitted when the parking space abuts a 6' wide sidewalk or when abutting a curbed open green/landscaped space. Parallel parking spaces shall not be less than 9' wide x 23' long.	**X**		
Sec. 12.120.F.1.e Curb blocks	The use of curb blocks in parking areas shall be prohibited, except at the head of accessible parking spaces when they are adjacent to a pedestrian walkway with no raised curb.	**X**		
Sec. 12.120.E.1 Aisle width	Adequate aisle width (per Table 12-4) for maneuvering into and out of each space.	**X**		
Sec. 12.120.E.4. Drive width	Minimum width (not including curb and gutter) is the same as aisle width (see Table 12-4).	**X**		
Sec. 12.120.E.5 Curb cut spacing	Distance of driveways from intersections and from other driveways shall conform to the Access Management Code.	**X**		
Sec. 7.280 Parking lot lighting	Any lights used to illuminate the parking area shall be arranged, located or screened so that light is directed away from and no light source is visible from a public street, a residentially-zoned area, or a residential use. (See Article 7).	**X**		
Sec. 12.120.F.1.a & b Improvement of Parking Area	Permanent surface, consisting of asphalt or concrete, per specifications.	**X**		

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FINAL DEVELOPMENT PLAN CHECKLIST

Table 4. Other Requirements				
	Ordinance Requirement	**Met**	**Not Met**	**N/A**
Sec. 12.120.F.1.d & f. Curbing	CG-1 concrete curbing required around all parking areas and access drives in office, commercial and industrial districts. Temporary asphalt curbs may be used in areas to be expanded only as shown and approved on the development plan.	X		
Sec. 12.080.B. Accessible Parking Space Size	Accessible parking spaces shall have an adjacent aisle 5 feet wide, and one in every 8 accessible spaces (but no less than one) shall be adjacent to an aisle 8 feet wide and the space shall be clearly marked with a sign indicating that the space is "van accessible." Accessible parking space aisles shall be clearly demarcated by lines painted on or otherwise applied to the parking lot surface. Access aisles shall be on the same level as the vehicle pull-up space they serve.	X		
Sec. 12.080.E. Accessible Parking Space Slope	Accessible parking spaces shall be located on a surface with a slope not exceeding 1 vertical foot in 50 horizontal feet.	X		
Sec. 12.080.H. Accessible Parking Space Clearance	Parking spaces for vans shall have a vertical clearance of 98 inches minimum at the space and along the vehicular route thereto. In cases of a loading zone, the vertical clearance of 114 inches minimum shall be provided at passenger loading zones and along vehicle access routes to such areas from site entrances.	X		
Sec. 12.080.C. No. of Accessible Parking Spaces	See Table 12-3	X		
Sec. 12.080.F. Accessible Parking Space Location	Accessible spaces shall be located at the nearest point to the front building entry and/or accessible ramp. Such spaces separated by a drive aisle shall have clearly discernable cross walks.	X		
Sec. 12.080.J. Accessible Parking Standards	All accessible parking shall comply with the requirements of the federal Americans with Disabilities Act.	X		
Sec. 12.080.I. Accessible Parking Sign	Every parking space required by this section shall be identified by a sign, mounted on a pole or other structure, located between 36 inches (3 feet) and 60 inches (5 feet) above the ground measured from the bottom of the sign, at the head of the parking space. The sign shall be at least 12" by 18" in area and meet the requirements set forth in the Manual on Uniform Traffic Control Devices, as referenced in Section 29-381 of the Lee's Summit General Code of Ordinances.	X		
UDO Art. 13 Signs				
Sec. 13.020.B Signs	All signs must comply with the sign requirements as outlined in the sign section of the ordinance	X		
UDO Art. 6. Div. I - Airport Overlay				
Sec. 6.030. Airport Zones	No structure shall be erected, altered, or maintained, and no tree shall be allowed to grow in any zone created by this District to a height in excess of the applicable height limit herein established for such zone. See Article 6			X

LEE'S SUMMIT
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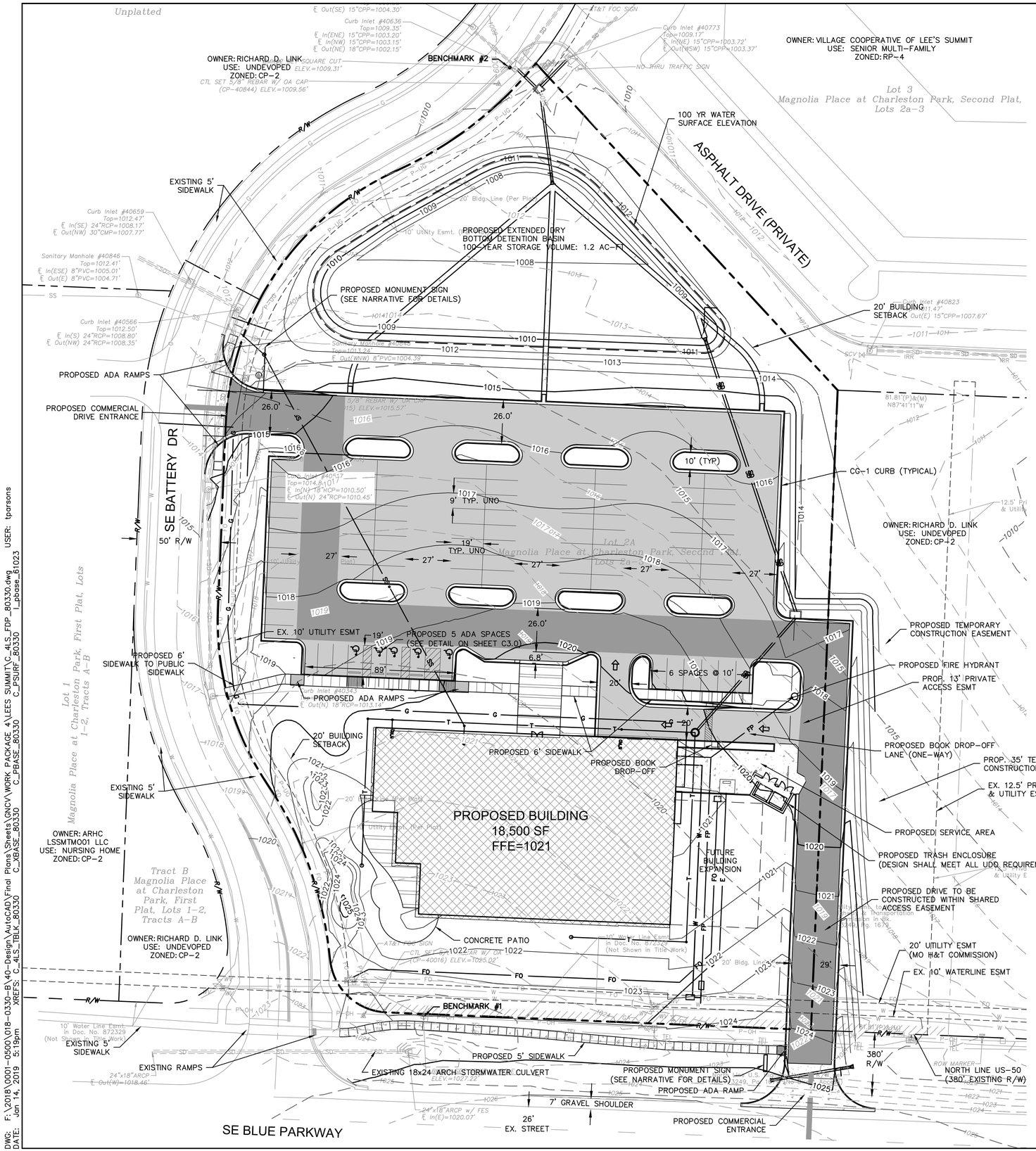
FINAL DEVELOPMENT PLAN CHECKLIST

Table 4. Other Requirements				
	Ordinance Requirement	**Met**	**Not Met**	**N/A**
Sec. 6.040 Use Restrictions	No use may be made of land or water within any zone established by this Article in such a manner as to create electrical interference with navigational signals or radio communication between the airport and aircraft, make it difficult for pilots to distinguish between airport lights and others, result in glare in the eyes of pilots using the airport, impair visibility in the vicinity of the airport, create bird strike hazards, or otherwise in any way endanger or interfere with the landing, takeoff, or maneuvering of aircraft intending to use the airport.			X
	For any property within two miles of the airport, a Form 7460 shall be completed and submitted to the FAA, and comments received back prior to any construction.			X
UDO Art. 6. Div. II - Flood Hazard and Zoning				
Misc.	Floodplain boundaries shall be shown, along with base flood elevations.			X
Misc.	Any lots which contain floodplain shall have a note establishing the minimum floor elevation and/or minimum low opening for structures.			X
UDO Art. 6. Div. III - Historic Preservation				
Misc.	Is the property in a local historic district?			X
Misc.	Is the property or structure listed in the National Register of Historic Places?			X
UDO Article 16. Platting				
Sec. 16.010.G	Any division of land or unplatted piece of property requires platting prior to the issuance of building permits PLAT WILL BE SUBMITTED SHORTLY			



SITE DATA		
ZONING & SITE AREA		
PROPOSED USE:	PUBLIC LIBRARY	
SITE AREA		ZONING
LOT 2 (AS DECRIBED):	3.80 ACRES (165,528 SF)	CP-2
IMPERVIOUS:	1.71 ACRES (74,488 SF) (45%)	
PERVIOUS:	2.09 ACRES (91,040 SF) (55%)	
FAR (0.55 MAX):	0.15	
BUILDING AREA		
BUILDING TYPE	# STORIES	SQUARE FOOTAGE
BUILDING	1	18,500 SF
FUTURE	1	4,700 SF
PARKING		
USE	REQUIRED	PROVIDED
LIBRARY	4 PER 1000 SF = 74	83
ADA	3 (PER CITY TABLE)	5
TOTAL	74	88 (INCLUDING ADA)

NOTE:
ACCORDING TO MDNR STATE OIL & GAS COUNSEL THERE ARE NO OIL AND GAS WELLS LOCATED WITHIN OR ADJACENT TO THE PROPERTY.

EXISTING CONDITIONS LEGEND

- PROPERTY LINES
- RIGHT-OF-WAY LINES
- EASEMENT LINES
- BUILDING SETBACK LINES
- P-OH — OVERHEAD ELECTRIC
- P-UG — UNDERGROUND ELECTRIC
- TEL — UNDERGROUND TELEPHONE
- FO — UNDERGROUND FIBER OPTIC
- G — GAS LINE
- W — WATER LINE
- SD — STORM SEWER LINE
- SS — SANITARY SEWER LINE
- 851 — GRADE CONTOURS

PROPOSED CONDITIONS LEGEND

- E — PROPOSED UNDERGROUND ELECTRIC
- FO — PROPOSED FIBER OPTIC
- W — PROPOSED WATER LINE
- FP — PROPOSED FIRE PROTECTION LINE
- SD — PROPOSED STORM SEWER LINE
- T — PROPOSED TURF DRAIN LINE
- SS — PROPOSED SANITARY SEWER SERVICE
- CONCRETE CURB & GUTTER
- PROPOSED BUILDING
- PROPOSED CONCRETE SIDEWALK
- PROPOSED LIGHT DUTY ASPHALT
- 851 — PROPOSED GRADE CONTOURS
- PROPOSED FIRE ACCESS ROAD

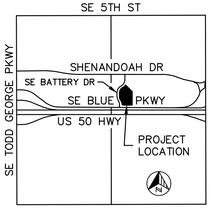
BENCHMARKS:

BENCHMARK #1:
ELEVATION=1027.22'
SET RAILROAD SPIKE IN THE NORTH SIDE OF A POWER POLE, 66'± NORTH OF THE ℄ OF SE BLUE PARKWAY, 86' EAST OF THE ℄ OF SE BATTERY DRIVE.

BENCHMARK #2:
ELEVATION=1009.31'
SET CHISELED "□" CUT ON THE SOUTHWESTERLY CORNER OF A CONCRETE CURB INLET #40636, 630'± NORTH OF THE ℄ OF SE BLUE PARKWAY, 15' EAST OF THE ℄ OF SE BATTERY DRIVE.

LEGAL DESCRIPTION:

LOT 2A, MAGNOLIA PLACE AT CHARLESTON PARK, SECOND PLAT, LOTS 2A-3, A SUBDIVISION IN LEE'S SUMMIT, JACKSON COUNTY, MISSOURI, EXCEPT THE EAST 81.81 FEET THEREOF, CONTAINING 165,561 SQUARE FEET OR 3.8008 ACRES, MORE OR LESS .



SECTION 10, T.47N., R.31W.

VICINITY MAP
SCALE: 1" = 2000'

SAPP DESIGN ARCHITECTS
3750 S. Fremont Ave.
Springfield, MO 65804 417.877.9600
Sapp Design Associates Architects, P.C.
Missouri State Certificate of Authority #000607

helix.
1629 Walnut
Kansas City, MO 64108 816.300.0300

SPECIAL NOTICES

Mid-Continent Public Library
CONSTRUCTION DOCUMENT PLANS FOR

EAST LEE'S SUMMIT BRANCH

2240 SE BLUE PARKWAY
LEE'S SUMMIT, MO 64063
JACKSON COUNTY

PACKAGE 04

Engineer of Record

STATE OF MISSOURI
TERRY M. PARSONS
NUMBER PE-2018010505
01-14-2018
PROFESSIONAL ENGINEER

Terry M Parsons, Engineer MO PE-2018010505

olsson
7301 West 133rd Street, Suite 200
Overland Park, KS 66213
TEL 913.381.1170
FAX 913.381.1174
www.olsson.com
Olsson
Missouri State Certificate of Authority #001592

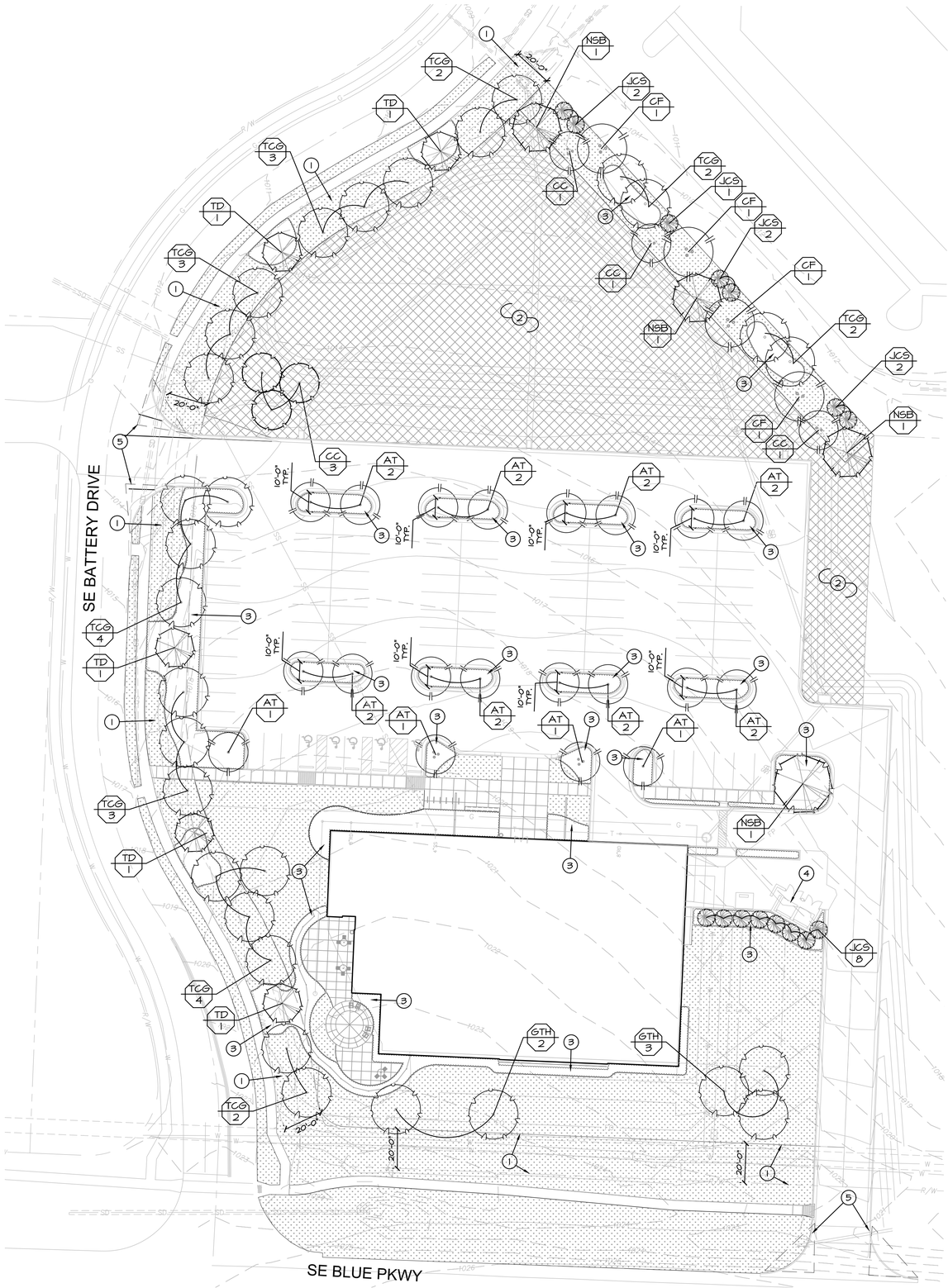
Revision No.	Description	Date
1	ASI#1	01.14.19

Project No.	Date	Drawn
B18-0330	12.07.18	RLK

Drawing No.

C1.0
FINAL DEVELOPMENT PLAN

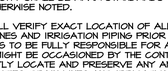
DWG: F:\2018\0001-0500\0018-0330-B\40-Design\AutoCAD\Final Plans\Sheets\GNCV\WORK PACKAGE 4\LEE'S SUMMIT\C-4LS_FDP_80330.dwg USER: tparsons
DATE: Jan 14, 2019 5:19pm XREFS: C-4LS_TBLK_80330 C_XBASE_80330 C_PBASE_80330 C_PSURF_80330 I_pbase_61023



1 **OVERSTORY LANDSCAPE PLAN**

LANDSCAPE GENERAL NOTES:

1. THE CONSTRUCTION COVERED BY THESE PLANS SHALL CONFORM TO ALL APPLICABLE STANDARDS AND SPECIFICATIONS OF THE CITY OF LEE'S SUMMIT, MISSOURI IN CURRENT USAGE. ALL STANDARDS NOT COVERED BY THE CITY SHALL BE APWA STANDARDS IN CURRENT USAGE UNLESS OTHERWISE NOTED.
2. CONTRACTOR SHALL VERIFY EXACT LOCATION OF ALL EXISTING UTILITIES, DRAIN LINES AND IRRIGATION PIPING PRIOR TO COMMENCING WORK AND AGREES TO BE FULLY RESPONSIBLE FOR ANY AND ALL DAMAGES WHICH MIGHT BE OCCASIONED BY THE CONTRACTOR'S FAILURE TO EXACTLY LOCATE AND PRESERVE ANY AND ALL UNDERGROUND UTILITIES, DRAIN LINES AND IRRIGATION PIPING.
3. CONTRACTOR SHALL VERIFY AND COORDINATE ALL FINAL GRADES WITH LANDSCAPE ARCHITECT PRIOR TO COMPLETION.
4. DEBRIS SHALL NOT BE ALLOWED TO ACCUMULATE AND SHALL BE REMOVED AT FREQUENT INTERVALS. AT COMPLETION OF WORK IN EACH AREA, THE CONTRACTOR SHALL GATHER AND REMOVE ALL DEBRIS, EQUIPMENT, AND EXCESS MATERIAL FROM THAT AREA. AT FINAL COMPLETION OF ALL WORK HE SHALL REMOVE ALL SUCH ITEMS FROM THE PREMISES.
5. LOCATION AND PLACEMENT OF ALL PLANT MATERIAL SHALL BE COORDINATED WITH LANDSCAPE ARCHITECT PRIOR TO INSTALLATION.
6. THE LANDSCAPE PLANTING PLAN GRAPHICALLY ILLUSTRATES OVERALL PLANT MASSINGS. EACH PLANT SPECIES SHALL BE PLACED IN THE FIELD TO UTILIZE THE GREATEST COVERAGE OF THE GROUND PLANE. THE FOLLOWING APPLIES FOR INDIVIDUAL PLANTINGS.
   -ALL EVERGREEN SHRUBS AND CREEPING GROUNDCOVERS SHALL BE MINIMUM OF 2' FROM ANY PAVING EDGE.
   -ALL PLANTS OF THE SAME SPECIES SHALL BE EQUALLY SPACED AND SITED FOR THE BEST AESTHETIC VIEWING.
   -ALL TREES, EVERGREEN OR DECIDUOUS, SHALL BE A MINIMUM OF 4' FROM ANY PAVING EDGE.
7. ANY SUBSTITUTION OF SPECIFIED PLANT MATERIAL WILL NOT BE ALLOWED WITHOUT WRITTEN AUTHORIZATION FROM LANDSCAPE ARCHITECT PRIOR TO INSTALLATION.
8. MULCH ALL PLANTING AREAS TO A DEPTH OF 3" DEPTH ACCORDING TO PLANS AND SPECIFICATIONS. SAMPLES SHALL BE APPROVED BY LANDSCAPE ARCHITECT.
9. ALL PLANT MATERIAL WILL BE HEALTHY, VIGOROUS AND FREE OF DISEASE AND INSECTS PER AAN STANDARDS. LANDSCAPE ARCHITECT RESERVES THE RIGHT TO REJECT ANY INFERIOR OR OTHERWISE UNSUITABLE PLANT MATERIAL PROPOSED FOR USE ON THE PROJECT.
10. ALL PLANTING BEDS NOT FULLY CONTAINED BY CONCRETE CURBS OR WALKS SHALL BE EDGED ACCORDING TO PLANS AND SPECIFICATIONS.
11. PLANTS AND LANDSCAPE MATERIALS SHALL BE INSTALLED AS DETAILED ON PLANS.
12. PLANT SOIL MIXTURE FOR BACKFILL OF TREES AND SHRUBS SHALL BE PER SPECIFICATIONS.
13. ALL PLANTING BEDS SHALL BE TREATED WITH DACTHAL PRE-EMERGENT HERBICIDE AT MANUFACTURER RECOMMENDED RATES AND SHALL BE COVERED WITH SPECIFIED MULCH APPLICATION. APPLY LIGHTER APPLICATION OF DACTHAL HERBICIDE TO TOP OF MULCH LAYER.
14. ALL AREAS DISTURBED DURING CONSTRUCTION THAT ARE NOT DESIGNATED AS PLANTING BEDS, SOD AREA OR PAVEMENT AREAS SHALL BE SEEDED WITH A TURF TYPE TALL FESCUE PER SPECIFICATIONS.
15. ALL PLANT MATERIAL SHALL BE GUARANTEED FOR A PERIOD OF ONE YEAR AFTER OWNER'S FINAL ACCEPTANCE OF FINISHED JOB. ALL DEAD AND DAMAGED PLANT MATERIAL SHALL BE REPLACED BY LANDSCAPE CONTRACTOR AT THEIR EXPENSE. LANDSCAPE CONTRACTOR SHALL MAINTAIN PLANT MATERIAL UNTIL FINAL ACCEPTANCE.
16. ALL LANDSCAPE BEDS SHALL BE MOUNDED AS SHOWN ON PLANS AND DETAILS.
17. LANDSCAPE CONTRACTOR SHALL BE RESPONSIBLE FOR VERIFYING ACTUAL PLANT QUANTITIES REQUIRED TO COMPLETE THE PROJECT AS SHOWN ON THE PLANS, AND BASE THEIR BID ACCORDINGLY.
18. PLANT KEY DESCRIPTION.



LANDSCAPE LEGEND:

- RIGHT OF WAY / PROPERTY LINE
- SHRUB BED
- DETENTIONS BASIN SEED MIX AREA; SEE SPECIFICATIONS
- TURF TYPE FESCUE SOD - SEE SPECIFICATIONS

LANDSCAPE PLAN NOTES:

1. 20' LANDSCAPE BUFFER STRIP
2. SEED MIX AREA; SEE SPECIFICATIONS FOR MIX
3. PLANTING BED; REF: LANDSCAPE GENERAL NOTES LANDSCAPE DETAILS &SPECIFICATIONS
4. TRASH ENCLOSURE; REF: CIVIL PLANS (SHALL MEET ALL UDO REQUIREMENTS)
5. SIGHT DISTANCE TRIANGLES

PARKING LOT LANDSCAPE - AREA CALCULATIONS

ORDINANCE REQUIREMENT

LANDSCAPE ISLANDS, STRIPS AND PLANTING AREAS SHALL CONSTITUTE AT LEAST FIVE PERCENT (5%) OF THE ENTIRE AREA DEVOTED TO PARKING.

TOTAL PARKING LOT AREA = 60,604 SQ FT
FIVE PERCENT (5%) OF 60,604 = 3,031 SQ FT

TOTAL ISLAND AREA = 2,584 SQ FT
TOTAL BUMP OUT AREA = 2,328 SQ FT
TOTAL LANDSCAPE AREA = 4,912 SQ FT

LOW IMPACT BUFFER TREES - PLANT SCHEDULE

KEY	BOTANICAL NAME	COMMON NAME	SIZE	COND.	QUANTITY
SHADE TREES					
TCG	Tilia cordata 'Greenspire'	GREENSPIRE LITTLELEAF LINDEN	3" CAL.	B & B	4
NSB	Nyssa sylvatica	BLACK GUM	3" CAL.	B & B	3
ORNAMENTAL TREES					
CC	Cercis canadensis	EASTERN REDBUD	3" CAL.	B & B	3
CF	Cornus florida	FLOWERING DOGWOOD	3" CAL.	B & B	4
EVERGREEN TREES					
JCS	Juniperus chinensis 'Spartan'	SPARTAN JUNIPER	8' HT MIN.	B & B	7

ORDINANCE REQUIREMENT

BUFFER LOT LINE LENGTH = 245'

245 LF x 20' = 4900 SQ FT
BUFFER TYPE "C"
SHADE TREES 1 / 750 SF = 6.5 TREES
ORNAMENTAL TREES 1 / 750 SF = 6.5 TREES
EVERGREEN TREES 1 / 750 SF = 6.5 TREES

7 DECIDUOUS TREES REQUIRED — **TOTAL PROPOSED 7**
7 ORNAMENTAL TREES REQUIRED — **TOTAL PROPOSED 7**
7 EVERGREEN TREES REQUIRED — **TOTAL PROPOSED 7**

STREET FRONTAGE TREES - PLANT SCHEDULE

KEY	BOTANICAL NAME	COMMON NAME	SIZE	COND.	QUANTITY
SHADE TREES					
GTH	Gleditsia triacanthos f. inermis 'Skycole'	SKYLINE HONEY LOCUST	3" CAL.	B & B	5
TCG	Tilia cordata 'Greenspire'	GREENSPIRE LITTLELEAF LINDEN	3" CAL.	B & B	21
TD	Taxodium distichum 'Michelson'	SHAWNEE BRAVE BALD CYPRESS	3" CAL.	B & B	5

ORDINANCE REQUIREMENT

ONE (1) TREE PER 30 LINEAR FEET OF STREET FRONTAGE.

921 FT. OF STREET FRONTAGE / 30 =
31 TREES REQUIRED — **TOTAL PROPOSED 31**

OPEN YARD TREES - PLANT SCHEDULE

KEY	BOTANICAL NAME	COMMON NAME	SIZE	COND.	QUANTITY
SHADE TREES					
AT	Acer truncatum	SHANTUNG MAPLE	3" CAL.	B & B	20
NSB	Nyssa sylvatica	BLACK GUM	3" CAL.	B & B	1
ORNAMENTAL TREES					
CC	Cercis canadensis	EASTERN REDBUD	3" CAL.	B & B	5
EVERGREN TREES					
JCS	Juniperus chinensis 'Spartan'	SPARTAN JUNIPER	8' HT MIN.	B & B	8

ORDINANCE REQUIREMENT

ONE (1) TREE PER 5000 SQ. FT. OF TOTAL LOT AREA EXCLUDING BUILDING FOOTPRINT (IN ADDITION TO STREET TREES).

165,464 SQ. FT. OF TOTAL LOT AREA MINUS 18,450 SQ. FT. OF BUILDING FOOTPRINT = 147,014 SF

147,014 SQ. FT. / 5000 = **29.4 TREES REQUIRED**

TOTAL PROPOSED 32

SAPP DESIGN ARCHITECTS
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Springfield, MO 65804 417.877.9600

Sapp Design Associates Architects, P.C.
Missouri State Certificate of Authority #000607

helix.
1629 Walnut
Kansas City, MO 64108 816.300.0300

Mid-Continent Public Library
RENOVATIONS TO
EAST LEE'S SUMMIT BRANCH
150 NW Oldham Pkwy
Lee's Summit, Missouri 64081
Jackson County

100% CD SUBMITTAL PACKAGE **04**

STATE OF MISSOURI
KOREY P SCHULZ
NUMBER LA-2002030605
LANDSCAPE ARCHITECT
12/4/18

ochsner hare + hare
the olsson studio
Ochsner Hare & Hare
Missouri State Certificate of Authority #2005000285

Revision No.	Description	Date
01	ASI 01	1/14/19

Project No.	Date	Drawn
016-1023	12-21-18	TG

Drawing No.
L500
OVERSTORY LANDSCAPE PLAN

1 **UNDERSTORY LANDSCAPE PLAN**

NORTH 0 15' 30' 60'

LOW IMPACT BUFFER SHRUBS - PLANT SCHEDULE

KEY	BOTANICAL NAME	COMMON NAME	SIZE	COND.	QUANTITY
DECIDUOUS SHRUBS					
AMB	Aronia melancarpa	BLACK CHOKEBERRY	5 GAL.	CONT.	4
CAB	Cornus alba 'Ballhalo'	IVORY HALO DOGWOOD	5 GAL.	CONT.	4
IVL	Itea virginica 'Little Henry'	LITTLE HENRY SWEETSPIRE	5 GAL.	CONT.	12
POD	Physocarpus opulifolius 'Diabolo'	DIABOLO NINEBARK	5 GAL.	CONT.	2
VCK	Viburnum carlesii	KOREANSPICE VIBURNUM	5 GAL.	CONT.	4

ORDINANCE REQUIREMENT

BUFFER LOT LINE LENGTH = 245'

245 LF x 20' = 4900 SQ FT
BUFFER TYPE "C"
ONE (1) SHRUB / 200 SF = 24.5 SHRUBS

25 SHRUBS REQUIRED **TOTAL PROPOSED 26**

STREET FRONTAGE SHRUBS - PLANT SCHEDULE

KEY	BOTANICAL NAME	COMMON NAME	SIZE	COND.	QUANTITY
DECIDUOUS SHRUBS					
AMB	Aronia melancarpa	BLACK CHOKEBERRY	5 GAL.	CONT.	5
CAB	Cornus alba 'Ballhalo'	IVORY HALO DOGWOOD	5 GAL.	CONT.	38
IVL	Itea virginica 'Little Henry'	LITTLE HENRY SWEETSPIRE	5 GAL.	CONT.	4
VCK	Viburnum carlesii	KOREANSPICE VIBURNUM	5 GAL.	CONT.	6
PERENNIALS / GRASSES					
EPP	Echinacea purpurea	PURPLE CONEFLOWER	1 GAL.	CONT.	4
RHB	Rudbeckia fulgida speciosa 'Goldsturm'	GOLDSTURM BLACK-EYED SUSAN	1 GAL.	CONT.	51

ORDINANCE REQUIREMENT

ONE (1) SHRUB PER 20 FEET OF STREET FRONTAGE.

921 FT. OF STREET FRONTAGE / 20 SF =46.05 SHRUBS REQUIRED

46 SHRUBS REQUIRED **TOTAL PROPOSED 108**

OPEN YARD SHRUBS - PLANT SCHEDULE

KEY	BOTANICAL NAME	COMMON NAME	SIZE	COND.	QUANTITY
DECIDUOUS SHRUBS					
AMB	Aronia melancarpa	BLACK CHOKEBERRY	5 GAL.	CONT.	3
CAB	Cornus alba 'Ballhalo'	IVORY HALO DOGWOOD	5 GAL.	CONT.	28
CLA	Clethra alnifolia	SUMMERSWEET	5 GAL.	CONT.	14
FXI	Forsythia X intermedia	BORDER FORSYTHIA	5 GAL.	CONT.	5
IVL	Itea virginica 'Little Henry'	LITTLE HENRY SWEETSPIRE	5 GAL.	CONT.	77
OHA	Hydrangea quercifolia	OAKLEAF HYDRANGEA	5 GAL.	CONT.	11
POD	Physocarpus opulifolius 'Diabolo'	NINEBARK 'DIABOLO'	5 GAL.	CONT.	4
RAG	Rhus aromatica 'Gro-low'	GRO-LOW FRAGRANT SUMAC	5 GAL.	CONT.	119
VCK	Viburnum carlesii	KOREANSPICE VIBURNUM	5 GAL.	CONT.	7
PERENNIALS / GRASSES					
BSF	Baptista 'Solar Flare'	SOLAR FLARE FALSE INDIGO	1 GAL.	CONT.	4
EPP	Echinacea purpurea	PURPLE CONEFLOWER	1 GAL.	CONT.	42
HOS	Hosta 'Patriot'	PATRIOT HOSTA	1 GAL.	CONT.	29
LS	Liatris spicata	BLAZING STAR	1 GAL.	CONT.	36
PVH	Panicum virgatum 'Heavy Metal'	HEAVY METAL SWITCHGRASS	5 GAL.	CONT.	48
RHB	Rudbeckia fulgida speciosa 'Goldsturm'	GOLDSTURM BLACK-EYED SUSAN	1 GAL.	CONT.	25
SHP	Sporobolus heterolepsis	PRAIRIE DROPSEED	5 GAL.	CONT.	84

ORDINANCE REQUIREMENT

TWO (2) SHRUBS PER 5000 SQ. FT. OF TOTAL LOT AREA EXCLUDING BUILDING FOOTPRINT.

165,464 SQ. FT. OF TOTAL LOT AREA MINUS 18,450 SQ. FT. OF BUILDING FOOTPRINT = 147,014 SQ. FT.

147,014 SQ. FT. / 5000 x 2 =

58.8 SHRUBS REQUIRED **TOTAL PROPOSED 620**

PARKING LOT SCREENING - PLANT SCHEDULE

KEY	BOTANICAL NAME	COMMON NAME	SIZE	COND.	QUANTITY
DECIDUOUS SHRUBS					
AMB	Aronia melancarpa	BLACK CHOKEBERRY	5 GAL.	CONT.	9
CAB	Cornus alba 'Ballhalo'	IVORY HALO DOGWOOD	5 GAL.	CONT.	21
CLA	Clethra alnifolia	SUMMERSWEET	5 GAL.	CONT.	33
FXI	Forsythia X intermedia	BORDER FORSYTHIA	5 GAL.	CONT.	5
IVH	Itea virginica 'Henry's Garnet'	HENRY'S GARNET SWEETSPIRE	5 GAL.	CONT.	41
IVL	Itea virginica 'Little Henry'	LITTLE HENRY SWEETSPIRE	5 GAL.	CONT.	5
OHA	Hydrangea quercifolia	OAKLEAF HYDRANGEA	5 GAL.	CONT.	9
VCK	Viburnum carlesii	KOREANSPICE VIBURNUM	5 GAL.	CONT.	2
PERENNIALS / GRASSES					
EPP	Echinacea purpurea	PURPLE CONEFLOWER	1 GAL.	CONT.	2
RHB	Rudbeckia fulgida speciosa 'Goldsturm'	GOLDSTURM BLACK-EYED SUSAN	1 GAL.	CONT.	21
SHP	Sporobolus heterolepsis	PRAIRIE DROPSEED	5 GAL.	CONT.	40
SSB	Schizachyrium scoparium	LITTLE BLUESTEM	5 GAL.	CONT.	6

ORDINANCE REQUIREMENT

12 SHRUBS PER 40 LINEAR FEET (MUST BE 2.5 FEET TALL; BERMS MAY BE COMBINED WITH SHRUBS)

WEST SIDE OF PARKING LOT:
175 LINEAR FT. / 40 LINEAR FT. x 12 =
52.5 SHRUBS REQUIRED
SOUTH SIDE OF PARKING LOT:
80 LINEAR FT. / 40 LINEAR FT. x 12 =
24 SHRUBS REQUIRED **TOTAL PROPOSED 141**

LANDSCAPE GENERAL NOTES:

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2. CONTRACTOR SHALL VERIFY EXACT LOCATION OF ALL EXISTING UTILITIES, DRAIN LINES AND IRRIGATION PIPING PRIOR TO COMMENCING WORK AND AGREES TO BE FULLY RESPONSIBLE FOR ANY AND ALL DAMAGES WHICH MIGHT BE OCCASIONED BY THE CONTRACTOR'S FAILURE TO EXACTLY LOCATE AND PRESERVE ANY AND ALL UNDERGROUND UTILITIES, DRAIN LINES AND IRRIGATION PIPING.
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5. LOCATION AND PLACEMENT OF ALL PLANT MATERIAL SHALL BE COORDINATED WITH LANDSCAPE ARCHITECT PRIOR TO INSTALLATION.
6. THE LANDSCAPE PLANTING PLAN GRAPHICALLY ILLUSTRATES OVERALL PLANT MASSINGS. EACH PLANT SPECIES SHALL BE PLACED IN THE FIELD TO UTILIZE THE GREATEST COVERAGE OF THE GROUND PLANE. THE FOLLOWING APPLIES FOR INDIVIDUAL PLANTINGS:
   -ALL EVERGREEN SHRUBS AND CREEPING GROUNDCOVERS SHALL BE MINIMUM OF 2' FROM ANY PAVING EDGE.
   -ALL PLANTS OF THE SAME SPECIES SHALL BE EQUALLY SPACED AND SITED FOR THE BEST AESTHETIC VIEWING.
   -ALL TREES, EVERGREEN OR DECIDUOUS, SHALL BE A MINIMUM OF 4' FROM ANY PAVING EDGE.
7. ANY SUBSTITUTION OF SPECIFIED PLANT MATERIAL WILL NOT BE ALLOWED WITHOUT WRITTEN AUTHORIZATION FROM LANDSCAPE ARCHITECT PRIOR TO INSTALLATION.
8. MULCH ALL PLANTING AREAS TO A DEPTH OF 3" DEPTH ACCORDING TO PLANS AND SPECIFICATIONS. SAMPLES SHALL BE APPROVED BY LANDSCAPE ARCHITECT.
9. ALL PLANT MATERIAL MILL BE HEALTHY, VIGOROUS AND FREE OF DISEASE AND INSECTS PER AAN STANDARDS. LANDSCAPE ARCHITECT RESERVES THE RIGHT TO REJECT ANY INFERIOR OR OTHERWISE UNSUITABLE PLANT MATERIAL PROPOSED FOR USE ON THE PROJECT.
10. ALL PLANTING BEDS NOT FULLY CONTAINED BY CONCRETE CURBS OR WALKS SHALL BE EDGED ACCORDING TO PLANS AND SPECIFICATIONS.
11. PLANTS AND LANDSCAPE MATERIALS SHALL BE INSTALLED AS DETAILED ON PLANS.
12. PLANT SOIL MIXTURE FOR BACKFILL OF TREES AND SHRUBS SHALL BE PER SPECIFICATIONS.
13. ALL PLANTING BEDS SHALL BE TREATED WITH DACTHAL PRE-EMERGENT HERBICIDE AT MANUFACTURER RECOMMENDED RATES AND SHALL BE COVERED WITH SPECIFIED MULCH APPLICATION. APPLY LIGHTER APPLICATION OF DACTHAL HERBICIDE TO TOP OF MULCH LAYER.
14. ALL AREAS DISTURBED DURING CONSTRUCTION THAT ARE NOT DESIGNATED AS PLANTING BEDS, SOD AREA OR PAVEMENT AREAS SHALL BE SEEDED WITH A TURF TYPE TALL FESCUE PER SPECIFICATIONS.
15. ALL PLANT MATERIAL SHALL BE GUARANTEED FOR A PERIOD OF ONE YEAR AFTER OWNER'S FINAL ACCEPTANCE OF FINISHED JOB. ALL DEAD AND DAMAGED PLANT MATERIAL SHALL BE REPLACED BY LANDSCAPE CONTRACTOR AT THEIR EXPENSE. LANDSCAPE CONTRACTOR SHALL MAINTAIN PLANT MATERIAL UNTIL FINAL ACCEPTANCE.
16. ALL LANDSCAPE BEDS SHALL BE MOUNDED AS SHOWN ON PLANS AND DETAILS.
17. LANDSCAPE CONTRACTOR SHALL BE RESPONSIBLE FOR VERIFYING ACTUAL PLANT QUANTITIES REQUIRED TO COMPLETE THE PROJECT AS SHOWN ON THE PLANS, AND BASE THEIR BID ACCORDINGLY.
18. PLANT KEY DESCRIPTION.

LANDSCAPE LEGEND:

RIGHT OF WAY / PROPERTY LINE

SEEDED BASIN AREA; SEE SPECIFICATIONS

TURF TYPE FESCUE SOD; SEE SPECIFICATIONS

LANDSCAPE PLAN NOTES:

1. 20' LANDSCAPE STRIP
2. AREA TO BE SODDED WITH TURF TYPE FESCUE; REF: SPECIFICATIONS
3. SEEDED AREA; MIX TO BE DETERMINED
4. PLANTING BED; REF: LANDSCAPE GENERAL NOTES, LANDSCAPE DETAILS & SPECIFICATIONS
5. HARDWOOD MULCH; REF: LANDSCAPE GENERAL NOTES & SPECIFICATIONS
6. CONSTRUCT STEEL BED EDGE; REF 4/L590
7. TRASH ENCLOSURE WITH 6' MASONRY SCREEN WALL (SHALL MEET ALL UDO REQUIREMENTS)
8. SIGHT TRIANGLES

SAPP DESIGN ARCHITECTS
3750 S. Fremont Ave.
Springfield, MO 65804 417.877.9600

Sapp Design Associates Architects, P.C.
Missouri State Certificate of Authority #000607

helix.
1629 Walnut
Kansas City, MO 64108 816.300.0300

SPECIAL NOTICES

Mid-Continent Public Library
RENOVATIONS TO
EAST LEE'S SUMMIT BRANCH
150 NW Oldham Pkwy
Lee's Summit, Missouri 64081
Jackson County

100% CD SUBMITTAL PACKAGE **04**

STATE OF MISSOURI
KOREY P. SCHULZ
NUMBER A-2002030605
LANDSCAPE ARCHITECT
12.14.18

ochsner hare + hare
the olsson studio
Ochsner Hare & Hare
Missouri State Certificate of Authority #2005000285

Revision No.	Description	Date
01	ASI 01	1/14/19

Project No.	Date	Drawn
016-1023	12-21-18	TG

Drawing No.
L510
UNDERSTORY LANDSCAPE PLAN

SITE LEGEND (THIS SHEET)

- POLE-MOUNTED LUMINAIRE
- LANDSCAPE FLOOD LUMINAIRE
- (#) KEYNOTE
- (J) JUNCTION BOX

SITE LUMINAIRE SCHEDULE

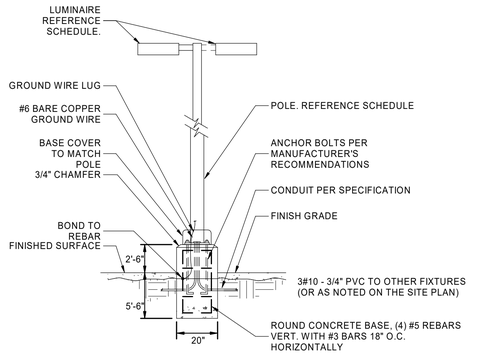
FIXTURE TYPE	DESCRIPTION	MANUFACTURER* OR APPROVED EQUIVALENT	MODEL	LAMPS (QTY) TYPE	LAMP CCT	LAMP CRI	INPUT VA	VOLTAGE	SCHEDULED NOTES
Z1	33" LONG x 13" WIDE x 7" TALL, LED SITE LUMINAIRE. IP65 RATED, UL WET LOCATION LISTED. TYPE IV DISTRIBUTION, FULL CUTOFF (NO UPLIGHT). TWO HEADS MOUNTED ON POLE, 180 DEGREES APART. PROVIDE 25'-0" SQUARE POLE AND MOUNTING COMPATIBLE WITH FIXTURE. ARCHITECT TO SELECT FINISH.	LITHONIA* (HUBBELL, MCGRAW-EDISON)	DSX1 LED P3 30K T4M MVOLT SPA	LED	3000 K	70	102 VA	277 V	
Z2	26" LONG x 13" WIDE x 7" TALL, LED SITE LUMINAIRE. IP65 RATED, UL WET LOCATION LISTED. TYPE III DISTRIBUTION, FULL CUTOFF (NO UPLIGHT). SINGLE HEAD MOUNTED ON POLE. PROVIDE 12'-0" SQUARE POLE AND MOUNTING COMPATIBLE WITH FIXTURE. ARCHITECT TO SELECT FINISH.	LITHONIA* (HUBBELL, MCGRAW-EDISON)	DSX0 LED P2 30K T3M MVOLT SPA	LED	3000 K	70	49 VA	277 V	

GENERAL NOTES (THIS SHEET)

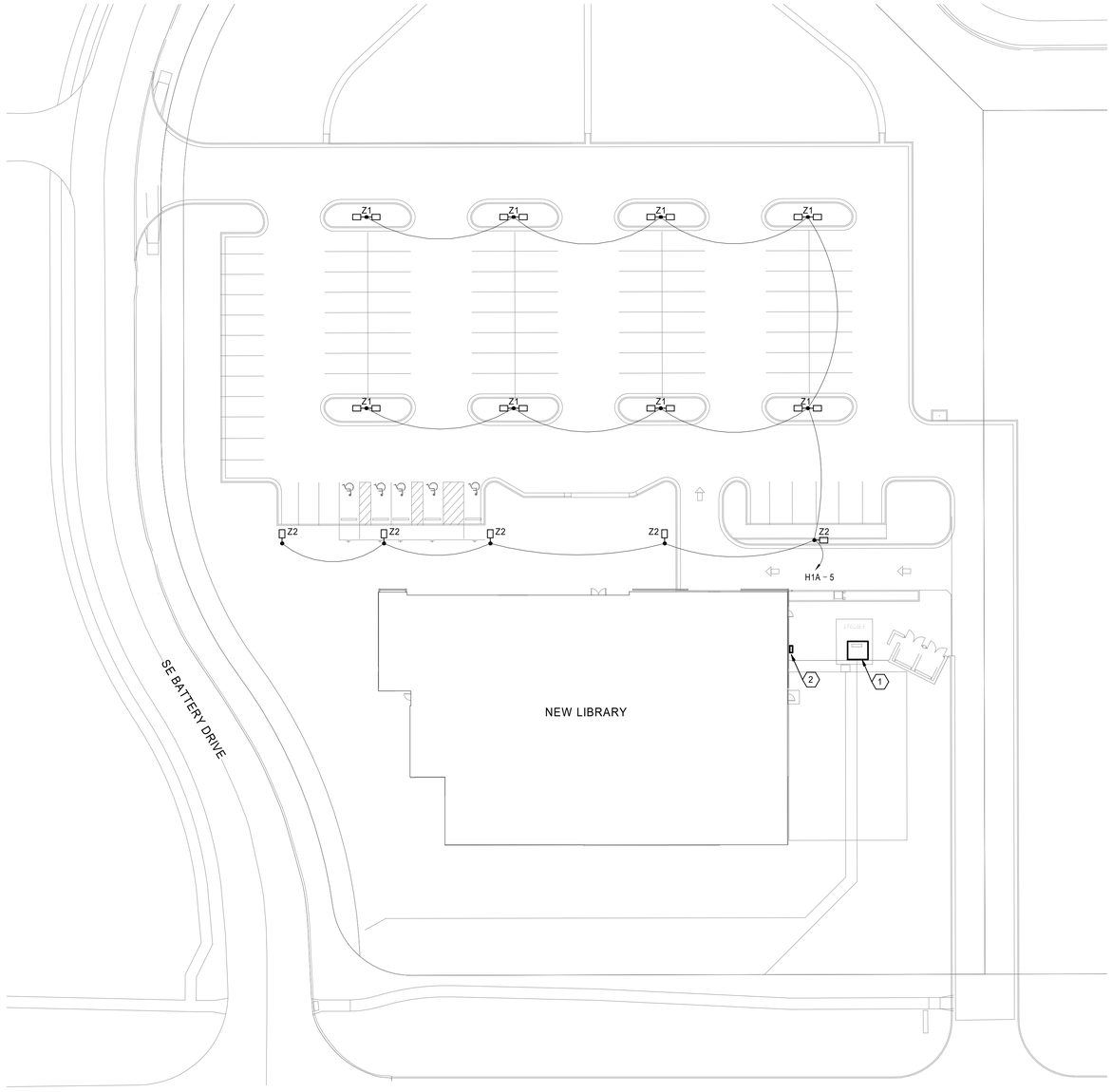
1. SEE SHEET E001 FOR LEGEND AND ADDITIONAL GENERAL NOTES.
2. COORDINATE WITH ARCHITECTURAL DRAWINGS AND ELEVATIONS FOR LOCATIONS AND MOUNTING HEIGHTS OF ALL LUMINAIRES. ARCHITECTURAL DRAWINGS AND ELEVATIONS SHALL TAKE PRECEDENCE WHERE ELECTRICAL DRAWINGS VARY FROM ARCHITECTURAL.
3. USE #10 AWG COPPER WIRE FOR ALL SITE WIRING, UNLESS NOTED OTHERWISE.
4. REFER TO LIGHTING PLAN FOR BUILDING MOUNTED EXTERIOR LUMINAIRES.

KEY NOTES (THIS SHEET)

1. NEW PAD-MOUNTED UTILITY TRANSFORMER BY KCP&L. MOUNT ON KCP&L APPROVED CONCRETE EQUIPMENT PAD, IN ACCORDANCE WITH ALL KCP&L CLEARANCE AND ACCESSIBILITY REQUIREMENTS. COORDINATE LOCATION WITH CIVIL DRAWINGS.
2. C.T. CABINET RATED 600A. NEMA 3R ENCLOSURE, AND UTILITY ELECTRIC METER. INSTALL PER KCP&L REQUIREMENTS.



A3 TYPICAL SITE POLE FIXTURE DETAIL
N.T.S.



A1 ELECTRICAL SITE PLAN
1" = 30'-0"

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PACKAGE **04**

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STATE OF MISSOURI · R. DAVID HARTZLER · E-23187 · REGISTERED PROFESSIONAL ENGINEER
1/14/2019
R. David Hartzler, Engineer MO 023187

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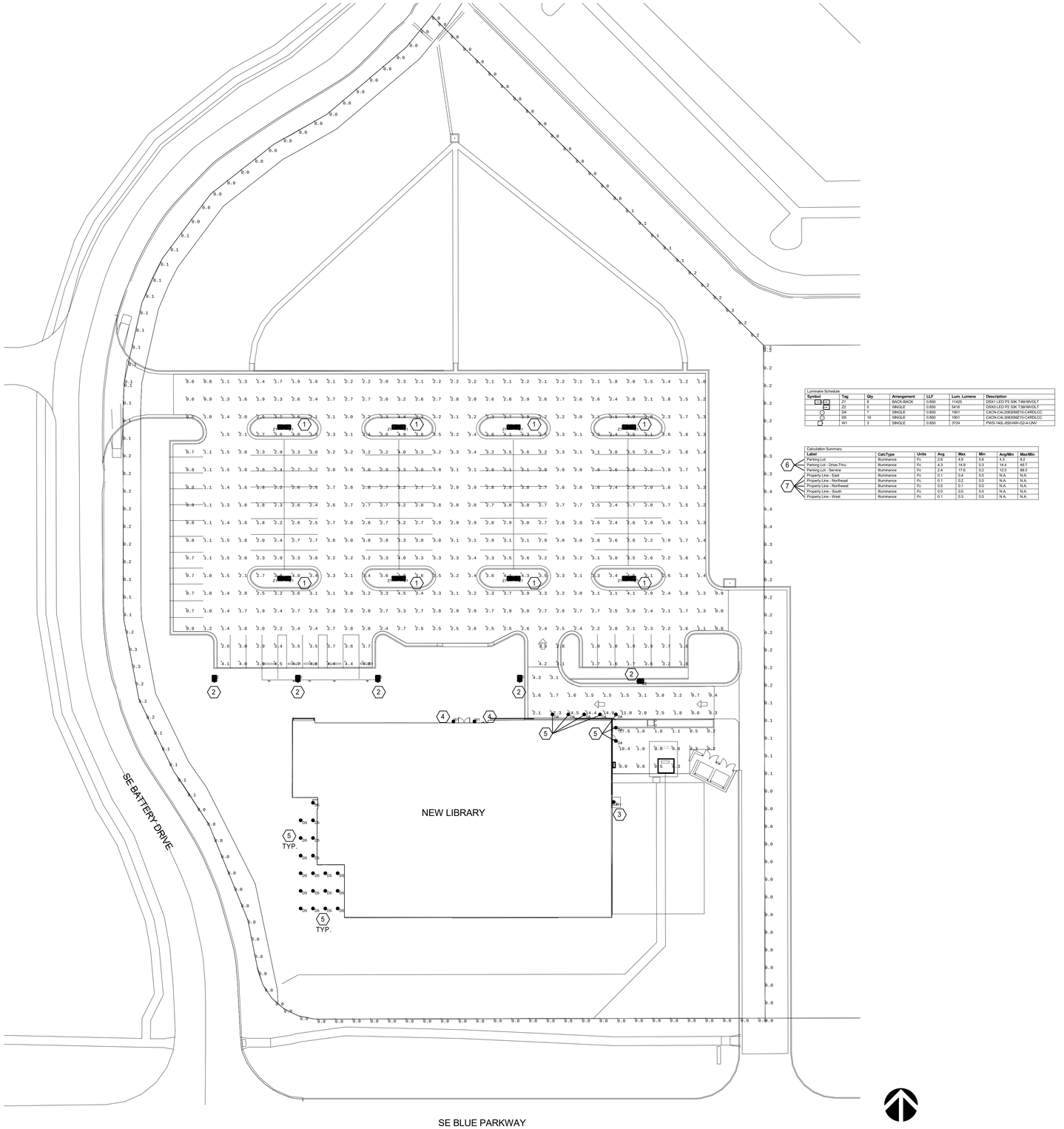
Missouri State Certificate of Authority # 2002002733

Revision No.	Description	Date

Project No.	Date	Drawn
1013-004	01-14-2019	AP

Drawing No.
ES101
ELECTRICAL SITE PLAN



Luminaire Schedule

Symbol	Tag	Qty	Arrangement	LLF	Lum. Lumens	Description
	Z1	8	BACK-BACK	0.850	11425	DSX1 LED P3 30K T4M MVOLT
	Z2	5	SINGLE	0.850	5416	DSX0 LED P3 30K T4M MVOLT
	D4	7	SINGLE	0.850	1901	CAON-C4L20830MZ10-C4RDLCC
	D5	19	SINGLE	0.850	1901	CAON-C4L30830MZ10-C4RDLCC
	W1	3	SINGLE	0.850	3724	PWS-140L-650-NW-G2-4-UNV

Calculation Summary

Label	CalcType	Units	Avg	Max	Min	Avg/Min	Max/Min
Parking Lot	Illuminance	Fc	2.6	4.9	0.6	4.3	8.2
Parking Lot - Drive-Thru	Illuminance	Fc	4.3	14.9	0.3	14.4	49.7
Parking Lot - Service	Illuminance	Fc	2.4	17.6	0.2	12.0	88.0
Property Line - East	Illuminance	Fc	0.1	0.4	0.0	N.A.	N.A.
Property Line - Northeast	Illuminance	Fc	0.1	0.2	0.0	N.A.	N.A.
Property Line - Northwest	Illuminance	Fc	0.0	0.1	0.0	N.A.	N.A.
Property Line - South	Illuminance	Fc	0.0	0.0	0.0	N.A.	N.A.
Property Line - West	Illuminance	Fc	0.1	0.3	0.0	N.A.	N.A.

GENERAL NOTES (THIS SHEET)

1. SEE SHEET ES101 FOR LEGEND AND ADDITIONAL GENERAL NOTES.
2. COORDINATE WITH ARCHITECTURAL DRAWINGS AND ELEVATIONS FOR LOCATIONS AND MOUNTING HEIGHTS OF ALL LUMINAIRES. ARCHITECTURAL DRAWINGS AND ELEVATIONS SHALL TAKE PRECEDENCE WHERE ELECTRICAL DRAWINGS VARY FROM ARCHITECTURAL.
3. PER IESNA LIGHTING HANDBOOK (9TH ED.), EXCERPTS FROM FIGURE 22-21: "FOR THE PURPOSE OF PROPERTY SECURITY, IT IS DESIRABLE THAT THE MINIMUM (LOW POINT) VALUE NOT BE LESS THAN 0.1 HORIZONTAL-FOOTCANDLES."

KEY NOTES (X) (THIS SHEET)

1. POLE HEIGHT FOR TYPE Z1 FIXTURES IS 25'-0".
2. POLE HEIGHT FOR TYPE Z2 FIXTURES IS 12'-0".
3. WALL MOUNT FIXTURE AT 10'-0" AFF.
4. WALL MOUNT FIXTURE AT 14'-0" AFF.
5. MOUNT DOWNLIGHT FIXTURE TYPES D4 AND D5 RECESSED IN CANOPY OVERHAND DIRECTLY ABOVE. SEE ARCHITECTURAL ELEVATION FOR HEIGHTS.
6. THE CALCULATED MINIMUM ILLUMINANCE VALUES (Min) FOR THE LISTED ZONES EXCEEDS THE IES RECOMMENDATION IN ALL ACTIVELY-LIT AREAS. SIMILARLY, THE CALCULATED AVERAGE ILLUMINACE VALUES (Avg) MEETS OR EXCEEDS THE IEs RECOMMENDED VALUES.
7. THE CALCULATED MAXIMUM ILLUMINANCE VALUES (Max) AT THE SITE PROPERTY LINES DO NOT EXCEED 0.5 FOOTCANDLES (FC), PER THE REQUIREMENTS OF LOCAL DESIGN CRITERIA.

1 PHOTOMETRIC PLAN
1" = 30'-0"

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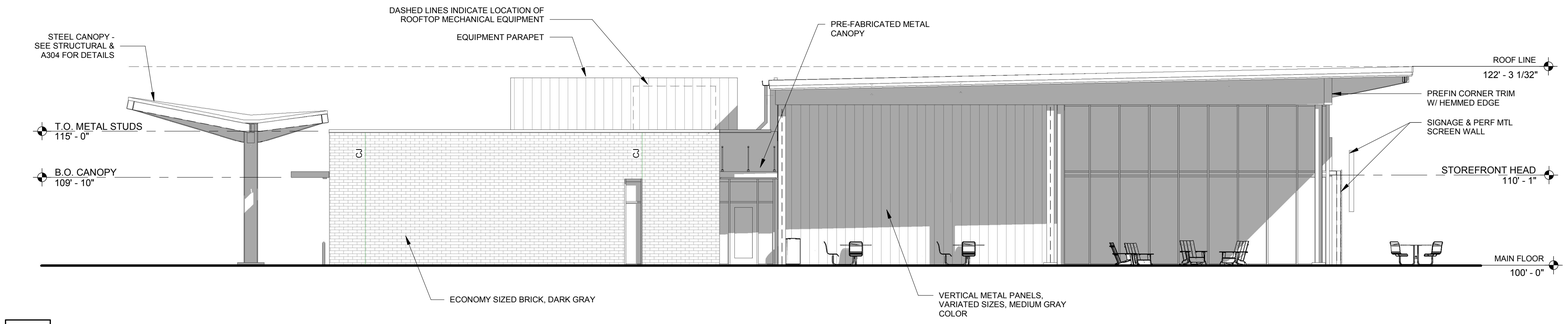
Revision No.	Description	Date

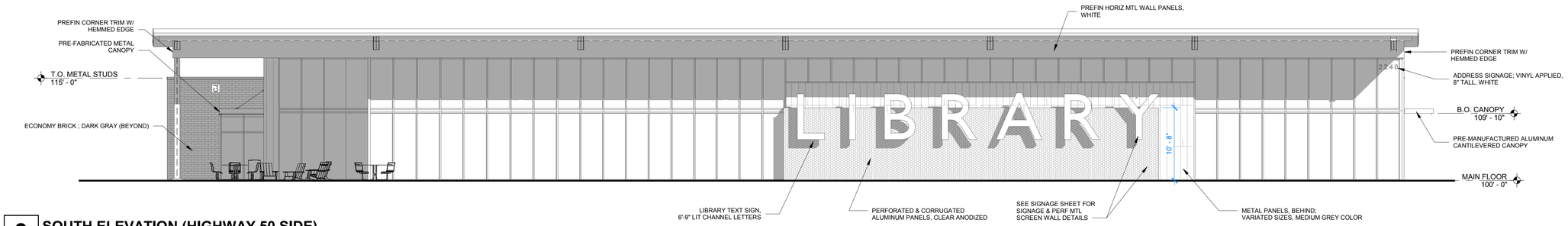
Project No.	Date	Drawn
1013-004	01-14-2019	AE

Drawing No.
ES102
PHOTOMETRIC PLAN



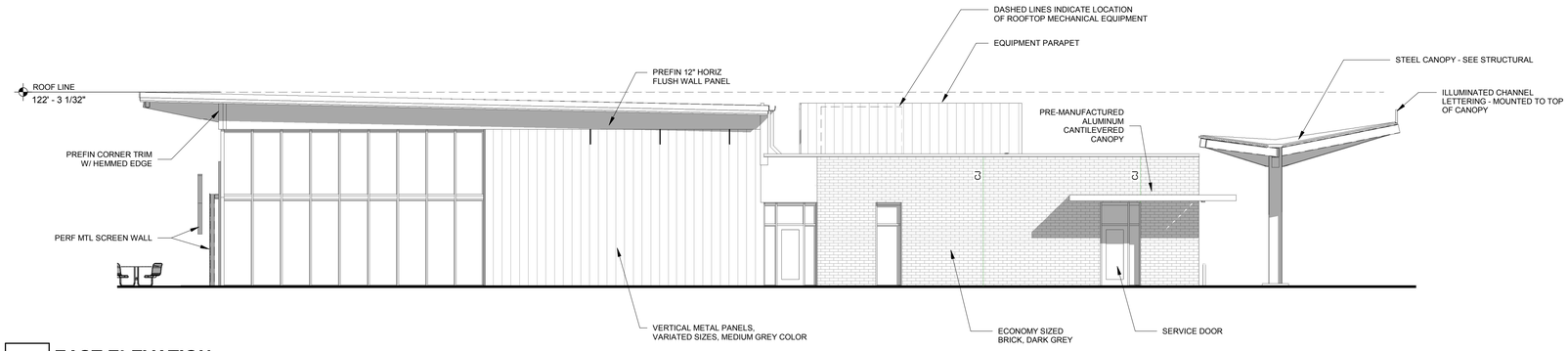
4 WEST ELEVATION

1/8" = 1'-0"



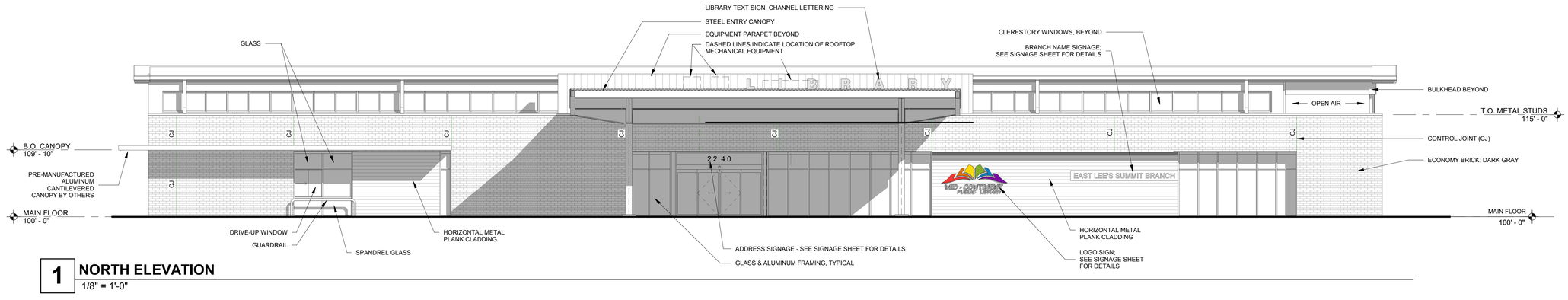
3 SOUTH ELEVATION (HIGHWAY 50 SIDE)

1/8" = 1'-0"



2 EAST ELEVATION

1/8" = 1'-0"



1 NORTH ELEVATION

1/8" = 1'-0"

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MICHAEL JAMES SAPP
NUMBER A-5051
REGISTERED ARCHITECT

1-16-2019

Michael James Sapp, Architect MO A-5051

Revision No.	Description	Date

Project No.	Date	Drawn
WP04	12-07-2018	Author

Drawing No.

FDP1

ELEVATIONS

VIEW OF NORTH FACADE

VIEW OF SOUTH FACADE

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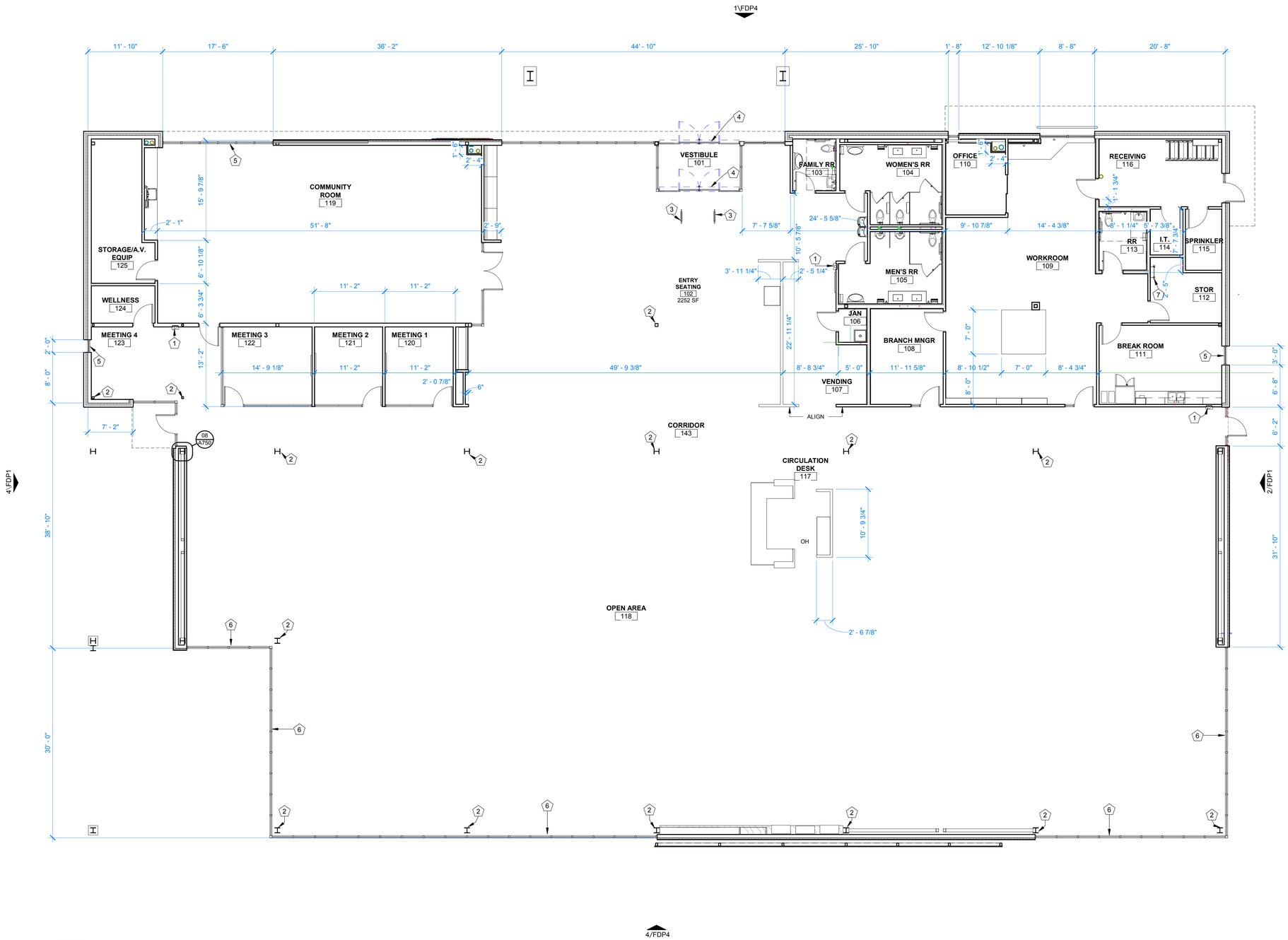
Revision No.	Description	Date

Project No.	Date	Drawn
WP04	12-07-2018	Author

Drawing No.

FDP2

EXTERIOR RENDERINGS



1 MAIN FLOOR PLAN

1/8" = 1'-0"

KEYNOTES

1	SEMI RECESSED FIRE EXTINGUISHER, CABINET AND EXTINGUISHER - SEE SPEC.
2	PAINTED EXPOSED STEEL COLUMNS - SEE STRUCTURAL
3	RFID SECURITY GATES PROVIDED BY OWNER
4	AUTOMATIC SLIDING DOOR SYSTEM, REFER TO DOOR & WINDOW SCHEDULE. SEE SPECIFICATIONS FOR MORE INFORMATION
5	INSTALL MECHOSHADE RECESSED POCKET WITH WHITE FASCIA AND MANUAL THERMOVEIL BASKET WEAVE 1300 SERIES SHADE (5% OPEN) COLOR: SILVER BIRCH THE FULL WIDTH AND HEIGHT OF THE STOREFRONT OPENING, PER SPECIFICATIONS. ENSURE SEAMS OF SHADE PANELS ARE CENTERED ON THE MULLIONS OF THE STOREFRONT
6	INSTALL MOTORIZED MECHOSHADE EXPOSED POCKET IN SATIN ANODIZED ALUM FINISH WITH THERMOVEIL BASKET WEAVE 1300 SERIES SHADE (5% OPEN) COLOR: SILVER BIRCH THE FULL WIDTH AND HEIGHT OF THE STOREFRONT OPENING, PER SPECIFICATIONS. ENSURE SEAMS OF SHADE PANELS ARE CENTERED ON THE MULLIONS OF THE STOREFRONT
7	ROOF ACCESS LADDER TO MEET OSHA FALL PROTECTION REGULATIONS, SEE SPECS

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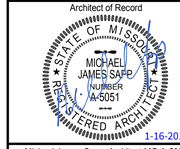
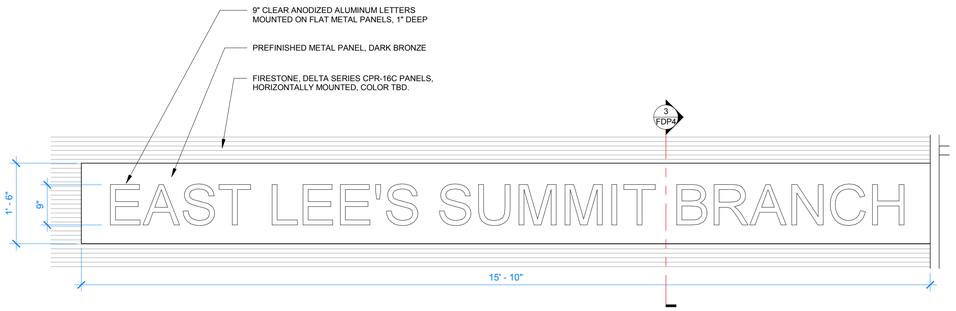


Michael James Sapp, Architect MO A-5051

Revision No.	Description	Date
1	ASI001	01-14-2019

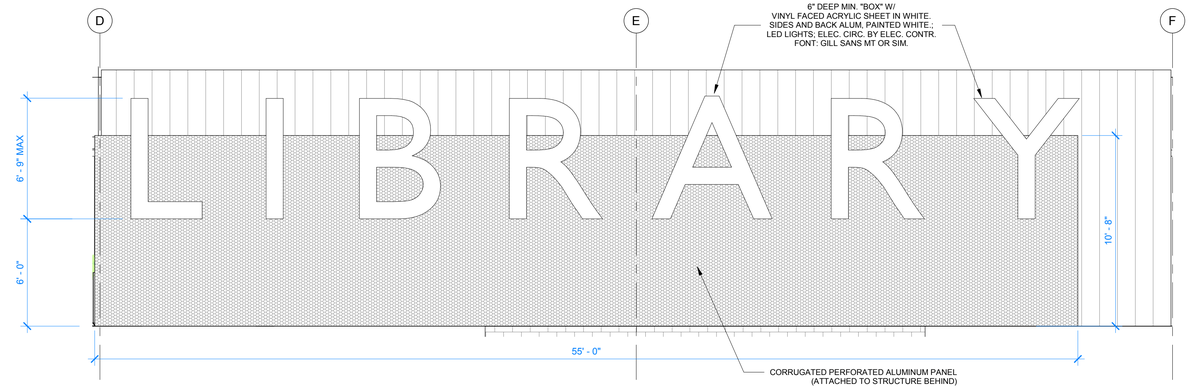
Project No.	Date	Drawn
WP04	12-07-2018	Author

Drawing No.
FDP3
FLOOR PLAN



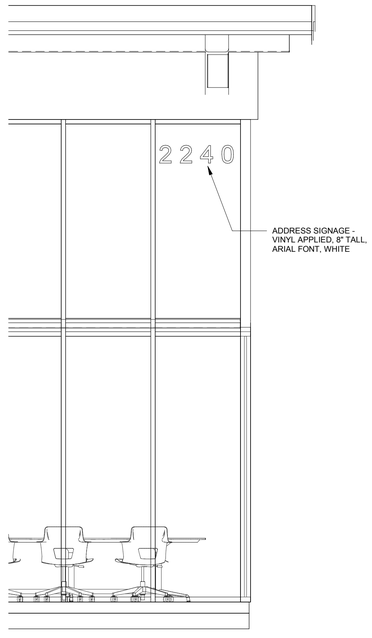
6 BRANCH NAME SIGNAGE

3/4" = 1'-0"



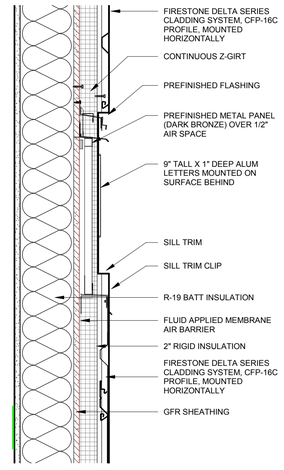
5 BUILDING WALL SIGN - SOUTH FACADE

1/4" = 1'-0"



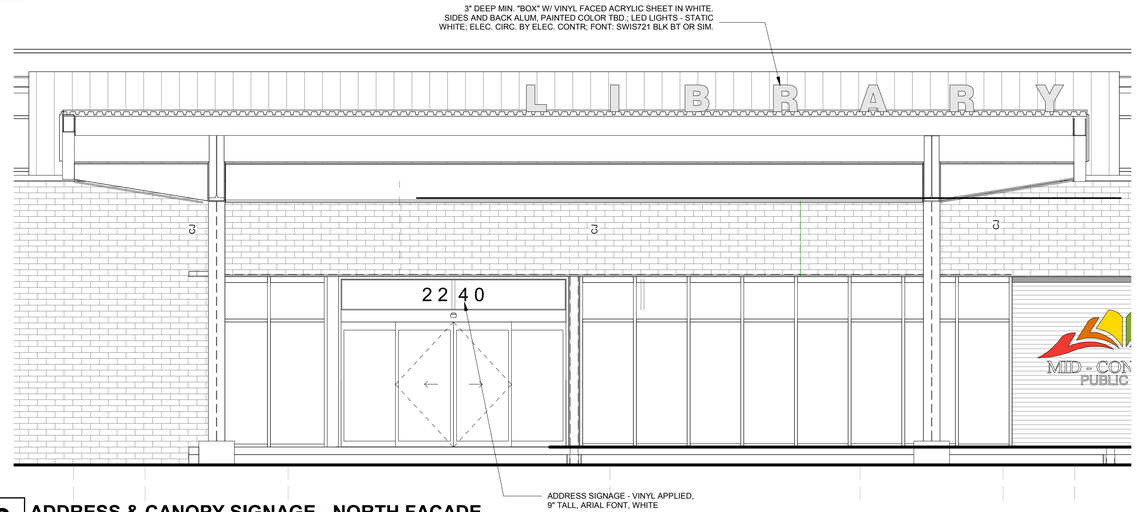
4 ADDRESS SIGNAGE - SOUTH FACADE

3/8" = 1'-0"



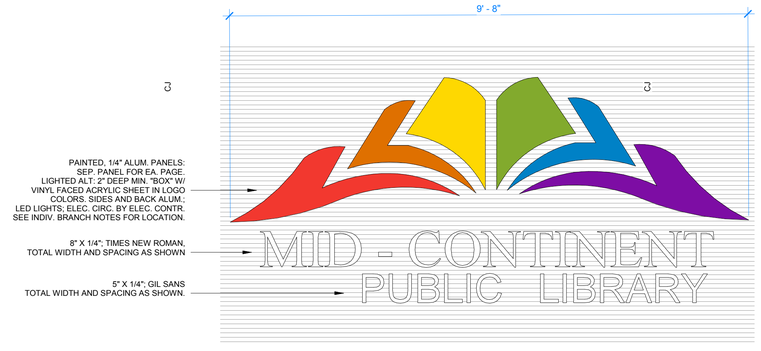
3 SECTION @ NORTH SIGNAGE WALL

1 1/2" = 1'-0"



2 ADDRESS & CANOPY SIGNAGE - NORTH FACADE

1/4" = 1'-0"



1 MCPL LOGO SIGNAGE (SIM TO BL-1)

3/4" = 1'-0"

GENERAL SIGNAGE NOTES:

1. PROVIDE LAYOUT DRAWING OF EACH SIGN SHOWING SIZE, SPACING, ETC. PROVIDE SAMPLE OF LETTER TYPES AND MATERIALS.
2. PRODUCTS TO BE SIMILAR OR EQUAL TO PRODUCTS BY GEMINI, OR EQ. COLORS AS SELECTED BY ARCHITECT FOR LETTERS.
3. ARCH TO PROVIDE LAYOUT FILE FOR LOGO, AND PANTONE COLORS TO BE MATCHED BY FABRICATOR.
4. BRANCH NAME AND ADDRESS LETTERS ARE 1" THICK CAST ALUM. OR ACRYLIC; COLOR BY ARCH FROM STANDARD COLORS, MIN. 8 COLORS. CONCEALED MOUNTING.
5. CONFIRM MOUNTING CONDITIONS AND ANCHOR TYPES FOR EACH TYPE OF SIGN PRIOR TO INSTALLATION. ALL ANCHORS ARE TO BE CONCEALED PINS AND STUDS. ALL ANCHORS ARE TO BE WATER TIGHT AND WEATHER PROOF.
6. PROVIDE PROPER BACKING & MOUNTING METHOD AT METAL SIDING TO AVOID DEROMING OR DAMAGE TO SIDING.
7. SIGN "BOXES": CONSTRUCT OF SHT MTG TYPE AND SIZE AS NEC.; WATER TIGHT, MINIMAL VISIBLE JOINTS, CONCEALED FASTENING; BRACING AND SUPPORTS AS REQUIRED; KYNAR FINISH OR EQ.; OR MAY BE PREFAB UNITS EQUAL TO MAPES. PROVIDE SHOP DRAWINGS.
8. PROVIDE ONE YR. FABRICATOR'S WARRANTY; AND MFR'S STANDARD WNTY. ON PRODUCT.
9. LIGHTED ALTERNATES: PROVIDE POWER FROM NEAREST VIABLE NON-SWITCHED CIRCUIT; INCLUDE TIME CLOCK AT APPROVED ACCESSIBLE LOCATION IN CLOSET OR UTILITY AREA.

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1-16-2019
Michael James Sapp, Architect MO A-5051

Revision No.	Description	Date

Project No.	Date	Drawn
WP04	12-07-2018	Author

Drawing No.
FDP4
SIGNAGE

AIR OUTLET AND INLET SCHEDULE

MARK	MANUFACTURER	MODEL	TYPE	MODULE SIZE	RUN-OUT DIA. (IN.)	NECK DIA. (IN.)	MAX. CFM	MATERIAL	BORDER	MAX. NC	MAX. TSP ("WC)	NOTES
D-1 D-1D	PRICE	ASPD	FULL FACE MODULE DIFFUSER DROPPED SQUARE PLAQUE	24"x24"	8	6	200	ALUMINUM	LAY-IN OR SURFACE (REF: RCP)	25	0.1	1,2,3,4,9
					10	8	320					
					12	10	400					
					14	12	475					
					16	14	560					
D-2 D-2D	PRICE	PDS	PERFORATED MODULE SUPPLY	SEE PLANS	SEE PLANS	SEE PLANS	SEE PLANS	ALUMINUM	LAY-IN OR SURFACE (REF: RCP)	25	0.1"	1,3,4,9
D-3 D-3D	PRICE	ASCD	FULL FACE MODULE DIFFUSER SQUARE CONE	12"x12"	8	6	180	ALUMINUM	LAY-IN OR SURFACE (REF: RCP)	25	0.1	1,2,3,4,9
					10	8	260					
D-4	PRICE	SDG	SPIRAL DUCT SUPPLY GRILLE	SEE PLANS	SEE PLANS	SEE PLANS	SEE PLANS	ALUMINUM	SPIRAL DUCT	25	0.1"	3,4,8
E-1 E-1D	PRICE	APDDR	PERFORATED MODULE EXHAUST	24"x24"	8x8	8x8	200	ALUMINUM	LAY-IN OR SURFACE (REF: RCP)	25	0.1	1,3,4,9
					10x10	10x10	360					
					12x12	12x12	590					
					14x14	14x14	890					
					16x16	16x16	1270					
					18x18	18x18	1730					
E-2 E-2D	PRICE	APDDR	PERFORATED MODULE EXHAUST	12"x12"	8x8	8x8	200	ALUMINUM	LAY-IN OR SURFACE (REF: RCP)	25	0.1	1,3,4,9
E-3 E-3D	PRICE	735HDSS	SIDEWALL EXHAUST GRILLE - 45° DEFLECTION	SEE PLANS	SEE PLANS	SEE PLANS	SEE PLANS	STAINLESS STEEL	SURFACE	25	0.1	3,4,9
LR-1 LR-1D LR-1L	PRICE	AS210 ASPI210 UPL	LINEAR SLOT RETURN WITH ENGINEERED PLENUM/ LOW-PROFILE PLENUM	48" 1-SLOT	8	6 [4x7]	160	ALUMINUM	LAY-IN OR SURFACE (REF: RCP)	25	0.3	1,3,4,5,6,8,9
					10	8 [4x10.125]	210					
LS-1 LS-1D LS-1L(D)	PRICE	AS210 ASPI210 UPL	LINEAR SLOT DIFFUSER WITH ENGINEERED PLENUM/ LOW-PROFILE PLENUM	48" 1-SLOT	8	6 [4x7]	160	ALUMINUM	LAY-IN OR SURFACE (REF: RCP)	25	0.3	1,3,4,5,6,9
					10	8 [4x10.125]	210					
R-1 R-1D	PRICE	APDDR	PERFORATED MODULE RETURN	24"x24"	8x8	8x8	260	ALUMINUM	LAY-IN OR SURFACE (REF: RCP)	25	0.1	1,3,4,9
					10x10	10x10	470					
					12x12	12x12	760					
					14x14	14x14	1140					
					16x16	16x16	1630					
					18x18	18x18	2220					
R-2 R-2D	PRICE	APDDR	PERFORATED MODULE RETURN	12"x12"	8x8	8x8	250	ALUMINUM	LAY-IN OR SURFACE (REF: RCP)	25	0.1	1,3,4,9
R-3 R-3D	PRICE	735HDSS	SIDEWALL EXHAUST GRILLE - 45° DEFLECTION	SEE PLANS	SEE PLANS	SEE PLANS	SEE PLANS	STAINLESS STEEL	SURFACE	25	0.1	3,4,9

NOTES:

1. FLUSH FACE PANEL.
2. 4-WAY AIR THROW PATTERN, UNLESS STATED OTHERWISE.
3. PROVIDE WITH REMOTE OR FACE OPERATED DAMPER REGULATOR IN AREAS WITH INACCESSIBLE CEILINGS / WALLS (REFERENCE "D" SUFFIX MARK).
4. CONTRACTOR TO COORDINATE AND CONFIRM BORDER AND MOUNTING TYPE WITH ARCHITECTURAL PLANS PRIOR TO ORDERING.
5. PROVIDE WITH MANUFACTURER'S INSULATED ENGINEERED PLENUM.
6. PROVIDE WITH MANUFACTURER'S INSULATED LOW-PROFILE PLENUM AND OVAL NECK CONNECTION [#x#] IN AREAS WHERE REQUIRED (REFERENCE "L" SUFFIX MARK).
7. ADJUST AIR PATTERN CONTROLLER FOR HORIZONTAL THROW IN DIRECTION SHOWN ON PLANS.
8. PROVIDE WITH SIGHT BAFFLE.
9. COORDINATE FINISH WITH ARCHITECT.

1/4/2019

CONDENSING UNIT SCHEDULE

MARK	MANUFACTURER	MODEL	DESCRIPTION	TOTAL COOLING CAPACITY (MBH)	HEATING CAPACITY (MBH)	CONDENSING TEMP RANGE (°F)		EFFICIENCY (NONDUCTED/DUCTED)		ELECTRICAL DATA				WEIGHT (LBS)	NOTES
						HIGH	LOW	EER	IEER	VOLTS	PH	MCA	MOCP		
CU-1	DAIKIN	REYQ288TATJU		276.9	253.9	100	0	11.8/10.5	21.6/18.6					1587.4	1-6
		- REYQ144TAYDU	HEAT RECOVERY							460	3	31.9	40		
		- REYQ144TAYDU	HEAT RECOVERY							460	3	31.9	40		
CU-2	DAIKIN	RXYQ336TATJU		303.7	247.0	100	0	9.5/9.5	20.6/18.5					1419.8	1-6
		- RXYQ168TAYDU	HEAT PUMP							460	3	25.9	35		
		- RXYQ168TAYDU	HEAT PUMP							460	3	25.9	35		

NOTES:

1. PROVIDE WITH REFRIGERANT R-410A.
2. PROVIDE REFRIGERANT PIPING TO INDOOR UNIT PER MANUFACTURERS REQUIREMENT.
3. PROVIDE WITH HAIL GUARD AND STANDARD WIND BAFFLE.
4. WARRANTY: 5-YEARS COMPRESSOR, 5-YEARS PARTS AND 5-YEARS LABOR FROM DATE OF START-UP.
5. VERIFY EXACT REFRIGERANT LINE SIZES WITH MANUFACTURER.
6. PROVIDE WITH FACTORY MOUNTED CONTROLS

1/8/2019

BRANCH SELECTOR UNIT

MARK	MANUFACTURER	MODEL	SERVES	ELECTRICAL CONNECTION DATA					WT (lbs)	NOTES
				VOLTS	PH	HZ	MCA	MOCP		
BS-1	DAIKIN	BS12Q54TVJ	CU-1	208	1	60	1.2	15	105.8	1-2
BS-2	DAIKIN	BS8Q54TVJ	CU-1	208	1	60	0.8	15	72.8	1-2

NOTES:

1. ENSURE VALVE NOISE LEVEL IS BELOW 50 DB WHILE IN OPERATION.
2. PROVIDE WITH FACTORY MOUNTED CONTROLS

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PACKAGE 04

Engineer of Record

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Revision No.	Description	Date
1	ASI 01	2019-01-14

Project No.	Date	Drawn
1013-004	08-16-2018	SE

Drawing No.

1 M701
MECHANICAL SCHEDULES

DEDICATED OUTDOOR AIR SYSTEM UNIT SCHEDULE

MARK	MANUF. AND MODEL	FAN DATA AIRSTREAM	DESIGN AIR (CFM)	ESP (in. w.g.)	FAN HP	ENERGY RECOVERY WHEEL COOLING RECOVERED CAPACITY MBH	HEATING RECOVERED CAPACITY MBH	EAT COOLING/HEATING	LAT COOLING/HEATING	APD (in w.g.)	DX COOLING EAT (DB/WB)	LAT (DB/WB)	TOTAL CAP (MBH)	SENSIBLE CAP (MBH)	AMBIENT TEMP (DB)	REF.	GAS HEATING TYPE	SIZE	STAGES	TOTAL CAP (MBH)	EER	ELECTRICAL DATA VOLTS	PH	FLA	W x H x L SIZE (in.)	WEIGHT (LBS.)	NOTES
DOAS-1	DPS015A	Supply	3960	1	4	109.3	198.1	95.8/2.4	82.0/39.8	0.9	82.0/68.2	54.7/54.6	169.0	118.5	100.0	R410A	GAS	200 MBH	10:1 TURNDOWN	160.0	10.8	460	3	68.8	96.5 X 56.8 X 111.0	2723	1-7
		Exhaust	3570	1	0.17																						

NOTES:

1. RETURN AIR BYPASS DAMPER IS NOT PROVIDED, BLANK-OFF.
2. AIR-FLOW MEASURING STATIONS TO BE MOUNTED IN UNIT OR PROVIDE PIEZO RINGS TO MEASURE AND CONTROL AIR SUPPLIED AND RETURNED FROM THE SPACE (VOLUME TRACKING).
3. PROVIDE A SINGLE VFD FOR EACH SUPPLY AND RETURN FAN ARRAY. ONE VFD PER FAN.
4. PROVIDE MERV 8 FOR THE OUTSIDE AIR INTAKE.
5. PROVIDE MERV 8 FILTRATION ON THE EXHAUST AIRSTREAM
6. PROVIDE ACCESS TO EACH SECTION, LIGHTS, CONROL CIRCUIT, ELECTRICAL PANEL WITH SINGLE POINT 460/3/60 ELECTRICAL SERVICE
7. PROVIDE WITH FACTORY MOUNTED CONTROLS
8. PROVIDE WITH HOT GAS REHEAT SECTION

INDOOR UNIT SCHEDULE

MARK	MANUFACTURER	MODEL	SERVED BY	OA CFM	MAX CFM	TOTAL COOLING CAPACITY (BTU/H)	HEATING CAPACITY (BTU/H)	ELECTRICAL DATA VOLTS	PH	MCA	MOCP	WEIGHT (LBS)	NOTES
FC-1	DAIKIN	FXAQ07PVJU	CU-1	-	260	6,433	5,441	208	1	0.3	15	26.5	1-6
FC-2A	DAIKIN	FXFQ30TVJU	CU-1	-	1,112	25,794	19,055	208	1	1.3	15	57.3	1-6
FC-2B	DAIKIN	FXFQ30TVJU	CU-1	-	1,112	25,794	19,055	208	1	1.3	15	57.3	1-6
FC-2C	DAIKIN	FXFQ30TVJU	CU-1	-	1,112	25,794	19,055	208	1	1.3	15	57.3	1-6
FC-2D	DAIKIN	FXFQ30TVJU	CU-1	-	1,112	25,794	19,055	208	1	1.3	15	57.3	1-6
FC-3	DAIKIN	FXZQ05TAVJU	CU-1	20	300	5,004	4,265	208	1	0.3	15	35.3	1-6
FC-4	DAIKIN	FXZQ07TAVJU	CU-1	60	307	6,596	5,133	208	1	0.3	15	35.3	1-6
FC-5	DAIKIN	FXZQ05TAVJU	CU-1	50	300	5,004	4,265	208	1	0.3	15	35.3	1-6
FC-6	DAIKIN	FXZQ05TAVJU	CU-1	40	300	5,004	4,265	208	1	0.3	15	35.3	1-6
FC-7	DAIKIN	FXMQ72MVJU	CU-1	360	2,048	61,895	47,752	208	1	9.0	15	302.0	1-7
FC-8	DAIKIN	FXSQ05TAVJU	CU-1	-	281	5,248	4,284	208	1	0.8	15	55.0	1-7
FC-9	DAIKIN	FXSQ05TAVJU	CU-1	-	281	5,248	4,284	208	1	0.8	15	55.0	1-7
FC-10	DAIKIN	FXZQ05TAVJU	CU-1	40	300	5,004	4,265	208	1	0.3	15	35.3	1-6
FC-11	DAIKIN	FXZQ05TAVJU	CU-1	30	300	5,004	4,265	208	1	0.3	15	35.3	1-6
FC-12	DAIKIN	FXSQ30TAVJU	CU-1	150	742	21,051	15,210	208	1	1.8	15	82.0	1-7
FC-13A	DAIKIN	FXFQ48TVJU	CU-1	20	1,220	41,284	29,886	208	1	1.8	15	104.0	1-6
FC-13B	DAIKIN	FXFQ48TVJU	CU-1	-	1,220	41,284	29,886	208	1	1.8	15	57.3	1-6
FC-14	DAIKIN	FXSQ05TAVJU	CU-1	10	281	5,248	4,284	208	1	0.8	15	55.0	1-6
FC-15	DAIKIN	FXZQ15TAVJU	CU-1	60	405	13,079	9,333	208	1	0.4	15	36.4	1-6
FC-16	DAIKIN	FXSQ48TAVJU	CU-2	130	1310	39,183	29,688	208	1	2.8	15	104.0	1-7
FC-17A	DAIKIN	FXSQ48TAVJU	CU-2	220	1310	39,183	29,688	208	1	2.8	15	104.0	1-7
FC-17B	DAIKIN	FXSQ48TAVJU	CU-2	130	1310	39,183	29,688	208	1	2.8	15	104.0	1-7
FC-18	DAIKIN	FXSQ54TAVJU	CU-2	330	1310	44,084	33,404	208	1	3.3	15	104.0	1-7
FC-19	DAIKIN	FXSQ54TAVJU	CU-2	360	1380	44,084	33,404	208	1	3.3	15	104.0	1-7
FC-20	DAIKIN	FXSQ54TAVJU	CU-2	360	1380	44,084	33,404	208	1	3.3	15	104.0	1-7
FC-21A	DAIKIN	FXSQ48TAVJU	CU-2	200	1310	39,183	29,688	208	1	2.8	15	104.0	1-7
FC-21B	DAIKIN	FXSQ54TAVJU	CU-2	160	1380	44,084	33,404	208	1	3.3	15	104.0	1-7

NOTES

1. PROVIDE UNIT WITH WALL MOUNTED THERMOSTAT.
2. PROVIDE REFRIGERANT PIPING TO CONDENSING UNIT PER MANUFACTURERS REQUIREMENTS.
3. WARRANTY: 5-YEARS PARTS AND 5-YEARS LABOR FROM THE DATE OF START-UP.
4. PROVIDE WITH CONDENSATE FLOAT TO SHUT DOWN UNIT AT OVERFLOW CONDITIONS.
5. PROVIDE WITH INTEGRAL CONDENSATE PUMP ACCESSORY.
6. PROVIDE WITH INTEGRAL DISCONNECT.
7. CONTRACTOR TO FIELD INSTALL FILTER BOXES.

1/14/2019

ELECTRIC UNIT HEATER SCHEDULE

MARK	MANUFACTURER	MODEL	SERVES	KW	CAPACITY (BTUh)	ELECTRICAL VOLTS	PH	MCA	TEMP RISE (°F)	CFM	WEIGHT (LBS.)	NOTES
UH-1	QMARK	CDF-558		5.0	17.1	208	1	24.0	45	300	27	1-3

NOTES:

1. MECHANICAL CONTRACTOR TO PROVIDE WITH REMOTE THERMOSTAT.
2. CONTRACTOR TO COORDINATE AND CONFIRM BORDER AND MOUNTING TYPE WITH ARCHITECTURAL PLANS PRIOR TO ORDERING.
3. PROVIDE WITH MANUFACTURER'S RECOMMENDED CLEARANCES.

1/11/2019

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Revision No.	Description	Date
1	ASI 01	2019-01-14

Project No.	Date	Drawn
1013-004	08-16-2018	SE

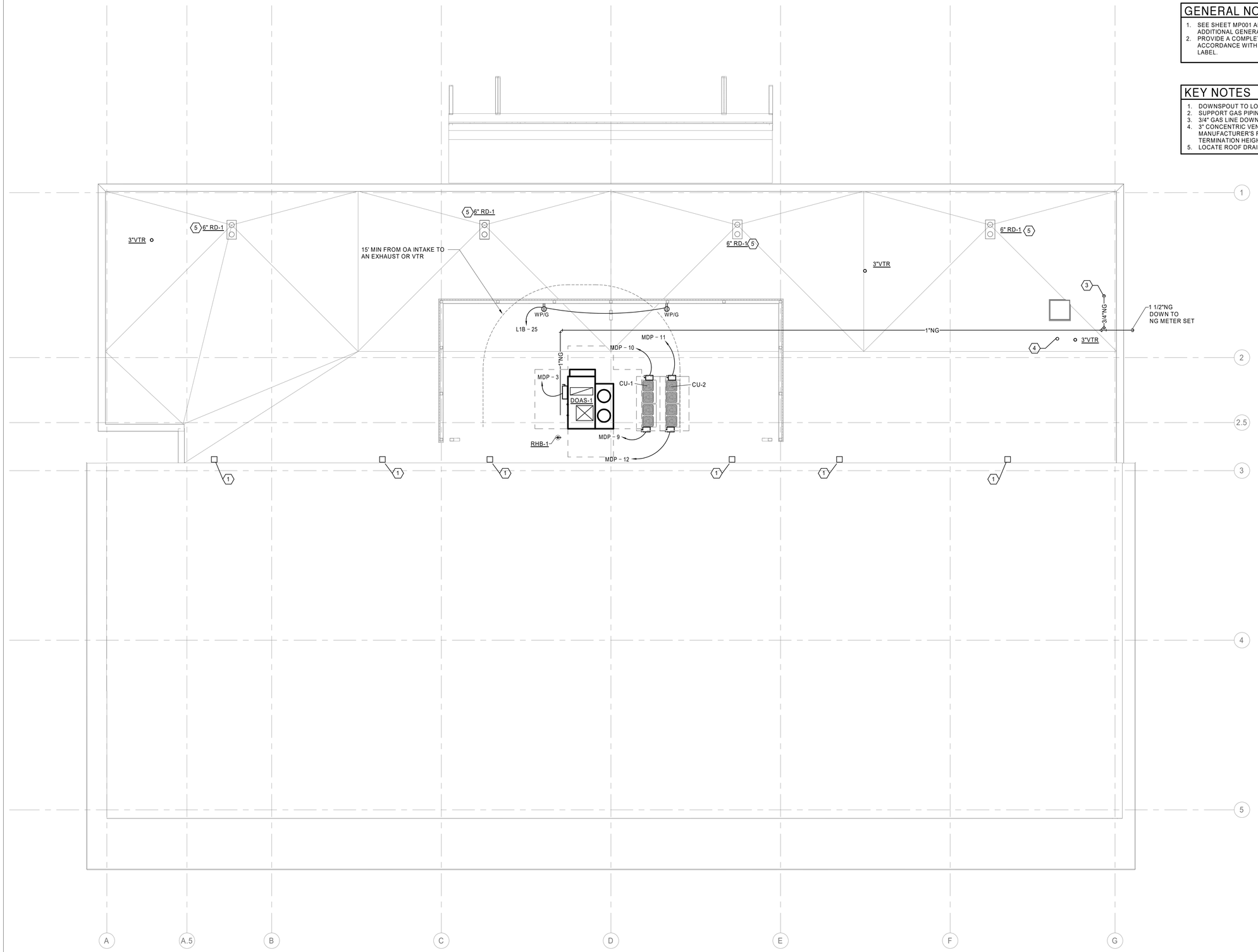
Drawing No.
M702
MECHANICAL SCHEDULES

GENERAL NOTES (THIS SHEET)

1. SEE SHEET MP001 AND SHEET E001 FOR LEGENDS AND ADDITIONAL GENERAL NOTES.
2. PROVIDE A COMPLETE LIGHTNING PROTECTION SYSTEM IN ACCORDANCE WITH NFPA 780. FURNISH WITH UL MASTER LABEL.

KEY NOTES (THIS SHEET)

1. DOWNSPOUT TO LOWER ROOF. SEE ARCHITECTURAL PLANS.
2. SUPPORT GAS PIPING PER DETAIL 5 ON SHEET P502.
3. 3/4" GAS LINE DOWN TO WH-1.
4. 3" CONCENTRIC VENT. INSTALL CONCENTRIC VENT PER MANUFACTURER'S RECOMMENDATION. ENSURE TERMINATION HEIGHT IS 1' ABOVE ANTICIPATED SNOW LEVEL.
5. LOCATE ROOF DRAIN ON FLAT AREA OF ROOF.



A1 MEP ROOF PLAN
1/8" = 1'-0"

0 4' 8' 16'

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Revision No.	Description	Date
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1013-004	08-16-2018	MEG

Drawing No.
1
MEP101
MEP ROOF PLAN

D-Series Size 1
LED Area Luminaire

Catalog Number

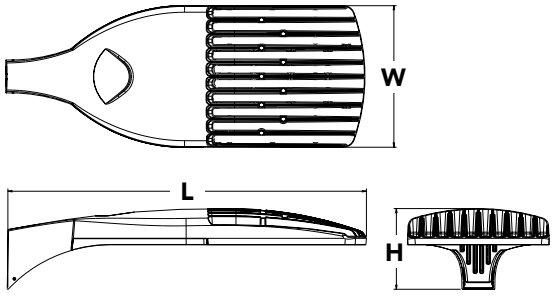
Notes

Type TYPE Z1

Hit the Tab key or mouse over the page to see all interactive elements.

Specifications

EPA:	1.01 ft² (0.09 m²)
Length:	33″ (83.8 cm)
Width:	13″ (33.0 cm)
Height:	7-1/2″ (19.0 cm)
Weight (max):	27 lbs (12.2 kg)



A+ Capable Luminaire

This item is an A+ capable luminaire, which has been designed and tested to provide consistent color appearance and system-level interoperability.

- All configurations of this luminaire meet the Acuity Brands' specification for chromatic consistency
- This luminaire is A+ Certified when ordered with DTL® controls marked by a shaded background. DTL DLL equipped luminaires meet the A+ specification for luminaire to photocontrol interoperability1
- This luminaire is part of an A+ Certified solution for ROAM® or XPoint™ Wireless control networks, providing out-of-the-box control compatibility with simple commissioning, when ordered with drivers and control options marked by a shaded background[1]

To learn more about A+, visit www.acuitybrands.com/aplus.

1. See ordering tree for details.
2. A+ Certified Solutions for ROAM require the order of one ROAM node per luminaire. Sold Separately: Link to Roam; Link to DTL DLL

A+ Capable options indicated by this color background.

Ordering Information

EXAMPLE: DSX1 LED P7 40K T3M MVOLT SPA DDBXD

DSX1LED

Series
DSX1 LED

LEDs
Forward optics
P1 P4 P7
P2 P5 P8
P3 P6 P9
Rotated optics
P10[1] P12[1]
P11[1] P13[1]

Color temperature
30K 3000 K
40K 4000 K
50K 5000 K
AMBPC Amber phosphor converted[2]

Distribution
T1S Type I short
T2S Type II short
T2M Type II medium
T3S Type III short
T3M Type III medium
T4M Type IV medium
TFTM Forward throw medium
T5VS Type V very short
T5S Type V short
T5M Type V medium
T5W Type V wide
BLC Backlight control[2,3]
LCCO Left corner cutoff[2,3]
RCCO Right corner cutoff[2,3]

Voltage
MVOLT[4,5]
120[6]
208[5,6]
240[5,6]
277[6]
347[5,6,7]
480[5,6,7]

Mounting
Shipped included
SPA Square pole mounting
RPA Round pole mounting
WBA Wall bracket
SPUMBA Square pole universal mounting adaptor[8]
RPUMBA Round pole universal mounting adaptor[8]
Shipped separately
KMA8 DDBXD U Mast arm mounting bracket adaptor (specify finish)[9]

Control options
Shipped installed
NLTAIR2 nLight AIR generation 2 enabled[10]
PER NEMA twist-lock receptacle only (controls ordered separate)[11]
PER5 Five-wire receptacle only (controls ordered separate)[11,12]
PER7 Seven-wire receptacle only (controls ordered separate)[11,12]
DMG 0-10V dimming extend out back of housing for external control (leads exit fixture)
DS Dual switching[13,14]
PIR Bi-level, motion/ambient sensor, 8-15' mounting height, ambient sensor enabled at 5fc[5,15,16]
PIRH Bi-level, motion/ambient sensor, 15-30' mounting height, ambient sensor enabled at 5fc[5,15,16]
PIRHN Network, Bi-Level motion/ambient sensor[17]
PIR1FC3V Bi-level, motion/ambient sensor, 8-15' mounting height, ambient sensor enabled at 1fc[5,15,16]
PIRH1FC3V Bi-level, motion/ambient sensor, 15-30' mounting height, ambient sensor enabled at 1fc[5,15,16]
BL30 Bi-level switched dimming, 30%[5,14,18]
BL50 Bi-level switched dimming, 50%[5,14,18]
PNMTDD3 Part night, dim till dawn[5,19]
PNMT5D3 Part night, dim 5 hrs[5,19]
PNMT6D3 Part night, dim 6 hrs[5,19]
PNMT7D3 Part night, dim 7 hrs[5,19]
FAO Field adjustable output[20]

Other options
Shipped installed
HS House-side shield[21]
SF Single fuse (120, 277, 347V)[6]
DF Double fuse (208, 240, 480V)[6]
L90 Left rotated optics[1]
R90 Right rotated optics[1]
Shipped separately
BS Bird spikes[22]
EGS External glare shield[22]

Finish *(required)*
DDBXD Dark bronze
DBLXD Black
DNAXD Natural aluminum
DWHXD White
DDBTXD Textured dark bronze
DBLBXD Textured black
DNATXD Textured natural aluminum
DWHGXD Textured white

Ordering Information

Accessories

Ordered and shipped separately.

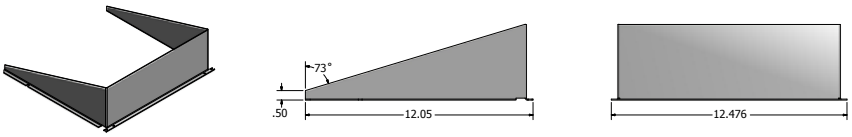
DLL127F 1.5 JU	Photocell - SSL twist-lock (120-277V) [23]
DLL347F 1.5 CUL JU	Photocell - SSL twist-lock (347V) [23]
DLL480F 1.5 CUL JU	Photocell - SSL twist-lock (480V) [23]
DSHORT SBK U	Shorting cap [23]
DSX1HS 30C U	House-side shield for 30 LED unit[21]
DSX1HS 40C U	House-side shield for 40 LED unit[21]
DSX1HS 60C U	House-side shield for 60 LED unit[21]
PUMBA DDBXD U*	Square and round pole universal mounting bracket (specify finish)[24]
KMA8 DDBXD U	Mast arm mounting bracket adaptor (specify finish) [8]

For more control options, visit DTL and ROAM online.

NOTES

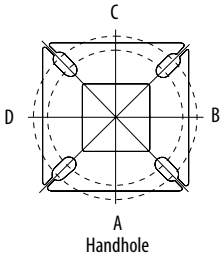
1 P10, P11, P12 or P13 and rotated optics (L90, R90) only available together.
2 AMBPC is not available with BLC, LCCO, RCCO or P4, P7, P8, P9 or P13.
3 Not available with HS.
4 MVOLT driver operates on any line voltage from 120-277V (50/60 Hz).
5 Any PIRx with BL30, BL50 or PNMT, is not available with 208V, 240V, 347V, 480V or MVOLT. It is only available in 120V or 277V specified.
6 Single fuse (SF) requires 120V, 277V or 347V. Double fuse (DF) requires 208V, 240V or 480V.
7 Not available in P1 or P10. Not available with BL30, BL50 or PNMT options.
8 Existing drilled pole only. Available as a separate combination accessory; for retrofit use only: PUMBA (finish) U; 1.5 G vibration load rating per ANCI C136.31.
9 Must order fixture with SPA option. Must be ordered as a separate accessory; see Accessories information. For use with 2-3/8" mast arm (not included).
10 Must be ordered with PIRHN.
11 Photocell ordered and shipped as a separate line item from Acuity Brands Controls. See accessories. Not available with DS option. Shorting cap included.
12 If ROAM® node required, it must be ordered and shipped as a separate line item from Acuity Brands Controls. Not available with DCR. Node with integral dimming. Shorting cap included.
13 Provides 50/50fixture operation via (2) independent drivers. Not available with PER, PER5, PER7, PIR or PIRH. Not available P1, P2, P3, P4 or P5.
14 Requires (2) separately switched circuits.
15 Reference Motion Sensor table on page 3.
16 Reference PER table on page 3 to see functionality.
17 Must be ordered with NLTAIR2. For more information on nLight Air 2 visit this link.
18 Not available with 347V, 480V, PNMT, DS. For PER5 or PER7, see PER Table on page 3. Requires isolated neutral.
19 Not available with 347V, 480V, DS, BL30, BL50. For PER5 or PER7, see PER Table on page 3. Separate Dusk to Dawn required.
20 Not available with other dimming controls options
21 Not available with BLC, LCCO and RCCO distribution. Also available as a separate accessory; see Accessories information.
22 Must be ordered with fixture for factory pre-drilling.
23 Requires luminaire to be specified with PER, PER5 or PER7 option. See PER Table on page 3.
24 For retrofit use only.

External Glare Shield

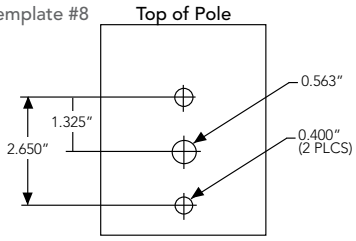


Drilling

HANDHOLE ORIENTATION



Template #8



Tenon Mounting Slipfitter **

Tenon O.D.	Single Unit	2 at 180°	2 at 90°	3 at 120°	3 at 90°	4 at 90°
2-3/8"	AST20-190	AST20-280	AST20-290	AST20-320	AST20-390	AST20-490
2-7/8"	AST25-190	AST25-280	AST25-290	AST25-320	AST25-390	AST25-490
4"	AST35-190	AST35-280	AST35-290	AST35-320	AST35-390	AST35-490

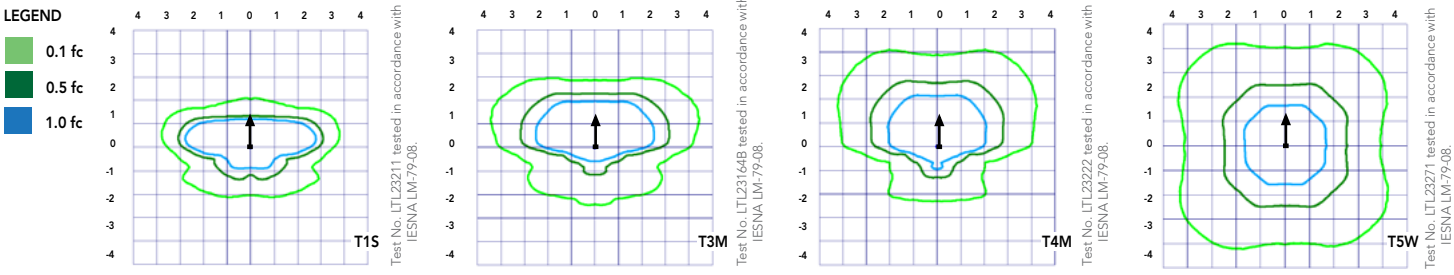
Pole drilling nomenclature: # of heads at degree from handhole (default side A)					
DM19AS	DM28AS	DM29AS	DM32AS	DM39AS	DM49AS
1 @ 90°	2 @ 280°	2 @ 90°	3 @ 120°	3 @ 90°	4 @ 90°
Side B	Side B & D	Side B & C	Round pole only	Side B, C, & D	Sides A, B, C, D
Note: Review luminaire spec sheet for specific nomenclature					

Pole top or tenon O.D.	4.5" @ 90°	4" @ 90°	3.5" @ 90°	3" @ 90°	4.5" @ 120°	4" @ 120°	3.5" @ 120°	3" @ 120°
DSX SPA	Y	Y	Y	N	-	-	-	-
DSX RPA	Y	Y	N	N	Y	Y	Y	Y
DSX SPUMBA	Y	N	N	N	-	-	-	-
DSX RPUMBA	N	N	N	N	Y	Y	Y	N
					*3 fixtures @120 require round pole top/tenon.			

Photometric Diagrams

To see complete photometric reports or download .ies files for this product, visit Lithonia Lighting's D-Series Area Size 1 homepage.

Isofootcandle plots for the DSX1 LED 60C 1000 40K. Distances are in units of mounting height (25').



Performance Data

Lumen Ambient Temperature (LAT) Multipliers

Use these factors to determine relative lumen output for average ambient temperatures from 0-40°C (32-104°F).

Ambient		Lumen Multiplier
0°C	32°F	1.04
5°C	41°F	1.04
10°C	50°F	1.03
15°C	50°F	1.02
20°C	68°F	1.01
25°C	**77°F**	**1.00**
30°C	86°F	0.99
35°C	95°F	0.98
40°C	104°F	0.97

Projected LED Lumen Maintenance

Data references the extrapolated performance projections for the platforms noted in a **25°C ambient**, based on 10,000 hours of LED testing (tested per IESNA LM-80-08 and projected per IESNA TM-21-11).

To calculate LLF, use the lumen maintenance factor that corresponds to the desired number of operating hours below. For other lumen maintenance values, contact factory.

Operating Hours	0	25000	50000	100000
Lumen Maintenance Factor	1.00	0.96	0.92	0.85

Electrical Load

					Current (A)					
	Performance Package	LED Count	Drive Current	Wattage	120	208	240	277	347	480
Forward Optics (Non-Rotated)	P1	30	530	54	0.45	0.26	0.23	0.19	0.10	0.12
	P2	30	700	70	0.59	0.34	0.30	0.25	0.20	0.16
	P3	30	1050	102	0.86	0.50	0.44	0.38	0.30	0.22
	P4	30	1250	125	1.06	0.60	0.52	0.46	0.37	0.27
	P5	30	1400	138	1.16	0.67	0.58	0.51	0.40	0.29
	P6	40	1250	163	1.36	0.78	0.68	0.59	0.47	0.34
	P7	40	1400	183	1.53	0.88	0.76	0.66	0.53	0.38
	P8	60	1050	207	1.74	0.98	0.87	0.76	0.64	0.49
	P9	60	1250	241	2.01	1.16	1.01	0.89	0.70	0.51
Rotated Optics (Requires L90 or R90)	P10	60	530	106	0.90	0.52	0.47	0.43	0.33	0.27
	P11	60	700	137	1.15	0.67	0.60	0.53	0.42	0.32
	P12	60	1050	207	1.74	0.99	0.87	0.76	0.60	0.46
	P13	60	1250	231	1.93	1.12	0.97	0.86	0.67	0.49

Motion Sensor Default Settings						
Option	Dimmed State	High Level (when triggered)	Photocell Operation	Dwell Time	Ramp-up Time	Ramp-down Time
PIR or PIRH	3V (37%) Output	10V (100%) Output	Enabled @ 5FC	5 min	3 sec	5 min
*PIR1FC3V or PIRH1FC3V	3V (37%) Output	10V (100%) Output	Enabled @ 1FC	5 min	3 sec	5 min
*for use with Inline Dusk to Dawn or timer.						

PER Table						
Control	PER (3 wire)	PER5 (5 wire)		PER7 (7 wire)		
			Wire 4/Wire5		Wire 4/Wire5	Wire 6/Wire7
Photocontrol Only (On/Off)	✔	⚠	Wired to dimming leads on driver	⚠	Wired to dimming leads on driver	Wires Capped inside fixture
ROAM	⊘	✔	Wired to dimming leads on driver	⚠	Wired to dimming leads on driver	Wires Capped inside fixture
ROAM with Motion (ROAM on/off only)	⊘	⚠	Wires Capped inside fixture	⚠	Wires Capped inside fixture	Wires Capped inside fixture
Future-proof*	⊘	⚠	Wired to dimming leads on driver	✔	Wired to dimming leads on driver	Wires Capped inside fixture
Future-proof* with Motion	⊘	⚠	Wires Capped inside fixture	✔	Wires Capped inside fixture	Wires Capped inside fixture

✔ Recommended
⊘ Will not work
⚠ Alternate

*Future-proof means: Ability to change controls in the future.

Performance Data

Lumen Output

Lumen values are from photometric tests performed in accordance with IESNA LM-79-08. Data is considered to be representative of the configurations shown, within the tolerances allowed by Lighting Facts. Contact factory for performance data on any configurations not shown here.

Forward Optics

LED Count	Drive Current	Power Package	System Watts	Dist. Type	30K (3000 K, 70 CRI)					40K (4000 K, 70 CRI)					50K (5000 K, 70 CRI)					AMBPC (Amber Phosphor Converted)				
					Lumens	B	U	G	LPW	Lumens	B	U	G	LPW	Lumens	B	U	G	LPW	Lumens	B	U	G	LPW
30	530	P1	54W	T1S	6,457	2	0	2	120	6,956	2	0	2	129	7,044	2	0	2	130	3,640	1	0	1	70
				T2S	6,450	2	0	2	119	6,949	2	0	2	129	7,037	2	0	2	130	3,813	1	0	1	73
				T2M	6,483	1	0	1	120	6,984	2	0	2	129	7,073	2	0	2	131	3,689	1	0	1	71
				T3S	6,279	2	0	2	116	6,764	2	0	2	125	6,850	2	0	2	127	3,770	1	0	1	73
				T3M	6,468	1	0	2	120	6,967	1	0	2	129	7,056	1	0	2	131	3,752	1	0	1	72
				T4M	6,327	1	0	2	117	6,816	1	0	2	126	6,902	1	0	2	128	3,758	1	0	1	72
				TFTM	6,464	1	0	2	120	6,963	1	0	2	129	7,051	1	0	2	131	3,701	1	0	1	71
				T5VS	6,722	2	0	0	124	7,242	3	0	0	134	7,334	3	0	0	136	3,928	2	0	0	76
				T5S	6,728	2	0	1	125	7,248	2	0	1	134	7,340	2	0	1	136	3,881	2	0	0	75
				T5M	6,711	3	0	1	124	7,229	3	0	1	134	7,321	3	0	2	136	3,930	2	0	1	76
				T5W	6,667	3	0	2	123	7,182	3	0	2	133	7,273	3	0	2	135	3,820	3	0	1	73
				BLC	5,299	1	0	1	98	5,709	1	0	2	106	5,781	1	0	2	107					
				LCCO	3,943	1	0	2	73	4,248	1	0	2	79	4,302	1	0	2	80					
				RCCO	3,943	1	0	2	73	4,248	1	0	2	79	4,302	1	0	2	80					
30	700	P2	70W	T1S	8,249	2	0	2	118	8,886	2	0	2	127	8,999	2	0	2	129	4,561	1	0	1	67
				T2S	8,240	2	0	2	118	8,877	2	0	2	127	8,989	2	0	2	128	4,777	1	0	1	70
				T2M	8,283	2	0	2	118	8,923	2	0	2	127	9,036	2	0	2	129	4,622	1	0	2	68
				T3S	8,021	2	0	2	115	8,641	2	0	2	123	8,751	2	0	2	125	4,724	1	0	1	69
				T3M	8,263	2	0	2	118	8,901	2	0	2	127	9,014	2	0	2	129	4,701	1	0	2	69
				T4M	8,083	2	0	2	115	8,708	2	0	2	124	8,818	2	0	2	126	4,709	1	0	2	69
				TFTM	8,257	2	0	2	118	8,896	2	0	2	127	9,008	2	0	2	129	4,638	1	0	2	68
				T5VS	8,588	3	0	0	123	9,252	3	0	0	132	9,369	3	0	0	134	4,922	2	0	0	72
				T5S	8,595	3	0	1	123	9,259	3	0	1	132	9,376	3	0	1	134	4,863	2	0	0	72
				T5M	8,573	3	0	2	122	9,236	3	0	2	132	9,353	3	0	2	134	4,924	3	0	1	72
				T5W	8,517	3	0	2	122	9,175	4	0	2	131	9,291	4	0	2	133	4,787	3	0	1	70
				BLC	6,770	1	0	2	97	7,293	1	0	2	104	7,386	1	0	2	106					
				LCCO	5,038	1	0	2	72	5,427	1	0	2	78	5,496	1	0	2	79					
				RCCO	5,038	1	0	2	72	5,427	1	0	2	78	5,496	1	0	2	79					
30	1050	P3	102W	T1S	11,661	2	0	2	114	12,562	3	0	3	123	12,721	3	0	3	125					
				T2S	11,648	2	0	2	114	12,548	3	0	3	123	12,707	3	0	3	125					
				T2M	11,708	2	0	2	115	12,613	2	0	2	124	12,773	2	0	2	125					
				T3S	11,339	2	0	2	111	12,215	3	0	3	120	12,370	3	0	3	121					
				T3M	11,680	2	0	2	115	12,582	2	0	2	123	12,742	2	0	2	125					
				T4M	11,426	2	0	3	112	12,309	2	0	3	121	12,465	2	0	3	122					
				TFTM	11,673	2	0	2	114	12,575	2	0	3	123	12,734	2	0	3	125					
				T5VS	12,140	3	0	1	119	13,078	3	0	1	128	13,244	3	0	1	130					
				T5S	12,150	3	0	1	119	13,089	3	0	1	128	13,254	3	0	1	130					
				T5M	12,119	4	0	2	119	13,056	4	0	2	128	13,221	4	0	2	130					
				T5W	12,040	4	0	3	118	12,970	4	0	3	127	13,134	4	0	3	129					
				BLC	9,570	1	0	2	94	10,310	1	0	2	101	10,440	1	0	2	102					
				LCCO	7,121	1	0	3	70	7,671	1	0	3	75	7,768	1	0	3	76					
				RCCO	7,121	1	0	3	70	7,671	1	0	3	75	7,768	1	0	3	76					
30	1250	P4	125W	T1S	13,435	3	0	3	107	14,473	3	0	3	116	14,657	3	0	3	117					
				T2S	13,421	3	0	3	107	14,458	3	0	3	116	14,641	3	0	3	117					
				T2M	13,490	2	0	2	108	14,532	3	0	3	116	14,716	3	0	3	118					
				T3S	13,064	3	0	3	105	14,074	3	0	3	113	14,252	3	0	3	114					
				T3M	13,457	2	0	2	108	14,497	2	0	2	116	14,681	2	0	2	117					
				T4M	13,165	2	0	3	105	14,182	2	0	3	113	14,362	2	0	3	115					
				TFTM	13,449	2	0	3	108	14,488	2	0	3	116	14,672	2	0	3	117					
				T5VS	13,987	4	0	1	112	15,068	4	0	1	121	15,259	4	0	1	122					
				T5S	13,999	3	0	1	112	15,080	3	0	1	121	15,271	3	0	1	122					
				T5M	13,963	4	0	2	112	15,042	4	0	2	120	15,233	4	0	2	122					
				T5W	13,872	4	0	3	111	14,944	4	0	3	120	15,133	4	0	3	121					
				BLC	11,027	1	0	2	88	11,879	1	0	2	95	12,029	1	0	2	96					
				LCCO	8,205	1	0	3	66	8,839	1	0	3	71	8,951	1	0	3	72					
				RCCO	8,205	1	0	3	66	8,839	1	0	3	71	8,951	1	0	3	72					
30	1400	P5	138W	T1S	14,679	3	0	3	106	15,814	3	0	3	115	16,014	3	0	3	116					
				T2S	14,664	3	0	3	106	15,797	3	0	3	114	15,997	3	0	3	116					
				T2M	14,739	3	0	3	107	15,878	3	0	3	115	16,079	3	0	3	117					
				T3S	14,274	3	0	3	103	15,377	3	0	3	111	15,572	3	0	3	113					
				T3M	14,704	2	0	3	107	15,840	3	0	3	115	16,040	3	0	3	116					
				T4M	14,384	2	0	3	104	15,496	3	0	3	112	15,692	3	0	3	114					
				TFTM	14,695	2	0	3	106	15,830	3	0	3	115	16,030	3	0	3	116					
				T5VS	15,283	4	0	1	111	16,464	4	0	1	119	16,672	4	0	1	121					
				T5S	15,295	3	0	1	111	16,477	4	0	1	119	16,686	4	0	1	121					
				T5M	15,257	4	0	2	111	16,435	4	0	2	119	16,644	4	0	2	121					
				T5W	15,157	4	0	3	110	16,328	4	0	3	118	16,534	4	0	3	120					
				BLC	12,048	1	0	2	87	12,979	1	0	2	94	13,143	1	0	2	95					
				LCCO	8,965	1	0	3	65	9,657	1	0	3	70	9,780	1	0	3	71					
					8,965	1	0	3	65	9,657	1	0	3	70	9,780	1	0	3	71					

Performance Data

Lumen Output

Lumen values are from photometric tests performed in accordance with IESNA LM-79-08. Data is considered to be representative of the configurations shown, within the tolerances allowed by Lighting Facts. Contact factory for performance data on any configurations not shown here.

Forward Optics

LED Count	Drive Current	Power Package	System Watts	Dist. Type	30K (3000 K, 70 CRI)					40K (4000 K, 70 CRI)					50K (5000 K, 70 CRI)					AMBPC (Amber Phosphor Converted)				
					Lumens	B	U	G	LPW	Lumens	B	U	G	LPW	Lumens	B	U	G	LPW	Lumens	B	U	G	LPW
40	1250	P6	163W	T1S	17,654	3	0	3	108	19,018	3	0	3	117	19,259	3	0	3	118					
				T2S	17,635	3	0	3	108	18,998	3	0	3	117	19,238	3	0	3	118					
				T2M	17,726	3	0	3	109	19,096	3	0	3	117	19,337	3	0	3	119					
				T3S	17,167	3	0	3	105	18,493	3	0	3	113	18,727	3	0	3	115					
				T3M	17,683	3	0	3	108	19,049	3	0	3	117	19,290	3	0	3	118					
				T4M	17,299	3	0	3	106	18,635	3	0	4	114	18,871	3	0	4	116					
				TFTM	17,672	3	0	3	108	19,038	3	0	4	117	19,279	3	0	4	118					
				T5VS	18,379	4	0	1	113	19,800	4	0	1	121	20,050	4	0	1	123					
				T5S	18,394	4	0	2	113	19,816	4	0	2	122	20,066	4	0	2	123					
				T5M	18,348	4	0	2	113	19,766	4	0	2	121	20,016	4	0	2	123					
				T5W	18,228	5	0	3	112	19,636	5	0	3	120	19,885	5	0	3	122					
				BLC	14,489	2	0	2	89	15,609	2	0	3	96	15,806	2	0	3	97					
				LCCO	10,781	1	0	3	66	11,614	1	0	3	71	11,761	2	0	3	72					
				RCCO	10,781	1	0	3	66	11,614	1	0	3	71	11,761	2	0	3	72					
40	1400	P7	183W	T1S	19,227	3	0	3	105	20,712	3	0	3	113	20,975	3	0	3	115					
				T2S	19,206	3	0	3	105	20,690	3	0	3	113	20,952	3	0	3	114					
				T2M	19,305	3	0	3	105	20,797	3	0	3	114	21,060	3	0	3	115					
				T3S	18,696	3	0	3	102	20,141	3	0	3	110	20,396	3	0	4	111					
				T3M	19,258	3	0	3	105	20,746	3	0	3	113	21,009	3	0	3	115					
				T4M	18,840	3	0	4	103	20,296	3	0	4	111	20,553	3	0	4	112					
				TFTM	19,246	3	0	4	105	20,734	3	0	4	113	20,996	3	0	4	115					
				T5VS	20,017	4	0	1	109	21,564	4	0	1	118	21,837	4	0	1	119					
				T5S	20,033	4	0	2	109	21,581	4	0	2	118	21,854	4	0	2	119					
				T5M	19,983	4	0	2	109	21,527	5	0	3	118	21,799	5	0	3	119					
				T5W	19,852	5	0	3	108	21,386	5	0	3	117	21,656	5	0	3	118					
				BLC	15,780	2	0	3	86	16,999	2	0	3	93	17,214	2	0	3	94					
				LCCO	11,742	2	0	3	64	12,649	2	0	3	69	12,809	2	0	3	70					
				RCCO	11,742	2	0	3	64	12,649	2	0	3	69	12,809	2	0	3	70					
60	1050	P8	207W	T1S	22,490	3	0	3	109	24,228	3	0	3	117	24,535	3	0	3	119					
				T2S	22,466	3	0	4	109	24,202	3	0	4	117	24,509	3	0	4	118					
				T2M	22,582	3	0	3	109	24,327	3	0	3	118	24,635	3	0	3	119					
				T3S	21,870	3	0	4	106	23,560	3	0	4	114	23,858	3	0	4	115					
				T3M	22,527	3	0	4	109	24,268	3	0	4	117	24,575	3	0	4	119					
				T4M	22,038	3	0	4	106	23,741	3	0	4	115	24,041	3	0	4	116					
				TFTM	22,513	3	0	4	109	24,253	3	0	4	117	24,560	3	0	4	119					
				T5VS	23,415	5	0	1	113	25,224	5	0	1	122	25,543	5	0	1	123					
				T5S	23,434	4	0	2	113	25,244	4	0	2	122	25,564	4	0	2	123					
				T5M	23,374	5	0	3	113	25,181	5	0	3	122	25,499	5	0	3	123					
				T5W	23,221	5	0	4	112	25,016	5	0	4	121	25,332	5	0	4	122					
				BLC	18,458	2	0	3	89	19,885	2	0	3	96	20,136	2	0	3	97					
				LCCO	13,735	2	0	3	66	14,796	2	0	4	71	14,983	2	0	4	72					
				RCCO	13,735	2	0	3	66	14,796	2	0	4	71	14,983	2	0	4	72					
60	1250	P9	241W	T1S	25,575	3	0	3	106	27,551	3	0	3	114	27,900	3	0	3	116					
				T2S	25,548	3	0	4	106	27,522	3	0	4	114	27,871	3	0	4	116					
				T2M	25,680	3	0	3	107	27,664	3	0	3	115	28,014	3	0	3	116					
				T3S	24,870	3	0	4	103	26,791	3	0	4	111	27,130	3	0	4	113					
				T3M	25,617	3	0	4	106	27,597	3	0	4	115	27,946	3	0	4	116					
				T4M	25,061	3	0	4	104	26,997	3	0	4	112	27,339	3	0	4	113					
				TFTM	25,602	3	0	4	106	27,580	3	0	4	114	27,929	3	0	4	116					
				T5VS	26,626	5	0	1	110	28,684	5	0	1	119	29,047	5	0	1	121					
				T5S	26,648	4	0	2	111	28,707	5	0	2	119	29,070	5	0	2	121					
				T5M	26,581	5	0	3	110	28,635	5	0	3	119	28,997	5	0	3	120					
				T5W	26,406	5	0	4	110	28,447	5	0	4	118	28,807	5	0	4	120					
				BLC	20,990	2	0	3	87	22,612	2	0	3	94	22,898	2	0	3	95					
				LCCO	15,619	2	0	4	65	16,825	2	0	4	70	17,038	2	0	4	71					
					15,619	2	0	4	65	16,825	2	0	4	70	17,038	2	0	4	71					

Performance Data

Lumen Output

Lumen values are from photometric tests performed in accordance with IESNA LM-79-08. Data is considered to be representative of the configurations shown, within the tolerances allowed by Lighting Facts. Contact factory for performance data on any configurations not shown here.

Rotated Optics

LED Count	Drive Current	Power Package	System Watts	Dist. Type	30K (3000 K, 70 CRI)					40K (4000 K, 70 CRI)					50K (5000 K, 70 CRI)					AMBPC (Amber Phosphor Converted)				
					Lumens	B	U	G	LPW	Lumens	B	U	G	LPW	Lumens	B	U	G	LPW	Lumens	B	U	G	LPW
60	530	**P10**	106W	T1S	13,042	3	0	3	123	14,050	3	0	3	133	14,228	3	0	3	134	7,167	2	0	2	72
				T2S	12,967	4	0	4	122	13,969	4	0	4	132	14,146	4	0	4	133	7,507	2	0	2	76
				T2M	13,201	3	0	3	125	14,221	3	0	3	134	14,401	3	0	3	136	7,263	2	0	2	73
				T3S	12,766	4	0	4	120	13,752	4	0	4	130	13,926	4	0	4	131	7,424	2	0	2	75
				T3M	13,193	4	0	4	124	14,213	4	0	4	134	14,393	4	0	4	136	7,387	2	0	2	75
				T4M	12,944	4	0	4	122	13,945	4	0	4	132	14,121	4	0	4	133	7,400	2	0	2	75
				TFTM	13,279	4	0	4	125	14,305	4	0	4	135	14,486	4	0	4	137	7,288	1	0	2	74
				T5VS	13,372	3	0	1	126	14,405	4	0	1	136	14,588	4	0	1	138	7,734	3	0	1	78
				T5S	13,260	3	0	1	125	14,284	3	0	1	135	14,465	3	0	1	136	7,641	3	0	0	77
				T5M	13,256	4	0	2	125	14,281	4	0	2	135	14,462	4	0	2	136	7,737	3	0	2	78
				T5W	13,137	4	0	3	124	14,153	4	0	3	134	14,332	4	0	3	135	7,522	3	0	2	76
				BLC	10,906	3	0	3	103	11,749	3	0	3	111	11,898	3	0	3	112					
				LCCO	7,789	1	0	3	73	8,391	1	0	3	79	8,497	1	0	3	80					
				RCCO	7,779	4	0	4	73	8,380	4	0	4	79	8,486	4	0	4	80					
60	700	**P11**	137W	T1S	16,556	3	0	3	121	17,835	3	0	3	130	18,061	4	0	4	132	8,952	2	0	2	68
				T2S	16,461	4	0	4	120	17,733	4	0	4	129	17,957	4	0	4	131	9,377	2	0	2	72
				T2M	16,758	4	0	4	122	18,053	4	0	4	132	18,281	4	0	4	133	9,072	2	0	2	69
				T3S	16,205	4	0	4	118	17,457	4	0	4	127	17,678	4	0	4	129	9,273	2	0	2	71
				T3M	16,748	4	0	4	122	18,042	4	0	4	132	18,271	4	0	4	133	9,227	2	0	2	70
				T4M	16,432	4	0	4	120	17,702	4	0	4	129	17,926	4	0	4	131	9,243	2	0	2	71
				TFTM	16,857	4	0	4	123	18,159	4	0	4	133	18,389	4	0	4	134	9,103	2	0	2	69
				T5VS	16,975	4	0	1	124	18,287	4	0	1	133	18,518	4	0	1	135	9,661	3	0	1	74
				T5S	16,832	4	0	1	123	18,133	4	0	2	132	18,362	4	0	2	134	9,544	3	0	1	73
				T5M	16,828	4	0	2	123	18,128	4	0	2	132	18,358	4	0	2	134	9,665	3	0	2	74
				T5W	16,677	4	0	3	122	17,966	5	0	3	131	18,193	5	0	3	133	9,395	4	0	2	72
				BLC	13,845	3	0	3	101	14,915	3	0	3	109	15,103	3	0	3	110					
				LCCO	9,888	1	0	3	72	10,652	2	0	3	78	10,787	2	0	3	79					
				RCCO	9,875	4	0	4	72	10,638	4	0	4	78	10,773	4	0	4	79					
60	1050	**P12**	207W	T1S	22,996	4	0	4	111	24,773	4	0	4	120	25,087	4	0	4	121					
				T2S	22,864	4	0	4	110	24,631	5	0	5	119	24,943	5	0	5	120					
				T2M	23,277	4	0	4	112	25,075	4	0	4	121	25,393	4	0	4	123					
				T3S	22,509	4	0	4	109	24,248	5	0	5	117	24,555	5	0	5	119					
				T3M	23,263	4	0	4	112	25,061	4	0	4	121	25,378	4	0	4	123					
				T4M	22,824	5	0	5	110	24,588	5	0	5	119	24,899	5	0	5	120					
				TFTM	23,414	5	0	5	113	25,223	5	0	5	122	25,543	5	0	5	123					
				T5VS	23,579	5	0	1	114	25,401	5	0	1	123	25,722	5	0	1	124					
				T5S	23,380	4	0	2	113	25,187	4	0	2	122	25,506	4	0	2	123					
				T5M	23,374	5	0	3	113	25,181	5	0	3	122	25,499	5	0	3	123					
				T5W	23,165	5	0	4	112	24,955	5	0	4	121	25,271	5	0	4	122					
				BLC	19,231	4	0	4	93	20,717	4	0	4	100	20,979	4	0	4	101					
				LCCO	13,734	2	0	3	66	14,796	2	0	4	71	14,983	2	0	4	72					
				RCCO	13,716	4	0	4	66	14,776	4	0	4	71	14,963	4	0	4	72					
60	1250	**P13**	231W	T1S	25,400	4	0	4	110	27,363	4	0	4	118	27,709	4	0	4	120					
				T2S	25,254	5	0	5	109	27,205	5	0	5	118	27,550	5	0	5	119					
				T2M	25,710	4	0	4	111	27,696	4	0	4	120	28,047	4	0	4	121					
				T3S	24,862	5	0	5	108	26,783	5	0	5	116	27,122	5	0	5	117					
				T3M	25,695	5	0	5	111	27,680	5	0	5	120	28,031	5	0	5	121					
				T4M	25,210	5	0	5	109	27,158	5	0	5	118	27,502	5	0	5	119					
				TFTM	25,861	5	0	5	112	27,860	5	0	5	121	28,212	5	0	5	122					
				T5VS	26,043	5	0	1	113	28,056	5	0	1	121	28,411	5	0	1	123					
				T5S	25,824	4	0	2	112	27,819	5	0	2	120	28,172	5	0	2	122					
				T5M	25,818	5	0	3	112	27,813	5	0	3	120	28,165	5	0	3	122					
				T5W	25,586	5	0	4	111	27,563	5	0	4	119	27,912	5	0	4	121					
				BLC	21,241	4	0	4	92	22,882	4	0	4	99	23,172	4	0	4	100					
				LCCO	15,170	2	0	4	66	16,342	2	0	4	71	16,549	2	0	4	72					
					15,150	5	0	5	66	16,321	5	0	5	71	16,527	5	0	5	72					

FEATURES & SPECIFICATIONS

INTENDED USE
The sleek design of the D-Series Size 1 reflects the embedded high performance LED technology. It is ideal for many commercial and municipal applications, such as parking lots, plazas, campuses, and streetscapes.

CONSTRUCTION
Single-piece die-cast aluminum housing has integral heat sink fins to optimize thermal management through conductive and convective cooling. Modular design allows for ease of maintenance and future light engine upgrades. The LED drivers are mounted in direct contact with the casting to promote low operating temperature and long life. Housing is completely sealed against moisture and environmental contaminants (IP65). Low EPA (1.01 ft^2) for optimized pole wind loading.

FINISH
Exterior parts are protected by a zinc-infused Super Durable TGIC thermoset powder coat finish that provides superior resistance to corrosion and weathering. A tightly controlled multi-stage process ensures a minimum 3 mils thickness for a finish that can withstand extreme climate changes without cracking or peeling. Available in both textured and non-textured finishes.

OPTICS
Precision-molded proprietary acrylic lenses are engineered for superior area lighting distribution, uniformity, and pole spacing. Light engines are available in standard 3000 K, 4000 K and 5000 K (70 CRI) configurations. The D-Series Size 1 has zero uplight and qualifies as a Nighttime Friendly™ product, meaning it is consistent with the LEED® and Green Globes™ criteria for eliminating wasteful uplight.

ELECTRICAL
Light engine configurations consist of high-efficacy LEDs mounted to metal-core circuit boards to maximize heat dissipation and promote long life (up to L85/100,000 hours at 25°C). Class 1 electronic drivers are designed to have a power factor >90%, THD <20%, and an expected life of 100,000 hours with <1% failure rate. Easily serviceable 10kV surge protection device meets a minimum Category C Low operation (per ANSI/IEEE C62.41.2).

INSTALLATION
Included mounting block and integral arm facilitate quick and easy installation. Stainless steel bolts fasten the mounting block securely to poles and walls, enabling the D-Series Size 1 to withstand up to a 3.0 G vibration load rating per ANSI C136.31. The D-Series Size 1 utilizes the AERIS™ series pole drilling pattern (template #8). Optional terminal block and NEMA photocontrol receptacle are also available.

LISTINGS
UL Listed for wet locations. Light engines are IP66 rated; luminaire is IP65 rated. Rated for -40°C minimum ambient. U.S. Patent No. D672,492 S. International patent pending.

DesignLights Consortium® (DLC) Premium qualified product and DLC qualified product. Not all versions of this product may be DLC Premium qualified or DLC qualified. Please check the DLC Qualified Products List at www.designlights.org/QPL to confirm which versions are qualified.

International Dark-Sky Association (IDA) Fixture Seal of Approval (FSA) is available for all products on this page utilizing 3000K color temperature only.

WARRANTY
5-year limited warranty. Complete warranty terms located at:
www.acuitybrands.com/CustomerResources/Terms_and_conditions.aspx

Note: Actual performance may differ as a result of end-user environment and application. All values are design or typical values, measured under laboratory conditions at 25 °C. Specifications subject to change without notice.

D-Series Size 0
LED Area Luminaire

Catalog Number

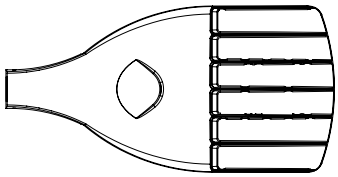
Notes

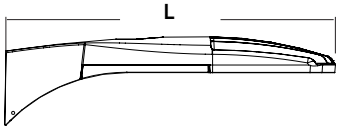
Type TYPE Z2

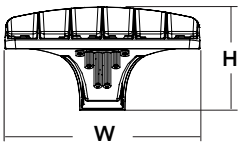
Hit the Tab key or mouse over the page to see all interactive elements.

Specifications

EPA:	0.95 ft² (.09 m²)
Length:	26" (66.0 cm)
Width:	13" (33.0 cm)
Height:	7" (17.8 cm)
Weight (max):	16 lbs (7.25 kg)







A+ Capable Luminaire

This item is an A+ capable luminaire, which has been designed and tested to provide consistent color appearance and system-level interoperability.

- All configurations of this luminaire meet the Acuity Brands' specification for chromatic consistency
- This luminaire is A+ Certified when ordered with DTL® controls marked by a shaded background. DTL DLL equipped luminaires meet the A+ specification for luminaire to photocontrol interoperability1
- This luminaire is part of an A+ Certified solution for ROAM® or XPoint™ Wireless control networks, providing out-of-the-box control compatibility with simple commissioning, when ordered with drivers and control options marked by a shaded background[1]

To learn more about A+, visit www.acuitybrands.com/aplus.

1. See ordering tree for details.
2. A+ Certified Solutions for ROAM require the order of one ROAM node per luminaire. Sold Separately: Link to Roam; Link to DTL DLL

A+ Capable options indicated by this color background.

Ordering Information

EXAMPLE: DSX0 LED P6 40K T3M MVOLT SPA DDBXD

DSX0 LED

Series

DSX0 LED

LEDs

Forward optics

P1 P4 P7
P2 P5
P3 P6

Rotated optics

P10[1] P12[1]
P11[1] P13[1]

Color temperature

30K	3000 K
40K	4000 K
50K	5000 K
AMBPC	Amber phosphor converted[2]

Distribution

T1S	Type I short	T5S	Type V short
T2S	Type II short	T5M	Type V medium
T2M	Type II medium	T5W	Type V wide
T3S	Type III short	BLC	Backlight control[2,3]
T3M	Type III medium	LCCO	Left corner cutoff[2,3]
T4M	Type IV medium	RCCO	Right corner cutoff[2,3]
TFTM	Forward throw medium		
T5VS	Type V very short		

Voltage

MVOLT	[4,5]
120	[6]
208	[5,6]
240	[5,6]
277	[6]
347	[5,6,7]
480	[5,6,7]

Mounting

Shipped included

SPA	Square pole mounting
RPA	Round pole mounting
WBA	Wall bracket
SPUMBA	Square pole universal mounting adaptor [8]
RPUMBA	Round pole universal mounting adaptor [8]

Shipped separately

KMA8 DDBXD U	Mast arm mounting bracket adaptor (specify finish)[9]

Control options

Shipped installed

NLTAIR2	nLight AIR generation 2 enabled[10]
PER	NEMA twist-lock receptacle only (control ordered separate) [11]
PER5	Five-wire receptacle only (control ordered separate) [11,12]
PER7	Seven-wire receptacle only (control ordered separate) [11,12]
DMG	0-10V dimming extend out back of housing for external control (control ordered separate)
PIR	Bi-level, motion/ambient sensor, 8-15' mounting height, ambient sensor enabled at 5fc [5,13,14]
PIRH	Bi-level, motion/ambient sensor, 15-30' mounting height, ambient sensor enabled at 5fc [5,13,14]
PIRHN	Network, Bi-Level motion/ambient sensor[15]
PIR1FC3V	Bi-level, motion/ambient sensor, 8-15' mounting height, ambient sensor enabled at 1fc [5,13,14]
PIRH1FC3V	Bi-level, motion/ambient sensor, 15-30' mounting height, ambient sensor enabled at 1fc [5,13,14]
BL30	Bi-level switched dimming, 30% [5,16,17]
BL50	Bi-level switched dimming, 50% [5,16,17]
PNMTDD3	Part night, dim till dawn [5,18]
PNMT5D3	Part night, dim 5 hrs [5,18]
PNMT6D3	Part night, dim 6 hrs [5,18]
PNMT7D3	Part night, dim 7 hrs [5,18]
FAO	Field adjustable output[19]

Other options

Shipped installed

HS	House-side shield [20]
SF	Single fuse (120, 277, 347V) [6]
DF	Double fuse (208, 240, 480V) [6]
L90	Left rotated optics [1]
R90	Right rotated optics [1]
DDL	Diffused drop lens [20]

Shipped separately

BS	Bird spikes[21]
EGS	External glare shield[21]

Finish *(required)*

DDBXD	Dark bronze
DBLXD	Black
DNAXD	Natural aluminum
DWHXD	White
DDBTXD	Textured dark bronze
DBLBXD	Textured black
DNATXD	Textured natural aluminum
DWHGXD	Textured white

Ordering Information

Accessories

Ordered and shipped separately.

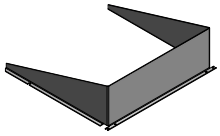
DLL127F 1.5 JU	Photocell - SSL twist-lock (120-277V) [22]
DLL347F 1.5 CUL JU	Photocell - SSL twist-lock (347V) [22]
DLL480F 1.5 CUL JU	Photocell - SSL twist-lock (480V) [22]
DSHORT SBK U	Shorting cap [22]
DSX0HS 20C U	House-side shield for 20 LED unit [20]
DSX0HS 30C U	House-side shield for 30 LED unit [20]
DSX0HS 40C U	House-side shield for 40 LED unit [20]
DSX0DDL U	Diffused drop lens (polycarbonate) [20]
PUMBA DDBXD U*	Square and round pole universal mounting bracket adaptor (specify finish) [23]
KMA8 DDBXD U	Mast arm mounting bracket adaptor (specify finish) [8]

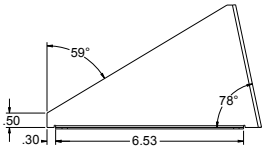
For more control options, visit DTL and ROAM online.

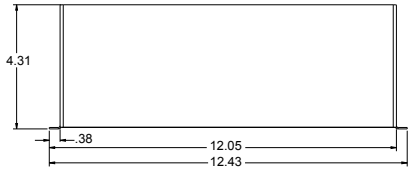
NOTES

1 P10, P11, P12 and P13 and rotated options (L90 or R90) only available together.
2 AMBPC is not available with BLC, LCCO, RCCO, P4, P7 or P13.
3 Not available with HS or DDL.
4 MVOLT driver operates on any line voltage from 120-277V (50/60 Hz).
5 Any PIRx with BL30, BL50 or PNMT, is not available with 208V, 240V, 347V, 480V or MVOLT. It is only available in 120V or 277V specified.
6 Single fuse (SF) requires 120V, 277V or 347V. Double fuse (DF) requires 208V, 240V or 480V.
7 Not available in P4, P7 or P13. Not available with BL30, BL50 or PNMT options.
8 Existing drilled pole only. Available as a separate combination accessory; for retrofit use only: PUMBA (finish) U; 1.5 G vibration load rating per ANCI C136.31.
9 Must order fixture with SPA mounting. Must be ordered as a separate accessory; see Accessories information. For use with 2-3/8" mast arm (not included).
10 Must be ordered with PIRHN.
11 Photocell ordered and shipped as a separate line item from Acuity Brands Controls. See accessories. Shorting Cap included.
12 If ROAM® node required, it must be ordered and shipped as a separate line item from Acuity Brands Controls. Shorting Cap included.
13 Reference Motion Sensor table on page 3.
14 Reference PER Table on page 3 to see functionality.
15 Must be ordered with NLTAIR2. For more information on nLight Air 2 visit this link.
16 Requires (2) separately switched circuits.
17 Not available with 347V, 480V or PNMT. For PER5 or PER7 see PER Table on page 3. Requires isolated neutral.
18 Not available with 347V, 480V, BL30 and BL50. For PER5 or PER7 see PER Table on page 3. Separate Dusk to Dawn required.
19 Not available with other dimming controls options.
20 Not available with BLC, LCCO and RCCO distribution. Also available as a separate accessory; see Accessories information.
21 Must be ordered with fixture for factory pre-drilling.
22 Requires luminaire to be specified with PER, PER5 or PER7 option. See PER Table on page 3.
23 For retrofit use only.

External Glare Shield

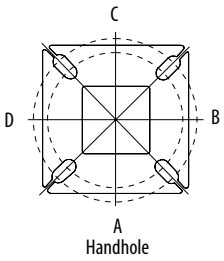




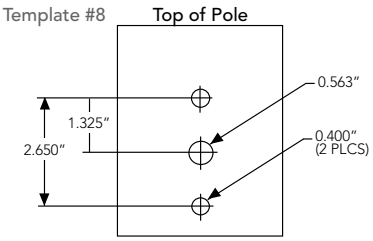


Drilling

HANDHOLE ORIENTATION



Template #8



Tenon Mounting Slipfitter **

Tenon O.D.	Single Unit	2 at 180°	2 at 90°	3 at 120°	3 at 90°	4 at 90°
2-3/8"	AST20-190	AST20-280	AST20-290	AST20-320	AST20-390	AST20-490
2-7/8"	AST25-190	AST25-280	AST25-290	AST25-320	AST25-390	AST25-490
4"	AST35-190	AST35-280	AST35-290	AST35-320	AST35-390	AST35-490

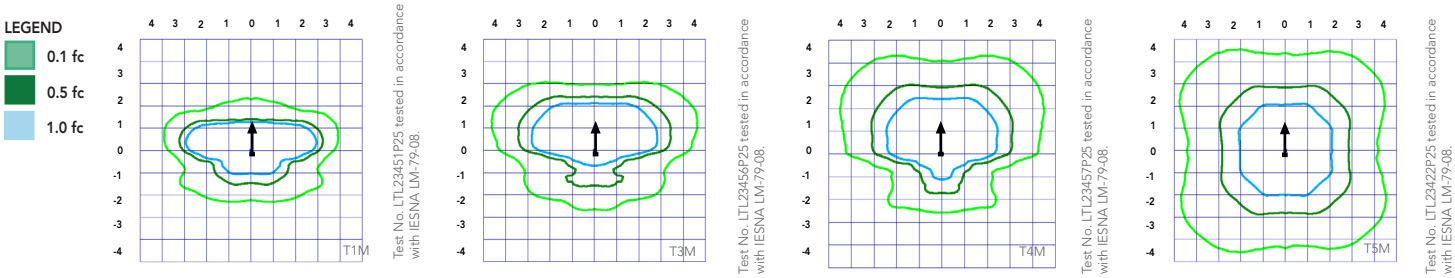
Pole drilling nomenclature: # of heads at degree from handhole (default side A)					
DM19AS	DM28AS	DM29AS	DM32AS	DM39AS	DM49AS
1 @ 90°	2 @ 280°	2 @ 90°	3 @ 120°	3 @ 90°	4 @ 90°
Side B	Side B & D	Side B & C	Round pole only	Side B, C, & D	Sides A, B, C, D
Note: Review luminaire spec sheet for specific nomenclature					

Pole top or tenon O.D.	4.5" @ 90°	4" @ 90°	3.5" @ 90°	3" @ 90°	4.5" @ 120°	4" @ 120°	3.5" @ 120°	3" @ 120°
DSX SPA	Y	Y	Y	N	-	-	-	-
DSX RPA	Y	Y	N	N	Y	Y	Y	Y
DSX SPUMBA	Y	N	N	N	-	-	-	-
DSX RPUMBA	N	N	N	N	Y	Y	Y	N
					*3 fixtures @120 require round pole top/tenon.			

Photometric Diagrams

To see complete photometric reports or download .ies files for this product, visit Lithonia Lighting's D-Series Area Size 0 homepage.

Isofootcandle plots for the DSX0 LED 40C 1000 40K. Distances are in units of mounting height (20').



Performance Data

Lumen Ambient Temperature (LAT) Multipliers

Use these factors to determine relative lumen output for average ambient temperatures from 0-40°C (32-104°F).

Ambient		Lumen Multiplier
0°C	32°F	1.04
5°C	41°F	1.04
10°C	50°F	1.03
15°C	50°F	1.02
20°C	68°F	1.01
25°C	**77°F**	**1.00**
30°C	86°F	0.99
35°C	95°F	0.98
40°C	104°F	0.97

Projected LED Lumen Maintenance

Data references the extrapolated performance projections for the platforms noted in a **25°C ambient**, based on 10,000 hours of LED testing (tested per IESNA LM-80-08 and projected per IESNA TM-21-11).

To calculate LLF, use the lumen maintenance factor that corresponds to the desired number of operating hours below. For other lumen maintenance values, contact factory.

Operating Hours	25000	50000	100000
Lumen Maintenance Factor	0.96	0.92	0.85

Electrical Load

	Performance Package	LED Count	Drive Current	Wattage	Current (A) 120	208	240	277	347	480
Forward Optics (Non-Rotated)	P1	20	530	38	0.32	0.18	0.15	0.15	0.10	0.08
	P2	20	700	49	0.41	0.23	0.20	0.19	0.14	0.11
	P3	20	1050	71	0.60	0.37	0.32	0.27	0.21	0.15
	P4	20	1400	92	0.77	0.45	0.39	0.35	0.28	0.20
	P5	40	700	89	0.74	0.43	0.38	0.34	0.26	0.20
	P6	40	1050	134	1.13	0.65	0.55	0.48	0.39	0.29
	P7	40	1300	166	1.38	0.80	0.69	0.60	0.50	0.37
Rotated Optics (Requires L90 or R90)	P10	30	530	53	0.45	0.26	0.23	0.21	0.16	0.12
	P11	30	700	72	0.60	0.35	0.30	0.27	0.20	0.16
	P12	30	1050	104	0.88	0.50	0.44	0.39	0.31	0.23
	P13	30	1300	128	1.08	0.62	0.54	0.48	0.37	0.27

Motion Sensor Default Settings						
Option	Dimmed State	High Level (when triggered)	Photocell Operation	Dwell Time	Ramp-up Time	Ramp-down Time
PIR or PIRH	3V (37%) Output	10V (100%) Output	Enabled @ 5FC	5 min	3 sec	5 min
*PIR1FC3V or PIRH1FC3V	3V (37%) Output	10V (100%) Output	Enabled @ 1FC	5 min	3 sec	5 min
*for use with Inline Dusk to Dawn or timer.						

PER Table						
Control	PER (3 wire)	PER5 (5 wire)		PER7 (7 wire)		
			Wire 4/Wire5		Wire 4/Wire5	Wire 6/Wire7
Photocontrol Only (On/Off)	✔	⚠	Wired to dimming leads on driver	⚠	Wired to dimming leads on driver	Wires Capped inside fixture
ROAM	⊘	✔	Wired to dimming leads on driver	⚠	Wired to dimming leads on driver	Wires Capped inside fixture
ROAM with Motion (ROAM on/off only)	⊘	⚠	Wires Capped inside fixture	⚠	Wires Capped inside fixture	Wires Capped inside fixture
Future-proof*	⊘	⚠	Wired to dimming leads on driver	✔	Wired to dimming leads on driver	Wires Capped inside fixture
Future-proof* with Motion	⊘	⚠	Wires Capped inside fixture	✔	Wires Capped inside fixture	Wires Capped inside fixture

✔ Recommended
⊘ Will not work
⚠ Alternate

*Future-proof means: Ability to change controls in the future.

Performance Data

Lumen Output

Lumen values are from photometric tests performed in accordance with IESNA LM-79-08. Data is considered to be representative of the configurations shown, within the tolerances allowed by Lighting Facts. Contact factory for performance data on any configurations not shown here.

Forward Optics

LED Count	Drive Current	Power Package	System Watts	Dist. Type	30K (3000 K, 70 CRI)					40K (4000 K, 70 CRI)					50K (5000 K, 70 CRI)					AMBPC (Amber Phosphor Converted)				
					Lumens	B	U	G	LPW	Lumens	B	U	G	LPW	Lumens	B	U	G	LPW	Lumens	B	U	G	LPW
20	530	P1	38W	T1S	4,369	1	0	1	115	4,706	1	0	1	124	4,766	1	0	1	125	2,541	1	0	1	73
				T2S	4,364	1	0	1	115	4,701	1	0	1	124	4,761	1	0	1	125	2,589	1	0	1	74
				T2M	4,387	1	0	1	115	4,726	1	0	1	124	4,785	1	0	1	126	2,539	1	0	1	73
				T3S	4,248	1	0	1	112	4,577	1	0	1	120	4,634	1	0	1	122	2,558	1	0	1	73
				T3M	4,376	1	0	1	115	4,714	1	0	1	124	4,774	1	0	1	126	2,583	1	0	1	74
				T4M	4,281	1	0	1	113	4,612	1	0	2	121	4,670	1	0	2	123	2,570	1	0	1	73
				TFTM	4,373	1	0	1	115	4,711	1	0	2	124	4,771	1	0	2	126	2,540	1	0	1	73
				T5VS	4,548	2	0	0	120	4,900	2	0	0	129	4,962	2	0	0	131	2,650	1	0	0	76
				T5S	4,552	2	0	0	120	4,904	2	0	0	129	4,966	2	0	0	131	2,690	1	0	0	77
				T5M	4,541	3	0	1	120	4,891	3	0	1	129	4,953	3	0	1	130	2,658	2	0	0	76
				T5W	4,576	3	0	2	120	4,929	3	0	2	130	4,992	3	0	2	131	2,663	2	0	1	73
				BLC	3,586	1	0	1	94	3,863	1	0	1	102	3,912	1	0	1	103					
				LCCO	2,668	1	0	1	70	2,874	1	0	2	76	2,911	1	0	2	77					
				RCCO	2,668	1	0	1	70	2,874	1	0	2	76	2,911	1	0	2	77					
20	700	P2	49W	T1S	5,570	1	0	1	114	6,001	1	0	1	122	6,077	2	0	2	124	3,144	1	0	1	70
				T2S	5,564	1	0	2	114	5,994	1	0	2	122	6,070	2	0	2	124	3,203	1	0	1	71
				T2M	5,593	1	0	1	114	6,025	1	0	1	123	6,102	1	0	1	125	3,141	1	0	1	70
				T3S	5,417	1	0	2	111	5,835	1	0	2	119	5,909	2	0	2	121	3,165	1	0	1	70
				T3M	5,580	1	0	2	114	6,011	1	0	2	123	6,087	1	0	2	124	3,196	1	0	1	71
				T4M	5,458	1	0	2	111	5,880	1	0	2	120	5,955	1	0	2	122	3,179	1	0	1	71
				TFTM	5,576	1	0	2	114	6,007	1	0	2	123	6,083	1	0	2	124	3,143	1	0	1	70
				T5VS	5,799	2	0	0	118	6,247	2	0	0	127	6,327	2	0	0	129	3,278	2	0	0	73
				T5S	5,804	2	0	0	118	6,252	2	0	0	128	6,332	2	0	1	129	3,328	2	0	0	74
				T5M	5,789	3	0	1	118	6,237	3	0	1	127	6,316	3	0	1	129	3,288	2	0	1	73
				T5W	5,834	3	0	2	119	6,285	3	0	2	128	6,364	3	0	2	130	3,295	2	0	1	73
				BLC	4,572	1	0	1	93	4,925	1	0	1	101	4,987	1	0	1	102					
				LCCO	3,402	1	0	2	69	3,665	1	0	2	75	3,711	1	0	2	76					
				RCCO	3,402	1	0	2	69	3,665	1	0	2	75	3,711	1	0	2	76					
20	1050	P3	71W	T1S	7,833	2	0	2	110	8,438	2	0	2	119	8,545	2	0	2	120					
				T2S	7,825	2	0	2	110	8,429	2	0	2	119	8,536	2	0	2	120					
				T2M	7,865	2	0	2	111	8,473	2	0	2	119	8,580	2	0	2	121					
				T3S	7,617	2	0	2	107	8,205	2	0	2	116	8,309	2	0	2	117					
				T3M	7,846	2	0	2	111	8,452	2	0	2	119	8,559	2	0	2	121					
				T4M	7,675	2	0	2	108	8,269	2	0	2	116	8,373	2	0	2	118					
				TFTM	7,841	2	0	2	110	8,447	2	0	2	119	8,554	2	0	2	120					
				T5VS	8,155	3	0	0	115	8,785	3	0	0	124	8,896	3	0	0	125					
				T5S	8,162	3	0	1	115	8,792	3	0	1	124	8,904	3	0	1	125					
				T5M	8,141	3	0	2	115	8,770	3	0	2	124	8,881	3	0	2	125					
				T5W	8,204	3	0	2	116	8,838	4	0	2	124	8,950	4	0	2	126					
				BLC	6,429	1	0	2	91	6,926	1	0	2	98	7,013	1	0	2	99					
				LCCO	4,784	1	0	2	67	5,153	1	0	2	73	5,218	1	0	2	73					
				RCCO	4,784	1	0	2	67	5,153	1	0	2	73	5,218	1	0	2	73					
20	1400	P4	92W	T1S	9,791	2	0	2	106	10,547	2	0	2	115	10,681	2	0	2	116					
				T2S	9,780	2	0	2	106	10,536	2	0	2	115	10,669	2	0	2	116					
				T2M	9,831	2	0	2	107	10,590	2	0	2	115	10,724	2	0	2	117					
				T3S	9,521	2	0	2	103	10,256	2	0	2	111	10,386	2	0	2	113					
				T3M	9,807	2	0	2	107	10,565	2	0	2	115	10,698	2	0	2	116					
				T4M	9,594	2	0	2	104	10,335	2	0	3	112	10,466	2	0	3	114					
				TFTM	9,801	2	0	2	107	10,558	2	0	2	115	10,692	2	0	2	116					
				T5VS	10,193	3	0	1	111	10,981	3	0	1	119	11,120	3	0	1	121					
				T5S	10,201	3	0	1	111	10,990	3	0	1	119	11,129	3	0	1	121					
				T5M	10,176	4	0	2	111	10,962	4	0	2	119	11,101	4	0	2	121					
				T5W	10,254	4	0	3	111	11,047	4	0	3	120	11,186	4	0	3	122					
				BLC	8,036	1	0	2	87	8,656	1	0	2	94	8,766	1	0	2	95					
				LCCO	5,979	1	0	2	65	6,441	1	0	2	70	6,523	1	0	3	71					
					5,979	1	0	2	65	6,441	1	0	2	70	6,523	1	0	3	71					

Performance Data

Lumen Output

Lumen values are from photometric tests performed in accordance with IESNA LM-79-08. Data is considered to be representative of the configurations shown, within the tolerances allowed by Lighting Facts. Contact factory for performance data on any configurations not shown here.

Forward Optics

LED Count	Drive Current	Power Package	System Watts	Dist. Type	30K (3000 K, 70 CRI)					40K (4000 K, 70 CRI)					50K (5000 K, 70 CRI)					AMBPC (Amber Phosphor Converted)				
					Lumens	B	U	G	LPW	Lumens	B	U	G	LPW	Lumens	B	U	G	LPW	Lumens	B	U	G	LPW
40	700	**P5**	89W	T1S	10,831	2	0	2	122	11,668	2	0	2	131	11,816	2	0	2	133					
				T2S	10,820	2	0	2	122	11,656	2	0	2	131	11,803	2	0	2	133					
				T2M	10,876	2	0	2	122	11,716	2	0	2	132	11,864	2	0	2	133					
				T3S	10,532	2	0	2	118	11,346	2	0	2	127	11,490	2	0	2	129					
				T3M	10,849	2	0	2	122	11,687	2	0	2	131	11,835	2	0	2	133					
				T4M	10,613	2	0	3	119	11,434	2	0	3	128	11,578	2	0	3	130					
				TFTM	10,842	2	0	2	122	11,680	2	0	2	131	11,828	2	0	2	133					
				T5VS	11,276	3	0	1	127	12,148	3	0	1	136	12,302	3	0	1	138					
				T5S	11,286	3	0	1	127	12,158	3	0	1	137	12,312	3	0	1	138					
				T5M	11,257	4	0	2	126	12,127	4	0	2	136	12,280	4	0	2	138					
				T5W	11,344	4	0	3	127	12,221	4	0	3	137	12,375	4	0	3	139					
				BLC	8,890	1	0	2	100	9,576	1	0	2	108	9,698	1	0	2	109					
				LCCO	6,615	1	0	3	74	7,126	1	0	3	80	7,216	1	0	3	81					
				RCCO	6,615	1	0	3	74	7,126	1	0	3	80	7,216	1	0	3	81					
40	1050	**P6**	134W	T1S	14,805	3	0	3	110	15,949	3	0	3	119	16,151	3	0	3	121	6,206	2	0	2	68
				T2S	14,789	3	0	3	110	15,932	3	0	3	119	16,134	3	0	3	120	6,322	2	0	2	69
				T2M	14,865	3	0	3	111	16,014	3	0	3	120	16,217	3	0	3	121	6,201	2	0	2	68
				T3S	14,396	3	0	3	107	15,509	3	0	3	116	15,705	3	0	3	117	6,247	1	0	2	69
				T3M	14,829	2	0	3	111	15,975	3	0	3	119	16,177	3	0	3	121	6,308	2	0	2	69
				T4M	14,507	2	0	3	108	15,628	3	0	3	117	15,826	3	0	3	118	6,275	1	0	2	69
				TFTM	14,820	2	0	3	111	15,965	3	0	3	119	16,167	3	0	3	121	6,203	1	0	2	68
				T5VS	15,413	4	0	1	115	16,604	4	0	1	124	16,815	4	0	1	125	6,671	2	0	0	73
				T5S	15,426	3	0	1	115	16,618	4	0	1	124	16,828	4	0	1	126	6,569	2	0	0	72
				T5M	15,387	4	0	2	115	16,576	4	0	2	124	16,786	4	0	2	125	6,491	3	0	1	71
				T5W	15,506	4	0	3	116	16,704	4	0	3	125	16,915	4	0	3	126	6,504	3	0	2	71
				BLC	12,151	1	0	2	91	13,090	1	0	2	98	13,255	1	0	2	99					
				LCCO	9,041	1	0	3	67	9,740	1	0	3	73	9,863	1	0	3	74					
				RCCO	9,041	1	0	3	67	9,740	1	0	3	73	9,863	1	0	3	74					
40	1300	**P7**	166W	T1S	17,023	3	0	3	103	18,338	3	0	3	110	18,570	3	0	3	112					
				T2S	17,005	3	0	3	102	18,319	3	0	3	110	18,551	3	0	3	112					
				T2M	17,092	3	0	3	103	18,413	3	0	3	111	18,646	3	0	3	112					
				T3S	16,553	3	0	3	100	17,832	3	0	3	107	18,058	3	0	3	109					
				T3M	17,051	3	0	3	103	18,369	3	0	3	111	18,601	3	0	3	112					
				T4M	16,681	3	0	3	100	17,969	3	0	3	108	18,197	3	0	3	110					
				TFTM	17,040	3	0	3	103	18,357	3	0	4	111	18,590	3	0	4	112					
				T5VS	17,723	4	0	1	107	19,092	4	0	1	115	19,334	4	0	1	116					
				T5S	17,737	4	0	2	107	19,108	4	0	2	115	19,349	4	0	2	117					
				T5M	17,692	4	0	2	107	19,059	4	0	2	115	19,301	4	0	2	116					
				T5W	17,829	5	0	3	107	19,207	5	0	3	116	19,450	5	0	3	117					
				BLC	13,971	2	0	2	84	15,051	2	0	2	91	15,241	2	0	2	92					
				LCCO	10,396	1	0	3	63	11,199	1	0	3	67	11,341	1	0	3	68					
					10,396	1	0	3	63	11,199	1	0	3	67	11,341	1	0	3	68					

Performance Data

Lumen Output

Lumen values are from photometric tests performed in accordance with IESNA LM-79-08. Data is considered to be representative of the configurations shown, within the tolerances allowed by Lighting Facts. Contact factory for performance data on any configurations not shown here.

Rotated Optics

LED Count	Drive Current	Power Package	System Watts	Dist. Type	30K (3000 K, 70 CRI)					40K (4000 K, 70 CRI)					50K (5000 K, 70 CRI)					AMBPC (Amber Phosphor Converted)				
					Lumens	B	U	G	LPW	Lumens	B	U	G	LPW	Lumens	B	U	G	LPW	Lumens	B	U	G	LPW
30	530	**P10**	53W	T1S	6,727	2	0	2	127	7,247	3	0	3	137	7,339	3	0	3	138					
				T2S	6,689	3	0	3	126	7,205	3	0	3	136	7,297	3	0	3	138					
				T2M	6,809	3	0	3	128	7,336	3	0	3	138	7,428	3	0	3	140					
				T3S	6,585	3	0	3	124	7,094	3	0	3	134	7,183	3	0	3	136					
				T3M	6,805	3	0	3	128	7,331	3	0	3	138	7,424	3	0	3	140					
				T4M	6,677	3	0	3	126	7,193	3	0	3	136	7,284	3	0	3	137					
				TFTM	6,850	3	0	3	129	7,379	3	0	3	139	7,472	3	0	3	141					
				T5VS	6,898	3	0	0	130	7,431	3	0	0	140	7,525	3	0	0	142					
				T5S	6,840	2	0	1	129	7,368	2	0	1	139	7,461	2	0	1	141					
				T5M	6,838	3	0	1	129	7,366	3	0	2	139	7,460	3	0	2	141					
				T5W	6,777	3	0	2	128	7,300	3	0	2	138	7,393	3	0	2	139					
				BLC	5,626	2	0	2	106	6,060	2	0	2	114	6,137	2	0	2	116					
				LCCO	4,018	1	0	2	76	4,328	1	0	2	82	4,383	1	0	2	83					
				RCCO	4,013	3	0	3	76	4,323	3	0	3	82	4,377	3	0	3	83					
30	700	**P11**	72W	T1S	8,594	3	0	3	119	9,258	3	0	3	129	9,376	3	0	3	130					
				T2S	8,545	3	0	3	119	9,205	3	0	3	128	9,322	3	0	3	129					
				T2M	8,699	3	0	3	121	9,371	3	0	3	130	9,490	3	0	3	132					
				T3S	8,412	3	0	3	117	9,062	3	0	3	126	9,177	3	0	3	127					
				T3M	8,694	3	0	3	121	9,366	3	0	3	130	9,484	3	0	3	132					
				T4M	8,530	3	0	3	118	9,189	3	0	3	128	9,305	3	0	3	129					
				TFTM	8,750	3	0	3	122	9,427	3	0	3	131	9,546	3	0	3	133					
				T5VS	8,812	3	0	0	122	9,493	3	0	0	132	9,613	3	0	0	134					
				T5S	8,738	3	0	1	121	9,413	3	0	1	131	9,532	3	0	1	132					
				T5M	8,736	3	0	2	121	9,411	3	0	2	131	9,530	3	0	2	132					
				T5W	8,657	4	0	2	120	9,326	4	0	2	130	9,444	4	0	2	131					
				BLC	7,187	3	0	3	100	7,742	3	0	3	108	7,840	3	0	3	109					
				LCCO	5,133	1	0	2	71	5,529	1	0	2	77	5,599	1	0	2	78					
				RCCO	5,126	3	0	3	71	5,522	3	0	3	77	5,592	3	0	3	78					
30	1050	**P12**	104W	T1S	12,149	3	0	3	117	13,088	3	0	3	126	13,253	3	0	3	127					
				T2S	12,079	4	0	4	116	13,012	4	0	4	125	13,177	4	0	4	127					
				T2M	12,297	3	0	3	118	13,247	3	0	3	127	13,415	3	0	3	129					
				T3S	11,891	4	0	4	114	12,810	4	0	4	123	12,972	4	0	4	125					
				T3M	12,290	3	0	3	118	13,239	4	0	4	127	13,407	4	0	4	129					
				T4M	12,058	4	0	4	116	12,990	4	0	4	125	13,154	4	0	4	126					
				TFTM	12,369	4	0	4	119	13,325	4	0	4	128	13,494	4	0	4	130					
				T5VS	12,456	3	0	1	120	13,419	3	0	1	129	13,589	4	0	1	131					
				T5S	12,351	3	0	1	119	13,306	3	0	1	128	13,474	3	0	1	130					
				T5M	12,349	4	0	2	119	13,303	4	0	2	128	13,471	4	0	2	130					
				T5W	12,238	4	0	3	118	13,183	4	0	3	127	13,350	4	0	3	128					
				BLC	10,159	3	0	3	98	10,944	3	0	3	105	11,083	3	0	3	107					
				LCCO	7,256	1	0	3	70	7,816	1	0	3	75	7,915	1	0	3	76					
				RCCO	7,246	3	0	3	70	7,806	4	0	4	75	7,905	4	0	4	76					
30	1300	**P13**	128W	T1S	14,438	3	0	3	113	15,554	3	0	3	122	15,751	3	0	3	123					
				T2S	14,355	4	0	4	112	15,465	4	0	4	121	15,660	4	0	4	122					
				T2M	14,614	3	0	3	114	15,744	4	0	4	123	15,943	4	0	4	125					
				T3S	14,132	4	0	4	110	15,224	4	0	4	119	15,417	4	0	4	120					
				T3M	14,606	4	0	4	114	15,735	4	0	4	123	15,934	4	0	4	124					
				T4M	14,330	4	0	4	112	15,438	4	0	4	121	15,633	4	0	4	122					
				TFTM	14,701	4	0	4	115	15,836	4	0	4	124	16,037	4	0	4	125					
				T5VS	14,804	4	0	1	116	15,948	4	0	1	125	16,150	4	0	1	126					
				T5S	14,679	3	0	1	115	15,814	3	0	1	124	16,014	3	0	1	125					
				T5M	14,676	4	0	2	115	15,810	4	0	2	124	16,010	4	0	2	125					
				T5W	14,544	4	0	3	114	15,668	4	0	3	122	15,866	4	0	3	124					
				BLC	7919	3	0	3	62	8531	3	0	3	67	8639	3	0	3	67					
				LCCO	5145	1	0	2	40	5543	1	0	2	43	5613	1	0	2	44					
					5139	3	0	3	40	5536	3	0	3	43	5606	3	0	3	44					

FEATURES & SPECIFICATIONS

INTENDED USE
The sleek design of the D-Series Size 0 reflects the embedded high performance LED technology. It is ideal for many commercial and municipal applications, such as parking lots, plazas, campuses, and pedestrian areas.

CONSTRUCTION
Single-piece die-cast aluminum housing has integral heat sink fins to optimize thermal management through conductive and convective cooling. Modular design allows for ease of maintenance and future light engine upgrades. The LED driver is mounted in direct contact with the casting to promote low operating temperature and long life. Housing is completely sealed against moisture and environmental contaminants (IP65). Low EPA (0.95 ft^2) for optimized pole wind loading.

FINISH
Exterior parts are protected by a zinc-infused Super Durable TGIC thermoset powder coat finish that provides superior resistance to corrosion and weathering. A tightly controlled multi-stage process ensures a minimum 3 mils thickness for a finish that can withstand extreme climate changes without cracking or peeling. Available in both textured and non-textured finishes.

OPTICS
Precision-molded proprietary acrylic lenses are engineered for superior area lighting distribution, uniformity, and pole spacing. Light engines are available in 3000 K, 4000 K or 5000 K (70 CRI) configurations. The D-Series Size 0 has zero uplight and qualifies as a Nighttime Friendly™ product, meaning it is consistent with the LEED® and Green Globes™ criteria for eliminating wasteful uplight.

ELECTRICAL
Light engine(s) configurations consist of high-efficacy LEDs mounted to metal-core circuit boards to maximize heat dissipation and promote long life (up to L85/100,000 hours at 25°C). Class 1 electronic drivers are designed to have a power factor >90%, THD <20%, and an expected life of 100,000 hours with <1% failure rate. Easily serviceable 10kV surge protection device meets a minimum Category C Low operation (per ANSI/IEEE C62.41.2).

INSTALLATION
Included mounting block and integral arm facilitate quick and easy installation. Stainless steel bolts fasten the mounting block securely to poles and walls, enabling the D-Series Size 0 to withstand up to a 3.0 G vibration load rating per ANSI C136.31. The D-Series Size 0 utilizes the AERIS™ series pole drilling pattern (template #8). Optional terminal block and NEMA photocontrol receptacle are also available.

LISTINGS
UL Listed for wet locations. Light engines are IP66 rated; luminaire is IP65 rated. Rated for -40°C minimum ambient. U.S. Patent No. D672,492 S. International patent pending.

DesignLights Consortium® (DLC) Premium qualified product and DLC qualified product. Not all versions of this product may be DLC Premium qualified or DLC qualified. Please check the DLC Qualified Products List at www.designlights.org/QPL to confirm which versions are qualified.

International Dark-Sky Association (IDA) Fixture Seal of Approval (FSA) is available for all products on this page utilizing 3000K color temperature only.

WARRANTY
5-year limited warranty. Complete warranty terms located at:
www.acuitybrands.com/CustomerResources/Terms_and_conditions.aspx

Note: Actual performance may differ as a result of end-user environment and application. All values are design or typical values, measured under laboratory conditions at 25 °C. Specifications subject to change without notice.

TYPE W1

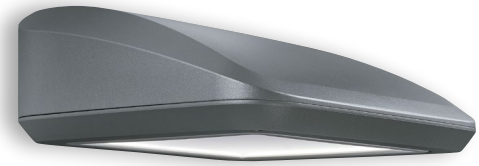
PHILIPS

GARDCO

Wall Mount

PureForm

LED wall sconce
with comfort optics



Project:

Location:

Cat.No:

Type:

Qty:

Notes:

Philips Gardco PureForm LED wall sconce comfort PWS offers a sleek, low profile design that will complement a range of architectural styles. Comfort optics are designed to enhance visual comfort by reducing glare. PureForm wall sconce provides up to 10,700 lumens to accommodate multiple mounting heights up to 20', and is available with Type 2, 3, 4, optical distributions. A full range of control options is available for additional energy savings. Optional emergency battery backup option is available for path-of-egress and is integral to the luminaire.

Ordering guide

example: PWS-140L-650-NW-G2-2-UNV-DGY

Prefix	Number of LEDs	Drive Current	LED Color - Generation	Distribution	Emergency	Voltage	Options: Dimming controls	Options: Motion sensing	Options: Photo-sensing	Options: Electrical	Finish
PWS	140L										
PWS PureForm wall sconce	**140L** 140 LEDs	**450** 450 mA **650** 650 mA **1150** 1150 mA [1] **1675** 1675 mA [1] **2100** 2100 mA [1,2]	**WW-G2** Warm White 3000K, 70 CRI Generation 2 **NW-G2** Neutral White 4000K, 70 CRI Generation 2 **CW-G2** Cool White 5000K, 70 CRI Generation 2 **WY-G2** Warm Yellow 2700K, 80 CRI Generation 2 [3] **AM-G2** Direct Amber (>590nm) Generation 2 [3]	**2** Comfort Type 2 **3** Comfort Type 3 **4** Comfort Type 4	**EBP** Emergency Battery Pack [1,7,12] **EBPC** Emergency Battery Pack Cold Weather [2,7,13] Leave blank to omit an emergency option	**UNV** 120-277V **HVU** 347-480V **120** 120V **208** 208V **240** 240V **277** 277V **347** 347V **480** 480V	**DD** 0-10V External dimming (controls by others) [4] **FAWS** Field Adjustable Wattage [4,5] **SW** Interface Module for SiteWise [4,5,6,8] **LLC** Integral wireless module [4,5,6,7] **BL** BL Bi-level functionary with motion sensor [4] **DynaDimmer: Automatic Profile Dimming** [4,5,7] **CS50** Security 50% Dimming, 7 hours **CM50** Median 50% Dimming, 8 hours **CE50** Economy 50% Dimming, 9 hours **DA50** All Night 50% Dimming **CS30** Security 30% Dimming, 7 hours **CM30** Median 30% Dimming, 8 hours **CE30** Economy 30% Dimming, 9 hours **DA30** All Night 30% Dimming	**MMRI** High-Frequency motion sensor integral [9]	**PCB** Photocontrol Button [7,10,11]	**Fusing** **F1** Single (120, 277, 347VAC) [10] **F2** Double (208, 240, 480VAC) [10] **F3** Canadian Double Pull (208, 240, 480VAC) [10] **Surge Protection (10kA is standard)** **SP2** Increased 20kA	**Textured** **BK** Black **WH** White **BZ** Bronze **DGY** Dark Gray **MGY** Medium Gray **Customer specified** **RAL** Specify optional color or RAL (ex: RAL7024) **CC** Custom color (Must supply color chip for required factory quote)

1. 1150, 1675, and 2100mA not available with emergency battery backup (EBP).
2. 2100mA not available with emergency battery backup cold weather (EBPC).
3. Extended lead times apply. Contact factory for details.
4. Not available with other control options.
5. Not available with motion sensor.
6. Not available with photocontrol.
7. Not available in 347 or 480V.
8. Available only in 120 or 277V.
9. MMRI not available with emergency battery backup cold weather (EBPC).
10. Must specify input voltage.
11. Not available with SiteWise (SW) and wireless control (LLC).
12. Not available with SiteWise (SW) or Dynadimmer (CS/CM/CE/DA).
13. Not available with SiteWise (SW), Wireless control (LLC), or DynaDimmer (CS/CM/CE/DA).

TYPE W1

PWS PureForm LED wall sconce

with comfort optics

Luminaire Accessories (order separately)

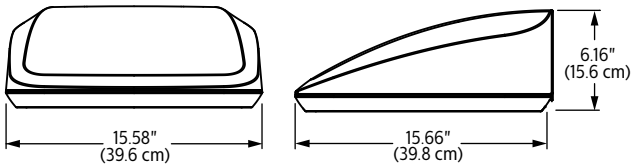
Mounting Accessories	
Wall Mount	
PWS-WS-G2	Wall Mounted Box for Surface Conduit

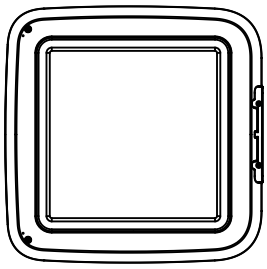
System accessories	
Wireless system remote mount module	
LLCR2-(F)	#2 lens - specify finish in place of (F)
LLCR3-(F)	#3 lens - specify finish in place of (F)
Central Remote Motion Response (used connected to SiteWise main panel)	
MS2-A-FVR-3	
MS2-A-FVR-7	

Wireless system remote controller accessory

Wireless system offers a remote radio/sensor module that allows connection to a Limelight system (sold by others). Remote module can be mounted to wall or pole with j-box supplied. May be specified by choosing one of two different lenses to accommodate a variety of mounting heights/sensor detection ranges. Must specify option DD on luminaires that are planned to be used with remote mount controllers.

Dimensions





Luminaire weights	
PureForm LED wall sconce PWS	**Weight**
Luminaire	20 lbs
Luminaire - EBP (EM battery pack)	22 lbs
Luminaire - EBPC (EM battery pack cold weather)	25 lbs

PWS PureForm LED wall sconce

with comfort optics

LED Wattage and Lumen Values

Ordering Code	LED Qty	LED Current (mA)	Color Temp.	Average System Watts	Type 2			Type 3			Type 4		
					Lumen Output	BUG Rating	Efficacy (LPW)	Lumen Output	BUG Rating	Efficacy (LPW)	Lumen Output	BUG Rating	Efficacy (LPW)
PWS-140L-450-NW-G2-x-UNV	140	450	4000	22	2448	B1-U0-G1	109	2516	B1-U0-G1	112	2671	B1-U0-G1	119
PWS-140L-650-NW-G2-x-UNV	140	650	4000	30	3412	B2-U0-G2	111	3508	B2-U0-G2	114	3724	B1-U0-G1	121
PWS-140L-1150-NW-G2-x-UNV	140	1150	4000	53	5899	B2-U0-G2	112	6064	B2-U0-G2	115	6436	B2-U0-G2	122
PWS-140L-1675-NW-G2-x-UNV	140	1675	4000	75	8189	B3-U0-G3	107	8419	B3-U0-G3	110	8935	B3-U0-G3	117
PWS-140L-2100-NW-G2-x-UNV	140	2100	4000	97	9804	B3-U0-G3	101	10079	B3-U0-G3	104	10698	B3-U0-G3	111

Values from photometric tests performed in accordance with IESNA LM-79 and are representative of the configurations shown. Actual performance may vary due to installation and environmental variables, LED and driver tolerances, and field measurement considerations. It is highly recommended to confirm performance with a photometric layout.

NOTE: Some data may be scaled based on tests of similar (but not identical) luminaires. Contact factory for configurations not shown.

LED Wattage and Lumen Values (Emergency Mode)

Ordering Code	LED Qty	LED Current (mA)	Color Temp.	Temp. Range (°C)	Avg. System Watts		Lumen Outputs					
							Type 2		Type 3		Type 4	
					Normal Mode	Emergency Mode	Normal Mode	Emergency Mode	Normal Mode	Emergency Mode	Normal Mode	Emergency Mode
PWS-140L-450-NW-G2-x-EBP-UNV	140	450	4000	0 to 40	22	10	2448	1376	2516	1415	2671	1502
PWS-140L-650-NW-G2-x-EBP-UNV	140	650	4000	0 to 40	30	10	3412	1376	3508	1415	3724	1502
PWS-140L-450-NW-G2-x-EBPC-UNV	140	450	4000	-20 to 40	22	18	2448	1964	2516	2019	2671	2143
PWS-140L-650-NW-G2-x-EBPC-UNV	140	650	4000	-20 to 40	30	18	3412	1964	3508	2019	3724	2143
PWS-140L-1150-NW-G2-x-EBPC-UNV	140	1150	4000	-20 to 40	52	18	5899	1964	6064	2019	6436	2143
PWS-140L-1675-NW-G2-x-EBPC-UNV	140	1675	4000	-20 to 40	75	18	8189	1964	8419	2019	8935	2143

For emergency EBPC option, publish values are based on initial lumens.

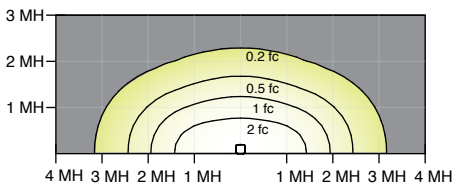
Predicted Lumen Depreciation Data

Predicted performance derived from LED manufacturer's data and engineering design estimates, based on IESNA LM-80 methodology. Actual experience may vary due to field application conditions. L_{70} is the predicted time when LED performance depreciates to 70% of initial lumen output. Calculated per IESNA TM21-11. Published L_{70} hours limited to 6 times actual LED test hours

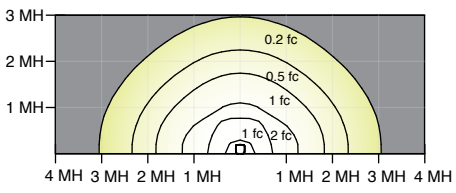
Ambient Temperature °C	Drive current	Calculated L_{70} Hours	L_{70} per TM-21	Lumen Maintenance % at 60,000 hrs
25°C	up to 2100 mA	>100,000 hours	>42,000 hours	>88%

Optical Distributions

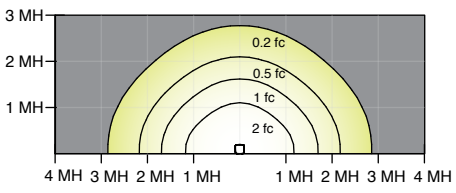
Based on 20' mounting height



Comfort Type 2



Comfort Type 3



Comfort Type 4

PWS PureForm LED wall sconce

with comfort optics

Specifications

Housing

Main body housing and door frame made of low copper die cast aluminum alloy for a high resistance to corrosion. Door hinges secured by aircraft cable to allow access to driver or other electronic components for servicing. The door frame acts as the main heat transfer component and it is optimized to allowing the main housing to have no fins, giving the freedom to have a clean minimalist aesthetic design while allowing it to house emergency battery backup equipment and various other options. Luminaire housing rated to IP65, tested in accordance to Section 9 of IEC 60598-1.

Light engine

Light guide technology provides low-glare, uniform illumination. Composed of 140 LEDs strategically positioned on the edge of the optical plate. Light engine luminous opening size optimized to best achieve a balance between lumen output and optical performance with the need to provide visual comfort. Light engine frame ensures contact with housing to provide heat conduction and sealing against the elements. Light engine is RoHS compliant. Standard color temperatures: 3000K +/- 130K, 4000K+/- 130K, 5000K +/- 225K. Minimum CRI of 70. Also available in 2700K and Amber (>590nm) with extended lead times. Contact factory for details. LED light engine is rated IP65 in accordance to Section 9 of IEC 60598-1.

Energy saving benefits

System efficacy up to 122 lms/W with significant energy savings over Pulse Start Metal Halide luminaires. Optional control options provide added energy savings during unoccupied periods.

Optical systems

The advanced LED comfort optical system provides Types 2, 3, and 4. Composed of high performance UV-stabilized optical grade lens with molded micro-optics to achieve desired distribution optimized to get a exceptional lighting uniformity. Performance tested per LM-79 and TM-15 (IESNA) certifying its photometric performance. Luminaire designed with 0% uplight (U0 per IESNA TM-15).

Mounting

Mounting is completed through integral back plate that features a separate recessed feature for hook and lock quick mount plate that secures with two set screws from bottom of luminaire. Luminaire ships fully assembled, ready to install.

Control options

0-10V dimming (DD): Access to 0-10V dimming leads supplied through back of luminaire (for secondary dimming controls by others). Cannot be used with other control options.

Field Adjustable Wattage Selector (FAWS): Luminaire equipped with the ability to manually adjust the wattage in the field to reduce total luminaire lumen output and light levels. Comes pre-set to the highest position at the lumen output selected. Use chart below to estimate reduction in lumen output desired. Cannot be used with other control options or motion response.

FAWS Position	Percent of Typical Lumen Output
1	25%
2	50%
3	55%
4	65%
5	75%
6	80%
7	85%
8	90%
9	95%
10	100%

Note: Typical value accuracy +/- 5%

SiteWise (SW): SiteWise system includes a controller fully integrated in the luminaire that enables the luminaires to communicate with a dimming signal transmitter cabinet located on site using Philips patented central dimming technology. A locally accessible mobile app allows users to access the system and set functionalities such as ON/OFF, dimming levels and scheduling. Cannot be used with other control options, motion response or photocell options. Additional functionalities are available such as communication with indoor lighting and connection to BMS systems. Complete information on the control system can be found on the SiteWise website at philips.com/sitewise.

Automatic Profile Dimming (CS/CM/CE/CA): Standard dimming profile of 30% or 50% provide flexibility towards energy savings goals while optimizing light levels during specific dark hours. Automatic dimming profile scheduled with the following settings:

- **CS50/CS30:** Security for 7 hours night duration (Ex., 11 PM - 6 AM)
- **CM50/CM30:** Median for 8 hours night duration (Ex., 10 PM - 6 AM)
- **CE50/CE30:** Economy for 9 hours night duration (Ex., 9 PM - 6 AM)
- **CA50/CA30:** for all night (during all dark hours)

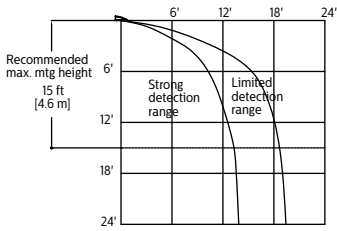
Cannot be used with other control options.

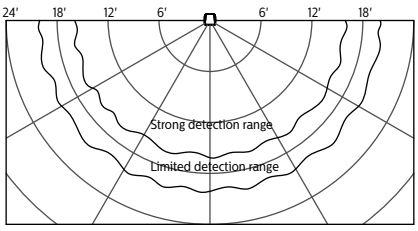
Emergency Battery Backup Cold Pack (EBP/EBPC): Emergency battery packs included integral to the luminaire, allowing for a consistent look between emergency and non-emergency luminaires. A separate surface mount accessory box is not required. EBP is suitable for use in ambient temperature conditions from 0°C (32°F) to 40°C (100°F) available on 450mA and 650mA only. EBPC cold weather rated down to -20°C (-4°F) available on all wattage except the 2100mA configuration. Both systems are designed to have a secondary driver with relay to immediately detect AC power loss to power luminaire for a minimum of 90 minutes from the time power is lost. Available with 120-277V, or 'UNV' only.

Wireless system (LLC): Optional wireless controller integral to luminaire ready to be connected to a Limelight system (sold by others). The system allows you to wirelessly manage the entire site, independent lighting groups or individual luminaires while on-site or remotely. Based on a high-density mesh network with an easy to use web-based portal, you can conveniently access, monitor and manage your lighting network remotely. Wireless controls can be combined with site and area, pedestrian, and parking garage luminaires as well, for a completely connected outdoor solution. Motion response capability can be installed in other luminaires in the mesh or on a remote pod accessory where pod is mounted to pole or wall.

Motion response options

Bi-Level Infrared Motion Response (BL-MMRI): High frequency (5.8GHz +/- 75MHz microwave ISM wave band with <0.5 mW transmitting power) motion sensor is mounted integral to the luminaire. This bi-level motion sensor is designed to detect motion through the light engine so it can be used inside the luminaire without any protruded components. Sensor allows energy savings and meeting code requirements without compromising comfort and aesthetics. The product comes with factory pre-programmed standard settings including a dimming level of 30%, hold time of 3 minutes with no stand-by period. This means that in operations, the sensor will keep the luminaire at 30% of total lumen output and when motion is detected, the luminaire returns to 100% output. It will remain on full power for 3 minutes default prior to dimming back to low when no motion is observed. Other dimming levels, holding times, and stand-by periods are possible. Please contact factory technical support for details.





PWS PureForm LED wall sconce

with comfort optics

Specifications (cont'd)

Electrical

Driver: Driver efficiency (>90% standard). 120-480V available (restrictions apply). Open/short circuit protection. Optional 0-10V dimming to 10% power. RoHS compliant.

Button Photocontrol (PCB): Button style design for internal luminaires mounting applications. The photocontrol is constructed of a high impact UV stabilized polycarbonate housing. Rated voltage of 120V or 208-277V with a load rating of 1000 VA. The photocell will turn on with 1-4Fc of ambient light.

Surge protection (SP1/SP2): Each luminaire is provided as standard with surge protector tested in accordance with ANSI/IEEE C62.45 per ANSI/IEEE C62.41.2 Scenario I Category C High Exposure 10kV/5kA waveforms for Line Ground, Line Neutral and Neutral Ground, and in accordance with U.S. DOE (Department of Energy) MSSLC (Municipal Solid-State Street Lighting Consortium) Model Specification for LED Roadway Luminaires Appendix D Electrical Immunity High Test Level 10kV / 5kA. Optional 20kV is available for additional protection.

Listings

UL/cUL listed to the UL 1598 standard, suitable for wet locations when mounted downward facing. Also listed for damp locations when inverted upward facing when mounted in covered ceiling application. Suitable for use in ambient temperatures from -40° to 40°C (-40° to 104°F). Most PureForm PWS configurations are qualified under Standard DesignLights Consortium® category. Consult DLC Qualified Products list for more details.

Finish

Each standard color luminaire receives a fade and abrasion resistant, electrostatically applied, thermally cured, triglycidal isocyanurate (TGIC) textured polyester powdercoat finish. The surface treatment achieves a minimum of 1000 hours for salt spray resistant finish in accordance with testing performed and per ASTM B117 standard. Standard colors include bronze (BZ), black (BK), white (WH), dark gray (DGY), and medium gray (MGY). Consult factory for specs on optional or custom colors.

Warranty

PureForm luminaires feature a 5-year limited warranty.
See philips.com/warranties for complete details and exclusions.

Philips Lighting North America Corporation
200 Franklin Square Drive, Somerset, NJ 08873
Tel. 855-486-2216

Philips Lighting Canada Ltd.
281 Hillmount Rd, Markham, ON, Canada L6C 2S3
Tel. 800-668-9008

TYPE D4

PHILIPS
LIGHTOLIER

Downlighting

Calculite LED gen 3

4" round downlight, 500 - 3000lm

Calculite LED 4" generation 3 features industry leading visual comfort, excellent uniform illumination over time, and patented installation flexibility.

Complete luminaire = Frame + Engine + Trim + Accessories (optional)

Project:
Location:
Cat.No:
Type:
Lamps: Qty:
Notes:

*** Note:** All **4RN** frames will replace **C4RN** frames beginning in 2Q18.

Frame

example: C4RN

Series	Aperture	Installation	Voltage / Options
	R		
C4 Calculite LED 4" **4** 4" Non-IC *	**R** Round	**N** New construction[1] **R** Remodeler	**—** Universal 120 V/277 V (specify for Power Over Ethernet configurations) **3** 347 V (not compatible with ELV dimming) **EM** Emergency[1,2] **LC** Chicago Plenum[1]

Engine

example: C4L15835NZ10U

Series	Lumens	CRI	CCT	Beam	Dimming / Driver	Voltage
C4L						
C4L Calculite LED 4"	**05** 500 lm[3] **10** 1000 lm **15** 1500 lm **20** 2000 lm[4] **25** 2500 lm[4] **30** 3000 lm[4]	**8** 80 CRI **9** 90 CRI	**27** 2700 K **30** 3000 K **35** 3500 K **40** 4000 K	**N** Narrow (43°) **M** Medium (56°) **W** Wide (76°)	**Z10** 0-10 V 1%[3] **SOL** EldoLED Solo 0-10 V 0.1% **D** Dali **L** Lutron LDE1 EcoSystem (fade-to-black) **DMX** Digital Multiplexing	**U** Universal 120 V/277 V/347 V
					E ELV (120V dimming only)[5]	**1** Universal 120 V/277 V
					P Power over Ethernet (PoE)	**E** Ethernet 48 V DC
					Only compatible with 1000 (10) to 2500 (25) lumen configurations.	

Trim

example: C4RDLCCP

Series	Aperture	Style	Finish	Flange
C4	**R**	**DL**		
C4 Calculite LED 4"	**R** Round	**DL** Downlight	**BK** Black (matte) **CL** Specular clear **CC** Comfort clear **CD** Comfort clear diffuse **CZ** Champagne bronze	**–** White (matte) **P** Polished **F** Flangeless
			WH White (matte)	**–** White (matte) **F** Flangeless
		SL Shower light (non-conductive)[6]	**WH** White (matte)	**–** Not applicable

Accessories

CA4RFT	Mud-in ring for use with flangeless installations (ordered with a flangeless trim)
CAEM	Field installable EM pack (not compatible with Power over Ethernet configurations)
C4RVPWH	IP65 rated vandal proof matte white accessory that mounts onto a flangeless trim
AMS	ActiLume multi-sensor (optional accessory for Power Over Ethernet configurations)
SWZDT	SpaceWise wireless controller with dwell time functionality (compatible with all 0-10V - see "SWZDT" spec sheet)

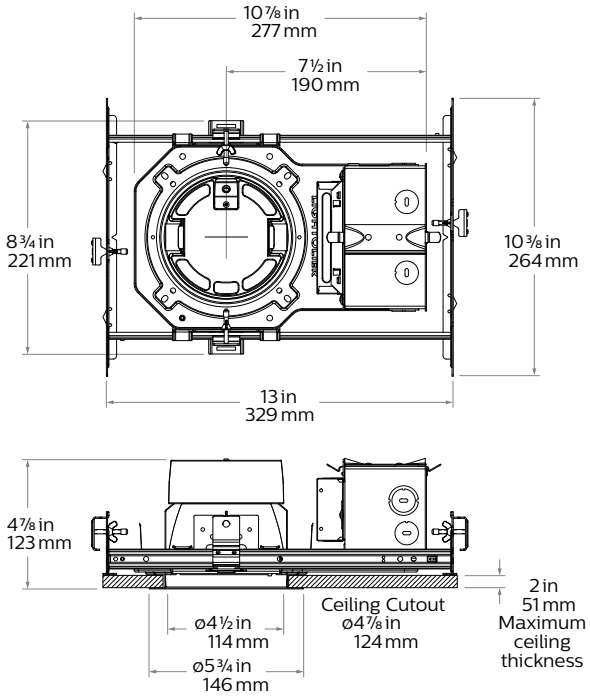
1. Emergency (EM) and Chicago Plenum (LC) options are only available with New construction (N) installations.
2. Emergency (EM) frame comes with emergency battery pack and ceiling mountable test switch (see page 4).
3. The 500lm (05) package is only compatible with 0-10V (Z10) dimming.
4. The 2000lm (20), 2500lm (25), and 3000lm (30) packages have marked spacing requirements (see page 3).
5. ELV (E) dimming is only compatible with up to 2000lm (20) configurations.
6. Non-conductive flush mount lens with pre-installed gasket (matte white non-conductive flange with diffuse lens that is flush with the flange).

TYPE D4

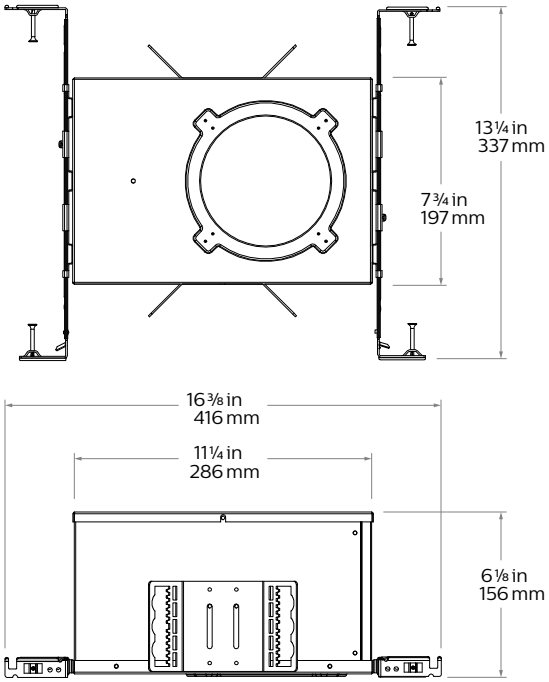
C4RDL Calculite LED generation 3

4" round downlight

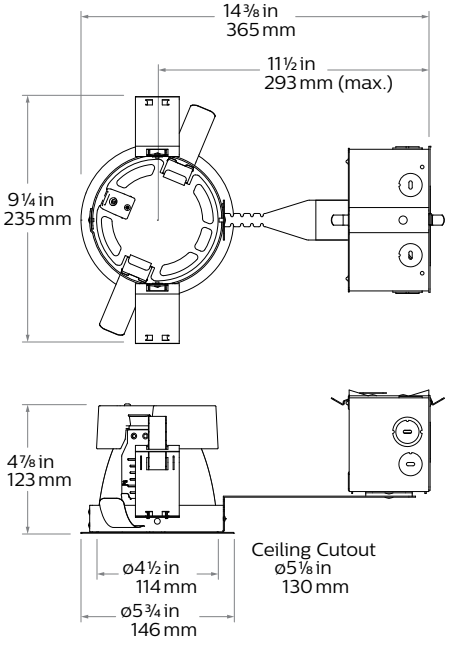
New Construction (N)



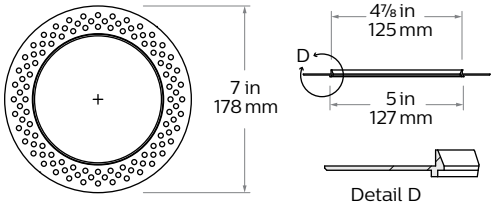
Chicago Plenum (LC)



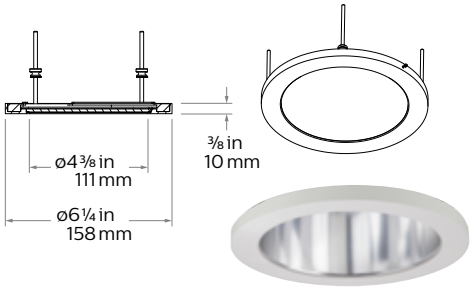
Remodeler (R)



Flangeless mud-in ring (CA4RFT) accessory



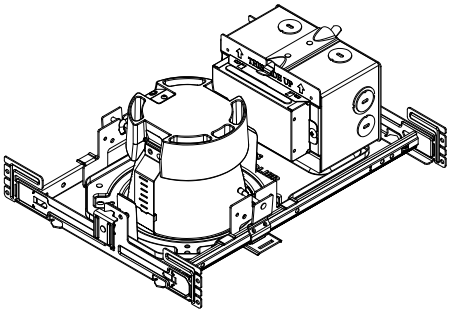
Vandal Proof (VP) accessory

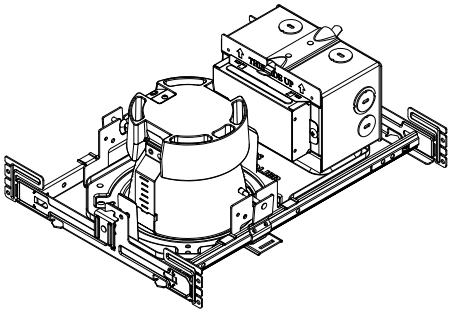


TYPE D4

C4RDL Calculite LED generation 3

4" round downlight





Narrow

Light engine	Input volts	Input freq	Input current	Drive current	Input power	THD power	Power factor
C4L05_NZ10U	120V	50/60Hz	0.05	110 mA	6W	<20%	>0.95
	277V		0.03			<20%	>0.90
C4L10_NZ10U	120V	50/60Hz	0.08	230 mA	11W	<15%	>0.95
	277V		0.04			<20%	>0.95
C4L15_NZ10U	120V	50/60Hz	0.12	360 mA	16W	<10%	>0.95
	277V		0.06			<15%	>0.95
C4L20_NZ10U	120V	50/60Hz	0.17	490 mA	21W	<10%	>0.95
	277V		0.08			<15%	>0.95
C4L25_NZ10U	120V	50/60Hz	0.22	640 mA	27W	<10%	>0.95
	277V		0.10			<15%	>0.95
C4L30_NZ10U	120V	50/60Hz	0.27	790 mA	33W	<10%	>0.95
	277V		0.13			<15%	>0.95

Medium/Wide

Light engine	Input volts	Input freq	Input current	Drive current	Input power	THD power	Power factor
C4L05_MZ10U	120V	50/60Hz	0.05	110 mA	6W	<20%	>0.95
	277V		0.03			<20%	>0.90
C4L10_MZ10U	120V	50/60Hz	0.08	230 mA	11W	<15%	>0.95
	277V		0.04			<20%	>0.95
C4L15_MZ10U	120V	50/60Hz	0.12	350 mA	16W	<10%	>0.95
	277V		0.06			<15%	>0.95
C4L20_MZ10U	120V	50/60Hz	0.16	470 mA	21W	<10%	>0.95
	277V		0.08			<15%	>0.95
C4L25_MZ10U	120V	50/60Hz	0.21	610 mA	25W	<10%	>0.95
	277V		0.09			<15%	>0.95
C4L30_MZ10U	120V	50/60Hz	0.26	770 mA	31W	<10%	>0.95
	277V		0.12			<15%	>0.95

Narrow (Power over Ethernet)

	Input				
Light engine	**Volts[1]**	**Voltage[2]**	**Freq**	**Current**	**Power**
C4L10___NPE	53V	51-54V	DC	160 mA	8.9 W
C4L15___NPE	53V	51-54V	DC	250 mA	13.6 W
C4L20___NPE	53V	51-54V	DC	340 mA	18.5 W
C4L25___NPE	53V	51-54V	DC	460 mA	24.6 W

Medium (Power over Ethernet)

	Input				
Light engine	**Volts[1]**	**Voltage[2]**	**Freq**	**Current**	**Power**
C4L10___MPE	53V	51-54V	DC	160 mA	8.8 W
C4L15___MPE	53V	51-54V	DC	250 mA	13.4 W
C4L20___MPE	53V	51-54V	DC	320 mA	17.6 W
C4L25___MPE	53V	51-54V	DC	430 mA	23.2 W

Wide (Power over Ethernet)

	Input				
Light engine	**Volts[1]**	**Voltage[2]**	**Freq**	**Current**	**Power**
C4L10___WPE	53V	51-54V	DC	160 mA	8.8 W
C4L15___WPE	53V	51-54V	DC	250 mA	13.4 W
C4L20___WPE	53V	51-54V	DC	320 mA	17.6 W
C4L25___WPE	53V	51-54V	DC	430 mA	23.2 W

1. Nominal input volts.
2. Preferred volt range.

Marked spacing applications

Light engine	2500 lm	3000 lm
C4L_Z10U series	—	X
C4L_LU series	X	X
C4L_DU series	—	X
C4L_DMXU series	—	X

Modules marked with an X require marked spacing:
- Center-to-center of adjacent luminaires: 24" (610mm)
- Luminaire center to side building member: 12" (305mm)

Lifetime (TM-21) data

Lumens	Narrow beam	Medium/Wide beam*
500lm **1000lm** **1500lm**	L90 @ 60,000hrs.	L90 @ 60,000hrs.
2000lm **2500lm** **3000lm***	L90 @ 60,000hrs.	L85 @ 60,000hrs.

* Lutron 3000lm with Medium/Wide beam is L80 @ 60,000hrs.

TYPE D4

C4RDL Calculite LED generation 3

4" round downlight

Reflector

Specular clear (CL): Most specular and most efficient finish, delivers maximum photometric performance but can produce a mirror image effect of the interior space.

Comfort clear (CC): Semi-specular finish that softens the light at the source of the reflector and creates a subtle, even luminance from the reflector cone.

Comfort clear diffuse (CD): Slightly diffuse clear finish, that eliminates iridescence and reduces the mirror image effect inherent with specular finishes.

Champagne bronze (CZ): Semi-specular finish that softens light at the source of the reflector while providing a warmer reflector appearance (slightly warmer).

White (WH): (matte) Brightest illuminated aperture and provides the smoothest transition to most ceilings when off (white is only available with a white flange).

Black (BK): (matte) Specular finish that provides the lowest aperture brightness possible and significantly reduces source identification in a ceiling.

Flange

White (–): (matte) Provides the smoothest transition to ceilings when off.

Polished (P): (matches aperture) Produces a continuous look throughout the reflector (aperture matching).

Flangeless (F): (flush-mount) Creates a flush, virtually seamless transition from aperture to ceiling.

Frame-in-kits

New Construction

Galvanized stamped steel for dry or plaster ceilings. Preinstalled telescoping mounting bars from 13" to 24". For 4' distances, use 1/2" EMT, 1-1/2" x 1/2" U or C channel.

Max ceiling thickness is 2" (51 mm). Including PoE frame 4.88" (124 mm).

Emergency

Reflector mounted test switch requires above ceiling access. For reflector mounted test switch, order emergency frame and add "EM" suffix to reflector (example: C4RDLCCEM).

Patented install Mounting frame

With no driver attached, this versatile frame is independent of driver accommodating a wide range of lumen packages, driver types and CCTs, including 120V and 277V inputs.

Pre-installed mounting bars for fast and tool-less installs into T-grid & hat channel ceilings.

Close-cut aperture design eliminates possibility of gap between ceiling opening & reflector flange.

Separate wiring compartment for wiring frame to building allows inspection prior to light engine install.

Simple plug-and-play connection between frame and light engine from below ceiling eliminates need for wiring between frame and LED driver, and also saves time during installation and future replacements/upgrades. Plug-and-play receptacle accommodates technology upgrade of light engines and replacements for the life of the building.

Dimming

- Advance 0-10V 1% dimming
- Lutron Hi-lume EcoSystem H Series 1% dimming
- EldoLED ECOdrive Dali 1% dimming
- EldoLED SOLOdrive 0-10V 0.1% dimming
- ELV dimming and DMX dimming

Power over Ethernet

Powered via Philips PoE lighting controller: complies with FCC rules per Title 47 part 15 (Class A) for EMI / RFI (conducted & radiated). PoE lighting controller accessible from below ceiling.

Rated life: 60,0000 hrs at 70% lumen maintenance based on IES LM-80-08 and TM-21-11.

Optical systems

Comfort throughout the space: Patented optical system combines primary and secondary optics to provide a true 50° physical cutoff and 45° reflected cutoff virtually eliminating the view of the light source and bright spots in the reflector. A new reflector curve reduces reflector brightness by up to 50% compared to existing products, allowing for the use of higher lumen packages in smaller apertures without creating bright spots in the ceiling.

Quality of light: 2 SDCM ensures color consistency from fixture to fixture and over the luminaire's long lifetime. Proprietary optical grade silicone lens with patterned surface provides soft, even beam diffusion without hotspots or dark rings.

Light Engine

Quick connect power pack comprised of light source and driver allow for easy installation and replacement from below ceiling with no need for additional wiring. This allows for:

- Frame and ceiling installation to be performed while still finalizing details such as lumen packages, CCT and control type.
- Easy replacement of electronics at end of life with minimal wasted material and labor required.
- Ease and upgradability of technology.

Options and Accessories

Flangeless mud-in ring: Use **CA4RFT** for use with flangless plaster installations.

Sloped ceilings: Compatible with sloped ceiling adapters (see **SCA** spec sheet).

Vandal Proof: Use **C4RVPWH** for an IP65 rated vandal proof matte white accessory. Must be ordered with a flangeless trim.

ENERGY STAR® exceptions

500lm & 90 CRI configurations
Champagne Bronze & Black finishes
347V & Emergency voltage/options
Dali, EldoLED Solo & PoE drivers

Title 24 exceptions

1000lm configurations
Champagne Bronze & Black finishes

Labels and Listings

cULus listed for wet location
ENERGY STAR®, RoHS & CEC Title 24 JA8 certified
CCEA (frames with *LC suffix)
IP65 rated with vandal proof accessory
IBEW Union made (light engines & reflectors)

Warranty

5 year warranty on complete system.

Complete warranty available at: http://images.philips.com/is/content/PhilipsConsumer/PDFDownloads/United%20States/ODLI20150930_003-UPD-en_US-Philips-warranty-indoor-PLS-us.pdf

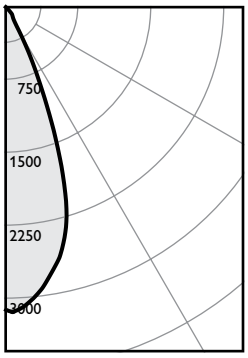
TYPE D4

C4RDL Calculite LED generation 3

4" round downlight

Narrow beam, 1500lm Engine, 103.8 lm/W at 14.7W or 112.2 lm/W at 13.6W (Power over Ethernet)

Candela Curve



Frame: **C4RN or 4RN**
Engine: **C4L15835NZ10U**
Trim: **C4RDLCL**

Output lumens:	1526 lms
Input watts:	14.7 W
CRI:	80 min
CCT[1]:	3500K
Spacing Crit.:	0.6
Beam Angle:	43°

Zonal summary

Zone	Lumens	%Luminaire
0-30	1354	88.7%
0-40	1469	96.3%
0-60	1526	100.0%
0-90	1526	100.0%

Angle	Mean CP	Lumens
0	3112	
5	3044	282
10	2785	
15	2410	652
20	1672	
25	837	420
30	324	
35	163	115
40	128	
45	77	57
50	0	
55	0	0
60	0	
65	0	0
70	0	
75	0	0
80	0	
85	0	0
90	0	

Single unit data

Height to lighted plane	Initial center beam foot-candles	Beam diameter (ft)*
5'	124	3.0'
6'	86	3.6'
7'	64	4.2'
8'	49	4.8'
9'	38	5.4'

* Beam diameter is where foot-candles drop to 50% of maximum.

Multiple unit data - RCR 2

Spacing on center	Initial center beam foot-candles	Watts per sq. ft.
5'	71.3	0.65
6'	46.8	0.43
7'	33.4	0.31
8'	27.8	0.25
9'	22.3	0.20

38' x 38' x 10' Room, Workplane 2.5' above floor, 80/50/20% Reflectances

Efficacy: 103.8 lm/w
Report[2]: T20161390

Adjustment factors

Finish		CCT		Lumens	
CL	= 100%	80CRI 4000K	= 107%	3000lm	= 200%
CC	= 95%	80CRI 3500K	= 100%	2500lm	= 167%
CD	= 87%	80CRI 3000K	= 99%	2000lm	= 133%
CZ	= 63%	80CRI 2700K	= 93%	1500lm	= 100%
WH	= 87%	90CRI 3000K	= 87%	1000lm	= 67%
BK	= 57%	90CRI 2700K	= 81%	500lm	= 33%

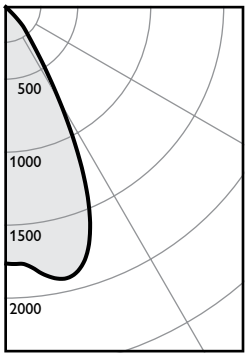
Coefficients of utilization

Ceiling	80%				70%		50%		30%		0%
Wall	70	50	30	10	50	10	50	10	50	10	0
RCR	Zonal cavity method - Effective floor reflectance = 20%										
0	119	119	119	119	116	116	111	111	106	106	100
1	114	112	110	108	110	106	106	103	102	100	95
2	110	106	102	99	104	98	101	96	98	94	91
3	105	100	96	92	99	92	96	90	94	89	86
4	101	95	90	87	94	86	92	85	90	84	82
5	97	90	85	82	89	81	88	81	86	80	78
6	93	86	81	77	85	77	84	77	83	76	74
7	90	82	77	74	81	73	80	73	79	73	71
8	86	79	74	70	78	70	77	70	76	69	68
9	83	75	70	67	75	67	74	67	73	66	65
10	80	72	67	64	72	64	71	64	70	64	62

Room Cavity Ratio

Medium beam, 1500lm Engine, 114.6 lm/W at 14.2W or 121.4 lm/W at 13.4W (Power over Ethernet)

Candela Curve



Frame: **C4RN or 4RN**
Engine: **C4L15835MZ10U**
Trim: **C4RDLCL**

Output lumens:	1627 lms
Input watts:	14.2 W
CRI:	80 min
CCT[1]:	3500K
Spacing Crit.:	0.9
Beam Angle:	56°

Zonal summary

Zone	Lumens	%Luminaire
0-30	1269	78.0%
0-40	1537	94.5%
0-60	1627	100.0%
0-90	1627	100.0%

Angle	Mean CP	Lumens
0	1760	
5	1783	174
10	1886	
15	1887	524
20	1702	
25	1283	572
30	762	
35	406	268
40	236	
45	116	89
50	14	
55	0	1
60	0	
65	0	0
70	0	
75	0	0
80	0	
85	0	0
90	0	

Single unit data

Height to lighted plane	Initial center beam foot-candles	Beam diameter (ft)*
5'	70	4.5'
6'	49	5.4'
7'	36	6.3'
8'	28	7.2'
9'	22	8.1'

* Beam diameter is where foot-candles drop to 50% of maximum.

Multiple unit data - RCR 2

Spacing on center	Initial center beam foot-candles	Watts per sq. ft.
5'	74.8	0.63
6'	49.1	0.41
7'	35.0	0.30
8'	29.2	0.25
9'	23.4	0.20

38' x 38' x 10' Room, Workplane 2.5' above floor, 80/50/20% Reflectances

Efficacy: 114.6 lm/w
Report[2]: T20161397

Adjustment factors

Finish		CCT		Lumens	
CL	= 100%	80CRI 4000K	= 102%	3000lm	= 200%
CC	= 95%	80CRI 3500K	= 100%	2500lm	= 167%
CD	= 87%	80CRI 3000K	= 97%	2000lm	= 133%
CZ	= 63%	80CRI 2700K	= 87%	1500lm	= 100%
WH	= 87%	90CRI 3000K	= 77%	1000lm	= 67%
BK	= 57%	90CRI 2700K	= 73%	500lm	= 33%

Coefficients of utilization

Ceiling	80%				70%		50%		30%		0%
Wall	70	50	30	10	50	10	50	10	50	10	0
RCR	Zonal cavity method - Effective floor reflectance = 20%										
0	119	119	119	119	116	116	111	111	106	106	100
1	114	111	109	107	109	105	105	102	101	99	94
2	108	104	100	97	102	96	99	94	96	92	88
3	103	97	93	89	96	88	93	87	91	85	82
4	98	91	86	82	90	81	88	81	86	80	77
5	94	86	80	76	85	76	83	75	81	74	72
6	89	81	75	71	80	71	79	70	77	70	68
7	85	76	70	66	76	66	74	66	73	66	64
8	81	72	66	62	71	62	70	62	69	62	60
9	77	68	63	59	68	59	67	58	66	58	57
10	74	65	59	55	64	55	63	55	63	55	54

Room Cavity Ratio

1. Correlated Color Temperature within specs as defined in ANSI_NEMA_ANSLG C78.377-2008: Specifications for the Chromaticity of Solid State Lighting Products.
2. Tested using absolute photometry as specified in LM79: IESNA Approved Method for the Electrical and Photometric Measurements of Solid-State Lighting Products.

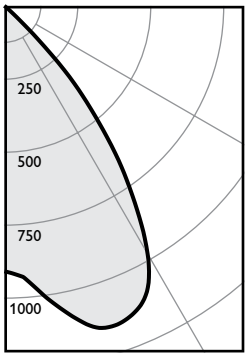
TYPE D4

C4RDL Calculite LED generation 3

4" round downlight

Wide beam, 1500lm Engine, 106.6 lm/W at 14.2W or 113.2 lm/W at 13.4W (Power over Ethernet)

Candela Curve



Frame: **C4RN or 4RN**
Engine: **C4L15835WZ10U**
Trim: **C4RDLCL**

Output lumens:	1517 lms
Input watts:	14.2 W
CRI:	80 min
CCT[1]:	3500K
Spacing Crit.:	1.2
Beam Angle:	76°

Zonal summary

Zone	Lumens	%Luminaire
0-30	918	60.5%
0-40	1368	90.2%
0-60	1517	100.0%
0-90	1517	100.0%

Angle	Mean CP	Lumens
0	906	
5	945	93
10	1040	
15	1128	318
20	1153	
25	1114	506
30	978	
35	732	450
40	460	
45	175	148
50	18	
55	0	2
60	0	
65	0	0
70	0	
75	0	0
80	0	
85	0	0
90	0	

Single unit data

Height to lighted plane	Initial center beam foot-candles	Beam diameter (ft)*
5′	36	6.0′
6′	25	7.2′
7′	18	8.4′
8′	14	9.6′
9′	11	10.8′

* Beam diameter is where foot-candles drop to 50% of maximum.

Multiple unit data - RCR 2

Spacing on center	Initial center beam foot-candles	Watts per sq. ft.
5′	68.5	0.63
6′	45.0	0.41
7′	32.1	0.30
8′	26.8	0.25
9′	21.4	0.20

38′ x 38′ x 10′ Room, Workplane 2.5′ above floor, 80/50/20% Reflectances

Efficacy: 106.6 lm/w
Report[2]: T20161406

Adjustment factors

Finish		CCT		Lumens	
CL	= 100%	80CRI 4000K	= 102%	3000lm	= 200%
CC	= 95%	80CRI 3500K	= 100%	2500lm	= 167%
CD	= 87%	80CRI 3000K	= 97%	2000lm	= 133%
CZ	= 63%	80CRI 2700K	= 87%	1500lm	= 100%
WH	= 87%	90CRI 3000K	= 77%	1000lm	= 67%
BK	= 57%	90CRI 2700K	= 73%	500lm	= 33%

Coefficients of utilization

Ceiling	80%				70%		50%		30%		0%
Wall	70	50	30	10	50	10	50	10	50	10	0
RCR	Zonal cavity method - Effective floor reflectance = 20%										
0	119	119	119	119	116	116	111	111	106	106	100
1	113	110	108	105	108	104	104	100	100	97	93
2	107	102	98	94	100	93	97	91	94	89	86
3	101	94	89	85	93	84	90	83	88	81	79
4	96	87	82	77	86	77	84	76	82	75	72
5	90	81	75	70	80	70	78	69	77	69	66
6	85	75	69	64	75	64	73	64	72	63	61
7	80	70	64	59	69	59	68	59	67	58	56
8	76	65	59	55	65	54	64	54	63	54	52
9	72	61	55	50	61	50	60	50	59	50	48
10	68	57	51	47	57	47	56	47	55	46	45

Room Cavity Ratio

1. Correlated Color Temperature within specs as defined in ANSI_NEMA_ANSLG C78.377-2008: Specifications for the Chromaticity of Solid State Lighting Products.
2. Tested using absolute photometry as specified in LM79: IESNA Approved Method for the Electrical and Photometric Measurements of Solid-State Lighting Products.

Philips Lighting, North America Corporation
200 Franklin Square Drive, Somerset, NJ 08873
Tel. 855-486-2216

Philips Lighting Canada Ltd.
281 Hillmount Rd, Markham, ON, Canada L6C 2S3
Tel. 800-668-9008

TYPE D5

PHILIPS
LIGHTOLIER

Downlighting

Calculite LED gen 3

4" round downlight, 500 - 3000lm

Calculite LED 4" generation 3 features industry leading visual comfort, excellent uniform illumination over time, and patented installation flexibility.

Complete luminaire = Frame + Engine + Trim + Accessories (optional)

Project:
Location:
Cat.No:
Type:
Lamps: Qty:
Notes:

*** Note:** All **4RN** frames will replace **C4RN** frames beginning in 2Q18.

Frame

example: C4RN

Series	Aperture	Installation	Voltage / Options
	R		
C4 Calculite LED 4" **4** 4" Non-IC *	**R** Round	**N** New construction[1] **R** Remodeler	**—** Universal 120 V/277 V (specify for Power Over Ethernet configurations) **3** 347 V (not compatible with ELV dimming) **EM** Emergency[1,2] **LC** Chicago Plenum[1]

Engine

example: C4L15835NZ10U

Series	Lumens	CRI	CCT	Beam	Dimming / Driver	Voltage
C4L						
C4L Calculite LED 4"	**05** 500 lm[3] **10** 1000 lm **15** 1500 lm **20** 2000 lm[4] **25** 2500 lm[4] **30** 3000 lm[4]	**8** 80 CRI **9** 90 CRI	**27** 2700 K **30** 3000 K **35** 3500 K **40** 4000 K	**N** Narrow (43°) **M** Medium (56°) **W** Wide (76°)	**Z10** 0-10 V 1%[3] **SOL** EldoLED Solo 0-10 V 0.1% **D** Dali **L** Lutron LDE1 EcoSystem (fade-to-black) **DMX** Digital Multiplexing	**U** Universal 120 V/277 V/347 V
					E ELV (120V dimming only)[5]	**1** Universal 120 V/277 V
					P Power over Ethernet (PoE)	**E** Ethernet 48 V DC
					Only compatible with 1000 (10) to 2500 (25) lumen configurations.	

Trim

example: C4RDLCCP

Series	Aperture	Style	Finish	Flange
C4	**R**	**DL**		
C4 Calculite LED 4"	**R** Round	**DL** Downlight	**BK** Black (matte) **CL** Specular clear **CC** Comfort clear **CD** Comfort clear diffuse **CZ** Champagne bronze	**–** White (matte) **P** Polished **F** Flangeless
			WH White (matte)	**–** White (matte) **F** Flangeless
		SL Shower light (non-conductive)[6]	**WH** White (matte)	**–** Not applicable

Accessories

CA4RFT	Mud-in ring for use with flangeless installations (ordered with a flangeless trim)
CAEM	Field installable EM pack (not compatible with Power over Ethernet configurations)
C4RVPWH	IP65 rated vandal proof matte white accessory that mounts onto a flangeless trim
AMS	ActiLume multi-sensor (optional accessory for Power Over Ethernet configurations)
SWZDT	SpaceWise wireless controller with dwell time functionality (compatible with all 0-10V - see "SWZDT" spec sheet)

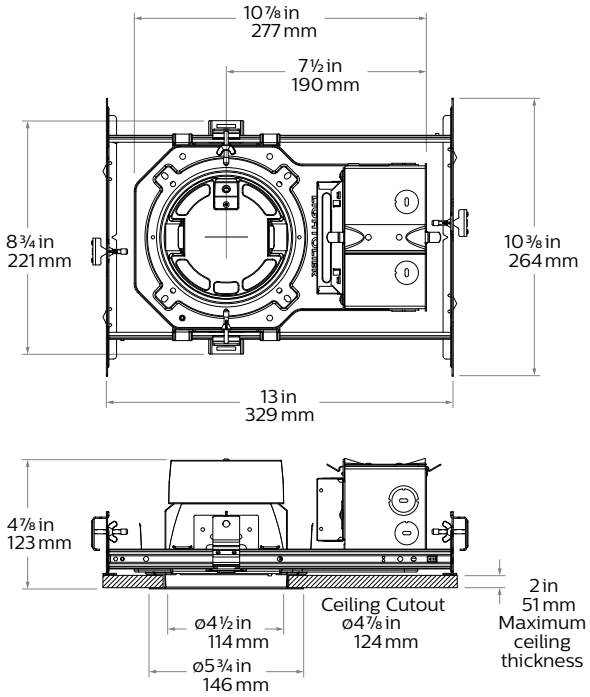
1. Emergency (EM) and Chicago Plenum (LC) options are only available with New construction (N) installations.
2. Emergency (EM) frame comes with emergency battery pack and ceiling mountable test switch (see page 4).
3. The 500lm (05) package is only compatible with 0-10V (Z10) dimming.
4. The 2000lm (20), 2500lm (25), and 3000lm (30) packages have marked spacing requirements (see page 3).
5. ELV (E) dimming is only compatible with up to 2000lm (20) configurations.
6. Non-conductive flush mount lens with pre-installed gasket (matte white non-conductive flange with diffuse lens that is flush with the flange).

TYPE D5

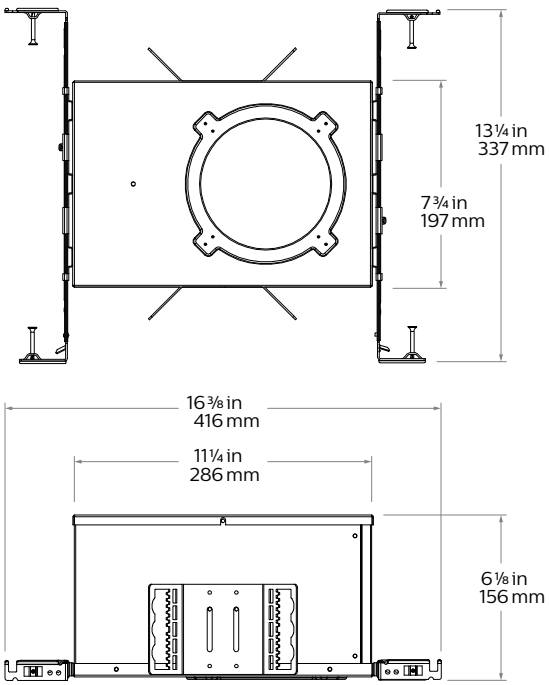
C4RDL Calculite LED generation 3

4" round downlight

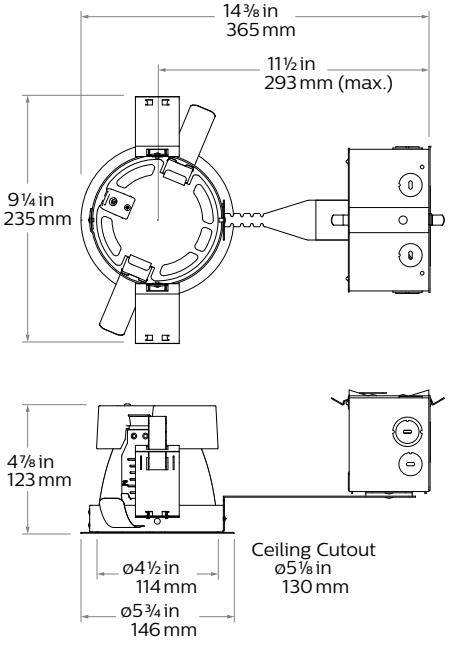
New Construction (N)



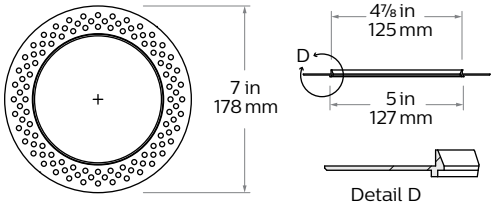
Chicago Plenum (LC)



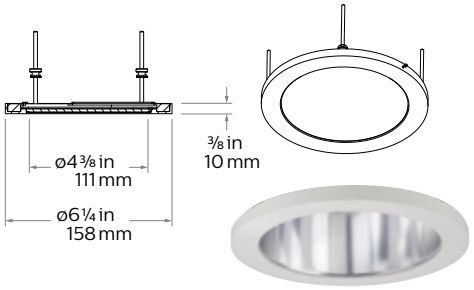
Remodeler (R)



Flangeless mud-in ring (CA4RFT) accessory



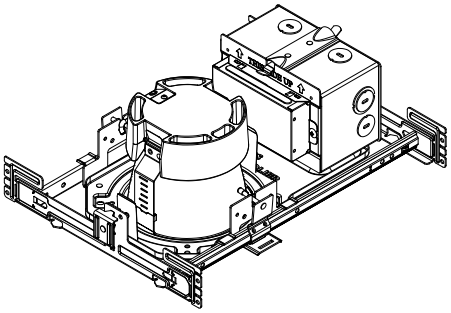
Vandal Proof (VP) accessory

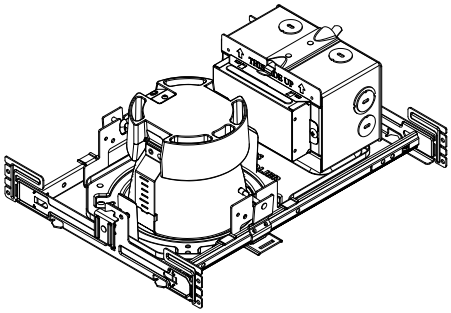


TYPE D5

C4RDL Calculite LED generation 3

4" round downlight





Narrow

Light engine	Input volts	Input freq	Input current	Drive current	Input power	THD power	Power factor
C4L05_NZ10U	120V	50/60Hz	0.05	110 mA	6W	<20%	>0.95
	277V		0.03			<20%	>0.90
C4L10_NZ10U	120V	50/60Hz	0.08	230 mA	11W	<15%	>0.95
	277V		0.04			<20%	>0.95
C4L15_NZ10U	120V	50/60Hz	0.12	360 mA	16W	<10%	>0.95
	277V		0.06			<15%	>0.95
C4L20_NZ10U	120V	50/60Hz	0.17	490 mA	21W	<10%	>0.95
	277V		0.08			<15%	>0.95
C4L25_NZ10U	120V	50/60Hz	0.22	640 mA	27W	<10%	>0.95
	277V		0.10			<15%	>0.95
C4L30_NZ10U	120V	50/60Hz	0.27	790 mA	33W	<10%	>0.95
	277V		0.13			<15%	>0.95

Medium/Wide

Light engine	Input volts	Input freq	Input current	Drive current	Input power	THD power	Power factor
C4L05_MZ10U	120V	50/60Hz	0.05	110 mA	6W	<20%	>0.95
	277V		0.03			<20%	>0.90
C4L10_MZ10U	120V	50/60Hz	0.08	230 mA	11W	<15%	>0.95
	277V		0.04			<20%	>0.95
C4L15_MZ10U	120V	50/60Hz	0.12	350 mA	16W	<10%	>0.95
	277V		0.06			<15%	>0.95
C4L20_MZ10U	120V	50/60Hz	0.16	470 mA	21W	<10%	>0.95
	277V		0.08			<15%	>0.95
C4L25_MZ10U	120V	50/60Hz	0.21	610 mA	25W	<10%	>0.95
	277V		0.09			<15%	>0.95
C4L30_MZ10U	120V	50/60Hz	0.26	770 mA	31W	<10%	>0.95
	277V		0.12			<15%	>0.95

Narrow (Power over Ethernet)

	Input				
Light engine	Volts[1]	Voltage[2]	Freq	Current	Power
C4L10___NPE	53V	51-54V	DC	160 mA	8.9 W
C4L15___NPE	53V	51-54V	DC	250 mA	13.6 W
C4L20___NPE	53V	51-54V	DC	340 mA	18.5 W
C4L25___NPE	53V	51-54V	DC	460 mA	24.6 W

Medium (Power over Ethernet)

	Input				
Light engine	Volts[1]	Voltage[2]	Freq	Current	Power
C4L10___MPE	53V	51-54V	DC	160 mA	8.8 W
C4L15___MPE	53V	51-54V	DC	250 mA	13.4 W
C4L20___MPE	53V	51-54V	DC	320 mA	17.6 W
C4L25___MPE	53V	51-54V	DC	430 mA	23.2 W

Wide (Power over Ethernet)

	Input				
Light engine	Volts[1]	Voltage[2]	Freq	Current	Power
C4L10___WPE	53V	51-54V	DC	160 mA	8.8 W
C4L15___WPE	53V	51-54V	DC	250 mA	13.4 W
C4L20___WPE	53V	51-54V	DC	320 mA	17.6 W
C4L25___WPE	53V	51-54V	DC	430 mA	23.2 W

1. Nominal input volts.
2. Preferred volt range.

Marked spacing applications

Light engine	2500 lm	3000 lm
C4L_Z10U series	—	X
C4L_LU series	X	X
C4L_DU series	—	X
C4L_DMXU series	—	X

Modules marked with an X require marked spacing:
- Center-to-center of adjacent luminaires: 24" (610mm)
- Luminaire center to side building member: 12" (305mm)

Lifetime (TM-21) data

Lumens	Narrow beam	Medium/Wide beam*
500lm **1000lm** **1500lm**	L90 @ 60,000hrs.	L90 @ 60,000hrs.
2000lm **2500lm** **3000lm***	L90 @ 60,000hrs.	L85 @ 60,000hrs.

* Lutron 3000lm with Medium/Wide beam is L80 @ 60,000hrs.

TYPE D5

C4RDL Calculite LED generation 3

4" round downlight

Reflector

Specular clear (CL): Most specular and most efficient finish, delivers maximum photometric performance but can produce a mirror image effect of the interior space.

Comfort clear (CC): Semi-specular finish that softens the light at the source of the reflector and creates a subtle, even luminance from the reflector cone.

Comfort clear diffuse (CD): Slightly diffuse clear finish, that eliminates iridescence and reduces the mirror image effect inherent with specular finishes.

Champagne bronze (CZ): Semi-specular finish that softens light at the source of the reflector while providing a warmer reflector appearance (slightly warmer).

White (WH): (matte) Brightest illuminated aperture and provides the smoothest transition to most ceilings when off (white is only available with a white flange).

Black (BK): (matte) Specular finish that provides the lowest aperture brightness possible and significantly reduces source identification in a ceiling.

Flange

White (–): (matte) Provides the smoothest transition to ceilings when off.

Polished (P): (matches aperture) Produces a continuous look throughout the reflector (aperture matching).

Flangeless (F): (flush-mount) Creates a flush, virtually seamless transition from aperture to ceiling.

Frame-in-kits

New Construction

Galvanized stamped steel for dry or plaster ceilings. Preinstalled telescoping mounting bars from 13" to 24". For 4' distances, use 1/2" EMT, 1-1/2" x 1/2" U or C channel.

Max ceiling thickness is 2" (51 mm). Including PoE frame 4.88" (124 mm).

Emergency

Reflector mounted test switch requires above ceiling access. For reflector mounted test switch, order emergency frame and add "EM" suffix to reflector (example: C4RDLCCEM).

Patented install Mounting frame

With no driver attached, this versatile frame is independent of driver accommodating a wide range of lumen packages, driver types and CCTs, including 120V and 277V inputs.

Pre-installed mounting bars for fast and tool-less installs into T-grid & hat channel ceilings.

Close-cut aperture design eliminates possibility of gap between ceiling opening & reflector flange.

Separate wiring compartment for wiring frame to building allows inspection prior to light engine install.

Simple plug-and-play connection between frame and light engine from below ceiling eliminates need for wiring between frame and LED driver, and also saves time during installation and future replacements/upgrades. Plug-and-play receptacle accommodates technology upgrade of light engines and replacements for the life of the building.

Dimming

- Advance 0-10V 1% dimming
- Lutron Hi-lume EcoSystem H Series 1% dimming
- EldoLED ECOdrive Dali 1% dimming
- EldoLED SOLOdrive 0-10V 0.1% dimming
- ELV dimming and DMX dimming

Power over Ethernet

Powered via Philips PoE lighting controller: complies with FCC rules per Title 47 part 15 (Class A) for EMI / RFI (conducted & radiated). PoE lighting controller accessible from below ceiling.

Rated life: 60,0000 hrs at 70% lumen maintenance based on IES LM-80-08 and TM-21-11.

Optical systems

Comfort throughout the space: Patented optical system combines primary and secondary optics to provide a true 50° physical cutoff and 45° reflected cutoff virtually eliminating the view of the light source and bright spots in the reflector. A new reflector curve reduces reflector brightness by up to 50% compared to existing products, allowing for the use of higher lumen packages in smaller apertures without creating bright spots in the ceiling.

Quality of light: 2 SDCM ensures color consistency from fixture to fixture and over the luminaire's long lifetime. Proprietary optical grade silicone lens with patterned surface provides soft, even beam diffusion without hotspots or dark rings.

Light Engine

Quick connect power pack comprised of light source and driver allow for easy installation and replacement from below ceiling with no need for additional wiring. This allows for:

- Frame and ceiling installation to be performed while still finalizing details such as lumen packages, CCT and control type.
- Easy replacement of electronics at end of life with minimal wasted material and labor required.
- Ease and upgradability of technology.

Options and Accessories

Flangeless mud-in ring: Use **CA4RFT** for use with flangless plaster installations.

Sloped ceilings: Compatible with sloped ceiling adapters (see **SCA** spec sheet).

Vandal Proof: Use **C4RVPWH** for an IP65 rated vandal proof matte white accessory. Must be ordered with a flangeless trim.

ENERGY STAR® exceptions

500lm & 90 CRI configurations
Champagne Bronze & Black finishes
347V & Emergency voltage/options
Dali, EldoLED Solo & PoE drivers

Title 24 exceptions

1000lm configurations
Champagne Bronze & Black finishes

Labels and Listings

cULus listed for wet location
ENERGY STAR®, RoHS & CEC Title 24 JA8 certified
CCEA (frames with *LC suffix)
IP65 rated with vandal proof accessory
IBEW Union made (light engines & reflectors)

Warranty

5 year warranty on complete system.

Complete warranty available at: http://images.philips.com/is/content/PhilipsConsumer/PDFDownloads/United%20States/ODLI20150930_003-UPD-en_US-Philips-warranty-indoor-PLS-us.pdf

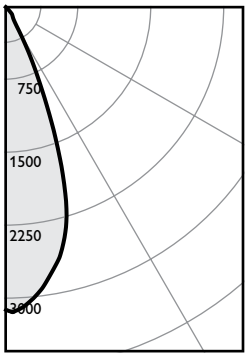
TYPE D5

C4RDL Calculite LED generation 3

4" round downlight

Narrow beam, 1500lm Engine, 103.8 lm/W at 14.7W or 112.2 lm/W at 13.6W (Power over Ethernet)

Candela Curve



Frame: **C4RN or 4RN**
Engine: **C4L15835NZ10U**
Trim: **C4RDLCL**

Output lumens:	1526 lms
Input watts:	14.7 W
CRI:	80 min
CCT[1]:	3500K
Spacing Crit.:	0.6
Beam Angle:	43°

Zonal summary

Zone	Lumens	%Luminaire
0-30	1354	88.7%
0-40	1469	96.3%
0-60	1526	100.0%
0-90	1526	100.0%

Angle	Mean CP	Lumens
0	3112	
5	3044	282
10	2785	
15	2410	652
20	1672	
25	837	420
30	324	
35	163	115
40	128	
45	77	57
50	0	
55	0	0
60	0	
65	0	0
70	0	
75	0	0
80	0	
85	0	0
90	0	

Single unit data

Height to lighted plane	Initial center beam foot-candles	Beam diameter (ft)*
5'	124	3.0'
6'	86	3.6'
7'	64	4.2'
8'	49	4.8'
9'	38	5.4'

* Beam diameter is where foot-candles drop to 50% of maximum.

Multiple unit data - RCR 2

Spacing on center	Initial center beam foot-candles	Watts per sq. ft.
5'	71.3	0.65
6'	46.8	0.43
7'	33.4	0.31
8'	27.8	0.25
9'	22.3	0.20

38' x 38' x 10' Room, Workplane 2.5' above floor, 80/50/20% Reflectances

Efficacy: 103.8 lm/w
Report[2]: T20161390

Adjustment factors

Finish	CCT	Lumens
CL = 100%	80CRI 4000K = 107%	3000lm = 200%
CC = 95%	80CRI 3500K = 100%	2500lm = 167%
CD = 87%	80CRI 3000K = 99%	2000lm = 133%
CZ = 63%	80CRI 2700K = 93%	1500lm = 100%
WH = 87%	90CRI 3000K = 87%	1000lm = 67%
BK = 57%	90CRI 2700K = 81%	500lm = 33%

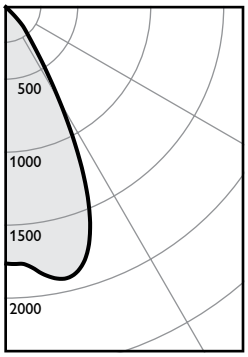
Coefficients of utilization

Ceiling	80%				70%		50%		30%		0%
Wall	70	50	30	10	50	10	50	10	50	10	0
RCR	Zonal cavity method - Effective floor reflectance = 20%										
0	119	119	119	119	116	116	111	111	106	106	100
1	114	112	110	108	110	106	106	103	102	100	95
2	110	106	102	99	104	98	101	96	98	94	91
3	105	100	96	92	99	92	96	90	94	89	86
4	101	95	90	87	94	86	92	85	90	84	82
5	97	90	85	82	89	81	88	81	86	80	78
6	93	86	81	77	85	77	84	77	83	76	74
7	90	82	77	74	81	73	80	73	79	73	71
8	86	79	74	70	78	70	77	70	76	69	68
9	83	75	70	67	75	67	74	67	73	66	65
10	80	72	67	64	72	64	71	64	70	64	62

Room Cavity Ratio

Medium beam, 1500lm Engine, 114.6 lm/W at 14.2W or 121.4 lm/W at 13.4W (Power over Ethernet)

Candela Curve



Frame: **C4RN or 4RN**
Engine: **C4L15835MZ10U**
Trim: **C4RDLCL**

Output lumens:	1627 lms
Input watts:	14.2 W
CRI:	80 min
CCT[1]:	3500K
Spacing Crit.:	0.9
Beam Angle:	56°

Zonal summary

Zone	Lumens	%Luminaire
0-30	1269	78.0%
0-40	1537	94.5%
0-60	1627	100.0%
0-90	1627	100.0%

Angle	Mean CP	Lumens
0	1760	
5	1783	174
10	1886	
15	1887	524
20	1702	
25	1283	572
30	762	
35	406	268
40	236	
45	116	89
50	14	
55	0	1
60	0	
65	0	0
70	0	
75	0	0
80	0	
85	0	0
90	0	

Single unit data

Height to lighted plane	Initial center beam foot-candles	Beam diameter (ft)*
5'	70	4.5'
6'	49	5.4'
7'	36	6.3'
8'	28	7.2'
9'	22	8.1'

* Beam diameter is where foot-candles drop to 50% of maximum.

Multiple unit data - RCR 2

Spacing on center	Initial center beam foot-candles	Watts per sq. ft.
5'	74.8	0.63
6'	49.1	0.41
7'	35.0	0.30
8'	29.2	0.25
9'	23.4	0.20

38' x 38' x 10' Room, Workplane 2.5' above floor, 80/50/20% Reflectances

Efficacy: 114.6 lm/w
Report[2]: T20161397

Adjustment factors

Finish	CCT	Lumens
CL = 100%	80CRI 4000K = 102%	3000lm = 200%
CC = 95%	80CRI 3500K = 100%	2500lm = 167%
CD = 87%	80CRI 3000K = 97%	2000lm = 133%
CZ = 63%	80CRI 2700K = 87%	1500lm = 100%
WH = 87%	90CRI 3000K = 77%	1000lm = 67%
BK = 57%	90CRI 2700K = 73%	500lm = 33%

Coefficients of utilization

Ceiling	80%				70%		50%		30%		0%
Wall	70	50	30	10	50	10	50	10	50	10	0
RCR	Zonal cavity method - Effective floor reflectance = 20%										
0	119	119	119	119	116	116	111	111	106	106	100
1	114	111	109	107	109	105	105	102	101	99	94
2	108	104	100	97	102	96	99	94	96	92	88
3	103	97	93	89	96	88	93	87	91	85	82
4	98	91	86	82	90	81	88	81	86	80	77
5	94	86	80	76	85	76	83	75	81	74	72
6	89	81	75	71	80	71	79	70	77	70	68
7	85	76	70	66	76	66	74	66	73	66	64
8	81	72	66	62	71	62	70	62	69	62	60
9	77	68	63	59	68	59	67	58	66	58	57
10	74	65	59	55	64	55	63	55	63	55	54

Room Cavity Ratio

1. Correlated Color Temperature within specs as defined in ANSI_NEMA_ANSLG C78.377-2008: Specifications for the Chromaticity of Solid State Lighting Products.
2. Tested using absolute photometry as specified in LM79: IESNA Approved Method for the Electrical and Photometric Measurements of Solid-State Lighting Products.

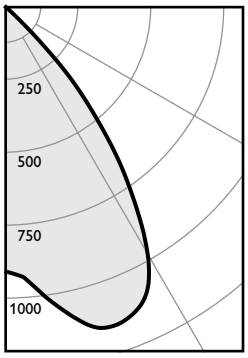
TYPE D5

C4RDL Calculite LED generation 3

4" round downlight

Wide beam, 1500lm Engine, 106.6 lm/W at 14.2W or 113.2 lm/W at 13.4W (Power over Ethernet)

Candela Curve



Frame: **C4RN or 4RN**
Engine: **C4L15835WZ10U**
Trim: **C4RDLCL**

Output lumens:	1517 lms
Input watts:	14.2 W
CRI:	80 min
CCT[1]:	3500K
Spacing Crit.:	1.2
Beam Angle:	76°

Zonal summary

Zone	Lumens	%Luminaire
0-30	918	60.5%
0-40	1368	90.2%
0-60	1517	100.0%
0-90	1517	100.0%

Angle	Mean CP	Lumens
0	906	
5	945	93
10	1040	
15	1128	318
20	1153	
25	1114	506
30	978	
35	732	450
40	460	
45	175	148
50	18	
55	0	2
60	0	
65	0	0
70	0	
75	0	0
80	0	
85	0	0
90	0	

Single unit data

Height to lighted plane	Initial center beam foot-candles	Beam diameter (ft)*
5′	36	6.0′
6′	25	7.2′
7′	18	8.4′
8′	14	9.6′
9′	11	10.8′

* Beam diameter is where foot-candles drop to 50% of maximum.

Multiple unit data - RCR 2

Spacing on center	Initial center beam foot-candles	Watts per sq. ft.
5′	68.5	0.63
6′	45.0	0.41
7′	32.1	0.30
8′	26.8	0.25
9′	21.4	0.20

38′ x 38′ x 10′ Room, Workplane 2.5′ above floor, 80/50/20% Reflectances

Efficacy: 106.6 lm/w
Report[2]: T20161406

Adjustment factors

Finish		CCT		Lumens	
CL	= 100%	80CRI 4000K	= 102%	3000lm	= 200%
CC	= 95%	80CRI 3500K	= 100%	2500lm	= 167%
CD	= 87%	80CRI 3000K	= 97%	2000lm	= 133%
CZ	= 63%	80CRI 2700K	= 87%	1500lm	= 100%
WH	= 87%	90CRI 3000K	= 77%	1000lm	= 67%
BK	= 57%	90CRI 2700K	= 73%	500lm	= 33%

Coefficients of utilization

Ceiling	80%				70%		50%		30%		0%
Wall	70	50	30	10	50	10	50	10	50	10	0
RCR	Zonal cavity method - Effective floor reflectance = 20%										
0	119	119	119	119	116	116	111	111	106	106	100
1	113	110	108	105	108	104	104	100	100	97	93
2	107	102	98	94	100	93	97	91	94	89	86
3	101	94	89	85	93	84	90	83	88	81	79
4	96	87	82	77	86	77	84	76	82	75	72
5	90	81	75	70	80	70	78	69	77	69	66
6	85	75	69	64	75	64	73	64	72	63	61
7	80	70	64	59	69	59	68	59	67	58	56
8	76	65	59	55	65	54	64	54	63	54	52
9	72	61	55	50	61	50	60	50	59	50	48
10	68	57	51	47	57	47	56	47	55	46	45

Room Cavity Ratio

1. Correlated Color Temperature within specs as defined in ANSI_NEMA_ANSLG C78.377-2008: Specifications for the Chromaticity of Solid State Lighting Products.
2. Tested using absolute photometry as specified in LM79: IESNA Approved Method for the Electrical and Photometric Measurements of Solid-State Lighting Products.

Philips Lighting, North America Corporation
200 Franklin Square Drive, Somerset, NJ 08873
Tel. 855-486-2216

Philips Lighting Canada Ltd.
281 Hillmount Rd, Markham, ON, Canada L6C 2S3
Tel. 800-668-9008

SECTION 230500 - GENERAL MECHANICAL REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish all material, equipment, tools, labor, and services as necessary & required to construct the fully coordinated, complete, and properly functioning Mechanical Systems as outlined in the Contract Documents.

B. Section includes:

1. General Requirements for Bidding and the Construction of the Mechanical Systems.
2. General Requirements for Material and Equipment
3. Dielectric Fittings
4. Sleeves.
5. Escutcheons.
6. Multiple Pipe Penetration Roof Curb
7. Grout.
8. Delivery, Storage, and Handling.
9. General Installation Requirements.
10. Miscellaneous Construction Coordination
11. Erection of Metal Supports and Anchorage.
12. Damage and Touch-up Painting.
13. Protection and Cleaning

C. Obtain and pay for all permits, fees and licenses required for the construction and acceptance of the Mechanical Systems by all Authorities-Having-Jurisdictions (AHJs).

D. Be responsible for all aspects of the mechanical systems' material condition, installation, operation, and maintenance until accepted by the Owner.

E. The Engineer's definition for the mechanical portion of the Contract Documents (hereinafter referred to as the Mechanical Documents) consist of:

1. All Specification Division 23 Sections.
2. All Mechanical (M) Drawings.
3. Mechanical portions of work shown on Mechanical/Plumbing (MP) or Mechanical/Electrical/Plumbing (MEP) Drawings.
4. Other related portions of the Contract Documents.
5. All mechanical-related Addendum items.

1.2 RELATED DOCUMENTS

A. If procedures, directions, or requirements are mentioned in other portions of the Contract Documents that pertain to or interact with work shown in the Mechanical Documents, the most stringent requirement will be utilized unless directed otherwise in accordance with Division 1.

B. Be thoroughly familiar with all portions of the Contract Documents to insure that all mechanical equipment, material, and work are fully coordinated with all other equipment, material, and work at this site.

C. Listing of Specification Sections and Drawings below is intended to highlight other relevant portions of the Contract Documents that apply to the Mechanical Documents., should be considered a courtesy, and does not relieve the Contractor from coordinating the Mechanical Work with all other parts of the Contract Documents.

1. Division 0 “Procurement and Contracting Requirements” - General and Supplemental or Special Conditions of the Contract.
2. Division 1 “General Requirements” - All sections.
3. Division 3 “Concrete” - Housekeeping pads and equipment supports.
4. Division 5 “Metals” - Miscellaneous metal supports not specified hereinafter in Division 23.
5. Division 6 “Woods, Plastics, and Composites – Fire-retardant-treated-wood blocking.
6. Division 7 “Thermal and Moisture Protection” – Sealing of roof/wall penetrations and membrane /penetration firestopping for fire and smoke rated assemblages.
7. Division 8 “Openings” – Access door coordination and louver requirements.
8. Division 9 “Finishes” - Painting of mechanical systems for aesthetic or identification purposes.
9. Division 12 “Furnishings” - Casework and wall mounted items for coordination.
10. Division 26 “Electrical” – Control-voltage electrical cables.
11. Architectural Drawings:

    a. Applicable Codes and Standards.
    b. Reflected ceiling plans for elevations and types of ceilings.
    c. Interior elevations for coordination with casework and wall-mounted mechanic component locations.
    d. Location of fire/smoke rated construction and egress paths.

12. Electrical Drawings:

    a. Location of power connections for Building Management System’s low-voltage transformers.
    b. Coordination of power connection and requirements for mechanical equipment.

13. Plumbing Drawings:

    a. Flue and combustion air duct requirements for water heaters.
    b. Additional information required for the connection of equipment to the mechanical systems.

D. If the above referenced related documents are not part of the Contract Documents, request a project specific copy in accordance with Division 1.

E. This section, General Mechanical Requirements, is specifically applicable to all Division 23 Specification Sections.

1.3 ABBREVIATIONS & DEFINITIONS

A. AHJ: Authority having Jurisdiction.

B. ANSI: American National Standards Institute.

C. ASTM: ASTM International, formally known as American Society of Testing and Material.

D. ASHRAE: American Society of Heating, Refrigeration, and Air-Conditioning Engineers.

E. AWS: American Welding Society.

F. Commodity items: Those mechanical components that comply with a specific standard and are identical in construction/manufacturing from one supplier to another, such as copper pipe and fittings.

G. Component: Any pipe, fitting, valve, specialty, duct, diffuser/register/grille, specialty, piece of equipment or other item required for the complete and fully functioning mechanical system.

H. Concealed: Items which are completely hidden from view by building elements (walls, ceilings, floors, etc.) under normal conditions from any angle or point-of-view to building occupants or people outside the building.

I. CPS: Copper pipe size.

J. CWP: Cold working pressure.

K. Exposed: Items which are visible under normal conditions from any angle or point-of-view to building occupants or people outside the building.

L. Exterior: Area or items located outside, subject to any portion of the ambient weather conditions, and unprotected by the building's complete thermal and moisture barriers.

M. Finished Spaces: Spaces that are accessible to building occupants (except maintenance personnel) at some time except those spaces such as mechanical/electrical/elevator equipment rooms, janitor closets, furred spaces, pipe and duct shafts, unconditioned spaces immediately below the roof, void spaces above ceilings, crawlspaces, and tunnels.

N. g/l: Grams per liter.

O. Interior: Area or items located inside and completely protected by the building's thermal and moisture barriers.

P. IPS: Iron pipe size.

Q. Max: Maximum.

R. Min: Minimum.

S. Means of Mechanical Disconnection: Providing a way of disconnection that can be reconnected utilizing only the original parts and does not require the destruction of any part of the original connection. Unions, screw fittings, and flanges for piping and slip or screwed connections for ducts are means of mechanical disconnection. Soldering, welding, gluing, or riveting are not considered types of mechanical disconnection.

T. Mechanical Scope of Work Area: Area includes:

1. Project Scope as defined by the Architectural Drawings.
2. Limited access to the following areas outside the Architectural Project Scope area as required for the modification of the existing building mechanical systems and connection of the new mechanical systems.

    a. Ceiling void below.
    b. Adjoining spaces on the same or other floors, including access to existing mechanical rooms.
    c. Unoccupied interstitial spaces above and below.
    d. Unoccupied crawl spaces below.
    e. Shafts.
    f. Roofs.

U. MPT: Male pipe thread.

V. MSS: Manufacturers Standardization Society for the Valve and Fittings Industry Inc.

W. NFPA: National Fire Protection Association.

X. NPS: Nominal pipe size.

Y. NPT: National Pipe Thread Taper.

Z. NRTL: Nationally Recognized Testing Laboratory as designated by OSHA.

AA. Pipe: A rigid conduit used to convey fluid or gas.

BB. Piping: Refers to both pipe and tubing.

CC. Private Spaces: Those spaces that are not available for all occupants to use.

DD. psig: pounds per square inch, gauge pressure.

EE. Public Spaces: Those spaces that are available for all or most occupants to use.

FF. Tubing: A flexible conduit used to convey fluid or gas.

GG. VOC: Volatile organic compounds.

HH. WOG: Water, Oil, Gas.

1.4 CODES, ORDINANCES, AND STANDARDS

A. Refer to the Architectural Code Review portion of the Contract Documents for the specific Code(s) under which the Project was designed.

1. All aspects of the applicable Code(s) are not specifically stated in the Mechanical Documents but are required for final installation.

B. All references to industry standards (Example: ASTM, MSS, SMACNA) in these Specifications refer to the most current edition of that standard unless the Mechanical Code in force references or the AHJ publically requires a specific edition.

1.5 INTENT OF MECHANICAL DOCUMENTS

A. Manufacturer and model numbers are given as a basis of design. Stated basic model numbers may not utilize all of the manufacturer's extended model number that outlines all options required.

B. The Mechanical Documents are not complete construction documents and are not intended for final system installation.

1. Because of the small scale and variations of different manufacturer's equipment; the mechanical drawings are diagrammatic, cannot be rigid in specific details for the final installation of the systems, and should not be scaled.
2. Routing of piping and ducts on the floor plans is for the clarity of the drawings, may not show exact location, may not show all required offsets/transitions/spacing, and must be field coordinated.

3. General location of equipment and specialties are indicated but may not show all details required for the final installation.
4. Details are provided to indicate minimum installation requirements and may require some modification to accommodate individual pieces of equipment or systems.

C. When the Mechanical Documents are in conflict with the requirements of other portions of the Contract Document, with any applicable codes/laws/ordinances, or with the manufacturer's recommendations for the equipment to be installed and/or connected under this Division that would adversely affect its operation or useful life; make such adjustments that are required to ensure that all such equipment is installed and connected for the safe and proper operation of the equipment and systems served.

1.6 REVIEW, INTERPRETATION, & CORRECTION OF MECHANICAL DOCUMENTS

A. Thoroughly review all portions of the Contract Documents to fully coordinate all mechanical items, including their proper installation, which will be utilized on this Project prior to Bid Submittal.

B. If any ambiguity, discrepancy, error, inconsistency or omission in or between the Contract Documents exists or appears to exist regarding the mechanical systems, notify the Architect thru the Construction Manager in writing prior to Bid Submittal for clarification in a manner hereinbefore specified in Division 1.

C. If a clarification request is not submitted or should a clarification, decision, or interpretation not be rendered by the Architect, it is understood by all Parties that the Contractor has reviewed all the Contract Documents to find the most costly item or method in question, which then is required.

D. No one portion of the Contract Documents takes precedent over another portion.

1.7 ACCEPTABLE MANUFACTURERS

A. The acceptable manufacturers mentioned are provided as a convenience only.

B. Acceptable manufacturers are ones that the Engineer considers to be "quality" companies making the same type of equipment as the stated basis of design manufacturer. Due to the ever changing nature of the manufacturing field, a stated approved manufacturer may not be producing a true equivalent product at the time of the Bid Submittal. The Engineer is the final arbiter of the acceptability of a manufacturer.

C. Equipment manufacturers other than those listed must obtain written authorization in accordance with the requirements of Division 1. When a manufacturer not listed is acceptable to the Engineer, it means that the manufacturer has been reviewed and judged as a maker of equipment which possess the similar performance qualities/characteristics and can fulfill the utilitarian functions without any apparent decrease in quality, durability, or efficiency.

D. The granting of acceptable manufacturer to a company does not constitute acceptance of specific equipment. The Engineer does not pre-review any specific equipment prior to Submittal/Shop Drawing Review process after the Bid.

1.8 ALTERNATE CONSTRUCTION

A. Refer to Architect's portion of the Contract Documents for Alternate Construction Work to determine the increase or decrease in the contract price to the Base Proposal for each alternate requested.

B. Coordinate and modify associated surrounding work as required to accommodate the alternate construction.

1.9 VALUE ENGINEERING (VE)

A. All proposed VE items must be fully coordinated with all related aspects of the Project and other affected building systems. Proposed items must include:

1. Specification (section and paragraph) and drawing (sheet/note, detail, and/or schedule) references related to the VE item.
2. Material/equipment that is being proposed.
3. Denote variations from the originally specified material/equipment and any associated benefit to the Owner.
4. Denote other building service(s) that will be affected.
5. Changes in the system's useful life.
6. Changes to operational energy efficiency including part load capabilities and standby losses.
7. Changes to the Project's utility usage.
8. Changes required for flues, gas piping, combustion air, electrical service, domestic water service, or other sub-systems needed for the proposed equipment's proper installation and operation.
9. Changes to space requirements for installation and maintenance.
10. Total Project Cost Savings including all savings/increases for all affected building systems.

1.10 QUALITY ASSURANCE

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

1.11 SUBMITTALS/SHOP DRAWINGS

A. In addition to the requirements of Division 1; provide submittal drawings, catalog data, installation instructions and descriptive literature (as applicable) for all items specified in Part 2 – Products of all Division 23 Sections or for equipment noted/scheduled on the drawings in accordance with the Contract Documents and as hereinafter specified in any Division 23 section.

B. Do not provide submittals/shop drawings for equipment that may be affected by the coordination process until after the resolution of the coordination process.

C. Action Submittals: As a minimum, submittals/shop drawings must conform to the following requirements.

1. Submittal sheets/product data/shop drawings must be grouped to include complete submittals of related systems, products, and accessories in a single submittal.
2. Reference must be made to the specific item's designation, specification section & paragraph, drawing number, & schedule/note/detail if applicable.
3. Provide values or information for all items listed in the specification, schedules, or as noted elsewhere in the Mechanical Documents.
4. Values must be in units to match those designated in the Mechanical Documents.
5. If standard manufacturer's data or submittal sheets are utilized, they must be marked definitively and legibly to indicate specifically which size(s) or option(s) are being provided.
6. Include diagrams for power, signal, and control wiring.

7. Include pump or fan curves.
8. Include a Statement of Compliance, on the manufacturer's letterhead, for the specified referenced standards if not included on their standard product data/submittal sheet.
9. Manufacturer's standard color charts for selection of color by the Architect.
10. If submitted equipment has not been available in the United States of America (USA) for a minimum of three (3) full years, submittal must include a list of installations in the USA and the year installed.

D. Informational Submittals:

1. Field quality-control reports
2. A copy of the installation manual, if one is published by the manufacturer, must be included. They will not be reviewed by the Engineer but need to be kept on the job site during construction.
3. A copy of the manufacturer's warranty.

E. Samples: Not required for Division 23 items unless noted hereinafter in other Division 23 sections.

F. Completely and thoroughly review all submittals/shop drawings for conformance with the Contract Documents prior to forwarding in accordance with Division 1. .

1. Contractor is completely responsible to provide the burden of proof regarding equivalency of a product. The Engineer will not be responsible for performing any additional research to determine the equivalency of the submitted item.
2. All requirements for the products shown in the Mechanical Documents must be adhered to and provided.
3. Submit complete information concerning all changes in the project required by the submitted products including detailed dimensional layouts of equipment, details of all required MEP service connections, clearances required for service and maintenance, weight, physical arrangement, engineering calculations, and all data necessary to assure that the equivalent product can be properly installed and operate in accordance with the requirements of the Contract Documents.

    a. Review installation and maintenance information to determine if any changes or specific installation instructions are required for any associated building system.

4. Any re-engineering or design changes required for any associated building system to accommodate the proposed product must be coordinated and provided. Required changes must be in accordance with the Contract Documents and submitted for review by the Engineer. Examples include, but are not limited to, sizes of electrical wiring/conduits/breakers, gas piping, flues, combustion air ducts, etc.
5. Attentions should be specifically given to the space limitations for the location of the submitted equipment and any manufacturer's recommended operational and maintenance clearances.

G. Highlight and clearly call to the Engineer's attention:

1. Any portion of the submittal/shop drawing that varies from the Mechanical Document's specifications/design values.
2. Changes required to any associated building systems.

H. Electronic copies of the Engineer's drawings may be obtained to use in preparing shop drawings for this specific project. A waiver provided by the Engineer must be signed and the required fee paid prior to the issuing of the drawing files by the Engineer. Drawings obtained electronically from the Engineer or electronic reproductions of the Engineer's drawings are not to be considered of adequate detail to be submitted as a shop drawing. Submitted shop drawings must reflect the following required for coordination.

1. Proposed equipment.
2. Specified items not shown on the floor plans.

3. Items shown in details or required by drawing notes or schedules.
4. Space around equipment required for access and maintenance.
5. Elevations of piping, ducts, and equipment.

I. Submittal will be reviewed by the Engineer for design conformity and general conformance to the Engineer's documents only. Confirm and correlate dimensions at the job site for tolerances, clearances, quantities, fabrication processes and techniques of construction, coordination of the mechanical work with other building systems and full compliance with the Contract Documents.

J. The following are the responses used by the Engineer, a short description of its meaning, and the action required. Submittals that contain multiple items may have multiple responses by the Engineer requiring multiple actions by the Contractor.

1. "Reviewed, No Exception Taken": Item(s) submitted appears to meet the requirements of the Bid Documents.
   Action: No further submittal required.
2. "Reviewed, Make Corrections Noted": Item(s) submitted appears to meet the requirements of the Mechanical Documents except for a few minor items noted.
   Action: No further submittal required. Coordinate minor changes with the equipment supplier prior to ordering and update submittals for inclusion in the Operation and Maintenance Manuals.
3. "Revise and Resubmit": Manufacturer and general qualities of the item submitted meet the intent of the Mechanical Documents but major portions of the item are not acceptable or are missing from the submittal.
   Action: Revise the submittal to conform to the Mechanical Documents and resubmit.
4. "Rejected": Manufacturer is not equivalent to the Basis of Design or the model/item provided from an equivalent manufacturer is of a lesser quality/grade that does not conform to the Mechanical Documents.
   Action: Prepare a new submittal with completely different equipment and resubmit.
5. "Submit Specified Item": Item noted is left out of a submittal of similar products.
   Action: Submit only the specific item(s) noted.
6. "Not Reviewed":
   a. Submittal has not been reviewed/stamped by the Contractor or is so bad or illegible that a proper review cannot be performed by the Engineer.
      Action: Prepare a new submittal and resubmit.
   b. Submittal is for an item not specified in Division 23 but some portion of the submittal needs to be coordinated for connection to a Division 23 system.
      Action: No further submittal to the Engineer required. Coordinate minor changes with the equipment supplier prior to ordering.

K. Obtain a positive review (Reviewed, No Exception Taken or Reviewed, Make Corrections Noted) of the material before delivery to the job site.

L. Where a submitted product has received a positive review by the Engineer, it does not relieve the Contractor from the responsibility for making all changes in the work necessary and required for a proper and fully functioning installation of the equivalent product.

M. If a submittal has not received a positive review by the second submission, Contractor shall pay for any subsequent reviews by the Engineer at the rate of One Hundred Fifty dollars ($150.00) per man-hour devoted by the Engineer's staff before the final inspection.

N. Retain clean copies of shop drawings for insertion in the Operation and Maintenance Manual.

1. Engineered reviewed shop drawings marked “Reviewed, No Exception Taken” may be inserted without additional changes.
2. Engineer reviewed shop drawings marked “Reviewed, Make Corrections Noted” may be inserted with hand-made or electronic changes that correctly represent equipment installed.
3. Do not include any Engineer reviewed shop drawings marked any other way.

1.12 PRE-CONSTRUCTION COORDINATION

A. All existing utilities must be located, verified, and marked to avoid damage and disruption of the existing services. Installation of new work must be done in accordance with the utility company’s requirements.

B. Location and routing of the mechanical components must be coordinated with all other building systems prior to installation. First system installed does not settle coordination issues.

C. When mounting heights of hung mechanical system components are not detailed or dimensioned in the Mechanical Documents, install components to provide the maximum headroom possible.

1. Components in mechanical equipment rooms may be mounted lower to facilitate operation and maintenance. Bottom of any exposed component or support hanger must be minimum 7’-0” above the finished floor unless noted otherwise in the Mechanical Documents.

D. Bid must include sufficient fittings, material, and labor to allow for adjustment in routing of the mechanical systems made necessary by the coordination process.

1.13 INSPECTIONS

A. Do not enclose, cover, insulate, or put any portion of the mechanical systems into operation until it has been inspected and approved by the AHJ.

B. Contact AHJs and coordinate the requirements, timing, and completion of all required inspections.

C. Furnish all material, equipment, tools, temporary connections, labor, and services as required by the AHJ to complete the inspection.

D. If a portion of the mechanical system does not pass tests or inspections, make required corrections and arrange for re-inspection.

1.14 OBSERVATION OF THE WORK

A. The Engineer's site visits will consist of visual observations of the construction to permit the Engineers to render their professional opinion as to the Contractor's conformance to the intent of the Mechanical Documents. Given the inherent limitations of such inspections, they cannot be relied upon by any party as acceptance of the work nor relieve any party from fulfillment of customary and contractual responsibilities/obligations.

B. Although the Engineer may confer on site with the Contractor regarding interpretation of the plans and specifications, such assistance does not relieve the Contractor of any responsibility from performing all required work.

C. The fact that the Engineer has failed to observe and/or documented work that is faulty or is not in accordance with the Mechanical Documents does not relieve the Contractor from the responsibility of correcting such work.

D. The Engineer's construction observation report(s) may recommend rejection of the work which, in the Engineer's professional opinion, does not conform to the intent of the Mechanical Documents.

E. The Engineer does not have the right to reject work or the right/duty to stop work.

1.15 GUARANTEE/WARRANTY

A. Guarantee all mechanical work against any defects due to faulty workmanship or material; all raceways are free from foreign material, obstructions, holes or breaks of any nature; ducted air systems have proper airflow, all equipment is fully functioning to the intent of their sequence of operation, and all piping systems have proper circulation.

B. Upon written notice from the Architect or Owner, promptly remedy any defects occurring within the Project's Base Warranty Period from the date as specified by the Architect.

C. Contractor is personally responsible to replace any equipment or portion of that equipment whose manufacturer's warranty is based on "time from shipment" which has expired prior to the end of the Project's Base Warranty Period or any specified special warranty period(s). Extended manufacturer's warranties may be utilized to provide coverage for the required warranty period(s) at no additional charge to the Owner.

D. The Project's Base Warranty Period does not supersede any extended warranty periods hereinafter specified.

1.16 PROJECT CLOSEOUT

A. Closeout Procedures, Project Record Documents, and Operation and Maintenance Data must be in accordance with Division 1 and as hereinafter specified.

B. Furnish Record Drawings showing all changes (whether generated by addenda, submittals, change orders, implemented request for information, field discovered condition, or construction coordination) in construction from that shown on the original Contract Documents in the manner as specified in Division 1.

C. At the front of the mechanical portion of the Operation and Maintenance Data, provide a typed Installer's Information List including the General Contractor and any Sub-Contractors who performed part of the Mechanical Systems installation. Paper page must be inserted in a heavyweight, non-glare, plastic sheet protector or the information can be printed on a piece of 8.5"x11" card stock with holes punched for binding as specified in Division 1. Information for each contractor must include:

1. Name of Company.
2. Company Address.
3. Company Phone Number.
4. Company Fax Number.
5. Company Email Address.
6. Contact Person in Company.
7. Portion of work performed by Company with reference to Specification Section(s) and Drawing Number(s).

D. Mechanical portion of the Operation and Maintenance Data must include:

1. Installer's Information List.
2. All equipment and specialties furnished under Division 23 must have the following grouped together in accordance with Division 1 requirements.

a. A clean copy of all approved shop drawings marked definitively and legibly with colored pencil/pens, highlighter, or electronically to show specific equipment provided and all changes (whether generated by addenda, change orders, or field discovered condition, etc.) in equipment from those shown on the original contract documents.
b. Manufacturer's Installation, Operation, & Maintenance (I/O/M) Instructions/Manual(s).
c. Manufacturer's parts list if not included in the I/O/M Instructions/Manual(s).
d. Manufacturer's recommended maintenance clearances if not included in the I/O/M Instructions/Manual(s).
e. Any other Manufacturer's printed data that would help the Owner in operating, maintaining, or modifying the installed system in the future.
f. Copy of all Warranties.

3. A copy of the final Test and Balance Report.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR MATERIAL AND EQUIPMENT

A. Manufacturers and model numbers used in the Mechanical Documents establish the type and basic quality required. Products must be provided with:

1. All standard devices/accessories/features as indicated in the latest edition of the manufacturer's catalog/brochure/website published at the date of the Bid.
2. Any options as stated in the Mechanical Documents.
3. As required for its proper installation or obvious intended use.

B. All mechanical components must comply with the following:

1. Manufactured by a company in the everyday business of producing that item.
2. New (not previously used or re-manufactured), of the best quality, and free from defects.
3. Have a minimum pressure rating equal to or greater than the system operating pressure.

C. All equipment provided for the Project must meet or exceed all minimum values and must not exceed all maximum values indicated in the Mechanical Documents.

D. Each type of mechanical component must be manufactured by a single company.

E. All equipment and systems must be coordinated with all other associated equipment and systems.

F. All material and equipment cannot contain any asbestos, lead, mercury, mercury compounds, urea-formaldehyde resin, or other recognized hazardous material of any kind or form.

G. All materials within mechanical system plenums must be noncombustible or must be listed and labeled by a NRTL recognized by the AHJ as having a flame-spread index of not more than 25 and a smoke-developed index of not more than 50 when tested in accordance with ASTM E84 or UL 723.

H. All equipment must be equipped with warning and information signs and labels in accordance with ANSI Z35.1.

2.2 PIPE SLEEVES

A. Galvanized-Steel Sheet: Minimum 0.0239-inch thickness; round tube closed with welded longitudinal joint.

B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.

1. Provide end with flange to act as an escutcheon for exposed penetrations in finished spaces.

2.3 GROUT

A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
2. Design Mix: 5000-psi, 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store and handle all mechanical components in accordance with manufacturer's recommendations.

B. While temporarily storing mechanical components, do not exceed the structural capacity of the floor.

C. Items intended for indoor installation cannot be stored exposed to outdoor weather conditions.

D. Any mechanical component that can be damaged by water must be protected from direct contact with rain, sprayed water, runoff, standing water, or any other type of moisture that will soak into or corrode the component. Items that have absorbed water or have been prematurely corroded cannot be utilized on the Project.

E. Any mechanical component that can be damaged by direct sunlight must be protected.

F. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent damage and entrance of dirt, debris, and moisture.

G. Maintain any factory-applied protective coatings during construction until removal is required for system testing or final cleaning is performed.

H. Any mechanical component that has been damaged during delivery, storage, or construction before final acceptance by the Owner must be repaired or replaced to return the item to a "like new" condition in a manner approved by the Architect.

1. Repair: This method may be used if a mechanical item can be repaired by field correcting or replacing the damaged component of that item without affecting the item's warranty, service life, construction integrity, or visual appearance. All work must be done in strict accordance with the manufacturer's instructions, requirements, and/or supervision.
2. Replace: This method must be used if, in the Architects opinion, the damage is too great to warrant a simple repair, the appearance of the item cannot be returned to a state where the original damage cannot be detected, or if the damage/repair voids any portion of the items warranty.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. All work must be done in a manner and appearance acceptable to the Architect.

B. Installation must be performed in a manner as required by the most stringent of the following:

1. The Mechanical Code referenced in the Architectural Code Review portion of the Contract Documents.
2. As required by the Mechanical Documents.
3. Ducts: Sheet Metal and Air Conditioning Contractors' National Association (SMACNA) requirements.
4. General piping: American Society of Testing and Material (ASTM) requirements.
5. Copper pipe: Copper Development Association (CDA) requirements.
6. Steel pipe: American Society of Mechanical Engineers (ASME) requirements.
7. Equipment, specialties, manufactured fittings, and specialized piping types: Manufacturer's requirements.

C. Inspect and verify that all conditions affecting the work are acceptable before beginning installation of the mechanical systems. Do not proceed with the installation until unacceptable conditions are corrected.

D. Piping or ducts cannot be installed through any solid structural component unless approved in writing by the Architect and Structural Consultant prior to the installation. Piping and ducts may be routed thru the open web of steel bar-joists or trusses.

E. Install piping and ducts in concealed locations except for the following locations:
1. If noted or shown to be exposed in finished areas on the drawings.
2. Spaces without ceilings.
3. Equipment rooms.
4. Service areas.

F. Installation of piping or ducts must conform to the following requirements.

1. Be free of sags and bends.
2. Be at right angles or parallel to building walls and other piping. Diagonal runs are prohibited above grade unless specifically indicated otherwise.
3. Utilize fittings for all changes in direction, branch connections, and size changes.
4. Permit the best accessibility for valve/damper operation and servicing.
5. Connect to equipment, fixtures, and specialties with a means of mechanical disconnection to allow removal of the mechanical component with minimum or no pipes, ducts, or specialties removal.
6. Cannot block maintenance or service access to mechanical components or any other building system component or equipment.
7. Allow insulation to be installed and properly sealed completely around individual pipes or ducts.
8. Allow sufficient space for ceiling panel removal above lay-in ceilings.

G. Installation of mechanical equipment and specialties must conform to the following requirements.

1. Be in accordance with the manufacturer's recommendations, in compliance with all Codes and referenced standards, and as required by the Contract Documents; whichever is more stringent.

    a. If the more stringent requirement(s) is in conflict with the manufacturer's recommendation, bring the conflict to the Architect and Construction Manager attention for clarification prior to installation.

2. Be level, plumb, and parallel/perpendicular to the building structure and other building systems components unless otherwise indicated.
3. Be positioned to facilitate service, maintenance, repair, or replacement of the equipment or one of its components.
4. Allow maximum possible headroom unless specific mounting heights are indicated.
5. Allow right of way for piping installed at required slope.
6. All floor-mounted equipment must be mounted on housekeeping pads. Metal legs, skids or bases that are part of the equipment are not adequate.

3.3 MISCELLANEOUS CONSTRUCTION COORDINATION

A. Coordinate and arrange for spaces, chases, slots, sleeves, dampers, and openings in the building structure and general construction during the progress of the Project to allow for mechanical systems installations.

B. Coordinate installation of required supporting devices.

C. Access Doors: Coordinate size and location requirements for doors providing access to mechanical equipment and specialties requiring maintenance or periodic inspection which are concealed behind non-removable finished building surfaces. Minimum size of access door openings must be as follows, or greater, as required for mechanical component maintenance or removal. Coordinate exact sizes with the Architect.

1. One-Hand or Inspection Access: 8 by 6 inches.
2. Two-Hand Access: 12 by 6 inches.
3. Head and Hand Access: 18 by 12 inches.
4. Body Access: 24 by 18 inches.
5. Body plus Ladder Access: 24 by 24 inches.

3.4 PIPE SLEEVE INSTALLATION

A. Install sleeves for pipes passing through penetrations of all ceiling, partitions, roofs, and walls. Sleeves are not required for:

1. Holes formed in new, solid concrete construction unless below grade in high hydrostatic soils.
2. Core-drilled holes in solid concrete construction.
3. Floor-mounted water closets.
4. Floor drains or sinks.

B. Install sleeves in new walls and slabs as they are constructed.

C. Each individual pipe must have its own sleeve.

D. Adjacent pipe sleeves must be centerline spaced as follows:

1. Horizontal pipe sleeves thru walls or partitions: Minimum of two (2) diameters of the largest adjacent pipe or pipe/insulation penetration.

E. Sleeves in metal stud walls must be supported by and securely fastened to a piece of horizontal stud framing material attached to the adjacent vertical studs. Coordinate additional framing installation.

F. Sleeves in hard ceilings must be supported by and securely fastened to the framing material used to support the ceiling. Coordinate additional framing installation.

G. Sleeves for insulated pipes must allow the full insulation thickness to pass thru the sleeve.

H. Diameter of sleeves must be as follows.

1. No less than 1/4" annular clear space between sleeve and bare pipe or pipe insulation.
2. Of sufficient size to permit pipe movement due to expansion and contraction perpendicular to the penetration.
3. No larger than what the UL-listed firestopping system allows for through or membrane pipe penetration.
4. For penetrations using mechanical sleeve seals, provide 1-inch annular, or as recommended by the mechanical sleeve seal manufacturer, clear space between piping and sleeve.

I. Cut sleeves to length for mounting flush with the exterior face of both penetrated surfaces (including stone, brick, or other veneers):

1. Exception: Extend length of sleeve past the exterior face of both penetrated surfaces as required for the UL-listed firestopping systems for through pipe penetrations.

J. Steel sleeves must be cut square with ends reamed clean of burrs.

K. Sleeves must be tight to adjoining wall surfaces. Seal minor holes around sleeve to adjoining wall as follows:

1. Masonry or concrete construction: Grout.
2. Fire-rated wall, floor, & ceiling assemblages – Firestopping caulk in accordance with the UL-listed firestopping pipe through penetration system.
3. Stud walls with sheathing or hard ceilings: Joint sealants appropriate for size, depth, and location of joint. Architect to approve color.

L. Fill the annular space between the pipe/pipe insulation and the surrounding surface/pipe sleeve as follows:

1. Exterior walls above grade: Joint sealants appropriate for size, depth, and location of joint. Provide backing if required. Architect to approve color.
2. Slab-on-grade floors: Joint sealants appropriate for size, depth, and location of joint. Provide backing if required. Architect to approve color.
3. Fire-rated wall, floor, & ceiling assemblages – Firestopping caulk in accordance with the UL-listed firestopping pipe through penetration system.
4. Sound sensitive interior walls (rooms with noise generating equipment, music practice rooms, performing arts spaces, courtrooms, executive offices and conference rooms, and similar spaces): Mechanical sleeve seal.
5. All other interior non-rated wall, floor, & ceiling assemblages - Compacted fill of 3/4 lb. density fiberglass.

M. Install galvanized-steel sheet type at pipe penetrations of the following:

1. Interior, non-bearing walls or partitions.

2. Hard ceilings.

N. Install steel pipe type at pipe penetrations of the following:

1. Exterior, above grade walls.
2. Bearing walls.

3.5 PIPE ESCUTCHEON INSTALLATION

A. Install escutcheons for exposed pipe penetrations of walls and ceilings in finish spaces.

B. Escutcheons for any type of pipe or conduit penetration of a fire or smoke walls must be metal type.

C. All visible escutcheons in a single space must be of the same type as approved by the Architect.

D. Plastic escutcheons installed with split face must have both sides of the split securely connected together. Locate split at least visible location.

E. Insulated pipes: Interior dimension of escutcheon must closely match exterior dimension of insulation.
1. For plastic escutcheons, neatly and professionally modify the interior pipe diameter to closely fit around the insulation if standard interior dimension is tight.
2. For metal escutcheons, neatly and professionally provide a non-combustible spacer between insulation and the escutcheon or securely fasten escutcheon to the wall/ceiling so the pipe is centered in the escutcheon.

F. Escutcheons must not be abutted to the adjoining surface until:
1. Final finish of the adjoining wall or ceiling surface is complete.
2. Installed firestopping at the pipe penetration has been inspected.

3.6 PIPE/CONDUIT ROOF PENETRATION INSTALLATION

A. Coordinate exact pipe roof penetrations locations with the structural and roofing systems being provided.

B. Securely anchor pipe to the structure below the roof penetration.

C. Single Pipe Penetrations: Watertight flashing and sealing of single pipe penetrations thru the roof must be in accordance with Division 7 “Thermal and Moisture Protection”.

3.7 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Refer to Division 05 Section "Metal Fabrications" for structural steel for mechanical systems.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.

C. Field Welding: Comply with AWS D1.1.

3.8 GROUTING

A. Mix and install grout for equipment base bearing surfaces, pump and other equipment base plates, and anchors.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placement of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases and provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout.

3.9 DAMAGE AND TOUCH-UP PAINTING

A. Painting of mechanical systems, equipment, and components is specified in Division 09.

B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures as provided by the equipment manufacturer to match the original factory finish and in a manner/appearance acceptable to the Architect.

3.10 PROTECTION AND CLEANING

A. Keep areas clear of debris during construction. Promptly remove waste material from premises.

B. Clean all exposed mechanical components in finished and unfinished areas.

C. Thoroughly clean both the accessible inside and the entire outside of all equipment.

D. Take measures to protect completed areas and/or existing areas of the building from the migration of construction-generated contaminants.

END OF SECTION 230500

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SECTION 230510 – EXISTING BUILDING & DEMOLITION REQUIREMENTS FOR MECHANICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Requirements for performing work in an existing building.
2. Requirements for the demolition, reuse, and salvage of existing plumbing systems.

B. Information regarding the existing mechanical systems is as accurate as could be secured. Information provided by Others has not been confirmed by the Engineer. Demolition drawings are based on:

1. Record Drawings.
2. Owner/Operating Personnel knowledge.
3. Investigation performed by other Consultants.
4. Engineer's limited visual observations of the facility performed without any demolition or removal of building components.

C. Demolition work must be satisfactorily adapted from the Contract Documents to the actual site conditions as required to accommodate all new construction associated with this Project.

1.2 RELATED DOCUMENTS

A. The requirements of Section 230500 – General Mechanical Requirements apply to this Section.

B. Listing of Specification Sections and Drawings below is intended to highlight other relevant portions of the Contract Documents, should be considered a courtesy, and does not relieve the Contractor from coordinating the Mechanical Work with all other parts of the Contract Documents.

1. Division 1 "General Requirements" – Referenced for:

a. Photographic documentation.
b. Construction waste management and disposal.
c. Sustainable design requirements.

2. Division 2 "Existing Conditions" – Referenced for selective demolition.
3. Architectural Drawings – Referenced for general demolition requirements and scope of demolition area.

C. If these documents do not exist in the Contract Documents, request a project specific copy in accordance with Division 1.

1.3 ABBREVIATIONS & DEFINITIONS

A. Demolish: Detach items from existing construction. Construction waste must be removed from site and recycles or properly disposed of in accordance with the requirements of the Contract Documents and all local, state, or federal codes, laws, ordinances, and statutes.

B. Existing-to-Remain: Existing mechanical item that will remain in place during construction, be protected during construction, and be utilized in the finished project.

C. Remove: Will mean the same as demolish.

D. Remove for Reinstallation: Detach items from existing construction in a manner to prevent damage, store and protect, and refurbish and prepare for reuse.

E. Remove for Salvage: Detach items from existing construction in a manner to prevent damage and deliver to Owner.

1.4 MATERIAL OWNERSHIP

A. Unless otherwise indicated, demolition waste becomes property of the Contractor.

B. The Owner may desire to salvage existing mechanical components for their use. Prior to demolition, coordinate which components are desired by the Owner and how many of each that they desire. Carefully salvage in a manner to prevent damage. If individual components are not specifically selected by the Owner, choose the items that are in the best condition and return same to the Owner.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION OF EXISTING CONDITIONS

A. As early as possible in the Project schedule and prior to any demolition, perform a field investigation of the existing building conditions that will affect the mechanical system installation, including adjoining areas out of the project scope. Coordinate, receive permission from the Construction Manager, and perform minor investigative demolition in areas out of the project scope if required to fully understand the existing conditions. As a minimum, investigate the following items and report conflicts to the Construction Manager for resolution.

1. Discover and document any significant discrepancies between the Contract Documents and the actual site conditions.
2. Identify and mark all mechanical piping and ducts that pass thru the project scope area which must be maintained to serve out-of-scope portions of the building.
3. Verify and document location and elevation of all existing-to-remain mechanical components for conflicts with the construction/installation of new architectural elements (walls, desired floor plan arrangements, ceiling heights, etc.)
4. Discover and document location of any existing abandoned-in-place piping or ducts.
5. Discover and document location of any other existing-to-remain building systems (plumbing, electrical, lighting, cable tray, etc.) that appears to conflict with the installation of the mechanical systems.
6. Survey, inventory, and record the condition of the existing-to-remain and/or to-be-salvaged mechanical systems. Provide photographs or video of conditions that might be misconstrued as damage caused by salvage or demolition operations.

3.2 EXISTING MECHANICAL SYSTEM REQUIREMENTS

A. Portions of the building outside of this Project’s scope will be occupied.

B. Prior to any interruption of mechanical services to the occupied portions of the building outside of this Project’s scope:

1. Notify the Owner in accordance with Division 1 or no fewer than five (5) working days in advance of proposed interruption of mechanical services.
2. Date, time, and duration of disrupted services must be agreed to by all affected parties and so stated in writing prior to any action.
3. Schedule of disruptions for non-occupied times to the greatest extent possible.

4. For disruptions when the building is occupied, provide temporary mechanical services for any disruptions lasting longer than one (1) hour.

C. Where portions of the existing-to-remain mechanical systems conflicts with the installation of any component of the new construction, that portion must be relocated and reconnected to facilitate the integrity of the new construction and to maintain the desired existing service.

D. For duct mains that will remain in service but who's distribution system and flow will be modified during this Project:

1. Test and record the existing flows (cfm) at the following locations prior to any mechanical demolition.

    a. At the duct connection to the fan creating the flow in the system.
    b. At the duct main where it enters the scope of work area.
    c. At all existing-to-remain duct branches or mains that exit the scope of work area.

2. As the branches to be demolished in the scope of work area have been disconnected from the main, immediately cap those connections at the main air or water tight. Sequence to minimize disruption to out of scope areas.
3. Furnish and install new manual balancing dampers (if none exist) in the existing-to-remain duct branches/mains that exit the scope of work area.
4. Utilize the pre-demolition test data to determine the existing-to-remain flow required for the out of scope areas during construction and make adjustments as follows.

    a. Adjust fan operating parameters to provide revised flow. Minimize energy usage.
    b. Adjust manual balancing valves and dampers in the existing-to-remain pipe or duct branches/mains that exit the scope of work area to maintain their pre-demolition flow. Minimize total pressure drop in the systems.

3.3 DEMOLITION REQUIREMENTS

A. Limits of the demolition area will be the boundary of the Mechanical Scope of Work Area.

B. Verify that mechanical services have been disconnected and capped for the area of demolition before starting demolition operations.

C. Some demolition may need to be delayed to accommodate:

1. Scheduling/phasing of general construction.
2. Maintaining services to areas outside of this Project's scope until new piping required to accommodate the new construction has been installed.

D. Coordinate the extent of demolition required in existing slabs-on-grade (including the excavation of below slab soil), walls, ceilings, roofs, or other building components required for the installation of the new mechanical systems.

E. Demolition of ducts.

1. Demolition will be to the greatest extend possible from the former diffuser/register/grille back to one of the following:

    a. The piece of air moving equipment.
    b. The active existing-to-remain duct.

2. Cap the remaining duct with same material as quickly as possible to maintain the integrity of the active duct system.
3. Demolition must include existing abandoned-in-place ducts within the boundary of the Project Scope that are now accessible for removal.
4. New abandoned–in-place ducts must be disconnected and isolated from any active duct. Ducts must be marked at both ends to indicate that it is abandoned and the location of the opposite end. Abandoned-in-place ducts will only be allowed for the following reasons.

    a. Ducts behind existing-to-remain hard ceilings.
    b. Ducts below slab-on-grade floors that are not being demolished will be slugged with concrete at the floor penetration level with the existing slab.
    c. Ducts in the ceiling void of the Project's Scope that are inaccessible due to being blocked by existing piping, ducts, mechanical equipment, cable tray, conduits, etc. that must remain in operation.

F. Demolition of equipment.

1. Coordinate the disconnection of all associated electrical, mechanical, plumbing, and control connections from and to the equipment to be demolished.
2. Demolition must include all housekeeping pads, hangers, insulation, and other accessories/specialties associated with the demolished equipment if not to be reutilized in the final project.
3. Equipment to Be Removed: Disconnect and remove services as previously specified. Remove from site and properly dispose in accordance with all applicable laws, ordinances, and statutes.
4. Equipment to Be Removed and Reinstalled: Disconnect and temporarily cap services. Remove, clean, and store equipment in a manner that protects the salvaged item from damage during construction. When appropriate during the project: reinstall, reconnect, and make equipment operational.
5. Equipment to Be Removed and Salvaged: Disconnect and remove services as previously specified. Remove equipment and deliver to Owner as directed.

END OF SECTION 230510

SECTION 230593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Balancing Air Systems: Constant-volume air systems.
2. Testing, adjusting, and balancing existing systems and equipment.
3. Control system verification.

1.2 RELATED DOCUMENTS

A. The requirements of Section 230500 – General Mechanical Requirements apply to this Section.

1.3 DEFINITIONS

A. AABC: Associated Air Balance Council.

B. BAS: Building automation systems.

C. NEBB: National Environmental Balancing Bureau.

D. TAB: Testing, adjusting, and balancing.

E. TABB: Testing, Adjusting, and Balancing Bureau.

F. TAB Specialist: An independent entity meeting qualifications to perform TAB work.

G. TDH: Total dynamic head.

1.4 QUALITY ASSURANCE

A. TAB Specialists Qualifications:

1. TAB Field Supervisor: Employee of the TAB specialist and certified by AABC, NEBB, or TABB.
2. TAB Technician: Employee of the TAB specialist and certified by AABC, NEBB, or TABB as a TAB technician.

B. Instrumentation Type, Quantity, Accuracy, and Calibration: Comply with requirements in ASHRAE 111, Section 4, "Instrumentation."

C. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."

D. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.7.2.3 - "System Balancing."

1.5 FIELD CONDITIONS

A. Partial Owner Occupancy: Owner may occupy completed areas of building before Substantial Completion. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

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PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems designs that may preclude proper TAB of systems and equipment.

B. Examine installed systems for balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are applicable for intended purpose and are accessible.

C. Examine the approved submittals for HVAC systems and equipment.

D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems output, and statements of philosophies and assumptions about HVAC system and equipment controls.

E. Examine ceiling plenums used for supply, return, or relief air to verify that they are properly separated from adjacent areas. Verify that penetrations in plenum walls are sealed and fire-stopped if required.

F. Examine equipment performance data including fan curves.

1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.

G. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.

H. Examine test reports specified in individual system and equipment Sections.

I. Examine HVAC equipment and verify that bearings are greased, belts are aligned and tight, filters are clean, and equipment with functioning controls is ready for operation.

J. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.2 PREPARATION

A. Perform system-readiness checks of HVAC systems and equipment to verify system readiness for TAB work. Include, at a minimum, the following:

1. Airside:

a. Verify that leakage and pressure tests on air distribution systems have been satisfactorily completed.
b. Duct systems are complete with terminals installed.
c. Volume, smoke, and fire dampers are open and functional.

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d. Clean filters are installed.
e. Fans are operating, free of vibration, and rotating in correct direction.
f. Automatic temperature-control systems are operational.
g. Ceilings are installed.
h. Windows and doors are installed.
i. Suitable access to balancing devices and equipment is provided.

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system according to the procedures contained in ASHRAE 111 or other recognized balancing standard and in this Section.

B. Cut insulation, ducts, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.

1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
2. After testing and balancing, install test ports and duct access doors.
3. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish.

C. Mark equipment and balancing devices, including damper-control positions, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.

D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Cross-check the summation of required outlet volumes with required fan volumes.

B. Prepare schematic diagrams of systems' "as-built" duct layouts.

C. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.

D. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

E. Verify that motor starters are equipped with properly sized thermal protection.

F. Check dampers for proper position to achieve desired airflow path.

G. Check for airflow blockages.

H. Check condensate drains for proper connections and functioning.

I. Check for proper sealing of air-handling-unit components.

J. Verify that air duct system is sealed as specified.

3.5 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.

1. Measure total airflow.

    a. Set outside-air and return-air dampers for proper position that simulates minimum outdoor-air conditions.
    b. Where duct conditions allow, measure airflow by Pitot-tube traverse. If necessary, perform multiple Pitot-tube traverses to obtain total airflow.

2. Measure fan static pressures as follows: Measure static pressure directly at the fan outlet or through the flexible connection.
3. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
4. Adjustment of fan speed higher or lower than indicated speed if required to achieve desired airflow.. Comply with requirements in HVAC Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
5. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload occurs. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.

B. Adjust air inlets and outlets for each space to indicated airflows.

1. Set airflow patterns of adjustable outlets for proper distribution without drafts.
2. Measure inlets and outlets airflow.
3. Adjust each inlet and outlet for specified airflow.
4. Re-measure each inlet and outlet after they have been adjusted.

C. Verify final system conditions.
1. Re-measure and confirm that minimum outdoor and return airflows are within design. Readjust to design if necessary.
2. Re-measure and confirm that total airflow is within design.
3. Re-measure all final fan operating data, rpms, volts, amps, and static profile.
4. Mark all final settings.
5. Test system in economizer mode. Verify proper operation and adjust if necessary.
6. Measure and record all operating data.
7. Record final fan-performance data.

D. Reporting: Include a summary of verifications performed, remaining deficiencies, and variations from indicated conditions.

3.6 PROCEDURES FOR TESTING, ADJUSTING, AND BALANCING EXISTING SYSTEMS

A. Perform a preconstruction inspection of existing equipment that is to remain and be reused.

1. Measure and record the operating speed, airflow, and static pressure of each fan.
2. Measure motor voltage and amperage. Compare the values to motor nameplate information.
3. Check the refrigerant charge.
4. Check the condition of filters.
5. Check the condition of coils.
6. Check the operation of the drain pan and condensate-drain trap.
7. Check bearings and other lubricated parts for proper lubrication.
8. Report on the operating condition of the equipment and the results of the measurements taken. Report deficiencies.

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B. Before performing testing and balancing of existing systems, inspect existing equipment that is to remain and be reused to verify that existing equipment has been cleaned and refurbished. Verify the following:

1. New filters are installed.
2. Coils are clean and fins combed.
3. Drain pans are clean.
4. Fans are clean.
5. Bearings and other parts are properly lubricated.
6. Deficiencies noted in the preconstruction report are corrected.

C. Perform testing and balancing of existing systems to the extent that existing systems are affected by the renovation work.

1. Compare the indicated airflow of the renovated work to the measured fan airflows, and determine the new fan speed and the face velocity of filters and coils.
2. Verify that the indicated airflows of the renovated work result in filter and coil face velocities and fan speeds that are within the acceptable limits defined by equipment manufacturer.
3. If calculations increase or decrease the airflow rates and water flow rates by more than 5 percent, make equipment adjustments to achieve the calculated rates. If increase or decrease is 5 percent or less, equipment adjustments are not required.
4. Balance each air outlet.

3.7 TOLERANCES

A. Set HVAC system's airflow rates and water flow rates within the following tolerances:

1. Equipment with Fans: Plus or minus 10 percent.
2. Air Outlets and Inlets: Plus or minus 10 percent.

B. Maintaining pressure relationships as designed shall have priority over the tolerances specified above.

END OF SECTION 230593

SECTION 230600 – IDENTIFICATION FOR MECHANICAL SYSTEMS

PART 1 - GENERAL

1,1 SUMMARY

A. Section includes the identification of the components of the Mechanical Systems.

1.2 RELATED WORK

A. The requirements of Section 230500, General Mechanical Requirements, apply to this Section.

1.3 STANDARD

A. All identifying items specified in this section shall conform to the latest ASME A13.1 – Scheme for the Identification of Piping Systems.

B. In existing buildings, in additions to exist buildings, or for Owner's who have an existing pipe identification system; all identifying items shall match the facilities existing scheme for identifying piping systems.

1.4 SUBMITTALS

A. In addition to the requirements of 230500, submittals shall include a statement that all plumbing identification items conform to ASME A13.1 when applicable.

PART 2 - PRODUCT

2.1 GENERAL REQUIREMENTS

A. Manufacturers shall be in the everyday business of producing permanent pipe markers, tags, nameplates, and ceiling tacks.

B. Identification items listed below are manufactured by Seton unless otherwise noted. Other acceptable manufacturers are Brady, Brimar, Marking Services Inc., or approved manufacturer.

2.2 PIPE IDENTIFICATION

A. Markers shall have lettering stating pipe service and arrow showing direction of flow as follows:

1. Refrigerant

B. Contractor shall choose one of the following methods of identifying all above grade plumbing piping.

1. Snap-on Marker: Factory-fabricated semi-rigid heavy vinyl type pre-formed to surround pipe and remain in place without the need for adhesives. Marker for larger piping may have a maximum size and be held in place with nylon ties. Lettering and arrows shall be printed with UV-resistant inks.
2. Self-adhesive Tape Marker: Flexible, vinyl tape with pressure-sensitive adhesive backing and printed marking. Utilize "Arrow-on-a-Roll" tape to show direction of flow. Background and color of arrow shall match printed marker.

2.3 NAMEPLATE

A. Interior Nameplates: Custom engraved plastic nameplates with beveled edges shall be minimum 4"wide x 1-1/2" tall x 1/16" thick with minimum 3/4" tall white lettering with black background.

B. Exterior Nameplates: Engraved aluminum nameplates shall be minimum 4"wide x 1-1/2" tall x 1/16" thick with minimum 3/4" tall lettering with black background.

C. Nameplates shall be provided with holes for screw or chain mounting.

2.4 DUCT STENCILS

A. Lettering Size: Minimum letter height of 1/2 inch for viewing distances up to 72 inches and proportionately larger lettering for greater viewing distances.

B. Stencil Material: Aluminum.

C. Stencil Paint: Exterior, gloss, alkyd enamel. Paint may be in pressurized spray-can form.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Above grade pipe Identification: Identify pipe, both concealed and exposed, with pipe markers and arrows. Markers for pipes above grade shall be clearly visible from the floor, aligned with axis of pipe, and installed:

1. at intervals not exceeding twenty (20) feet unless hereinafter specified differently,
2. on both sides of wall penetrations (not exterior),
3. and at all connections to equipment.

B. Above grade pipe identification shall not be installed until painting of the pipe has been completed.

C. Nameplates shall be installed on all equipment.

D. Nameplate shall be securely screwed onto a visible portion of a coverplate, panel, or support that will not affect the operation of the equipment.

E. For devices that cannot be attached with screws, nameplates can be securely attached with beaded chain as specified for valve tags.

F. Stencil duct labels showing service and flow direction.

1. Green: For exhaust-, outside-, relief-, return-, and mixed-air ducts.

END OF SECTION 220600

SECTION 230713 - DUCT INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes insulating the following duct services:

1. Indoor, concealed, round single–wall, supply air.
2. Indoor, exposed, round, single wall supply air.

1.2 RELATED DOCUMENTS

A. The requirements of Section 230500 – General Mechanical Requirements apply to this Section.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied if any).

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.7 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."

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B. Coordinate clearance requirements with duct Installer for duct insulation application. Before preparing ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

C. Coordinate installation and testing of heat tracing.

1.8 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type II for sheet materials.

B. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type II with factory-applied ASJ or Type III with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

2.2 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

B. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.

C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

D. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

2.3 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below ambient services.

1. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
2. Service Temperature Range: Minus 20 to plus 180 deg F.
3. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
4. Color: White.

2.4 SEALANTS

A. FSK Flashing Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.

2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F.
4. Color: Aluminum.

B. ASJ Flashing Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F.
4. Color: White.

2.5 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

2.6 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

1. Width: 3 inches.
2. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.

1. Width: 3 inches.
2. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.

1. Verify that systems to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

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3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of ducts and fittings.

B. Install insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each item of duct system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Keep insulation materials dry during application and finishing.

G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

H. Install insulation with least number of joints practical.

I. Where vapor barrier is installed; seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously around anchor attachments.

J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

K. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.
2. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
3. Where vapor barriers are indicated, apply vapor-barrier mastic at ends adjacent to duct flanges and fittings.

L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

3.4 PENETRATIONS

A. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

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B. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches.

1. Comply with requirements in Section 078413 "Penetration Firestopping."

3.5 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.6 INSTALLATION OF MINERAL-FIBER INSULATION

A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.

a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.

3.7 FINISHES

A. Exposed, insulation with ASJ: Paint jacket with paint system identified below and as specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.

a. Finish Coat Material: Interior, flat, latex-emulsion size.

B. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

C. Do not field paint aluminum or stainless-steel jackets.

3.8 DUCT INSULATION SCHEDULE, GENERAL

A. Plenums and Ducts Requiring Insulation:

1. Indoor, concealed round, sheet metal supply air.
2. Indoor, exposed, round supply air.

B. Items Not Insulated:

1. Interior rectangular metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.

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2. Factory-insulated flexible ducts.

3.9 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

A. Concealed, round, sheet metal supply-air duct insulation shall be the following:

1. Mineral-Fiber Blanket with FSK: 1-1/2 inches thick and 0.75-lb/cu. ft. nominal density.

B. Exposed, round, sheet metal supply-air duct insulation shall be the following:

1. Mineral-Fiber Blanket with ASJ: 1-1/2 inches thick and 0.75-lb/cu. ft. nominal density.

END OF SECTION 230713

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SECTION 230719 - HVAC PIPING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes insulating the following HVAC piping systems:

1. Condensate drain piping, indoors.
2. Refrigerant suction and hot-gas piping, indoors and outdoors.

1.2 RELATED DOCUMENTS

A. Section 23 05 00, General Mechanical Requirements, is specifically applicable to this section.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory and field applied if any).

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.7 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields.

1.8 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.

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2.2 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

B. Flexible Elastomeric Adhesive: Comply with MIL-A-24179A, Type II, Class I.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.

1. Verify that systems to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Keep insulation materials dry during application and finishing.

G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

H. Install insulation with least number of joints practical.

I. Apply adhesives at manufacturer's recommended coverage rate and wet and dry film thicknesses.

J. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

K. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

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3.4 PENETRATIONS

A. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

B. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.

1. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.

3.5 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, and Unions:

1. Install insulation over fittings, valves, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

3.6 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:
1. Install mitered sections of pipe insulation.

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2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
2. Install insulation to flanges as specified for flange insulation application.
3. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.7 FINISHES

A. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

B. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

3.8 INDOOR PIPING INSULATION SCHEDULE

A. Condensate and Equipment Drain Water below 60 Deg F:
1. All Pipe Sizes: Flexible Elastomeric: 3/4 inch thick.

B. Refrigerant Suction and Hot-Gas Piping:
1. All Pipe Sizes: Flexible Elastomeric: 1 inch thick.

3.9 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE

A. Refrigerant Suction and Hot-Gas Piping:
1. All Pipe Sizes: Flexible Elastomeric: 2 inches thick.

END OF SECTION 230719

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SECTION 232500 – VRV AIR CONDITIONING SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. Variable Refrigerant Volume (VRV) air conditioning system shall include all indoor units, branch selector boxes, outdoor units, DDC controls, refrigerant piping and other accessories as necessary & required to construct the complete and properly functioning system.

B. Section Includes:
1. Indoor Units.
2. Outdoor Condensing Units.
3. Branch Selector Boxes.

C. Delegated Design - VRV manufacturer shall design and be responsible for:
1. Providing all necessary and required accessories for their system, whether shown in the Mechanical Documents or not, to insure that their proposed VRV system is fully functioning under all load conditions.
2. The design for this job specific refrigerant piping system connecting all the indoor units, branch selector boxes, and outdoor units to operate as a complete system.
3. The controls to insure the proper operation of the complete VRV system.

1.2 RELATED DOCUMENTS

A. Section 230500 “General Mechanical Requirements” is specifically applicable to this section.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
1. Include literature that indicates dimensions, weights, capacities, ratings, fan performance, thickness and finishes of materials, and electrical characteristics and connection requirements.

B. Shop Drawings:
1. Include details of equipment assemblies and piping configuration and layout. Indicate dimensions, weights, loads, required clearances, methods of field assembly, components, and location and size of each field connection.
2. Include diagrams for power, signal, and control wiring.
3. Provide a Submittal Compliance Analysis for the proposed system as specified in Section 2350000. Variations shall be explained and benefits/detriments outlined.

1.4 INFORMATIONAL SUBMITTALS

A. Letter(s) of certification that the Installer(s) have been trained by the VRV manufacturer to install their product.

B. Installation, operation, and maintenance manuals.

C. Field quality-control reports.

D. Warranty: The units shall have a manufacturer’s warranty for a min. period of ten (10) years from date of factory-certified start up. The units shall have a limited labor warranty for a min. period of one (1) year from date of factory-certified start up. The compressors shall have a min. warranty of ten (10) years from date of factory-certified start up. During the stated period, should any part fail due to defects in material and workmanship, it shall be repaired or replaced at the discretion of the manufacturer according to their terms and conditions. All warranty service work shall be performed by a manufacturer trained service professional.

PART 2 - PRODUCTS

2.1 GENERAL SYSTEM DESCRIPTION

A. Acceptable Manufacturers:
   1. Daikin AC
   2. Mitsubishi City Multi
   3. York/Hitachi

B. The variable capacity, heat recovery air conditioning system shall consist of multiple indoor fan coil units, branch selector boxes, manufacturer's joints and headers, a three pipe refrigeration distribution system using PID control, and outdoor condenser/compressor units.

C. Operation of the system shall permit either individual cooling or heating of each fan coil simultaneously or all of the fan coil units associated with one branch cool/heat selector box. Each fan coil or group of fan coils shall be able to provide set temperature independently via a local remote controller, an Intelligent Controller, an Intelligent Manager or a BMS interface.

D. Each branch of the branch selector box shall consist of three electronic expansion valves, refrigerant control piping and electronics to facilitate communications between the box and main processor and between the box and indoor units. The branch selector box shall control the operational mode of the subordinate indoor units. Design shall ensure continuous heating during defrost (multiple condenser systems), no heating impact during changeover, and reduced sound levels.

E. System Performance:
   1. Operating Range:
      a. The operating range in cooling shall be 0 °FDB to 110°FDB.
      b. The operating range in heating shall be -4°FDB to 77°FDB.
      c. Simultaneous cooling/heating operating range shall be 0°FWB to 60°FWB.
   2. Refrigerant Piping: The system shall be capable of handling
      a. Refrigerant piping up to 540 actual feet or 620 equivalent feet from the outdoor unit to the furthest indoor unit.
      b. A total combined liquid line length of 3,280 feet of piping between the condensing and fan coil units with 295 feet maximum vertical difference, without any oil traps.

2.2 OUTDOOR UNIT

A. General requirements.
   1. The outdoor unit shall be factory assembled in the USA and pre-wired with all necessary electronic and refrigerant controls. The refrigeration circuit of the condensing unit shall consist of a scroll compressors, motors, fans, condenser coil, electronic expansion valves, solenoid valves, 4-way valve, distribution headers, capillaries, filters, shut off valves, oil separators, service ports and refrigerant regulator. All outdoor units must have a minimum of 2 compressors. In the event of compressor failure the remaining compressors shall continue to operate and provide heating or cooling as required at a proportionally reduced capacity.
   2. High/low pressure gas line, liquid and suction lines must be individually insulated between the outdoor and indoor units.
   3. The outdoor unit can be wired and piped with outdoor unit access from the left, right, rear or bottom.
   4. The connection ratio of indoor units to outdoor unit shall be permitted up to 200%.
   5. Each outdoor system shall be able to support the connection of up to 64 indoor units dependent on the model of the outdoor unit.
   6. The outdoor unit shall be capable of operating automatically at further reduced noise during night time.
   7. The system will automatically restart operation after a power failure and will not cause any settings to be lost, thus eliminating the need for reprogramming.

8. The unit shall incorporate an auto-charging feature and a refrigerant charge check function.
9. The outdoor unit shall be modular in design and should allow for side-by-side installation with minimum spacing.
10. The following safety devices shall be included on the condensing unit; high pressure switch, control circuit fuses, crankcase heaters, fusible plug, high pressure switch, overload relay, inverter overload protector, thermal protectors for compressor and fan motors, over current protection for the inverter and anti-recycling timers.
11. To ensure the liquid refrigerant does not flash when supplying to the various fan coil units, the circuit shall be provided with a sub-cooling feature.
12. Oil recovery cycle shall be automatic occurring 2 hours after start of operation and then every 8 hours of operation.
13. The outdoor unit shall be capable of heating operation at down to -40°F dry bulb ambient temperature without additional low ambient controls.
14. The system shall continue to provide heat to the indoor units in heating operation while in the defrost mode.

B. Unit Cabinet:
1. The outdoor unit shall be completely weatherproof and corrosion resistant. The unit shall be constructed from rust-proofed mild steel panels coated with a baked enamel finish.

C. Fan:
1. The condensing unit shall consist of two or more propeller type, direct-drive fan motors that have multiple speed operation via a DC (digitally commutating) inverter. All outdoor units must have a minimum of 2 fans.
2. The condensing unit fan motor shall have multiple speed operation of the DC (digitally commutating) inverter type, and be of high external static pressure and shall be factory set as standard at 0.12 in. WG
3. The fan shall be a vertical discharge configuration.
4. The fan motor shall have inherent protection and permanently lubricated bearings and be mounted.
5. The fan motor shall be provided with a fan guard to prevent contact with moving parts.
6. Night setback control of the fan motor for low noise operation by way of automatically limiting the maximum speed shall be a standard feature.

D. Condenser Coil:
1. Shall be constructed with copper tubes expanded into aluminum, waffle louver fins to form a mechanical bond and a tube design.
2. The heat exchanger on the condensing units shall be manufactured from Hi-X seamless copper tube with N-shape internal grooves mechanically bonded on to aluminum fins to an e-Pass Design.
3. The fins are to be covered with an anti-corrosion Ultra Gold coating as standard with a salt spray test rating of 1000hr (ASTM B117 & Blister Rating:10), Acetic acid salt spray test: 500hr (ASTM G85 & Blister Rating:10).
4. The pipe plates shall be treated with powdered polyester resin for corrosion prevention. The thickness of the coating must be between 2.0 to 3.0 microns.
5. The outdoor coil shall have three-circuit heat exchanger design eliminating the need for bottom plate heater. The lower part of the coil shall be used for inverter cooling and be on or off during heating operation enhancing the defrost operation.

E. Compressor:
1. The inverter scroll compressors shall be variable speed (PAM inverter) controlled which is capable of changing the speed to follow the variations in total cooling and heating load as determined by the suction gas pressure as measured in the condensing unit. In addition, samplings of evaporator and condenser temperatures shall be made so that the high/low pressures detected are read every 20 seconds and calculated. With each reading, the compressor capacity (INV frequency or STD ON/OFF) shall be controlled to eliminate deviation from target value.
2. The inverter driven compressor in each condensing unit shall be of highly efficient reluctance DC (digitally commutating), hermetically sealed scroll “G-type” with a maximum speed of 7,980 rpm.

3. Neodymium magnets shall be adopted in the rotor construction to yield a higher torque and efficiency in the compressor instead of the normal ferrite magnet type. At complete stop of the compressor, the neodymium magnets will position the rotor into the optimum position for a low torque start.
4. The capacity control range shall be as low as 6% to 100%.
5. Each compressor shall be equipped with a crankcase heater, high pressure safety switch, and internal thermal overload protector.
6. Oil separators shall be standard with the equipment together with an intelligent oil management system.
7. The compressor shall be spring mounted to avoid the transmission of vibration.
8. Units sized 8-12 ton shall contain a minimum of 2 compressors, 14-16 ton units shall contain a minimum of 3 compressors and 18-20 ton shall contain a minimum of 4 compressors. In the event of compressor failure the remaining compressors shall continue to operate and provide heating or cooling as required at a proportionally reduced capacity. The microprocessor and associated controls shall be designed to specifically address this condition.
9. In the case of multiple condenser modules, conjoined operation hours of the compressors shall be balanced by means of the Duty Cycling Function, ensuring sequential starting of each module at each start/stop cycle, completion of oil return, completion of defrost or every 8 hours.

F. Electrical:
1. A separate power supply will be required of 208/230 volts, 1 phase, 60 hertz. The acceptable voltage range shall be 187 to 253 volts.
2. The control voltage between the indoor and outdoor unit shall be 16VDC non-shielded, stranded 2 conductor cable.
3. The control wiring shall be a two-wire multiplex transmission system, making it possible to connect multiple indoor units to one outdoor unit with one 2-cable wire, thus simplifying the wiring operation.
4. Transmission (control) wiring between the indoor and outdoor unit shall be a maximum of 3,280 feet (total 6,560 feet).
5. Transmission (control) wiring between the indoor and remote controller shall be a maximum distance of 1,640 feet.

2.3 BRANCH SELECTOR BOX

A. General requirements.
1. The branch selector box shall consist of three electronic expansion valves, refrigerant control piping and electronics to facilitate communications between the box and main processor and between the box and indoor units. The branch selector box shall control the operational mode of the subordinate indoor units. The use of three EEV's ensures continuous heating during oil return and defrost, rapid heating/cooling changeover and reduced sound levels.
    a. Use of multi-port branch selector boxes shall only be acceptable if no common valves are shared within the box. If manufacturer's branch controller box contain valves that are common between multiple different fan coil units, and individual box must be provided per each fan coil.
2. If manufacturer's branch controller box requires a condensate drain, a secondary drain pan with condensate pump and overflow shut down switch shall be provided. The condensate switch shall be interlocked with all downstream fan coils to prohibit operation in cooling when an overflow condition has been sensed.
3. These selector boxes shall be factory assembled, wired, and piped.
4. These branch controllers must be run tested at the factory.
5. These selector boxes must be mounted indoors.
6. When simultaneously heating and cooling, the units in heating mode shall energize their sub-cooling electronic expansion valve.

B. Unit Cabinet:
1. These units shall have a galvanized steel plate casing.
2. The cabinet shall contain one sub-cooling heat exchanger per branch.
3. The unit shall have sound absorption thermal insulation material made of flame and heat resistant foamed polyethylene.

C. Refrigerant Valves:
1. The unit shall be furnished with 3 electronic expansion valves per branch to control the direction of refrigerant flow.
2. The refrigerant connections must be of the braze type.

D. Electrical:
1. The unit electric al power shall be 208/230 volts, 1 phase, 60 hertz.
2. The unit shall be capable of operation within the limits of 187 volts to 253 volts.
3. The minimum circuit amps (MCA) shall be 0.1 and the maximum over current protection amps (MOP) shall be 15.
4. The control voltage between the indoor and condensing unit shall be 16VDC non-shielded 2 conductor cable

2.4 DDC CONTROL SYSTEM

A. Auto-Changeover:
1. Auto-changeover shall be programmed to allow for the optimal room temperature to be maintained by automatically switching mode between Cool and Heat in accordance with the room temperature and setpoint**.**
2. The setpoint differential should adjustable between 0°F to 13°F. The Thermal Differential is the tolerance for the indoor unit's setpoint.
3. The operational mode shall change from cooling to heating when the room setpoint is exceeded by 1°F (adjustable).

4. The operational mode shall change from heating to cooling when the room temperature drops 1°F (adjustable) below setpoint.
5. A guard timer (adjustable 15-60 minutes) should be in place to prevent rapid changing, but is overridden if the room setpoint is changed.

B. Zone Controllers:
1. The Remote controller shall feature a Backlit LCD Display with contrast adjustment and auto off after 30 seconds.
2. Multiple display modes must be available: Detailed, Standard, and Simple
3. Zone controllers must have the capability of individual function button lockout (On/Off, Mode, Fan Speed, Up/Down/Left/Right Arrows)
4. Controller Face Plate must be available as an option to hide unnecessary (locked out) buttons. Face plate and simplified display mode shall enable the user full control of the system with minimum amount of user input.
5. The following is available to display errors and to assist service personnel in troubleshooting:
   a. A blinking LED will signal system abnormality/error
   b. Error codes will be displayed in the event of system abnormality/error directly on zone controller
6. Service personnel shall be able to access the following from the room controller:
   a. Return Air Temperature
   b. Liquid Line Temperature
   c. Gas Line Temperature
   d. Discharge Air Temperature (depending on unit)
   e. Remote Controller Sensor Temperature

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, with Installer present, to receive fan coil units for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for piping and electrical connections to verify actual locations before fan coil unit installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. The VRV system shall be installed per Manufacturer's Installation Instructions.

3.3 SEQUENCE OF OPERATIONS

A Variable Refrigerant Flow System: Variable refrigerant flow system shall consist of indoor fan coil units, heat / cool branch selector boxes and outdoor heat recovery units with a minimum of two compressors per module.
1 Occupied Mode
   a Heat recovery unit shall run a start-up of the unit using PI control to equalize the system pressure and reducing start load. Inverter ON to charge capacitor.
   b Compressor shall start and ramp to maintain load based on PI control
   c Multiple compressors shall start based on load and PI step control.
   d Heat recovery units and compressors on multiple units will rotate starting to equalize run time.
   e Unit shall be equipped with multiple outdoor fans that step modulate on PI control to maintain head pressure.
   f Heat recovery unit shall use PI control to maintain heating availability during the cooling mode to allow for heat recovery operation.

g Heat recovery unit shall use two condenser coils per unit to allow for heat rejection between the indoor and outdoor units during heat recovery using PI control.

h Fan coils shall operate in heating or cooling mode to maintain space setpoint.

2 Defrost Mode when Occupied

a Heat recovery unit shall perform defrost during the heating operation without disruption of the heating cycle

b Indoor fans shall remain on and never shut off during defrost mode.

c Heating operation shall stay operational during oil recovery.
d Condenser coils shall defrost independently and the heating operation shall stay operational.
e Heat recovery unit shall have multiple outdoor fan motors PI step controlled to maintain head pressure during defrost

3 Oil Recovery Mode when Occupied
a If anytime during operation, the heat recovery unit reaches eight hours of operation in heating or cooling, the unit will perform an oil recovery cycle without disruption of the heating cycle.
b Indoor fans shall remain on and never shut off during oil recovery.
c Heating operation shall stay operational during oil recovery.
d Oil recovery cycle shall last between three and five minutes.

4 Unoccupied Mode
a During the unoccupied cycle the heat recovery unit shall cycle to maintain setpoint in heating or cooling based on demand from onboard DDC controls as required by indoor fan coil setback temperatures.
b Heat recovery unit function shall be the same as occupied, defrost and oil recovery
c Pump down operation will be available to remove refrigerant from evaporator coils prior to shut-down.

5 Safety Devices: Heat recovery unit shall be equipped with the following safety devices.
a High pressure safety operation.
b Low pressure safety operation
c Discharge pipe protection control.
d Inverter protection control
e Standard compressor overload protection.
f Heat recovery unit shall be capable of back up operation in event of a compressor failure (multiple condenser application with multiple compressors).

END OF SECTION 232500

SECTION 233113 - METAL DUCTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Single-wall rectangular ducts and fittings.
2. Sheet metal materials.
3. Duct liner.
4. Sealants and gaskets.
5. Hangers and supports.

1.2 RELATED DOCUMENTS

A. The requirements of Section 230500 – General Mechanical Requirements apply to this Section.

1.3 PERFORMANCE REQUIREMENTS

A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated in "Duct Schedule" Article.

B. Structural Performance: Duct hangers and supports shall withstand the effects of gravity loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible".

C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

1.4 ACTION SUBMITTALS

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

1. Liners and adhesives.
2. Sealants and gaskets.

1.5 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-up."

B. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."

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PART 2 - PRODUCTS

2.1 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.2 SINGLE-WALL ROUND DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

D. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.3 SHEET METAL MATERIALS

A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

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1. Galvanized Coating Designation: G60.
2. Finishes for Surfaces Exposed to View: Mill phosphatized.

C. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.

D. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.4 DUCT LINER

A. Fibrous-Glass Duct Liner: Comply with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."
1. Maximum Thermal Conductivity: Type I, Flexible: 0.27 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
2. Antimicrobial Erosion-Resistant Coating: Apply to the surface of the liner that will form the interior surface of the duct to act as a moisture repellent and erosion-resistant coating. Antimicrobial compound shall be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.
3. Water-Based Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C 916.

B. Shop Application of Duct Liner: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 7-11, "Flexible Duct Liner Installation."

1. Adhere a single layer of indicated thickness of duct liner with at least 90 percent adhesive coverage at liner contact surface area. Attaining indicated thickness with multiple layers of duct liner is prohibited.
2. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.
3. Butt transverse joints without gaps, and coat joint with adhesive.
4. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted-edge overlapping.
5. Do not apply liner in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and dimensions of standard liner make longitudinal joints necessary.
6. Apply adhesive coating on longitudinal seams in ducts with air velocity of 2500 fpm.
7. Secure liner with mechanical fasteners 4 inches from corners and at intervals not exceeding 12 inches transversely; at 3 inches from transverse joints and at intervals not exceeding 18 inches longitudinally.
8. Secure transversely oriented liner edges facing the airstream with metal nosings that have either channel or "Z" profiles or are integrally formed from duct wall. Fabricate edge facings at the following locations:

a. Fan discharges.
b. Intervals of lined duct preceding unlined duct.
c. Upstream edges of transverse joints in ducts where air velocities are higher than 2500 fpm or where indicated.

2.5 SEALANT AND GASKETS

A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.

B. Water-Based Joint and Seam Sealant:

1. Application Method: Brush on.

2. Solids Content: Minimum 65 percent.
3. Shore A Hardness: Minimum 20.
4. Water resistant.
5. Mold and mildew resistant.
6. VOC: Maximum 75 g/L (less water).
7. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
8. Service: Indoor or outdoor.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

C. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

2.6 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

B. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."

C. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

D. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

E. Trapeze and Riser Supports: Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.

B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.

C. Install round ducts in maximum practical lengths.

D. Install ducts with fewest possible joints.

E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.

F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.

G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

H. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.

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I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.

J. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.

K. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Section 233300 "Air Duct Accessories" for fire and smoke dampers.

L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines."

3.2 INSTALLATION OF EXPOSED DUCTWORK

A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.

B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.

C. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.

D. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.3 DUCT SEALING

A. Seal ducts to the following seal classes according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":

1. All ducts: Seal Class A.

3.4 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."

B. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.

C. Hangers Exposed to View: Threaded rod and angle or channel supports or cable system.

D. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum interval of 16 feet.

E. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

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3.5 CONNECTIONS

A. Make connections to equipment with flexible connectors.

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.6 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Duct System Cleanliness Tests: Visually inspect duct system to ensure that no visible contaminants are present.

3.7 DUCT CLEANING (If the duct system has not been properly protected during construction and the ducts are visually dirty.)

A. Clean new and existing duct system(s) before testing, adjusting, and balancing.

B. Use service openings for entry and inspection.

1. Create new openings and install access panels appropriate for duct static-pressure class if required for cleaning access. Provide insulated panels for insulated or lined duct. Patch insulation and liner as recommended by duct liner manufacturer.
2. Disconnect and reconnect flexible ducts as needed for cleaning and inspection.
3. Remove and reinstall ceiling to gain access during the cleaning process.

C. Particulate Collection and Odor Control:

1. When venting vacuuming system inside the building, use HEPA filtration with 99.97 percent collection efficiency for 0.3-micron-size (or larger) particles.
2. When venting vacuuming system to outdoors, use filter to collect debris removed from HVAC system, and locate exhaust downwind and away from air intakes and other points of entry into building.

D. Clean the following components by removing surface contaminants and deposits:

1. Air outlets and inlets (registers, grilles, and diffusers).
2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
4. Coils and related components.
5. Return-air ducts, dampers, actuators, and turning vanes except in ceiling plenums and mechanical equipment rooms.
6. Supply-air ducts, dampers, actuators, and turning vanes.
7. Dedicated exhaust and ventilation components and makeup air systems.

E. Mechanical Cleaning Methodology:

1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.

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2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.
3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.
4. Clean fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet. Replace fibrous-glass duct liner that is damaged, deteriorated, or delaminated or that has friable material, mold, or fungus growth.
5. Clean coils and coil drain pans according to NADCA 1992. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.
6. Provide drainage and cleanup for wash-down procedures.
7. Antimicrobial Agents and Coatings: Apply EPA-registered antimicrobial agents if fungus is present. Apply antimicrobial agents according to manufacturer's written instructions after removal of surface deposits and debris.

3.8 DUCT SCHEDULE

A. Supply Ducts Connected to Constant-Volume Air-Handling Units:

1. Pressure Class: Positive 3-inch wg.
2. Minimum SMACNA Seal Class: A.

B. Plenum Return Ducts and Boots Connected to Air-Handling Units:

1. Pressure Class: Positive or negative -2-inch wg.
2. Minimum SMACNA Seal Class: B.

C. Exhaust Ducts Connected to Fans:

1. Pressure Class: Negative 1-inch wg.
2. Minimum SMACNA Seal Class: A.

D. Intermediate Reinforcement:

1. Galvanized-Steel Ducts: Galvanized steel.

E. Liner:

1. Supply Air Ducts: Fibrous glass, Type I, 1 inch thick.
2. Return Air Ducts: Fibrous glass, Type I, 1 inch thick.
3. Return- and Exhaust-Fan Plenums: Fibrous glass, Type II, 1 inch thick.
4. Transfer Ducts: Fibrous glass, Type I, 1 inch thick.

F. Elbow Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."

a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
c. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

2. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "Round Duct Elbows."

    a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.
        1) Radius-to Diameter Ratio: 1.5.
    b. Round Elbows, 12 Inches and Smaller in Diameter: Stamped or pleated.
    c. Round Elbows, 14 Inches and Larger in Diameter: Standing seam.

G. Branch Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connection."

    a. Rectangular Main to Rectangular Branch: 45-degree entry.
    b. Rectangular Main to Round Branch: Conical spin-in or 45-degree entry square-to-round

2. Round: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees." Saddle taps are permitted in existing duct.

    a. Conical tap.

END OF SECTION 233113

SECTION 233300 - AIR DUCT ACCESSORIES

PART 1 - GENERAL

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. Backdraft and pressure relief dampers.
2. Manual volume dampers.
3. Flange connectors.
4. Turning vanes.
5. Remote damper operators.
6. Flexible connectors.
7. Flexible ducts.
8. Duct accessory hardware.
9. Air filters.
10. Diffusers and grilles

1.3 RELATED DOCUMENTS

A. The requirements of Section 230500 – General Mechanical Requirements apply to this Section.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For air duct accessories to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTION

A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

2.2 MATERIALS

A. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G60.

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2. Exposed-Surface Finish: Mill phosphatized.

B. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.

C. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.3 BACKDRAFT DAMPERS

A. Description: Gravity balanced.

B. Maximum System Pressure: 1-inch wg.

C. Frame: Hat-shaped, 0.05-inch-thick, galvanized sheet steel, with welded corners or mechanically attached and mounting flange.

D. Blades: Multiple single-piece blades, end pivoted, maximum 6-inch width, 0.025-inch-thick, roll-formed aluminum with sealed edges.

E. Blade Action: Parallel.

F. Blade Seals: Extruded vinyl or neoprene , mechanically locked.

G. Blade Axles:
1. Material: Nonferrous metal.
2. Diameter: 0.20 inch.

H. Tie Bars and Brackets: Galvanized steel.

I. Return Spring: Adjustable tension.

J. Bearings: Steel ball or synthetic pivot bushings.

K. Accessories:

1. Adjustment device to permit setting for varying differential static pressure.
2. Counterweights and spring-assist kits for vertical airflow installations.

2.4 MANUAL VOLUME DAMPERS

A. Standard, Steel, Manual Volume Dampers:

1. Standard leakage rating.
2. Suitable for horizontal or vertical applications.
3. Frames:

a. Frame: Hat-shaped, 0.094-inch-thick, galvanized sheet steel.
b. Mitered and welded corners.
c. Flanges for attaching to walls and flangeless frames for installing in ducts.

4. Blades:

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a. Multiple or single blade.
b. Parallel- or opposed-blade design.
c. Stiffen damper blades for stability.
d. Galvanized-steel, 0.064 inch thick.

5. Blade Axles: Galvanized steel.
6. Bearings:

a. Oil-impregnated bronze.
b. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.

7. Tie Bars and Brackets: Galvanized steel.

2.5 FLANGE CONNECTORS

A. Description: Add-on or roll-formed, factory-fabricated, slide-on transverse flange connectors, gaskets, and components.

B. Material: Galvanized steel.

C. Gage and Shape: Match connecting ductwork.

2.6 TURNING VANES

A. Manufactured Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.

B. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 4-3, "Vanes and Vane Runners," and 4-4, "Vane Support in Elbows."

C. Vane Construction: Single wall.

2.7 REMOTE DAMPER OPERATORS

A. Description: Cable system designed for remote manual damper adjustment.

B. Tubing: Brass.

C. Cable: Stainless steel.

D. Wall-Box Mounting: Recessed.

E. Wall-Box Cover-Plate Material: Steel.

2.8 FLEXIBLE CONNECTORS

A. Materials: Flame-retardant or noncombustible fabrics.

B. Coatings and Adhesives: Comply with UL 181, Class 1.

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C. Metal-Edged Connectors: Factory fabricated with a fabric strip [**3-1/2 inches**] [**5-3/4 inches**] wide attached to two strips of 2-3/4-inch-wide, 0.028-inch-thick, galvanized sheet steel or 0.032-inch-thick aluminum sheets. Provide metal compatible with connected ducts.

D. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.

1. Minimum Weight: 26 oz./sq. yd..
2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
3. Service Temperature: Minus 40 to plus 200 deg F.

2.9 FLEXIBLE DUCTS

A. Insulated, Flexible Duct: UL 181, Class 1, 2-ply vinyl film supported by helically wound, spring-steel wire; fibrous-glass insulation; polyethylene vapor-barrier film.

1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.
2. Maximum Air Velocity: 4000 fpm.
3. Temperature Range: Minus 10 to plus 160 deg F.
4. Insulation R-value: Comply with ASHRAE/IESNA 90.1.

B. Flexible Duct Connectors:

1. Clamps: Nylon strap in sizes 3 through 18 inches, to suit duct size.

2.10 DUCT ACCESSORY HARDWARE

A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.

B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

2.11 AIR FILTERS

A. The Contractor shall furnish and install filters during construction and shall simulate dirty filter pressure drops during all testing and balancing of systems. The Contractor shall furnish and install all new filters or filter media at the time of final acceptance by the Owner.

B. Pleated type filters shall be Camfil Farr "30/30" pleated panel air filters.

1. Air Filters shall be 2" deep as required. Each filter shall consist of a cotton and synthetic media, support grid, and enclosing frame. The filter shall be listed as Underwriters' Laboratories Class 2.
2. Filter media shall have an average dust spot efficiency of 25-30% when tested in accordance with ASHRAE Standard 52.1-1992 and Minimum Efficiency Reporting Value of MERV 7 when tested in accordance with ASHRAE Standard 52.2.
3. The filters shall have a maximum initial resistance at 500 fpm of .28" WG.
4. Grid shall be welded wire on 1" centers. Grid shall be bonded to the media to eliminate oscillation and pull away. The grid shall be formed to effect a radial pleat, allowing total use of media.
5. The frame shall be a rigid, high wet-strength beverage board, with diagonal support members bonded to the air entering and air exiting side of each pleat. The enclosing frame shall be chemically bonded to the filter pack.

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2.12 DIFFUSERS AND GRILLES

A. All grilles and registers with fixed louvers shall be arranged so that the louver faces are as nearly perpendicular to the normal line of sight as possible. All air terminals shall have a sponge rubber strip between flange and adjacent surface. All wall mounted air terminals shall be provided with factory primed coatings unless otherwise specified. All ceiling mounted air terminals shall be finished in a baked enamel finish acceptable to the Architect. Wall mounted grilles located near the floor shall have bottom of openings a minimum of 3" AFF.

B. Air terminals shall be as manufactured by Titus or equivalent by Tuttle & Bailey, Anemostat, Price, Krueger, Nailor or approved manufacturer.

C. Diffusers and grilles shall be provided without dampers unless hereinafter specified or noted differently. Damper shall be located as far from the diffuser or grille as possible.

1. Diffusers/registers installed directly on main ducts shall be supplied with integral dampers in lieu of a separate duct mounted damper.

D. Provide frame type to match adjoining ceiling and installation requirements. Refer to Architectural drawings for ceiling types.

E. Perforated plate return air grilles in plenum return systems without return air boots at the grille shall be of steel construction.

F. Square ceiling diffusers shall be louver face, of steel construction, and shall be provided with an equalizing grid.

G. Slot type linear ceiling diffusers shall be heavy gauge aluminum with white baked acrylic finish on the face and black baked acrylic on the interior and shall be provided with deflectors, numbers of slots, slot width, and insulated plenum.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.

B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.

C. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.

1. Install steel volume dampers in steel ducts.
2. Install aluminum volume dampers in aluminum ducts.

D. Set dampers to fully open position before testing, adjusting, and balancing.

E. Install test holes at fan inlets and outlets and elsewhere as indicated.

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F. Install flexible connectors to connect ducts to equipment.

G. Connect diffusers to ducts directly (exposed) or with maximum 60-inch lengths of flexible duct (concealed) strapped in place.

H. Connect flexible ducts to metal ducts with draw bands.

I. Install duct test holes where required for testing and balancing purposes.

3.2 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Operate dampers to verify full range of movement.
2. Inspect locations of access doors and verify that purpose of access door can be performed.
3. Operate fire, smoke, and combination fire and smoke dampers to verify full range of movement and verify that proper heat-response device is installed.
4. Inspect turning vanes for proper and secure installation.
5. Operate remote damper operators to verify full range of movement of operator and damper.

END OF SECTION 233300

SECTION 233423 - HVAC POWER VENTILATORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Centrifugal roof ventilator
2. Centrifugal inline fans.

1.2 RELATED DOCUMENTS

A. The requirements of Section 230500 – General Mechanical Requirements apply to this Section.

1.3 PERFORMANCE REQUIREMENTS

A. Project Altitude: Base fan-performance ratings on sea level.

B. Operating Limits: Classify according to AMCA 99.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. Also include the following:

1. Certified fan performance curves with system operating conditions indicated.
2. Certified fan sound-power ratings.
3. Motor ratings and electrical characteristics, plus motor and electrical accessories.
4. Material thickness and finishes.
5. Dampers, including housings, linkages, and operators.
6. Roof curbs.
7. Fan speed controllers.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Wiring Diagrams: For power, signal, and control wiring.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For power ventilators to include in emergency, operation, and maintenance manuals.

1.6 QUALITY ASSURANCE

A. 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.

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B. AMCA Compliance: Fans shall have AMCA-Certified performance ratings and shall bear the AMCA-Certified Ratings Seal.

C. UL Standards: Power ventilators shall comply with UL 705.

1.7 COORDINATION

A. Coordinate size and location of structural-steel support members.

B. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

PART 2 - PRODUCTS

2.1 CENTRIFUGAL ROOF VENTILATORS

A. Manufacturers: Greenheck, Cook, or approved manufacturer.

B. Housing: Removable, spun-aluminum, dome top and outlet baffle; square, one-piece, aluminum base with venturi inlet cone.

1. Hinged Subbase: Galvanized-steel hinged arrangement permitting service and maintenance.

C. Fan Wheels: Aluminum hub and wheel with backward-inclined blades.

D. Accessories:
1. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
2. Disconnect Switch: Nonfusible type, with thermal-overload protection mounted inside fan housing, factory wired through an internal aluminum conduit.
3. Bird Screens: Removable, 1/2-inch mesh, aluminum or brass wire.
4. Dampers: Counterbalanced, parallel-blade, backdraft dampers mounted in curb base; factory set to close when fan stops.

2.2 CENTRIFUGAL INLINE FANS

A. Description: Factory-fabricated, -assembled, -tested, and -finished, direct-drive centrifugal fans consisting of housing, wheel, fan shaft, bearings, motor and disconnect switch, drive assembly, and support structure.

B. Wheel:

1. Non-overloading, backward inclined centrifugal wheel.
2. Constructed of aluminum.
3. Statically and dynamically balanced in accordance to AMCA Standard 204-05.
4. The wheel cone and fan inlet will be matched and shall have precise running tolerances for maximum performance and operating efficiency.
5. Single thickness blades are securely riveted or welded to a heavy gauge back plate and wheel cone.

C. Electronically Commutated Motor

1. Motor enclosures: Open type.
2. Motor to be a DC electronic commutation type motor (ECM) specifically designed for fan applications.

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3. Motors are permanently lubricated, heavy duty ball bearing type to match with the fan load and pre-wired to the specific voltage and phase.
4. Internal motor circuitry to convert AC power supplied to the fan to DC power to operate the motor.
5. Motor shall be speed controllable down to 20% of full speed (80% turndown). Speed shall be controlled by either a potentiometer dial mounted at the motor or by a 0-10 VDC signal.
6. Motor shall be a minimum of 85% efficient at all speeds.

D. Housing/Cabinet Construction.

1. Construction material: Galvanized.
2. Square design constructed of heavy gauge galvanized steel and shall include square duct mounting collars
3. Housing and bearing supports shall be constructed of heavy gauge bolted and welded steel construction to prevent vibration and to rigidly support the shaft and bearing assembly.

E. Disconnect Switch.

1. NEMA rated: 1.
2. Positive electrical shut-off.
3. Wired from fan motor to junction box.

2.3 SOURCE QUALITY CONTROL

A. Certify sound-power level ratings according to AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install power ventilators level and plumb.

B. Secure roof-mounted fans to roof curbs with cadmium-plated hardware.

C. Label units according to requirements specified.

3.2 CONNECTIONS

A. Make final duct connections with flexible connectors.

B. Install ducts adjacent to power ventilators to allow service and maintenance.

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Tests and Inspections:

1. Verify that shipping, blocking, and bracing are removed.

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2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
3. Verify that cleaning and adjusting are complete.
4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
5. Adjust damper linkages for proper damper operation.
6. Verify lubrication for bearings and other moving parts.
7. Energize motor and adjust fan to indicated rpm, and measure and record motor voltage and amperage.
8. Remove and replace malfunctioning units and retest as specified above.

C. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.4 ADJUSTING

A. Adjust damper linkages for proper damper operation.

B. Comply with requirements for testing, adjusting, and balancing procedures.

C. Lubricate bearings.

END OF SECTION 23342

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SECTION 237433 - DEDICATED OUTDOOR-AIR UNITS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes factory-packaged units capable of supplying up to 100 percent outdoor air and providing cooling and heating.

1.2 RELATED DOCUMENTS

A. The requirements of Section 230500 – General Mechanical Requirements apply to this Section.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include rated capacities, operating characteristics, and furnished specialties and accessories.

B. Shop Drawings:
1. Include plans, elevations, sections, and attachment details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

C. Startup service reports.

D. Sample Warranty: For special warranty.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For units to include in emergency, operation, and maintenance manuals.

1.5 WARRANTY

A. Special Warranty: Manufacturer agrees to replace components of units that fail in materials or workmanship within specified warranty period.
1. Warranty Period for Compressors: Five years from date of Substantial Completion.
2. Warranty Period for Heat Exchangers: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 QUALIFICAITONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum five years documented experience, who issues complete catalog data on total product.

B. Startup must be done by trained personnel experienced with rooftop equipment.

C. Do not operate units for any purpose, temporary or permanent, until ductwork is clean, filters and remote controls are in place, bearings lubricated, and manufacturers' installation instructions have been followed.

2.2 GENERAL DESCRIPTION

A. Furnish as shown on plans, Daikin Applied Rebel Single-Zone, Heating/Cooling Unit(s) model DPS or equivalent. Unit performance and electrical characteristics shall be per sheet notes.

B. Configuration:
   1. Return plenum / economizer section.
   2. Filter section.
   3. Cooling coil section.
   4. Supply fan section.
   5. Gas heating section.
   6. Condensing unit section.

C. The complete unit shall be cETLus listed.

D. The unit shall be ASHRAE 90.1-2013 compliant and labeled.

E. Each unit shall be specifically designed for outdoor rooftop application and include a weatherproof cabinet. Each unit shall be completely factory assembled and shipped in one piece. Packaged units shall be shipped fully charged with R-410 Refrigerant and oil.

F. The unit shall undergo a complete factory run test prior to shipment. The factory test shall include a refrigeration circuit run test, a unit control system operations checkout, a unit refrigerant leak test and a final unit inspection.

G. All units shall have decals and tags to indicate caution areas and aid unit service. Unit nameplates shall be fixed to the main control panel door. Electrical wiring diagrams shall be attached to the control panels. Installation, operating and maintenance bulletins and start-up forms shall be supplied with each unit.

H. Performance: All scheduled EER, IEER, capacities and face areas are minimum accepted values. All scheduled amps, kW, and HP are maximum accepted values that allow scheduled capacity to be met

I. Warranty: The manufacturer shall provide 12-month parts only warranty. Defective parts shall be repaired or replaced during the warranty period at no charge. The warranty period shall commence at startup or six months after shipment, whichever occurs first.

2.3 CABINET, CASING, AND FRAME

A. Panel construction shall be double-wall construction for all panels. All floor panels shall have a solid galvanized steel inner liner on the air stream side of the unit to protect insulation during service and maintenance. Insulation shall be a minimum of 1" thick with an R-value of 7.0, and shall be 2 part injected foam. Panel design shall include no exposed insulation edges. Unit cabinet shall be designed to operate at total static pressures up to 5.0 inches w.g.

B. Exterior surfaces shall be constructed of pre-painted galvanized steel for aesthetics and long term durability. Paint finish to include a base primer with a high quality, polyester resin topcoat of a neutral beige color. Finished panel surfaces to withstand a minimum 750-hour salt spray test in accordance with ASTM B117 standard for salt spray resistance.

C. Service doors shall be provided on the fan section, filter section, control panel section, and heating vestibule in order to provide user access to unit components. All service access doors shall be mounted on multiple, stainless steel hinges and shall be secured by a latch system. Removable service panels secured by multiple mechanical fasteners are not acceptable.

D. The unit base shall overhang the roof curb for positive water runoff and shall seat on the roof curb gasket to provide a positive, weathertight seal. Lifting brackets shall be provided on the unit base to accept cable or chain hooks for rigging the equipment.

2.4 OUTDOOR AIR SECTION

A. Unit shall be provided with an outdoor air economizer section. The economizer section shall include outdoor, return, and exhaust air dampers. The economizer operation shall be fully integral to the mechanical cooling and allow up to 100% of mechanical cooling if needed to maintain the cooling discharge air temperature. The outdoor air hood shall be factory installed and constructed from galvanized steel finished with the same durable paint finish as the main unit. The hood shall include moisture eliminator filters to drain water away from the entering air stream. The outside and return air dampers shall be sized to handle 100% of the supply air volume. The dampers shall be parallel blade design. Damper blades shall be gasketed with side seals to provide an air leakage rate of 1.5 cfm / square foot of damper area at 1" differential pressure in according with testing defined in AMCA 500. A barometric exhaust damper shall be provided to exhaust air out of the back of the unit. A bird screen shall be provided to prevent infiltration of rain and foreign materials. Exhaust damper blades shall be lined with vinyl gasketing on contact edges. Control of the dampers shall be by a factory installed direct coupled actuator. Damper actuator shall be of the modulating, spring return type. A comparative enthalpy control shall be provided to sense and compare enthalpy in both the outdoor and return air streams to determine if outdoor air is suitable for "free" cooling. If outdoor air is suitable for "free" cooling, the outdoor air dampers shall modulate in response to the unit's temperature control system.

2.5 FILTERS

A. The indoor coil section shall be installed in a draw through configuration, upstream of the supply air fan. The coil section shall be complete with a factory piped cooling coil and an ASHRAE 62.1 compliant double sloped drain pan.

B. The direct expansion (DX) cooling coils shall be fabricated of seamless high efficiency copper tubing that is mechanically expanded into high efficiency aluminum plate fins. Coils shall be a multi-row, staggered tube design with a minimum of 3 rows. All cooling coils shall have an interlaced coil circuiting that keeps the full coil face active at all load conditions. All coils shall be factory leak tested with high pressure air under water.

C. The cooling coil shall have an electronic controlled expansion valve. The unit controller shall control the expansion valve to maintain liquid subcooling and the superheat of the refrigerant system.

D. The refrigerant suction lines shall be fully insulated from the expansion valve to the compressors.

E. The drain pan shall be stainless steel and positively sloped. The slope of the drain pan shall be in two directions and comply with ASHRAE Standard 62.1. The drain pan shall have a minimum slope of 1/8" per foot to provide positive draining. The drain pan shall extend beyond the leaving side of the coil. The drain pan shall have a threaded drain connection extending through the unit base.

2.6 COOLING COIL

A. The indoor coil section shall be installed in a draw through configuration, upstream of the supply air fan. The coil section shall be complete with a factory piped cooling coil and an ASHRAE 62.1 compliant double sloped drain pan.

B. The direct expansion (DX) cooling coils shall be fabricated of seamless high efficiency copper tubing that is mechanically expanded into high efficiency aluminum plate fins. Coils shall be a multi-row, staggered tube design with a minimum of 3 rows. All cooling coils shall have an interlaced coil circuiting that keeps the full coil face active at all load conditions. All coils shall be factory leak tested with high pressure air under water.

C. The cooling coil shall have an electronic controlled expansion valve. The unit controller shall control the expansion valve to maintain liquid subcooling and the superheat of the refrigerant system.

D. The refrigerant suction lines shall be fully insulated from the expansion valve to the compressors.

E. The drain pan shall be stainless steel and positively sloped. The slope of the drain pan shall be in two directions and comply with ASHRAE Standard 62.1. The drain pan shall have a minimum slope of 1/8" per foot to provide positive draining. The drain pan shall extend beyond the leaving side of the coil. The drain pan shall have a threaded drain connection extending through the unit base.

2.7 HOT GAS REHEAT

A. Unit shall be equipped with a fully modulating hot gas reheat coil with hot gas coming from the unit condenser.

B. Hot gas reheat coil shall be a Micro Channel design. The aluminum tube shall be a micro channel design with high efficiency aluminum fins. Fins shall be brazed to the tubing for a direct bond. The capacity of the reheat coil shall allow for a 20°F temperature rise at all operating conditions.

C. The modulating hot gas reheat systems shall allow for independent control of the cooling coil leaving air temperature and the reheat coil leaving air temperature. The cooling coil and reheat coil leaving air temperature setpoints shall be adjustable through the unit controller. During the dehumidification cycle the unit shall be capable of 100% of the cooling capacity. The hot gas reheat coil shall provide discharge temperature control within +/- 2°F.

D. Each coil shall be factory leak tested with high-pressure air under water.

2.8 SUPPLY FAN

A. Supply fan shall be a single width, single inlet (SWSI) airfoil centrifugal fan. The fan wheel shall be Class II construction with fan blades that are continuously welded to the hub plate and end rim. The supply fan shall be a direct drive fan mounted to the motor shaft. Belts and sheaves are not acceptable due to the additonal maintenance.

B. All fan assemblies shall be statically and dynamically balanced at the factory, including a final trim balance, prior to shipment.

C. Supply fan and motor assembly combinations larger than 8 hp or 22” diameter shall be internally isolated on 1” deflection, spring isolators and include removable shipping tie downs.

D. The fan motor shall be a totally enclosed EC motor that is speed controlled by the rooftop unit controller. The motor shall include thermal overload protection and protect the motor in the case of excessive motor temperatures. The motor shall have phase failure protection and prevent the motor from operation in the event of a loss of phase. Motors shall be premium efficiency.

E. The supply fan shall be capable of airflow modulation from 30% to 100% of the scheduled designed airflow. The fan shall not operate in a state of surge at any point within the modulation range.

2.9 HEATING SECTION

A. The rooftop unit shall include a natural gas heating section. The gas furnace design shall be one natural gas fired heating module factory installed downstream of the supply air fan in the heat section. The heating module shall be a tubular design with in-shot gas burners.

B. Each module shall have two stages of heating control. The module shall be complete with furnace controller and control valve capable of 5:1 modulating operation.

C. The heat exchanger tubes shall be constructed of stainless steel.

D. The module shall have an induced draft fan that will maintain a negative pressure in the heat exchanger tubes for the removal of the flue gases.

E. Each burner module shall have two flame roll-out safety protection switches and a high temperature limit switch that will shut the gas valve off upon detection of improper burner manifold operation. The induced draft fan shall have an airflow safety switch that will prevent the heating module from turning on in the event of no airflow in the flue chamber.

F. The factory-installed DDC unit control system shall control the gas heat module. Field installed heating modules shall require a field ETL certification. The manufacturer's rooftop unit ETL certification shall cover the complete unit including the gas heating modules.

2.10 CONDENSING SECTION

A. Outdoor coils shall be cast aluminum, micro-channel coils. Plate fins shall be protected and brazed between adjoining flat tubes such that they shall not extend outside the tubes. A sub-cooling coil shall be an integral part of the main outdoor air coil. Each outdoor air coil shall be factory leak tested with high-pressure air under water.

B. Fan motors shall be an ECM type motor for proportional control. The unit controller shall proportionally control the speed of the condenser fan motors to maintain the head pressure of the refrigerant circuit from ambient condition of 0~120°F. Mechanical cooling shall be provided to 25º F. The motor shall include thermal overload protection and protect the motor in the case of excessive motor temperatures. The motor shall have phase failure protection and prevent the motor from operation in the event of a loss of phase

C. The condenser fan shall be low noise blade design. Fan blade design shall be a dynamic profile for low tip speed. Fan blade shall be of a composite material.

D. The unit shall have scroll compressors. One of the compressors shall be an inverter compressor providing proportional control. The unit controller shall control the speed of the compressor to maintain the discharge air temperature. The inverter compressor shall have a separate oil pump and an oil separator for each compressor that routes oil back to the compressor instead of through the discharge line

E. Pressure transducers shall be provided for the suction pressure and head pressure. Temperature sensor shall be provided for the suction temperature and the refrigerant discharge temperature of the compressors. All of the above devices shall be an input to the unit controller and the values be displayed at the unit controller.

F. Refrigerant circuit shall have a bypass valve between the suction and discharge refrigerant lines for low head pressure compressor starting and increased compressor reliability. When there is a call for mechanical cooling the bypass valve shall open to equalizing the suction and discharge pressures. When pressures are equalized the bypass valve shall close and the compressor shall be allowed to start.

G. Each circuit shall be dehydrated and factory charged with R-410A Refrigerant and oil.

2.11 ELECTRICAL

A. Unit wiring shall comply with NEC requirements and with all applicable UL standards. All electrical components shall be UL recognized where applicable. All wiring and electrical components provided with the unit shall be number and color-coded and labeled according to the electrical diagram provided for easy identification. The unit shall be provided with a factory wired weatherproof control panel. Unit shall have a single point power terminal block for main power connection. A terminal board shall be provided for low voltage control wiring. Branch short circuit protection, 115-volt control circuit transformer and fuse, system switches, and a high temperature sensor shall also be provided with the unit. Each compressor and condenser fan motor shall be furnished with contactors and inherent thermal overload protection. Supply fan motors shall have contactors and external overload protection. Knockouts shall be provided in the bottom of the main control panels for field wiring entrance.

2.12 CONTROLS

A. Provide a complete integrated microprocessor based Direct Digital Control (DDC) system to control all unit functions including temperature control, scheduling, monitoring, unit safety protection, including compressor minimum run and minimum off times, and diagnostics. This system shall consist of all required temperature sensors, pressure sensors, controller and keypad/display operator interface. All MCBs and sensors shall be factory mounted, wired and tested.

B. The stand-alone DDC controllers shall not be dependent on communications with any on-site or remote PC or master control panel for proper unit operation. The microprocessor shall maintain existing set points and operate stand alone if the unit loses either direct connect or network communications. The microprocessor memory shall be protected from voltage fluctuations as well as any extended power failures. All factory and user set schedules and control points shall be maintained in nonvolatile memory. No settings shall be lost, even during extended power shutdowns.

C. The DDC control system shall permit starting and stopping of the unit locally or remotely. The control system shall be capable of providing a remote alarm indication. The unit control system shall provide for outside air damper actuation, emergency shutdown, remote heat enable/disable, remote cool enable/disable, heat indication, cool indication, and fan operation.

D. All digital inputs and outputs shall be protected against damage from transients or incorrect voltages. All field wiring shall be terminated at a separate, clearly marked terminal strip

E. The DDC controller shall have a built-in time schedule. The schedule shall be programmable from the unit keypad interface. The schedule shall be maintained in nonvolatile memory to insure that it is not lost during a power failure. There shall be one start/stop per day and a separate holiday schedule. The controller shall accept up to sixteen holidays each with up to a 5-day duration. Each unit shall also have the ability to accept a time schedule via BAS network communications.

F. The keypad interface shall allow convenient navigation and access to all control functions. The unit keypad/display character format shall be 4 lines x 20 characters. All control settings shall be password protected against unauthorized changes. For ease of service, the display format shall be English language readout. Coded formats with look-up tables will not be accepted. The user interaction with the display shall provide the following information as a minimum:
   1. Return air temperature.
   2. Discharge air temperature.
   3. Outdoor air temperature.
   4. Space air temperature.
   5. Outdoor enthalpy, high/low.
   6. Compressor suction temperature and pressure
   7. Compressor head pressure and temperature
   8. Expansion valve position
   9. Condenser fan speed
   10. Inverter compressor speed
   11. Dirty filter indication.
   12. Airflow verification.
   13. Cooling status.
   14. Control temperature (Changeover).
   15. VAV box output status.
   16. Cooling status/capacity.
   17. Unit status.
   18. All time schedules.
   19. Active alarms with time and date.
   20. Previous alarms with time and date.
   21. Optimal start

22. Supply fan and exhaust fan speed.
23. System operating hours.
    a. Fan
    b. Exhaust fan
    c. Cooling
    d. Individual compressor
    e. Heating
    f. Economizer
    g. Tenant override

G. The user interaction with the keypad shall provide the following:
1. Controls mode
    a. Off manual
    b. Auto
    c. Heat/Cool
    d. Cool only
    e. Heat only
    f. Fan only

2. Occupancy mode
    a. Auto
    b. Occupied
    c. Unoccupied
    d. Tenant override
3. Unit operation changeover control
    a. Return air temperature
    b. Space temperature
    c. Network signal
4. Cooling and heating change-over temperature with deadband
5. Cooling discharge air temperature (DAT)
6. Supply reset options
    a. Return air temperature
    b. Outdoor air temperature
    c. Space temperature
    d. Airflow (VAV)
    e. Network signal
    f. External (0-10 vdc)
    g. External (0-20 mA)
7. Temperature alarm limits
    a. High supply air temperature
    b. Low supply air temperature
    c. High return air temperature
8. Lockout control for compressors.
9. Compressor interstage timers
10. Night setback and setup space temperature.
11. Building static pressure.
12. Economizer changeover
    a. Enthalpy
    b. Drybulb temperature
13. Currently time and date
14. Tenant override time
15. Occupied/unoccupied time schedule
16. One event schedule
17. Holiday dates and duration
18. Adjustable set points
19. Service mode
    a. Timers normal (all time delays normal)
    b. Timers fast (all time delays 20 sec)

H. If the unit is to be programmed with a night setback or setup function, an optional space sensor shall be provided. Space sensors shall be available to support field selectable features. Sensor options shall include:
    1. Zone sensor with tenant override switch
    2. Zone sensor with tenant override switch plus heating and cooling set point adjustment. (Space Comfort Control systems only)

I. To increase the efficiency of the cooling system the DDC controller shall include a discharge air temperature reset program for part load operating conditions. The discharge air temperature shall be controlled between a minimum and a maximum discharge air temperature (DAT) based on one of the following inputs
    1. Airflow
    2. Outside air temperature
    3. Space temperature
    4. Return air temperature
    5. External signal of 1-5 vdc

6. External signal of 0-20 mA
7. Network signal

2.13 ROOF CURB

A. A prefabricated heavy gauge galvanized steel, mounting curb shall be provided for field assembly on the roof decking prior to unit shipment. The roof curb shall be a full perimeter type with complete perimeter support of the air handling section and condensing section. The curb shall be a minimum of 14" high and include a nominal 2" x 4" wood nailing strip. Gasket shall be provided for field mounting between the unit base and roof curb.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for piping, ducts, and electrical systems to verify actual locations of connections before equipment installation.

C. Examine roof curbs and equipment supports for suitable conditions where units will be installed.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with manufacturer's rigging and installation instructions for unloading units and moving to final locations.

B. Curb Support: Install roof curb on roof structure according to "The NRCA Roofing Manual."
1. Install and secure units on curbs and coordinate roof penetrations and flashing with roof construction.
2. Coordinate size, location, and installation of unit manufacturer's roof curbs and equipment supports with roof Installer.

C. Install wall- and duct-mounted sensors furnished by manufacturer for field installation. Install control wiring and make final connections to control devices and unit control panel.

D. Comply with requirements for gas-fired furnace installation in NFPA 54, "National Fuel Gas Code."

E. Install separate devices furnished by manufacturer and not factory installed.

F. Install new filters at completion of equipment installation and before testing, adjusting, and balancing.

3.3 CONNECTIONS

A. Where installing piping adjacent to units, allow space for service and maintenance.

B. Gas Piping Connections:
1. Connect gas piping to furnace, full size of gas train inlet, and connect with union, pressure regulator, and shutoff valve with sufficient clearance for burner removal and service.
2. Install AGA-approved flexible connectors.

C. Duct Connections:
1. Connect ducts to units with flexible duct connectors.

D. Electrical Connections: Comply with requirements for power wiring, switches, and motor controls in electrical Sections.
   1. Install electrical devices furnished by unit manufacturer but not factory mounted.

3.4 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.
   1. Complete installation and startup checks according to manufacturer's written instructions.
   2. Inspect units for visible damage to furnace combustion chamber.
   3. Perform the following operations for both minimum and maximum firing and adjust burner for peak efficiency:
      a. Measure gas pressure at manifold.
      b. Measure combustion-air temperature at inlet to combustion chamber.
      c. Measure flue-gas temperature at furnace discharge.
      d. Perform flue-gas analysis. Measure and record flue-gas carbon dioxide and oxygen concentration.
      e. Measure supply-air temperature and volume when burner is at maximum firing rate and when burner is off. Calculate useful heat to supply air.
   4. Verify operation of remote panel including pilot-light operation and failure modes. Inspect the following:
      a. High-limit heat exchanger.
      b. Alarms.
   5. Inspect units for visible damage to refrigerant compressor, condenser and evaporator coils, and fans.
   6. Start refrigeration system when outdoor-air temperature is within normal operating limits and measure and record the following:
      a. Cooling coil leaving-air, dry- and wet-bulb temperatures.
      b. Cooling coil entering-air, dry- and wet-bulb temperatures.
      c. Condenser coil entering-air dry-bulb temperature.
      d. Condenser coil leaving-air dry-bulb temperature.
   7. Simulate maximum cooling demand and inspect the following:
      a. Compressor refrigerant suction and hot-gas pressures.
      b. Short-circuiting of air through outside coil or from outside coil to outdoor-air intake.
   8. Inspect casing insulation for integrity, moisture content, and adhesion.
   9. Verify that clearances have been provided for servicing.
   10. Verify that controls are connected and operable.
   11. Verify that filters are installed.
   12. Clean coils and inspect for construction debris.
   13. Clean furnace flue and inspect for construction debris.
   14. Inspect operation of power vents.
   15. Purge gas line.
   16. Inspect and adjust vibration isolators and seismic restraints.
   17. Verify bearing lubrication.
   18. Clean fans and inspect fan-wheel rotation for movement in correct direction without vibration and binding.
   19. Adjust fan belts to proper alignment and tension.
   20. Start unit.
   21. Inspect and record performance of interlocks and protective devices including response to smoke detectors by fan controls and fire alarm.
   22. Operate unit for run-in period.
   23. Calibrate controls.
   24. Adjust and inspect high-temperature limits.
   25. Inspect outdoor-air dampers for proper stroke.
   26. Verify operational sequence of controls.
   27. Measure and record the following airflows. Plot fan volumes on fan curve.
      a. Supply-air volume.
      b. Exhaust-air flow.

B. After startup, change filters, verify bearing lubrication, and adjust belt tension.

C. Remove and replace components that do not properly operate and repeat startup procedures as specified above.

D. Prepare written report of the results of startup services.

3.5 ADJUSTING

A. Adjust initial temperature and humidity set points.

B. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

3.6 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain units.

END OF SECTION 237433

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SECTION 238126 – DUCTLESS SPLIT-SYSTEM AIR-CONDITIONERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes split-system air-conditioning units consisting of separate evaporator-fan and compressor-condenser components.

1.2 RELATED DOCUMENTS

A. The requirements of Section 230500 – General Mechanical Requirements apply to this Section.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. Include performance data in terms of capacities, outlet velocities, static pressures, sound power characteristics, motor requirements, and electrical characteristics.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Wiring Diagrams: For power, signal, and control wiring.

C. Samples for Initial Selection: For units with factory-applied color finishes.

1.4 INFORMATIONAL SUBMITTALS

A. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For split-system air-conditioning units to include in emergency, operation, and maintenance manuals.

1.6 QUALITY ASSURANCE

A. 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.

B. ASHRAE Compliance:

1. Fabricate and label refrigeration system to comply with ASHRAE 15, "Safety Standard for Refrigeration Systems."
2. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 4 - "Outdoor Air Quality," Section 5 - "Systems and Equipment," Section 6 - " Procedures," and Section 7 - "Construction and System Start-up."

C. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1.

PART 2 - PRODUCTS

2.1 WALL MOUNTED DUCTLESS SPLIT SYSTEM AIR CONDITIONER

A. Manufacturers: Mitsubishi, Daikin, EFI or approved manufacturer.

B. Equipment shall consist of refrigerant piping, indoor fan/evaporator unit, and an outdoor condenser/compressor unit. Equipment shall be complete in every aspect and shall consist of matched equipment furnished as a complete package by a single manufacturer.

C. Air-Cooled, Compressor-Condenser Components:

1. Casing: White plastic with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Provide brass service valves, fittings, and gage ports on exterior of casing.
2. Compressor: DC inverter-driven twin rotary type mounted on vibration isolation device. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.

    a. Refrigerant Charge: R-410A.
    b. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and liquid subcooler. Comply with ARI 206/110.

3. Fan: Aluminum-propeller type, directly connected to motor.
4. Motor: Permanently lubricated, with integral thermal-overload protection.
5. Low Ambient Kit: Permits operation down to 0 deg F.
6. Mounting Base: Polyethylene.

D. Ceiling or Wall-Mounted, Evaporator-Fan Components:

1. Cabinet: White plastic with removable panels on front and ends in color selected by Architect, and discharge drain pans with drain connection.
2. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and thermal-expansion valve. Comply with ARI 206/110.
3. Fan: Direct drive, centrifugal.
4. Fan Motors:

    a. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements.
    b. Multitapped, multispeed with internal thermal protection and permanent lubrication.
    c. Enclosure Type: Totally enclosed, fan cooled.
    d. NEMA Premium (TM) efficient motors as defined in NEMA MG 1.
    e. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in electrical Sections.

5. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
6. Condensate Drain Pans:

    a. Fabricated with one percent slope in at least two planes to collect condensate from cooling coils (including coil piping connections, coil headers, and return bends) and to direct water toward drain connection.
    b. Drain Connection: Located at lowest point of pan and sized to prevent overflow. Terminate with nipple on one end of pan.
    c. Units will be provided with integral condensate pumps.

7. Washable and reusable air filter.

2.2 ACCESSORIES

A. Control shall be by the manufacturer's wall-mounted, direct wired unit to allow visual interface with the indoor unit for temperature control and mode of operation.

1. Compressor time delay.
2. 24-hour time control of system stop and start.
3. Liquid-crystal display indicating temperature, set-point temperature, time setting, operating mode, and fan speed.
4. Fan-speed selection including auto setting.

B. Automatic-reset timer to prevent rapid cycling of compressor.

C. Refrigerant Line Kits: Soft-annealed copper suction and liquid lines factory cleaned, dried, pressurized, and sealed; factory-insulated suction line with flared fittings at both ends.

D. Condensate pump for the evaporator unit.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install units level and plumb.

B. Install evaporator-fan components using manufacturer's standard mounting devices securely fastened to building structure.

C. Install roof-mounted, compressor-condenser components on equipment supports.

D. Install and connect pre-charged refrigerant tubing to component's quick-connect fittings. Install tubing to allow access to unit.

3.2 CONNECTIONS

A. Where piping is installed adjacent to unit, allow space for service and maintenance of unit.

3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

B. Tests and Inspections:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Remove and replace malfunctioning units and retest as specified above.

D. Prepare test and inspection reports.

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3.4 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.
2. Insert startup steps if any.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain units.

END OF SECTION 238126