QUIL CEDA VILLAGE CARWASH

TULALIP, WASHINGTON

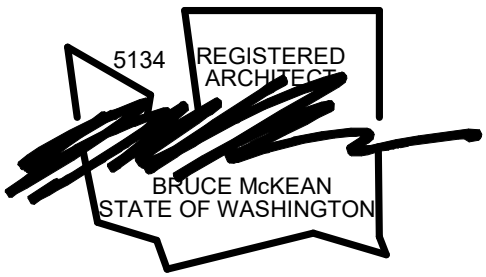
FOR:
QUIL CEDA VILLAGE

VOLUME 2 OF 2
DIVISION 02 THOUGH 32

12 August, 2022

HELIX PROJECT NUMBER
A20-112

BID SET



PROJECT MANUAL

HELIX DESIGN GROUP, INC. | 6021 12TH ST E SUITE 201, TACOMA, WA 98424 | P.253.922.9037 | F.253.922.6499 | **HELIXDESIGNGROUP.NET**

SECTION 02 26 14
SUBSURFACE INVESTIGATION REPORT

PART 1 - GENERAL

1.01 SUBSURFACE INVESTIGATION REPORT

A. A copy of a geotechnical report is included with this document, titled: Geotechnical Investigation Tulalip Gas Station, Tulalip, Washington, April 22, 2009, prepared by Materials Testing & Consulting, Inc.

B. This report identifies properties of below grade conditions and offers recommendations for the design of foundations, prepared primarily for the use of the Architect/Engineer.

C. The recommendations described shall be construed as a requirement of this contract.

D. This report, by its nature, cannot reveal all conditions that exist on the site. Should subsurface conditions be found to vary substantially from this report, changes in the design and construction of foundations will be made, with resulting credits or expenditures to the Contract Price/Sum accruing to the Owner.

1.02 ORIGINAL DOCUMENTS

A. The original set of construction documents is available upon request. Contact project manager.

END OF SECTION

PAGE LEFT BLANK INTENTIONALLY

Materials Testing & Consulting, Inc.

Geotechnical Engineering • Materials Testing • Special Inspection • Environmental Consulting

April 22, 2009

Ms. Debbie Bray
Tulalip Tribes
8802 27th Ave. N.E.
Tulalip, WA 98271

Ref:
Geotechnical Investigation
Tulalip Gas Station
116th Ave. N.E. and Quil Ceda Road
Tulalip, WA

Project No.: 09B036

Dear Ms. Bray:

In accordance with your request, Materials Testing & Consulting, Inc. (MTC) has conducted a soils investigation and geotechnical engineering analysis for the referenced project. The results of this investigation, together with our recommendations, are contained in the following report.

To investigate the site, we excavated 10 test pits, obtained soil samples for laboratory testing, advance two dynamic cone penetrometers and performed geotechnical engineering analysis. In addition, we hand excavated five shallow test pits to augment the topsoil thickness measurements. The results of the field work indicate that the soils are granular in nature and are suitable for the planned development utilizing conventional spread footing foundations. The soils include some loose fill and buried topsoil as described in further detail in the report which may require some reworking, especially in the proposed building areas. The water table was encountered at depths ranging from 5.9 to 8.0 feet deep. The soils are suitable for on-site storm water infiltration.

Questions related to soil conditions often arise during design and construction of a project. We would be pleased to continue our role as geotechnical consultants during the project planning and construction. We also have a keen interest in providing materials testing and special inspection during construction of this project. We will be pleased to meet with you at your convenience to discuss these services.

We appreciate this opportunity to be of service to you and look forward to working with you in the future.

If you have any questions concerning the above items, the procedures used, or if MTC can be of any further assistance please do not hesitate to call.

Respectfully Submitted,
MATERIALS TESTING & CONSULTING, INC.

Corporate ~ 777 Chrysler Drive • Burlington, WA 98233 • Phone (360) 755-1990 • Fax (360) 755-1980
NW Region ~ 2126 East Bakerview Rd., Suite #101 • Bellingham, WA 98226 • Phone (360) 647-6061 • Fax (360) 647-8111
SW Region ~ 2118 Black Lake Blvd. SW • Olympia, WA 98512 • Phone (360) 534-9777 • Fax (360) 534-9779

Visit our website: www.mtc-inc.net

Table of Contents

1.0 Introduction 1
1.1 Purpose 1
1.2 Scope 1
2.0 Project Description 2
3.0 Site Description 2
3.1 General Description 2
3.2 Area Geology 2
4.0 Field Exploration 2
4.1 Excavation & Sampling Procedures 2
4.2 Laboratory Testing 3
5.0 Subsurface Conditions 3
6.0 Conclusions 4
6.1 General Suitability for Planned Development 4
6.2 Infiltration 4
6.3 Liquefaction Potential 4
6.4 Site Classification 5
6.5 Groundwater Control 5
7.0 Discussion and Recommendations 5
7.1 Grading 5
7.2 Fill Quality, Placement and Compaction 6
7.3 Excavations 7
7.4 Wet Weather Construction 7
7.5 Bearing Capacity and Foundation Design 7
7.6 Floor Slab-On-Grade 8
7.7 Pavement 9
8.0 Additional Services and Limitations 10
Appendix A. Site Plans *11*
Appendix B. Logs of Test Pits and DCPs *13*
Appendix C. Laboratory Results *27*
Appendix D. Footing Details *29*
Appendix E. Limitations and Use of This Report *30*

1.0 Introduction

This report presents the results of a soils investigation and foundation analysis for the proposed Tulalip Gas Station complex to be constructed southwest of the corner 116th Ave. N.E. and Quil Ceda Blvd. in Tulalip, WA. This investigation was conducted for the Tulalip Tribes, who provided written authorization to proceed on April 14, 2009.

1.1 Purpose

The purpose of this investigation was to determine the various soil profile components, the engineering characteristics of the soils, verify the suitability of soils for the planned construction, and provide criteria for use by the design engineers and architects for infiltration and foundation design.

1.2 Scope

As detailed in our proposal for geotechnical services dated March 25, 2009, the scope of services included:

Subsurface Exploration

- Excavate 10 test pits
- Conduct 4 dynamic cone penetrometer tests

Laboratory Testing

- Gradation
- Moisture content

Geotechnical Report

- Subsurface soil conditions
- Ground water
- Bearing capacity
- Lateral pressures
- Grading recommendations
- Settlement

We were not requested to provide an environmental site assessment for this property. Any comments concerning on-site conditions and/or observations, including soil appearances and odors, are provided as general information. Information in this report is not intended to describe, quantify or evaluate any environmental concern or situation.

2.0 Project Description

The project consists of constructing a gas station with kiosk that will be expanded in the future to include a convenience store and other amenities. The location of improvements on the subject property has not been determined at this time. The site development will include on-site storm water disposal in an infiltration system. Exterior paved parking and driveway areas are anticipated to serve the site. Vehicle loads will include cars and highway long haul trucks.

3.0 Site Description

3.1 General Description

The project site is located on a property approximately 4.5 acres in area. The property will probably be accessed from 116th Ave. N.E. to the north and Quil Ceda Blvd. to the east. The project site is located at the southwest corner of these two streets in Tulalip, Washington (see Site Plans, Appendix A). The site is nearly level and is partially densely covered with brush to 10 feet tall.

3.2 Area Geology

According to the USDA Soil Conservation Service Survey, the geology of the site consists of Ragner Fine Sandy Loam, a somewhat well drained soil on outwash plains formed in glacial outwash. These soils generally have low water capacity, moderately high permeability. Runoff is medium and the hazard to water erosion is moderate.

According to the Surficial Geologic Map of the Port Townsend Quadrangle (1989), the geology of the site consists of recessional marine deposits from the Vashon-age glaciation. These deposits include: 1) fossil-bearing stony silt, sand and clay; and 2) medium to well-sorted, massive to laminated sand, silt and clay. Recessional marine deposits range in thickness from 3 to 30 feet. This unit locally overlies or is interbedded with well graded sand and gravel in which deformed bedding associated with ice contact collapse is common.

Field observations indicate the site soils are consistent with area geology sources overlain by fill. This formation, known as Marysville Sand, is known to be over 100 feet thick.

4.0 Field Exploration

On April 17, 2009, our geologist visited the site and conducted a subsurface exploration of the soil and groundwater conditions. The field investigation included the excavation of 10 geotechnical test pits scattered across the site augmented by five additional shallow hand dug test pits to map surface organics.

4.1 Excavation & Sampling Procedures

Test Pits were excavated using a tracked excavator subcontracted to MTC. Grab samples representative of each soil type were obtained from each test pit. The samples were classified in the field in accordance with the Unified Soil Classification System (USCS, see Appendix B), identified according to test pit number and depth, placed in plastic bags to protect against moisture loss and transported to the laboratory for testing. The Logs of Test Pits are shown in Appendix B. Five shallow test pits were hand excavated specifically to map the thickness of the surface organic topsoil and augment information

obtained from the other test pits.

DCP results were obtained with a Wildcat Dynamic Cone Penetrometer at two locations. Blow counts were recorded for 10 centimeter increments as a thirty five pound weight was dropped a distance of 15 inches. The blow counts were then converted to resistance in kilograms per square centimeter (kg/cm^2), standard penetration blow counts (N-values), consistency descriptions, and bearing capacity in pounds per square foot (psf). The DCP Logs are presented in Appendix B following the Logs of Test Pits.

4.2 Laboratory Testing

Upon demobilizing from the field, laboratory testing was conducted on selected samples to determine pertinent engineering characteristics of the soils encountered. The laboratory testing included supplementary visual classification, moisture content (ASTM D2216), and Grain Size Analysis (ASTM C117, C136). The results of these tests are presented in Appendix C.

5.0 Subsurface Conditions

Soil profiles were fairly consistent across the site. Four distinct soil units were observed in the test pits. The identified units are as follows with increasing depth below the surface:

Table 1. Observed soil units with decreasing depth

Topsoil (SP-SM)	Dark brown organic sand with silt that is loose and dry to moist. Between 0.5 to 1.0 feet thick at location of excavations. Will require stripping prior to placing footings or structural fill for buildings or pavements.
Fill: (SP)	Orange brown clean sand, medium dense, moist with no mottling in most test pits. This layer absent in Test Pits 1 and 3 and extended to depths of 1.7 to 2.8 feet in the remaining test pits.
Relic Topsoil (SP-SM)	Encountered in all but Test Pits 1 and 3 consisting of 0.4 to 1.0 feet of organic sand approximately 10% by volume; medium dense, moist. This layer will require stripping in the building areas and possibly in paved areas as well depending on final grqades.

Recessional Marine Deposits (SP)	Extending to the bottom of all test pits at 5.9 to 8.0 feet, consisting of light orange brown clean sand, fine to coarse grained with generally moderate mottling; medium dense, moist, becoming grey , coarser grained in most test pits near the bottom of the pit. The water table was encountered at the base of all test pits where pit wall caving prevented advancing the test pits further.

The recessional marine deposit is considered to be normally consolidated, meaning that the soil has not experienced previous loading(s) greater than the present loading condition.

6.0 Conclusions

6.1 General Suitability for Planned Development

Based on the subsurface conditions encountered and the planned construction, we conclude that the site is suitable for the planned development utilizing conventional shallow spread and continuous wall footing foundations. The surface layer of topsoil should be stripped from the site where buildings and pavements are planned. The recommended depths of stripping are summarized in Table 2. The existing sand fill beneath the surface topsoil layer is loose and may require proof-rolling or re-compacting in parking and building areas, depending on the finish design grade elevations. The relic topsoil at about two to three feet deep may not require removal in parking and driveway areas depending on final design grades, but should be removed from beneath building foundations.

Loads of 2,500 pounds per square foot were assumed for settlement analysis. Settlements should not exceed tolerable limits if the design and construction recommendations presented below are followed. Our recommendations for site preparation, fill placement, and foundation and pavement design are outlined below.

6.2 Infiltration

The site soils are suitably permeable for design of infiltration facilities. The results of a sieve analysis we performed on a sample of the native sand from Test Pit 7 at 4.0 feet indicates an uncorrected long term infiltration rate of 1.8 inches per hour in accordance with Table 3.8 of the Stormwater Management manual for Western Washington (SWMM). Once the location of the infiltration facility has been selected, MTC should obtain additional samples of the soil and conduct laboratory tests for the soil infiltration rate.

6.3 Liquefaction Potential

According to the Liquefaction Susceptibility Map of Snohomish County, Washington, 2004, by the Washington State Department of Natural Resources, Stephen P. Palmer and others, the site has a low to moderate Susceptibility to liquefaction during a major earthquake. Because the site is underlain by medium dense to dense sands below the water table, this appears to be a reasonable classification for this site.

6.4 Site Classification

According to the Site Classification Map of Snohomish County, Washington, 2004, by the Washington State Department of Natural Resources, Stephen P. Palmer and others, the site has a site classification of Site Class D to E. All structures planned for this site should be designed to meet this classification.

6.5 Groundwater Control

Ground water was encountered in all test pits at depths of 5.9 to 8.0 feet. Ground water should not pose problems for construction on this site with the exception of deep excavations such as utilities or underground vaults. Excavations below the water table will require pumping and will probably require the installation of dewatering wells and manifold piping to handle the ground water infiltration.

7.0 Discussion and Recommendations

7.1 Grading

Excessively organic and loose soils generally undergo high volume changes when subjected to loads. This is detrimental to the behavior of pavements, floor slabs, structural fills and foundations placed upon them. Therefore, excessively organic and loose soils should be stripped from these areas and wasted or stockpiled for later use. If loose or yielding soils are encountered underlying the recommended stripping depths, these soils will need to be re-compacted or replaced with structural fill in accordance with recommendations outlined in Fill Quality, Placement and Compaction (Section 7.2). Table 2 below presents our recommended stripping depths. The second stripping depth column is for the relic topsoil layer should it be necessary to strip from this location. Once final design grades and building locations have been established, MTC should be consulted regarding the requirements for stripping of the relic topsoil layer.

Table 2. Recommended Stripping Depths

Test Pit	Reference Location	Stripping Depth (Inches)	Stripping Depth Relic topsoil (Inches)
1	180' W, 130' N of SE Property Corner	12	-
2	80' W, 135' N of SE Property Corner	6	30
3	165' W, 245' N of SE Property Corner	13	-
4	75' W, 250' N of SE Property Corner	8	48
5	190' W, 360' N of SE Property Corner	7	31
6	95' W, 370' N of SE Property Corner	6	39
7	180' W, 470' N of SE Property Corner	7	32
8	90' W, 480' N of SE Property Corner	7	32
9	190' W, 640' N of SE Property Corner	7	42
10	85' W, 640' N of SE Property Corner	8	37
11	120' W, 590' N of SE Property Corner	6	*
12	160' W, 450' N of SE Property Corner	6	*
13	150' W, 330' N of SE Property Corner	8	*
14	60' W, 220' N of SE Property Corner	8	*
15	150' W, 70' N of SE Property Corner	11	*

*These shallow hand dug test pits were not deep enough to identify whether the relic topsoil is present here or not.

Exact depths of stripping should be adjusted in the field to ensure that the entire root or loose zone is removed. The final exposed subgrade should be inspected by MTC to verify that all organic material has been removed. Any soft spots or deflecting areas should be removed to firm unyielding soils and replaced with structural fill.

Once the existing soils are excavated to the design grade, proper control of the subgrade conditions (i.e., moisture content) and the placement and compaction of new fill (if required) should be overseen by MTC. The recommendations for structural fill presented in this report should be followed to minimize differential settlements that are detrimental to the behavior of footings, and floor slabs.

1. Prior to any site work, all organic soils should be stripped from the site and stockpiled for later re-use in landscaped areas or disposed of off site.
2. At the building location, stripping, and over-excavation if required, should extend beyond the building perimeter a distance of at least 3 feet. Stripping in the building areas should include the relic topsoil layer.
3. Prior to placing fills, the exposed subgrade should be proofrolled under the inspection of an MTC representative and if any other soft, pumping or otherwise unsuitable soils are encountered, they should be overexcavated and backfilled with compacted structural fill as outlined below.
4. Excavated native till soils may be reused for structural fill as outlined below.
5. Permanent cut slopes should be graded no steeper that 1-1/2 horizontal to 1 vertical (1.5:1).
6. Permanent cut slopes should be track-walked to help retain topsoil and seed, covered with a layer of topsoil and protected from erosion by planting with grass or ground cover.

7.2 Fill Quality, Placement and Compaction

Imported structural fill should consist of a mixture of clean sand and gravel that is relatively free of fines as outlined in the recommendations section below. If structural fill is used for the support of foundations, fill quality, placement, and compaction should be monitored continuously by MTC so that the work is performed in accordance with the recommendations presented below.

The existing sand fill and native sand may be re-used for structural fill. Because clean sands are difficult to compact, it is essential that they be properly moisture conditioned to minimize the difficulty in meeting the required compaction percentages.

1. Imported structural fill should consist of 4 inch minus select, clean, granular soil with no more than 5% fines (-#200 sieve size).
2. Structural fill should be placed in layers of not more than 12 inches in thickness, at moisture contents within three percent of optimum, and compacted to a minimum density of 95 percent of the maximum dry density as determined by ASTM D1557.
3. For structural fill below footings, the compacted backfill should extend outside the perimeter of the footing for a distance equal to the thickness of the fill beneath the bottom of the footing.
4. Any excessively loose or soft spots or areas that do not meet the compaction requirements that are encountered in the footing subgrade will require over-excavation and backfilling with structural fill.
5. Existing fill and native sand used as structural fill should be near optimum moisture according to the modified Proctor test method (ASTM D1557) and as determined by MTC. Soils not meeting

optimum moisture content should be moisture conditioned by wetting or drying prior to placement. Soil with a moisture content exceeding 3% of optimum should be spread in thin lifts or wind rows, aerated, and turned over until it reaches near-optimum moisture conditions.

6. Existing fill and native sand should be placed in loose lifts not exceeding 8" in thickness and compacted to 95% of maximum dry density according to the modified Proctor (ASTM D1557).
7. Existing fill and native sand should be free of organic debris or other deleterious material and should not contain cobbles or boulders that exceed 5" diameter.
8. To prevent surface runoff from ponding against building foundations, the ground surface adjacent to the building and extending for a distance of at least 10 feet should be graded to slope away from the building at a 5% slope.
9. Fill slopes should be constructed "fat" and then trimmed back to final grade or the slope face should be properly compacted as outlined above.
10. Permanent fill slopes should be graded no steeper than 2:1.
11. Permanent fill slopes should be track-walked to help retain topsoil and seed, covered with a layer of topsoil and protected from erosion by planting with grass or ground cover.

7.3 Excavations

Foundation excavations that do not exceed four feet in depth may be constructed with side slopes approaching vertical. For deeper excavations, the soils cannot be relied on to remain standing. These soils can fail, and collapse into any excavation. This is especially true when working at depths near the water table. Proper care must be taken to protect personnel and equipment working in or near excavations.

The information provided in the following table is for planning purposes. Maintaining safe working conditions is the responsibility of the contractor. Job-site conditions such as soil moisture content, weather condition, earth movements and equipment type and operation can all affect slope stability. All excavations should be sloped or braced as required by applicable local, state and federal requirements. The contractor should not exceed the following maximum cut slope inclinations:

Table 3. Recommended Temporary Cut Slopes

Soil Type	Temporary Maximum Inclination	OSHA Classification
All soils this site	1.5H:1V	C

7.4 Wet Weather Construction

Surface runoff should be directed away from all open excavations. The on-site silty soils can be expected to become soft and pump if subjected to excessive traffic after becoming wet during periods of rain. This can be avoided by constructing temporary or permanent driveway sections. All prepared subgrade surfaces should be protected from the adverse effects of freeze/thaw, rain and construction traffic.

7.5 Bearing Capacity and Foundation Design

Two requirements must be fulfilled in the design of foundations. First, the load must be less than the

ultimate bearing capacity of the foundation soils to maintain stability; and secondly, the differential settlement must not exceed an amount that will produce adverse behavior of the structure. The allowable settlement is usually exceeded before bearing capacity considerations become important; thus, the allowable bearing pressure is normally controlled by settlement considerations.

Bearing capacity analysis is based on the visual classification of soil type, results of DCP probes and laboratory tests. These data indicate that the soils exhibit bearing capacities and settlement characteristics suitable for the planned improvements.

1. For fills installed as recommended above, and for undisturbed native soils, dead plus long term live loads of 2,500 pounds per square foot (psf), respectively, may be used for foundation design. This bearing value is limited to the native sand below the relic topsoil layer. These values may be increased by 1/3 for dead plus short term live loads, such as wind and seismic.
2. Resistance to lateral loads may be calculated by multiplying the buried portion of foundation elements by an equivalent fluid pressure of 300 pounds per cubic foot (pcf). Unless the adjacent ground surface is protected by slabs or pavement, neglect the upper one foot. Additional resistance to lateral loads may be calculated by multiplying the vertical dead load on the base of the footing by a factor of 0.35.
3. Footings should be proportioned to meet the stated bearing capacity and/or the IBC 2006 minimum requirements. Interior or isolated column footing should be a minimum of 24 inches wide. Continuous strip footings should be a minimum of 16 inches wide.
4. Isolated exterior and perimeter footings should be buried a minimum of 18 inches; interior footings should be buried a minimum of 12 inches.
5. In order to minimize the effects of any slight differential movement that may occur due to variations in the characters of the supporting soils and seasonal moisture contents, we recommend that all footings be suitably reinforced to make them as rigid as possible.
6. Total settlement of footings installed as recommended above will be limited to 1 inch with differential settlement limited to ¾ inch.
7. Footing drains should be used to displace seasonal water from the bearing soil level. The drains should consist of 4 inch diameter perforated pipe, surrounded by drain rock, wrapped in a filter geotextile and having a sufficient gradient to displace water away from the structure and directed to an appropriate outfall as shown in the footing drain details, attached. Roof or other storm drains should not outfall into the footing drains.

7.6 Floor Slab-On-Grade

1. Before placing concrete floors or pavements, or before any floor supporting fill is placed, the organic, loose or obviously compressive materials must be removed.
2. The subgrade should be proof-rolled to confirm that the subgrade contains no soft or deflecting areas. Areas of excessive yielding should be excavated and backfilled with structural fill. Any additional fill used to increase the elevation of the floor slab should meet the requirements for structural fill.
3. To provide a capillary moisture break, a five inch thick, properly compacted granular mat should be provided below floor slabs. The mat should consist of crushed rock all passing the 1 inch sieve and all retained on the #4 sieve.

4. Because groundwater can be expected to be at shallower depths during the winter months a vapor barrier such as 10 mil polyethylene film should be placed beneath all floor slabs to prevent transmission of moisture through the slab where floor coverings may be affected. Care should be taken during construction not to puncture or damage the vapor barrier. To protect the membrane, a layer of sand, no more than 2 inches thick may be placed over the membrane.

7.7 Pavement

1. In all areas to receive pavements, the organic, loose or obviously compressive materials must be removed. Because the exposed subgrade soils will be moisture sensitive and rapidly degrade under construction traffic loads when wet, care should be exercised to protect subgrades until pavements have been placed. Once final design grades have been established, MTC should be consulted regarding the need to strip the underlying relic topsoil or add geotextile fabric to the pavement structural section.
2. The pavement and driveway subgrade should be proof-rolled to confirm that the subgrade contains no soft or deflecting areas. Areas of excessive yielding should be excavated and backfilled with structural fill.
3. Alternatively, a woven geotextile reinforcing fabric such as Mirafi X Series or equivalent may be used to stabilize and isolate soft subgrade soils. The fabric should be placed a minimum of 18 inches below finished grade exclusive of the pavement structural section. Follow the manufacturer's recommendations regarding installation of the fabric.
4. If required, structural fill should meet the requirements outlined above and should be compacted to a minimum of 95% relative compaction. Where reinforcing fabric is used over soft subgrades, an initial lift of 18 inches of structural fill should be placed prior to compacting.
5. Parking and driveway pavement structural sections should consist of a minimum of 2-1/2 inches of Class B asphalt pavement over a minimum of 3 inches of crushed surfacing base course (CSBC) per WSDOT 9-03.9(3) founded on 6 inches of gravel borrow per WSDOT 9-03.14(1).
6. In truck driveway and parking areas, provide a minimum of 4 inches of Class B asphalt concrete pavement (ACP) over 4 inches of (CSBC) founded on 8 inches of gravel borrow
7. The above pavement recommendations assume a *minimum* subgrade R-value of 40.

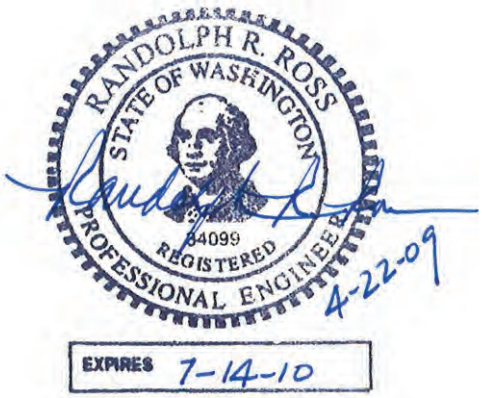
8.0 Additional Services and Limitations

We recommend that MTC be engaged to test and evaluate the soils in the footing excavations before placing concrete to determine that the soils meet the required bearing capacities and that unexpected conditions are not present. Monitoring and testing should be performed to verify that suitable materials are used for structural fills and that they are properly placed and compacted.

The work described in this report is considered sufficient in detail and scope to form a reasonable basis for the foundation design. MTC should be notified of any revision in the plans for the proposed structure from those presented in this report so that we may determine if changes in the foundation recommendations are required. If deviations from the noted subsurface conditions are encountered during construction, they should also be brought to our attention.

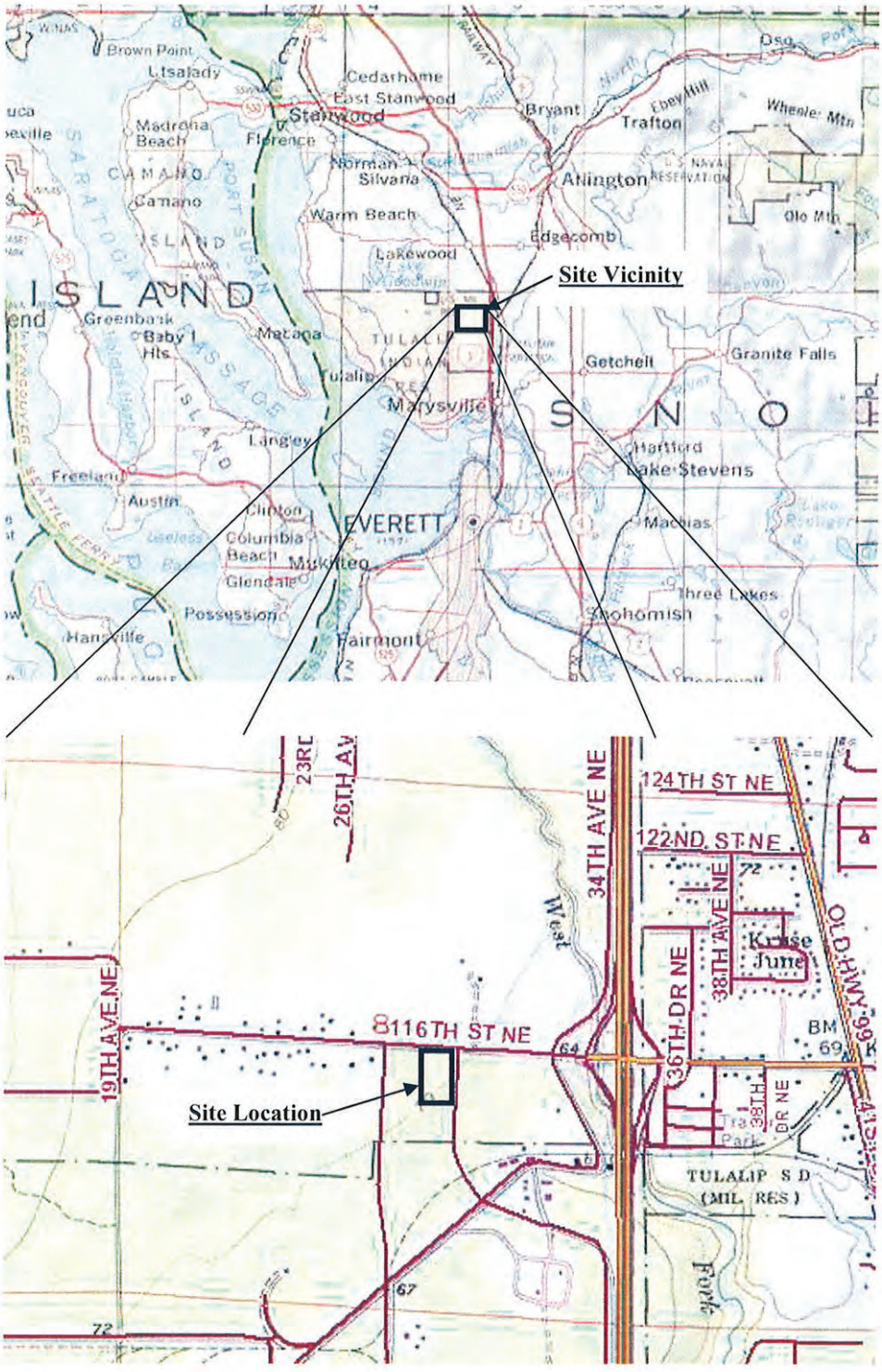
MTC warrants that the findings, recommendations, specifications, or professional advice contained in this report, have been developed after being prepared in accordance with generally accepted professional practice in the fields of soil mechanics and engineering geology. No other warranties are implied or expressed.

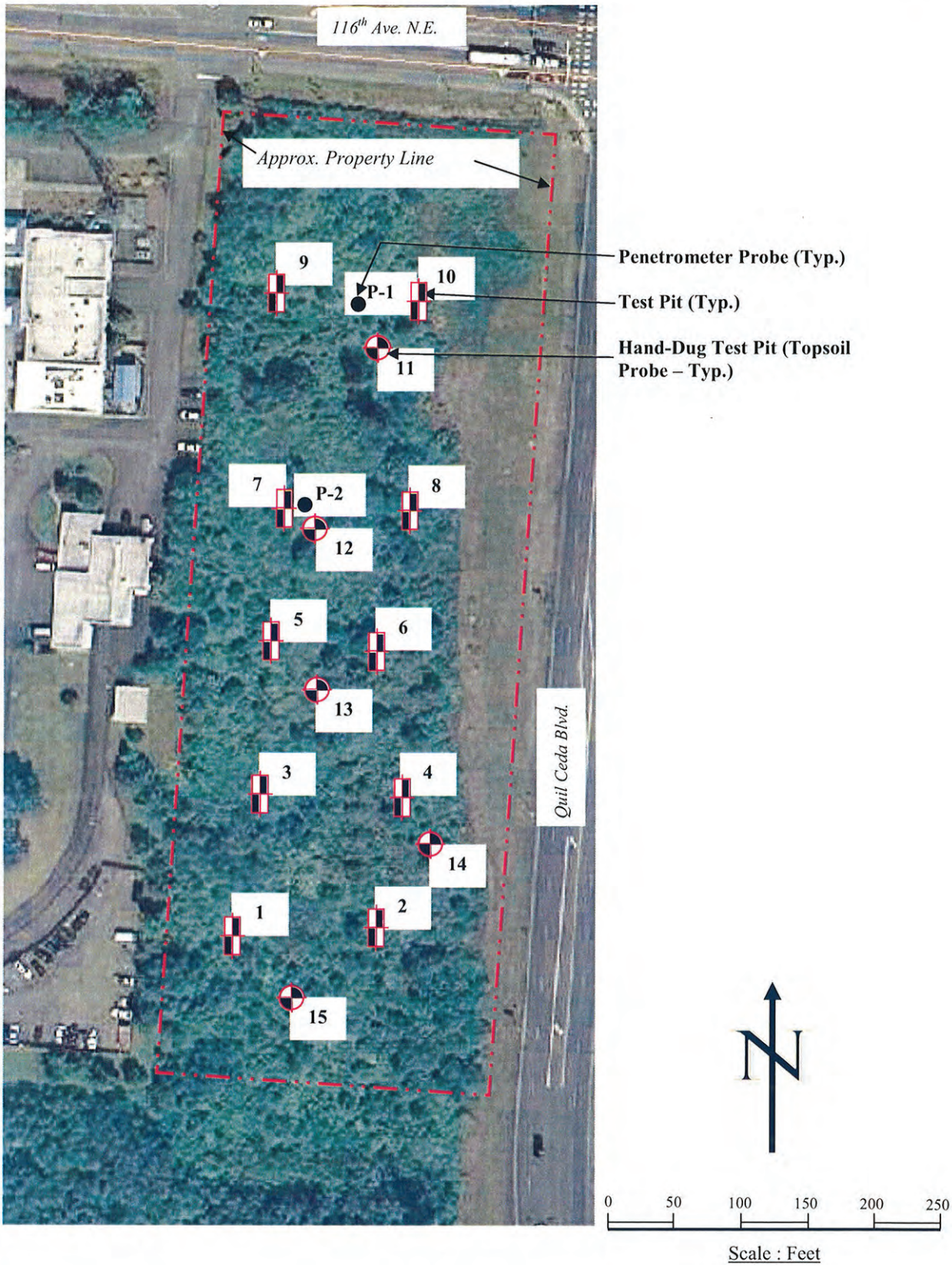
This report has been prepared for the exclusive use of the Tulalip Tribes and their retained design consultants. Findings and recommendations within this report are for specific application to this site and proposed project.



Randolph R. Ross, P.E.
Senior Geotechnical Engineer

Appendix A. Site Plans




116th Ave. N.E.
Approx. Property Line
Penetrometer Probe (Typ.)
Test Pit (Typ.)
Hand-Dug Test Pit (Topsoil Probe – Typ.)
9
P-1
10
11
7
P-2
8
12
5
6
13
3
4
14
1
2
15
Quil Ceda Blvd.
0
50
100
150
200
250
Scale : Feet

Appendix B. Logs of Test Pits and DCPs

Unified Soil Classification System Chart

Major Divisions			Graph	USCS	Typical Description
Coarse Grained Soils More Than 50% Retained On No. 200 Sieve	**Gravel** More Than 50% of Coarse Fraction Retained On No. 4 Sieve	Clean Gravels		GW	Well-graded Gravels, Gravel-Sand Mixtures
				GP	Poorly-Graded Gravels, Gravel-Sand Mixtures
		Gravels With Fines		GM	Silty Gravels, Gravel-Sand-Silt Mixtures
				GC	Clayey Gravels, Gravel-Sand-Clay Mixtures
	Sand More Than 50% of Coarse Fraction Passing No. 4 Sieve	Clean Sands		SW	Well-graded Sands, Gravelly Sands
				SP	Poorly-Graded Sands, Gravelly Sands
		Sands With Fines		SM	Silty Sands, Sand-Silt Mixtures
				SC	Clayey Sands, Clay Mixtures
Fine Grained Soils More Than 50% Passing The No. 200 Sieve	**Silts & Clays**	Liquid Limit Less Than 50		ML	Inorganic Silts, rock Flour, Clayey Silts With Low Plasticity
				CL	Inorganic Clays of Low To Medium Plasticity
				OL	Organic Silts and Organic Silty Clays of Low Plasticity
	Silts & Clays	Liquid Limit Greater Than 50		MH	Inorganic Silts of Moderate Plasticity
				CH	Inorganic Clays of High Plasticity
				OH	Organic Clays And Silts of Medium to High Plasticity
Highly Organic Soils				PT	Peat, Humus, Soils with Predominantly Organic Content

Sampler Symbol Description

- Standard Penetration Test (SPT)
- Shelby Tube
- Grab or Bulk
- California (3.0" O.D.)
- Modified California (2.5" O.D.)

Stratigraphic Contact

- Distinct Stratigraphic Contact Between Soil Strata
- Gradual Change Between Soil Strata
- Approximate location of stratagraphic change

- Groundwater observed at time of exploration
- Measured groundwater level in exploration, well, or piezometer
- Perched water observed at time of exploration

Modifiers

Description	%
Trace	>5
Some	5-12
With	>12

Soil Consistency

Granular Soils		Fine-grained Soils	
Density	***SPT Blowcount***	***Consistency***	***SPT Blowcount***
Very Loose	0-4	Very Soft	0-2
Loose	4-10	Soft	2-4
Medium Dense	10-30	Firm	4-8
Dense	30-50	Stiff	8-15
Very Dense	> 50	Very Stiff	15-30
		Hard	> 30

Grain Size

DESCRIPTION		SIEVE SIZE	GRAIN SIZE	APPROXIMATE SIZE
Boulders		> 12"	> 12"	Larger than a basketball
Cobbles		3 - 12"	3 - 12"	Fist to basketball
Gravel	Coarse	3/4 - 3"	3/4 - 3"	Thumb to fist
	Fine	#4 - 3/4"	0.19 - 0.75"	Pea to thumb
Sand	Coarse	#10 - #4	0.079 - 0.19"	Rock salt to pea
	Medium	#40 - #10	0.017 - 0.079"	Sugar to rock salt
	Fine	#200 - #40	0.0029 - 0.017"	Flour to Sugar
Fines		Passing #200	< 0.0029"	Flour and smaller

Materials Testing & Consulting, Inc.	Log of Test Pit TP-1 (Page 1 of 1)
Tulalip Gas Station Geotechnical Site Investigation Marysville, WA	Date Started : 4-17-09 Date Completed : 4-17-09 Sampling Method : Excavator and grab sampling Location : 180' W, 130' N of SE Property Corner Logged By : Troy Baggerman

Depth in Feet	Surf. Elev.	USCS	GRAPHIC	DESCRIPTION	Samples	Water Level
0		SP-SM		Brown to grey organic SAND with silt, loose, dry to moist, no mottling. TOPSOIL.		
1		SP		Orange brown medium grain clean SAND, medium dense, moist.		
2				Soil becomes mottled.	1	
3					2	
4						
5				Sand becomes medium to coarse grained sand with thin silty sand lenses between 4.7 to 6.0 feet BPG.		
6				Sand becomes clean, loose, and moist. No mottling.		
7					3	▼
8				T.D. 7.2 Rapid caving of test pit sidewalls below water table. Excavation ceased.		
9						
10						

04-21-2009

Materials Testing & Consulting, Inc.

Log of Test Pit TP-2

(Page 1 of 1)

Tulalip Gas Station
Geotechnical Site Investigation
Marysville, WA

Date Started : 4-17-09
Date Completed : 4-17-09
Sampling Method : Excavator and grab sampling
Location : 80' W, 135' N of SE Property Corner
Logged By : Troy Baggerman

Depth in Feet	Surf. Elev.	USCS	GRAPHIC	DESCRIPTION	Samples	Water Level
0		SP-SM		Dark brown organic fine to medium grained SAND with silt, loose, dry to moist, no mottling. TOPSOIL.		
1		SP		Orange brown medium grain clean SAND, medium dense, moist.	1	
2		SP-SM		Dark brown to black organic SAND with silt, medium dense, moist. RELIC TOPSOIL.	2	
3		SP		Orange to light brown clean SAND, medium dense, moist. Moderate mottling.	3	
4						
5				Soil color changes to light grey with little to no mottling observed below 5.3 feet BPG.		
6					4	▼
7				T.D. 6.6 Rapid caving of test pit sidewalls below water table. Excavation ceased. Some gravels observed at base of excavation.		
8						
9						
10						

04-21-2009

Materials Testing & Consulting, Inc.

Log of Test Pit TP-3

(Page 1 of 1)

Tulalip Gas Station
Geotechnical Site Investigation
Marysville, WA

Date Started : 4-17-09
Date Completed : 4-17-09
Sampling Method : Excavator and grab sampling
Location : 165' W, 245' N of SE Property Corner
Logged By : Troy Baggerman

Depth in Feet	Surf. Elev.	USCS	GRAPHIC	DESCRIPTION	Samples	Water Level
0		SP-SM		Brown brown organic SAND with silt, loose, dry to moist, no mottling. TOPSOIL.		
1		SP		Orange brown medium grain clean SAND, medium dense, moist. Moderate mottling.		
2				Sand becomes medium to coarse grained.		
3					1	
4				Soil color changes to grey. No mottling belw 5.9 feet BPG.	2	▼
5						
6				T.D. 5.9 Rapid caving of test pit sidewalls below water table. Excavation ceased.		
7						
8						
9						
10						

04-21-2009

Materials Testing & Consulting, Inc.

Log of Test Pit TP-4

(Page 1 of 1)

Tulalip Gas Station
Geotechnical Site Investigation
Marysville, WA

Date Started : 4-17-09
Date Completed : 4-17-09
Sampling Method : Excavator and grab sampling
Location : 75' W, 250' N of SE Property Corner
Logged By : Troy Baggerman

Depth in Feet	Surf. Elev.	USCS	GRAPHIC	DESCRIPTION	Samples	Water Level
0		SP-SM		Dark brown organic fine to medium grained SAND with silt, loose, dry to moist, no mottling. TOPSOIL.		
1		SP		Orange brown medium grain clean SAND, medium dense, moist. No soil mottling observed. FILL.	1	
3		SP-SM		Dark brown to black organic SAND with silt, medium dense, moist. RELIC TOPSOIL.	2	
4		SP		Orange to light brown clean SAND, medium dense, moist. Moderate mottling.		▼
6.5				T.D. 6.5 Rapid caving of test pit sidewalls below water table. Excavation ceased.		
7						
8						
9						
10						

04-21-2009

Materials Testing & Consulting, Inc.

Log of Test Pit TP-5

(Page 1 of 1)

Tulalip Gas Station
Geotechnical Site Investigation
Marysville, WA

Date Started : 4-17-09
Date Completed : 4-17-09
Sampling Method : Excavator and grab sampling
Location : 190' W, 360' N of SE Property Corner
Logged By : Troy Baggerman

Depth in Feet	Surf. Elev.	USCS	GRAPHIC	DESCRIPTION	Samples	Water Level
0		SP-SM		Dark brown organic SAND loose, moist, medium grained, no mottling. TOPSOIL.		
1		SP		Light brown and orange brown medium grained SAND, medium dense, moist, with light mottling. FILL.		
2					1	
		SM		Dark brown organic rich sand, medium dense, moist, with 10% organics by volume. RELIC TOPSOIL.		
3		SP		Light orange brown SANDmedium dense, moist to wet, with moderate mottling.		
4						
5					2	
6				Becomes grey medium grained sand at 6.0'.		▼
				T.D. 6.5'		
7				Rapid caving of test pit sidewalls below water table. Excavation ceased.		
8						
9						
10						

04-21-2009

Materials Testing & Consulting, Inc.

Log of Test Pit TP-6

(Page 1 of 1)

Tulalip Gas Station
Geotechnical Site Investigation
Marysville, WA

Date Started : 4-17-09
Date Completed : 4-17-09
Sampling Method : Excavator and grab sampling
Location : 95' W, 370' N of SE Property Corner
Logged By : Troy Baggerman

Depth in Feet	Surf. Elev.	USCS	GRAPHIC	DESCRIPTION	Samples	Water Level
0		SP-SM		Dark brown organic SAND medium dense, moist, medium grained, no mottling. TOPSOIL.		
1		SP		Light brown medium grained SAND, medium dense, moist. FILL.	1	
2						
3		SM		Dark brown organic rich SAND, medium dense, moist. RELIC TOPSOIL.		
4		SP		Light orange brown medium SAND, medium dense, moist, with moderate mottling.	2	
5						
6				Becomes heavily mottled at 6.5'.		
7				T.D. 6.8' Rapid caving of test pit sidewalls below water table. Excavation ceased.		
8						
9						
10						

04-21-2009

Materials Testing & Consulting, Inc.

Log of Test Pit TP-7

(Page 1 of 1)

Tulalip Gas Station
Geotechnical Site Investigation
Marysville, WA

Date Started : 4-17-09
Date Completed : 4-17-09
Sampling Method : Excavator and grab sampling
Location : 180' W, 470' N of SE Property Corner
Logged By : Troy Baggerman

Depth in Feet	Surf. Elev.	USCS	GRAPHIC	DESCRIPTION	Samples	Water Level
0		SP-SM		Dark brown organic SAND loose, moist, medium grained, no mottling. TOPSOIL.		
1		SP		Light brown to grey medium grained SAND, loose to medium dense, moist, with occasinoal mottling. FILL.	1	
2		SM		Dark brown organic rich medium SAND, medium dense, moist. RELIC TOPSOIL.		
3		SP		Orange brown medium SAND, medium dense, moist, with moderate mottling.		
4					2	
5				Becomes heavily mottled at 5.5'.		
6				Becomes grey, medium to coarse grained at 6.0'.		
7				T.D. 6.8' Rapid caving of test pit sidewalls below water table. Excavation ceased.	3	▼
8						
9						
10						

04-21-2009

Materials Testing & Consulting, Inc.

Log of Test Pit TP-8

(Page 1 of 1)

Tulalip Gas Station
Geotechnical Site Investigation
Marysville, WA

Date Started : 4-17-09
Date Completed : 4-17-09
Sampling Method : Excavator and grab sampling
Location : 90' W, 480' N of SE Property Corner
Logged By : Troy Baggerman

Depth in Feet	Surf. Elev.	USCS	GRAPHIC	DESCRIPTION	Samples	Water Level
0		SP-SM		Dark brown organic SAND loose, moist, medium grained. TOPSOIL.		
1		SP		Light brown medium grained SAND, loose to medium dense, moist, little to no mottling. FILL.	1	
2		SM		Dark brown organic rich SAND, medium dense, moist. RELIC TOPSOIL.		
3		SP		Orange brown medium SAND, medium dense, moist.	2	
4						
5						
6						
7		SP		Becomes grey at 6.7' Grey goarse SAND with gravel, loose, wet. T.D. 7.0' Rapid caving of test pit sidewalls below water table. Excavation ceased.		▼
8						
9						
10						

04-21-2009

Materials Testing & Consulting, Inc.

Log of Test Pit TP-9

(Page 1 of 1)

Tulalip Gas Station
Geotechnical Site Investigation
Marysville, WA

Date Started : 4-17-09
Date Completed : 4-17-09
Sampling Method : Excavator and grab sampling
Location : 190' W, 640' N of SE Property Corner
Logged By : Troy Baggerman

Depth in Feet	Surf. Elev.	USCS	GRAPHIC	DESCRIPTION	Samples	Water Level
0		SP-SM		Dark brown organic SAND loose, moist, fine grained. TOPSOIL.		
1		SP		Light grey brown medium to fine grained SAND, loose, moist. FILL.		
2						
3		SM		Dark brown medium grained organic rich SAND, medium dense, moist. RELIC TOPSOIL.		
4		SP		Light orange brown medium to fine grained SAND, medium dense, moist, with moderate mottling.	1	
5						
6						
7		SP		Grey medium to coarse SAND.		▼
8				T.D. 7.4' Rapid caving of test pit sidewalls below water table. Excavation ceased.		
9						
10						

04-21-2009

Materials Testing & Consulting, Inc.

Log of Test Pit TP-10

(Page 1 of 1)

Tulalip Gas Station
Geotechnical Site Investigation
Marysville, WA

Date Started : 4-17-09
Date Completed : 4-17-09
Sampling Method : Excavator and grab sampling
Location : 85' W, 640' N of SE Property Corner
Logged By : Troy Baggerman

Depth in Feet	Surf. Elev.	USCS	GRAPHIC	DESCRIPTION	Samples	Water Level
0		SP-SM		Dark brown organic SAND loose, moist. TOPSOIL.		
1		SP		Light orange brown medium grained SAND, loose to medium dense, moist. FILL.	1	
2						
3		SM		Dark brown medium grained organic rich SAND, medium dense, moist. RELIC TOPSOIL.		
4		SP		Light orange brown medium grained SAND, medium dense, moist, with moderate mottling.		
5						
6						
7				With heavy mottling at 7.0'		
8				T.D. 8.0' Rapid caving of test pit sidewalls below water table. Excavation ceased.		
9						
10						

04-21-2009

WILDCAT DYNAMIC CONE LOG

Materials Testing and Consulting
777 Chrysler Drive
Burlington, WA 98233

PROJECT NUMBER: 09B036
DATE STARTED: 04-17-2009
DATE COMPLETED: 04-17-2009

HOLE #: P-1
CREW: TB
PROJECT: Tulalip Gas Station
ADDRESS: Quil Ceda Blvd and 116th Ave NE
LOCATION: 110' W., 620' N. of SE Property Corner

SURFACE ELEVATION:
WATER ON COMPLETION:
HAMMER WEIGHT: 35 lbs.
CONE AREA: 10 sq. cm

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm²	GRAPH OF CONE RESISTANCE 0 50 100 150	N'	TESTED CONSISTENCY SAND & SILT	TESTED CONSISTENCY CLAY
-	3	13.3	•••	3	VERY LOOSE	SOFT
-	4	17.8	•••••	5	LOOSE	MEDIUM STIFF
- 1 ft	6	26.6	•••••••	7	LOOSE	MEDIUM STIFF
-	6	26.6	•••••••	7	LOOSE	MEDIUM STIFF
-	7	31.1	••••••••	8	LOOSE	MEDIUM STIFF
- 2 ft	5	22.2	••••••	6	LOOSE	MEDIUM STIFF
-	6	26.6	•••••••	7	LOOSE	MEDIUM STIFF
-	6	26.6	•••••••	7	LOOSE	MEDIUM STIFF
- 3 ft	7	31.1	••••••••	8	LOOSE	MEDIUM STIFF
- 1 m	6	26.6	•••••••	7	LOOSE	MEDIUM STIFF
-	4	15.4	••••	4	VERY LOOSE	SOFT
- 4 ft	2	7.7	••	2	VERY LOOSE	SOFT
-	1	3.9	•	1	VERY LOOSE	VERY SOFT
-	6	23.2	••••••	6	LOOSE	MEDIUM STIFF
- 5 ft	20	77.2	••••••••••••••••••••	22	MEDIUM DENSE	VERY STIFF
-	22	84.9	•••••••••••••••••••••	24	MEDIUM DENSE	VERY STIFF
-	22	84.9	•••••••••••••••••••••	24	MEDIUM DENSE	VERY STIFF
- 6 ft	21	81.1	••••••••••••••••••••	23	MEDIUM DENSE	VERY STIFF
-	18	69.5	•••••••••••••••••	19	MEDIUM DENSE	VERY STIFF
- 2 m	20	77.2	••••••••••••••••••••	22	MEDIUM DENSE	VERY STIFF
- 7 ft	18	61.6	••••••••••••••••	17	MEDIUM DENSE	VERY STIFF
-	19	65.0	•••••••••••••••••	18	MEDIUM DENSE	VERY STIFF
-	25	85.5	•••••••••••••••••••••	24	MEDIUM DENSE	VERY STIFF
- 8 ft	28	95.8	•••••••••••••••••••••••	-	MEDIUM DENSE	VERY STIFF
-	26	88.9	•••••••••••••••••••••	25	MEDIUM DENSE	VERY STIFF
-	39	133.4	••••••••••••••••••••••••••••••••••	-	DENSE	HARD
- 9 ft	36	123.1	••••••••••••••••••••••••••••••••	-	DENSE	HARD
-	24	82.1	••••••••••••••••••••	23	MEDIUM DENSE	VERY STIFF
-	24	82.1	••••••••••••••••••••	23	MEDIUM DENSE	VERY STIFF
- 3 m 10 ft	30	102.6	•••••••••••••••••••••••	-	MEDIUM DENSE	VERY STIFF
-	43	131.6	••••••••••••••••••••••••••••••••••	-	DENSE	HARD
-	50	153.0	••	-	DENSE	HARD
-						
- 11 ft						
-						
-						
- 12 ft						
-						
-						
- 4 m 13 ft						

WILDCAT.XLS

WILDCAT DYNAMIC CONE LOG

Materials Testing and Consulting
777 Chrysler Drive
Burlington, WA 98233

PROJECT NUMBER: 09B036
DATE STARTED: 04-17-2009
DATE COMPLETED: 04-17-2009

HOLE #: P-2
CREW: TB
PROJECT: Tulalip Gas Station
ADDRESS: Quil Ceda Blvd and 116th Ave NE
LOCATION: 160' W., 470' N. of SE Property Corner

SURFACE ELEVATION:
WATER ON COMPLETION:
HAMMER WEIGHT: 35 lbs.
CONE AREA: 10 sq. cm

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm²	GRAPH OF CONE RESISTANCE 0 50 100 150	N'	TESTED CONSISTENCY SAND & SILT	TESTED CONSISTENCY CLAY
-	3	13.3	•••	3	VERY LOOSE	SOFT
-	5	22.2	••••••	6	LOOSE	MEDIUM STIFF
- 1 ft	6	26.6	•••••••	7	LOOSE	MEDIUM STIFF
-	7	31.1	•••••••••	8	LOOSE	MEDIUM STIFF
-	8	35.5	•••••••••	10	LOOSE	STIFF
- 2 ft	12	53.3	••••••••••••••	15	MEDIUM DENSE	STIFF
-	8	35.5	•••••••••	10	LOOSE	STIFF
-	5	22.2	••••••	6	LOOSE	MEDIUM STIFF
- 3 ft	3	13.3	•••	3	VERY LOOSE	SOFT
- 1 m	2	8.9	••	2	VERY LOOSE	SOFT
-	4	15.4	••••	4	VERY LOOSE	SOFT
- 4 ft	10	38.6	•••••••••••	11	MEDIUM DENSE	STIFF
-	18	69.5	••••••••••••••••••	19	MEDIUM DENSE	VERY STIFF
-	22	84.9	•••••••••••••••••••••	24	MEDIUM DENSE	VERY STIFF
- 5 ft	25	96.5	•••••••••••••••••••••••••	-	MEDIUM DENSE	VERY STIFF
-	18	69.5	••••••••••••••••••	19	MEDIUM DENSE	VERY STIFF
-	19	73.3	•••••••••••••••••••	20	MEDIUM DENSE	VERY STIFF
- 6 ft	16	61.8	•••••••••••••••	17	MEDIUM DENSE	VERY STIFF
-	18	69.5	••••••••••••••••••	19	MEDIUM DENSE	VERY STIFF
- 2 m	21	81.1	•••••••••••••••••••••	23	MEDIUM DENSE	VERY STIFF
- 7 ft	20	68.4	•••••••••••••••••	19	MEDIUM DENSE	VERY STIFF
-	19	65.0	••••••••••••••••••	18	MEDIUM DENSE	VERY STIFF
-	31	106.0	•••••••••••••••••••••••••••	-	MEDIUM DENSE	VERY STIFF
- 8 ft	35	119.7	••••••••••••••••••••••••••••••	-	DENSE	HARD
-	36	123.1	•••••••••••••••••••••••••••••••	-	DENSE	HARD
-	37	126.5	••••••••••••••••••••••••••••••••	-	DENSE	HARD
- 9 ft	32	109.4	••••••••••••••••••••••••••••	-	DENSE	HARD
-	29	99.2	•••••••••••••••••••••••••	-	MEDIUM DENSE	VERY STIFF
-	26	88.9	•••••••••••••••••••••••	25	MEDIUM DENSE	VERY STIFF
- 3 m 10 ft	33	112.9	••••••••••••••••••••••••••••	-	DENSE	HARD
-	36	110.2	••••••••••••••••••••••••••••	-	DENSE	HARD
-	31	94.9	•••••••••••••••••••••••••	-	MEDIUM DENSE	VERY STIFF
-	22	67.3	••••••••••••••••••	19	MEDIUM DENSE	VERY STIFF
- 11 ft	28	85.7	•••••••••••••••••••••••	24	MEDIUM DENSE	VERY STIFF
-	21	64.3	•••••••••••••••••	18	MEDIUM DENSE	VERY STIFF
-	23	70.4	•••••••••••••••••••	20	MEDIUM DENSE	VERY STIFF
- 12 ft	19	58.1	••••••••••••••••	16	MEDIUM DENSE	VERY STIFF
-	18	55.1	••••••••••••••••	15	MEDIUM DENSE	STIFF
-	15	45.9	••••••••••••••	13	MEDIUM DENSE	STIFF
- 4 m 13 ft	17	52.0	••••••••••••••••	14	MEDIUM DENSE	STIFF

WILDCAT.XLS

HOLE #: P-2

WILDCAT DYNAMIC CONE LOG

PROJECT: Tulalip Gas Station

PROJECT NUMBER: 09B036

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm²	GRAPH OF CONE RESISTANCE 0 50 100 150	N'	TESTED CONSISTENCY SAND & SILT	CLAY
	19	52.6	••••••••••••••	15	MEDIUM DENSE	STIFF
	21	58.2	••••••••••••••	16	MEDIUM DENSE	VERY STIFF
14 ft	21	58.2	••••••••••••••	16	MEDIUM DENSE	VERY STIFF
	29	80.3	••••••••••••••••••••••	22	MEDIUM DENSE	VERY STIFF
	22	60.9	•••••••••••••••	17	MEDIUM DENSE	VERY STIFF
15 ft	29	80.3	••••••••••••••••••••••	22	MEDIUM DENSE	VERY STIFF
	23	63.7	•••••••••••••••••	18	MEDIUM DENSE	VERY STIFF
	21	58.2	••••••••••••••	16	MEDIUM DENSE	VERY STIFF
16 ft	26	72.0	••••••••••••••••••	20	MEDIUM DENSE	VERY STIFF
5 m						
17 ft						
18 ft						
19 ft						
6 m						
20 ft						
21 ft						
22 ft						
7 m 23 ft						
24 ft						
25 ft						
26 ft						
8 m						
27 ft						
28 ft						
29 ft						
9 m						

WILDCAT.XLS

Appendix C. Laboratory Results

Sieve Report

Project: Tulalip Gas Station
Project #: 09B036
Client: Tulalip Tribes
Source: TP-2 @ 1.0
Sample#: 090047

Date Received: 17-Apr-09
Sampled By: T. Baggerman
Date Tested: 20-Apr-09
Tested By: T. Baggerman

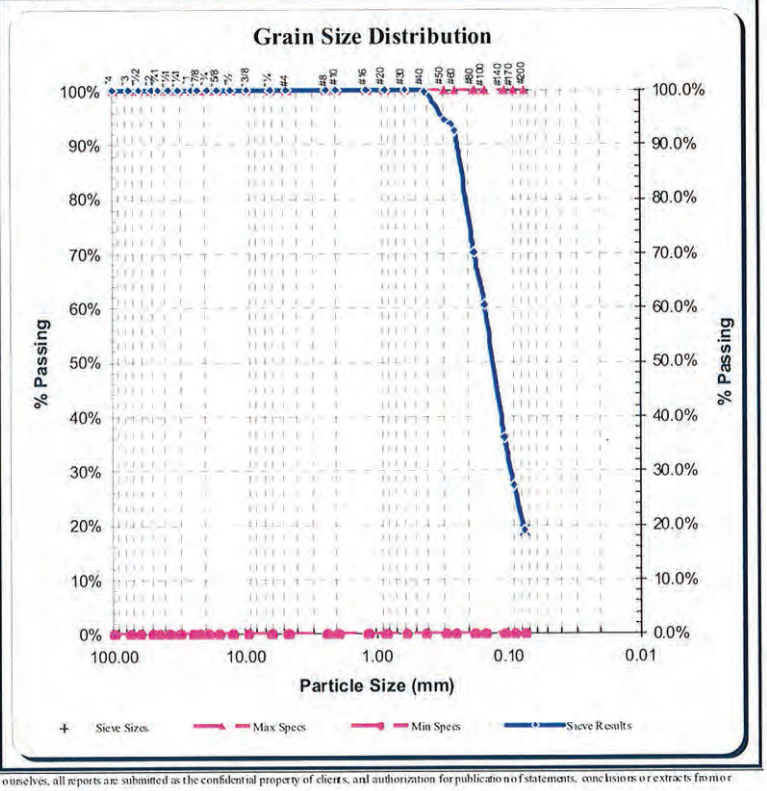
ASTM D-2487 Unified Soils Classification System
SM, Silty Sand
Sample Color:
light brown

Specifications
No Specs
Sample Meets Specs ?

$D_{(5)}$ = 0.020 mm	% Gravel = 0.0%	Coeff. of Curvature, C_C = 0.81
$D_{(10)}$ = 0.040 mm	% Sand = 81.1%	Coeff. of Uniformity, C_U = 0.19
$D_{(30)}$ = 0.095 mm	% Silt & Clay = 18.9%	Fineness Modulus = 0.45
$D_{(50)}$ = 0.131 mm	Fracture % = n/a	Liquid Limit = 0.0%
$D_{(60)}$ = 0.149 mm	Moisture %, as sampled = 14.6%	Plastic Limit = 0.0%
$D_{(90)}$ = 0.312 mm		Plasticity Index = 0.0%

ASTM C-136, ASTM D-4318

Sieve Size US	Sieve Size Metric	Actual Cumulative Percent Passing	Interpolated Cumulative Percent Passing	Specs Max	Specs Min
6.00"	150.00		100%	100.0%	0.0%
4.00"	100.00		100%	100.0%	0.0%
3.00"	75.00		100%	100.0%	0.0%
2.50"	63.00		100%	100.0%	0.0%
2.00"	50.00		100%	100.0%	0.0%
1.75"	45.00		100%	100.0%	0.0%
1.50"	37.50		100%	100.0%	0.0%
1.25"	31.50		100%	100.0%	0.0%
1.00"	25.00		100%	100.0%	0.0%
7/8"	22.40		100%	100.0%	0.0%
3/4"	19.00		100%	100.0%	0.0%
5/8"	16.00		100%	100.0%	0.0%
1/2"	12.50		100%	100.0%	0.0%
3/8"	9.50		100%	100.0%	0.0%
1/4"	6.30		100%	100.0%	0.0%
#4	4.75		100%	100.0%	0.0%
#8	2.360		100%	100.0%	0.0%
#10	2.000		100%	100.0%	0.0%
#16	1.180		100%	100.0%	0.0%
#20	0.850		100%	100.0%	0.0%
#30	0.600		100%	100.0%	0.0%
#40	0.425	100%	100%	100.0%	0.0%
#50	0.300		95%	100.0%	0.0%
#60	0.250	92%	92%	100.0%	0.0%
#80	0.180		70%	100.0%	0.0%
#100	0.150	60%	60%	100.0%	0.0%
#140	0.106		36%	100.0%	0.0%
#170	0.090		27%	100.0%	0.0%
#200	0.075	18.9%	18.9%	100.0%	0.0%



Comments:

Reviewed by:

Sieve Report

Project: Tulalip Gas Station
Project #: 09B036
Client: Tulalip Tribes
Source: TP-7 @ 4.0
Sample#: 090048

Date Received: 17-Apr-09
Sampled By: T. Baggerman
Date Tested: 20-Apr-09
Tested By: T. Baggerman

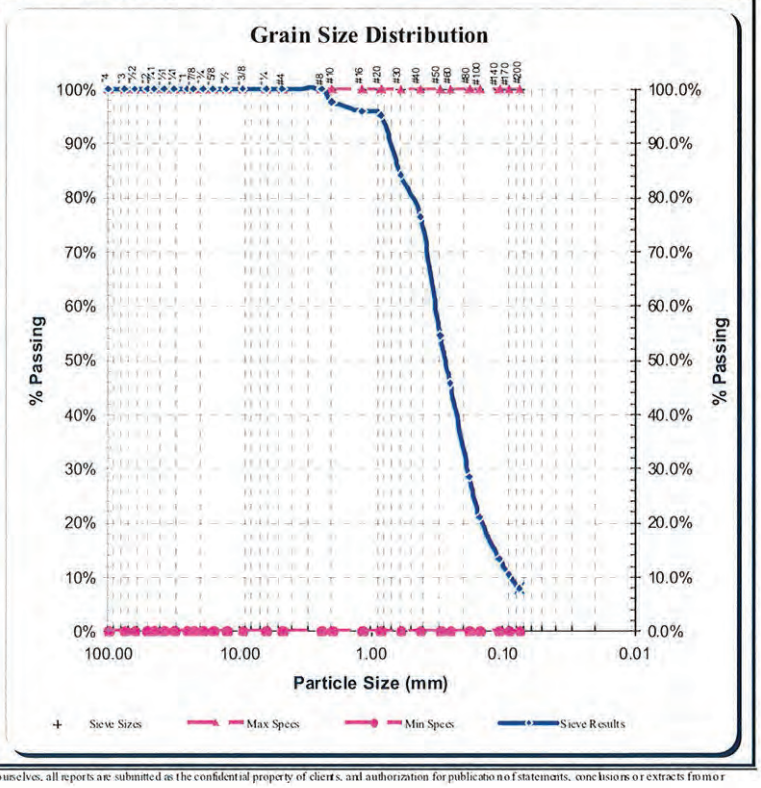
ASTM D-2487 Unified Soils Classification System
SP-SM, Poorly graded Sand with Silt
Sample Color:
Brown

Specifications
No Specs
Sample Meets Specs ?

$D_{(5)}$ =	mm	% Gravel = 0.0%	Coeff. of Curvature, C_C = 0.92
$D_{(10)}$ = 0.087	mm	% Sand = 92.2%	Coeff. of Uniformity, C_U = 0.08
$D_{(30)}$ = 0.186	mm	% Silt & Clay = 7.8%	Fineness Modulus = 1.44
$D_{(50)}$ = 0.274	mm	Fracture % = n/a	Liquid Limit = 0.0%
$D_{(60)}$ = 0.331	mm	Moisture %, as sampled = 26.3%	Plastic Limit = 0.0%
$D_{(90)}$ = 0.982	mm		Plasticity Index = 0.0%

ASTM C-136, ASTM D-4318

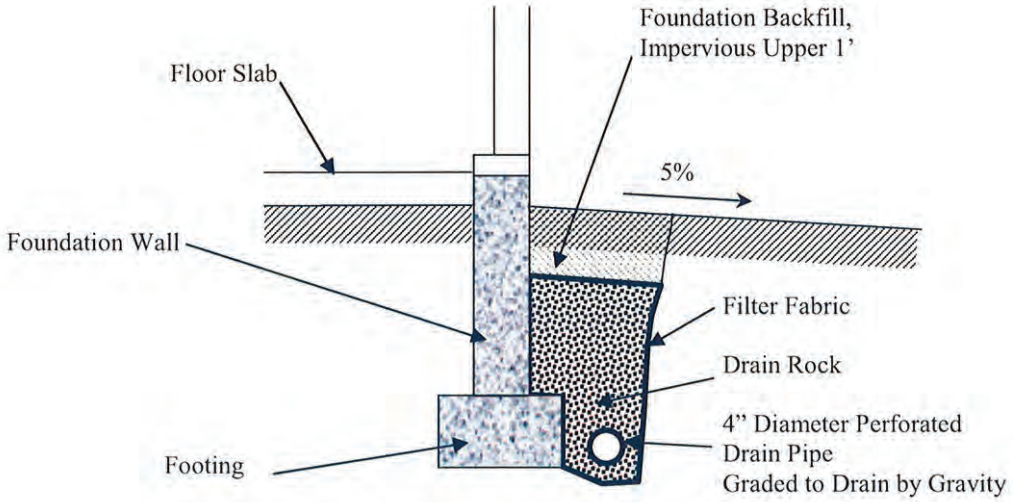
Sieve Size US	Sieve Size Metric	Actual Cumulative Percent Passing	Interpolated Cumulative Percent Passing	Specs Max	Specs Min
6.00"	150.00		100%	100.0%	0.0%
4.00"	100.00		100%	100.0%	0.0%
3.00"	75.00		100%	100.0%	0.0%
2.50"	63.00		100%	100.0%	0.0%
2.00"	50.00		100%	100.0%	0.0%
1.75"	45.00		100%	100.0%	0.0%
1.50"	37.50		100%	100.0%	0.0%
1.25"	31.50		100%	100.0%	0.0%
1.00"	25.00		100%	100.0%	0.0%
7/8"	22.40		100%	100.0%	0.0%
3/4"	19.00		100%	100.0%	0.0%
5/8"	16.00		100%	100.0%	0.0%
1/2"	12.50		100%	100.0%	0.0%
3/8"	9.50		100%	100.0%	0.0%
1/4"	6.30		100%	100.0%	0.0%
#4	4.75		100%	100.0%	0.0%
#8	2.360		100%	100.0%	0.0%
#10	2.000	98%	98%	100.0%	0.0%
#16	1.180		96%	100.0%	0.0%
#20	0.850	95%	95%	100.0%	0.0%
#30	0.600		84%	100.0%	0.0%
#40	0.425	76%	76%	100.0%	0.0%
#50	0.300		54%	100.0%	0.0%
#60	0.250	46%	46%	100.0%	0.0%
#80	0.180		28%	100.0%	0.0%
#100	0.150	21%	21%	100.0%	0.0%
#140	0.106		13%	100.0%	0.0%
#170	0.090		10%	100.0%	0.0%
#200	0.075	7.8%	7.8%	100.0%	0.0%



Comments:

Reviewed by:

Appendix D. Footing Details



Not to Scale

Materials Testing and Consulting, Inc. 777 Chrysler Drive Burlington, WA 98233	**Recommended Footing Drain Details** Skagit County Fire District #13 La Conner, WA	**Figure** **5**

Appendix E. Limitations and Use of This Report

The following is adapted from "Important Information About Your Geotechnical Report" provided by ASFE The Best People On Earth; www.asfe.org; and "The Geotechnical Engineering and Environmental Services Standards of Care with Respect to Mold Potentials 1998 – 2003" by ASFE The Best People On Earth.

Geotechnical Services are Performed for Specific Purposes, Persons, and Projects

Materials Testing & Consulting, Inc. (MTC) services are structured to meet the specific needs of their clients. A geotechnical engineering study conducted for a civil engineer may not fulfill the needs of a construction contractor or even another civil engineer. Because each geotechnical engineering study is unique, prepared solely for the client, no one except you should rely on your geotechnical engineering report without first conferring with the geotechnical engineer who prepared it. This report may not be applied to any purpose or project except the one originally contemplated.

A Geotechnical Engineering Report is Based on a Unique Set of Project-Specific Factors

The scope of study for which this geotechnical report was prepared considered several unique, project-specific factors. These factors include, but are not limited to: the clients goals, objectives, and risk management preferences; the general nature of the structure involved, its size and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless MTC specifically indicates otherwise, do not rely on this report if it was: not prepared for you; not prepared for your project; not prepared for the specific site explored; or completed before important project changes were made.

Typical changes that can reduce the reliability and application of this report include those that affect: the function of the proposed structure; elevation, configuration, location, orientation, or weight of the proposed structure; compositions of the design team; or project ownership.

Changes made to the project following completion of this report should be made known to MTC so that MTC can assess the potential impact of such changes and make any necessary modifications to our interpretations and recommendations in writing.

Subsurface Conditions Can Change

This report is based on conditions that existed at the time the study was performed. The interpretations, conclusions, and recommendations in this report may be affected by: the passage of time; by man-made events, such as construction on or adjacent to the site; or by natural events, such as floods, earthquakes, or groundwater fluctuations. MTC should always be contacted to determine if the report is still reliable.

Most Geotechnical Findings Are Professional Opinions

Site exploration utilizes test borings and/or test pits that are widely spaced over ground area relevant to a unique scope of work; additionally, soil samples are taken at variable spacing over the depth of exploration. The variability of subsurface conditions may exceed that of the site investigation program. MTC reviews field and laboratory data and then apply professional judgment to render an opinion about subsurface conditions throughout the site. Actual site subsurface conditions may significantly deviate from those indicated in this report. Retaining MTC to provide construction observation is the most effective method of managing the risks associated with unanticipated conditions.

A Report's Recommendations Are Not Final

Do not over-rely on the construction recommendations included in this report. The recommendations in this report are not final; they are developed principally from the judgment and opinion of MTC staff. MTC's recommendations are contingent upon observing actual subsurface conditions revealed during construction. MTC cannot assume responsibility or liability for the report's recommendations if MTC does not perform construction observation.

A Geotechnical Report May be Subject to Misinterpretation

Misinterpretation of this report by members of the project design team not employed by MTC can result in costly problems. This risk may be reduced by having MTC confer with appropriate members of the design team after submittal of this report. MTC should be retained to review pertinent elements of the design team's plans and specifications. To avoid misinterpretation of this report by contractors, MTC may be retained to participate in pre-bid and pre-construction conferences, and by providing construction monitoring.

Do Not Redraw The Exploration Logs

Geotechnical engineers and geologists prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical engineering report should never be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproductions are acceptable, but recognize that separating logs from the report can elevate risk.

Give Contractors A Complete Report and Guidance

Some owners and design professionals mistakenly believe they can make contractors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give contractors the complete geotechnical engineering report, but preface it with a clearly written letter of transmittal. In that letter, advise contractors that the report was not prepared for purposed of bid development and that the report's accuracy is limited; encourage them to confer with MTC and/or to conduct additional study to obtain the specific type of information they need or prefer. A pre-bid conference can also be valuable. Be sure contractors have sufficient time to perform additional study. Only then might you be in a position to give contractors the best information available to you, while requiring them to at least share some financial responsibilities stemming from unanticipated conditions.

Read Limitations Provisions Closely

Some clients, design professionals, and contractors do not recognize that geotechnical engineering and engineering geology are far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that have lead to disappointments, claims, and disputes. To help reduce the risk of such outcomes, MTC includes *limitations* in this report. Read the limitations closely and contact MTC if you have any questions regarding these provisions.

Environmental Concerns Are Not Addressed In This Report

The equipment, techniques, and personnel used to perform an environmental site assessment study differ significantly from those used to perform a geotechnical study. For that reason, a geotechnical engineering report does not usually relate any environmental findings, conclusions, or recommendations.

SECTION 03 11 00
CONCRETE FORMING

PART 1 - GENERAL

1.01 **REFERENCES**

A. ACI 301 - Structural Concrete for Buildings.

B. ACI 318 - Building Code Requirements for Reinforced Concrete.

C. ACI 347 - Recommended Practice For Concrete Formwork.

D. PS 1 - Construction and Industrial Plywood.

1.02 **DESIGN REQUIREMENTS**

A. Design, engineer and construct formwork, shoring, and bracing to conform to design and code requirements; resultant concrete to conform to required shape, line and dimension.

1.03 **QUALITY ASSURANCE**

A. Perform Work in accordance with ACI 347.

1.04 **REGULATORY REQUIREMENTS**

A. Conform to International Building Code and Local Building Department requirements for design, fabrication, erection, and removal of formwork.

1.05 **DELIVERY, STORAGE, AND PROTECTION**

A. Section 01 60 00 – Product Requirements: Transport, handle, store, and protect products.

B. Store off ground in ventilated and protected manner to prevent deterioration from moisture.

1.06 **ALTERNATES**

A. See Section 01 23 00 for bidding alternates affecting the Work of this Section.

PART 2 - PRODUCTS

2.01 **WOOD FORM MATERIALS**

A. Conform to ACI 347.

B. Form Panels: For concrete exposed to view use HDO plywood with high-density phenolic overlay, Swanson Group "Multipour® Concrete Form". Form panels for all other concrete shall be B-B Grade form plywood.

2.02 **FORMWORK ACCESSORIES**

A. Form Ties: Provide snap-off metal form ties, designed to prevent form deflection, and to prevent spalling concrete surfaces upon removal. The portion of tie remaining within concrete after removal of exterior parts shall be recessed 3/4 inch from the outer concrete surface and will not leave a hole larger than 1 inch diameter in the concrete surface. Form ties shall be manufactured items with stress value published.

B. Form Release Agent: Colorless mineral oil that will not stain concrete or absorb moisture.

PART 3 - EXECUTION

3.01 **EXAMINATION**

A. Verify lines, levels, and centers before proceeding with formwork. Ensure that dimensions agree with drawings.

3.02 **EARTH FORMS**

A. Hand trim sides and bottom of earth forms. Remove loose soil prior to placing concrete.

3.03 **ERECTION - FORMWORK**

A. Erect formwork, shoring, and bracing to achieve design requirements in accordance with requirements of ACI 301.

B. Provide bracing to ensure stability of formwork. Shore or strengthen formwork subject to overstressing by construction loads.

C. Arrange and assemble formwork to permit dismantling and stripping. Do not damage concrete during stripping. Permit removal of remaining principal shores.

D. Align joints and make watertight. Keep form joints to a minimum.

E. Obtain approval before framing openings in structural members that are not indicated on drawings.

F. Provide 3/4 inch chamfer at all external corners.

G. Coordinate this Section with other sections of work that require attachment of components to formwork.

H. If formwork is placed after reinforcement resulting in insufficient concrete cover over reinforcement before proceeding, request instructions from Architect / Engineer.

3.04 **APPLICATION - FORM RELEASE AGENT**

A. Apply form release agent on formwork in accordance with manufacturer's recommendations.

B. Apply prior to placement of reinforcing steel, anchoring devices, and embedded items.

C. Do not apply form release agent where concrete surfaces will receive special finishes or applied coverings that are affected by agent. Soak inside surfaces of untreated forms with clean water. Keep surfaces coated prior to placement of concrete.

3.05 INSERTS, EMBEDDED PARTS, AND OPENINGS

A. Provide formed openings where required for items to be embedded in passing through concrete work.

B. Locate and set in place items that will be cast directly into concrete.

C. Coordinate with work of other sections in forming and placing openings, slots, reglets, recesses, sleeves, bolts, anchors, other inserts, and components of other Work.

D. Install accessories in accordance with manufacturer's instructions, straight, level, and plumb. Ensure items are not disturbed during concrete placement.

E. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection. Locate openings at bottom of forms to allow flushing water to drain.

F. Close temporary openings with tight fitting panels, flush with inside face of forms, and neatly fitted so joints will not be apparent in exposed concrete surfaces.

3.06 FORM CLEANING

A. Clean forms as erection proceeds, to remove foreign matter within forms.

B. Clean formed cavities of debris prior to placing concrete.

C. Flush with water or use compressed air to remove remaining foreign matter. Ensure that water and debris drain to exterior through clean-out ports.

D. During cold weather, remove ice and snow from within forms. Do not use de-icing salts. Do not use water to clean out forms, unless formwork and concrete construction proceed within heated enclosure. Use compressed air or other means to remove foreign matter.

3.07 FORMWORK TOLERANCES

A. Construct formwork to maintain tolerances required by ACI 301.

3.08 FIELD QUALITY CONTROL

A. Section 01 45 00 - Quality Control: Field inspection and testing.

B. Inspect erected formwork, shoring, and bracing to ensure that work is in accordance with formwork design, and that supports, fastenings, wedges, ties, and items are secure.

3.09 FORM REMOVAL

A. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads.

B. Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.

C. Store removed forms in manner that surfaces to be in contact with fresh concrete will not be damaged. Discard damaged forms.

END OF SECTION

PAGE LEFT BLANK INTENTIONALLY

SECTION 03 20 00
CONCRETE REINFORCING

PART 1 - GENERAL

1.01 REFERENCES

A. ACI 301 - Structural Concrete for Buildings.

B. ACI 315 – Details and Detailing of Concrete Reinforcement.

C. ACI 318 - Building Code Requirements for Structural Concrete.

D. ACI SP-66 - American Concrete Institute - Detailing Manual.

E. ASTM A82 - Cold Drawn Steel Wire for Concrete Reinforcement.

F. ASTM A185 - Welded Steel Wire Fabric for Concrete Reinforcement.

G. ASTM A767 - Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement

H. ASTM A775 - Epoxy-Coated Steel Reinforcing Bars

I. AWS D1.4 - Structural Welding Code for Reinforcing Steel.

J. AWS D12.1 - Welding Reinforcement Steel, Metal Inserts and Connections in Reinforced Concrete Construction.

K. CRSI - Concrete Reinforcing Steel Institute - Manual of Practice.

L. CRSI 63 - Recommended Practice For Placing Reinforcing Bars.

M. CRSI 65 - Recommended Practice For Placing Bar Supports, Specifications and Nomenclature.

N. IBC – International Building Code.

O. Structural General Notes on Structural Drawings.

1.02 SUBMITTALS

A. Section 01 34 00 - Submittals: Procedures for submittals.

B. Shop Drawings: Indicate bar sizes, spacing, locations, and quantities of reinforcing steel and wire fabric, bending and cutting schedules, supporting and spacing devices and other arrangements and assemblies as required for fabrication and placement of reinforcement for all cast-in-place concrete work.

1.03 QUALITY ASSURANCE

A. Codes and Standards: Comply with provisions of references listed in Paragraph 1.01 (above), except where more stringent requirements are shown or specified. Refer also to Structural General Notes on Structural Drawings.

1.04 **REGULATORY REQUIREMENTS**

A. Conform to International Building Code and Local Building Department requirements for testing, inspection, etc. during construction.

1.05 **ALTERNATES**

A. See Section 01 23 00 for bidding alternates affecting the work of this Section.

PART 2 - PRODUCTS

2.01 **REINFORCEMENT**

A. Reinforcing Steel: Refer to Structural General Notes on Structural Drawings.

1. Galvanized bars shall conform to ASTM A767.

2. Epoxy coated bars shall conform to ASTM A775.

3. Welded Steel Wire Fabric: Refer to Structural General Notes on Structural Drawings.

2.02 **ACCESSORIES**

A. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for strength and support of reinforcement during concrete placement conditions including load bearing pad on bottom to prevent vapor barrier puncture.

B. Special Chairs, Bolsters, Bar Supports, Spacers Adjacent to Weather Exposed Concrete Surfaces: Plastic coated steel type; size, and shape as required.

2.03 **FABRICATION**

A. Fabricate concrete reinforcing in accordance with CRSI Manual of Practice.

B. Detail and fabricate in accordance to ACI 315 and ACI 318.

C. Fabrication: Conform with CRSI. Provide all bars in longest lengths available or required; conform to sizes, shapes, and dimensions shown on Structural Drawings.

PART 3 - EXECUTION

3.01 **PLACEMENT (REINFORCING STEEL)**

A. Place in accordance with CRSI. Place, support and secure reinforcement against displacement. Do not deviate from required position.

B. Place in accordance to ACI 315 and ACI 318.

C. Do not displace or damage vapor barrier.

D. Accommodate placement of formed openings.

E. Unless shown otherwise, maintain minimum 3/4-inch space between all formwork and reinforcement, tie wires, etc.

F. Provide concrete cover over reinforcement as follows; unless noted otherwise:

1.	Concrete cast against Earth:	3 inches.
2.	Concrete exposed to Weather or Earth:	2 inches.
3.	Ties on Beams and Columns:	1-1/2 inches.
4.	Walls and Slabs not exposed to Weather:	3/4 inch.

END OF SECTION

PAGE LEFT BLANK INTENTIONALLY

SECTION 03 30 00
CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 REFERENCES

A. ACI 117 – Tolerances for Concrete Construction and Materials

B. ACI 301 – Structural Concrete for Buildings.

C. ACI 302 – Guide for Concrete Floor and Slab Construction.

D. ACI 303R – Guide to Cast-In-Place Architectural Concrete Practice.

E. ACI 304 – Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete.

F. ACI 305R – Hot Weather Concreting.

G. ACI 306R – Cold Weather Concreting.

H. ACI 308 – Standard Practice for Curing Concrete.

I. ACI 315 – Details and Detailing of Concrete Reinforcement.

J. ACI 318 – Building Code Requirements for Structural Concrete.

K. ASTM C 309 – Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete

L. ASTM C 1315 – Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete

M. ASTM E 1155 – Standard Test Method for Determining FF Floor Flatness and FL Floor Levelness Numbers

N. ASTM E 1643 – Standard Practice for Installation of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs

O. ASTM E 1745 – Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs

P. IBC – International Building Code.

Q. Structural General Notes on Drawings.

1.02 REGULATORY REQUIREMENTS

A. Conform to International Building Code and local Building Department requirements for testing, inspection, etc. during construction.

1.03 TESTS

A. Testing and analysis of concrete will be performed under provisions of Section 01 45 00.

B. Provide copy of concrete mix design submittal for each class of concrete to Testing Lab ten (10) days prior to commencement of work.

1.04 **SUBGRADE APPROVAL**

A. Subgrade Approval: Do not proceed with on-grade concrete placement over any subgrade condition until the Soils Engineer and testing lab have approved existing subgrade, structural backfill, and utility trench backfill.

B. Coordination: Contractor shall contact and schedule review of subgrade with Soils Engineer and testing laboratory ten (10) days (minimum) prior to any on-grade concrete placement.

1.05 **SUBMITTALS FOR REVIEW**

A. Section 01 34 00 - Submittals: Procedures for submittals.

B. Product Data: Provide data on joint devices, attachment accessories, admixtures and finishes products.

1.06 **QUALITY ASSURANCE**

A. Quality Control: Conform to requirements of Section 01 45 00.

B. Codes and Standards: Comply with provisions of references listed in Paragraph 1.01 (above), except where more stringent requirements are shown or specified. Refer also to Structural General Notes on Structural Drawings.

C. Concrete and Formwork: Performed by company experienced for five (5) years (minimum) in construction of top quality, site cast concrete work, familiar with and capable of producing concrete work in accordance with referenced standards listed in Paragraph 1.01 (above) and these specifications and drawings.

D. Architectural Concrete: Perform Work in accordance with ACI 301 and ACI 303R.

1.07 **ALTERNATES**

A. See Section 01 23 00 for bidding alternates affecting the work of this Section.

1.08 **COLORS**

A. Colors are specified on the Colors and Materials Schedule on drawings.

PART 2 - PRODUCTS

2.01 **CONCRETE MATERIALS AND MIX**

A. Concrete: Refer to Structural General Notes on Structural Drawings.

2.02 **CONCRETE REINFORCING**

A. Concrete Reinforcing: Refer to Section 03 20 00 Concrete Reinforcing.

2.03 **EXTERIOR CONCRETE PAVING**

B. Exterior Concrete Paving: Refer to Section 32 13 13 Exterior Concrete Paving.

2.04 ADMIXTURES

A. Admixtures: Only upon Structural Engineer's approval.

B. Air Entertainment Admixture: ASTM C260 at all exterior concrete.

2.05 ACCESSORIES

A. Bonding Agent: 100% acrylic emulsion; “Acrylic Bond” manufactured by the Meadow Burke or approved. Use for all plug or patch work on cured concrete to increase bond strength.

B. Non-Shrink Grout (Non-Structural): Premixed compound consisting of non-metallic aggregate, cement, water reducing, and plasticizing agents, capable of 4500 PSI at seven (7) days.

C. Non-Shrink Grout (Structural): See Structural General Notes on Structural Drawings.

2.06 JOINT DEVICES AND FILLER MATERIALS

A. Joints: Refer to Structural General Notes and Details on Structural Drawings.

B. Joint Filler: ASTM D994; asphalt impregnated fiberboard or felt, 1/4 inch thick; full depth of slab.

2.07 VAPOR BARRIER

A. Materials:

1. Vapor barrier shall exceed all of the following performance criteria:

   a. Permeance: Less than 0.01 Perms [grains/(ft^2 · hr · inHg)] as tested in accordance with ASTM E 1745 Section 7.

   b. Other performance criteria:

      1) Strength: ASTM E 1745 Class A.

      2) Puncture Resistance: ASTM D 1709.

      3) Tensile Strength: ASTM D 882.

      4) Thickness: 15 mils minimum.

2. Vapor Barrier: Basis of Design: Stego Wrap 15-mil Vapor Barrier.
   Manufacturer: Stego Industries LLC, (877) 464-7834 www.stegoindustries.com.

B. Accessories: Provide all manufacturer’s accessories for complete installation including:

   1. Seam Tape: Stego Tape by Stego Industries LLC,
      (877) 464-7834 www.stegoindustries.com.

   2. Vapor-proofing mastic: Stego Mastic by Stego Industries LLC,
      (877) 464-7834 www.stegoindustries.com.

2.08 CURING MATERIALS

A. Water: Clean and drinkable.

B. Curing Membrane: White 4 mil polyethylene film or a combination sheet plastic and paper, 20 ft minimum roll width.

C. Concrete Curing Compound: A transparent curing, sealing, and dust proofing compound for interior and exterior concrete.

1. No oils, saponifiable resins waxes or chlorinated rubbers.

2. Coordinate work with 07 92 00 - Sealants.

3. Apply to concrete as recommended by manufacturer's product data. Verify compatibility with flooring adhesives where floor covering is scheduled.

D. Absorptive Mat: Burlap-polyethylene minimum 8 oz./sq yd., bonded to prevent separation during use.

2.09 CONCRETE SEALER

A. Manufacturers:

1. W.R. Meadows, Inc.: VOCOMP-20.

2. Dayton Superior: Cure & Seal 1315 J22WB.

3. BASF Corporation: MasterKure CC 200 WB.

4. OR approved.

B. Sealers shall be non-yellowing, clear, penetrating, non-flammable, odorless, low VOC, water-based conforming to ASTM C309, Type 1, Class B. Acrylic polymer minimum 20% solids by resins weight.

2.10 CEMENTITIOUS UNDERLAYMENT

A. Portland Cement-based powder with non-re-emulsifiable architectural grade, acrylic latex, liquid bonding agent suitable for interior and exterior use on cured concrete. Product must be capable of smooth, thin edge tapers.

1. Raeco Products - Raecolith R-25.

2. Substitutions: Under provisions of Section 01 60 00.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify site conditions under provisions of Section 01 31 00.

B. Verify requirements for concrete cover over reinforcement.

C. Verify that anchors, seats, plates, reinforcement, and other items to be cast into concrete are accurately placed, positioned securely, and will not cause hardship in placing concrete.

3.02 PREPARATION

A. Prepare previously placed concrete by cleaning with steel brush and applying bonding agent in accordance with manufacturer's instructions.

B. In locations where new concrete is dowelled to existing work, drill holes in existing concrete, insert steel dowels, and pack solid with non-shrink grout.

C. Coordinate the placement of joint devices with erection of concrete formwork and placement of form accessories.

D. Vapor Retarder: Place vapor retarder in accordance with manufacturer’s recommendations and ASTM E 1643. Ensure all penetrations and seams are sealed and defects repaired.

E. Responsibility: Contractor is responsible for correcting at his own expense, any moisture related floor-coating failures due to improper installation and protection of vapor barrier.

F. Embedded Items:

1. No aluminum items shall be embedded in any concrete.

2. All embed plates shall be securely fastened in place.

3. All embedded steel items exposed to earth shall be galvanized.

4. All embedded steel items exposed to weather shall be painted unless noted as galvanized.

5. Embedded conduit in not permitted in concrete slabs on metal deck unless specifically noted on the structural drawings.

6. Embedded flexible conduit is permitted in other cast in place concrete slabs with a thickness greater or equal to 5-1/2 inches. Where permitted it may be placed on top of the bottom mat of reinforcing. The outside diameter of the conduit shall not be greater than 1-inch. A minimum of 2-inches clear shall be provided between conduit and parallel reinforcing. Space conduits a minimum of 12-inches apart, where this is not possible notify engineer for additional reinforcing requirements.

3.03 NOTIFICATION PRIOR TO PLACING CONCRETE

A. Notify Architect/Engineer minimum twenty-four (24) hours prior to commencement of concreting operations.

B. Notify Owner's testing lab prior to concrete placement and coordinate their field inspections.

C. Notify Building Department in accordance with their requirements prior to concrete placement.

3.04 PLACING CONCRETE

A. Place concrete in conformance with ACI 304. Conform to ACI 305R for hot weather concreting

and ACI 306R for cold weather concreting. Conform to ACI 303R for Architectural concreting.

B. Notify Architect/Engineer minimum twenty-four (24) hours prior to commencement of operations.

C. Ensure reinforcement, inserts, embedded parts, formed expansion and contraction joints, are not distributed during concrete placement.

D. Install vapor barrier under interior slabs on grade. Lap joints minimum 6 inch and seal watertight by taping edges and ends.

E. Repair vapor barrier damaged during placement of concrete reinforcing. Repair with vapor retarder material; lap over damaged areas minimum 6 inch and seal watertight.

F. Separate slabs on grade from vertical surfaces with thick joint filler.

G. Place joint filler in pattern placement sequence. Set top to required elevations. Secure to resist movement by wet concrete.

H. Extend joint filler from bottom of slab to within 1/8 inch of finished slab surface.

I. Install joint devices in accordance with manufacturer's instructions.

J. Install construction joint devices in coordination with pattern placement sequence. Set top to required elevations. Secure to resist movement by wet concrete.

K. Install joint device anchors. Maintain correct position to allow joint cover to be flush with floor and wall finish.

L. Install joint covers in longest practical length, when adjacent construction activity is complete.

M. Place concrete continuously between predetermined expansion, control, and construction joints.

N. Do not interrupt successive placement; do not permit cold joints to occur.

O. Place floor slabs in pattern indicated.

P. Saw cut joints within twenty-four (24) hours after placing. Use 3/16 inch thick blade, cut into 1/4 depth of slab thickness.

3.05 CONCRETE FINISHING

A. Unformed Surfaces

1. Finish concrete floor surfaces in accordance with ACI 301.

2. Wood float surfaces that will receive tile flooring with full bed setting system.

3. Steel trowel surfaces that will receive carpeting, resilient flooring, seamless flooring or thin set quarry tile.

4. Steel trowel surfaces that are scheduled to be exposed.

5. In areas with floor drains, maintain floor elevation at walls; pitch surfaces uniformly to drains.

B. Formed Surfaces

1. Tolerances: Tolerances in accordance with ACI 117 and as indicated.

2. As-Cast Rough Form: Provide for surfaces not exposed to public view a surface finish SF-1.0. Patch holes and defects in accordance with ACI 301.

3. Standard Smooth Finish: Provide for surfaces exposed to public view a surface finish SF-3.0. Patch holes and defects in accordance with ACI 301.

C. Architectural Concrete Finishes

1. Concrete finishes shall conform to the approved finishes. Finishing shall be accomplished at the time of concrete placement or immediately after formwork removal, as follows:

a. Smooth finish: (1) As cast using flat smooth nonporous forms. (2) As cast using fluted, sculptured, board finish or textured form liners.

3.06 TOLERANCES

A. Floor slab surfaces shall be finished to meet a floor surface classification of “flat” in accordance with ACI 117. Floor levelness testing is not required for sloped or elevated slabs.

B. Finished Floor Slab: Surfaces that do not meet the required tolerance shall be corrected by localized grinding of high spots or by a concrete topping / cementitious underlayment to fill low areas.

3.07 CURING AND PROTECTION

A. Cure floor surfaces in accordance with ACI 308.

B. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.

C. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.

D. Spraying: Spray water over floor slab areas and maintain wet for seven (7) days.

3.08 CONCRETE SEALER

A. Prior to installation of sealer, check and repair any defects in the slab surface. Grind high spots and cut out and re-pour low spots.

B. Install specified sealer in strict compliance with manufacturer's specifications. Contractor to dispose of all waste materials resulting from sealer application in accordance with applicable regulations.

C. Install clear sealer at interior concrete floor slabs.

3.09 VAPOR BARRIER

A. Preparation: Ensure that base material is approved by Architect or Geotechnical Engineer.

1. Level and compact base material.

B. Installation: Install vapor barrier in accordance with manufacturer's instructions and ASTM E 1643.

1. Unroll vapor barrier with the longest dimension parallel with the direction of the concrete placement.

2. Lap vapor barrier over footings and/or seal to foundation walls.

3. Overlap joints 6 inches and seal with manufacturer's tape.

4. Seal all penetrations (including pipes) per manufacturer's instructions.

5. No penetration of the vapor barrier is allowed except for reinforcing steel and permanent utilities.

6. Repair damaged areas by cutting patches of vapor barrier, overlapping damaged area 6 inches and taping all sides with tape.

3.10 PATCHING

A. Allow Architect/Engineer to inspect concrete surfaces immediately upon removal of forms.

B. Excessive honeycomb or embedded debris in concrete is not acceptable. Notify Architect/Engineer upon discovery.

C. Patch imperfections in accordance with ACI 301 and ACI 303R.

3.11 DEFECTIVE CONCRETE

A. Defective Concrete: Concrete not conforming to required lines, details, dimensions, tolerances or specified requirements.

B. Repair or replacement of defective concrete will be determined by the Architect/Engineer.

C. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of Architect/Engineer for each individual area.

3.12 PROTECTION

A. Protect all concrete from mechanical damage or contamination by any substance which would adversely affect the strength, integrity, appearance, usefulness or successful performance of coatings, finishes, or floor coverings applied to the concrete.

B. Contractor is solely responsible for the means and methods employed to afford this protection.

END OF SECTION

SECTION 04 05 10
MASONRY MORTARING AND GROUTING

PART 1 - GENERAL

1.01 REFERENCES

A. ASTM C5 - Quicklime for Structural Purposes.

B. ASTM C94 - Ready-Mixed Concrete.

C. ASTM C144 - Aggregate for Masonry Mortar.

D. ASTM C150 - Portland Cement.

E. ASTM C207 - Hydrated Lime for Masonry Purposes.

F. ASTM C270 - Mortar for Unit Masonry.

G. ASTM C387 - Packaged, Dry, Combined Materials for Mortar and Concrete.

H. ASTM C476 - Grout for Reinforced and Non-Reinforced Masonry.

I. The National Masonry Systems Guide (Northwest Edition), Masonry Institute of Washington, Seattle, Washington (206) 582-5072.

J. Structural General Notes on Structural Drawings.

1.02 TESTS

A. Testing of mortar and grout will be performed under provisions of Section 01 45 00.

1.03 SUBMITTALS

A. Submit product data under provisions of Section 01 34 00.

B. Include mortar and grout design mix and admixtures.

1.04 ENVIRONMENTAL REQUIREMENTS

A. Conform to recommendations of Masonry Systems Guide during cold, hot, or wet weather.

1.05 ALTERNATES

A. See Section 01 23 00 for bidding alternates affecting work of this Section.

1.06 COLORS

A. Colors are specified on the Colors and Materials Schedule on drawings.

PART 2 - PRODUCTS

2.01 **MORTAR AND GROUT MIXES**

A. General:

1. Refer to Structural General Notes on Structural Drawings.

2. Do not add admixtures, including color pigments, air-entraining agents, accelerators, retarders, water repellant agents, anti-freeze compounds, or other admixtures unless otherwise indicated.

3. Do not use calcium chloride in mortar or grout.

B. Mortar for Unit Masonry: Comply with ASTM C270, Type S.

1. Add water repellant agent to mortar: Dry-Block" mortar admixture by W.R. Grace & Co.

C. Mortar Color Pigment: Solomon Colors Inc. SGS H series color units. Iron oxide pigments for Portland cement and Lime mortar mixtures.

D. Grout for Unit Masonry: Comply with ASTM C476 for grout for use in construction of reinforced and non-reinforced unit masonry.

E. Mortar for Glass Block: Type S in accordance with ASTM C270; with clean, white quartzite-type sand free of iron compounds, in accordance with ASTM C144, no less than 100% passing No. 16 sieve. Provide integral waterproofer, Sonneborn Hydrocide powder. Mortar shall conform to glass block manufacturer's recommendations.

F. Mixing: Combine and thoroughly mix cement, water, and aggregates in a mechanical batch mixer; comply with referenced ASTM standards for mixing time and water content.

PART 3 - EXECUTION

3.01 **INSTALLATION**

A. Mortar and grout installation is specified in Section 04 20 00.

B. Work grout into cores and cavities to eliminate voids.

C. Do not displace reinforcing steel or anchors when placing grout.

D. Clean concrete grout spaces of excess mortar and debris.

END OF SECTION

SECTION 04 20 00
UNIT MASONRY

PART 1 - GENERAL

1.01 REFERENCES

A. ACI 315 - Standard Practice for Detailing Reinforced Concrete Structures.

B. ASTM C90 - Hollow Load-Bearing Concrete Masonry Units.

C. MIW - Masonry Institute of Washington - Northwest Masonry Guide.

D. IBC - International Building Code.

E. CRSI - Concrete Reinforcing Steel Institute - Manual of Standard Practice.

F. Structural General Notes on Structural Drawings.

1.02 SUBMITTALS

A. Submit product data and shop drawings under provisions of Section 01 34 00.

B. Submit product data on CMU and wall ties.

C. Indicate bar sizes, spacings, locations, and quantities of reinforcing steel, bending and cutting schedules, and supporting and spacing devices.

1.03 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to jobsite on palates with weatherproof covering.

B. Store masonry units on palates that allow air circulation under stacked unit.

C. Cover and protect against wetting and weather prior to use.

1.04 ENVIRONMENTAL REQUIREMENTS

A. Conform to recommendations of MIW - Northwest Masonry Guide for Masonry Construction during cold, hot, or wet weather.

1.05 ALTERNATES

A. See Section 01 23 00 for bidding alternates affecting the work of this Section.

1.06 COLORS

A. Colors are specified on the Colors and Materials Schedule on drawings.

PART 2 - PRODUCTS

2.01 MANUFACTURERS - CONCRETE MASONRY UNITS

A. Concrete Masonry Units: Baselite Concrete Products, Mutual Materials

B. Acoustical Concrete Masonry Units: Johnson Concrete Company, SOUNDBLOX product.

C. Glass Block: Pittsburgh Corning Corp.

D. Substitutions: Under provisions of Section 01 60 00.

2.02 CONCRETE MASONRY UNITS (CMU)

A. General: Provide hollow concrete masonry units conforming to ASTM C90, Grade N, medium weight 50/50 (above-grade) and normal weight sand and gravel (below-grade). Linear shrinkage shall not exceed 0.065%. Provide both load bearing and non-load bearing (veneer) units in sizes and locations shown on Drawings. Nominal modular face size of 8 in. x 16 in.

B. Shapes: Provide shapes necessary to achieve the design shown on the Drawings and provide finish face at all conditions/surfaces exposed to view. Provide solid bottom lintels at head of openings in walls where exposed to view. Provide 8 in. corner returns on veneer corner block.

C. Face Configuration: Provide both load bearing units with face configuration as indicated on drawings.

D. Concrete masonry units shall incorporate Grace Construction Materials “Dry-Block” integral water repellent admixture.

2.03 REINFORCEMENT

A. Reinforcing Steel: Refer to Structural General Notes on Structural Drawings.

B. Reinforcing Steel Position Ties: 9 gauge galvanized steel, Dur-O-Wall or approved.

2.04 MASONRY FLASHING AND ACCESSORIES

A. Flashing: "Perm-A-Barrier Wall Flashing" as manufactured by W.R. Grace & Co. Flexible, self-sealing, self-healing 40 mil thick.

B. Mortar Diverter: Mortar net drainage system by Mortar Net.

C. Weep Vents: Mortar net weep vents by Mortar Net.

2.05 MORTAR

A. Mortar mix shall incorporate Grace Construction Materials “Dry-Block” integral water repellent admixture.

2.06 ACCESSORIES

A. Control Joints: Extruded rubber material, ASTM D-2000 2AA-805. Model: RS series. Types: RS-12, RS-8 and RS Standard. Hohmann & Barnard Inc or equal.

1. Install in accordance with manufacturer’s installation instruction.

B. Weep Holes: 3/8 inch O.D. x 4 inch long, round polyethylene plastic tubes, with both wick and screen insert. Stainless steel screen. Hohmann & Barnard, Inc. #341W/S.

C. Mortar Trap: High-density polyethylene (HDPE) strands woven into 90% open mesh construction. Provide in thickness of *1-1/2 inch*. Mortar trap provided in 10 inch high x 4 feet long sections. Hohmann & Barnard, Inc. Mortar Trap.

PART 3 - EXECUTION

3.01 PREPARATION

A. Verify items provided by other Sections of work are properly sized and located.

B. Establish lines, levels, and coursing. Protect from disturbance.

C. Provide temporary bracing during erection of masonry work. Maintain in place until building structure provides permanent bracing.

D. All concrete unit masonry exposed to view shall have undamaged faces, discard units with chipped or scratched faces.

3.02 COURSING

A. Place masonry to lines and levels indicated.

B. Maintain masonry courses to uniform width. Make vertical and horizontal joints equal and of uniform thickness.

C. Match existing CMU coursing adjacent.

D. Lay concrete unit masonry in running bond.

3.03 PLACING AND BONDING

A. Lay masonry in full bed of mortar, properly jointed with other work. Buttering corners of joints, and deep or excessive furrowing of mortar joints are not permitted.

B. Fully bonded intersections and external and internal corners.

C. Do not shift or tap masonry units after mortar has taken initial set. Where adjustment must be made, remove mortar and replace.

D. Remove excess mortar; strike mortar flush with face of ribbed units to match appearance of existing masonry joints. (Wait until mortar is quite stiff to prevent mortar slumping in joint or any concave shape to joint.) Joints shall not have any "shelf" or crack which could collect water.

E. Perform jobsite cutting with proper tools to provide straight unchipped edges. Take care to prevent breaking masonry unit corners or edges.

F. Tool all mortar joints to compress mortar and provide consistent, uniform finish on mortar free of voids or irregularities.

G. All masonry exposed to view shall have finish face (saw cuts or grouted cells not acceptable).

H. Lay sound absorbing CMU in strict accordance with manufacturer's requirements in order to achieve published sound absorption coefficients.

I. Construct control joints where shown on drawings and where recommended by MIW in accordance with MIW recommendations.

3.04 REINFORCEMENT

A. See Structural Drawings.

B. Place reinforcement in accordance with CRSI.

C. Locate reinforcing splices at points of minimum stress. Review location of splices with Architect/Engineer.

D. Place reinforcing bars supported and secured against displacement. Maintain position within 1/2 in. of true dimension. Use reinforcing steel position ties at top, bottom, and intervals in-between not exceeding 192 bar diameters in accordance with the UBC.

E. Verify reinforcement is clean, free of scale, dirt, or other foreign coatings that would reduce bond to grout.

3.05 GROUTING

A. Solid grout all CMU cells and void spaces containing reinforcing steel, embedded items, or thru-bolts; see Structural Drawings.

B. Solid grout cells of all CMU.

C. Solid grout all cells of integrally-colored CMU to receive a clear water repellent sealer.

D. Set anchor bolts and imbedded items required in fresh grout prior to initial set.

3.06 TOLERANCES

A. Variation from Unit to Adjacent Unit: 1/32 inch maximum.

B. Variation from Plane of Wall: 1/4 inch in 10 ft and 1/2 inch in 20 ft or more.

C. Variation from Plumb: 1/4 inch per story non-cumulative; 1/2 inch in two stories or more.

D. Variation from Level Coursing: 1/8 inch in 3 ft: 1/4 inch in 10 ft; 1/2 inch maximum.

E. Variation of Joint Thickness: 1/8 inch in 10 ft.

3.07 LINTELS

A. Refer to Structural Drawings and Notes; install either masonry or steel lintel at every opening in masonry wall.

3.08 BUILT-IN WORK

A. As work progresses, build-in metal doorframes, anchor bolts, plates, veneer support angles and other items to be built in the work supplied by other Sections.

B. Build-in items plumb and level.

C. Bed anchors of metal doorframes in mortar joints. Fill frame voids solid with mortar.

D. Do not build-in organic materials subject to deterioration.

E. Coordinate installation of sleeves for openings and conduit run in walls with those sections responsible.

3.09 CUTTING AND FITTING

A. Cut CMU with masonry saw to accommodate work of other trades and to fit configuration and layout shown on Drawings. Coordinate with other Sections of work to provide correct size, shape, and location.

B. Obtain approval prior to cutting or fitting any area not indicated or where appearance or strength of masonry work may be impaired.

3.10 WALL FLASHING

A. Install continuous, unbroken masonry flashing in locations shown on Drawings and wherever recommended by MIW for weatherproof masonry construction including, but not limited to, at bottom of all masonry walls, and at the head of all openings, horizontal angles or floor slabs projecting into masonry wall.

B. Lap all joints in flashing 6 inch minimum seal with lap sealant.

C. Install weep holes 2 ft 0 in. on center maximum at all flashings to direct water to building exterior. Keep cavity clean to prevent debris blocking weep hole drainage.

3.11 CAVITY SPACE

A. Provide mortar barrier to prevent mortar from plugging weep holes.

B. Install weep holes in veneer at 32 inch o.c. horizontally above through-wall flashings.

C. Install mortar trap continuous within cavity space. Provide and install mortar trap for full width of cavity space.

D. Install accessories in accordance to manufacturer’s installation instructions.

3.12 CLEANING AND REPAIR

A. Fill all holes, chipped corners, or edges and defects on exposed faces of CMU with mortar.

B. Replace defective mortar. Match adjacent work.

C. Clean soiled surfaces with a solution that will not harm masonry or adjacent materials. Consult masonry manufacturer for acceptable cleaners.

D. Use non-metallic tools in cleaning operations.

E. Remove any visible mortar or grout from exposed faces of CMU.

3.13 PROTECTION

A. Protect finished installation from damage and stains.

B. Maintain protective boards at exposed external corners that may be damaged by construction

activities.

C. Provide protection without damaging completed work.

D. At day's end, cover unfinished walls to prevent moisture infiltration.

END OF SECTION

SECTION 05 12 00
STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.01 REFERENCES

A. ANSI/AISC 303 Code of Standard Practice for Steel Buildings and Bridges – Section 10 Architecturally Exposed Structural Steel (AESS).

B. ANSI/AISC 360 - Specification for Structural Steel Buildings.

C. ASTM A36/A36M - Structural Steel.

D. ASTM A53 - Hot-Dipped, Zinc-coated Welded and Seamless Steel Pipe.

E. ASTM A108 - Steel Bars, Carbon, Cold-Finished, Standard Quality.

F. ASTM A123 - Zinc (Hot Dip Galvanized) Coatings on Iron and Steel Products.

G. ASTM A307 - Carbon Steel Externally Threaded Standard Fasteners.

H. ASTM A325 - High Strength Bolts for Structural Steel Joints.

I. ASTM A500 - Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Round and Shapes.

J. ASTM A501 - Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.

K. ASTM A780 – Repair of Damaged and Uncoated Areas of Hot Dip Galvanized Coatings.

L. AWS A2.4 - Symbols for Welding, Brazing, and Nondestructive Examination.

M. AWS D1.1 - Structural Welding Code.

N. SSPC (Steel Structures Painting Council) - Painting Manual.

O. UL - Fire Resistance Directory.

P. Structural General Notes on Structural Drawings.

1.02 SUBMITTALS

A. Section 01 34 00 - Submittals: Procedures for submittals.

B. Shop drawings shall detail all structural members showing sizes, spacing, cambers, connections, openings, welds, etc. showing all aspects of fabrication.

1.03 QUALITY ASSURANCE

A. Fabricate structural steel members in accordance with AISC Code of Standard Practice.

B. Fabricator: Company specializing in performing the work of this Section with minimum five (5) years documented experience.

C. Erector: Company specializing in performing the work of this Section with minimum five (5) years documented experience.

D. Welder(s): Qualified within previous twelve (12) months for type of welding required for this project in accordance with AWS D1.1 and AWS D1.4 and/or WABO (Washington Association of Building Officials) certified as required by local Building Department.

1.04 **SPECIAL INSPECTIONS**

A. Coordinate and pay for special inspections required by governing agencies.

1.05 **TESTS**

A. Testing of field welding will be performed under provisions of Section 01 45 00.

1.06 **ALTERNATES**

A. See Section 01 23 00 for bidding alternates affecting work of this Section.

1.07 **COLORS**

A. Colors are specified on Colors and Materials Schedule on drawings.

PART 2 - PRODUCTS

2.01 **MATERIALS**

A. Structural Steel Members: Refer to structural notes on structural drawings.

B. Structural Tubing: Refer to structural notes on structural drawings.

C. Bolts, Nuts and Washers: Refer to structural notes on structural drawings.

D. Welding Materials: Refer to structural notes on structural drawings.

E. Non-Shrink Grout: Refer to structural notes on structural drawings.

F. Shop and Touch-Up Primer: SSPC 15, Type 1, red oxide. Provide for steel surfaces that are not indicated or specified to be galvanized, and are not indicated or specified to be finish painted in accordance with Section 09 91 00.

G. Touch-up Primer for Galvanized Surfaces: SSPC 20, Type 1, inorganic, zinc rich.

2.02 **FABRICATION**

A. Field verify actual dimensions and conditions on site prior to shop fabrication.

B. Fabricate in accordance with AISC Specifications.

C. Continuously seal joined members by continuous welds. Grind exposed welds smooth.

D. Welding shall conform to AWS D1.1.

2.03 **FINISH**

A. Prepare structural component surfaces in accordance with SSPC SP-3 for interior locations. SSPC SP-6 for exterior locations.

B. Protective Coatings:

1. Shop prime structural steel members with primer paint. Do not shop prime steel that is indicated or specified to be galvanized. For steel that is indicated or specified to be field finish painted, coordinate shop primer with the paint system specified in Section 09 91 00.

a. Shop prime surfaces to be embedded in concrete or mortar to a depth of 2 inches.

b. Do not shop prime surfaces to be field welded.

c. Do not shop prime surfaces to be high-strength bolted with slip-critical connections.

2. Galvanized Coating: All structural members on building exterior, exposed to outdoor atmosphere or shown on drawings shall be hot-dip galvanized in accordance with ASTM A123; provide minimum 2.0 oz/sq. ft. galvanized coating. Do not apply pre-treatments or passivation to steel members that are indicated to be primed and painted.

PART 3 - EXECUTION

3.01 **EXAMINATION**

A. Verify that field conditions are acceptable and are ready to receive work.

B. Beginning of installation means erector accepts existing conditions.

3.02 **ERECTION**

A. Allow for erection loads and for sufficient temporary bracing to maintain structure safe, plumb, and in true alignment until completion of erection and installation of permanent bracing.

B. Field weld components in accordance with AWS D1.1.

C. Splice members only where indicated.

D. After erection, prepare any unprimed bare metal surfaces on primed or galvanized steel in accordance with SSPC SP-3 and prime/paint.

E. Do not field cut or alter structural members without approval of Design Consultant.

F. Grout under baseplates.

3.03 **ERECTION TOLERANCES**

A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch.

C. Structural Steel Members: As specified in AISC - Code of Standard Practice for Steel Buildings and Bridges - Section 7 – Erection.

3.04 ADJUSTING AND CLEANING

A. Galvanized Surfaces: Clean field welds, bolted connections and abraded area. Repairs to galvanized surfaces shall be performed in accordance with ASTM A780.

END OF SECTION

SECTION 05 31 00
STEEL DECKING

PART 1 - GENERAL

1.01 REFERENCES

A. AISI - Specification for the Design of Cold-Formed Steel Structural Members.

B. ASTM A446 - Steel Sheet, Zinc-Coated, (Galvanized) by the Hot-Dip Process, Structural (Physical) Quality.

C. ASTM A525 - Steel Sheet, Zinc-Coated, Galvanized by the Hot-Dip Process.

D. AWS D1.1 - Structural Welding Code.

E. SDI - Design Manual for Composite Decks, Form Decks, Roof Decks.

1.02 SUBMITTALS

A. Submit shop drawings and product data under provisions of Section 01 34 00.

B. Shop Drawings shall indicate decking type and gauge, decking plan, support locations, projections, openings, welding schedule, pertinent details, and accessories.

C. Product data shall indicate deck profile characteristics and dimensions, structural properties, finishes, and acoustic noise reduction coefficient.

1.03 QUALIFICATIONS

A. Installer: Company specializing in performing the work of this Section with minimum five (5) years experience.

B. Welder(s): Qualified within previous twelve (12) months for type of welding required for this project in accordance with AWS D1.1 and AWS D1.4 and/or WABO (Washington Association of Building Officials) certified as required by local Building Department.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site under provisions of Section 01 60 00.

B. Store and protect products under provisions of Section 01 60 00.

C. Cut plastic wrap to encourage ventilation.

D. Separate sheets and store decking on dry wood sleepers; slope for positive drainage.

1.05 ALTERNATES

A. See Section 01 23 00 for bidding alternates affecting the work of this Section.

1.06 **COLORS**

A. Colors are specified on Colors and Materials Schedule on the drawings.

PART 2 - PRODUCTS

2.01 **MATERIALS**

A. Sheet Steel: See Structural Drawings: Provide G60 galvanized coating conforming to ASTM A525.

B. Welding Materials: AWS D1.1 is minimum requirement; see Structural Drawings for additional special requirements.

C. Touch-Up Primer: Zinc chromate type.

2.02 **ACCESSORIES**

A. Acoustical Insulation: Glass fiber type, minimum 1.1 lb/cu ft density; profiled to suit decking.

2.03 **FABRICATION**

A. Steel Decking: See Structural Drawings for gauge, profile, and special requirements.

B. Metal Closure Strips, Cover Plates, and Related Accessories: See Structural Drawings for gauge, configuration, and special requirements.

2.04 **FINISH**

A. Passivation: Do not apply pre-treatments or passivation to deck surfaces that are indicated to be field primed and painted.

B. Primer: Factory apply manufacturer's standard primer finish to the underside of steel decking to be installed in areas where it will be exposed to view and painted.

PART 3 - EXECUTION

3.01 **EXAMINATION**

A. Verify that field conditions are acceptable and are ready to receive work.

B. Beginning of installation means installer accepts existing conditions.

3.02 **INSTALLATION**

A. Erect metal decking in conformance with SDI Design Manual for Composite Decks, Form Decks, Roof Decks.

B. Bear ends and perimeter of decking on structural supports with 3 in. minimum overlap between sheets. Align and level.

C. Fasten deck to steel support members at ends and intermediate supports with welds per Structural Drawings.

D. Weld in conformance with AWS D1.1.

E. Connect decking sidelaps as shown on Structural Drawings.

F. Cut openings for work of other trades.

G. Install acoustic insulation in deck flute of acoustic decking.

END OF SECTION

PAGE LEFT BLANK INTENTIONALLY

SECTION 05 50 00
METAL FABRICATIONS

PART 1 - GENERAL

1.01 **REFERENCES**

A. AAMA – American Architectural Manufacturers Association.

B. AAMA 611 – Specification for Anodized Architectural Aluminum.

C. AAMA 2605 – Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Architectural Extrusions and Panels.

D. Aluminum Association – Aluminum Design Manual.

E. ANSI/AISC 303 Code of Standard Practice forSteel Buildings and Bridges – Section 10 Architecturally Exposed Structural Steel (AESS).

F. ANSI/AISC 360 - Specification for Structural Steel Buildings.

G. ANSI A14.3 - Ladders, Fixed, Safety Requirements.

H. ASTM A36 - Structural Steel.

I. ASTM A53 - Hot-Dipped, Zinc-coated Welded and Seamless Steel Pipe.

J. ASTM A123 - Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

K. ASTM A153 - Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

L. ASTM A283 - Carbon Steel Plates, Shapes, and Bars.

M. ASTM A307 - Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.

N. ASTM A385 - Standard Practice for Providing High Quality Zinc Coatings (Hot Dip)

O. ASTM A500 - Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Round and Shapes.

P. ASTM A501 - Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.

Q. AWS A2.0 - Standard Welding Symbols.

R. AWS D1.1 - Structural Welding Code.

S. OSHA 1910.23 – Occupational Safety and Health Standards – Fixed Ladders.

T. OSHA 1910.25 – Occupational Safety and Health Standards – Stairways.

U. PCI – Powder Coating Institute.

V. SSPC (Steel Structures Painting Council) - Steel Structures Painting Manual.

1.02 **SUBMITTALS**

A. Section 01 34 00 - Submittals: Procedures for submittals.

B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.

C. Indicate welded connections using standard AWS A2.0 welding symbols. Indicate net weld lengths.

1.03 **QUALITY ASSURANCE**

A. Fabricate steel members in accordance with AISC Code of Standard Practice.

B. Perform Work in accordance with Aluminum Association – Aluminum Design Manual.

C. Fabricate (AESS) steel members in accordance with AISC Code of Standard Practice, Section 10.

D. Fabricator: Company specializing in performing the work of this Section with minimum five (5) years documented experience.

E. Erector: Company specializing in performing the work of this Section with minimum five (5) years documented experience.

F. Welder(s): Qualified within previous twelve (12) months for type of welding required for this project in accordance with AWS D1.1 and AWS D1.4 and/or WABO (Washington Association of Building Officials) certified as required by local Building Department.

1.04 **DELIVERY, STORAGE AND PROTECTION**

A. Protect products and fabrications under provisions of Section 01 60 00.

1.05 **ALTERNATES**

A. See Section 01 23 00 for bidding alternates affecting the work of this Section.

1.06 **COLORS**

A. Colors are specified on Colors and Materials Schedule on the drawings.

PART 2 - PRODUCTS

2.01 **MATERIALS - STEEL**

A. Steel Sections: ASTM A36.

B. Steel Tubing: ASTM A500, Grade B.

C. Steel Plates: ASTM A283.

D. Steel Pipe: ASTM A53, Grade B, Schedule 40.

E. Steel Bolts, Nuts, Acorn Nuts, Threaded Rods and Washers: ASTM A307, galvanized to ASTM A153 for galvanized components.

F. Welding Materials: AWS D1.1; type required for materials being welded.

2.02 FABRICATION - MISCELLANEOUS ITEMS

A. Field verify actual dimensions and conditions at site prior to shop fabrication.

B. Fit and shop assemble items in largest practical sections for delivery to site.

C. Fabricate items with joints tightly fitted and secured.

D. Continuously seal joined members by continuous welds. Grind exposed welds smooth.

E. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

F. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.

G. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

H. Eased edges to be smooth, straight and uniform in appearance.

I. Welding shall conform to AWS D1.1.

J. Fabricated Items include but not limited to the following:

1. Bollards: Galvanized steel pipe, refer to drawings for profile, shape and dimensions. Welded fabrication.

2. Dumpster Enclosure Steel Gates (Swinging): Galvanized steel, refer to drawings for profile, shapes and dimensions. Provide all heavy-duty galvanized steel hardware for swinging and locking operation; (3) hinges per gate, cane bolts and padlockable slide bolt. Galvanized steel pipe posts. Welded fabrication.

3. Steel Channel Frame (Sectional Doors): Galvanized steel channels, refer to drawings for profile, shape and dimensions. Welded fabrication.

4. Lintels (Masonry Openings): lintels, refer to drawings for profile, shape and dimensions.

5. Fixed Ladders: Furnish and install fixed Galvanized Steel ladders including all fasteners for complete installation. One-piece welded assembly meeting or exceeding OSHA 1910.23, OSHA 1910.28 and ANSI A14.3 standards. Ladders shall comply with IMC 306.5 requirements. Provide galvanized steel fasteners, bolts, nuts and washers. Refer to floor plan and/or roof plan for ladder locations.

a. Minimum Design and Fabrication Requirements:

(1) Loading: At least two loads of 250 pounds each, concentrated

between any two consecutive attachments, (the number and position of additional concentrated loads of 250 pounds each, determined from anticipated usage of the ladder, shall be included), plus anticipated loads causes by ice buildup, winds, rigging, and impact loads resulting from the use of ladder safety devises.

(2) Ladders shall have rung or step spacing not to exceed 14 inches on center. The uppermost rung shall be a maximum of 24 inches below the upper edge of the roof hatch, roof or parapet as applicable.

(3) Ladders shall have a toe spacing not less than 6 inches deep.

(4) The minimum perpendicular clearance between fixed ladder rungs or steps and any obstruction behind the ladder shall be 7 inches.

(5) There shall be a minimum of 18 inches between rails.

(6) Each rung or step shall be capable of withstanding at least a single concentrated 300-pound load applied to the middle of the rung or step.

(7) Each corrugated rung shall have a minimum 0.75-inch diameter.

(8) Rungs or steps of fixed metal ladders shall be corrugated, knurled, dimpled, coated with skid-resistant material or otherwise treated to minimize slipping.

(9) The side rails of through or side-step fixed ladders shall extend 42 inches above the top of the access level or landing platform served by the ladder.

(10) Climbing Clearance: The distance from the centerline of the rung or steps to the nearest permanent object on the climb side of the ladder shall be a minimum of 30 inches measured perpendicular to the rungs or steps. This distance shall be maintained from the point of ladder access to the bottom of the roof hatch. A minimum clear width of 15 inches shall be provided on both sides of the ladder measured from the midpoint of and parallel with the rungs or steps.

(11) Fixed ladders shall be provided with ladder safety devices where the ladder extends a distance greater than 24 feet above lower levels.

(12) Where a fixed ladder extends more than 24 feet above a lower level, it shall be equipped with safety devices and rest platforms at intervals not exceed 150 feet.

(13) Landing Required: The ladder shall be provided with a clear and unobstructed bottom landing area having a minimum dimension of 30 inches by 30 inches centered in front of the ladder.

2.03 FINISH - STEEL

A. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.

B. Clean surfaces to SSPC SP-6 prior to finishing.

C. Do not prime surfaces in direct contact with concrete or where field welding is required.

D. Protective Coatings:

1. Shop and Touch-Up Primer: SSPC 15, Type 1, red oxide.

2. Prime paint interior items with one (1) coat. Do not shop prime steel that is indicated or specified to be galvanized. For steel that is indicated or specified to be finish painted, coordinate shop primer with the paint system specified in Section 09 91 00.

3. Galvanized Coating: All metal exposed to outdoor atmosphere or shown on drawings shall be hot-dipped galvanized coated to minimum 2.0 oz/sq. ft. zinc coating in accordance with ASTM A385 and ASTM A123.

E. Architecturally Exposed Structural Steel (AESS) Members and Components: Surface preparation SSPC-SP 6 “Commercial Blast Cleaning”; shop priming and finish as specified in Section 09 91 00.

F. Field-Applied Finish: As specified in Section 09 91 00.

PART 3 - EXECUTION

3.01 **EXAMINATION**

A. Verify that field conditions are acceptable and are ready to receive work.

B. Beginning of installation means erector accepts existing conditions.

3.02 **PREPARATION**

A. Obtain Architect/Engineer approval prior to site cutting or making adjustments not scheduled.

B. Clean and strip primed steel items to bare metal where site welding is required.

C. Supply steel items required to be cast into concrete or embedded in masonry with setting templates to appropriate sections.

3.03 **INSTALLATION - MISCELLANEOUS ITEMS**

A. Install items plumb and level, accurately fitted, free from distortion or defects.

B. Provide for erection loads and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.

C. Field weld components indicated on drawings.

D. Perform field welding in accordance with AWS D1.1.

E. Obtain approval prior to site cutting or making adjustments not scheduled.

F. After erection, prime welds, abrasions, and surfaces not shop primed, except surfaces to be in contact with concrete.

3.04 **ERECTION TOLERANCES**

A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch.

C. Maximum Out-of-Position: 1/4 inch.

D. Structural Steel Members: As specified in ANSI/AISC 303 - Code of Standard Practice for Steel Buildings and Bridges - Section 7 – Erection.

3.05 SCHEDULE

A. Provide and install items listed or shown on drawings with anchorage and attachments necessary for installation.

END OF SECTION

SECTION 06 10 00
ROUGH CARPENTRY

PART 1 - GENERAL

1.01 **REFERENCES**

A. APA - American Plywood Association.

B. AWPA - American Wood Preservers Association) Book of Standards.

C. WCLIB - West Coast Lumber Inspection Bureau.

D. WWPA -Western Wood Products Association.

E. SPIB – Southern Pine Inspection Bureau.

F. Structural General Notes.

1.02 **DELIVERY, STORAGE, AND PROTECTION**

A. Section 01 60 00 – Product Requirement: Transport, handle, store, and protect products.

1.03 **COORDINATION**

A. Coordinate and provide solid blocking for wall and ceiling mounted items.

B. Coordinate sequencing and installation of gypsum wallboard for firewall and ceiling assemblies.

1.04 **ALTERNATES**

A. See Section 01 23 00 for bidding alternates affecting the work of this Section.

1.05 **COLORS**

A. Colors are specified on Colors and Materials Schedule on the drawings.

PART 2 - PRODUCTS

2.01 **LUMBER MATERIALS**

A. Lumber Grading Rules: WCLIB or WWPA.

B. Lumber Materials:

1. Framing, Blocking, Plates, Beams, Stringers, Columns and Joists: Reference Structural General Notes.

B. Maximum Moisture Content: 19%.

C. Exterior Finished Lumber (Exposed): Refer to specification Section 06 20 13.

2.02 SHEATHING MATERIALS

A. Plywood Grade and Species: Refer to Structural Notes.

2.03 ACCESSORIES

A. Nail Fasteners: See Structural General Notes; use hot-dipped galvanized steel (American or Canadian manufacture). Use ring-shank nails at catwalk subfloor.

B. Joist Hangers and Framing Connectors: Galvanized steel, sized to suit loads, joists and framing conditions; Simpson, Bowman Morton Manufacturing & Machine, Seattle, WA or approved. Refer to Structural General Notes.

C. Anchors Bolts, Bolts, Nuts, Threaded Rods and Washers: Refer to Structural General Notes. Non-structural anchor bolts shall conform to ASTM A307.

1. Use hot-dipped galvanized type at exterior locations or where exposed to exterior environment.

2. Use stainless steel type where fasteners installed into concrete, brick masonry units and concrete masonry units.

D. Drywall Screws: ASTM C1002, bugle shaped heads, Type W.

E. Sill Sealer: 1/4 inch thick fiberglass, 5-1/2 inch wide.

F. Weather Resistive Barrier: Refer to Section 07 25 00 Weather Resistive Barrier.

G. Membrane Flashing (Self-Adhered): Refer to Section 07 25 00 Weather Resistive Barrier.

H. Subfloor Adhesive: APA approved, waterproof, cartridge dispensed.

I. Weather Resistive Barrier: As specified in Section 07 25 00.

J. Metal Flashing at Wall Openings: Refer to specification Section 07 62 00 Sheet Metal Flashing and Trim.

PART 3 - EXECUTION

3.01 FRAMING

A. Set structural members level and plumb, in correct position.

B. Make provisions for erection loads and for sufficient temporary bracing to maintain structure safe, plumb, and in true alignment until completion of erection and installation of permanent bracing.

C. Place horizontal members, crown side up.

D. Construct framing members' full length without splices.

E. Double members at openings over 1 sq ft. Space short studs over and under opening to stud spacing.

F. Construct double joist headers at floor and ceiling openings and under wall stud partitions that are parallel to floor joists. Frame rigidly into joists.

G. Bridge Joists in Excess of 8 ft Span: Fit solid blocking at ends of members.

H. Place full width continuous sill flashings under framed walls on cementitious foundations.

I. Coordinate installation of glue laminated structural units and wood trusses.

J. Curb roof openings except where prefabricated curbs are provided. Form corners by alternating lapping side members.

K. Provide framing members at all vertical ends/edges of gypsum wallboard and wall sheathing and at ends of floor sheathing.

L. Size rough openings for recessed electrical panels and other recessed equipment to receive gypsum wallboard in 1-hour walls.

M. Provide full depth 2x blocking between framing members wherever required by IBC, Building Official, structural drawings or good construction practice.

N. Provide full-depth 2x solid blocking in continuous row between wall framing members wherever abutted by fire rated ceilings.

O. Install insect screen at vent openings.

P. Provide solid 2x framing members to support toilet compartment pilasters above ceiling.

Q. Install rainscreen wall assembly in accordance to Building Assembly Legend instructions as indicated in Construction Documents.

R. Provide solid blocking or backing for all wall-mounted items.

3.02 PLYWOOD SHEATHING

A. Secure roof sheathing with longer edge perpendicular to framing members and with ends staggered and sheet ends over bearing.

B. Drill roof sheathing for required ventilation area at ridge vent assembly.

C. Secure catwalk subfloor sheathing perpendicular to floor framing with end joints staggered and sheet ends over firm bearing. Attach with continuous bead of subfloor adhesive and ring-shank nails.

D. Secure wall sheathing horizontally perpendicular to wall studs, with ends staggered, over firm bearing. Solid block edges with 2 inch x blocking. Screws at 8 inch o.c. maximum.

E. Weather Resistive Barrier: Provide weather resistive barrier over sheathing in accordance with Section 07 25 00.

F. Membrane Flashing: Provide membrane flashing at all exterior wall openings and penetrations in accordance with Section 07 25 00.

3.03 BACKING

A. Use only 2x6 (minimum) No. 1 or No. 2 Douglas Fir, free of splits or shakes, large knots, checks, holes, or wane.

B. Align face of backing flush with face of framing members.

C. Attach to framing members with minimum four 16 penny nails each piece (2 nails each end).

D. Replace any backing that splits during nailing.

3.04 COORDINATION

A. Install solid 2x wood backing for all wall and ceiling mounted items included in other Sections of these specifications including Division 23 and 26, and any Owner-furnished items shown on the Construction Documents.

B. Coordinate installation of glue laminated structural units, plywood web joists and open web trusses.

C. Coordinate wall tolerance requirements and backing requirements for gypsum wallboard and veneer plaster.

D. Coordinate opening sizes required for work of other trades.

E. Coordinate drilling, cutting, and notching performed by other trades so that structural integrity of framing members is not violated.

F. Coordinate location and height of framing to support expansion tanks with work of Division 23.

G. Coordinate location of solid backing to support toilet compartment pilasters with Section 10 28 13.

3.05 TOLERANCES

A. Faces of Abutting Framing Members: Flush alignment.

B. Framing Members: 1/8-inch maximum from true position.

C. Misalignment of Framing Members: 1/8-inch maximum between adjacent members at center of span/length.

END OF SECTION

SECTION 06 20 23
INTERIOR FINISH CARPENTRY

PART 1 - GENERAL

1.01 REFERENCES

A. ANSI A135.4 - Basic Hardboard.

B. ANSI A208.1 - Mat Formed Wood Particleboard.

C. ANSI A208.2 – Medium Density Fiberboard (MDF) for Interior Applications

D. AWS - Architectural Woodwork Standards. AWI - Architectural Woodwork Institute.

E. FS MMM-A-130 - Adhesive, Contact.

F. HPMA (Hardwood Plywood Manufacturer's Association) HP - American Standard for Hardwood and Decorative Plywood.

G. NEMA (National Electric Manufacturers Association) LD3 – High-Pressure Decorative Laminates.

H. NHLA (National Hardwood Lumber Association).

I. PS 1 - Construction and Industrial Plywood.

J. PS 20 - American Softwood Lumber Standard.

1.02 SUBMITTALS

A. Submit under provisions of Section 01 34 00.

B. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details and accessories. Submit Interior elevations.

C. Samples: Submit two (2) samples of each material specified in this section, minimum 12 inch x 12 inch samples, illustrating specified color and finish.

D. Manufacturer’s installation instructions.

1.03 QUALITY ASSURANCE

A. Perform work in accordance with AWS/AWI Premium Grade quality standards.

B. Comply with "Quality Assurance" provisions, "References, Specifications and Manufacturer's Data".

1. Conform to referenced AWS/AWI standards; Section 2 – Care and Storage, for "Premium Grade" quality product.
2. Conform to referenced AWS/AWI standards; Section 3 - Lumber, for "Premium Grade" quality product.
3. Conform to referenced AWS/AWI standards; Section 4 – Sheet Products, for

"Premium Grade" quality product.

4. Conform to referenced AWS/AWI standards; Section 5 - Finishing, for "Premium Grade" quality product.

5. Conform to referenced AWS/AWI standards; Section 6 - Millwork, for "Premium Grade" quality product.

6. Conform to referenced AWS/AWI standards; Section 7 – Stairwork and Rails, for "Premium Grade" quality product.

7. Conform to referenced AWS/AWI standards; Section 8 – Wall / Ceiling Surfacing and Partitions, for "Premium Grade" quality product.

1.04 **DELIVERY, STORAGE, AND HANDLING**

A. Deliver, store, protect, and handle products to site under provisions of Section 01 60 00.

B. Protect work from moisture damage.

1.05 **QUALIFICATIONS**

A. Fabricator and Installer: Company specializing in fabricating and installing the products specified in this Section with minimum three (3) years documented experience.

1.06 **ALTERNATES**

A. See Section 01 23 00 for bidding alternates affecting the work of this Section.

1.07 **COLORS**

A. Colors are specified on Colors and Materials Schedule on the drawings.

1.08 **ENVIRONMENTAL REQUIREMENTS**

A. Do not install materials when temperature or humidity conditions may have a detrimental affect on materials.

1.09 **COORDINATION**

A. Coordinate work under provisions of Section 01 31 00.

B. Coordinate the work with plumbing and electrical rough-in; installation of associated materials, finishes and adjacent components; including interior signage.

PART 2 - PRODUCTS

2.01 **WINDOW SILL [AND CASING] MATERIALS**

A. Window Sill Material: Plastic Laminate as specified.

1. Refer to drawing for sizes, shapes and dimensions. Window sill shapes include stool and apron. Fabricate to AWS/AWI Section 6, Premium Grade quality standard.

2.02 ACCESSORIES

A. Building Paper: No: 15 asphalt saturated felt.

B. Nails: Stainless Steel, size and finish type to suit application.

C. Bolts, Nuts, Washers, Blind Fasteners, Lags, and Screws: Concealed Size and type to suit application; plain finish.

D. Primer: Alkyd primer sealer type.

E. Wood Filler: Solvent base, tinted to match surface finish color.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify adequacy of backing and support framing.

B. Verify mechanical, electrical, and building items affecting work of this Section are placed and ready to receive this work.

3.02 INSTALLATION OF INTERIOR FINISH CARPENTRY ITEMS

A. Install work in accordance with AWS/AWI Premium Grade quality standard.

B. Set and secure materials and components in place, plumb and level.

C. Scribe work abutting other components to AWS/AWI tolerances; with maximum gaps of 1/32 inch. Do not use additional overlay trim to conceal larger gaps.

3.03 FINAL TREATMENT OF LUMBER MATERIALS SCHEDULED FOR SHOP APPLIED FINISHES

A. Set exposed fasteners.

B. Apply wood filler to match finished lumber at fastener indentations and lumber joints.

C. Use wood filler which matches surrounding surfaces and of types recommended for applied finishes.

3.04 FINAL TREATMENT OF LUMBER MATERIALS SCHEDULED FOR FIELD APPLIED FINISHES

A. Sand work smooth and set exposed nails and screws to receive filler and leave ready to receive field applied finishes.

B. Priming: Before installation, all work in this Section scheduled to be painted or stained is to be primed or stained, as applicable, in a heated place at jobsite. Priming paints of finish lumber specified under Section 09 91 00; painter subcontractor will make an adequate quantity of priming material, of applicable types, to carpenters for priming jobsite cut ends, edges, and concealed surfaces, as the installation work proceeds.

C. Before installation, prime paint surfaces of items or assemblies to be in contact with cementitious materials.

D. Field Finishing: As specified in Section 09 91 00.

E. Provide cutouts for plumbing fixtures, inserts, appliances, outlet boxes, and other fixtures and fitments. Verify locations of cutouts from site dimensions.

3.05 ERECTION TOLERANCES

A. Maximum Variation from True Position: 1/16-inch.

B. Maximum Offset from True Alignment with Abutting Materials: 1/32-inch.

END OF SECTION

SECTION 07 21 00
THERMAL INSULATION

PART 1 - GENERAL

1.01 REFERENCES

A. ASTM C612 – Mineral Fiber Block and Board Insulation.

B. ASTM C665 - Mineral Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.

C. ASTM C1104 – Standard Test Method for Determining the Water Vapor Sorption of Unfaced Mineral Fiber Insulation.

D. ASTM E84 - Test Method for Surface Burning Characteristics of Building Materials.

E. NFPA 255 - Test of Surface Burning Characteristics of Building Materials.

F. UL 723 - Tests for Surface Burning Characteristics of Building Materials.

1.02 SUBMITTALS

A. Submit under provisions of Section 01 34 00.

B. Product Data: Provide data on product characteristics, performance criteria, and limitations.

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.03 ALTERNATES

A. See Section 01 23 00 for bidding alternates affecting the work of this Section.

1.04 COLORS

A. Colors are specified on Color and Materials Schedule on drawings.

PART 2 - PRODUCTS

2.01 THERMAL BATT INSULATION MATERIALS

A. Thermal Batt Insulation (Unfaced Fiberglass): ASTM C665; preformed glass fiber batt; friction fit, unfaced, widths required for snug, friction fit between framing free of gaps or voids. Product: Owens Corning “EcoTouch” or approved equal. Use: Non-exposed locations.

2.02 ACCESSORIES

A. Insulation Hangers (Impaling Pins): 12 gauge, stainless steel pins and base plate of not less than 4 inches square for anchorage to substrate. Provide impaling pins of length to extend beyond insulation and retain cap washer when self-locking washer is placed on the pin.

B. Vapor Barrier (Clear Polyethylene Film): Reinforced clear polyethylene film, 6 mil thick. Water Vapor Permeance of 0.06 (Class I Vapor Barrier). Use: Unfaced thermal batt insulation at non-exposed locations.

C. Vapor barrier (Exposed Foil-Faced): Single-sided foil facing of minimum 0.0003" Aluminum foil bonded to 30lb natural fraft paper with frame retardant adhesive and reinforced with tri-directional fiberglass scrim. Less than 0.02 permeance (WVTR) per ASTM E96. Flame Spread Index of 5. Provide manufacturer's tape. Product: Fi-Foil Company. FSK Shield or approved. Use: Unfaced thermal batt insulation at exposed locations.

D. Tape: Polyethylene self-adhering type, 2 inch wide, and foil faced, self-adhering, reinforced, 2 inch wide.

E. Adhesive: Spray type, suitable for adhering polyethylene film and foil faced vapor barriers permanently to metal studs.

F. Head-of-Wall Insulation: Thermafiber TopStop. Mineral fiber (inorganic material; rock and blast furnace slag); ASTM E136 noncombustible; moisture-resistant; ASTM C665 noncorrosive type I; non-deteriorating; mildew-proof; vermin-proof; density of 6.0 PCF. Tested to ASTM C518. R-4.0 per inch of thickness. Unfaced Flame Spread = 0.
Smoke Development = 0.

1. Used at head-to-wall (below roof deck) conditions.

2. Provide insulation profile and size to match installation condition and deck profile.

F. Sealant: Suitable for sealing perimeters of vapor barrier membrane to adjacent materials, OSI SC-170.

G. Support Wire: 25 gauge, annealed steel wire.

H. Staples: Coated, non-rusting steel.

2.03 SOUND BATT INSULATION MATERIALS

A. Sound Batt Insulation: ASTM C665, 3-1/2 [5-1/2] inch thickness, preformed fiberglass batt, friction fit, unfaced, widths required for snug, friction fit between framing free of gaps or voids. Product: Owens Corning "EcoTouch Sound Attenuation Batts" with PureFiber Technology or approved equal.

2.04 PERIMETER FOUNDATION INSULATION MATERIALS

A. Foundation Perimeter Insulation: Polystyrene (XPS) insulation, extruded cellular type, square edges, ASTM C578 Type IV, 25 psi minimum compressive strength, Dow Chemical Co. "Styrofoam," Owens Corning "Foamular," or approved.

2.05 MINERAL WOOL INSULATION (FOR MISCELLANEOUS PACKING)

A. Mineral Wool Insulation and Safing; Mineral fiber (inorganic material; rock and blast furnace slag); ASTM C612 type IA, IB, II; ASTM E96 unfaced 50 perms as tested; ASTM E136 noncombustible; moisture-resistant; ASTM C665 noncorrosive type I, type III; non-deteriorating; mildew-proof; vermin-proof; 2" or greater thickness; 4.0 PCF safing. Tested to ASTM C518. R-4.0 per inch of thickness. Unfaced Flame Spread = 0. Smoke Development = 0. Thermafiber Inc. or approved equal.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify site conditions under provisions of Section 01 31 00.

B. Verify that substrate, adjacent materials, and insulation are dry and ready to receive insulation.

3.02 THERMAL BATT INSULATION INSTALLATION

A. Install thermal batt insulation and vapor barrier in accordance with insulation and impaling pin manufacturer's instructions.

B. Install in exterior walls, roof, and ceiling spaces without gaps or voids. Do not compress insulation.

C. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.

D. Fit insulation tight in spaces and tight to exterior side of mechanical and electrical services within the plane of insulation.

E. Install vapor barrier membrane facing warm side of building spaces.

F. Metal Stud Framing: Friction fit thermal batt insulation between metal stud framing.

G. Tape seal butt ends, lapped flanges, and tears or cuts in vapor barrier membrane. Seal perimeter to adjacent construction.

H. Use kraft-faced or foil-faced vapor barrier where framing is covered with finish surface.

I. Use polyethylene film vapor barrier with unfaced thermal batt insulation where framing is covered with finish surface.

J. Extend vapor barrier tight to full perimeter of adjacent window frames, door frames, louvers and other items interrupting the plane of membrane. Tape seal ends of vapor barrier to frames and items.

K. Insulation shall not block the required ventilation spaces in roof framing above insulation. Confirm that ventilation air passageways have the required free area above the top of the insulation in each joist bay from roof eave to ridge or other vent. Correct any blockages.

L. Pack insulation around door frames and windows and in cracks, expansion joints, control joints, door soffits and other voids. Pack behind outlets, around pipes, ducts, and services encased in wall or partition. Hold insulation in place with pressure sensitive tape or adhesive.

M. Fill all cavities formed within built-up or multiple framing members including, but not limited to: head, jamb and sill framing at openings, and other concealed voids.

3.03 SOUND BATT INSULATION INSTALLATION

A. Install insulation in accordance with manufacturer's instructions.

B. Install at all interior stud walls; fill cavity space without gaps or voids, trim to fit.

C. Provide and install insulation in thickness to match stud cavity.

D. Friction fit insulation securely between studs. Butt ends of blankets closely together and fill all voids.

E. Install insulation for full height on interior stud walls; extending to underside of floor/roof deck.

F. Install insulation for full height of interior partial height stud walls; extending to top side of intersecting framed horizontal soffits / ceilings.

G. Extend insulation full length of interior walls.

3.04 MINERAL WOOL INSULATION AND SAFING INSTALLATION

A. Install insulation in accordance with manufacturer's instructions.

B. Pack mineral wool insulation between top of wall and roof metal deck/structure on non-load bearing walls full width of wall.

C. Pack mineral wool insulation around all mechanical, plumbing and electrical penetrations through walls, floors, soffits, ceilings and roof assemblies / structures.

D. Install mineral wool insulation at heads of interior full height walls abutting underside of metal deck (roof decks). Fill all voids between metal deck flutes and wall slip track.

E. Pack mineral wool insulation around door frames and windows frames and in cracks, expansion joints, control joints, door soffits and other voids. Pack behind outlets, around pipes, ducts, and services encased in wall or partition. Hold insulation in place with pressure sensitive tape or adhesive.

F. Pack mineral wool insulation within cavities of exterior hollow metal frames. Fill all voids.

G. Pack mineral wool insulation within cavities of interior hollow metal frames. Fill all voids.

H. Install mineral wool insulation around all floor assembly and roof assembly penetrations.

3.05 PERIMETER FOUNDATION INSULATION INSTALLATION

A. Install insulation in accordance with manufacturer's instructions.

B. Run insulation board in continuous, unbroken line, butt joints tight, leave no voids or gaps.

3.06 MINERAL WOOL INSULATION (FOR MISCELLANEOUS PACKING)

A. Pack insulation between top plate/runner and roof deck/structure on non-load bearing walls full width of plate/runner.

B. Pack insulation around all mechanical and electrical penetrations through walls, floors, ceilings, and roof structure.

C. Install mineral wool safing insulation at each floor level, full width of exterior metal stud cavity for depth of floor slab. Fill all voids between exterior metal studs and edge of floor slab.

D. Install mineral wool safing insulation at heads of interior full height walls abutting underside of metal decking (floor and roof decks). Fill all voids between metal deck flutes and wall slip

track.

E. Pack mineral wool insulation within cavities of exterior hollow metal frames. Fill all voids.

END OF SECTION

PAGE LEFT BLANK INTENTIONALLY

SECTION 07 25 00
WEATHER RESISTIVE BARRIER

PART 1 – GENERAL

1.01 **REFERENCES**

A. NWCB – Northwest Wall and Ceiling Bureau

B. ASTM – American Society of Testing Materials

C. UL – Underwriters' Laboratories

D. WH – Warnock Hersey

E. GA – Gypsum Association

F. BM&WT – Building Materials and Wood Technology

1.02 **DELIVERY, STORAGE AND PROTECTION**

A. Section 01 60 00 – Product Requirements: Transport, Handle, Store and Protect Products.

1.03 **COORDINATION**

A. Coordinate installation with flashing installation.

B. Coordinate sequencing and installation of finish siding materials.

C. Coordinate installation sequencing at "Rain-Screen" system.

1.04 **QUALITY ASSURANCE**

A. Fire-Test-Response Characteristics: For assemblies with fire-resistance ratings, provide materials and construction identical to those of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.

1. Fire-Resistance Ratings: Indicated by design designations from GA-600, "Fire Resistance Design Manual.

B. Manufacturer Qualifications: Minimum 2 years production of similar products.

1.05 **PRE-INSTALLATION MEETING**

A. Convene two (2) weeks before starting work of this section.

1.06 **SUBMITTALS**

A. Submit under provisions of Section 01 34 00.

B. Product Data: Manufacturer's data sheets on each product to be used, including:

C. Preparation instructions and recommendations.

D. Storage and handling requirements and recommendations.

E. Installation methods.

F. Manufacturer standard installation details.

1.07 **DELIVERY, STORAGE AND HANDLING**

A. Store products in manufacturer's unopened packaging until ready for installation.

PRODUCTS

2.01 **MATERIALS – MEMBRANE FLASHING (SELF-ADHERING)**

A. Membrane Flashing (Self-Adhering): Grace Construction Products or approved equal.

1. Grace Vycor Plus: 25 mil thickness. Use: Sealing joints, seams, holes and unwanted openings in vertical surfaces. Window and door rough openings and other exterior wall rough openings. Not for use at roof areas.

2. Grace Vycor V40: 40 mil thickness. Use: Sealing critical non-roof detail areas, joints, seams, wall terminations and intersection details. Masonry Walls. Not for use at roof areas.

3. Grace VYCORners: Prefabricated corners for use at windows, doors, louvers and other exterior wall openings and penetrations.

4. Grace Perm-A-Barrier Wall Flashing: 40 mil thickness. Use: Base of wall detail areas, foundation detail areas, parapet wall detail areas, vertical leg of metal flashings.

5. Grace Perm-A-Barrier Detail Membrane: 3/64-inch thickness. Use: Detail areas, steel angles and steel framing, masonry wall details.

2.02 **MATERIALS – MEMBRANE UNDERLAYMENT**

A. Membrane Underlayment (High-Temperature): Grace Ultra. Cold-applied, self-adhering membrane for high temperature applications; composed of a high strength polyethylene film coated on one side with a layer of butyl rubber adhesive. Color: Gray-Black. 30 mil thickness. 34” wide rolls. 300 deg F Temperature Resistance.

1. Installation: One layer of membrane underlayment (high-temperature) on sloped surfaces at roof ridges, eaves, rakes edges, valleys, hips, dormers, sidewalls and roof penetrations. One layer of membrane underlayment (high-temperature) to the entire roof deck for wind-driven rain protection.

2.03 **MATERIALS – WEATHER RESISTIVE BARRIER**

A. Weather Resistive Barrier (Spray-Applied Membrane):

1. Weather Resistive Barrier (Vapor Permeable Air Barrier): Grace Construction Products. Perm-A-Barrier VP (Vapor Permeable). Single-component, fluid-applied, acrylic, vapor-permeable air barrier cures to form a resilient, monolithic, fully bonded elastomeric membrane. Impermeable to liquid water. Minimum 90 mil wet thickness, 45 mil dry thickness. Provide related primers, tapes, membrane flashings, sealants and other accessory components for complete system.

A. Cold Weather Installation: Grace Construction Products.
Perm-A-Barrier VP LT (Low Temp).

2.04 ACCESSORIES

A. Provide Stainless Steel fasteners.

B. Manufacturer's tape compatible with exterior plywood sheathing, exterior gypsum sheathing, weather resistive barrier and membrane flashing materials.

C. Metal Flashing and Trim: As specified in Section 07 62 00.

D. Joint Sealants: Silicone sealant as specified in Section 07 92 00.

E. Adhesives: Manufacturer's recommended adhesives.

F. Primers: Manufacturer's recommended primers.

G. Tape compatible with exterior gypsum sheathing.

EXECUTION

3.01 INSTALLATION WEATHER RESISTIVE BARRIER SPRAY-APPLIED MEMBRANE

A. Do not use materials with defects that impair quality of product.

B. Cover exterior sheathing with weather resistive barrier.

C. Coordinate weather resistive barrier installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.

D. Extend weather resistive barrier coverage to interior side of wall openings at stud framing (heads / jambs / sills) prior to installation of membrane flashings at rough openings.

E. Install in accordance with manufacturer's application instructions.

F. Install siding furring hat channels and aluminum composite material wall panel attachments and clips after installation of weather resistive barrier.

3.02 INSTALLATION MEMBRANE FLASHING AND ACCESSORIES

A. Rough openings in exterior walls shall have membrane flashing placed on wall surfaces as indicated on drawings and as listed below:

1. Membrane flashing shall extend to interior side of wall opening (full depth of opening) at all sides of opening. Membrane flashing shall extend a minimum of 9 inches beyond face of opening at all sides, lapping over weather resistive barrier.

2. Frames shall have membrane flashing adhesively attached to the frame.

3. Openings shall have metal head and sill flashing installed in accordance to drawings.

B. Install membrane underlayment (high-temperature) over tops of parapet walls, prior to installation of metal coping. Membrane underlayment to lap over weather resistive barrier, extend over top of wall and over wall vertical face a minimum of 6 inches.

1. Install membrane underlayment at saddle flashing locations. Lap up vertical face of abutting walls a minimum of 6 inches.

C. Install membrane flashing at all wall penetrations. Comply with manufacturer's standard installation details and in accordance to drawings.

3.03 INSTALLATION MEMBRANE UNDERLAYMENT

A. Install membrane underlayment in accordance with manufacturer's instructions.

3.04 INSTALLATION MEMBRANE UNDERLAYMENT (HIGH TEMPERATURE)

B. Install membrane underlayment (High Temperature) in accordance with manufacturer's instructions.

END OF SECTION

SECTION 07 41 33
PLASTIC ROOF PANELS (TRANSLUCENT ROOFING)

PART 1 GENERAL

1.01 **SECTION INCLUDES**

A. Modular UV protected standing seam translucent polycarbonate plastic glazing panels.

1.02 **RELATED SECTIONS**

A. Section 079200 - Joint Sealers.

1.03 **REFERENCES**

A. ASTM Z 97.1 - American National Standard for Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test.

B. ASTM D 256 - Standard Test Method for Determining the Pendulum Impact Resistance of Notched Specimens of Plastics.

C. ASTM D 638-03 - Standard Test Method for Tensile Properties of Plastics.

D. ASTM D 790-03 - Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.

E. ASTM D 792 - Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement.

F. ASTM D 1929 - Standard Test Method for Ignition Properties of Plastics.

G. ASTM F 1233 - Standard Test Method for Security Glazing Materials and Systems.

H. MEA 94-04-M – City of New York, Department of Buildings, Report of Materials and Equipment Acceptable Division, pursuant to Administrative Code Section 27-231.

I. ASTM G 155-05A – Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Non-Metallic Materials.

J. ASTM E 308 – Standard Practice for Computing the Colors of Objects by Using CIE (International Commission on Illuminance) System.

K. ASTM E 313 – Standard Practice for Calculating Yellowness and Whiteness Indices from Instrumentally Measured Color Coordinates.

L. ASTM E 84 – Standard Test Method for Surface Burning Characteristics of Building Materials.

M. ASTM D 635 – Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position.

N. ICC Evaluation Services – ESR-1760

1.04 SUBMITTALS

A. Submit under provisions of Section 01 34 00.

B. Manufacturer's data sheets on each product to be used, including:
   1. Physical properties including data on material weight, wind load capacity, light transmission, shading coefficient, and thermal expansion.
   2. Preparation instructions and recommendations.
   3. Storage and handling requirements and recommendations.
   4. Installation methods and glazing procedures, including edge engagement guidelines.

C. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.

D. Verification Samples: Submit samples for each finish product specified, two samples, minimum size 6 inches (150 mm) square, representing actual product and framed on two adjacent sides to show glazing system.

1.05 QUALITY ASSURANCE

A. Manufacturer’s Qualifications: ISO 9001 and ISO 14001 certified.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver polycarbonate sheets on enclosed pallets. Do not store stacked sheets in direct sunlight.

B. Store products in manufacturer's unopened packaging until ready for installation.

C. Store in dry, well-ventilated and covered areas at temperatures below 80 degrees F (27 degrees C).

D. Handle polycarbonate sheets carefully to prevent damage; do not drop, slide, or drag.

1.07 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.08 WARRANTY

A. Provide manufacturer's written 10 year limited warranty covering yellowing, loss of light transmission compared to original value and loss of crash resistance due to atmospheric agents.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Provide products manufactured by Gallina USA LLC, 4335 Capital Circle, Janesville, WI 53546; ASD. Tel: (608)531-0450, Fax: (608)531-0451. www.Gallinausa.com.

B. Substitutions: Not permitted.

2.02 POLYCARBONATE SHEET

C. Polycarbonate Sheet - General: Comply with ANSI Z 97.1 and with properties as follows:
   1. Tensile strength, yield: 8,500-10,200 psi (58.6-70 Mpa), in accordance with ASTM D 638.
   2. Tensile strength, ultimate: 7,830-10,400 psi (54-72 Mpa), in accordance with ASTM D 638.
   3. Tensile modulus: 232-348 ksi (1.6-2.4 GPa), in accordance with ASTM D 638.
   4. Flexural yield strength: 10,900-16,000 psi (75-110 Mpa), in accordance with ASTM D 790.
   5. Flexural modulus: 261-600 ksi (1.8-4.134 GPa), in accordance with ASTM D 790.
   6. Izod impact strength (0.125 inch notched): .937-18.3 ft lb/in/in (0.5-9.77 J/cm) of notch, in accordance with ASTM D 256.
   7. Self ignition temperature: 986 degrees F (530 degrees C), in accordance with ASTM D 1929.
   8. Horizontal Burn Rate for Light Transmitting Plastic is CC-1 with extent of burn 1 inch (25.4 mm) or less per ASTM D635. (Gallina Sheets of 1/4 inch (6 mm), 5/16 inch (8 mm), 3/8 inch (10 mm) and 5/8 inch (16 mm) thicknesses are classified CC-1.)
   9. Smoke density rating of less than 450 when tested in accordance with ASTM E 84.
   10. Flame Spread and Smoke Developed, Class A.

D. Modular panel alveolar translucent polycarbonate sheet: Provide standing seam, insulated polycarbonate sheet in sizes indicated on the Drawings and as follows:
   1. Six Wall 2-side U.V. protected Sheet: ArcoPlus 626 (Standard)
      a. Thickness/U-Factor: 11/16 inch (20 mm) nominal. U-Factor 0.264.

2.03 ACCESSORIES

A. Basic Assembly: Provide connector profile, starter profile, terminal profile, foam pads, aluminum block cover, base/side profile, and drip-stopper “V” eave.

B. Glazing Accessories: As recommended by manufacturer of plastic glazing sheet for wet or dry glazing installations.

C. Aluminum Channel: Provided approved aluminum channel mounting.

D. Fixing Washers with Gaskets: Provide 2.09 inch (53 mm) diameter Neoprene washers for fastening sheet to substrate.

E. Fixing Screws: Self tapping, corrosion resistant, gasketed screws as appropriate for the installation.

F. Sealant Tape: 3M Aluminum Tape, AntiDUST Tape or equal.

PART 2 EXECUTION

3.01 EXAMINATION

A. Inspect pallets upon delivery for evidence of damage.

B. Inspect and verify that frame openings are correct size and conform to recommendations of the plastic glazing sheet manufacturer.

3.02 PREPARATION

A. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

B. Clean frame contact surfaces with compatible solvent and wipe dry. Do not allow solvent to pool in glazing channels.

C. Immediately prior to installation, expose glazing edges of plastic sheet by peeling back factory-applied protective masking to a dimension sufficient for edge engagement.

3.03 INSTALLATION

A. Install plastic glazing in accordance with manufacturer's recommendations for edge engagement and expansion allowance.

B. Employ only silicone sealants and glazing accessories that have been approved by manufacturer of plastic glazing sheet.

C. Remove protective film immediately after all glazing operations are completed.

3.04 PROTECTION

A. Protect installed products until completion of project.

B. Clean with water and neutral soap only.

C. Repair or replace damaged products before Substantial Completion.

3.05 SCHEDULE

END OF SECTION

SECTION 07 42 33
ARCHITECTRUAL WALL PANELS (AWP)

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Provide labor, materials, products, equipment, and services to complete the solid phenolic plank siding work specified herein. This includes, but is not necessarily limited, to:

1. Fabricated exterior rear-ventilated solid phenolic plank siding systems.
2. Water-resistive barriers.
3. Auxiliary materials required for a complete installation.

B. Related Requirements: Specifications throughout all Divisions of the Project shall be read as a whole and may be directly applicable to this Section.

1. Related requirements provided below are for convenience purposes only.
   a. Section 07 21 00, Thermal Insulation: for provision of insulation.
   b. Section 07 27 00, Air Barriers: for provision of air barriers.
   c. Section 07 61 00, Sheet Metal Flashing and Trims: for provision of miscellaneous flashings and accessories.
   d. Section 07 92 00, Joint Sealants: for provision of joint sealants.

1.02 REFERENCES

A. The latest published edition of a reference shall be applicable to this Project unless identified by a specific edition date.

B. All reference amendments adopted prior to the Bid Closing date of this Project shall be applicable to this Project.

C. All materials, installation and workmanship shall comply with all applicable requirements and standards.

D. American Architectural Manufacturers Association

1. AAMA 501.2-15: Quality Assurance and Diagnostic Water Leakage Field Check of Installed Storefronts, Curtain Walls and Sloped Glazing Systems

1.03 DEFINITIONS

A. Drained / back-ventilated rainscreen cladding (D/BV): Rainscreen system that deflects and drains off the majority of rainwater using the outermost surface of the wall. Joints are intended to withstand

the kinetic action of wind-driven rain wind. However, no attempt is made to minimize leakage using pressure equalization or other methods.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Conduct conference at Project site.

1. Meet with Owner, Architect, solid phenolic plank siding Subcontractor, solid phenolic plank siding manufacturer's representative, structural-support Subcontractor, and Subcontractors whose work interfaces with or impacts Solid Phenolic Plank Siding, such as doors, windows, and louvres Subcontractors.
2. Review and finalize construction schedule, as well as establish staffing, material, equipment, and facilities requirements to proceed with the work of this Section and avoid delays.
3. Review procedures necessary for solid phenolic plank siding installation, including manufacturer's written instructions.
4. Verify condition of sub-framing and supports, including alignment and connection to structural elements, and confirm that such framing meets manufacturer's acceptance criteria.
5. Conduct a review of flashing, penetrations, openings, and other special details that may impact solid phenolic plank siding installation.
6. Review regulations and requirements pertaining to insurance, certificates, as well as requirements for testing and inspections.
7. Confirm requirements for temporary protection of solid phenolic plank siding assemblies during and after installation.
8. Review and establish procedures for repairing siding planks that have been damaged during or after installation.
9. Maintain records of proceedings, including remedial measures and action items. Provide copy of meeting records to each participant.

B. Coordination: Coordinate work of this Section with Subcontractors providing rain drainage work, flashings, trims, sealants, and other adjacent components to ensure final installation is secure and free from air or water leakage beyond limits indicated in Contract Documents.

1.05 SUBMITTALS

A. Make Submittals in accordance with provisions indicated in Section 01 34 00, Submittal Procedures.

B. Product Data: Submit product literature and data sheets for solid phenolic siding planks indicating product features, performance criteria, physical dimensions, finishes and limitations.

C. Shop Drawings: Show the following:

1. Solid phenolic plank siding manufacturing and installation details, including edge conditions, joints, profiles, corners, anchorages, attachment assembly, trims, flashings, closures, and accessories.

D. Delegated-Design Submittals: Submit Shop Drawings and submittals for solid phenolic siding that have been signed and sealed by a Professional Engineer licensed in the jurisdiction of the Project, and who is responsible for their preparation.

E. Samples: Submit samples minimum 305 mm (12 inches) in length by actual plank width for each exposed finish required. Include fasteners, closures, and other solid phenolic plank siding accessories.

1.06 INFORMATIONAL SUBMITTALS

A. Sample Warranties: Submit sample warranties for extended warranties indicated in this Section for Architect's review.

B. Test and Evaluation Reports: Submit copies of test and evaluation reports prepared by independent testing agencies acceptable to authorities having jurisdiction attesting to the conformity of solid phenolic plank siding with fire performance requirements stipulated in this Section.

C. Code Evaluation Reports: Submit ICC-ES or UES report validating conformity with appropriate chapters and clauses of International Building Code.
Certificates:

1. Submit proof of manufacturer's ISO 9001 registration and compliance.

2. Submit proof of manufacturer's ISO 14001 registration and compliance.

1.07 CLOSEOUT SUBMITTALS

A. Maintenance Data: Submit solid phenolic plank siding maintenance data for inclusion in building's operation and maintenance manuals.

1.08 QUALITY ASSURANCE

A. Manufacturer Qualifications: Provide Products from a manufacturer with minimum 20 years of experience and capable of providing solid phenolic plank siding systems that meet or exceed performance requirements indicated in this Section.

1. Manufacturer must be an ISO 9001 and ISO 14001 registered company.

B. Installer Qualifications: Provide competent installers who are trained and approved by manufacturer,]and have a minimum of five years' experience in the application of the Products, systems, and assemblies indicated in this Section.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Conform to manufacturer’s written instructions for delivery, storage, and handling.

B. Deliver solid phenolic plank siding and accessories undamaged and undeformed. Provide protection to solid phenolic plank siding during transportation and handling.

C. Unload, store, and erect solid phenolic plank siding such way that are not bent, warped, twisted, or suffer other damage.

D. Store solid phenolic plank siding horizontally on platforms or pallets, covered with appropriate weathertight and ventilated covering. Provide protective polyethylene sheet between pallet and the first planks, as well as on top of stack.

E. Provide steel or nylon straps to secure planks to pallets to prevent them from moving. Protect edges and corners.

F. Store solid phenolic plank siding in a dry location with positive slope for water drainage. Do not store solid phenolic plank siding in contact with other materials that may discolor, dent, or otherwise affect them.

1.10 FIELD CONDITIONS

A. Weather Conditions: Begin installation only when current and anticipated weather conditions allow for proper assembly of solid phenolic plank siding in accordance with manufacturers' written instructions and warranty requirements.

1.11 WARRANTY

A. Extended Warranty: Submit, for Owner's acceptance, manufacturer's standard warranty certificate, in which manufacturer undertakes to repair or replace components of solid phenolic plank siding systems that exhibit material defects within warranty period. Defects include, but are not limited to, spontaneous splitting, splintering, rot, or delamination caused by material or manufacturing flaws.

B. Manufacturer's warranty is in addition to, and does not supersede, any other rights that Owner may have under Contract Documents.

C. Warranty Period: Ten years from date of completion of solid phenolic plank siding installation.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Basis-of-Design: Materials specified in this Section are based on “EASY MEG F1” as supplied by ABET Inc; 60 West Sheffield Ave.; Englewood, New Jersey 0763111; Tel: 1-800-223-2238; web: https://abetlaminati.com

C. Substitution Limitations: Conforming to requirements of Section 01 25 00, Substitution Procedures and as follows:

2.02 REGULATORY REQUIREMENTS

A. System Fire Propagation Characteristics: Solid phenolic wall panel system must be tested to and pass the requirements of NFPA 285.

1. Flaming on, or in wall assembly: not more than 2.75 m above opening.

2. Maximum heat flux during flame exposure on wall assembly: not more than 14.5 kW/m2 when measured at 3.5 m above opening.

B. Surface Burning Characteristics: in accordance with ASTM E84 with the following results:

1. Flame Spread Index (FSI): 10 or less.

2. Smoke Developed Index (SDI): 70 or less.

2.03 DESIGN/PERFORMANCE REQUIREMENTS

A. Design system as a drained / back-ventilated rainscreen cladding. Provide minimum 25 mm (1 inch) air space behind siding unless otherwise indicated.

B. Design drainage system to allow free flow of water from wall's interior to the exterior. Provide flashings and accessories to prevent moisture from entering the wall or to divert it to the exterior. Ensure drained water does not discolor architectural finishes, pool in puddles, or create icicles.

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.

2.04 ARCHITECTURAL WALL PANEL (AWP-#1)

A. Provide exterior-grade compact solid phenolic siding planks conforming to BS EN 438-6 and NEMA LD3 (Grade CGS) consisting of a core layer fabricated from sheets of kraft paper impregnated with phenolic resins, and with the following minimum characteristics:

1. Accelerated Weathering Test: to ASTM G155; minimum 2,000 hours exposure with no cracking, checking, crazing or other factors that may affect performance after exposure.

2. Freeze-thaw testing: To ICC-ES AC92; Pass 10 freeze-thaw cycles cycling between 120 deg F to -20 deg F (49 deg C to -29 deg C)

3. Bond Strength: to ICC-ES AC92 ASTM C297; average tensile stress of minimum 10 psi (69 kPa) for all specimens.

4. Flexural Strength: to ICC-ES A92 and ASTM D1037. Average flexural strengths of freeze-thaw and wet specimens must minimum 60% of the average strength of drycontrol specimens to pass.

5. Salt Spray Resistance: to ICC-ES A92 and ASTM B117; no deleterious effects such as cracking, checking, crazing, erosion, delamination, or any other distress that might affect performance as an exterior wall covering after 300 hours of exposure to salt solution.

6. Water Resistance: to ICC-ES AC92 and ASTM D2247; no deleterious effects such as cracking, checking, crazing, erosion, delamination, or any other distress that might affect performance as an exterior wall covering after 14 days of exposure to water.

7. Fastener Pull-Through: to ICC-ES AC92 and ASTM D1037; average load of not less than 1442 lbs. (6.4 kN).

B. Plank Nominal Thickness: 10 mm (3/8 inch

C. Attachment system: Manufacturer's standard attachment system suitable for open joint siding configurations.

D. Plank Dimensions: As indicated on Drawings.

E. Finish: Manufacturer's standard UV-resistant single sided decorative finish.

F. Colors and patterns: Colors are specified on Colors and Materials schedule on drawings.

2.05 AUXILIARY MATERIALS

A. Substructure: manufacturer's standard clip system fabricated from aluminum extrusions as specified below and capable of providing joint aesthetic indicated in this Section.

1. Aluminum extrusions: Aluminum alloy to 6063-T5 or 6063-T6 J-channels and hatchannels conforming to ASTM B317 or ASTM B221 attached to existing building structure and designed to support cladding panels.

2. Material visible after assembly of siding planks: finished to be inconspicuous in final installation. Paint as required to be concealed behind open joints.

B. Bird and Insect Screening: Aluminum mesh with minimum wire diameter of 0.012 inch (0.30 mm), painted as necessary to be concealed behind siding open joints. Screening must provide at least 50% open area.

C. Accessories: as required for full weathertight siding system. Include starter strips, edge trims, flashings, closures, corner caps and similar components. Unless otherwise indicated, ensure accessories are fabricated from aluminum to match to solid phenolic plank siding finishes.

D. Fasteners for Siding Planks: Stainless steel self-tapping screws or other fasteners suitable for withstanding design loads and stresses.

E. Fasteners for Miscellaneous Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten miscellaneous metal framing members to substrates.

F. Air Barrier/Vapor Retarder: As specified in Section 07 27 00, Air Barriers.

G. Insulation: As specified in Section 07 21 00, Building Insulation.

2.06 FABRICATION

A. Allow planks and substrates to acclimatize for at least 48 hours prior to beginning fabrication operations. Conform to manufacturer's instructions.

B. Fabricate and finish solid phenolic plank siding and accessories in the shop using techniques and processes indicated in manufacturer's written fabrication instructions.

C. Plank lines, breaks, and angles must be straight and true, with no warping or buckled surfaces.

D. Cut, sand and round edges to a smooth finish. Plank edges "as-provided" from solid phenolic manufacturer's factory are not permitted in final installation.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, locations, and existing conditions to ensure compliance with required installation tolerances, solid phenolic plank siding supports, and other factors that might impact performance of the work.

B. Ensure framing, girts, angles, channels, studs, and other support components and attachments are installed within alignment tolerances specified by solid phenolic plank siding manufacturer.

C. Where applicable, verify that air-barriers, vapor-retarders, and water-resistive barriers have been properly installed over sheathing or backing substrate to prevent air infiltration or water penetration.

D. Proceed with installation only after unsatisfactory conditions have been corrected. Commencement of work implies acceptance of in-place conditions.

3.02 PREPARATION

A. Install sub-framing, furring and other miscellaneous support members and anchorages according to solid phenolic plank siding manufacturer's written recommendations. Space sub-framing channels at interval indicated on reviewed Shop Drawings.

B. Install water resistive barrier behind solid phenolic siding planks in accordance with water resistive barrier manufacturer's instructions.

3.03 SOLID PHENOLIC PLANK SIDING INSTALLATION

A. Install solid phenolic plank siding in accordance with the manufacturer's written instructions, in the orientations, sizes, and locations indicated on Drawings. Unless otherwise indicated in manufacturer's installation instructions or on reviewed Shop Drawings, install siding planks perpendicular to supports.

B. Securely fasten solid phenolic plank siding and other components to structure, while allowing for thermal and structural movements.

C. Install accessories with positive attachment to building and with weathertight mounting. Coordinate installation with flashings and other components.

3.04 ERECTION TOLERANCES

A. Installation Tolerances: align solid phenolic siding planks within installed tolerance of 2 mm per m (0.08 inch per 3.3 feet) between fixing points, non-accumulative, on level, plumb, and location lines as indicated.

3.05 FIELD QUALITY CONTROL

A. Engage fabricator of products supplied under this Section to conduct a review of procedures including handling, installation, application, protection, and cleaning of products and provide written reports to Architect. Provide field services, which include product use recommendations and periodic site visits to ensure that products are installed according to the manufacturer's instructions.

1. Schedule site visits to review Work at the following stages:

   a. After delivery and storage of products, and when preparatory Work on which Work of this Section depends is complete, but before installation begins.
   b. Twice during progress of Work at 25% and 60% complete.
   c. Upon completion of Work, after cleaning is carried out.

2. Obtain reports promptly after field reviews are completed and submit to Architect.

3.06 CLEANING AND PROTECTION

A. Remove temporary protective covers and strippable films before installing solid phenolic plank siding. Where films are provided on both sides of siding planks, ensure both films are removed at the same time to avoid siding warpage.

B. Clean completed surfaces of solid phenolic plank siding according to manufacturer's instructions.

C. Following installation of solid phenolic plank siding, clean obstructions, dirt, and sealants from weep holes and drainage channels.

D. Replace broken or damaged solid phenolic plank siding that cannot be repaired successfully using finish touchup or equivalent minor repair operations.

END OF SECTION

PAGE LEFT BLANK INTENTIONALLY

SECTION 07 42 44
ALUMINUM COMPOSITE MATERIAL (ACM) WALL PANELS

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. Aluminum faced, thermoplastic core, composite wall panel system.

2. Accessories including attachments, clips, subgirts, shims, and fasteners.

3. Factory applied coating system.

1.02 REFERENCES

A. Reference Standards: Current edition.

American Architectural Manufacturers Association (AAMA): AAMA 2605
Voluntary Specification Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.

B. ASTM International (ASTM):

1. ASTM B209 Aluminum-Ally Sheet and Plate.

2. ASTM D 1781 Standard Test Method for Climbing Drum Peel for Adhesives.

3. ASTM E 330 Standard Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.

4. ASTM E 331 Test Method for Waster Penetration of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference

5. ASTM E 84 Test Method for Surface Burning Characteristics of Building Materials.

6. ASTM E 283 Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.

1.03 SYSTEM DESCRIPTION

A. Thermoplastic core thermally bonded to aluminum alloy face sheets; including copings, soffits, and curved panels.

B. Mechanical attachments, subgirts and fasteners.

C. Rout and return, dry gasket joint system. Wet sealed systems not accepted.

D. Rainscreen pressure equalized wall panel system design.

1.04 **DESIGN REQUIREMENTS**

A. Components: Design and size to withstand dead and live loads caused by positive and negative wind pressure acting normal to plane of panel, conforming to IBC Chapter 16; wind loading criteria indicated on Structural General Notes.

B. Wall Panel Deflection: L/60.

C. Perimeter Framing Deflection: L/175.

D. Thermal Movement: Design system to accommodate vertical and horizontal thermal movement of components without causing buckling, failure of joint seals, undue stress on fasteners, and oil canning when subject to seasonal temperature cycling.

E. Drainage: Design for positive drainage of water leakage and condensation to exterior of wall panel system, including gutter system at each horizontal joint.

F. Tolerance of Substructure: Design system to accommodate up to 1/4 inch in 10 foot variation out of plane. Accommodate tolerances of building structural framing.

G. Seismic Design: Conform to IBC for Seismic Category D. Allow for movement in the panel joints.

1.05 **PERFORMANCE REQUIREMENTS**

A. Conduct testing specified this Section on mock-up.

B. Air Leakage: Maximum 0.02 cfm per square foot of wall area at 6.24 psf, tested to ASTM E 283.

C. Static Water Penetration: No uncontrolled water penetration under static pressure differential of 20 percent of inward acting design load at minimum 15 lbf/sf after 15 minutes, tested to ASTM E 331.

D. Structural Performance: No permanent deformation at 150 percent of design pressure exceeding L/100 for frame and L/60 for material, tested to ASTM E 330.

1.06 **SUBMITTALS**

A. Submit under provisions of Section 01 34 00.

B. Shop Drawings: Show thickness and dimensions of panels, panel profile, layout, fastening and anchoring methods, details, and locations of joints and gaskets.

C. Product Data: Manufacturer's panel profiles, dimensions, characteristics, structural properties, and fire-rating performance criteria.

D. Design and Performance Data: Fabricator's system including standard drawings, details, and design. Indicate seismic, thermal, environmental, and structural characteristics of system.

E. Panel Samples: Minimum 8 inch by 8 inch in specified thickness, including attachment extrusions, clips, subgirts, fasteners, closures, and other panel accessories.

F. Color Samples: Panel material finished to specified color and finish.

G. Fabricator Instructions:

1. Include installation instructions, technical bulletins, and other product data.

2. Include instructions for substrate requirements, special handling criteria, installation Sequence, perimeter conditions, cleaning procedures, and conditions requiring special attention.

H. Test Reports: Meet or exceed specified design and performance requirements, documented and certified by independent testing agency acceptable to Architect and building code officials.

I. Structural Calculations for Panel System: Stamped registration seal and signed by licensed structural engineer, licensed in State of Washington.

K. Sample Warranty: Meet or exceed provisions specified by this Section.

1.07 **QUALITY ASSURANCE**

A. Single Source Responsibility:

1. Provide design and fabrication of wall panel system under responsibility of fabricator Including composite panels, attachments, clips, girts, fasteners, and other accessories.

2. Install composite wall panel system by or under responsibility of panel system Fabricator.

1.08 **QUALIFICATIONS**

A. Manufacturer:

1. Company specializing in manufacturing composite panel products specified by this Section.

2. Able to document minimum 10 years experience.

B. Fabricator:

1. Company specializing in designing, engineering, and fabricating work of this Section.

2. Able to document minimum 7 years experience.

3. Approved by panel manufacturer as qualified to perform work of this Section.

C. Installer:

1. Company specializing in installing work of this Section.

2. Able to document minimum 3 years experience. Submit project contact information. Owner, general contractor, Architect names and phone numbers. Project addresses.

3. Trained and authorized by wall panel system fabricator as qualified to perform work of this Section.

1.09 **MOCK-UP**

A. Provide under provisions of Section 01 45 00.

B. Construct mock-up, including outside corner condition showing complete system assembly. Refer to Section 07 25 00 for assembly requirements.

C. Construct size and type and locate as directed by Architect.

D. Conduct testing by Owner's independent testing laboratory to verify performance requirements as specified this Section for air and water tightness of joints.

E. Mock-up shall not be incorporated into Work.

1.10 **PRE-INSTALLATION CONFERENCE**

A. Arrange in accordance with Section 01 04 10.

B. Attendance: General Contractor, installer, Owner, Architect, manufacturer's representative, and those requested to attend.

C. Meeting Time: Minimum 2 weeks prior to prior to beginning work of this Section and work of related Sections affecting work of this Section.

D. Location: Project Site.

1.11 **DELIVERY, STORAGE, AND HANDLING**

A. Conform to manufacturer's instructions.

B. Deliver in manufacturers protective packaging with protective strippable film and identifying labels intact.

C. Store in well ventilated space under cover, off ground, protected from direct sunlight, weather, moisture, soiling, and marring of surface.

D. Protect panels from temperatures exceeding 120 degrees F.

E. Slope stored panels for positive drainage of water and condensation.

F. Handle to prevent twisting, bending, and abrasion. Prevent contact with materials which may cause discoloration or staining.

1.12 **PROJECT CONDITIONS**

A. Field Measurements: Verify actual conditions prior to fabrication and show on Shop Drawings.

1.13 **COORDINATION**

A. Conform to Section 01 32 16 for coordination with work of other Sections.

B. Field dimensions, Shop Drawings, and fabrication with critical path of construction Progress Schedule as necessary to meet lead time and avoid delays.

C. Work of related Sections interfacing with work of this Section as necessary to maintain watertight integrity of building envelope including; weather resistive barrier, cold formed

metal framing, curtain wall system, storefront system, horizontal steel siding and metal flashing systems.

1.14 **WARRANTY**

A. Conform to Warranty provisions specified Section 01 78 36.

B. Finish Coating System: Standard 20 year materials Warranty against fading, crazing, and chalking of coating system.

C. Panel Manufacturer: Standard 5 year materials Warranty against delamination of panels and defective materials.

D. Panel System Fabricator: 5 year fabrication Warranty for conformance to design and performance and requirements.

E. Installer: 5 year workmanship Warranty for watertightness.

PART 2 – PRODUCTS

2.01 **MANUFACTURERS AND FABRICATORS**

A. Aluminum Composite Material (ACM) Wall Panel Manufacturers:

1. Mitsubishi Chemicals America Inc., ALPOLIC Composite Materials Division.

a. Tel (425) 454-6250, Fax (425) 454-6538, Cell (425) 985-2408, Email asirepx@aol.com (Architectural Systems, Inc, Gene Robinson).

b. Web Site: http://www.alpolic.com

2. Alcan Composites, Inc., ALUCOBOND Wall Cladding.

a. Voice Mail 1-800-254-2284 Ext 2238, Tel (916) 427-8811 (Jim Vann CSI).

b. Tel 1-800-626-3365 (Head Office)

c. Web Site http://www.alucobondusa.com/

3. Reynolds Metal Company, REYNOBOND FR Aluminum Composite Material,

a. Tel (925) 362-0365, Fax (925) 362-0368, Email frank.meehan@alcoa.com (Frank J. Meehan).

b. Web Site: http://www.rmc.comhttp://www.aluminum-Panels.com/products/plReynoBond.asp

B. Aluminum Composite Materials (ACM) Wall Panel System Fabricators:

1. Keith Panel Systems. Tel (425) 635-0080, Fax (425) 635-0171. North Vancouver, BC Basis of Design for performance and appearance.

2. Bestworth-Rommel Inc. Tel (360) 435-2927, Fax (360) 435-3617. Arlington, WA.

C. Substitution Requests: Submit for approval under provisions of Section 01 25 00.

2.02 ALUMINUM COMPOSITE MATERIALS (ACM) WALL PANEL MATERIALS

A. Core: Thermoplastic material conforming to performance and design requirements when fabricated into thermally bonded composite assembly. Submit data regarding which type of core is suitable according to the project condition.

B. Face Sheets: ASTM B 205, 3105 aluminum alloy, 0.020 inch (0.51 mm) thick.

C. Physical Characteristics: Resistance to delamination.

1. Peel Strength: 22.5 inch-pound per inch, tested to ASTM D 1781.

D. Fire Rating: Tested to ASTM E 84.

1. Flame Spread: 10.

2. Smoke Developed: Maximum 0.

E. Panel Thickness: 3/16 inch (4mm).

2.03 ACCESSORIES

A. Attachments, Clips and Subgirts: As instructed by manufacturer.

B. Pop Rivets: Stainless steel and as instructed by manufacturer to prevent galvanic action.

C. Screw Fasteners: Type S, self drilling, self tapping framing screws, stainless steel with carbide head, as instructed by manufacturer to suit application.

D. Shims: As instructed by manufacturer.

E. Joint Sealant: Non-exposed areas only. Silicone sealant and backer rod as specified Section 07 92 00 as instructed by manufacturer to contact metal to metal, metal to concrete and metal to masonry.

F. Isolation Accessories: Isolation tape, pads, or coatings as necessary to prevent galvanic action between dissimilar metals.

G. Weather Resistive Barrier: As specified Section 07 25 00.

H. Membrane Flashing: As specified Section 07 25 00.

2.04 FABRICATION

A. Shop fabricate aluminum composite material wall panels in sizes and joint configurations to accommodate field installation tolerances. Reinforce with stiffeners where applicable to meet design requirements.

B. Where final dimension cannot be established by field measurements, make allowances for Field adjustment.

C. Form panel lines, breaks, and angles with routed back-cut break form corners for sharp edges in one continuous panel return, free from warp and buckle, and with no displacement of aluminum sheet or protrusion of core.

D. Encapsulate panel edges with mitered aluminum edging with hairline joints matching finish of face panel. Exposed fasteners at edges not accepted.

E. Fabricate panels with gutter system to weep moisture out of panel system at each horizontal panel joint.

F. Form sections true to shape, accurate in size, square, and free from distortion or defects.

2.05 **FINISHES**

A. Exposed Aluminum: PPG Duranar, PVDF, minimum 70 percent Kynar 500, or Hylar 5000 resin content, factory applied baked-on finish, conforming to AAMA 2605.

B. Uncoated exposed metal not accepted. Touch up uncoated metal for smooth, finished Appearance matching color and gloss level of adjacent finish.

C. Field Touch-up Paint: PPG Coraflon ADS, air-dry system, fluorocarbon resin coating matching color and texture of finish coating.

D. Color: As specified in Colors and Materials Schedule on drawings.

PART 3 – EXECUTION

3.01 **EXAMINATION**

A. Verify conditions ready to receive work of this Section before beginning installation.

B. Verify substrate framing members suitable for installation ready to receive wall panel system.

3.02 **PREPARATION**

A. Shim metal framed framing members and supports as necessary to provide level and plumb Substrate for fastening panels.

B. Weather Resistive Barrier Tape: Apply tape continuously over sheathing joints, stud lines, and wall openings as specified Section 07 25 00.

C. Weather Resistive Barrier: Install over sheathing as specified Section 07 25 00.

3.03 **INSTALLATION**

A. Install in accordance with manufacturer's instructions and provisions of Contract Documents.

B. Install dry set system with weeps to channel and carry internal water to exterior of system.

C. Permanently fasten and anchor aluminum composite material wall panel system to metal cold rolled wall framing system using manufacturers anchors, clips, and subgirts.

D. Install aluminum composite material wall panel aligned, level, and plumb, within specified

tolerances.

E. Use concealed fasteners and clip attachments.

F. Install backer rod and silicon joint sealant as necessary for permanent, watertight joints at interfacements with adjacent construction as specified Section 07 92 00.

G. Isolate aluminum from dissimilar metal, as required to prevent galvanic action.

H. Remove protective film immediately following installation of wall panels.

3.04 TOLERANCES

A. Maximum Offset From Alignment Between Adjacent Wall Panels: 1/16 inch.

B. Maximum Variation from Horizontal and Vertical Plane: 1/4 inch in 20 foot, non-accumulative.

3.05 FIELD QUALITY CONTROL

A. Manufacturers Field Service:

1. Make periodic visits and final inspection by manufacturers authorized product representative as necessary to verify conformance to manufacturers instructions and Warranty provisions.

2. Promptly notify Architect of non-conforming work.

3.06 ADJUSTING

A. Make adjustments to wall panel installations not conforming to specified tolerances.

B. Field touch-up damaged finishes to match color and finish of factory applied panel finish.

C. Replace work which cannot be repaired so that repairs are not discernable at distance of 10 foot.

3.07 CLEANING

A. Dry-wipe panels as work progresses.

B. Leave installation clean, free from residue and debris resulting from work of this Section.

END OF SECTION

SECTION 07 46 19
METAL SIDING, METAL SOFFIT AND METAL ROOFING PANELS

PART 1 – GENERAL

1.01 REFERENCES

A. AISI (American Iron and Steel Institute) - Stainless Steel - Uses in Architecture.

B. ASTM A525 - Steel Sheet, Zinc Coated, (Galvanized) by the Hot-Dip Process.

C. ASTM B32 - Solder Metal.

D. ASTM B209 - Aluminum and Alloy Sheet and Plate.

E. ASTM B370 - Copper Sheet and Strip for Building Construction.

F. ASTM B486 - Paste Solder.

G. ASTM D226 - Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.

H. ASTM D4586 - Asphalt Roof Cement, Asbestos-Free.

I. CDA (Copper Development Association) - Contemporary Copper, A Handbook of Sheet Copper Fundamentals, Design, Details and Specifications.

J. CDA - Copper Roofing - A Practical Handbook.

K. FS O-F-506 - Flux, Soldering, Paste and Liquid.

L. NRCA (National Roofing Contractors Association) - Roofing Manual.

M. SMACNA - Architectural Sheet Metal Manual.

N. AAMA – American Architectural Manufacturers Association.

1.02 SUBMITTALS

A. Submit under provisions of Section 01 34 00.

B. Shop Drawings: Indicate siding material and panel material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.

C. Samples: Submit two (2) siding material and panel material samples, illustrating typical material and finish.

1.03 QUALIFICATIONS

A. Fabricator and Installer: Company specializing in sheet metal flashing work with three (3) years experience.

1.04 **DELIVERY, STORAGE, AND HANDLING**

A. Deliver, store, protect, and handle products to site under provisions of Section 01 60 00.

B. Stack preformed material to prevent twisting, bending, or abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.

C. Prevent contact with materials that may cause discoloration or staining.

1.05 **ALTERNATES**

A. See Section 01 23 00 for bidding alternates affecting the Work of this Section.

1.06 **COLORS**

A. Colors are specified on Colors and Materials Schedule on the drawings.

PART 2 – PRODUCTS

2.01 **METAL WALL PANEL – HORIZONTAL (MWP)**

A. Specification standard: AEP Span, Perception Collection, 22 gauge. Concealed fastener wall panel system.

B. Panel Profile: 12" coverage with profiles #PC10-12, #PC20—12 and #PC40-12.

C. Factory Finish: Duratech 5000 factory paint coating.

D. Substitutions: Under provisions of Section 01 60 00.

2.02 **ACCESSORIES**

A. Concealed Fasteners: Stainless steel self-tapping screws with soft neoprene washers. Stainless steel rivets.

B. Metal Flashings and Trim: Fabricated of same material, gauge and finish as panel material, unless noted otherwise on drawings.

C. Profiles and Closures: Provide manufacturers standard profiles and closure strips.

D. Isolation Tape (Dissimilar Metal Tape): Provide manufacturers standard separation tape.

E. Accessories: Provide manufacturer's standard outside closure, inside closure, retention clips, metal flashings, metal trim profiles and other accessories as required for complete installation.

F. Membrane Flashings: Type as specified in Section 07 25 00.

G. Weather Resistive Barrier: Type as specified in Section 07 25 00.

H. Joint Sealant: Silicone sealant. Type as specified in Section 07 92 00.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are ready to receive work.

B. Beginning of installation means acceptance of substrate.

3.02 INSTALLATION

A. General: Comply with metal siding and metal panel manufacturer's written installation instructions applicable to products and applications indicated unless more stringent requirements apply. Center fasteners in elongated slots without binding metal siding and metal panel to allow for thermal movement. Overlap joints to shed water away from direction of prevailing wind.

B. Install horizontal metal siding, trim, flashing and accessories according to manufacturer's installation instructions.

C. Install metal flashings and accessories according to SMACNA - Architectural Sheet Metal Manual.

D. Install metal panels plumb and true and in proper alignment.

E. Install metal panel systems without waves, warps, buckles or distortion, allow for thermal movement.

F. Secure metal siding and metal panels without warp or deflection.

G. Install metal profiles and trim pieces at end conditions of horizontal metal siding; including wall openings, outside corners, inside corners and base of wall conditions.

H. Refer to Section 07 62 00 for exterior wall assembly metal flashing installation requirements prior to installation of horizontal metal siding.

I. Isolate dissimilar metals be separating with rubber gaskets or elastomeric sealant. Use rubber washers where fasteners made from dissimilar metal penetrate panels. Isolate dissimilar metals behind panels by covering with polyethylene film.

3.03 ADJUSTING AND CLEANING

A. Remove damaged, improperly installed, or otherwise defective panel materials and replace with new materials complying with specified requirements.

B. Clean finished surfaces according to panel manufacturer's written instructions and maintain in a clean condition during construction.

END OF SECTION

PAGE LEFT BLANK INTENTIONALLY

SECTION 07 54 23
SINGLE PLY MEMBRANE ROOFING (SPMR)

PART 1 – GENERAL

1.01 **REFERENCES**

A. ANSI/ASTM D412 – Rubber Properties in Tension.

B. ANSI/ASTM D746 – Brittleness Temperature of Plastics and Elastomers by Impact.

C. ASTM D624 – Rubber Property – Tear Resistance.

D. ASTM D822 – Practice for Operating Light and Water-exposure Apparatus (Carbon-Arc Type) for Testing Paint, Varnish, Lacquer, and Related Products.

E. ASTM D1004 – Initial Tear Resistance of Plastic Film and Sheeting.

F. ASTM D2240 – Rubber Property – Durometer Hardness.

G. ASTM E96 – Water Vapor Transmission of Materials.

H. FS HH-I-526 – Insulation Board, Thermal (Mineral Fiber).

I. FS HH-I-529 – Insulation Board, Thermal (Mineral Aggregate).

J. FS HH-I-530 – Insulation Board, Thermal (Urethane).

K. FS HH-I-551 – Insulation Block and Board, Thermal (Cellular Glass).

L. FS LLL-I-535 – Insulation Board, Thermal (Cellulosic Fiber).

1.02 **SYSTEM DESCRIPTION**

A. 60 mil thick Reinforced Thermoplastic Polyolefin (TPO) membrane roof assembly to conform to UL requirements for a Class A rated assembly and UL requirements for uplift resistance. Manufacturer / installer shall provide all components required to meet UL Class A rated assembly.

1.03 **QUALITY ASSURANCE**

A. Membrane Manufacturer: Company specializing in sheet roof membranes with five (5) years experience.

B. Applicator: Company specializing in installation of sheet roof membranes with three (3) years documented experience approved by membrane manufacturer.

C. All materials used in or in conjunction with the roofing system shall be manufactured by or approved by one manufacturer.

D. Each Bidder shall be prepared to provide documentation for Class-A assembly provided by their product;

1.04 **REGULATORY REQUIREMENTS**

A. Underwriters Laboratories, Inc. (UL): Class - A Fire Hazard Classification.

1.05 SUBMITTALS

A. Product Data: Submit specifications, installation instructions, and general recommendations from manufacturers of sheet roofing system materials, for types of roofing required. Include data substantiating that materials comply with requirements.

B. Shop Drawings: Submit complete shop drawings showing roof configuration and sheet layout, details at perimeter, and special conditions:

1. Indicate layout of tapered insulation materials and thicknesses.

2. Indicate layout of all mechanical fasteners.

3. Submit manufacturer's standard details, modified standard details or special details. Submit letter (prior to roofing installation) from manufacturer stating that all materials and details used by the installer meet the manufacturer's requirements to be warranted by the manufacturer for twenty (20) years.

C. Samples: Submit samples of all roofing materials and accessories.

D. Pre-Roofing Conference: Submit copies of pre-roofing conference records.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site under provisions of Section 01 60 00.

B. Under provisions of Section 01 60 00, store materials in weather protected environment clear of ground and moisture. Protect foam insulation from direct sunlight exposure.

1.07 ENVIRONMENTAL REQUIREMENTS

A. Do not apply membrane during inclement weather or when air temperature is below 40 degrees F.

1.08 PRE-INSTALLATION CONFERENCE

A. Convene a pre-installation conference one (1) week prior to commencing work of this Section.

B. Require attendance of parties directly affecting work of this Section.

C. Review conditions of installation, installation procedures, and coordination required with related work.

1.09 WARRANTY

A. Provide minimum twenty (20) year manufacturer's warranty under provisions of Section 01 74 00. Warranty shall be provided by the manufacturer of the system, not the marketer.

B. Warranty: Include coverage of materials (entire system, including fasteners) and installation and resultant damage resulting from failure to resist penetration of moisture; defective materials and workmanship.

1. Warranty Period: Minimum twenty (20) years after date of Final Acceptance. Warranty shall not exclude damage from improper application or environmental contaminants.

1.10 **PRECAUTIONS**

A. Adhesives, primer, and caulks as indicated are extremely flammable and/or toxic. Use precautions indicated on can and carton labels.

B. Surfaces to be bonded shall be dry and clean. Suitable surfaces are usually considered to be smooth, solid masonry, wood, and metal plus well-fastened insulation board that is considered water resistant and accepted for adhered applications by roofing manufacturer.

C. After exposure to sunlight for 24 hours or longer, membranes may have achieved a "surface curing". Prior to hot air welding an application of primer is required to achieve a proper weld. The need for primer is determined by a test weld.

D. All fasteners should be installed with a depth-sensing screw gun to prevent overdriving.

1.05 **ALTERNATES**

A. See Section 01 23 00 for bidding alternates affecting work of this Section.

1.06 **COLORS**

A. Colors are specified on the Colors and Materials Schedule on drawings.

PART 2 – PRODUCTS

2.01 **ACCEPTABLE MANUFACTURERS – MEMBRANE**

A. Carlisle SynTec, Sure-Weld, Reinforced Thermoplastic Polyolefin (TPO) membrane, mechanically fastened system.

B. Or approved.

C. Substitution: Under provisions of Section 01 60 00.

D. Material specifications and installation details are based upon Sure-Weld TPO by Carlisle SynTec. Mechanically attached.

2.02 **MEMBRANE MATERIALS**

A. Membrane: White, 60 mils thick, Sure-Weld Reinforced Thermoplastic Polyolefin (TPO) membrane and scrim reinforcement, minimum 8 feet wide roll conforming to the following criteria.

PROPERTIES	TEST	RESULTS
Breaking strength, minimum (Grab method)	ASTM D751	250 lbf
Tear strength, minimum (Tongue tear)	ASTM D751	55 lbf
Brittleness	ASTM D2137	-40 deg C Pass
Heat aging, 32 days	ASTM D573	90% breaking strength,

at 240 degrees F,		90% elongation (reinforced)
Water absorption psi minimum (Method A) 158 degrees F, 7 days	ASTM D471	Plus 3% weight change
Ozone resistance 100 deg F – 70 hours	ASTM D1149	Pass
Dimensional stability 24 hours at 54 deg C	ASTM D1204	+/- 0.3%
Puncture resistance, minimum	FTM 101C Method 2031	300 lbf

B. Seaming and Adhesive Materials: As recommended by membrane manufacturer.

C. Flexible Flashing: 60 mil thick unreinforced TPO membrane; white color; manufactured by membrane manufacturer.

D. Prefabricated Perimeter Flashing: TPO coated metal flashing flanges.

2.03 CANTS

A. Fiber Cant and Tapered Edge Strips: Perlite or wood fiberboard, approved by membrane manufacturer, preformed to 45 degree angle; or as required by details.

2.04 TAPERED INSULATION AND CRICKETS

A. Tapered Insulation System: Factory tapered perlite with a minimum slope of 1/4 in./ft unless otherwise noted; ASTM C728; approved for use with single-ply mechanically attached membrane roofing. Compression resistance: 35 psi, water absorption 1.2%; ASTM C209; weight: 0.9lbs/SF.

1. Provide tapered cricket insulation over rigid foam insulation cover board earlier specified.

2. Provide roofing membrane manufacturer's written approval of system layout and fastening.

2.06 ACCESSORIES

A. Sealants: As recommended by membrane manufacturer.

B. Cover Board: Georgia-Pacific, DensDeck cover board, minimum 1/4 inch thickness, ASTM C1177 as recommended and provided by membrane manufacturer. 4 ft x 8 ft boards.

C. Reglet and Counter Flashing: As specified in Section 07 62 00.

D. Roof Drains:

1. Jay R. Smith, Model No. 1010 and 1080 with clamping ring.

2. Provide expansion joint if drain is connected directly to vertical rainleader or with less than 2 ft offset.

E. Mechanical Fasteners for Insulation: Appropriate to purpose intended and approved by UL; length required for thickness of material; with metal washers; manufactured by membrane manufacturer.

F. Disc Washers and Screws: Membrane manufacturer's standard.

G. Flashing Materials: Manufacturer's standard system compatible with sheet membrane. Including premolded inside and outside corners, pipe flashing and square tube wraps.

H. Roof Vents: One-way 2-inch-diameter vapor pressure relief vents at a rate of one per 1000 sq ft of roof area.

I. All roof accessories to be installed per sheet roofing membrane manufacturer's approved details.

2.07 WOOD TREATMENT

A. Creosote and asphaltic preservatives are not acceptable for use with membrane.

B. Preservative Treatment: Where lumber or plywood is indicated as "treated," or is specified herein to be treated, comply with applicable requirements of AWPA Standards C2 (lumber) and C9 (plywood) and of AWPB standards listed below. Mark each treated item with the AWPB Quality Mark Requirements.

C. Pressure-treat aboveground items with water-borne preservatives to comply with AWPB LP-2. After treatment, kiln-dry lumber and plywood to a maximum moisture content, respectively, of 19% and 15%. Treat indicated items and the following:

1. Wood cants, sleepers, nailers, curbs, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers and waterproofing.

PART 3 – EXECUTION

3.01 INSPECTION

A. Membrane manufacturer's technical advisor shall field inspect prepared roof surface prior to membrane application and compile a written report to the Architect prior to roofing membrane application.

B. Contractor shall verify that insulation and other systems have been installed complying with membrane manufacturer's recommended practices.

C. Verify deck is clean and smooth, free of depressions, waves, or projections, properly sloped to drains.

D. Verify roof openings and penetrating elements through roof are solidly set, wood cant strips, wood nailing strips, and reglets are in place. Verify deck is supported and secured.

E. Do not apply roofing materials to damp, frozen, dirty, dusty, or deck surfaces unacceptable to manufacturer.

F. Verify deck surfaces are dry and free of snow or ice. Confirm dry deck by moisture meter with 12 percent moisture maximum.

G. Ensure flatness and verify tight joints of wood deck.

H. Beginning installation means acceptance of substrate.

3.02 **PREPARATION**

A. Seal joints of plywood deck with tape. Fill knotholes with latex filler.

B. Install metal reglets flashing and mechanically fasten rigid. Apply sealant to top edge continuous.

3.03 **INSULATION APPLICATION**

A. Verify sheathing paper is clean and dry.

B. Place layers of insulation and cover board in accordance with insulation manufacturer's instructions.

C. Insulation shall be installed in compliance with the flamespread and smoke density requirements of Section 2603 of the IBC.

D. Lay insulation boards to moderate contact without forcing joints. Cut insulation to fit neatly to perimeter blocking and around protrusions through roof.

E. Lay tapered boards back from roof drains for positive drainage.

F. Lay tapered boards to establish pitch to drains. Provide positive slope (minimum 1/8 in./ft; unless otherwise noted; from horizontal).

G. Mechanically or adhesively fasten insulation boards per roofing manufacturer's recommendations.

H. Tape joints of insulation in accordance with insulation manufacturer's instructions.

I. Install cant strips to internal corners by mechanical fasteners.

J. Apply separation sheet in accordance with manufacturer's instructions.

3.04 **MEMBRANE INSTALLATION**

A. Install membrane roofing in accordance with membrane manufacturer's instructions.

B. Roll out membrane. Minimize wrinkles and bubbles.

C. Overlap edges and ends minimum 4-1/2 inch and heat seal. Apply uniform bead of sealant to cut edges.

D. Install mechanical fasteners in accordance with manufacturer's recommendations.

E. Shingle joints on sloped substrate in direction of drainage.

F. Seal adjoining surfaces.

G. Continue membrane up vertical surfaces minimum 8 in. unless otherwise noted.

H. Seal items penetrating membrane with counterflashing membrane material.

I. Install flashings. Seal watertight to membrane.

J. Reinforce membrane with multiple thickness of membrane material over joints, whether joints are static or moving

K. Apply roof control and expansion joint materials to isolate roof into areas as shown.

L. Place traffic surfacing (walkway roll) at locations noted on roof plan. As a minimum, install continuous walkway extending from roof hatch to each roof drain and each HVAC mechanical unit. Install walkway along all sides of HVAC mechanical units.

M. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed during same day.

3.05 PROTECTION

A. Protect finished installation under provisions of Section 01 50 00.

B. After installation, close off area to prevent unauthorized traffic.

3.06 FIELD QUALITY CONTROL

A. Inspection will be performed by firm appointed in accordance with Section 01 45 00 for compliance to the work of this Section.

B. Manufacturer's technical representative shall provide final inspection report to Architect. This inspection will verify acceptance of installation by manufacturer for issuance of manufacturer's warranty. If any deficiencies are found to effect final acceptance by manufacturer, then the Contractor shall make any repairs; changes required for final acceptance by manufacturer; at his own expense with no cost to Owner/Architect.

3.07 CLEANING

A. Remove trash, debris, equipment, and parts from job site.

B. Repair damage and remove stains caused by work of this Section.

3.08 MAINTENANCE/EXTRA STOCK

A. Instruct Owner's Representative in periodic maintenance of roof membrane. Provide maintenance manuals, warranties and information required for future maintenance.

B. Maintenance Material: Provide complete set of materials to Owner for maintenance of roof membrane. Include 10 sf of material, all adhesives, caulk, and miscellaneous items required to repair minor leaks. Obtain receipt from Owner upon delivery and submit to Architect.

END OF SECTION

PAGE LEFT BLANK INTENTIONALLY

SECTION 07 62 00
SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.01 REFERENCES

A. AISI (American Iron and Steel Institute) - Stainless Steel - Uses in Architecture.

B. ASTM A653 – Steel sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

C. ASTM A792 – Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.

D. ASTM B32 - Solder Metal.

E. ASTM B209 - Aluminum and Alloy Sheet and Plate.

F. ASTM B370 - Copper Sheet and Strip for Building Construction.

G. ASTM B486 - Paste Solder.

H. ASTM D226 - Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.

I. ASTM D4586 - Asphalt Roof Cement, Asbestos-Free.

J. FS O-F-506 - Flux, Soldering, Paste and Liquid.

K. NRCA (National Roofing Contractors Association) - Roofing Manual.

L. SMACNA - Architectural Sheet Metal Manual.

M. AAMA – American Architectural Manufacturers Association.

N. AAMA 611 – Specification for Anodized Architectural Aluminum.

O. AAMA 2605 – Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Architectural Extrusions and Panels.

P. AA - Aluminum Association. Aluminum Design Manual.

Q. PCI – Powder Coating Institute.

1.02 SUBMITTALS

A. Submit under provisions of Section 01 34 00.

B. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.

C. Samples: Submit two (2) samples, illustrating typical material, color and finish.

1.03 QUALIFICATIONS

A. Fabricator and Installer: Company specializing in sheet metal flashing work with three (3) years experience.

1.04 **DELIVERY, STORAGE, AND HANDLING**

A. Deliver, store, protect, and handle products to site under provisions of Section 01 60 00.

B. Stack preformed material to prevent twisting, bending, or abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.

C. Prevent contact with materials that may cause discoloration or staining.

1.05 **ALTERNATES**

A. See Section 01 23 00 for bidding alternates affecting the Work of this Section.

1.06 **COLORS**

A. Colors are specified on Colors and Materials Schedule on the drawings.

PART 2 - PRODUCTS

2.01 **MATERIALS – SHEET METAL**

A. Steel Sheet: ASTM A792, AZ-60 [AZ-55] Zincalume / Galvalume (Aluminum-Zinc hot dip coating) steel sheet, minimum yield 50,000 psi, minimum [20] 24 gauge thickness if not specified under components. Factory Finish. Shop-Applied Finish.

B. Aluminum Sheet: ASTM B209, alloy 5005 aluminum sheet, minimum 0.0403-inch (18 gauge) thickness if not specified under components. Factory Finish.

C. Stainless Steel Sheet: ASTM A167, alloy 316 stainless steel sheet, minimum 24 gauge thickness if not specified under components. Factory Finish.

2.02 **COMPONENTS**

A. Coping: As shown in SMACNA figure 3-4A. Including continuous cleat. Exterior fascia style E1 as shown in SMACNA page 3.4. Coping seam as shown in SMACNA figure 3-3 #22 (Single lock standing seam). Steel sheet material. Minimum thickness of as recommended by SMACNA. Panels with 5 inch or greater face to be a minimum of 20 gauge thickness.

B. Flashing, Trim and Break Shapes: Steel sheet material. Minimum thickness of 24 gauge.

C. Masonry Flashing (Through-Wall): Stainless steel sheet material. Minimum 20 gauge thickness.

D. Masonry Flashing (Base of Wall): Stainless steel sheet material. Minimum 20 gauge thickness.

E. Exterior Wall Flashing (Base of Wall): Stainless steel sheet material. Minimum 20 gauge thickness.

F. Saddle Flashing (Concealed): Stainless steel sheet material. Minimum 24 gauge thickness. Soldered fabrication.

G. Gutters: Fabricate gutter profile with dimensions of 6" width x 6" depth. Shape as shown in SMACNA figure 1-2 Style J. Steel sheet material. Minimum thickness of 20 gauge. Form gutters in sections as long as possible, but not less than 10 feet in length complete with end pieces, outlet tubes and special pieces as required.

1. Gutters (Installation): Install gutter with continuous cleat, hanger straps and spacers. Straps and spacers installed at 36" o.c. maximum, fabricated from 1/8 inch x 1 inch flat stock. Material, color and finish same as gutters. Gutter installation similar to that shown in SMACNA figure 1-17B. Fabricate strap profile and coordinate strap installation to allow for removable gutter screen.

2. Gutter Outlet Tubes: Shape and sized to fit into downspouts. Material, gauge, color and finish same as gutters. Downspout to gutter connection similar as shown in SMACNA figure 1-33B, detail 2.

3. Eave Drip Flashing Over Gutter: Material, gauge, color and finish same as gutters.

4. Gutter Expansion Joint: Butt type with cover plate similar to SMACNA figure 1-5.

H. Downspouts: Rectangular 3" width x 6" depth, smooth, non-corrugated. Steel sheet material. Minimum thickness of 20 gauge. Mitered and welded or soldered for watertight fabrication. Form downspouts in sections as long as possible, but not less than 10 feet in length complete with special pieces as required. Factory Finish.

I.

1. Downspout Hangers: 3" wide flat stock. Material, color and finish same as downspouts. Minimum thickness of 20 gauge Hanger profile as shown in SMACNA figure 1-35B or 1-35H for rectangular profiles and SMACNA Figuire 1-35E for round profiles.

J. Reglet and Counter Flashing: Fry Reglet Architectural Metals. Springlok Flashing System. Type MA (Masonry Reglet) Provide 24 gauge stainless steel, type 304 for flashing and reglet. Manufacturer's prefabricated corners. Provide all accessories, components and fasteners for complete installation.

1. Factory Finish:

a) Galvanized Steel: Kynar 500 / Hylar 500 finish or factory applied powder coating in standard Fry Reglet colors.

b) Aluminum: Gray polyester coating.

c) Stainless Steel (type 304): Standard uncoated finish.

2. Shop-Fabricated Reglet and Counter Flashing: Shop-fabricated two-piece reglet and counter flashing system; with counter flashing spring action contact and profile as shown in SMACNA figure 4-4, FIG 4-4D. Stainless Steel sheet material. Minimum thickness of 24 gauge Surface mounted reglet with vertical leg. Shop-fabricated corners. Color and finish as specified under Materials.

K. Conductor Head: Dimensions of 20" width x 10" depth x 15" height. Fabricate shape similar to SMACNA figure 1-25F. Mitered and welded or soldered for watertight fabrication. Steel sheet material. Minimum thickness of 24 gauge Color and finish as specified under Materials.

L. Exterior Wall Opening Flashing (Windows, Doors, Louvers): Steel sheet material. Minimum thickness of 20 gauge.

M. Exterior Wall Opening Flashing (Aluminum Storefront): Minimum 0.0403-inch aluminum sheet material. Color and finish to match storefront frame as specified in Section 08 41 13.

N. Exterior Wall Opening Flashing (Hollow Metal Door Frames @ Masonry Wall Openings): Steel sheet material. Minimum thickness of 24 gauge [as indicated under Materials. Color and finish to match [hollow metal frame.

2.03 ACCESSORIES

A. Fasteners: Stainless steel screws with soft neoprene washers. Stainless steel rivets.

B. Felt Underlayment: ASTM D226, No. 15 asphalt saturated roofing felt.

C. Slip Sheet: Red Rosin building paper. W.R. Meadows Sealtight.

D. Protective Backing Paint: Bituminous coating.

E. Sealant: As specified in Section 07 92 00.

F. Plastic Cement: ASTM D4586, Type I.

G. Membrane Flashing: As specified in Section 07 25 00.

H. Membrane Underlayment (High-Temp): As specified in Section 07 25 00.

I. Isolation Tape (Dissimilar Metal Tape): Kelcom Inc or equal. Separation tape.

J. Neoprene Tape (Weather Stripping): Kelcom Inc or equal. Neoprene tape. Compressible closed cell used for sealing and weather stripping.

K. Butyl Tape (Sealing): Kelcom Inc or equal. Butyl tape. Used for watertight seal between two substrates.

2.04 FABRICATION

A. Shop-fabricate work to greatest extent possible and comply with details shown and with applicable requirements of SMACNA Architectural Sheet Metal Manual.

B. Form gutters of profiles and size required. Fabricate gutter screen to fit gutter profile and hanger.

C. Field measure site conditions prior to fabricating work.

D. Form the work to fit substrates. Comply with material manufacturer instructions and recommendations for forming material.

E. Fabricate with required connection pieces.

F. Form sections square, true, and accurate in size and shape, in maximum possible lengths but not less than 10 feet in length and free of distortion or defects detrimental to appearance or performance. Allow for expansion at joints where required by SMACNA recommendations. Keep joints to minimum, but any joint that is required, shall be provided with butt seam with concealed backup plate at joints unless specified otherwise. Coordinate joint layout with Architect prior to installation of sections.

G. Hem exposed edges of metal.

H. Mitered and soldered or welded fabricated components.

I. Seam and install sealant at metal joints watertight.

J. Fabricate gutters, downspouts and related components; seal watertight.

K. Fabricate through-wall scuppers, conductor heads and related components; seal watertight.

L. Fabricate copings in minimum of 10 ft sections and jointed to allow for longitudinal expansion. Corners on copings shall be mitered, lap-seamed and sealed. Install copings with continuous concealed cleat at the side of exterior walls opposite of the roof.

M. Fabricate corners from one piece with minimum 18 to 24 inch long legs; seal corner watertight.

N. Form exposed sheet metal work without excessive oil-canning, buckling and tool marks, true to line and levels indicated with exposed edges folded back to form hems.

O. Fabricate sheet metal flashing, trim and components of specified profiles and shapes such that all visible exposed surfaces shall be of color and finish as specified. Conditions where both sides of the sheet metal material surface is visibly exposed to view; Contractor has option to provide single-piece of sheet metal material with specified color and finish on both visibly exposed surfaces or provide 2-pieces of sheet metal material with specified color and finish on one surface, fabricate the item with the two sheet metal material pieces back-to-back such that all visible exposed surfaces are of color and finish specified.

2.05 FINISH - STEEL

A. Prepare surfaces in accordance with Section 09 91 00.

B. All visible exposed surfaces shall be of color and finish as specified.

C. Back paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mils.

D. Factory Finish: Kynar 500 / Hylar 5000 High-Performance (PVDF) Fluoropolymer Resin Finish (minimum 70% Polyvinylidene Fluoride (PVDF) resins) complying with AAMA 2605 specification requirements. Color as specified in Colors and Materials Schedule. Provide custom color when specified.

2.06 FINISH – ALUMINUM

A. Prepare surfaces in accordance with Section 09 91 00.

B. All visible exposed surfaces shall be of color and finish as specified.

C. Back paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mils.

D. Factory Finish: Kynar 500 / Hylar 5000 High-Performance (PVDF) Fluoropolymer Resin Finish (minimum 70% Polyvinylidene Fluoride (PVDF) resins) complying with AAMA 2605 specification requirements. Color as specified in Colors and Materials Schedule. Provide custom color when specified.

2.07 **FINISH – STAINLESS STEEL**

A. Prepare surfaces in accordance with Section 09 91 00.

B. All visible exposed surfaces shall be of color and finish as specified.

C. Back paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mils.

D. Factory Finish: Kynar 500 / Hylar 5000 High-Performance (PVDF) Fluoropolymer Resin Finish (minimum 70% Polyvinylidene Fluoride (PVDF) resins) complying with AAMA 2605 specification requirements. Color as specified in Colors and Materials Schedule. Provide custom color when specified.

PART 3 - EXECUTION

3.01 **EXAMINATION**

A. Verify that surfaces are ready to receive work.

B. Verify roof openings, curbs, pipes, sleeves, ducts, or vents through roof are solidly set, reglets in place, and nailing strips located.

C. Verify roofing termination and base flashings are in place, sealed, and secure.

D. Beginning of installation means acceptance of substrate.

3.02 **PREPARATION**

A. Install starter and edge strips, and cleats before starting installation.

B. Install surface-mounted reglets true to lines and levels. Seal top of reglets with sealant.

3.03 **INSTALLATION**

A. Except as otherwise indicated, comply with manufacturer’s installation instructions and recommendations and with SMACNA Architectural Sheet Metal Manual.

B. Install conductor heads, through-wall scuppers, flashing, trim and break shapes, reglets and counter flashing system, copings, saddles, gutters, downspouts, eave and rake flashings, and accessories in accordance with manufacturer's instructions and SMACNA manual. Coordinate installation of flashings with other sections.

C. Secure flashings in place using concealed fasteners. Use exposed fasteners only where permitted.

D. Apply plastic cement compound between metal flashings and felt flashings.

E. Install isolation tape between dissimilar metals.

F. Fit flashings tight in place. Make corners square, surfaces true and straight in planes, and lines accurate to profiles.

G. Install work with laps, joints and seams that will be permanently watertight and weatherproof.

H. Drip edge flashing shall be provided with butt seam with concealed backup plate at joints; form drip edge flashing in sections as long as possible, but not less than 10 feet in length. Coordinate joint layout with Architect prior to installation of drip edge flashing.

I. Trim, flashing and break shapes shall be provided with butt seam with concealed backup plate at joints; form trim, flashing and break shapes in sections as long as possible, but not less than 10 feet in length. Coordinate joint layout with Architect prior to installation of trim, flashing and break shapes.

J. Join lengths with seams of joint type allowing flush alignment of adjacent lengths, sealed watertight and allowing for thermal movement. Flash and seal gutters to downspouts and accessories.

K. Install L-shaped metal flashing at base of exterior framed walls. Minimum 4 inch vertical leg. Install metal base flashing after weather resistive barrier installed over exterior gypsum sheathing. Seal vertical leg of metal base flashing to weather resistive barrier with membrane flashing. Set bottom leg of metal base flashing in beads of sealant.

L. Install concealed L-shaped vertical metal flashing at inside corners of exterior framed walls and ends of exterior framed walls abutting brick masonry or concrete. Minimum 3 inch legs. Install metal flashing after weather resistive barrier installed over exterior gypsum sheathing. Seal leg of metal flashing to weather resistive barrier with membrane flashing. Set leg of metal flashing in beads of sealant at face of brick masonry wall.

M. Slope gutters 1/16 inch per foot towards downspouts for positive drainage.

N. Locate gutter expansion joints and unrestrained gutter terminations indicated to allow for thermal movement. Fix gutter at inside corners and outlet tubes.

O. Seal and seal metal joints watertight. Coordinate with Section 07 92 00 for sealants.

P. Install downspout hangers at 12 inch maximum distance from each end of downspout in contact with exterior wall and maximum 10 feet o.c. vertical spacing. Install a minimum of (3) hangers for each downspout.

Q. Secure flashings in place using concealed fasteners and cleats.

R. Secure gutters in place using concealed fasteners.

S. Connect downspouts to storm sewer system. Seal connection watertight. Provide downspout connections and cleanouts as indicated in Section 05 50 00 Metal Fabrications.

END OF SECTION

PAGE LEFT BLANK INTENTIONALLY

SECTION 07 72 00
ROOF ACCESSORIES

PART 1 - GENERAL

1.01 SUBMITTALS

A. Product Data and Samples:

1. Submit per Section 01 34 00.

B. Shop Drawings:

1. Submit per Section 01 34 00.

2. Snow guards: Include roof plans showing layout, attachment details and spacing, signed and sealed by a professional engineer.

1.02 DELIVERY, STORAGE, AND HANDLING

A. In accordance with Section 01 60 00 and the following:

1. Acceptance at site:

a. Verify undamaged condition.

2. Protection (prior to installation):

a. Store out of harm's way.

3. Handle to prevent marring finishes.

1.03 COLORS

A. Colors are specified on the Colors and Materials Schedule on drawings.

1.04 ALTERNATES

A. See Section 01 23 00 for bidding alternates affecting the work of this Section.

PART 2 - PRODUCTS

2.01 ROOF HATCH

A. Furnish and install Bilco “Type S”, 36 x 30 inch, galvanized steel roof hatch.

PART 3 - EXECUTION

3.01 INSPECTION

A. Verify installation conditions as satisfactory to receive work of this Section. Do not install until

any unsatisfactory conditions are corrected. Beginning work constitutes acceptance of conditions as satisfactory.

3.02 PREPARATION

A. Protect surrounding surfaces to preclude damage from work of this Section.

3.03 INSTALLATION

A. Install in accordance with specifications and manufacturer's directions. Where these may be in conflict, the more stringent requirements apply.

END OF SECTION

SECTION 07 92 00
JOINT SEALANTS

PART 1 - GENERAL

1.01 REFERENCES

A. ASTM C661 - Standard Test Method for Indentation Hardness of Elastomeric Type Sealants by Means of a Durometer.

B. ASTM C834 - Latex Sealants.

C. ASTM C920 - Elastomeric Joint Sealants.

D. ASTM C1248 - Test Method for Staining of Porous Substrate by Joint Sealants.

E. ASTM C1311 - Standard Specification for Solvent Release Sealants.

F. ASTM C1330 - Cylindrical Sealant Backing for Use with Cold Liquid Applied Sealants.

G. ASTM D2240 - Standard Test Method for Rubber Property - Durometer Hardness.

H. FDA (U.S. Food and Drug Administration) - 21 CFR 177.2600: Title 21 Part 177 Indirect Food Additives: Polymers

I. NSF (NSF International) - Standard 51: Food Equipment Materials.

J. SWRI (Sealant, Waterproofing and Restoration Institute) - Sealant and Caulking Guide Specification.

K. SWRI (Sealant, Waterproofing and Restoration Institute) – Validation Program.

1.02 SUBMITTALS

A. Submit under provisions of Section 01 34 00.

B. Data: Provide data indicating sealant chemical characteristics, performance criteria, substrate preparation, limitations, and color availability. Colors will be selected by Architect from manufacturer's full line of available colors.

C. Samples for Color Selection: For each joint sealant type.

D. Mockups: Provide joint sealant application within mockups required in other sections identical to specified joint sealants and installation methods.

1.03 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the products specified in this Section with minimum five (5) years documented experience.

B. Applicator: Company specializing in performing the work of this Section with minimum five (5) years experience approved by manufacturer.

1.04 ENVIRONMENTAL REQUIREMENTS

A. Maintain temperature and humidity recommended by the sealant manufacturer during and after installation.

1.05 **COORDINATION**

A. Coordinate work under provisions of Section 01 04 10.

1.06 **WARRANTY**

A. Provide one (1) year warranty under provisions of Section 01 74 00.

B. Warranty: Include coverage for installed sealants and accessories that fail to achieve watertight seal and exhibit loss of adhesion or cohesion, or do not cure.

C. Special Manufacturer's Warranty: Manufacturer's standard form in which joint sealant manufacturer agrees to furnish joint sealants to repair or replace those that demonstrate deterioration or failure under normal use within warranty period specified.

1. Warranty Period for Silicone Sealants: Twenty (20) years from date of Substantial Completion.

1.07 **ALTERNATES**

A. See Section 01 23 00 for bidding alternates affecting the work of this Section.

1.08 **COLORS**

A. Colors are specified on Colors and Materials Schedule on the drawings.

PART 2 - PRODUCTS

2.01 **MATERIALS**

A. General:

1. [VOC Content for Interior Applications: Provide sealants and sealant primers complying with the following VOC content limits per 40 CFR 59, Subpart D (EPA Method 24):

a. Architectural Sealants: 250 g/L.

b. Sealant Primers for Nonporous Substrates: 250 g/L.

c. Sealant Primers for Porous Substrates: 775 g/L.]

2. Compatibility: Provide joint sealants and accessory materials that are compatible with one another and with materials in close proximity under use conditions, as demonstrated by sealant manufacturer using ASTM C1087 testing and related experience.

3. Stain Test Characteristics: Where sealants are required to be nonstaining, provide sealants tested per ASTM C 1248 as non-staining on porous joint substrates indicated for Project.

4. Food Contact Suitability: Where sealants are required to be suitable for contact with

food provide sealants complying with 21 CFR 177.2600.

B. Liquid Joint Sealants:

1. Single-Component, Nonsag, Neutral-Curing Sealant:
ASTM C 920, Type S, Grade NS, Class 50, for Use NT, G, M, A, and O; SWRI validation.
Hardness, ASTM D 2240: 35 durometer Shore A, minimum.

The Dow Chemical Company, DOWSIL 756 SMS Building Sealant.

Use in the following locations:

a. Exterior joints in metal panel cladding systems.

2. Acrylic Latex Sealant:
Siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.

Pecora AC20 + Silicone.
Sonneborn Sonolac.
Tremco Tremflex 834.

Use in the following locations:

a. Interior perimeter joints of interior frames.
b. Interior non-moving joints between interior painted surfaces and adjacent materials.

3. Butyl-Rubber-Based Sealant:
ASTM C 1311.

Tremco Butyl Sealant.

Use in the following locations:

a. Interior concealed sealants at thresholds and sills.

4. Single-Component, Nonsag, Neutral-Curing Sealant:
ASTM C 920, Type S, Grade NS, Class 50, for Use NT, G, M, and A; SWRI validation.
Hardness, ASTM D 2240: 34 durometer Shore A, minimum.

The Dow Chemical Company, DOWSIL 791 Silicone Weatherproofing Sealant.

Use in the following locations:

a. Interior perimeter joints of exterior frames.

5. Self-Leveling Urethane Sealant:
ASTM C920, Type S or M, Grade P, Class 25, Use T.

Sonolastic SL2.
Pecora Urexpan NR-200.
Tremco THC 900.

Use in the following locations:

a. Exterior horizontal traffic and traffic isolation joints.
b. Interior traffic joints in floor and between floor and wall construction.

6. Paintable Urethane Acrylic Sealant:

   OSI Pro Series H2U Acrylic Urethane.
   Benjamin Moore Moorlastic Urethane Acrylic Sealant 465.

   Use in the following locations:

   Exterior joints in wood or fiber cement siding to be painted.

7. Single-Component, Nonsag, Non-Staining, Neutral-Curing Silicone Sealant:
   ASTM C920, Type S, Grade NS, Class 100/50, for Use NT, G, M, A, and O; SWRI validation. Hardness, ASTM D2240: 15 durometer Shore A.
   Staining, ASTM C1248: None on concrete, granite, limestone, and brick.

   The Dow Chemical Company, DOWSIL 790 Silicone Building Sealant.
   Tremco Spectrem 3.

   Use in the following locations:

   a. Exterior construction joints in cast-in-place concrete. Above-grade.
   b. Exterior movement joints in concrete unit masonry. Above-grade.
   c. Exterior movement joints in brick masonry. Above-grade.
   d. Exterior movement joints in stone masonry. Above-grade.
   e. Exterior joints within exterior insulation finish systems (EIFS).
   f. Exterior joints between different materials listed above. Above-grade.
   g. Exterior perimeter joints at frames of doors, windows, storefront frames, curtain wall frames, and louvers.
   h. All other exterior non-traffic joints. Above-grade.
   i. Interior movement joints in exterior concrete and unit masonry.

8. Mildew-Resistant, Single-Component, Nonsag, Acid-Curing Sealant:
   ASTM C 920, Type S, Grade NS, Class 25, for Use NT.
   NSF Standard 51 and FDA Regulation No. 21 CFR 177.2600 compliant.
   Hardness, ASTM D 2240: 25 durometer Shore A, minimum.

   The Dow Chemical Company, DOWSIL 786 Silicone Sealant.
   Sonneborn OmniPlus.
   Tremco Tremsil 200.

   Use in the following locations:

   a. Interior sanitary joints between plumbing fixtures and food preparation fixtures and casework and adjacent walls, floors, and counters.

9. Single-Component, Nonsag, Neutral-Curing Silicone Sealant:
   ASTM C 920, Type S, Grade NS, Class 25, for Use NT; SWRI validation.
   Hardness, ASTM D 2240: 45 durometer Shore A, minimum.

   The Dow Chemical Company, DOWSIL 758 Silicone Building Sealant.

   Use in the following locations:

   a. Exterior concealed watertight joints in cladding systems.

10. Non-hardening Acoustical Sealant:

Tremco Acoustical Sealant.
OSI SC-175.
USG sheetrock Acoustical Sealant.

Use in the following locations:

a. Interior exposed and non-exposed acoustical applications.

11. Single Component Urethane Sealant:

Pecora Dynatrol 1-XL
Sonneborn Sonolastic NP-1
Tremco Dymonic

Use in the following locations:

a. Expansion joints in ceramic tile floors.

12. Single Component Silicone Sealant:

The Dow Chemical Company, DOWSIL 799 Silicone Glass and Metal Building Sealant.

Use in the following locations:

a. Clear sealant at exposed bolt and fastener connections in exterior exposed metal fabrications.

13. Single Component High Performance Neutral Cure Silicone Sealant:

The Dow Chemical Company, DOWSIL Glass and Metal Silicone Sealant.

Use in the following above-grade locations:

b. Sealant for sheet metal and aluminum roofing, flashing, gutters and rainwater accessories.

C. Pre-formed Joint Sealants

1. Preformed Silicone Elastomer Extrusion Seal:
Highly flexible low-modulus flashing and transition material for bonding to substrates with silicone sealant. SWRI validation.
Surface: **[**Smooth matte**] [**Textured**] [**Grooved to facilitate bending**]**.
Bonding Sealant: Manufacturer's recommended neutral-curing silicone.
Hardness, ASTM D 2240: 25 durometer Shore A, minimum.

The Dow Chemical Company, DOWSIL 123 Silicone Seal.

Use for repair of existing sealant joints as indicated.

2. Preformed Silicone Elastomer Custom Two- and Three- Dimension Extrusion Seal:
Highly flexible flashing and transition material for bonding to substrates with silicone sealant. Formulation: General Purpose**.** Shape: Multi-dimensional as indicated on drawings and approved shop drawings and as required to fit and functionally seal specific application and prevent air and water penetration.

The Dow Chemical Company, DOWSIL 123 Silicone Seal Custom Designs H.C.

Use for repair of existing sealant joints as indicated where surfaces are not in the same plane.

D. Sealant Color: As selected by Architect.

2.03 ACCESSORIES

A. Joint Substrate Primers: Substrate primer recommended by sealant manufacturer for application.

B. Cylindrical Sealant Backing: ASTM C 1330, Type B non-absorbent, bi-cellular material with surface skin, Type C closed cell polyethylene or Type O open-cell polyurethane, as recommended by sealant manufacturer for application. Diameter 1/3 to 1/2 greater than width of joint where it is to be installed.

1. Polystyrene foam not acceptable.

C. Bond Breaker Tape: Polymer tape compatible with joint sealant materials and recommended by sealant manufacturer.

D. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.

E. Bond Breaker: Pressure sensitive polyethylene tape/plastic tape recommended by sealant manufacturer, applied to sealant contact surfaces where bond to substrate or backer rod must be avoided for proper performance of sealant.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces and joint openings are ready to receive work.

B. Verify that joint backing and release tapes are compatible with sealant.

3.02 PREPARATION

A. Remove loose materials and foreign matter that might impair adhesion of sealant.

B. Clean joints in accordance with manufacturer's instructions.

C. Perform preparation in accordance with ASTM C804 for solvent release and ASTM C790 for latex base sealants.

D. Verify that joint backing and release tapes are compatible with sealant.

E. Protect elements surrounding the work of this Section from damage or disfiguration.

3.03 PRIMER APPLICATION

A. General: Install primer wherever recommended by sealant manufacturer for conditions/materials being sealed to achieve manufacturer's published joint performance criteria including applicable federal specifications.

B. Prime all exterior joints, using primer recommended by sealant manufacturer for substrate/conditions.

3.04 INSTALLATION

A. Install sealant in accordance with manufacturer's instructions.

B. Measure joint dimensions and size materials to achieve required width/depth ratios. Minimum joint width for exterior joints not indicated otherwise shall be 1/4 -in.

C. Install joint backing to achieve a neck dimension no greater than 1/3 of the joint width.

D. Install bond breaker where joint backing is not used.

E. Install sealant free of air pockets, foreign embedded matter, ridges, and sags.

F. Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

G. Tool joints concave, unless noted otherwise.

H. Remove improperly applied sealant and replace with new.

3.05 PRE-FORMED JOINT SEALANTS

A. Sealant: Apply bead of silicone sealant on each side of joint and 1/4 inch inside masking tape.

1. Bead size:

a. Rough substrate: 1/4 inch.

b. Smooth substrate: 1/8-inch.

2. Minimum bonding area: 3/8 inch.

B. Preformed Silicone seal: Within 10 minutes of sealant application, press silicone extrusion into wet sealant. Apply consistent pressure with roller to ensure uniform contact.

C. Complete horizontal joints prior to vertical joints. Lap vertical seal over seal on horizontal joint.

D. At joint ends, cut extrusion with razor knife.

E. Cleaning: Remove masking tape and excess sealant.

3.06 FIELD QUALITY CONTROL

A. Perform adhesion tests for replacement silicone sealant joints and preformed silicone seal in accordance with manufacturer’s instructions and ASTM C1193, Method A, Field-Applied Sealant Joint Hand-Pull Tab.

1. Perform 5 tests for first 1,000 linear feet of applied silicone sealant and 1 test for each 1,000 feet sealant thereafter or perform 1 test per floor per building elevation minimum.

2. For sealants applied between dissimilar materials, test both sides of joint.

B. Sealants failing adhesion test shall be removed, substrates cleaned, seals re-installed, and re-testing performed.

C. Maintain test log and submit report to Architect indicating tests, locations, dates, results, and remedial actions.

3.07 CLEANING

A. Clean work under provisions of Section 01 56 00.

B. Clean adjacent soiled surfaces.

3.08 PROTECTION OF FINISHED WORK

A. Protect sealants until cured.

B. Repair or replace defaced or disfigured finishes caused by work of this Section.

END OF SECTION

SECTION 08 11 13
HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.01 **REFERENCES**

A. ASTM A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

B. ASTM A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

C. ASTM A924 – Standard Specification for General Requirements for Steel Sheet Metallic-Coated by the Hot-Dip Process.

D. ASTM C236 - Test Method for Steady-State Thermal Performance of Building Assemblies by Means of a Guarded Hot-Box.

E. ASTM E152 - Methods of Fire Tests of Door Assemblies.

F. ASTM E413 - Classification for Determination of Sound Transmission Class.

G. DHI (Door Hardware Institute) - The Installation of Commercial Steel Doors and Steel Frames, Insulated Steel Doors in Wood Frames and Builder's Hardware.

H. NFPA 80 - Fire Doors and Windows.

I. NFPA 252 - Fire Tests for Door Assemblies.

J. ANSI A250.8- SDI-100 - Recommended Specifications for Standard Steel Doors and Frames.

K. SDI – Steel Door Institute.

L. SDI-105 - Recommended Erection Instructions for Steel Frames.

M. SDI-111 – Standard Steel Doors, Frames, Accessories and Related Components.

N. SDI-112 – Zinc-Coated (Galvanized / Galvannealed) Steel Doors and Frames.

O. UL 10B - Fire Tests of Door Assemblies.

1.02 **SUBMITTALS**

A. Submit shop drawings and product data under provisions of Section 01 34 00 - Submittals.

B. Indicate frame configuration, anchor types and spacings, location of cutouts for hardware, reinforcement and finish.

1.03 **QUALITY ASSURANCE**

A. Conform to requirements of ANSI A250.8.

B. Conform to Steel Door Institute (SDI) published standards and performance requirements.

C. Manufacturer: Company specializing in manufacturing the products specified in this Section with minimum three (3) years documented experience.

1.04 **REGULATORY REQUIREMENTS**

A. Fire Rated Door and Panel Construction: Conform to UL 10B.

B. Installed Door and Frame Assembly: Conform to NFPA 80 for fire rated class as indicated on drawings.

C. Thermal Performance of Exterior Doors: The maximum U-value for opaque doors, having less than 50% glass area, shall be 0.37. The maximum U-value for glazed swinging doors, having 50% or more glass area, shall be 0.60 when tested in accordance with NFRC 100, and the maximum SHGC value shall be 0.40 when tested in accordance with NFRC 200, and assemblies shall carry NFRC labels

D. Air Leakage: Maximum air infiltration rates for exterior door assemblies shall be 0.30 cfm/sq. ft. when tested in accordance with AAMA/WDMA/CSA101/I.S.2/A440 at 6.24 psf, or 0.20 cfm/sq. ft. when tested in accordance with AAMA/WDMA/CSA101/I.S.2/A440 or NFRC 400 at 1.57 psf. Assemblies shall be labeled.

1.05 **DELIVERY, STORAGE, AND PROTECTION**

A. Section 01 60 00 – Product Requirements: Transport, handle, store, and protect products.

B. Protect doors and frames as recommended by manufacturer.

C. Break seal on site to permit ventilation, store doors and frames in protected area. Stack doors and frames minimum of 6 inch off floor and provide space between each.

1.06 **ALTERNATES**

A. See Section 01 23 00 for bidding alternates affecting the work of this Section.

1.07 **COLORS**

A. Colors are specified on Colors and Materials schedule on drawings.

PART 2 - PRODUCTS

2.01 **ACCEPTABLE MANUFACTURERS**

A. Assa Abloy, Ceco Door.

B. Assa Abloy, Curries.

C. Allegion, Steelcraft.

D. Allegion, Republic.

E. Stiles Custom Metal, Inc.

F. SDI or NAAMM members that conform to the specific requirements of this Specification.

G. Substitutions: Under provisions of Section 01 60 00.

2.02 DOORS

A. General: Provide 1-3/4 inch thick hollow metal doors of the best commercial quality meeting Steel Door Institute (SDI) recommended specifications / standards and these Specifications. Flush panel design.

B. Exterior Doors: SDI-100 Level 3, Model 2, 16 gauge, A60 Galvannealed (hot-dip process), seamless design. See special requirements under "Fabrication".

C. Interior Doors: SDI-100 Level 3, Model 2, 16 gauge, seamless design. See special requirements under "Fabrication".

D. Provide frames with minimum of three (3) anchors per jamb plus floor anchors. Anchors minimum 18-gauge steel or minimum 3/16-inch diameter wire, adjustable.

2.03 FRAMES

A. General: Provide hollow metal frames of the best commercial quality, meeting Steel Door Institute (SDI) recommended specifications / standards and these Specifications.

1. Modular Masonry Construction: Provide butt type frame for modular masonry construction in accordance with SDI-110 published standard.

B. Exterior Frames: SDI-100 Level 3, 16 gauge, A60 Galvannealed (hot-dip process), mitered corners and fully-welded frames. Provide double rabbet profile frame. Provide Level 4, 14 gauge for frames wider than 8-3/4 inch. See special requirements under “Fabrication”.

C. Interior Frames: SDI-100 Level 3, 16 gauge, mitered corners and fully-welded frames. Provide double rabbet profile frame. Provide Level 4, 14 gauge for frames wider than 8-3/4 inch. See special requirements under “Fabrication”.

1. Pocket Door Frame: Provide manufacturer’s standard doorframe and hardware.

2.04 DOOR CORE

A. Exterior Doors and interior doors thermally separated from other non-heated areas: Polyurethane insulation or polystyrene insulation.

2.05 ACCESSORIES

A. Rubber Silencers: Resilient rubber.

B. Glazing Stops:

1. Painted Steel: Rolled steel channel shape, minimum 18 gauge, mitered corners; prepared for oval head, countersunk tamper-proof screws; size as shown on Drawings. Prime paint for field finish selected by Architect.

C. Louvers:

1. Fabrication: SDI-111-C. Galvanized steel, minimum 20 gauge frame, minimum

24 gauge louver blades, inverted “Y” blades, mitered corners; countersunk tamper-proof screws at interior side of door; size as shown on Drawings. Provide and install insect screen. Prime paint for field finish selected by Architect.

D. Mortar Guard Boxes: Minimum 22 gauge welded in place.

2.06 PROTECTIVE COATINGS

A. Galvanized Finish: Hot-dip process, G60 galvanized coating; minimum 0.6 oz/sq. ft.

B. Galvannealed Finish: Hot-dip process, A60 galvanized coating; heat treatment converting zinc coating layer to a zinc-iron alloy (90% zinc / 10% iron); minimum 0.6 oz/sq. ft.

C. Primer: Baked on rust inhibiting shop primer.

D. Field Finish: Field paint as specified in Section 09 91 00.

E. Bituminous Back Coating: Waterproof, fibrated asphalt emulsion, thickness of 1/16 inch, Assa Abloy Curries water-based bituminous back coating, Assa Abloy Ceco Door water-based asphaltic frame undercoating or equal.

2.07 MINERAL WOOL INSULATION

A. Mineral Wool Insulation: As specified in Section 07 21 00.

2.08 FABRICATION

A. Construction: Fabricate frames as mitered corners and fully-welded unit type, exposed welds shall be ground smooth and flush. Conform with SDI-100.

B. Hardware Provisions: Mortise and reinforce doors and frames to accommodate hardware specified in Section 08 71 00.

C. Hinge Reinforcement: Hinge reinforcement in doors shall be minimum 7 gauge. Hinge reinforcement in frames shall be minimum 7 gauge. Fabricate frames and doors with hardware reinforcement plates securely welded in place. At exterior frames, provide hinge reinforcement full width of doorframe. In addition to manufacturer's standard weld attachment, provide full fillet weld at top and bottom of frame hinge reinforcement. Provide mortar guard boxes. Coordinate with Section 08 71 00.

D. Security Electronics Provisions: Mortise and reinforce door and frames to accommodate security electronics specified in Division 28.

E. Hardware Reinforcement: All reinforcement shall be securely welded to door/ frame (spot welding not acceptable). Provide closer reinforcement "sleeve" the full width of doorframes. Reinforcement minimum 14 gauge, except minimum 10 gauge for hinges.

F. Wide Frames: Reinforce frames wider than 48 inch with roll formed steel channels fitted tightly into frame head, flush with top.

G. Door Edges: Square edge. Edge seams shall be continuously welded full length and ground flush and smooth.

H. Door Silencers: Prepare frame for silencers. Provide three (3) single rubber silencers for single doors and mullions of double doors on strike side, and two (2) single silencers on frame head at double doors without mullions where continuous smoke/weather seals are not specified.

I. Fire Door Labels: Attach metal fire rating label to each fire-rated frame and door unit.

J. Door Tops (End Closure): Close top edge of doors with 16 gauge flush steel channel; Flush End Closure with Offset Channel as illustrated in SDI-127A.

1. Door Closers, Overhead Stops and Holders Hardware: If required for door hardware installation provide close top edge of doors with inverted steel channel; Inverted End Closure with Reinforcement Channel as illustrated in SDI-127A. Seal joints watertight.

K. Door Bottoms (End Closure): Close bottom edge of doors with 16 gauge flush steel channel; Flush End Closure with Offset Channel as illustrated in SDI-127A.

1. Door Bottom Seal Hardware: If required for door hardware installation provide close bottom edge of doors with inverted steel channel; Inverted End Closure with Reinforcement Channel as illustrated in SDI-127A.

L. Floor Anchors: Provide 16 gauge (minimum) steel angle floor anchors securely welded to frame with two (2) holes for anchoring frame to floor. Provide 12-gauge stirrup floor anchor at mullions.

M. Jamb Anchors: Provide jamb anchors to suit wall condition and meet fire-rating requirements of frame. Jamb anchors shall be concealed type except punch and dimpled frame with countersunk anchor bolt attachment to concrete wall on painted metal frames is acceptable; patching head is specified in Part 3.

N. Relite Stops: Mount stops for relites on interior side of room or building.

O. Door Clearance: Provide clearance to accommodate door hardware clearance requirements and code requirements. The clearance under the bottom of a door shall be a maximum of 3/4-inch. Coordinate with Section 08 71 00.

P. Glazing Provisions: Glazing in exterior doors shall be insulating glass units with minimum 1/2-inch airspace.

2.11 FINISH

A. Interior Field Painted Units: Factory protective coating of prime paint. Field paint as specified in Section 09 91 00.

B. Exterior Field Painted Units: Factory protective coating of hot-dip galvanized coating as specified with prime paint. Factory or shop applied bituminous coating to interior surfaces of all exterior frames and frames mounted in masonry and concrete. Field paint as specified in Section 09 91 00.

C. Primer Adhesion: Must pass the ASTM D3359 Cross Hatch Test, Method A, X-Cut.

D. Stainless Steel: Factory Finish. Finish as specified under “Specialty Doors and Frames”.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Section 01 04 10 – Project Management and Coordination: Verification of existing conditions before starting work.

1. Verify that opening sizes and tolerances are acceptable.

3.02 INSTALLATION

A. Install frames in accordance with SDI-105; installed tolerances for squareness, alignment, twist, and plumbness shall not exceed 1/16-inch total. Maintain proper door perimeter clearances.

B. Install doors in accordance with SDI-100 and DHI.

C. Coordinate installation of glass and glazing.

D. Install door louvers, plumb and level.

E. Coordinate installation of doors with installation of hardware specified in Section 08 71 00.

F. Coordinate with wall construction for anchor placement and throat widths.

G. Secure all doorframe floor anchors to floor with steel concrete anchors, two (2) concrete anchors per jamb or mullion.

H. Fasten concealed jamb anchors to 16 gauge jamb stud wall framing with minimum four (4) case-hardened, self-drilling steel screws at each anchor. Weld to steel angle anchors where shown on drawings.

I. Grind head of exposed anchor bolt fasteners flush with face of frame and fill with polyester metal patching compound; sand flush and smooth to hide bolt head from view.

J. Exterior Hollow Metal Frames: Solidly pack mineral wool insulation within cavities of exterior hollow metal frames. Fill all voids.

1. Masonry and Concrete Walls: Coordinate installation of frames to allow for solidly filling cavities.

K. Interior Hollow Metal Frames: Solidly pack mineral wool insulation within cavities of interior hollow metal frames. Fill all voids.

1. Masonry and Concrete Walls: Coordinate installation of frames to allow for solidly filling cavities.

3.03 ERECTION TOLERANCES

A. Maximum Diagonal Distortion: 1/16-inch measured with straight edge, corner to corner.

3.04 ADJUSTING

A. Adjust door and hardware for smooth and balanced door movement.

END OF SECTION

SECTION 08 31 00
ACCESS DOORS AND PANELS

PART 1 - GENERAL

1.01 **QUALITY ASSURANCE**

A. Manufacture fire rated access doors and frames to conform to UL requirements.

B. Provide labels indicating rating.

1.02 **SUBMITTALS**

A. Submit product data under provisions of Section 01 34 00.

B. Include sizes, types, finishes, scheduled locations, and details of adjoining work.

1.03 **ALTERNATES**

A. See Section 01 23 00 for bidding alternates affecting the work of this Section.

1.04 **COLORS**

A. Colors are specified on Color and Materials Schedule on drawings.

PART 2 - PRODUCTS

2.01 **MANUFACTURERS**

A. Access Panel:

1. J.L. Industries Type FDWB, Fire Rated Panel.

2. Substitutions: Under provisions of Section 01 60 00.

B. Locks:

1. Corbin Russwin Cylinder Lock.

2.02 **ACCESS PANEL**

A. Construction: Hinged lockable steel access door with 16-gauge frame and 14-gauge door, concealed hinge, lock, and adjustable anchor straps. Provide of steel construction with prime coated finish in other areas.

B. Sizes: 36” x 36”, 30” x 30” and as indicated in the documents.

C. Fire Rating: Door shall maintain fire rating of system installed in.

D. Access door shall be keyed to the building key system.

2.03 **MECHANICAL ACCESS DOORS**

A. Meet requirements of this Section. Provide by Division 22 and Division 23.

2.04 **FINISH**

A. Prime coat with baked on primer.

B. Field paint per Section 09 91 00.

PART 3 - EXECUTION

3.01 **INSPECTION**

A. Verify rough openings for door and frame are correctly sized and located for coordination with access to concealed work and adjoining systems at access points.

B. Beginning of installation means acceptance of existing conditions.

C. Coordinate with Section 09 29 00 for gypsum wallboard.

D. Coordinate with Section 06 10 00 for opening requirements.

3.02 **INSTALLATION**

A. Install frame plumb and level in openings.

B. Coordinate position to provide convenient access to concealed work requiring access.

C. Secure rigidly in place in accordance with manufacturer's instructions.

END OF SECTION

SECTION 08 33 23
ROLLING SERVICE DOORS

PART 1 - GENERAL

1.01 REFERENCES

A. ANSI/DASMA 105 – Thermal Transmittance and Air Infiltration of Garage Doors

B. ASTM A480/A480M - Flat Rolled Stainless Heat Resisting Steel Plate, Sheet, and Strip.

C. ASTM A658/A924 - Steel Sheet, Zinc-coated (Galvanized) by the Hot-Dip Process.

D. ASTM A526/A526M - Steel Sheet, Zinc-coated (Galvanized) by the Hot-dip Process, Commercial Quality.

E. ASTM B221/A221M - Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes.

F. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

G. NEMA ICS 2 - Standards for Industrial Control Devices, Controllers and Assemblies.

H. NEMA MG1 - Motors and Generators.

I. UL - Fire Resistance Directory.

J. UL 325 - Door, Drapery, Gate, Louver, and Window Operators and Systems.

1.02 SUBMITTALS

A. Section 01 34 00 - Submittals: Procedures for submittals.

B. Product Data: Provide general construction, component connections and details, and hardware.

C. Shop Drawings: Indicate pertinent dimensioning, anchorage methods, hardware locations, and installation details.

D. Samples: Submit exterior finish samples illustrating shape, color and finish texture.

1.03 OPERATION AND MAINTENANCE DATA

A. Submit under provisions of Section 01 73. 00.

B. Operation Data: Include electrical and control adjustments.

C. Maintenance Data: Include data for [motor and] transmission, shaft and gearing, lubrication frequency, spare part sources.

1.04 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the products specified in this Section

with minimum three (3) years documented experience.

B. Installer: Company specializing in performing the work of this Section approved by manufacturer.

1.05 **REGULATORY REQUIREMENTS**

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

B. Provide certificate of compliance from indicating approval of door and operating hardware assembly.

C. Thermal Performance of Exterior Doors: The minimum R-value for opaque doors, having less than 50% glass area, shall be 4.75.

1.06 **WARRANTY**

A. Provide five (5) year warranty under provisions of Section 01 74 00.

1.07 **ALTERNATES**

A. See Section 01 23 00 for bidding alternates affecting the work of this Section.

1.08 **COLORS**

A. Colors are specified on Color and Materials Schedule on drawings.

PART 2 - PRODUCTS

2.01 **ACCEPTABLE MANUFACTURERS**

A. Overhead Door Company.

B. Wayne-Dalton Corporation.

C. Raynor.

D. Substitutions: Under provisions of Section 01 60 00.

2.02 **INSULATED ROLLING SERVICE DOORS – HEAVY DUTY**

A. Specification Standard: Overhead Door Company; Series 625, Stormtite insulated.

B. Components:

1. Curtain: Interlocking flat profile slats (Type F-265l). Foamed in place with CFC-Free foamed in place polyurethane insulation. Front and back slat shall be fabricated of 20-gauge stainless steel.

2. Guides: Structural *stainless steel* sections. Face of wall mounted*;* angle guides.

3. Lock: Inside side mounted, adjustable keeper, spring activated latch bar with feature to keep in locked or retracted position; interior handle.

4. Door Panel Weatherstripping: At bottom and head of door panel, full width; contact resilient.

5. Jam Weatherstripping: Roll formed steel fitted full height of jamb with integral resilient weatherstripping in moderate contact with door panels.

6. Hood: The hood shall be minimum 20 gauge stainless steel. The hood shall be supplied with integral hood baffle weatherseal.

7. Operation: Adjustable helical wound torsion springs (designed for 100,000 cycles) on crossheader shaft, motorized operation – top of hood mounted. Enclosed counter balance assembly. The counterbalance shall be adjustable by means of an adjusting tension wheel.

8. Provide the manufacturer's follow Options: Bottom Sensing Edge, high use package.

9. Options: Provide the following manufacturer's options; Push-button, key or combination stations, surface mounted or flush mounted, interior or exterior.

10. Finish: Curtain slats and hood shall be;

    a) Stainless steel with No.4 satin finish.

PART 3 - EXECUTION

3.01 **EXAMINATION**

A. Verify that wall openings are ready to receive work and opening dimensions and tolerances are within specified limits.

B. Beginning of installation means acceptance of existing surfaces.

3.02 **PREPARATION**

A. Prepare opening to permit correct installation of door unit to perimeter air and vapor barrier seal.

3.03 **INSTALLATION**

A. Install door unit assembly in accordance with manufacturer's instructions.

B. Anchor assembly to wall construction and building framing without distortion or stress.

C. Securely brace door tracks suspended from structure. Secure tracks to structural members only.

D. Fit and align door assembly including hardware, level and plumb, to provide smooth operation.

E. Coordinate installation of electrical service. Complete power and control wiring from disconnect to unit components.

F. Coordinate installation of sealants and backing materials at frame perimeter as specified in Section 07 92 00.

G. Install perimeter trim and closures.

3.04 TOLERANCES

A. Maintain dimensional tolerances and alignment with adjacent work.

B. Maximum Variation from Plumb: 1/16-inch.

C. Maximum Variation from Level: 1/16-inch.

D. Longitudinal or Diagonal Warp: Plus or minus 1/8-inch from 10 ft straight edge.

3.05 ADJUSTING

A. Adjust door assembly to smooth operation.

3.06 CLEANING

A. Clean doors and frames.

B. Remove labels and visible markings.

3.07 PROTECTION OF FINISHED WORK

A. Protect finished Work under provisions of Section 01 50 00.

END OF SECTION

SECTION 08 41 13
ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.01 **REFERENCES**

A. AA - Aluminum Association. Designation System for Aluminum Finishes.

B. AAMA - Metal Curtain Wall, Window, Store Front and Entrance - Guide Specifications Manual.

C. AAMA 501.2 - Methods of Test for Metal Curtain Walls.

D. AAMA 603.8 - Performance Requirements and Test Procedures for Pigmented Organic Coatings on Extruded Aluminum.

E. AAMA 605.2 - Specification for High Performance Organic Coatings on Architectural Extrusions and Panels.

F. AAMA 606.1 - Specifications and Inspection Methods for Integral Color Anodic Finishes for Architectural Aluminum.

G. AAMA 607.1 - Specifications and Inspection Methods for Clear Anodic Finishes for Architectural Aluminum.

H. AAMA SFM-1 - Aluminum Storefront and Entrance Manual.

I. ASTM A36/A36M - Structural Steel.

J. ASTM B209 - Aluminum and Aluminum-Alloy Sheet and Plate.

K. ASTM B221 - Aluminum-Alloy Extruded Bar, Rod, Wire, Shape, and Tube.

L. ASTM E283 - Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors.

M. ASTM E330 - Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.

N. AAMA – American Architectural Manufacturers Association.

O. AAMA 611 – Specification for Anodized Architectural Aluminum.

P. AAMA 2605 – Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Architectural Extrusions and Panels.

Q. AA - Aluminum Association. Aluminum Design Manual.

R. PCI – Powder Coating Institute.

1.02 **PERFORMANCE REQUIREMENTS**

A. Window components to provide for expansion and contraction caused by a cycling temperature range of 170 degrees F without causing detrimental effects to components.

B. Design and size members to withstand dead loads and live loads caused by pressure and suction of wind as calculated in accordance with structural notes and applicable codes.

C. Limit deflection to 1/175 of the span, or flexure limit of glass with full recovery of glazing materials, whichever is less.

D. Drain water entering joints, condensation occurring in glazing channels, or migrating moisture occurring within system, to exterior.

E. Water infiltration shall be tested in accordance with ASTM E331. No water penetration at a test pressure of 6.24 psf.

F. Thermal Performance of Exterior Assemblies: The maximum U-value for storefront, non operable, shall be U=0.38, and the maximum SHGC value shall be SHGC=0.40. The maximum U-value for storefront windows, operable, shall be U=0.40, and the maximum SHGC value shall be SHGC=0.40. The maximum U-value for glazed swinging doors, having 50% or more glass area, shall be U=0.60, and the maximum SHGC value shall be SHGC=0.40. U-values shall be tested in accordance with NFRC 100. SHGC values shall be tested in accordance with NFRC 200. Assemblies shall be labeled in accordance with NFRC standards.

F. Air Leakage: Assemblies shall be labeled. Maximum air infiltration rates for exterior assemblies shall be as follows:

1. Windows: 0.30 cfm/sq. ft. when tested in accordance with AAMA/WDMA/CSA101/I.S.2/A440 at 6.24 psf, or 0.20 cfm/sq. ft. when tested in accordance with AAMA/WDMA/CSA101/I.S.2/A440 or NFRC 400 at 1.57 psf.

2. Storefront Glazing: 0.06 cfm/sq. ft. when tested in accordance with NFRC 400 or ASTME E283 at 1.57 psf.

3. Swinging Entrance Doors: 1.00 cfm/sq. ft. when tested in accordance with NFRC 400 or ASTME E283 at 1.57 psf.

1.03 SUBMITTALS

A. Submit shop drawings and product data under provisions of Section 01 34 00.

B. Include wall opening and component dimensions; wall opening tolerances required; anchorage and fasteners; affected related work; installation requirements.

C. Submit manufacturer's installation instructions under provisions of Section 01 34 00.

D. Submit samples under provisions of Section 01 34 00.

1.04 QUALITY ASSURANCE

A. Perform work in accordance with AAMA - Metal Curtain Wall, Window, Store Front and Entrance - Guide Specifications Manual.

B. Manufacturer: Company specializing in manufacturing aluminum glazing systems with minimum three (3) years documented experience.

1.05 DELIVERY, STORAGE, AND PROTECTION

A. Section 01 60 00 – Product Requirements: Transport, handle, store, and protect products.

B. Protect finished aluminum surfaces. Do not use adhesive papers or sprayed coatings which bond when exposed to sunlight or weather.

1.06 **WARRANTY**

A. Provide five (5) year manufacturer warranty for glazed units, under provisions of Section 01 74 00.

B. Warranty: Include coverage for complete system for failure to meet specified requirements.

1.07 **COLORS**

A. Colors are specified on Colors and Materials Schedule on drawings.

1.08 **ALTERNATES**

A. See Section 01 23 00 for bidding alternates affecting the work of this Section.

PART 2 - PRODUCTS

2.01 **MANUFACTURERS**

A. General: The following manufacturers are acceptable provided they supply products meeting the requirements of this specification and specification standard:

1. C.R. Laurence Company (CRL) / U.S. Aluminum.

2. Kawneer.

3. EFCO Corporation

4. Arcadia, Inc.

B. Substitutions: Under provisions of Section 01 60 00.

2.02 **MATERIALS**

A. Extruded Aluminum: ANSI/ASTM B221; 6063-T5 alloy and temper.

B. Steel Sections: ANSI/ASTM A36; shapes to suit mullion sections.

C. Primer: FS TT-P-31; red; for shop application and field touch-up.

D. Touch-Up Primer for Galvanized Surfaces: FS TT-P-641.

2.03 **ALUMINUM STOREFRONT SYSTEM (EXTERIOR)**

A. Storefront System: CRL / U.S. Aluminum. Series FF600 (tunnel locations) and FT600 (office locations), Thermal Framing System, Center Glazing. The assembly shall have National Fenestration Rating Council (NFRC) certification in accordance with Washington State Energy Code requirements.

B. Framing System: 2-inch x 6-inch, thermally broken aluminum framing system to accept ¼

inch thick glazing unit at carwash tunnel and 1-inch thick insulated glazing unit at office location. Exterior glazing method.

C. Schedule: Use at the following exterior conditions: Storefronts Entrances Windows.

D. Provide doorjamb and head frame section similar to TJ450 with continuous vinyl thermal break. Provide all accessories necessary to accept aluminum entrance doors with butt hinges into aluminum storefront system. Provide steel reinforcement for door hinge attachment.

E. Glazing Gaskets: Elastomeric extrusions of manufacturer's standard. Square glass stops.

F. Fasteners: Stainless steel type.

G. Sealant: As specified in Section 07 92 00.

H. Internal Sealants: Type recommended by manufacturer.

I. Reinforcement: As recommended by manufacturer to achieve deflection limits specified herein.

J. Factory Finish: Color and finish as specified in Colors and Materials Schedule.

K. Sheet Metal Flashing and Trim: Minimum 0.0403-inch aluminum sheet material, shapes as shown on drawings. Minimum 0.0508 inch aluminum sheet material where exposed faces or legs of material exceed 5 inch widths. Materials color and finish to match storefront system framing.

L. Filler: Provide manufacturer’s standard filler pieces for open backs of jamb, sill, and head framing.

M. Subsill: Provide manufacturer’s standard extruded aluminum subsill and subsill end closures to form a continuous flashing pan at the bottom of exterior storefront framing.

N. Accessories: Provide all clips, fasteners, connectors, anchors and accessories required for a complete installation and as recommended by manufacturer.

2.04 ALUMINUM ENTRANCE DOORS (EXTERIOR)

A. Aluminum Entrance Doors: CRL / U.S. Aluminum, Series 850, heavy duty doors, Durafront, wide stile [medium stile], center hung, single acting, to accept 1-inch thick insulated glazing unit. Square glass stops. 9-1/2 inch height ADA bottom rail.

1. Provide all hardware for complete functional and operational doors. Hardware color and finish to match aluminum entrance doors.

a. Hinges: Single Acting. Stainless steel butts as specified in Section 08 71 00.

b. Deadlock: Manufacturer’s standard deadlock.

c. Closer: Exposed overhead closer as specified in Section 08 71 00.

d. Cylinder Guard.

e. Thumb Turn Lock Cylinders.

f. Threshold: Aluminum, ADA compliant, commercial saddle threshold. Threshold width to match door frame width.

g. Door Pull Hardware:

(1) Standard Pulls: Astral II, PR032. Set.

E. Glazing Gaskets: Elastomeric extrusions of manufacturer's standard. Square glass stops.

F. Glass and Glazing Materials: As specified in Section 08 81 00.

G. Fasteners: Stainless steel type.

H. Sealant: Refer to Section 07 92 00.

I. Factory Finish: Color and finish to match Storefront system.

2.05 GLASS AND GLAZING MATERIALS

A. Glass and Glazing Materials: As specified in Section 08 81 00.

B. Glass: Provide all clips, fasteners, connectors, etc., required for a complete installation and as recommended by manufacturer.

2.06 FABRICATION

A. Fabricate components with minimum clearances and shim spacing around perimeter of assembly, yet enabling installation and dynamic movement of perimeter seal.

B. Accurately fit and secure joints and corners. Make joints flush, hairline, and weatherproof.

C. Prepare components to receive anchor devices. Fabricate anchors.

D. Arrange fasteners and attachments to conceal from view.

E. Prepare components with internal reinforcement for door hardware and door operator hinge hardware.

F. Reinforce framing members for imposed loads.

2.07 FINISH – ALUMINUM

A. Factory Finish: Provide Anodized Finish on all surfaces conforming with; AAMA 611, Architectural Class I, minimum of 0.0007-inch thickness. Coating shall be applied under controlled conditions at factory in manner recommended by manufacturer. Color as indicated in Colors and Materials Schedule.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify dimensions, tolerances, and method of attachment with other work.

B. Verify wall openings and adjoining air and vapor seal materials are ready to receive work of this Section.

C. Beginning of installation means acceptance of existing conditions.

3.02 INSTALLATION

A. Install storefront framing system in accordance with manufacturer's instructions.

B. Install aluminum entrance doors in accordance with manufacturer's instructions.

C. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.

D. Provide alignment attachments and shims to permanently fasten system to building structure.

E. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.

F. Provide thermal isolation where components penetrate or disrupt building insulation.

G. Coordinate attachment and seal of perimeter air and vapor barrier materials.

H. Pack mineral wool insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.

I. Install hardware specified in this Section and in Section 08 71 00 in accordance with hardware and entrance manufacturer's instructions and Section 08 71 00. Adjust for proper operation. Install thresholds on top of finish flooring.

J. Install glass and infill panels in accordance with Section 08 81 00, to exterior dry method of glazing.

K. Install perimeter sealant in accordance with Section 07 92 00.

3.03 ADJUSTING

A. Adjust operating hardware for smooth operation.

3.04 CLEANING

A. Remove protective material from pre-finished aluminum surfaces.

B. Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths. Take care to remove dirt from corners. Wipe surfaces clean.

C. Remove excess sealant by method acceptable to sealant manufacturer.

END OF SECTION

SECTION 08 71 00
DOOR HARDWARE

PART 1 - GENERAL

1.01 **REFERENCES**

A. ANSI/BHMA – A156 Series Standards

1.02 **QUALITY CONTROL**

A. Supplier: Finish hardware shall be supplied by a factory authorized builder's hardware distributor for products as specified, or approved and who has been furnishing hardware in the same area as the project for a period of not less than two (2) years. The supplier's organization shall include a member of the American Society of Architectural Hardware Consultants who is available at all reasonable times during the course of work to meet with the Owner, Architect, or Contractor for project hardware consultation.

B. Installer: Finish hardware shall be installed only by experienced tradesmen, either at the door and frame fabrication plant or at the project site.

C. Codes:

1. All finish hardware shall comply with applicable local and/or current building codes.

2. Hardware for fire-rated openings shall also be in compliance with all fire building codes applicable to the district in which the building is located. Provide only hardware that has been tested and listed by UL for the types and sizes of doors required and which complies with the requirements of the door and doorframe labels.

3. Provide hardware that meets or exceeds handicap accessibility per local building codes. Conform to the Americans with Disabilities Act (ADA) Accessibility Guidelines.

4. Lever handle locks and latches to have levers return within 1/2 in. of the face of the door.

5. Knobs or handles or other operating hardware on doors leading to loading platforms, stages, mechanical equipment rooms or other areas hazardous to the blind shall be knurled or otherwise rough to the touch.

6. Closer adjustment shall not exceed the following opening force:

a. Interior doors - 5 pounds pressure.

b. Exterior doors - 10 pounds pressure.

c. Fire doors - 15 pounds pressure.

1.03 **SUBMITTALS**

A. Product Data: Submit one (1) copy of manufacturer's data for each item of finish hardware

along with hardware schedules submitted. Data to be used to assist Architect in reviewing schedule.

B. Samples: If requested by the Architect, submit one (1) sample of each exposed hardware category, finished as required, and tagged with full description for coordination with the hardware schedule. Samples will be reviewed by the Architect for design and finish only, and compliance with other requirements is the responsibility of the Contractor. Units that are acceptable and remain undamaged through submittal procedures may be used on the project.

C. Hardware Schedule:

1. At the earliest possible date, submit five (5) copies of the finish hardware schedule, organized into "hardware sets" and indicating complete designation of every item required for each door opening. Each door must have a complete hardware set for that door. No multiple doors or headings using a "typical" hardware set will be approved. Approval of the hardware schedule does not relieve the Contractor of the responsibility to fulfill the project requirements in accordance with the Contract Documents.

2. Submit a keying schedule in accordance with the instructions from the Owner and/or Architect.

3. After the schedules have been approved by the Architect, submit two (2) copies of the corrected schedules to the Contractor for use and distribution. One additional copy plus catalog cuts of each item and installation and maintenance instructions shall be sent to:

4. Format for Schedule (Sample Only):

HEADING 101 - HW1

ONE SGL DOOR 101 CORRIDOR FROM OFFICE 101 LHR 90
3 ft 0 in. X 7 ft 0 in. X 1-3/4 WD X HM 20 Min

1-1/2 PR. Butts	BB1279 652 4-1/2 X 4-1/2
1 Lockset	35H7J14C
1 Closer	4111 EDA
1 Kickplate	#285 - 10 X 34 - COLOR
1 Wall Bumper	W9 626
3 Silencers	64

5. Templates: Furnish approved hardware schedule and templates for each fabricator of doors, frames, and other work to be factory prepared for the installation of hardware. Upon request, check the shop drawings of such other work to confirm that adequate provisions will be made for the proper installation of hardware.

1.04 PRODUCT HANDLING AND STORAGE

A. Packaging: Each item or package is to be separately tagged with identification related to the final hardware schedule. Basic installation instructions shall be included in the packages.

B. Storage: The General Contractor shall provide a locked room at the jobsite for the storage of hardware.

C. Inventory: The hardware supplier shall inventory the hardware with a representative of the

Contractor at or shortly after the hardware is delivered to the jobsite for the purpose of verifying quantities shipped and applied to particular headings of the approved hardware schedule/packing list.

1.05 **GUARANTEE**

A. Unless otherwise stated, Finish Hardware shall carry a limited warranty against defects in material, workmanship, and operation for a period of at least one (1) year, backed by a factory warranty of the hardware manufacturer, except the door closers shall have a minimum ten (10) year warranty. Exit devices shall have a minimum five (5) year warranty.

1.06 **SUBSTITUTIONS**

A. No substitutions of material listed will be allowed without written consent of the Architect, except approved substitutions as listed. When substitutions are requested, they shall be in writing and accompanied by catalog cuts of the proposed item, as well as the specified item. Request for substitutions to be made no less than ten (10) days prior to bid date.

PART 2 - PRODUCTS

2.01 **KEYING**

A. All cylinders shall be keyed to the SCHLAGE Master Key System. Permanent keying shall be as directed by the Architect and/or the Owner. All cylinders shall be provided with removable cores.

B. All cylinders shall be construction keyed and the Contractor provided six (6) construction keys.

C. All keys shall be stamped "DO NOT DUPLICATE".

D. Furnish:

4 Master Keys
2 Keys each keyed lock, 6 keys each KA group.

2.02 **FINISH**

A. Exposed surfaces of all hardware shall be 626 BRUSHED SATIN CHROME (US26D) unless otherwise stated in this finish hardware specification.

B. Surface door closers to be sprayed to match adjacent hardware.

2.03 **MATERIALS**

A. Items not specifically mentioned but necessary to complete the work shall be furnished, matching the items specified in quality and finish. The use of hardware manufacturer's product numbers and designs is for the purpose of identifying type, function and quality. Request for permission to bid other products of the same type, function and quality is to be made in accordance with instructions described in Section 1.06 Substitutions. All hardware is to be ANSI/BHMA Grade 1, unless specified otherwise.

B. Butt Hinges:

1. Manufacturer Listed: Hager.

2. Acceptable Substitutions: Bommer, McKinney.

3. Sizes: Unless specified in the hardware groups differently hinge height to be:

   a. 4-1/2 inch for doors 1-3/4 inch thick and up to 36 inch in width.
   b. 5 inch for doors 1-3/4 inch thick, over 36 inch in width.

4. Quantity: 1-1/2 pair up to and including 90 in. in height. For doors over 90 in. in height, supply one (1) additional butt for each additional 30 in. in height, or fraction thereof.

5. For unusual size or weight doors, furnish type, size and quantity recommended by the butt manufacturer.

6. All exterior and interior reverse bevel locked doors to have non-removable pins (NRP set screw in barrel).

7. Exterior hinges and hinges in kitchen, laundry and locker/shower rooms shall be stainless steel finish 630.

8. Hinges for fire-rated doors shall be BHMA finish 652 Satin Chromium Plated (on steel base metal) or 630 Stainless Steel as required for fire-rating.

C. Lockset: Cylindrical Type.

1. Manufacturer Listed: Schlage Series ALX, ANSI/BHMA Grade 2.

2. Acceptable Substitutions: Sargent, Yale, Corbin Russwin.

3. Design: Lever handle, Sparta style.

4. Provide curved lip strikes of minimum length to protect trim with wrought boxes.

D. Exit Devices:

1. Manufacturer listed: Von Duprin. 98 Series, ANSI/BHMA Grade 1, touch-bar, rim concealed vertical rod.

2. Acceptable Substitutions: Sargent, Yale, Adams Rite, Corbin-Russwin.

3. Furnish steel channel reinforcement.

4. Glass bead fillers shall be supplied for Panic Hardware where interference with glass light frame occurs.

5. Exit devices to carry a three (3) year warranty against defects in material or workmanship.

6. Provide lever handle trim on opposite side of door to match style and finish of locksets specified. Provide recessed dustproof strikes for vertical rod bottom bolts where no door thresholds are provided.

E. Flush Bolts and Dustproof Strikes:

1. Manufacturer: Trimco/BBW.

2. Acceptable Substitutions: Hager, Glynn Johnson, Ives.

3. Bolts shall be installed top and bottom inactive leaf of pair of doors. Dustproof strike-mounted in floor or threshold to accept bolt at bottom of inactive leaf. Supply 12 inch standard length for doors up to 84 inch in height. Doors over 84 in. will have top rod extension to place centerline of bolt no more than 72 inch from floor.

F. Automatic Flushbolts/Coordinators:

1. Manufacturer: Trimco

2. Acceptable Substitution: Hager, Glynn Johnson

G. Deadbolt

1. Manufacturer Listed: Yale D series cylindrical deadbolt.

2. Acceptable Substitutions: Schlage, Sargent, Corbin Russwin.

H. Mortise Deadlock

1. Manufacturer Listed: Yale 350 series.

2. Acceptable Substitutions: Schlage, Sargent, Corbin Russwin.

I. Door Closers:

1. Manufacturer Listed: LCN.

2. Acceptable Substitutions: Sargent, Yale, Corbin-Russwin, Norton.

3. Door Closers to meet ADA requirements for maximum door-opening force in accordance with ICC A117.1 Section 404.2.8 (Washington State Amendment – IBC Section 1101.2.3). Other than fire doors; exterior hinged doors of 10.0 lbs maximum and interior hinged doors of 5 lbs maximum force for pushing or pulling.

4. Door Closers to meet ADA requirements for closing speed in accordance with ICC A117.1 Section 404.2.7. Door closers shall be adjusted so that from an open position of 90 degrees, the time required to move the door to an open position of 12 degrees shall be 5 seconds minimum.

5. Size as recommended by manufacturer.

6. Spray closers to match adjacent hardware.

7. Whether specified or not, provide the proper feet to suit the conditions and the proper length arm to allow fullest degree of opening allowed by wall conditions.

8. Provide drop plates where required.

9. Contractor shall install all the screws required for the foot.

10. Provide special closer mounting as required where interference with weatherstrip or sound seal occurs.

11. Door closer foot brackets shall be rabbet applied where soffit width is not wide enough to clear the door seal.

12. Door closers to carry a ten (10) year warranty against defects, material, and workmanship.

J. Kick, Mop, and Armor Plates:

1. Manufacturer Listed: Trimco/BBW.

2. Acceptable Substitutions: Hager, Ives.

3. Material: 630 Stainless Steel.

4. Plates shall be mounted with trusshead screws of matching finish.

5. Sizes: All plates shall be furnished with width 1-1/2 inch less than door width except pairs of doors without mullions shall be 1 inch less than door width. The height shall be 10 inch or as specified in the detailed hardware list.

6. Where door seal, sound seal or weatherstrip is installed on the jamb stop, adjust kick plate width to allow 1/8 inch - 1/4 inch clearance each side.

7. Where kick plate width will interfere with installation of other hardware adjust width for proper clearance.

K. Stops and Holders:

1. Manufacturer Listed: Trimco/BBW, CRL, RBA Door.

2. Acceptable Substitutions: Hager, Ives, RBA Door, CRL.

3. Hold Open (Floor Type): Ives FS446. Manual with holder and keeper. Attached by surface screws to door, anchors into concrete floor slab.

4. Hold Open (Floor Type) Storefront Doors: CRL, DL2521A. Manual with holder and keeper. Attached by surface screws to door, anchors into concrete floor slab.

5. Hold Open (Floor Type – Heavy-duty) Herculite Glass Doors: Trimco, 1209HAHO or equal. Heavy-duty type; stud anchorage in slab or pavement. Manual with holder and keeper.

6. There shall be stops to protect all walls, cabinet work or hardware operation. Wall stops shall be used wherever possible, unless otherwise called for in the hardware types. Where floor stops are used, they shall be installed no farther than 8 in. from the latch edge of the door.

L. Weatherstrip and Thresholds:

1. Manufacturer Listed: Pemko.

2. Acceptable Substitutions: Hager, National Guard, Zero International.

3. Where it occurs, weatherstrip shall be applied to both sides of meeting stiles.

4. Thresholds: Commercial (CT), extruded aluminum plates. ADA height. Threshold width to match door frame width.

5. Door seal shall be adjusted to allow closing and latching of the door without slamming.

6. Air Leakage: Weatherstrip shall limit air leakage of exterior doors to a maximum rate of 0.2 cfm/sf of assembly area, when tested in accordance with NFRC 400 or AAMA/WDMA/CSA101/I.S.2/A440 at a differential pressure of 1.57 psf (75 Pa). Alternatively, the maximum air leakage rate shall be 0.3 cfm/sf of assembly area when tested at a differential pressure of 6.24 psf (300 Pa).

M. Door Silencers:

1. Manufacturer Listed: Trimco/BBW.

2. Acceptable Substitutions: Hager, Glynn Johnson.

3. Quantity: Provide three (3) for each single doorframe and four (4) for each double doorframe on interior doors where gasketing is not provided.

4. Provide W07 for HM Frames; W08 for Wood Frames.

N. Key Cabinets:

1. Manufacturer: Lund

2. Acceptable Substitution: HPC, Inc.

3. Provide one (1) each – 1200.

2.04 HARDWARE GROUPS

HDW-1 (at Aluminum Entrances)

2	EA	Mortise Cylinders	20-001
1	Set	Push/Pulls	

Provide Hager Companies, #154V, Aluminum Push/Pull Set, 10" Pull, finish to match storefront.

1 EA Exit sign mounted on storefront door header above all storefront doors with "THIS DOOR TO REMAIN UNLOCKED WHEN BUILDING IS OCCUPIED" message, 1" high white letters on 1-1/2" high black background strip, upper case.

Balance of hardware by aluminum entrance supplier.

HDW-2 (pair outswinging exterior entry door-hollow metal)

6	EA	Hinges	BB1191
2	EA	Exit Device	98-L x 17
2	EA	Closer	4110EDA
2	EA	Floor stop	1215 CKU
1	EA	Threshold	171A
1	SET	Weatherstripping	PK55D, 345DP
4	EA	Kickplates	
3	EA	Hinges	BB1279
1	EA	Lockset	ALX53 (push button locking from inside)
1	EA	Closer	4010
1	EA	Wall stop	1270 CV
1	SET	Smoke/Fire Gasket	S88D

HDW- 5 (single interior classroom door)

3	EA	Hinges	BB1279
1	EA	Lockset	**[ALX70] [ND70PD]** (cannot lock from inside)
[1	**EA**	**Closer**	**4010]**
1	EA	Wall stop	1270 CV
[1	**SET**	**Smoke/Fire Gasket**	**S88D] [+ HSS2000]**

HDW-4 (Single interior restroom door, single user)

3	EA	Hinges	BB1279
1	EA	Latchset	**[ALX40] [ND40S]** (with privacy function)
[1	**EA**	**Closer**	**4010]**
1	EA	Wall stop	1270 CV
[1	**SET**	**Smoke/Fire Gasket**	**S88D] [+ HSS2000]**

HDW-3 (Electrical room door, exterior)

3	EA	Hinges	BB1191
1	EA	Exit Device	98-L x 17
1	EA	Closer	4110
1	EA	**[Wall][Floor]** stop	**[1270 CV][1215 CKU]**
1	EA	Threshold	171A
1	SET	Weatherstripping	PK55D, 345DP

PART 3 – EXECUTION

3.01 **PREPARATION**

A. Provide solid blocking for all wall stops and bumpers.

B. Fasteners: Check all conditions and use fastening devices as needed to secure or anchor all hardware as per manufacturer's published templates. Self-tapping sheet metal screws are not acceptable. All closers and exit devices on wood doors shall be thru-bolted. The Contractor shall be responsible for drilling wood or metal with the recommended hole sizes.

3.02 INSTALLATION

A. The General Contractor shall be responsible for proper installation and operation of hardware in locations specified. Door closers shall in stalled and adjusted to close and latch the door without slamming.

B. The General Contractor shall protect exposed hardware surfaces during construction period from damage to products and finishes.

C. In the absence of other hardware installation requirements in this Section or indicated, the following recommendations shall be used as a guide:

1. Top Hinge: 5-inch, header rabbet to top of hinge.

2. Bottom Hinge: 10-inch, finish floor to bottom of hinge.

3. Center Hinge: Centered between top and bottom hinges.

4. Mortise Locks: 40 5/16-inch, finish floor to center of lock case and strike.

5. Deadlocks and Deadlatches: 48-inch, finish floor to center of cylinder.

6. Exit Devices: 38-inch, finish floor to center of cross bar.

7. Push Plates: 45-inch, finish floor to center of plate.

8. Door Pulls: 42-inch, finish floor to center of pull.

D. All other hardware shall be installed as recommended by the manufacturer.

3.03 ADJUSTMENT

A. Adjust and check each operating item of hardware at each door to ensure proper operation or function of every unit.

B. Clean adjacent surfaces soiled by hardware installation and/or adjustment.

C. Whenever hardware installation is made more than one (1) month prior to acceptance or occupancy, make a final check and adjustment of all hardware items during the week prior to acceptance or occupancy. Clean and lubricate operating items necessary to restore proper function and finish of hardware.

D. Adjust door control devices to compensate for final operation for heating and ventilating equipment.

E. Instruct Owner's personnel in proper operation and maintenance of hardware and hardware finishes.

F. Replace units which cannot be adjusted to operate properly.

END OF SECTION

PAGE LEFT BLANK INTENTIONALLY

SECTION 08 81 00
GLASS GLAZING

PART 1 - GENERAL

1.01 REFERENCES

A. ASTM C1036 - Standard Specification for Flat Glass.

B. ASTM C1048 – Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass.

C. ASTM C1172 - Standard Specification for Laminated Architectural Flat Glass.

D. ASTM E774 - Sealed Insulating Glass Units.

E. IBC – International Building Code.

F. SIGMA - Sealed Insulated Glass Manufacturers Association.

G. FGMA - Glazing Manual and Glazing Sealing Systems Manual.

H. U.S. Consumer Product Safety Commission Standard 16 CFR 1201.

I. National Fenestration Rating Council (NFRC) Certification.

1.02 QUALITY ASSURANCE

A. Conform to Flat Glass Marketing Association (FGMA) Glazing Manual and Glazing Sealing Systems Manual and SIGMA for glazing installation methods.

B. Insulating glass unit shall be manufactured by a SIGMA member.

C. Provide safety glazing where required by IBC Section 2406.

D. Glazing assemblies shall be certified and labeled in accordance to National Fenestration Rating Council (NFRC) standards and in compliance with 2015 Washington State Energy Code Requirements. Coordinate with requirements specified for windows, entrances, and storefronts.

1.03 SUBMITTALS

A. Submit product data and samples under provisions of Section 01 34 00.

B. Product Data: Provide manufacturer's product description for each type of glass and product specified.

Samples: Submit two 12 inch x 12 inch samples of each glass type specified. Identify glass manufacturer and glass type clearly on each sample.

1.04 DELIVERY, STORAGE AND PROTECTION

A. Protect glass materials during delivery, storage, and handling to comply with manufacturer's direction and as required to prevent edge damage.

1.05 **WARRANTY**

A. Provide ten (10) year manufacturer's warranty on sealed insulating glass. Include coverage for sealed glass units from seal failure, interpane dusting to misting, and replacement of same.

B. Replace any units failing to comply at no additional cost to the Owner within 45 days after receipt of written notice.

1.06 **ALTERNATES**

A. See Section 01 23 00 for bidding alternates affecting the work of this Section.

1.07 **COLORS**

A. Colors are specified on Colors and Materials Schedule on drawings.

PART 2 - PRODUCTS

2.01 **ACCEPTABLE GLASS MANUFACTURERS**

A. Manufacturers listed:

1. PPG Industries

2. Technical Glass Products (Fire-Rated Safety Glass)

3. Joel Berman Glass Studios. (Architectural Decorative Glass.)

B. The following manufacturers may provide products equal to products specified.

1. Pilkington.

2. Guardian Glass - Guardian Industries Corporation.

3. SAFTI FIRST. (Fire-Rated Safety Glass.)

4. Vetrotech Saint-Gobain (Fire-Rated Safety Glass)

C. Substitutions: Under provisions of Section 01 60 00.

2.02 **GLASS MATERIALS**

A. Float Glass: ASTM C1036; Type I, Class 1, clear, quality q3; 1/8 inch thick minimum.

B. Safety Glass: ASTM C1048; Fully-tempered with horizontal tempering conforming to CPSC 16 CFR 1201, labeled in accordance with IBC requirements.. Provide permanent etched mark on corner of each panel indicating safety glass. Provide in clear, tinted, and mirror glass types. Glazing shall comply with CPSC 16 CFR 1201 Category I for lights 9 square feet or less and Category II for all lights over 9 square feet and all lights in sliding glass patio doors and doors to showers, tubs, hot tubs, saunas and steam rooms.

C. Insulating Glass Units (Clear Glass): ASTM E774, double pane hermetically sealed unit; 1-inch glazing unit with 1/2-inch air space filled with Argon Gas and two 1/4-inch glass panes; conform to SIGMA Specifications, five (5) year minimum warranty. Low-E coating on insulating unit to side #2 for Visible Light Transmittance of 70%. U-Value = 0.24 for winter. Solar Heat

Gain Coefficient of SHGC = 0.39. PPG Solarban 60 (2) Clear + Clear (Argon Gas) or equal. Float glass and fully-tempered safety glass. Aluminum spacer to be clear anodized. SHGC and U-value: As required to comply with Washington State Energy Code requirements for fenestration values. Use for Glazing Type: GL-1.

2.03 GLAZING TYPES

Provide glazing system that meets Washington State energy code Thermal Envelope requirements when combined with door, window or storefront system.

A. Type GL-1 (Exterior Glazing): Insulating glass unit (Clear Glass). Provide safety glazing at locations shown on drawings and required by International Building Code.

B. Type GL-2 (Exterior Glazing): Single pane glass unit (Clear Glass). Provide safety glazing at locations shown on drawings and required by International Building Code.

2.04 GLAZING ACCESSORIES

A. Setting Blocks: Neoprene; 70-90 Shore A durometer hardness.

B. Spacer Shims: Neoprene; 50 Shore A durometer hardness.

C. Glazing Tape: Closed cell polyvinyl chloride foam, black color, coiled on release paper over adhesive on two sides (or one side where noted), maximum water absorption by volume of 2 percent, designed for compression of 25 percent to effect an air and vapor seal; size as required to suit condition.

D. Glazing Splines: Resilient neoprene extruded shape to suit glazing channel retaining slot; type recommended by aluminum storefront and curtain wall manufacturer.

E. Glazing Clips: Manufacturer's standard type.

F. Silicone Sealant: ASTM C920; Class A; single component; solvent curing; capable of water immersion without loss of properties; cured Shore A hardness of 15-25; stock color selected by Design Consultant.

PART 3 - EXECUTION

3.01 INSPECTION

A. Verify surfaces of glazing channels or recesses are clean, free of obstructions, and ready to receive glazing.

B. Beginning of installation means acceptance of substrate.

3.02 PREPARATION

A. Clean contact surfaces with solvent and wipe dry.

B. Seal porous glazing channels or recesses.

C. Prime surfaces scheduled to receive sealant.

3.03 EXTERIOR GLAZING

A. Install glazing in doors and windows per manufacturer's recommendations.

B. Install removable stops with glazing centered in space by inserting spacer shims both sides at 24-inch, interval (maximum), 1/4 inch below sight line.

3.04 **INTERIOR GLAZING - DRY METHOD (TAPE AND TAPE)**

A. Cut glazing tape to length and set against permanent stops, projecting 1/16 inch above sight line.

B. Place setting blocks at ¼ inch points with edge block no more than 6 inches from corners.

C. Rest glazing on setting blocks and push against tape for full contact at perimeter of pane or unit.

D. Place glazing tape on free perimeter of glazing in same manner described above.

E. Install removable stops without displacement of tape. Exert pressure on tape for full continuous contact.

F. Knife trim protruding tape.

G. Fire-Rated Glass: Install as recommended by glass manufacture to achieve fire rating and in accordance with IBC requirements.

H. Mirrors: Install mirrors with glazing tape (adhesive one side only) applied horizontally to wall construction behind mirror at 10 inch (maximum) on center and at wood trim retainers.

3.05 **CURE, PROTECTION AND CLEANING**

B. Protect exterior glass from breakage immediately upon installation by use of crossed streamers attached to framing and held away from glass. Do not apply markers to surfaces of glass. Remove nonpermanent labels and clean surfaces. Cure sealants for high early strength and durability.

C. Remove and replace glass which is broken, chipped, cracked, abraded, or damaged in other ways during construction period; including natural causes, accidents, and vandalism.

D. Wash and polish glass on both faces not more than four (4) days prior to date scheduled for inspections intended to establish date of completion in each area of project. Comply with glass product manufacturer's recommendations for final cleaning.

END OF SECTION

SECTION 09 22 16
NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.01 REFERENCES

A. ASTM A653 - Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.

B. ASTM C645 - Non-structural steel framing members.

C. ASTM C754 - Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.

D. GA 203 - Installation of Screw-Type Steel Framing Members to Receive Gypsum Board.

E. Steel Stud Manufacturers Association (SSMA) – Product Technical Information.

1.02 SUBMITTALS

A. Submit under provisions of Section 01 34 00.

B. Product Data: Provide data describing standard framing member materials and finish, product criteria, load charts, limitations, and installation.

1.03 QUALITY ASSURANCE

A. Perform work in accordance with GA 203 and ASTM C754.

B. Maintain one (1) copy of each document on site.

1.04 QUALIFICATIONS

A. Installer: Company specializing in performing the work of this Section with minimum five (5) years documented experience.

1.05 COORDINATION

A. Coordinate work under provisions of Section 01 04 10.

1.06 ALTERNATES

A. See Section 01 23 00 for bidding alternates affecting the work of this Section.

1.07 COLORS

A. Colors are specified on Colors and Materials Schedule on drawings.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Scafco Corporation.

B. Steeler Inc.

C. Substitutions: Under provisions of Section 01 60 00.

2.02 FRAMING MATERIALS

A. Studs: ASTM A653 galvanized rolled steel, channel shaped, punched for utility access:

1. Non-Bearing Stud Thickness: Minimum 25 gauge, except ASTM C754 limiting heights shall not be exceeded for maximum deflection of l/240. Minimum 20 gauge for applications to receive ceramic tile finishes, or where required for fire-rated construction.

2. Load-Bearing Stud Thickness: See Structural Drawings.

B. Ceiling Grid Suspension Systems: ASTM C645.

C. Runners: Of same material and thickness as studs, bent leg retainer notched to receive studs with provision for crimp locking to stud.

D. Furring and Bracing Members: Of same material as studs; thickness to suit purpose.

E. Fasteners: GA 203. Self-drilling, self-tapping screws.

F. Sheet Metal Backing: 20 gauge (0.9 mm thick) galvanized steel for reinforcement of wall-mounted items. Similar to Metal-Lite, Inc. “Flush Mount” product.

G. Anchorage Devices: Power actuated driven and drilled expansion bolts.

H. Sealant: As specified in Section 07 92 00.

I. Slip Track: Extended leg-ceiling runner over standard track or ceiling runner system designed to permit vertical deflection of structure, but not lateral deflection of wall. Slip track shall maintain integrity of fire-rated partitions. Similar to Dietrich Metal Framing, Inc. “SLP-TRK” products.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify site conditions under provisions of Section 01 04 10.

B. Verify that conditions are ready to receive work.

C. Verify that rough-in utilities are in proper location.

3.02 CEILING FRAMING INSTALLATION

A. Install in accordance with ASTM C754.

B. Coordinate location of hangers with other work.

C. Install ceiling framing independent of walls, columns, and above ceiling work.

D. Reinforce openings in ceiling suspension system that interrupt main carrying channels or furring channels, with lateral channel bracing. Extend bracing minimum 24 in. past each end of openings.

E. Laterally brace entire suspension system.

3.03 ERECTION

A. Align and secure top and bottom runners at 24 in. (600 mm) o.c.

B. Stud splicing not permissible.

C. Fabricate corners using a minimum of three (3) studs.

D. Double stud at wall openings, door and window jambs, not more than 2 in. (50 mm) from each side of openings.

E. Brace stud framing system rigid. Brace all partitions that terminate below ceiling structure at intervals not-to-exceed 10 ft.

F. Coordinate erection of studs with requirements of doorframes; install supports and attachments.

G. Backing: Secure to studs. Install backing for support of plumbing fixtures, toilet accessories, and hardware. Backing shall be installed to provide a smooth wall surface.

H. Refer to drawings for indication of partitions extending to finished ceiling only and for partitions extending to the structure above. Maintain minimum 3/4 in. clearance under structural building members to avoid deflection transfer to studs. Provide extended leg ceiling runner slip track attached to structure. Slip track shall not be rigidly attached to wall framing or finishes, and shall prevent lateral deflection of wall.

I. Coordinate placement of insulation in stud spaces made inaccessible after stud framing erection.

3.04 ERECTION TOLERANCES

A. Install member to provide surface plane with maximum variation of 1/8 in. in 10 ft in any direction.

END OF SECTION

PAGE LEFT BLANK INTENTIONALLY

SECTION 09 29 00
GYPSUM BOARD

PART 1 - GENERAL

1.01 **REFERENCES**

A. ANSI A118.9 – Test Method and Specifications for Cementitious Backer Units

B. ASTM C475 - Joint Treatment Materials for Gypsum Wallboard Construction.

C. ASTM C557 - Adhesive for Fastening Gypsum Wallboard to Wood Framing.

D. ASTM C645 – Non-structural steel framing members.

E. ASTM C665 - Mineral Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.

F. ASTM C754 - Installation of Framing Members to Receive Screw Attached Gypsum Panel Products.

G. ASTM C840 - Application and Finishing of Gypsum Board.

H. ASTM C1002 – Steel Self Piercing Tapping Screws for the application of Gypsum Panel Products, metal plaster bases to wood or steel studs.

I. ASTM C1278 – Standard Specification for Fiber Reinforced Gypsum Panel.

J. ASTM C1396 – Standard Specification for Gypsum Board.

K. ASTM E119 - Fire Tests of Building Construction and Materials.

L. GA-214 – Recommended Levels of Gypsum Board Finish.

M. GA-216 - Recommended Specifications for the Application and Finishing of Gypsum Board.

N. GA-600 - Fire Resistance Design Manual.

O. NWCB – Northwest Wall and Ceiling Bureau Technical Library.

1.02 **SUBMITTALS**

A. Shop Drawings: Show locations, fabrication, and installation of control and expansion joints including plans, elevations, sections, details of components, and attachments to other units of work.

B. Product Data: Provide manufacturer's product information for each product specified.

1.03 **QUALITY ASSURANCE**

A. Applicator: Company specializing in performing the work of this Section with minimum five (5) years experience.

1.04 **REGULATORY REQUIREMENTS**

A. Conform to applicable code for fire rated assemblies.

1.05 ALTERNATES

A. See Section 01 23 00 for bidding alternates affecting the work of this Section.

1.06 COLORS

A. Colors are specified on Colors and Materials Schedule on drawings.

1.07 DELIVERY, STORAGE, AND PROTECTION

A. Deliver materials in original packages, containers or bundles bearing brand name and identification of manufacturer or supplier.

B. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic and other causes. Neatly stack gypsum boards flat to prevent sagging.

C. Handle gypsum boards to prevent damage to edges, ends and surfaces. Do not bend or otherwise damage metal corner beads and/or trims.

D. Steel framing and related accessories shall be stored and handled in accordance with AISI's "Code of Standard Practice".

PART 2 - PRODUCTS

2.01 GYPSUM BOARD MATERIALS

A. Acceptable Manufacturers: The design is based on the specified products of the United States Gypsum Company, LLC. Subject to compliance with project requirements, other acceptable manufacturers are Georgia-Pacific Gypsum, Certainteed Gypsum and National Gypsum.

B. Gypsum Wallboard (Moisture Resistant): ASTM C1396; fire resistive type, 5/8-inch thick, maximum permissible length; ends square cut, tapered and beveled edges. USG SHEETROCK Mold Tough, Firecode X.

2.02 ACCESSORIES

A. Provide manufacturer's standard trim accessories for gypsum board work, per ASTM C 1047. Provide with either knurled or perforated expanded flanges for nailing or stapling, and beaded for concealment of flanges, in joint compound.

B. Fasteners: ASTM C1002 Buglehead screws, length as recommended by U.S. Gypsum Handbook, required for penetration into framing members.

C. Acoustical Sealant: Non-hardening, non-skinning, for use in conjunction with gypsum board.

D. Corner Beads: Metal.

E. Edge Trim: GA 216; Type LC, L, LK bead.

F. Joint Materials: GA 216; reinforcing tape, joint compound, adhesive, and water.

G. Control Joint: GA 216; roll-formed zinc control joint with removable strip, similar to USG No. 093 or ClarkDietrich™ 093 Control Joint.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that site conditions are ready to receive work.

3.02 GYPSUM BOARD INSTALLATION

A. Install gypsum board in accordance with GA 216, and GA 600.

B. Single Layer Applications: Erect single layer board horizontal, perpendicular to framing with ends and edges occurring over firm bearing.

C. Multiple Layer Applications: Offset joints of successive layers from joints of preceding layers; conform to requirements of fire-rated horizontal assemblies utilized.

D. Use screws when fastening gypsum board to metal furring or framing.

E. Use screws when fastening gypsum board to wood furring or framing.

F. Erect exterior gypsum soffit board perpendicular to supports, with staggered end joints over supports.

G. Treat cut edges and holes in moisture resistant gypsum board and exterior gypsum soffit board with sealant.

H. Control Joints: Install control joints to provide for movement at the following conditions, in specific locations approved by Architect for visual effect. Control joints in fire-rated partitions shall be backed with fire-rated gypsum wallboard or fire safing insulation as tested to maintain required rating.

1. Building expansion or control joints in substrate.

2. Walls, Partitions, or Furring: Straight runs that exceed 30 ft.

3. Ceilings: Dimensions that exceed 50 ft in either direction with perimeter relief or 30 ft without perimeter relief. Changes in direction of ceiling framing or furring.

4. Exterior Soffits: Dimensions that exceed 30 ft in either direction.

I. Place corner beads at external corners. Use longest practical length. Place edge trim where gypsum board abuts dissimilar materials.

J. Apply gypsum board to curved walls in accordance with GA-216.

3.03 ACOUSTICAL ACCESSORIES INSTALLATION

A. Install acoustical sealant at gypsum board perimeter at:

1. All penetrations of partitions by conduit, pipe, ductwork, and rough-in boxes.

2. Perimeter of all partitions shown to receive acoustic insulation, where abutting dissimilar materials.

3.04 JOINT TREATMENT

A. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.

B. Feather coats onto adjoining surfaces so that camber is maximum 1/32 in.

C. Seal gypsum wallboard prior to texturing in accordance with manufacturer's instructions.

D. Apply one (1) coat tape system (fire tape) at walls and ceilings exposed in attic and attic mechanical rooms.

3.05 LEVELS OF FINISH (per GA-214)

A. Level 4 Exposed Office Areas:
All joints and interior angles shall have tape embedded in joint compound and three (3) separate coats of joint compound applied over all joints, angles, fastener heads, and accessories. All joint compound shall be smooth and free of tool marks and ridges.

3.06 TOLERANCES

A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 in. in 10 ft in any direction.

END OF SECTION

SECTION 09 51 00
ACOUSTICAL CEILINGS

PART 1 – GENERAL

1.01 REFERENCES

A. ASTM C635 - Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.

B. ASTM C636 - Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels.

C. ASTM C665 - Mineral Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.

D. ASTM E580 – Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions.

E. ASTM E1264 - Classification of Acoustical Ceiling Products.

F. Ceilings and Interior Systems Contractors Association (CISCA) - Acoustical Ceilings: Use and Practice.

G. UL - Fire Resistance Directory and Building Material Directory.

H. IBC – International Building Code.

I. ASCE Standard 7 – Minimum Design Loads for Buildings and Other Structures.

1.02 SYSTEM DESCRIPTION

A. Suspension system to rigidly secure acoustical ceiling system including integral mechanical and electrical components with maximum deflection of 1/360.

1.03 QUALITY ASSURANCE

A. Installer: Company with five (5) years minimum experience. Approved by manufacturer.

1.04 REGULATORY REQUIREMENTS

A. Conform to applicable code for fire rated assembly and combustibility requirements for materials and seismic standards.

B. Conform to International Building Code (IBC) and ASCE Standard 7 for seismic resistance requirements.

1.05 ENVIRONMENTAL REQUIREMENTS

A. Maintain uniform temperature of minimum 60 degrees F (16 degrees C), and humidity of 20 to 40 percent prior to, during, and after installation.

1.06 **SUBMITTALS**

A. Submit under provisions of Section 01 34 00.

B. Product Data: Provide data on metal grid system components and acoustical units.

C. Samples: Submit samples illustrating material and finish of acoustical units.

D. Shop Drawings: Submit shop drawings for all areas requiring seismic bracing to indicate layout and types of bracing materials.

E. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

1.07 **SEQUENCING/SCHEDULING**

A. Do not install acoustical ceilings until building is enclosed, sufficient heat is provided, dust-generating activities have terminated, and overhead work is completed, tested and approved.

B. Schedule installation of acoustic units after interior wet work is dry.

C. Coordinate and schedule installation of mechanical/electrical items incorporated and cut into ceiling tile/panels and/or suspension system.

1.08 **EXTRA STOCK**

A. Provide extra quantity of acoustic units under provisions of Section 01 73 00.

B. Provide minimum twelve (12) extra panels in cartons delivered to Owner.

1.09 **ALTERNATES**

A. See Section 01 23 00 for bidding alternates affecting the work of this Section.

1.10 **COLORS**

A. Colors are specified on Colors and Materials Schedule on drawings.

PART 2 - PRODUCTS

2.01 **SUSPENSION SYSTEM**

A. Acceptable Manufacturers

1. Armstrong World Industries

2. USG Interiors, Inc. (Donn Systems).

3. Rockfon LLC, Chicago, IL.

4. CertainTeed

5. Substitutions: Under provisions of Section 01 60 00.

B. Suspension Grid

1. Heavy duty class; ASTM C635 non-fire rated.

2. Type (SS-1): Armstrong. Clean Room. 15/16 in. face, exposed Tee grid. Hot-dipped Galvanized Steel. Hold down clips (CHDC).

C. Main Runners, Cross Tees, and Wall Angles

1. Cold rolled steel

a. Positive lock grid components.

b. Pull out tension 300 lbs.

c. Double web construction.

2. Standard factory painted finish on exposed surfaces - "White" color.

3. Maximum deflection allowed: 1/360, including load carrying capacities for light fixtures, HVAC elements and acoustical panels.

D. Hanger Wire

1. Minimum 12 gauge galvanized, soft annealed, mild steel.

2. Lateral bracing and vertical struts per ASCE Standard 7 and ASTM E580.

E. Accessories

1. Stabilizer bars, clips, splices, curved wall angles, hold down clips; per IBC and manufacturer's standards.

2. Armstrong – BERC2 Clips [shall] [may] be used instead of 2” perimeter angles and end stabilizers, in accordance with ICC-ES-ESR1308

F. All components of ceiling suspension system shall be the products of one (1) manufacturer.

2.02 ACOUSTICAL PANEL UNITS

A. Acceptable Manufacturers

1. Armstrong, referenced manufacturer. Other manufacturer’s products shall match referenced product characteristics and appearance.

2. USG.

3. BPB America, Inc.

4. CertainTeed.

5. Substitutions: Under provisions of Section 01 60 00.

B. Products

1. Type (ACT-1): 24 in. x 24 in. x 5/8 in.; lay-in.

a. Armstrong – Clean Room VL, Item 868, Fire Guard / Fire Resistive, flame spread 25 or under; 40 CAC; light reflectance 0.80, anti-mold and mildew,

sag resistant, unperforated, smooth texture, square edge. Washable, scrubbable and soil resistant.

PART 3 - EXECUTION

3.01 **EXAMINATION**

A. Verify site conditions are ready to receive work.

B. Verify that layout of hangers will not interfere with other work.

C. Beginning of installation means acceptance of existing conditions.

3.02 **INSTALLATION - LAY-IN GRID SUSPENSION SYSTEM**

A. Install suspension system in accordance with ASTM C636 and manufacturer's instructions, and as supplemented in this section.

B. Install system capable of supporting imposed loads to a deflection of 1/360 maximum.

C. Locate system on room axis according to reflected plan.

D. Install after major above ceiling work is complete. Coordinate the location of hangers with other work.

E. Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.

F. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.

G. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability. Support fixture loads by supplementary hangers located within 6 in. of each corner, or as required by ASTM E580.

H. Do not eccentrically load system, or produce rotation of runners.

I. Install edge molding at intersection of ceiling and vertical surfaces, using longest practical lengths. Miter corners. Provide edge moldings at junctions with other interruptions.

J. Install light fixture boxes constructed of gypsum board above light fixtures in accordance with UL assembly requirements.

K. Installation shall conform to International Building Code (IBC) and ASCE Standard 7 for seismic resistance.

3.03 **INSTALLATION - ACOUSTICAL UNITS**

A. Install acoustical units in accordance with manufacturer's instructions.

B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.

C. Install units after above ceiling work is complete.

D. Install acoustical units level, in uniform plane, and free from twist, warp and dents.

E. Cut tile to fit irregular grid and perimeter edge trim. Double cut and field paint exposed edges of tegular units.

3.04 **ERECTION TOLERANCES**

A. Maximum Variation from Flat and Level Surface: 1/8 in. in 10 ft.

B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

END OF SECTION

PAGE LEFT BLANK INTENTIONALLY

SECTION 09 67 23
EPOXY FLOORING

PART 1 - GENERAL

1.01 SUMMARY

A. Work Included: Provide and install multi-part epoxy resin floor system, complete, as shown on Drawings and as specified, including:

1. Locations: Areas as indicated by the Plan finish schedule.

2. Provide preparation of substrate as recommended by the epoxy flooring manufacturer.

3. Provide and install cove base with trims and accessories as specified in this Section.

4. Provide and install multi-part epoxy floor system as specified in this Section.

5. Provide and install sealant joint material for the Work of this Section as specified in this Section.

1.02 SUBMITTALS

A. Submit product data under provisions of project Quality Management Plan.

B. Product Data: Submit manufacturer's technical data, installation instructions, and general recommendations for each epoxy flooring material required.

1. Include certification that indicates compliance of materials with requirements.

C. Samples: Submit, for verification purposes, 5-inch square samples of each type of epoxy flooring required, applied to a rigid backing, in color and finish indicated.

1. For initial selection of colors and finishes, submit manufacturer's color charts showing full range of colors and finishes available.

D. Certificates: By manufacturer of epoxy flooring; upon completion of Work, written statement that technical support to applicator and field supervision was sufficient to assure proper application of materials and that installation is acceptable.

E. Maintenance Instructions: Submit manufacturer's written instructions for recommended maintenance practices.

1.03 QUALITY REQUIREMENTS

A. Qualifications of the Applicator: Licensed or approved by the manufacturer of the coating system and has successfully completed 5 projects of similar size and complexity.

B. Single Source Responsibility: Obtain primary epoxy flooring materials including primers, resins, hardening agents, finish or sealing coats from a single manufacturer with not less than ten years of successful experience in manufacturing and installing principal materials described in this Section.

B. Special Requirements: Regulatory Agencies: Use materials for Work of this Section which comply with volatile organic compound limitations and other regulations of local Air Quality

Management District and other local, state, and federal agencies having jurisdiction.

D. ISO 9001: All materials, including primers, resins, curing agents, finish coats, aggregates and sealants are manufactured and tested under an ISO 9001 registered quality system.

1.04 **PROJECT CONDITIONS**

A. Concrete shall be properly cured for a minimum of 30 days.

B. Utilities, including electric, water, heat (air temperature between 60 and 85°F/16 and 30°C) and finished lighting to be supplied by General Contractor.

C. Job area to be free of other trades during, and for a period of 24 hours, after floor installation.

D. Protection of finished floor from damage by subsequent trades shall be the responsibility of the General Contractor.

1.05 **DELIVERY, STORAGE AND HANDLING**

A. Material shall be delivered to job site and checked by flooring contractor for completeness and shipping damage prior to job start.

B. All materials used shall be factory pre-weighed and pre-packaged in single, easy to manage batches to eliminate on site mixing errors.

1. No on site weighing or volumetric measurements allowed.

C. Material shall be stored in a dry, enclosed area protected from exposure to moisture.

1. Temperature of storage area shall be maintained between 60 and 85-degrees F.

1.06 **WARRANTY**

A. Manufacturer's standard warranty that complies with the RFP.

1.07 **ALTERNATES**

A. See Section 01 23 00 for bidding alternates affecting the Work of this Section.

1.08 **COLORS**

A. Colors are specified on Colors and Materials Schedule on drawings.

B. Field-applied adhesives, sealants, and coatings used on the interior of the building shall meet Low-VOC requirements. Submit documentation of VOC content for these materials.

PART 2 - PRODUCTS

2.01 **EPOXY FLOORING (EF)**

A. Epoxy Flooring:

1. Basis of Design: Stonhard Stonclad HT total minimum thickness 1/8", is a self-priming, textured, four component, polyurethane mortar and broadcast system consisting of a urethane-urea binder, pigments, powders and quartz aggregates.

Stonhard, Contact: Kevin Vaughn, Phone: (503) 410-1263, kvaughn@stonhard.com.

B. System Components: Manufacturer's standard components that are compatible with each other and are as follows:

1. Stonclad UT Mortar

a. Four component multi-functional urethane-urea slurry.

2. Stonshield Aggregate

a. Brightly colored, quartz broadcast aggregate.

3. Stonseal CA7

a. Two-component, UV resistant, aliphatic polyaspartic urethane sealer.

C. Waterproofing:

a. Stonproof ME7 Laembrane system.

D. Surface Texture:

1. Stonshield – Medium Texture

a. Surface texture shall approximate sample submittal approved by the Architect.

E. Expansion/Isolation Joint Sealant Materials:

1. Stonflex MP7: Two-component, pourable polyurethane sealant.

F. Coved Base:

1. Stonshield Cove Base: Four-component, epoxy cove base mortar applied to the height indicated on Drawings.

G. Edge Strip:

1. Johnsonite CTA-NA-J.

PART 3 - EXECUTION

3.01 EXAMINATION

A. General: Examine substrate to receive epoxy flooring; give written notification of deficiencies. Do not proceed until unsatisfactory conditions are corrected.

1. Substrate must be dry and free of all wax, grease, oils, fats, soil, loose or foreign materials and laitance.

a. Laitance and unbonded cement particles must be removed by abrasive

blasting, scarifying.

b. Other contaminants may be removed by scrubbing with a heavy-duty industrial detergent, “Stonkleen DG9”, or equal; and rinsing with clean water.

c. The surface must show open pores throughout and have a sandpaper texture.

B. Moisture Testing: Test horizontal substrates to determine acceptable dryness. Test method as recommended by resinous flooring manufacturer.

1. Perform in situ probe test, ASTM F 2170. Proceed with application only after substrates do not exceed a maximum potential equilibrium relative humidity of 85 percent.

2. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with application only after substrates have maximum moisture-vapor-emission rate of 6 lb per 1,000 sq. ft. per 24 hours

3. Perform additional moisture tests recommended by manufacturer. Proceed with application only after substrates pass testing and/or directed by manufacturer in writing.

3.02 PREPARATION

A. Surface Preparation: Concrete preparation shall be by mechanical means and include use of a scabbler, scarifier or shot blast machine for removal of bond inhibiting materials such as curing compounds or laitance.

3.03 MIXING

A. General: Mix components only in amounts that can be applied within recommended application life.

1. Discard materials not used within application life.

3.04 SYSTEM APPLICATION

A. General: Apply each component of resinous flooring system in compliance with manufacturer's written directions to produce a uniform monolithic wearing surface of thickness indicated, uninterrupted except at divider strips, sawn joints or other types of joints (if any), indicated or required.

B. Epoxy Flooring:

1. Primer: Mix and apply primer over properly prepared substrate with strict adherence to manufacturer's installation procedures and coverage rates. Coordinate timing of primer application with application of troweled mortar to ensure optimum adhesion between resinous flooring materials and substrate.

2. Troweled Mortar: Mix mortar material according to manufacturer's recommended procedures. Uniformly spread mortar over substrate using manufacturer's specially designed screed rake adjusted to manufacturer's recommended height. Hand trowel apply mixed material over freshly primed substrate using steel finishing trowels or power trowel material using manufacturer's specially designed power trowel blades.

3. Under Coat: Remove any surface irregularities by lightly abrading and vacuuming the

floor surface. Mix and apply undercoat with strict adherence to manufacturer's installation procedures and coverage rates.

4. Broadcast: Immediately broadcast quartz silica aggregate into the undercoat using manufacturer's specially designed spraycaster. Strict adherence to manufacturer's installation procedures and coverage rates is imperative.

5. Sealer: Remove excess unbonded granules by lightly brushing and vacuuming the floor surface. Mix and apply sealer with strict adherence to manufacturer's installation procedures.

C. Cove Base:

1. Mix and apply cove base mortar in conjunction with mortar base of resinous flooring at the height indicated on Drawings and/or Finish Schedule.

D. Surface Texture:

1. Apply Sealer at a rate to achieve a surface that matches samples submitted.

E. Stonflex MP7:

1. Sealant: Mix and apply sealant to properly prepared cut joints (if any). The use of a polyethylene backer rod should be used in expansion and/or isolation joints.

3.05 PROTECTION OF ADJACENT WORK

A. General: Epoxy floor system will be installed in locations where other adjacent finish materials, including ornamental metal, lath and plaster, and other finish assemblies may already be in place. Protect all adjacent surfaces during installation and finishing.

1. Installed adjacent finishes shall be completely isolated from epoxy coating system installation. Provide Plastic ("Visqueen") wrap and mask all edges.

2. Provide constant supervision and immediate clean up throughout epoxy floor system installation.

3. After epoxy floor system has fully cured, remove protection from adjacent surfaces and wipe down surfaces using clean, cotton towels.

3.06 CURING, PROTECTION AND CLEANING

A. Cure epoxy flooring materials in compliance with manufacturer's directions, taking care to prevent contamination during stages of application and prior to completion of curing process.

1. Close area of application for a minimum of 24 hours.

B. Protect epoxy flooring materials from damage and wear during construction operation.

1. Where temporary covering is required for this purpose, comply with manufacturer's recommendations for protective materials and method of application.

C. Cleaning:

1. Remove temporary covering and clean epoxy flooring just prior to final inspection.

2. Use cleaning materials and procedures recommended by epoxy flooring manufacturer.

END OF SECTION

SECTION 09 91 00
PAINTING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Field-Applied paints, stains, sealers and other coatings.

B. Shop-Applied paints, stains, sealers and other coatings.

1.02 REFERENCES

A. Master Painters Institute (MPI) Architectural Painting Specification Manual.

B. Master Painters Institute (MPI) Maintenance and Repainting Manual.

C. AAMA – American Architectural Manufacturers Association.

D. AAMA 2605 – Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Architectural Extrusions and Panels.

E. ASTM B449 – Standard Specification for Chromates on Aluminum

F. ASTM D1730 – Preparation of Aluminum and Aluminum-Alloy Surfaces for Painting

G. ASTM D7803 – Preparation of Zinc (Hot-Dip Galvanized) Coated Iron and Steel Product and Hardware Surfaces for Powder Coating

H. PCI – Powder Coating Institute.

1.03 SUBMITTALS

A. Samples:

1. Submit per Section 01 34 00 and the following:

a. Submit 8 in. x 10 in. color samples of color selections indicated on Colors and Materials Schedule on drawings. Submit samples in gloss selections scheduled.

b. Furnish additional required samples until colors, finishes, and textures are reviewed and Architect issues written authorization to proceed.

c. Retain approved samples for reference.

B. Materials and Products Lists:

1. Submit complete lists of products proposed for use in scheduled finish systems.

a. Arrange in same format as scheduled in this Section, and list MPI product numbers applicable to each system.

b. Include applicable manufacturer's recommendations.

c. Include additional information requested by Architect.

1.04 QUALITY ASSURANCE

A. Manufacturer: Company specializing in manufacturing the products specified in this Section with minimum three (3) years documented experience.

B. Applicator: Company specializing in performing the work of this Section with minimum three (3) years documented experience.

1.05 REGULATORY REQUIREMENTS

A. Conform to applicable code for flame and smoke rating requirements for finishes.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect, and handle products to site under provisions of Section 01 60 00.

B. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

C. Container label to include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

D. Store paint materials at minimum ambient temperature of 45 degrees F (7 degrees C) and a maximum of 90 degrees F (32 degrees C), in ventilated area, and as required by manufacturer's instructions.

E. Apply manufacturer’s standard protective coverings to shop-applied finished surfaces.

F. Deliver, store and handle shop-applied finished components in manner to prevent damage to finishes. Furnish touch-up paint along with each material shipment.

1.07 ENVIRONMENTAL REQUIREMENTS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.

B. Do not apply exterior coatings during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.

C. Minimum Application Temperatures for Latex Paints: 45 degrees F (7 degrees C) for interiors; 50 degrees F (10 degrees C) for exterior; unless required otherwise by manufacturer's instructions.

1.08 EXTRA MATERIALS

A. Furnish under provisions of Section 01 75 00.

B. Maintenance Materials: Leave 1/2 gallon of each type and color of paint and other coating products for maintenance purposes.

1. Label for positive identification.

2. Store where directed.

3. Turn over to Owner at jobsite and obtain signed receipt.

1.09 **WARRANTY**

A. Furnish two (2) year warranty in accordance with referenced services "Manual" on full value of work included in this Section.

1. Warrant work to be in accordance with Specifications, standards and requirements incorporated in referenced manual.

2. Warranty not applicable to defective items through faulty work by other trades, or for failure of substrates.

3. Warranty does not assume any liability for claim other than repairing painting and finishing defects, as determined by Manual.

1.10 **COLORS**

A. Colors are specified on Colors and Materials Schedule on drawings.

PART 2 - PRODUCTS

2.01 **MATERIALS**

A. Materials shall be in accordance with the MPI Architectural Painting Specification Manual “Approved Product” listing and shall be from a single manufacturer for each system used.

B. Conform also to governing regulations such as Federal and State requirements for pollution, safety, and health. Finishes shall have flamespread ratings that do not exceed those permitted by the IBC.

C. Materials not specifically indicated, but required, such as linseed, oil, shellac, thinners, shall be the highest quality product of an approved manufacturer listed in the MPI Architectural Painting Specification Manual.

D. Mixing: Furnish ready-mixed products.

PART 3 - EXECUTION

3.01 **EXAMINATION**

A. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.

C. Test shop applied protective coatings (primers) for compatibility with subsequent cover materials.

D. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:

1. Plaster and Gypsum Wallboard: 12 percent.

2. Masonry, Concrete, and Concrete Unit Masonry: 12 percent.

3. Interior Wood: 15 percent, measured in accordance with ASTM D2016.

4. Exterior Wood: 15 percent, measured in accordance with ASTM D2016.

5. Concrete Floors: 8 percent.

3.02 MATERIALS NOT TO BE FINISHED

A. The following receive no finish except as indicated:

1. Metals as listed:

a. Brass, bronze, copper, plated metals, and stainless steel.

2. Plastic laminate surfacing.

3. Glass, unless otherwise noted.

4. Electronic switchplates; lighting fixtures.

5. Finish hardware.

3.03 PREPARATION

A. Prepare surfaces as follows and as specified in the MPI Architectural Painting Specifications Manual and the MPI Maintenance Repainting Manual. Consult manuals for surface preparations not indicated.

B. Remove electrical plates, hardware, light fixture trim, escutcheons, and fittings prior to preparing surfaces or finishing.

C. Correct defects and clean surfaces that affect work of this Section. Remove existing coatings that exhibit loose surface defects.

D. Seal with shellac and seal marks which may bleed through surface finishes.

E. Impervious Surfaces: Remove mildew by scrubbing with solution of tri-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

F. Aluminum Surfaces Scheduled for Paint Finish: Remove surface contamination by steam or high-pressure water. Remove oxidation with acid etch and solvent washing. Apply etching primer immediately following cleaning.

G. Surfaces Scheduled for Shop-Applied Powder Coated High-Performance (PVDF) Fluoropolymer Resin Finish: Prepare surfaces in accordance with PCI and AAMA 2605 specification and performance standards.

H. Asphalt, Creosote, or Bituminous Surfaces Scheduled for Paint Finish: Remove foreign particles to permit adhesion of finishing materials. Apply compatible sealer or primer.

I. Insulated Coverings: Remove dirt, grease, and oil from canvas and cotton.

J. Concrete Floors: Remove contamination, acid etch, and rinse floors with clear water. Verify required acid-alkali balance is achieved. Allow to dry.

K. Copper Surfaces Scheduled for a Paint Finish: Remove contamination by steam, high-

pressure water, or solvent washing. Apply vinyl etch primer immediately following cleaning.

L. Copper Surfaces Scheduled for a Natural Oxidized Finish: Remove contamination by applying oxidizing solution of copper acetate and ammonium chloride in acetic acid. Rub on repeatedly for required effect. Once attained, rinse surfaces with clear water and allow to dry.

M. Gypsum Board Surfaces: Fill minor defects with filler compound. Spot prime defects after repair.

N. Galvanized Surfaces: Prepare surfaces to receive specified coating systems by removing contaminants, oils and pre-treatments, including chromate passivation, using one of the following methods approved by the paint manufacturer:

1. Apply a commercial clean and etch solution conforming to MPI #25 – Etching Cleaner in accordance with manufacturer's instructions.

2. Provide brush-off blast cleaning of the surface in accordance with SSPC-SP 7, using air pressures and abrasives that produce a suitable surface with minimal damage to underlying zinc coating.

3. Contractor may test surfaces for chromate passivation and use alternate methods of preparation as recommended by the paint manufacturer for galvanized surfaces that are confirmed to be negative for pre-treatment or passivation.

4. Coordinate with galvanized metal manufacturer for factory priming, where applicable, and prepare and prime factory-primed surfaces as recommended by the paint manufacturer to receive the specified topcoats. Test coat factory-primed surfaces for paint compatibility and adhesion.

O. Concrete and Unit Masonry Surfaces Scheduled to Receive Paint Finish: Remove dirt, loose mortar, scale, salt or alkali powder, and other foreign matter. Remove oil and grease with a solution of tri-sodium phosphate; rinse well and allow to dry. Remove stains caused by weathering of corroding metals with a solution of sodium metasilicate after thoroughly wetting with water. Allow to dry.

P. Plaster Surfaces: Fill hairline cracks, small holes, and imperfections with latex patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.

Q. Uncoated Steel and Iron Surfaces: Remove grease, mill scale, weld splatter, dirt, and rust. Where heavy coatings of scale are evident, remove by wire brushing or sandblasting; clean by washing with solvent. Apply a treatment of phosphoric acid solution, ensuring weld joints, bolts, and nuts are similarly cleaned. Spot prime paint after repairs.

R. Exposed Structural Steel and Miscellaneous Metal Surfaces (Except Galvanized Surfaces). Remove grease, mill scale, weld splatter, dirt, and rust. White metal blast clean (SSPC SP-5) surfaces of entire member to remove scale coating; clean by washing with solvent. Apply a treatment of phosphoric acid solution, ensuring weld joints, bolts, and nuts are similarly cleaned. Prime paint after cleaning.

S. Shop Primed Steel Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Prime metal items including shop primed items.

3.04 APPLICATION

A. Perform the work in accordance with MPI Architectural Painting Specifications Manual and manufacturer's directions. Where these may be in conflict, the more stringent requirements govern.

B. All work shall be “Premium Grade” in accordance with referenced MPI manuals.

C. Perform the work for Shop-Applied Powder Coated High-Performance (PVDF) Fluoropolymer Resin Finish in accordance with PCI and AAMA 2605 specification and performance standards. Where these may be in conflict, the more stringent requirements govern.

D. Apply products in accordance with manufacturer's instructions.

E. Do not apply finishes to surfaces that are not dry.

F. Apply each coat to uniform finish.

G. Apply each coat of paint slightly darker than preceding coat unless otherwise approved.

H. Vacuum clean surfaces free of loose particles. Use tack cloth just prior to applying next coat.

I. Allow applied coat to dry before next coat is applied.

J. Where clear finishes are required, tint fillers to match wood. Work fillers into the grain before set. Wipe excess from surface.

K. Prime concealed surfaces of woodwork with primer paint.

L. Prime concealed surfaces of interior woodwork scheduled to receive stain or varnish finish with gloss varnish reduced 25 percent with mineral spirits.

3.05 FINISHING MECHANICAL AND ELECTRICAL EQUIPMENT

A. Paint exterior exposed conduit, pipes and other miscellaneous unfinished electrical and mechanical equipment, components, assemblies and devices; including exposed related brackets and supports.

1. Electrical Panelboards.

2. Gas Meter Assembly.

3. Pipe and fittings.

4. Electrical Transformer.

5. HVAC Equipment

B. Refer to Division 22, Division 23 and Division 26 for schedule of color coding and identification banding of equipment, duct work, piping, and conduit.

C. Paint shop primed equipment. Paint shop prefinished items occurring at interior areas.

D. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.

E. Prime and paint insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, except where items are prefinished.

F. Paint interior surfaces of air ducts that are visible through grilles and louvers with one coat of flat black paint, to visible surfaces. Paint dampers exposed behind louvers and grilles to match face panels.

G. Paint exposed conduit and electrical equipment occurring in finished areas.

H. Paint both sides and edges of plywood backboards for electrical and telephone equipment before installing equipment.

I. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

J. Paint existing mechanical grilles and diffusers that are to be reused in renovated spaces.

3.06 PATCHING

A. As work is completed in room areas, repair surfaces damaged by other trades requiring touch-up or refinishing. Surfaces where touch-up of damaged areas remains distinguishable from surrounding undamaged areas under normal viewing conditions shall be refinished to nearest corners or intersections.

3.07 CLEANING

A. As work proceeds, and on completion of work, promptly remove all spilled, splashed or splattered products so as not to damage surfaces.

1. During work progress, keep premises free from any unnecessary accumulation of tools, equipment, surplus materials, and debris.

3.08 PAINTING AND FINISHING TITLES AND CODE NUMBERS

A. References are from referenced manual unless otherwise indicated. They indicate coating system, grades, and acceptable manufacturers and products.

3.09 GLOSS

A. All finishes: Gloss as scheduled.

3.10 EXTERIOR PAINTING AND FINISHING SCHEDULE

(All Work Premium Grade)

A. Paint exterior surfaces in accordance with the following MPI Painting Specification Manual requirements:

1. Asphalt Surfaces: (traffic markings)

EXT 2.1B: Alkyd Zone / Traffic Marking.

2. Concrete Vertical Surfaces: (exposed concrete including soffits)

3. Concrete Horizontal Surfaces: (plaza, sidewalks, curbs, paving and traffic markings)

EXT 3.2F: Alkyd Zone / Traffic Marking. (fire lane curbs and traffic markings)

EXT 3.2H: Clear Sealer. W.B. (plaza, sidewalks, curbs and paving)

4. Concrete Masonry Units: (smooth and split face concrete block – and interior face of exposed CMU in Equipment Tunnel and Equipment Room)

   Graffiti Protection and Water Repellent Sealer: ProSoco. Sure Klean. Weather Seal Blok-Guard & Graffiti Control Ultra. Water and graffiti repellent. 2-coat application.

5. Structural Steel Framing and Metal Fabrications (Field-Applied): (columns, beams, joists, metal stair systems, metal railing systems and metal fabrications)

   EXT 5.1J: Polyurethane, pigmented (over high build epoxy) G6 gloss finish.

6. Galvanized (Protective Coating) Structural Steel Framing and Metal Fabrications (Field-Applied): (columns, beams, joists, metal stair systems, metal railing systems and metal fabrications)

   EXT 5.3L: Polyurethane, pigmented (over high build epoxy) G6 gloss finish.

7. Galvanized (Protective Coating) Metal: (hollow metal doors and frames, miscellaneous steel, pipes, metal decking, ducts, ladders, bollards, sheet metal flashing and trim)

   EXT 5.3D: Polyurethane, pigmented (over high build epoxy) G6 gloss finish.

3.11 INTERIOR PAINTING AND FINISHING SCHEDULE

(All Work Premium Grade)

A. Paint interior surfaces in accordance with the following MPI Painting Specification Manual requirements:

1. Concrete Vertical Surfaces: (including horizontal soffits)

   INT 3.1A: Latex G3 eggshell finish.

   Concrete Finishing Coat: As specified in Section 03 30 00.

2. Concrete Horizontal Surfaces: (floors and stairs)

   Concrete floor sealer as specified in Section 03 30 00.

   Epoxy Coating as specified in Section 09 67 23.

3. Concrete Masonry Units: (smooth and split face block and brick)

   Graffiti Protection and Water Repellent Sealer: ProSoco. Sure Klean. Weather Seal Blok-Guard & Graffiti Control Ultra. Water and graffiti repellent. 2-coat application.

4. Structural Steel and Metal Fabrications:

   EXT 5.1J: Polyurethane, pigmented (over high build epoxy) G6 gloss finish.

5. Galvanized Metal:

EXT 5.3L: Polyurethane, pigmented (over high build epoxy) G6 gloss finish.

6. Plaster and Gypsum Board:

INT 9.2B: High Performance Architectural Latex, G3 eggshell finish with PVA primer.

3.12 FIELD QUALITY CONTROL

A. Conform to referenced manual's standards for work, unless otherwise indicated.

3.13 REPLACEMENT OF HARDWARE AND MISCELLANEOUS ITEMS

A. Reinstall items previously required to be removed.

3.14 CLEANING

A. At conclusion of project, thoroughly clean paint and splatters from glass, mirrors, and other surfaces. Take care not to scratch surfaces.

B. Clean residue of work of this section from any other surfaces.

C. At work's conclusion, leave premises neat and clean.

END OF SECTION

PAGE LEFT BLANK INTENTIONALLY

SECTION 10 14 00
SIGNAGE

PART 1 - GENERAL

1.01 REFERENCES

A. ICC/ANSI A117.1 - Accessible and Usable Buildings and Facilities.

1.02 SUBMITTALS

A. Submit under provisions of Section 01 34 00.

B. Shop Drawings: Indicate sign styles, lettering font, foreground and background colors, locations, overall dimensions of each sign.

C. Samples: Submit sample signs, illustrating type, style, letter font, and colors specified; method of attachment.

D. Manufacturer's Installation Instructions: Include installation template and attachment devices.

1.03 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three (3) years documented experience.

1.04 REGULATORY REQUIREMENTS

A. Install in conformance with Title III of the Americans and Disabilities Act, Public Law 101-336.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect, and handle products to site under provisions of Section 01 60 00.

B. Package signs, labeled in name groups.

1.06 ALTERNATES

A. See Section 01 23 00 for bidding alternates affecting the work of this Section.

1.07 COLORS

A. Colors are specified on Colors and Materials Schedule.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Plaque and Letter Signs

1. Inpro Corporation, Muskego, WI; 800-222-5556

2. Gemini USA, Cannon Falls, MN 800-538-8377 (letters & logos), 877-877-2922 (plaques)

3. Apco Northwest,Seattle, WA: 800-815-8028

4. Graphic Systems, Inc., Fort Wayne, IN 260-485-9667

5. ASI Sign Systems, Inc., Irving, TX: 800-274-7732

B. Traffic Signs

1. Zumar Industries, Tacoma, WA: 253-536-7740

2. My Parking Sign, 800-952-1457

C. Substitutions under provisions of Section 01 60 00.

2.02 EXTERIOR SIGNAGE

A. Building Identification Numbers:

1. Building address numbers consist of cast aluminum dimensional text.

2. Dimensional Text (Letters/Numbers):

a. Material: Cast aluminum text with threaded studs.

b. Finish: Cast aluminum, brushed satin.

c. Letter Thickness: 1/2 in. minimum.

d. Text and Size: 12”.

e. Text Style: Helvetica, medium.

f. Type Code: All letters uppercase text.

g. Mounting: Flush mount; conceal fasteners.

h. Location: as indicated.

i. Manufacturer: Similar to Gemini, Inc. or ZAX Signage Systems, exterior cast aluminum signage (603) 889-4126.

B. Van Accessible Parking Signs

1. Accessible parking sign with "Van Accessible" and "State Disabled Parking Permit Required" messages.

2. Location: At van accessible parking stall.

3. Manufacturer: Zumar Industries, Inc. (800) 426-7967.

a. Model Number: Washington State Regulatory Sign #R7-801. Note: include "Van Accessible" notation.

4. Installation: Posts are 2-3/8 in. O.D. galvanized steel with exposed end capped. Attachment bolts and nuts to be peened to deter removal.

C. "Do Not Enter" Traffic Sign

1. "Do Not Enter" traffic sign with universal "Do Not Enter" graphic symbol, post mounted.

2. Location: As indicated on site/parking lot plan.

3. Manufacturer: Zumar Industries, Inc. (800) 426-7967.

a. Model Number: Regulatory Signs #R5-1.

4. Installation: Posts are 2-3/8 in. O.D. galvanized steel with exposed end capped. Attachment bolts and nuts to be peened to deter removal.

D. "One Way" Traffic Sign

1. "One Way" traffic sign with directional arrow, post mounted.

2. Location: As indicated on site/parking lot plan.

3. Manufacturer: Zumar Industries, Inc. (800) 426-7967.

a. Model Number: Regulatory Signs #R6-2(R).

4. Installation: Posts are 2-3/8 in. O.D. galvanized steel with exposed end capped. Attachment bolts and nuts to be peened to deter removal.

2.03 INTERIOR SIGNAGE

A. Plaque Sign with Tactile Text, Braille and Tactile Graphics (Uni-Sex Restroom).

1. Room name identification plaque sign consists of unframed acrylic plaques with tactile text (letters and numbers), Braille characters, and tactile graphics (universal symbols).

2. Construction:

a. Plaque Size: 8 in. x 8 in.

b. Plaque Material: Transparent acrylic (0.125 in. thickness) base with matte finish.

c. Tactile Text, Braille Characters and Tactile Graphics: A thin photoetched plastic is laminated to the acrylic plaque, to produce a single panel with tactile text, Braille characters and tactile graphics. Text, Braille and graphics shall be raised 1/32 in.

d. Finish: Sign edges are to be straight and free from saw marks or other imperfections. The corners of the sign are square.

3. Tactile Text, Braille Characters, and Tactile Graphics:

a. Construction: Photoetched plastic

b. Thickness: 1/32 in.

c. Height (text): 5/8 in.

d. Text Style: Helvetica

e. Type Code: Uppercase

4. Mounting: Mechanically fasten with tamper resistant ("Pan Head Square Drive") fasteners. Use a 2 in. screw to penetrate GWB to plywood backing.

5. Colors: Specified on Colors and Materials Schedule.

6. Manufacturers similar to Apco; ADA Process 1 System (206) 589-3144.

B. Tactile Exit Signs: Provide sign stating “EXIT” at doors as indicated on Door Schedule.

1. Tactile exit sign shall comply with IBC 1011.4 and ICC/ANSI A117.1 Chapter 7 requirements.

PART 3 - EXECUTION

3.01 **EXAMINATION**

A. Verify that substrate surfaces are ready to receive work.

3.02 **INSTALLATION**

A. Install in accordance with manufacturer's instructions.

B. Install signs after all wall and ceiling surfaces are painted and finished.

C. Install centered and level, in line and in accordance with manufacturer's instructions. Mount signs as indicated and in accordance with the provisions of ICC/ANSI A117.1.

D. Install exterior pole-mounted sign in minimum 2 ft 0 in. deep by 12 in. diameter concrete base. Locate traffic signage per Pierce County requirements relative to roadway and sign height.

E. Clean and polish in accordance with manufacturer's recommendations.

END OF SECTION

SECTION 10 26 13
CORNER GUARDS

PART 1 - GENERAL

1.01 **SUBMITTALS**

A. Product Data and Samples: Submit per Section 01 34 00.

1.02 **DELIVERY, STORAGE, AND HANDLING**

A. In accordance with Section 01 60 00 and the following:

1. Acceptance at Site:

a. Verify undamaged condition.

2. Protection (prior to installation):

a. Store out of harm's way.

3. Handle to prevent marring finishes.

1.03 **SEQUENCING/SCHEDULING**

A. Phase in properly with Construction Schedule per Section 01 34 00.

1.04 **COLORS**

A. Colors are specified on Colors and Materials Schedule on drawings.

PART 2 - PRODUCTS

2.01 **CORNER GUARDS**

A. Manufacturers:

1. InPro Corporation.

2. Substitutions: Under provisions of Section 01 60 00.

B. Products:

3. Model 160, surface mounted corner guard, rigid vinyl with continuous aluminum retainer.

4. Size: 2” x 2” x 4’-0”. 90 degree corner.

PART 3 - EXECUTION

3.01 **INSPECTION**

A. Verify installation conditions as satisfactory to receive work of this Section. Do not install until any unsatisfactory conditions are corrected. Beginning work constitutes acceptance of conditions as satisfactory.

3.02 PREPARATION

A. Protect surrounding surfaces to preclude damage from work of this Section.

3.03 INSTALLATION

A. Install in accordance with specifications and manufacturer's directions. Where these may be in conflict, the more stringent requirements apply.

END OF SECTION

SECTION 10 28 13
TOILET ACCESSORIES

PART 1 - GENERAL

1.01 REFERENCES

A. ICC/ANSI A117.1 - Accessible and Usable Buildings and Facilities.

B. ASTM A167 - Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.

C. ASTM A269 - Seamless and Welded Austenitic Stainless Steel Tubing for General Service.

D. ASTM A366 - Steel, Carbon, Cold-Rolled Sheet, Commercial Quality.

E. ASTM B456 - Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium.

F. NEMA LD-3 - High Pressure Decorative Laminates.

1.02 SUBMITTALS

A. Submit under provisions of Section 01 34 00.

B. Product Data: Provide data on accessories describing size, finish, details of function, attachment methods.

C. Samples: Submit samples of each component, illustrating color and finish.

D. Manufacturer's Installation Instructions: Indicate special procedures, and perimeter conditions requiring special attention.

1.03 REGULATORY REQUIREMENTS

A. Install in conformance with ICC/ANSI A117-1.

1.04 COORDINATION

A. Coordinate the work with the placement of internal wall reinforcement and reinforcement of toilet partitions to receive anchor attachments.

1.05 SEQUENCING AND SCHEDULING

A. Coordinate the work of this Section with Section 06 10 00 for the placement of blocking to receive anchor attachments. Contractor to provide blocking for all accessories and toilet compartments, including Owner furnished accessories.

1.06 KEYING

A. Master key all accessories.

1.07 COLORS

A. Colors are specified on Colors and Materials Schedule on drawings.

1.08 **ALTERNATES**

A. See Section 01 23 00 for bidding alternates affecting the work of this Section.

PART 2 - PRODUCTS

2.01 **MANUFACTURERS**

A. Subject to conformance with specification requirements, the following manufacturers are acceptable:

1. Bobrick Washroom Equipment, Inc.

2. American Specialties.

3. Bradley.

B. Substitutions: Under provisions of Section 01 60 00.

2.02 **MATERIALS**

A. Stainless Steel Sheet: ASTM A167, Type 304.

B. Tubing: ASTM A269, stainless steel.

C. Plastic Laminate: NEMA LD-3, Fire Rated Type; 0.125 in. thick, matte finish, color as selected.

D. Adhesive: Contact type, waterproof.

E. Concealed Fasteners, Screws, and Bolts: Hot-dip galvanized of type and size as required.

F. Exposed Fasteners, Screws, and Bolts: Tamper-proof, stainless steel of type and size as required.

G. Expansion Shields: Fiber, lead, or rubber as recommended by accessory manufacturer for component and substrate.

2.03 **FABRICATION**

A. Weld and grind joints of fabricated components, smooth.

B. Form exposed surfaces from single sheet of stock, free of joints. Form surfaces flat without distortion. Maintain surfaces without scratches or dents.

C. Fabricate grab bars of tubing, free of visible joints, return to wall with end attachment flanges.

D. Shop assemble components and package complete with anchors and fittings.

E. Provide steel anchor plates, adapters, and anchor components for installation.

2.04 **FINISHES**

A. Galvanizing Ferrous Metals: ASTM A123 to 2.0 oz/sq yd. Galvanize ferrous metal and fastening devices.

B. Shop Primed Ferrous Metals: Pretreat and clean, spray apply one (1) coat primer and bake.

C. Enamel: Pretreat to clean condition, apply one (1) coat primer and minimum two (2) coats epoxy baked enamel.

D. Chrome/Nickel Plating: ASTM B456; Satin finish.

E. Stainless Steel: No. 4 Satin finish.

F. Back paint components where contact is made with building finishes to prevent electrolysis.

2.05 TOILET ACCESSORIES

Models listed are Bobrick unless manufacturer is listed.

A. Toilet Paper Dispenser (Surface Mounted): B-686; surface-mounted with theft resistant spindle; 2-roll capacity.

B. Soap Dispenser (Surface Mounted): B-2112. Classic Series, surface mounted soap dispenser.

C. Mirrors (Framed): Tempered glass mirror with stainless steel channel frame. Model: B-165 2436.

D. Paper Towel Dispenser Waste Receptacle (Recessed): B-369; recessed combined paper towel dispenser waste receptacle.

E. Toilet Seat Cover Dispenser (Surface Mounted): B-221; surface mounted seat-cover dispenser.

F. Grab Bars: B-6806 Series, concealed mounting flange, 1-1/2 inch diameter tubing, 18-gauge, straight bars. Install (3) grab bars at each ADA water closet stall; refer to drawings for minimum grab bar lengths and mounting requirements.

G. Sanitary Napkin Disposal (Surface-Mounted): B-270; surface mounted sanitary napkin disposal. Contura Series.

H. Coat hooks: B-2116; heavy-duty clothes hook, stainless steel. Theft-resistant mounting. Install (1) coat hook at each water closet stall (behind wall).

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that site conditions are ready to receive work and dimensions are as indicated on shop drawings.

B. Verify exact location of accessories for installation.

3.02 PREPARATION

A. Deliver inserts and rough-in frames to site for timely installation.

B. Provide templates and rough-in measurements as required.

3.03 INSTALLATION

A. Install accessories in accordance with manufacturers' instructions and ANSI A117.1.

B. Install plumb and level, securely and rigidly anchored to substrate.

3.04 ADJUSTING AND CLEANING

A. Adjust all moving parts to operate perfectly.

B. Clean all exposed surfaces.

C. Leave installations free of imperfections; premises free of any residue of work of this section.

END OF SECTION

SECTION 10 44 00
FIRE PROTECTION SPECIALTIES

PART 1 - GENERAL

1.01 **REFERENCES**

A. NFPA 10 - Portable Fire Extinguishers.

1.02 **SUBMITTALS**

A. Section 01 34 00 - Submittals: Procedures for submittals.

B. Product Data: Provide extinguisher operational features, color and finish, anchorage details, rough-in measurements, location and details.

1.03 **ENVIRONMENTAL REQUIREMENTS**

A. Do not install extinguishers when ambient temperature may cause freezing of extinguisher ingredients.

1.04 **ALTERNATES**

A. See Section 01 23 00 for bidding alternates affecting the work of this Section.

1.05 **COLORS**

A. Colors are specified on Colors and Materials Schedule on drawings.

PART 2 - PRODUCTS

2.01 **MANUFACTURERS**

A. Acceptable Manufacturers:

1. J. L. Industries.

2. Larsens' Manufacturing Co.

3. Potter – Roemer.

4. Substitutions: Under provisions of Section 01 60 00.

5. Specification is based on products manufactured by Larsen's.

2.02 **EXTINGUISHERS**

A. Multipurpose dry chemical type, Larsen's MP5, 2A-10BC U.L. rating. Provide maintenance/inspection recordkeeping tag on each extinguisher meeting requirements of NFPA 10 and local authority having jurisdiction. Extinguishers shall be properly charged with charging/inspection date noted on tag.

2.03 **CABINETS**

A. Larsen's Model No. 2409-SM (Surface-Mounted) Duo narrow glass door style with ”Larson-Loc” lock and handle, clear anodized aluminum construction, with tempered glass. Provide mounting bracket for fire extinguisher inside cabinet so that extinguisher is clearly visible with door closed.

B. Mounting Hardware: Appropriate to cabinet and wall construction.

PART 3 - EXECUTION

3.01 **EXAMINATION**

A. Section 01 04 10 – Project Management and Coordination: Verification of existing conditions before starting work.

B. Verify rough openings for cabinet are correctly sized and located.

3.02 **INSTALLATION**

A. Install in accordance with manufacturer's instructions.

B. Install cabinets plumb and level in wall openings.

C. Secure cabinets rigidly in place in accordance with manufacturer's instructions.

D. Place extinguishers and accessories in cabinets.

END OF SECTION

SECTION 10 51 00
LOCKERS

PART 1 – GENERAL

1.01 SUBMITTALS

A. Product Data and Samples: Submit per Section 01 34 00.

1.02 DELIVERY, STORAGE, AND HANDLING

A. In accordance with Section 01 60 00 and the following:

1. Acceptance at Site:

a. Verify undamaged condition.

2. Protection (prior to installation):

a. Store out of harm's way.

3. Handle to prevent marring finishes.

1.03 COLORS

A. Colors are specified on Colors and Materials Schedule on drawings.

PART 2 – PRODUCTS

2.01 HEAVY DUTY PLASTIC LOCKERS

A. Furnish and install Heavy Duty Plastic Lockers, Salsbury Industries, www.lockers.com. (1-800-lockers.) Double tier, #42168, unit size 12” x 18” x 72”, 1/2” thick high density polyethylene (HDPE) material, water resistant heavy duty plastic lockers. Stainless steel hasp for combination lock #44420, matching sloping hood and 3-inch high black plastic base. Provide all components and accessories for complete installation. Provide in quantity shown on drawings.

PART 3 – EXECUTION

3.01 INSPECTION

A. Verify installation conditions as satisfactory to receive work of this Section. Do not install until any unsatisfactory conditions are corrected. Beginning work constitutes acceptance of conditions as satisfactory.

3.02 PREPARATION

A. Protect surrounding surfaces to preclude damage from work of this Section.

3.03 **INSTALLATION**

A. Install in accordance with manufacturer's directions. Bolt lockers to wall to prevent overturning.

END OF SECTION

SECTION 12 32 00
MANUFACTURED WOOD CASEWORK

PART 1 - GENERAL

1.01 REFERENCES

A. ANSI A135.4 - Basic Hardboard.

B. ANSI A208.1 - Mat Formed Wood Particleboard.

C. AWS - Architectural Woodwork Standards. AWI - Architectural Woodwork Institute.

D. BHMA A156.9 - Cabinet Hardware.

E. FS MMM-A-130 - Adhesive, Contact.

F. HPMA (Hardwood Plywood Manufacturer's Association) HP - American Standard for Hardwood and Decorative Plywood.

G. NEMA (National Electric Manufacturers Association) LD3 – High-Pressure Decorative Laminates.

H. NHLA (National Hardwood Lumber Association).

I. PS 1 - Construction and Industrial Plywood.

J. PS 20 - American Softwood Lumber Standard.

1.02 SUBMITTALS

A. Section 01 34 00 - Submittals: Procedures for submittals.

B. Shop Drawings: Indicate materials, component profiles and elevations, assembly methods, joint details, fastening methods, accessory listings, hardware location and schedule of finishes.

C. Product Data: Include manufacturer's published literature for specified products, including accessories, specifications, physical characteristics and performance data.

D. Samples: Submit samples of all cabinet materials and hardware including:

1. 5 inch x 7 inch samples of each color/pattern selection of cabinet finishes.

2. Sample drawer illustrating all fabrication techniques and surface materials.

3. Hardware: Locks, hinges, pulls, drawer glides, door catches, coat hooks, shelf supports, grommets, coat rod and hanger, and sliding glass door track assembly components.

E. Certificates: Submit certification of manufacturer’s qualifications.

1.03 **QUALITY ASSURANCE**

A. Perform work in accordance with AWS/AWI Premium Grade quality standards.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this Section with minimum three (3) years documented experience.

C. Comply with "Quality Assurance" provisions, "References, Specifications and Manufacturer's Data".

1. Conform to referenced AWS/AWI standards; Section 2 – Care and Storage, for "Premium Grade" quality product.

1.04 **DELIVERY, STORAGE, AND PROTECTION**

A. Section 01 60 00 - Product Requirements: Transport, handle, store, and protect products.

B. Protect units from moisture damage.

1.05 **ENVIRONMENTAL REQUIREMENTS**

A. Section 01 60 00 - Product Requirements: Environmental conditions affecting products on site.

B. During and after installation of work of this Section, maintain the same temperature and humidity conditions in building spaces as will occur after occupancy.

1.06 **COORDINATION**

A. Coordinate with the mechanical and electrical subcontractors for location, number, size, and shape of cutouts for mechanical and electrical fixtures and fittings. Coordinate with Contractor for location of backing between studs in walls required for casework installation and anchorage.

B. Coordinate with Owner where equipment to be furnished and installed by Owner may affect casework dimensions.

1.07 **COLORS**

A. Colors are specified on the Colors and Materials Schedule on drawings.

1.08 **ALTERNATES**

A. See Section 01 23 00 for bidding alternatives affecting work in this Section.

PART 2 - PRODUCTS

2.01 **MANUFACTURERS**

A. The following manufacturers are approved to produce product in full compliance with this specification. Approval does not relieve manufacturers from strict compliance with materials and details listed herein.

1. Cabinetmakers, Inc., Puyallup, WA (253) 848-3541

2. Genothen Holdings LLC, Tumwater, WA (360) 352-3636

3. Hewitt Cabinets, Tacoma, WA (253) 272-0404

4. Interior Wood Products, LLC, Olympia, WA (360) 352-7273

5. Martin Furniture Manufacturing, Olympia, WA (360) 709-9147

B. Substitutions: Under provisions of Section 01 60 00.

2.02 MATERIALS

A. Comply with "Quality Assurance" provisions, "References, Specifications and Manufacturer's Data".

1. Conform to referenced AWS/AWI standards; Section 3 - Lumber, for "Premium Grade" quality product.

2. Conform to referenced AWS/AWI standards; Section 4 – Sheet Products, for "Premium Grade" quality product.

3. Conform to referenced AWS/AWI standards; Section 5 - Finishing, for "Premium Grade" quality product.

4. Conform to referenced AWS/AWI standards; Section 10 - Casework, for "Premium Grade" quality product.

5. Conform to referenced AWS/AWI standards; Section 11 - Countertops, for "Premium Grade" quality product.

B. High-Pressure Plastic Laminate Materials (PLAM): Colors as selected by Architect or as indicated on Colors and Materials Schedule.

1. High-Pressure Plastic Laminate (Vertical Surfaces): Material to be 0.028 inch thick and have textured surface.

2. High-Pressure Plastic Laminate (Horizontal Surfaces): Countertops and horizontal surfaces to be 0.048 inch thick and have textured finish. Balancing sheet a minimum 0.020 inch thick required on countertops.

3. Balancing sheet on inside of doors 0.028 inch thick high-pressure plastic laminate, neutral color and shall meet NEMA standards for vertical grade, matte finish.

4. Neutral color melamine or polyester overlay shall be factory bonded with heat and pressure (thermo-fused).

5. Edge banding shall be high-pressure plastic laminate. Edge banding shall match color and appearance of adjacent high-pressure plastic laminate face.

C. Plywood shall be five (5) ply solid face laminated with Type 2 water resistant glue. Provide 1/4 inch plywood for laminated multi-layers, used in curved casework installations.

D. Particleboard: Three (3) ply board of balanced construction of 45 pounds per cubic foot density with moisture content of 8% or less. Provide polyester or melamine overlay factory bonded with 200 psi at 300 degrees F for all open casework not requiring plastic laminate. Polyester or melamine overlay color shall match adjacent plastic laminate color. Provide

thermo-fused melamine or polyester overlay on both faces of particleboard not required to have plastic laminate overlay. Submit full range of melamine colors for selection by Architect.

E. Factory Prefinished Hardboard: 1/4 inch thick with smooth face neutral colored. Opposite face finished with balance coating.

F. Medium Density Fiberboard: ANSI A208.2, product class MD-Exterior. Industrial grade medium density fiberboard with formaldehyde-free binder. "Medex" manufactured by SierraPine Limited.

2.03 COUNTERTOPS AND BACKSPLASH

A. Solid Surface Material (SSM):

1. Dupont Corian Solid Surface. Solid nonporous homogeneous surfacing material.

a. Countertops: [1/2] inch thick material, 30 inch x 144 inch sheets.

b. Backsplash: [1/2] inch thick material.

c. Vertical Surfaces: [1/4] inch thick material.

2. Accessories: Provide manufacturer's recommended adhesives, sealants, grout, hardware, fasteners and other necessary accessories for complete installation.

2.04 HARDWARE

A. Hinges:

1. Fix Pin: Five knuckle, 2-3/4 inch x 0.90 inch, fastened with four (4) screws into cabinet panel, five (5) screws into door panel, dull chrome finish (4S26D). Knape & Vogt #2629 NP125. No edge fastenings permitted.

B. Pulls for Doors and Drawers: Provide one (1) pull for each door or drawer.

1. Manufacturer's standard 4-inch wire pulls, satin stainless-steel finish.

C. Adjustable Shelf Supports: Nickel-plated steel or injection molded A.B.S. plastic, champagne color friction fit into end panels and vertical dividers. Provide with integral bearing plate to prevent rotation failure. Knape & Vogt #346.

D. Drawer Slides:

1. Drawer Slides: Knape & Vogt #1284 nylon roller.

2. Full Extension Drawer Slides (for File Drawers): Knape & Vogt #8405 ball bearing, 100-pound rated.

2.05 FABRICATION AND WORKMANSHIP

A. Fabrication and workmanship of casework and countertops to comply with AWS/AWI "Premium" grade quality standards.

B. All exposed surfaces to be finished with high-pressure plastic laminate, unless indicated otherwise.

C. All parts machined for accurate fit and assembled with appropriate fastenings and adhesives to result in true, square, level, rigid, and plumb units.

D. Bases: Unit bases of 3/4-inch thick particleboard. Provide 3/4 inch recessed toe space at exposed cabinet ends.

1. Fabricate bases supporting precast architectural concrete and natural stone material countertops to support the additional weight of the countertops. Provide proper level support of countertop to prevent cracks in precast architectural concrete slab after installation.

E. Cabinet Top, Bottom, and Divisions: 3/4-inch thick particleboard. 1-inch thick for bottoms if 42 inches or more in length. Solid subtop for all lower base cabinets. Plastic laminate at exposed edges unless noted otherwise.

F. Cabinet Ends: Particleboard, 3/4 inch thick with holes drilled for adjustable shelf clips at 2 inch o.c. Plastic laminate edges at exposed edges, unless noted otherwise. Machine ends to accurate configuration for joining to top and bottom.

G. Support Panels and End Panels Exposed to View (at open knee spaces): Edges to be plastic laminate self-edge to match adjacent plastic laminate color.

H. Fixed and Adjustable Shelves: Shelves shall support a load of 40 pounds per square foot. Particleboard, unless noted otherwise; plastic laminate edges. Fixed shelves to be 3/4 inch thick for shelving up to 36 inches wide and 1 inch thick if span is over 36 inches wide. Adjustable shelves shall be ¾ inch thick for shelving up to 36 inches wide, and 1 inch thick if span is over 36 inches wide.

I. Semi-Exposed Cabinet Interiors and Shelves: Thermo-fused polyester overlay with plastic laminate or PVC shelf edges to match adjacent plastic laminate color.

J. Cabinet Back: 1/2 inch thick particleboard.

K. Cabinet Doors, Hinged: High-pressure plastic laminate factory bonded to face of 3/4 inch particleboard with same material as outside face on inside face; plastic laminate edges flush overlay.

L. Divisions: Particleboard 3/4-inch thick, plastic laminate edges unless noted otherwise.

M. Drawers: Applied front, particleboard 3/4 inch thick. Plastic laminate edges as specified. Connect front to drawers in accordance with manufacturer's standards. Bottoms shall be 1/4 inch plywood. Sides, subfront, and backs shall be 1/2 inch plywood surfaced with neutral color polyester overlay.

N. Plastic Laminate (PLAM) Countertops and Backsplash: Provide continuous top for counter-type cabinets fixed in a line. Include returns at ends of counter where abutting walls. Tops of backsplash shall be scribed and sealed to walls. Seal juncture between countertop and backsplash/sidesplash watertight. Provide [4-inch] high backsplash and sidesplash at countertops unless noted otherwise on drawings.

O. Solid Surface Material (SSM) Countertops and Backsplash: [4 inch] high backsplash and sidesplash. Provide backsplash and sidesplash at countertops unless noted otherwise on drawings. Factory fabrication in accordance to manufacturer’s specification standards. Install materials in accordance to manufacturer’s installation instructions. Shop assembly fabricated components to greatest extent practical to sizes and shapes indicated in accordance with approved shop drawings and manufacturer’s installation and technical bulletins. Finish components with clean smooth edges.

1. Sink Mounting Condition: Drop-in.
2. Edge Treatment: As indicated on drawings.

P. Mechanical and Electrical Penetrations: Coordinate locations and provide finished openings to accommodate mechanical and electrical penetrations. Finish openings shall consist of grommets, plastic laminate, or materials approved by Architect.

PART 3 - EXECUTION

3.01 **PREPARATION**

A. Obtain dimensions affecting work of this Section from the site.

3.02 **EXAMINATION**

A. Section 01 04 10 - Project Management and Coordination: Verification of existing conditions before starting work.

B. Verify adequacy of backing and support framing.

C. Verify location and sizes of utility rough-in associated with work of this Section.

3.03 **INSTALLATION**

A. Install casework and countertops to AWS/AWI “Premium” grade quality standards.

B. Set and secure casework and countertops in place: rigid, plumb, and level.

C. Use fixture attachments in concealed locations for wall-mounted components.

D. Use concealed joint fasteners to align and secure adjoining cabinet units and countertops.

E. Carefully scribe casework abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim for this purpose.

F. Secure cabinet and counter bases to floor using appropriate angles and anchorages.

G. Countersink anchorage devices at exposed locations. Conceal with solid wood plugs of species to match surrounding wood; finish flush with surrounding surfaces.

H. No continuous bases permitted, unless specifically shown otherwise.

I. Where several units are installed in-line, drill through end panels and secure by bolting using "T" nuts, bolts and finishing washers or hex bolts with finishing washers, or approved connection system. Countertops shall be continuous over units below.

J. Permanently fix cabinet and counter bases to floor using appropriate angles and anchorages, unless specifically shown on drawings or provided otherwise hereinabove.

K. Install and adjust cabinet hardware to ensure smooth and correct operation.

L. No splices in continuous countertops over knee spaces, or otherwise not directly over casework, permitted, unless splices occur directly over wall bracket. Joints, where approved, are to be tight, in perfect alignment, with invisible seams, and not allowing of excessive deflections.

M. Install Solid Surface Material (SSM) countertops and backsplash in accordance to manufacturer's installation instructions. Install structural substrate material and supports in accordance to manufacturer's specification guide and approved shop drawings.

N. Install Precast Architectural Concrete (PAC) countertops in accordance to manufacturer's installation instructions. Install structural substrate material and supports in accordance to manufacturer's specification guide and approved shop drawings.

3.04 ADJUSTING

A. Adjust moving or operating parts to function smoothly and correctly.

3.05 CLEANING

A. Clean casework, counters, shelves, hardware, fittings, and fixtures.

END OF SECTION

PAGE LEFT BLANK INTENTIONALLY

SECTION 12 49 40
ROLLER SHADES

PART 1 - GENERAL

1.01 REFERENCES

A. ASTM G 21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.

B. NFPA 701-99 - Fire Tests for Flame-Resistant Textiles and Films.

1.02 SUBMITTALS

A. Submit under provisions of Section 01 34 00-Submittal Procedures.

B. Product Data: Manufacturer's data sheets on each product to be used, including:

1. Preparation instructions and recommendations.

2. Styles, material descriptions, dimensions of individual components, profiles, features, finishes and operating instructions.

3. Storage and handling requirements and recommendations.

4. Mounting details and installation methods.

C. Shop Drawings: Plans, elevations, sections, product details, installation details, operational clearances, wiring diagrams and relationship to adjacent work.

D. Prepare shop drawings on Autocad or Microstation format using base sheets provided electronically by the Architect.

E. Window Treatment Schedule: For all roller shades. Use same room designations as indicated on the Drawings and include opening sizes and key to typical mounting details.

F. Selection Samples: For each finish product specified, one set of shade cloth options and aluminum finish color samples representing manufacturer's full range of available colors and patterns.

G. Verification Samples: For each finish product specified, one complete set of shade components, unassembled, demonstrating compliance with specified requirements. Shadecloth sample and aluminum finish sample as selected. Mark face of material to indicate interior faces.

H. Maintenance Data: Methods for maintaining roller shades, precautions regarding cleaning materials and methods, instructions for operating hardware and controls.

1.03 QUALITY ASSURANCE

A. Installer Qualifications: Installer trained and certified by the manufacturer with a minimum of ten years' experience in installing products comparable to those specified in this section.

B. Fire-Test-Response Characteristics: Passes NFPA 701-99 small and large-scale vertical burn. Materials tested shall be identical to products proposed for use.

C. Anti-Microbial Characteristics: 'No Growth' per ASTM G 21 results for fungi ATCC9642, ATCC 9644, ATCC9645.

D. Product Standard: Provide roller shades complying with WCMA A 100.1.

E. Mock-Up: Provide a mock-up (manual shades only) of one roller shade assembly for evaluation of mounting, appearance and accessories.

1. Locate mock-up in window designated by Architect.

2. Do not proceed with remaining work until, mock-up is accepted by Architect.

1.04 DELIVERY, STORAGE AND HANDLING

Deliver shades in factory-labeled packages, marked with manufacturer and product name, fire-test-response characteristics, and location of installation using same room designations indicated on Drawings and in the Window Treatment Schedule.

1.06 PROJECT CONDITIONS

A. Environmental Limitations: Install roller shades after finish work including painting is complete and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1.07 WARRANTY

A. Roller Shade Hardware, Chain and Shadecloth (except EcoVeil™): Manufacturer's standard non-depreciating twenty-five year limited warranty.

1. EcoVeil standard non-depreciating 10-year limited warranty.

B. Roller Shade Installation: One year from date of Substantial Completion, not including scaffolding, lifts or other means to reach inaccessible areas.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURER

A. MechoShade Systems, Inc.; 42-03 35th Street, Long Island City, NY 11101. ASD. Tel: (718) 729-2020. Fax: (718) 729-2941. Email: info@mechoshade.com, www.mechoshade.com.

B. Inpro Corporation; S80 W18766 Apollo Drive, Muskego, WI 53150. Tel: (800) 222-5556. Fax: (888) 715-8407. www.inprocorp.com. Solidarity Solar Shade products equivalent to those specified below are acceptable.

C. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00.

2.02 MATERIALS

A. Shade Cloth: Visually Transparent Single-Fabric, MechoShade Systems, Inc., ThermoVeil group, single thickness non-raveling 0.030-inch (0.762 mm) thick vinyl fabric, woven from 0.018-inch (0.457 mm) diameter extruded vinyl yarn comprising of 21 percent polyester and 79 percent reinforced vinyl, in colors selected from manufacturer's available range.

1. Color: Selected from manufacturer’s standard colors.

B. Shade Bands: Construction of shade band includes the fabric, the hem weight, hem-pocket, shade roller tube, and the attachment of the shade band to the roller tube. Sewn hems and open hem pockets are not acceptable.

1. Hem Pockets and Hem Weights: Fabric hem pocket with RF-welded seams (including welded ends) and concealed hem weights. Hem weights shall be of appropriate size and weight for shade band. Hem weight shall be continuous inside a sealed hem pocket. Hem pocket construction and hem weights shall be similar, for all shades within one room.
2. Shade band and Shade Roller Attachment:

a. Use extruded aluminum shade roller tube of a diameter and wall thickness required to support shade fabric without excessive deflection. Roller tubes less than 1.55 inch (39.37 mm) in diameter for manual shades, and less than 2.55 inches (64.77 mm) for motorize shades are not acceptable.

b. Provide for positive mechanical engagement with drive / brake mechanism.

c. Provide for positive mechanical attachment of shade band to roller tube; shade band shall be made removable / replaceable with a "snap-on" snap-off" spline mounting, without having to remove shade roller from shade brackets.

d. Mounting spline shall not require use of adhesives, adhesive tapes, staples, and/or rivets.

e. Any method of attaching shade band to roller tube that requires the use of: adhesive, adhesive tapes, staples, and/or rivets are not acceptable.

C. Shade Fabrication: Fabricate units to completely fill existing openings from head to sill and jamb-to-jamb, unless specifically indicated otherwise.

1. Fabricate shadecloth to hang flat without buckling or distortion. Fabricate with heat-sealed trimmed edges to hang straight without curling or raveling. Fabricate unguided shadecloth to roll true and straight without shifting sideways more than 1/8 inch (3.18 mm) in either direction per 8 feet (2438 mm) of shade height due to warp distortion or weave design. Fabricate hem as follows: Bottom hem weights.

2. Provide battens in standard shades as required to assure proper tracking and uniform rolling of the shadebands. Contractor shall be responsible for assuring the width-to-height (W:H) ratios shall not exceed manufacturer's standards or, in absence of such standards, shall be responsible for establishing appropriate standards to assure proper tracking and rolling of the shadecloth within specified standards. Battens shall be roll-formed stainless steel or tempered steel, as required.

2.03 COMPONENTS

A. Access and Material Requirements:

1. Provide shade hardware allowing for the removal of shade roller tube from brackets without removing hardware from opening and without requiring end or center supports to be removed.

2. Provide shade hardware that allows for removal and re-mounting of the shade bands without having to remove the shade tube, drive or operating support brackets.

3. Use only Delrin engineered plastics by DuPont for all plastic components of shade hardware. Styrene based plastics, and /or polyester, or reinforced polyester will not be acceptable.

B. Manual Operated Chain Drive Hardware and Brackets:

1. Provide for universal, regular and offset drive capacity, allowing drive chain to fall at front, rear or non-offset for all shade drive end brackets. Universal offset shall be adjustable for future change.

2. Provide positive mechanical engagement of drive mechanism to shade roller tube. Friction fit connectors for drive mechanism connection to shade roller tube are not acceptable

3. Provide shade hardware constructed of minimum 1/8-inch (3.18 mm) thick plated steel or heavier as required to support 150 percent of the full weight of each shade.

4. Drive Bracket / Brake Assembly:

a. MechoShade Drive Bracket model M5 shall be fully integrated with all MechoShade accessories, including, but not limited to: SnapLoc fascia, room darkening side / sill channels, center supports and connectors for multi-banded shades.

b. M5 drive sprocket and brake assembly shall rotate and be supported on a welded 3/8 inch (9.525 mm) steel pin.

c. The brake shall be an over -unning clutch design which disengages to 90 percent during the raising and lowering of a shade. The brake shall withstand a pull force of 50 lbs. (22 kg) in the stopped position.

d. The braking mechanism shall be applied to an oil-impregnated hub on to which the brake system is mounted. The oil impregnated hub design includes an articulated brake assembly, which assures a smooth, non-jerky operation in raising and lowering the shades. The assembly shall be permanently lubricated. Products that require externally applied lubrication and or not permanently lubricated are not acceptable.

e. The entire M5 assembly shall be fully mounted on the steel support bracket, and fully independent of the shade tube assembly, which may be removed and reinstalled without effecting the roller shade limit adjustments.

C. Drive Chain: #10 qualified stainless steel chain rated to 90 lb. (41 kg) minimum breaking strength. Nickel plate chain shall not be accepted.

PART 3 – EXECUTION

3.01 **EXAMINATION**

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearance, and other conditions affecting performance.

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

3.02 ROLLER SHADE INSTALLATION

A. Install roller shades level, plumb, and aligned with adjacent units according to manufacturer's written instructions, and located so shade band is not closer than 2 inches (50 mm) to interior face of glass. Allow clearances for window operation hardware.

3.02 ADJUSTING

A. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

3.03 CLEANING AND PROTECTION

A. Clean roller shade surfaces after installation, according to manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that roller shades are without damage or deterioration at time of Substantial Completion.

C. Replace damaged roller shades that cannot be repaired, in a manner approved by Architect, before time of Substantial Completion.

3.04 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain roller shades. Refer to Division 1 Section Demonstration and Training."

END OF SECTION

PAGE LEFT BLANK INTENTIONALLY

SECTION 31 23 33
TRENCHING AND BACKFILLIING

PART 1 - GENERAL

1.01 REFERENCES

A. ANSI/ASTM C136 – Method for Sieve Analysis of Fine and Coarse Aggregates.

B. ANSI/ASTM D1556 – Test Method for Density of Soil in Place by Sand-Cone Method.

C. ANSI/ASTM D1557 – Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixture Using 10 lb (4.54 kg) Rammer and 18-inch (457 mm) Drop.

1.02 SUBMITTALS

A. Submit under provisions of Section 01 34 00 – Submittals.

PART 2 - PRODUCTS

2.01 FILL MATERIAL

A. Types A, B, C, D, E, and F materials as specified in Section 31 23 23 – Fill.

2.02 BEDDING MATERIALS

A. As specified for Type B (Pea Gravel) in Section 31 23 23 – Fill.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify fill materials to be reused is acceptable.

3.02 PREPARATION

A. Identify required lines, levels, contours, and datum.

B. Maintain and protect existing utilities remaining, which pass through work area.

C. Protect plant life, lawns, and other features remaining as a portion of final landscaping.

D. Protect bench marks, existing structures, fences, walks, paving, and curbs from excavation equipment and vehicular traffic.

E. Protect above and below grade utilities that are to remain.

F. Cut out soft areas of subgrade not capable of in situ compaction. Backfill with Type D fill and compact for density equal to or greater than requirements for subsequent backfill material.

3.03 EXCAVATION

A. Excavate subsoil requirements to connection shown on drawings.

B. Cut trenches sufficiently wide to enable installation of utilities and allow inspection.

C. Excavation shall not interfere with normal splay of foundations.

D. Hand trim excavation. Remove loose matter.

E. Remove lumped subsoil, boulders, and rock up to 1/3 cu. yd., measure by volume.

F. Correct unauthorized excavation at no cost to Owner.

G. Correct areas over-excavated by error at no cost to Owner.

H. Remove surplus and unsatisfactory excavated material from site.

3.04 BEDDING

A. Conform to Paragraph 2.01 and WSDOT/APWA Standard Plan B-11, as applicable to the pipe or conduit material being installed.

B. Support pipe during placement and compaction of bedding fill.

3.05 BACKFILLING

A. Backfill trenches to contours and elevations with unfrozen materials.

B. Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen, or spongy subgrade surfaces.

C. Granular Fill: Place and compact materials in continuous layers not exceeding 6 in. compacted depth.

D. Soil Fill: Place and compact material in continuous layers not exceeding 8 inches compacted depth.

E. Minimum Compaction: Under slabs, structures, and paving shall be 95 percent of maximum dry density, per ASTM D1557.

F. Employ a placement method that does not disturb or damage foundation perimeter drainage in trench and advance structures.

G. Maintain optimum moisture content of backfill materials to attain required compaction density. Note higher compaction requirements indicated from backfilling under pavement areas.

H. Remove surplus backfill materials from site.

3.06 TOLERANCES

A. Top Surface of Backfilling: Plus or minus 1 in. from required elevations.

3.07 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed per ANSI/ASTM.

B. Tests and analysis of fill material will be performed in accordance with ASTM D1557.

C. Compaction testing will be performed in accordance with ASTM D1556.

D. If tests indicate work does not meet specified requirements, remove work, place and retest at no cost to Owner.

END OF SECTION

PAGE LEFT BLANK INTENTIONALLY

SECTION 32 12 16
ASPHALT PAVING

PART - GENERAL

1.01 PERMITS

A. All permits and fees are to be obtained or scheduled by the Contractor at his expense.

1.02 REFERENCES

A. WSDOT-APWA - Standard Specifications for Road, Bridge, and Municipal Construction (not including measurement and payment provisions) (Latest Edition).

B. ASTM D1557 - Methods of Test for Moisture-Density Relations of Soils, Using 10 lb (4.5 kg) Rammer and 18 In. (457 mm) Drop

1.03 SYSTEM DESCRIPTION

A. Where asphalt pavement is indicated, the work shall consist of one or more courses of plant mixed asphalt concrete placed on a prepared foundation or base in accordance with these specifications and in reasonably close conformity with the lines, grades, thicknesses, and typical cross-sections shown in the plans.

B. Asphalt pavement shall be composed of asphalt and aggregate which, with or without the addition of mineral filler and blending sand as may be required, shall be mixed in the proportions specified to provide a homogenous, stable and workable mixture.

1.04 REGULATORY REQUIREMENTS

A. Conform to applicable code for paving work on public property.

1.05 ENVIRONMENTAL REQUIREMENTS

A. Do not place asphalt when ambient air or base surface temperature is less than 40 degrees F, or surface is wet or frozen.

1.06 SUBMITTALS

A. Submit under provisions of Section 01 34 00 mix design that has been approved for use by the Washington State Department of Transportation within 90 days from the date of this contract.

B. Submit Certificates under provisions of Section 01 34 00. Furnish certification that all materials comply with specification requirements; include laboratory test reports verifying compliance. Mixing plant to be member of Asphalt Paving Association of Washington.

1.07 QUALITY ASSURANCE

A. Design, Hot Mix Asphalt that has been approved for use by the Washington State Department of Transportation within 90 days from the date of this Contract. Contractor shall not begin paving until the design mix has been reviewed and approved.

B. All work shall be done in accordance with the WSDOT-APWA Standard Specifications for Road,

Bridge and Municipal Construction, including APWA supplements, except as modified herein or on the drawings.

1.08 **HAULING EQUIPMENT**

A. In accordance with Section 5-04.3(3)B of WSDOT-APWA.

1.09 **ALTERNATES**

A. See Section 01 23 00 for bidding alternates affecting work of this Section.
B.

PART 2 - PRODUCTS

2.01 **GENERAL**

A. Comply with "Quality Assurance" provisions, "References", Specifications and Manufacturer's data. Where these may be in conflict, the more stringent requirements govern.

2.02 **BASE COURSE**

A. Provide a base course of aggregate conforming to Section 9-03.10 of WSDOT-APWA.

2.03 **LIQUID ASPHALT**

A. Liquid asphalt for tack coats and treatment of aggregate base shall be grade MC 250 and shall comply with Section 9-02 of WSDOT-APWA.

2.04 **ASPHALT PAVEMENT**

A. Hot mix asphalt shall comply with Section 5-04 of WSDOT-APWA. Aggregate shall conform to Section 9-03.8 of the WSDOT-APWA. Asphalt binder shall be paving asphalt, Grade AR-4000, and shall comply with Section 9-02.1 of WSDOT-APWA. Asphalt concrete mixing and proportioning shall comply with Section 9-03.8 of the WSDOT-APWA.

2.05 **SEAL COAT**

A. Aggregate and asphalt emulsion pavement sealer shall comply with Section 5-02 of WSDOT-APWA.

2.06 **SOIL STERILANT**

A. A soil sterilant is ***[not]*** to be used on this site.

2.07 **PAVEMENT STRIPING AND MARKING**

A. Parking Lot Marking Paint: Alkyd-resin type, ready-mixed complying with AASHTO M 248, Type I.

1. Colors: White and Yellow

PART 3 - EXECUTION

3.01 **EXAMINATION**

A. Verify installation conditions as satisfactory to receive work of this Section. Do not install until

unsatisfactory conditions are corrected. Beginning work constitutes your acceptance of conditions as satisfactory.

1. Construction shall conform to the details, dimensions and grades specified. Maximum variations in finished grade of paving shall be +/- 0.05 ft.

2. All areas to be paved shall be graded and compacted in accordance with Section 31 20 00.

3.02 PREPARATION

A. Protect surrounding areas and surfaces to preclude damage from work of this Section.

1. Protect existing trees to remain.

2. Protect work of other trades. Take special care in work adjacent to buildings.

3. Should any defacement or damage occur, repair or replace as directed.

B. Preparation of Asphalt Patches:

1. Where existing asphalt pavement upon a granular base is required to be removed due to deterioration and/or settlement, the area shall be uniformly defined in size and shape. The existing asphalt shall be removed by cutting pavement vertically at a sufficient distance of at least 6" over the undisturbed base surface, and then the affected pavement shall be broken up and removed.

2. The granular base under the removed pavement shall be restored so as to correct the condition that caused the deterioration and/or settlement, and this shall be shown on the plans or designated in special provisions.

3.03 BASE COURSE

A. Placing of aggregate base and top course shall comply with Section 4-04 of the WSDOT-APWA. Relative dry compaction shall be a minimum of 95 percent of maximum dry density as determined in accordance with ASTM D1557.

B. Prior to asphalt concrete placement on existing paved surfaces, the prepared surface shall be treated in accordance with Section 5-04.3(4) of WSDOT-APWA.

3.04 ASPHALT PAVEMENT

A. Placement of asphalt shall be in accordance with Section 5-04 of WSDOT-APWA. Surfaces shall be prepared in accordance with Section 5-04.3(5). Spreading, finishing and compaction shall be in accordance with Sections 5-04.3(7) and 5-04.3(10).

1. All patching of existing asphalt paved surfaces shall be to match the existing paving thickness (depth), unless otherwise indicated on the plans.

B. Joints shall be constructed in accordance with Section 5-04.3(12). Surface smoothness shall be in accordance with Section 5-04.3(13). Paving shall be accomplished in accordance with the weather limitations outlined in Section 5-04.3(1).

C. Sampling and testing of asphalt concrete shall be in accordance with Sections 5-04.3(9).

3.05 PAVEMENT STRIPING AND MARKING

A. Cleaning: Sweep and clean surfaces to eliminate loose material and dust.

B. Do not apply traffic and lane marking paint until layout and placement have been verified with Architect.

C. Apply paint with mechanical equipment to produce uniform straight edges. Apply at manufacturer's recommended rates to provide minimum 12 to 15 mils dry thickness.

3.06 ASPHALT EMULSION SLURRY SEAL

A. Apply seal coat to asphalt paving surface in accordance with Section 5-02.3.

3.07 CLEANING

A. After completion of paving operations, clean surfaces of excess or spilled asphaltic materials.

B. Do not permit vehicular traffic on asphaltic paving until it has cooled and hardened, and in no case sooner than six (6) hours after placing.

C. Provide barricades and warning devices as required for vehicular and pedestrian safety and protection of work and crew.

END OF SECTION

SECTION 32 13 13
EXTERIOR CONCRETE PAVING

PART 1 - GENERAL

1.01 REFERENCES

A. ACI 304 - Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete.

B. ASTM A185 - Welded Steel Wire Fabric for Concrete Reinforcement.

C. ASTM A497 - Welded Deformed Steel Wire Fabric for Concrete Reinforcement.

D. ASTM A615 - Deformed and Plain Billet-Steel for Concrete Reinforcement.

E. ASTM C33 - Concrete Aggregates.

F. ASTM C94 - Ready Mix Concrete.

G. ASTM C150 - Portland Cement

H. ASTM C260 - Air-Entraining Admixtures for Concrete.

I. ASTM C309 - Liquid Membrane-Forming Compounds for Curing Concrete.

J. ASTM D1751 - Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction.

K. WSDOT-APWA - Standard Specifications for Road, Bridge and Municipal Construction (Latest Version).

1.02 QUALITY ASSURANCE

A. Perform work in accordance with ACI 301.

B. Obtain cementitious materials from same source throughout.

1.03 ENVIRONMENTAL REQUIREMENTS

A. Do not place concrete when base surface temperature is less than 40 degrees F, or surface is wet or frozen.

1.04 ALTERNATES

A. See Section 01 23 00 for bidding alternates affecting the work of this Section.

1.05 COLORS

A. Colors are specified on Colors and Materials Schedule on drawings.

PART 2 - PRODUCTS

2.01 FORM MATERIALS

A. Formwork: Matched, tight fitting and adequately stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of concrete.

B. Joint Filler and Sealant: Shall be in accordance with WSDOT Section 9-04.1 and 9-04.2.

2.02 REINFORCEMENT

A. Reinforcing Steel: Refer to Structural General Notes on Structural Drawings.

B. Welded Steel Wire Fabric: Refer to Structural General Notes on Structural Drawings.

C. Tie Wire: Annealed steel, minimum 16 gauge size.

2.03 CRUSHED GRAVEL BASE COURSE

A. Provide a crushed rock base course of 1-1/4 inch maximum crushed aggregate described as follows:

1. Gravel base shall consist of granular material, either naturally occurring or processed. It shall be essentially free from various types of wood waste or other extraneous or objectionable materials. It shall have such characteristics of size and shape that it will compact readily and shall meet the following test requirements:

Stabilometer "R" Value	72 min.
Swell pressure	0.3 psi max.

2. The maximum particle size shall not exceed 2/3 of the depth of the layer being placed.

3. Gravel base shall meet the following requirements for grading and quality.

Sieve Size		Percent Passing
square		25 min.
No. 200		10.0 max.
Dust Ratio:	% Passing U.S. No. 200 / % Passing U.S. No. 40	2/3 max.
Sand Equivalent		30 min.

All percentages are by weight.

4. Gravel base material retained on a 1/4-inch square sieve shall contain not more than 0.20 percent by weight of wood waste.

2.04 CONCRETE MATERIALS

A. Concrete Pavement and Curbs: Refer to structural notes for concrete.

2.05 ACCESSORIES

A. Curing Compound: ASTM C309, Type 1.

B. Clear Sealer: L&M Construction Chemicals, LATICRETE International Inc.: “Aquapel Plus”.

C. Surface Retarder.

D. Joint Filler: ASTM D994; asphalt impregnated fiberboard or felt, 1/4 inch thick; full depth of concrete slab.

2.06 **ADMIXTURES**

A. Use accelerating admixtures in cold weather only when acceptable to Architect. Use of admixtures shall not relax cold weather placement requirements. Do not use calcium chloride.

B. Use set-retarding admixtures during hot weather only when acceptable to Architect.

C. Air entrainment, ASTM C260 at all exterior concrete.

2.07 **CONCRETE MIX**

A. Mix concrete in accordance with ASTM C94. Refer to Civil Notes.

2.08 **TACTILE WARNING SURFACE**

A. Engineered Plastics, Inc. (800) 682-2525. Armor-Tile detectable tactile warning tile. Truncated dome pattern and slip resistance shall meet the requirements of the Americans with Disabilities Act and applicable codes. Tiles shall have embedment flanges and shall be set in place during concrete installation. Provide size indicated. Color: Safety yellow.

PART 3 - EXECUTION

3.01 **EXAMINATION**

A. Verify compacted granular base is acceptable and ready to support paving and imposed loads.

B. Verify gradients and elevations of base are correct.

C. Beginning of installation means acceptance of existing conditions.

3.02 **PREPARATION**

A. Moisten base to minimize absorption of water from fresh concrete.

B. Notify Architect/Engineer minimum twenty-four (24) hours prior to commencement of concreting operations.

3.03 **FORMING**

A. Place and secure forms to correct location, dimension, profile, and gradient.

B. Assemble formwork to permit easy stripping and dismantling without damaging concrete.

C. Place joint filler vertical in position, in straight lines. Secure to formwork during concrete placement.

3.04 **REINFORCEMENT**

A. Place reinforcement at mid-height of slabs-on-grade.

B. Interrupt reinforcement at control joints.

C. Place reinforcement to achieve pavement and curb alignment as detailed.

D. Provide doweled joints at interruptions of concrete with one end of dowel set in capped sleeve to allow longitudinal movement.

3.05 PLACING CONCRETE

A. Place concrete in accordance with ACI 304.

B. Ensure reinforcement, inserts, embedded parts, and formed joints are not disturbed during concrete placement.

C. Place concrete continuously between predetermined construction joints. Do not break or interrupt successive pours such that cold joints occur.

3.06 JOINTS

A. Place control joints at maximum 20-ft intervals. Align curb, gutter, and sidewalk joints.

B. Place joint filler between paving components and building or other appurtenances.

C. Extend joint fillers full width and depth of joint (less sealant thickness), not less than 1/2 inch or more than 1 inch below finished surface where joint sealer is indicated.

D. Furnish joint fillers in one-piece lengths for full width being placed wherever possible. Where more than one length is required, lace or clip joint filler sections together.

E. Protect top edge of joint filler during concrete placement with a metal cap or other temporary materials. Remove protection after concrete has been placed on both sides of joint.

F. Tool dummy joints at maximum 5-ft intervals.

3.07 EXPOSED AGGREGATE

A. Wash exposed aggregate surface with acid etch solution exposing aggregate to match sample panel.

3.08 FINISHING

A. Exterior Concrete Paving: Light broom.

B. Place sealer on exterior concrete paving surfaces immediately after finishing. Apply in accordance with manufacturer's instructions.

3.09 TACTILE WARNING TILES

A. Place and finish concrete to required levels prior to installation of tile. Install tactile warning tiles directly in freshly placed concrete by tamping or vibrating into place in accordance with manufacturer’s detailed installation instructions. Tile shall not be placed by stepping on the tile to embed. Field level of the tile shall be flush with adjacent concrete surface. Finish adjacent concrete edges around the tile with a 3/8 inch radius edging tool. Place weights on the tile as recommended by the manufacturer to prevent floating or loss of contact between tile and concrete during concrete curing. Remove protective plastic after concrete has

substantially cured.

3.10 PROTECTION

A. Immediately after placement, protect pavement from premature drying, excessive hot or cold temperatures, and mechanical injury. Do not allow traffic or external forces in contact with tactile warning tiles during concrete curing stage, to avoid dislodging tiles or creating voids beneath the tiles.

END OF SECTION

PAGE LEFT BLANK INTENTIONALLY

SECTION 32 84 23
UNDERGROUND SPRINKLERS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contracts, including General and Supplementary Conditions and Division 1 Specification sections apply to work specified in this Section.

1.02 DESCRIPTION OF WORK

A. The sprinkler system shall be constructed using the sprinklers, valves, piping, fittings, controller, wiring, etc., of sizes and types as shown on the drawings and as called for in these specifications. The systems shall be constructed to grades and conformed to areas and locations as shown on the drawings.

1.03 EXAMINATION OF SITE AND DOCUMENTS

A. Before submitting a proposal, the bidder shall:

1. Visit the site of work.

2. Carefully examine and acquaint himself with all portions of the drawings and specifications.

3. Fully inform himself of existing conditions and limitations.

4. Include in his bid sums sufficient to cover all items required by the contract and the conditions of the site and shall rely entirely upon his own examination in making the proposal.

1.04 INTERPRETATIONS

A. Should bidder find discrepancies in, or omissions from, the drawings or specifications, or be in doubt as to their meaning, he should at once notify the Landscape Architect, who will send written instructions or addenda to all bidders. Neither Owner or Landscape Architect will be responsible for oral interpretations. All addenda issued during the time of bidding shall become part of the Contract Document.

1.05 LABOR AND MATERIALS

A. The Contractor shall provide and pay for all labor and materials and all equipment and transportation required by such labor and materials for the complete and efficient construction and finishing of the project work as shown on the drawings herein specified.

1.06 NUMBER OF ITEMS

A. Whenever an item is referred to in a singular number or where the number of items required is listed, the Contractor shall supply all the items necessary to make the installation complete. The number of items, when given by the Landscape Architect, is for assistance only.

1.07 PERMITS AND INSPECTIONS

A. Any permits that are required for the installation shall be obtained and paid for by the Contractor. Open trench inspections will be required of the mainline and all zones installed. The Contractor shall notify the Landscape Architect two (2) weeks in advance of the date when such inspection is required. Any necessary re-excavation or alterations to the system needed because of failure or lack of inspection shall be performed at the Contractor's own expense.

1.08 ORDINANCES AND REGULATIONS

A. All local, municipal, and state laws governing or relating to any portion of this work are hereby incorporated into and made a part of these specifications and shall be carried out by the Contractor.

1.09 PROTECTION OF OWNER'S PROPERTY

A. The Contractor shall maintain adequate protection of all of his work from damage and shall protect the Owner's and adjacent property from injury or loss arising from this Contract.

1.10 PROTECTION OF EXISTING UTILITIES

A. The exact locations of all existing utilities not indicated on the drawings shall be determined by the Contractor, and he shall conduct his work so as to prevent interruption of service or damage to them. It is the Contractor's responsibility to coordinate with the underground utility companies.

1.11 PROTECTION OF EXISTING TREES

A. Contractor shall take due care to protect existing trees from limb or root damage.

1.12 GUARANTEE

A. It shall be the Contractor's responsibility to insure and guarantee complete coverage of the areas shown on the drawings to be irrigated. He shall also warranty the satisfactory operation of the entire system in every detail for a period of three (3) years from the date of its acceptance. All materials, installation, equipment, and operation shall be guaranteed for a period of one (1) year from final acceptance. All repairs, replacement, alterations, relocations, and adjustments shall be made at the installing Contractor's expense during guarantee period.

1.13 SYSTEM PROTECTION

A. As part of the warranty under this contract, the Contractor shall be responsible for deactivating and draining of the system prior to the onset of the freezing season, and for reactivating the system at the onset of the spring growing season. Each event must be accomplished once during the three (3) year warranty.

B. In the event the system is completed in a season when the system will not be in use, the Contractor shall winterize the system upon completion of testing, and reactivate the system in the spring. The Contractor certifying that the system is protected from freezing. The Contractor will be liable for any damage resulting from failure to comply.

1.14 SUBSTITUTIONS

A. No substitutions will be permitted that have not been submitted for prior approval to the Landscape Architect. Sufficient descriptive literature must be furnished for any materials submitted as equal substitutes. If standardization of products is required by the Owner, no substitutions will be permitted. Owner has right of refusal for proposed substitutes.

1.15 CERTIFICATION

A. Provide a letter signed by an officer or the construction superintendent of the General Contractor's company certifying that the products specified herein and shown on the drawings to be incorporated into the work meets the requirements specified.

1.16 SUBMITTALS

A. Provide submittals per Division 1 of the specifications.

B. Furnish supplier's compliance statement and/or manufacturer's data sheets and other associated information for each product listed. Conform to the following:

1. General Contractor shall submit all items required within this Section under one (1) submittal.

2. The Contractor to furnish manufacturer's literature sheets of all equipment that will be used within the irrigation system.

3. Exact model numbers and sizes shall be indicated on catalog sheets.

4. Contractor's signature and statement that products proposed to be incorporated into the work meet the project requirements.

5. Submittals not complying with these provisions shall not be reviewed by the Landscape Architect and will be returned to the Contractor for compliance.

1.17 QUALIFICATIONS

A. The Contractor must have minimum five (5) years documented experience in sprinkler installation approved by manufacturer. All electric work must conform to current state laws.

1.18 DISTRIBUTION OF WATER

A. Distribution of water in planting areas shall be in a manner as shown on the drawings and care shall be taken to provide minimum or no water distribution on buildings, walks, and dry areas so designated. The Contractor is responsible to provide adequate precipitation in all planting areas.

1.19 SERVICE MANUALS

A. Furnish two (2) service manuals to the Landscape Architect for use by the Owner. Manuals to be bound and shall contain catalog and parts breakdown sheets of all equipment numbers used. Manufacturer's name and address shall be included along with operation and

maintenance instructions. These service manuals shall be delivered at the time of final inspection.

1.20 RECORD DRAWINGS

A. Contractor shall procure mylar copy of the irrigation system and mark on them the exact as-built arrangement of all piping, sprinkler heads, remote control valves, controller location, and low voltage wire record drawings, with installer's name, address, phone number, and date installed. The drawing shall contain a legend listing all equipment and components installed including symbol for each item, manufacturer, model numbers and description of equipment/components. After final inspection and prior to final payment, the mylar shall be delivered to the Landscape Architect who will forward it to the Owner. Any changes made shall have the written approval of the Landscape Architect prior to being changed.

1.21 ALTERNATES

A. See Section 01 23 00 for bidding alternates affecting the work of this Section.

1.22 COLORS

A. Colors are specified on Colors and Materials Schedule on drawings.

PART 2 - PRODUCTS

2.01 MATERIALS

A. All materials to be incorporated in this system shall be new and without flaws or defects and of quality and performance as specified herewith. All material overages at the completion of the installation are the property of the Contractor and are to be removed from the site.

2.02 PIPE AND FITTINGS - GENERAL

A. All pipe shall be new, of standard weight for its class, and of virgin components. All pipes shall be continuously and permanently marked with the manufacturer's name or trademark, size, schedule, and type of pipe, working pressure at 73° F and National Sanitation Foundation (NSF) approved.

B. Galvanized steel pipe and fittings shall not be used within the project unless approved by the Irrigation Engineer.

2.03 PVC PIPE

A. All plastic pipe shall be suitable for solvent weld. Pipe shall be homogeneous throughout and free from visible cracks, holes, foreign materials, blisters, deleterious wrinkles and dents. Pipe shall be handled with care as specified by manufacturer, from truck unloading through to backfill completion. All pipe shall conform to, or exceed, Commercial Standard CS 256-63 of the U.S. Department of Commerce. All pipe shall be as specified on the drawings.

1. Fittings shall be specifically made for the type of pipe used. All plastic fittings shall be Schedule 40 Polyvinyl Chloride (PVC) and shall meet selected pipe tolerances.

2. Plastic pipe and fittings shall be joined with the solvent in the detail manner

manufacturer specifies, including cleaning and uniformity of coating. Pipe shall be installed in a manner to provide for expansion and contraction as recommended by manufacturer. When connection is plastic to metal, male adapters shall be used. Male adapters shall be hand tightened plus one (1) turn with strap wrench. Joint compound shall be Permatix Type II or equivalent.

3. Polyvinyl Chloride primer shall be applied to all fittings' connections prior to solvent welding pipe and fittings.

2.04 IRRIGATION SUPPLY MAIN

A. PVC pipe shall meet ASTM D 2241 specifications for PVC 1220 Sch-40 PVC Schedule 40 fittings shall be used. Join pipe by solvent welding process.

2.05 LATERAL LINES

A. PVC pipe shall meet ASTM Specifications D 2241 for PVC 1220 CL 200.

2.06 SWING JOINT RISERS

A. SCH-80 PVC nipples with Schedule 40 threaded fittings shall be used and joined by using Teflon tape on threads or Liquid Teflon #100.

2.07 POP-UP SPRAY SPRINKLER HEADS

A. Pop-up spray sprinkler heads to be as specified on the drawings. The sprinkler body, stem, nozzle, and screen shall be constructed of heavy-duty, ultra-violet resistant plastic. It shall have a heavy-duty stainless steel retract spring for positive pop-down and a ratcheting system for easy alignment of the pattern. The sprinkler shall have an internal positive seal feature. Sprinkler shall also include a check valve to prevent low head drainage of up to ten feet of head. The sprinkler shall have a matched precipitation rate plastic nozzle with an adjusting screw capable of regulating the radius and flow. The sprinkler shall be as manufactured by Toro Corporation, Riverside, California.

2.08 ELECTRIC REMOTE CONTROL VALVES

A. Electric remote control valves to be as specified on drawings. The complete valve shall be guaranteed for a period of one (1) year against defective parts and workmanship. The electric remote control valve shall be a normally closed 24 VAC 50/60 cycle solenoid actuated globe pattern with a balanced pressure diaphragm design. The valve pressure rating shall not be less than 200 psi. The valve body and bonnet shall be constructed of brass and have stainless steel studs and flange nuts; diaphragm shall be of nylon reinforced rubber. The valve shall have manual open/close control and external bleed for manual opening and closing of valve without electrically energizing the solenoid. The valve's internal bleed shall prevent flooding of the valve box. The valve shall house a fully-encapsulated, one-piece solenoid with capture plunger. This 24 VAC 50/60 Hz solenoid shall open with a 19.6 volt minimum at 200 psi. At 24 VAC average in rush current shall not exceed .23 amps. The valve shall have a brass flow control system for accurate manual regulation and/or shut off of outlet flow. The valve must open or close in less than one (1) minute at 200 psi, and less than thirty (30) seconds at 20 psi. The valve construction shall be such as to provide for all internal parts to be removable from the top of the valve without disturbing the valve installation. The valve shall be as manufactured by Superior Controls Co., Inc., Valencia, California, or approved equal.

2.09 VALVE BOXES

A. All valve boxes shall be of heavy-duty thermoplastic construction with locking cover. Valve boxes shall be Ametek.

2.10 DOUBLE CHECK VAULTS

A. Double check box or vault to be the manufacture and model number as called for on drawings.

2.11 MANUAL DRAIN VALVES

A. Manual drain valves shall be heavy-duty grass construction. Install at all low points on mainline. All valves to be installed inside valve box or marked with a 2-in. C1-160 PVC tube and rubber valve marker. Provide gravel sump for proper drainage.

2.12 QUICK COUPLER SWING JOINTS

A. Swing joints for Quick Couplers shall be as shown on details. Quick coupler swing joints to be made of Sch-80 PVC fittings and nipples. All joints shall be assembled using Teflon tape.

2.13 QUICK COUPLING VALVES

A. Quick coupling valves shall be heavy-duty, two-piece brass construction with locking vinyl covers. Quick coupling valves shall be Rain Bird Model NP 44, or approved equal.

2.14 CONTROL CABLE

A. All electronic underground control cables shall be wire to be placed in the trench to one side of the pipe. Where it is necessary to run wire in a separate trench, the wire shall have a minimum cover of 18-in. All wire connectors at remote control valve or splice connections to be left with sufficient slack so that, in case of repair, the splice may be brought to the surface without disconnecting the wires. No splices permitted between controller and valve on hot wire. All splices to be made with a 3M DBY splice connector.

2.15 SWING JOINTS

A. Provide swing joints for all irrigation heads using triple Marlex SCH-40 90° ells thread by thread. The outlet tee or ell to be threaded and installed on its side, as per detail. For large rotary sprinkler heads and quick coupling valves, do not use Marlex Street 90° ells.

2.16 BACKFLOW PREVENTER/DOUBLE CHECK ASSEMBLY

A. Double check valve shall be Febco 805Y-BV. Double check valve assembly shall be approved by the local sanitarian or Health Development.

2.17 AUTOMATIC CONTROLLER

A. Controller shall be Superior ST Series with all features identified in the manufacturer's specifications.

2.18 MISCELLANEOUS EQUIPMENT AND COMPONENTS

A. Miscellaneous equipment and components not specifically indicated herein or shown on the drawings, but normally included in the work performed, shall be furnished and installed by the Contractor.

PART 3 - EXECUTION

3.01 EXCAVATION

A. Excavations shall be open vertical construction sufficiently wide to provide free working space around the work installed and to provide ample space for backfilling and tamping. Trenches for pipe shall be cut to required grade lines compacted to provide accurate grade and grade lines, and compacted to provide uniform bearing for the full length of the line. When two (2) pipes are to be placed in the same trench, it is required to maintain a four-inch space between pipes as a minimum.

B. Pipes under paved areas shall be bedded in six-inches of clean sand all around pipe(s). The Contractor shall be responsible to coordinate with the General Contractor the locations of the sprinkler heads and sleeving in all paved areas. The Contractor will have to work with other contractors to clearly locate and stake those areas where the asphalt will be cut and removed.

3.02 THRUST BLOCKING

A. Contractor shall provide concrete thrust blocking of mainline as required, or under the following conditions:

1. Mainline diameter exceeds 2-in.

2. Working water pressure exceeds 50 psi.

B. Blocks shall be placed at each location main changes direction, as at ells, tees, and where the main terminates. Main line pressure test shall be not made for a period of 48 hours following the completed pouring. Concrete thrust blocks for the supply mains shall be sized and placed in strict accordance with the pipe manufacturer's specifications, and shall be of adequate size, shape, and so placed as to handle all thrust pressures and pipe movement created by the maximum internal water pressures. Minimum size for the thrust block shall be 12 in. x 12 in. plus the amount of concrete required to fill the excavation pit fully without gaps.

3.03 PLASTIC PIPE LINES

A. PVC pipe, indicated herein, shall be installed for all pressure supply lines including quick coupling valves. Plastic pipe shall be installed in a manner so as to provide for expansion and contraction as recommended by the manufacturer. Plastic pipes shall be cut with a hand saw or hacksaw in a manner so as to insure square ends. Burrs at cut ends shall be removed prior to installation so that a smooth, unobstructed flow will be obtained.

3.04 SOLVED WELD JOINTS

A. Contractor shall use only the solvent supplied and recommended by the manufacturer to make plastic pipe joints. All connections shall be made per manufacturer's recommendations for solvent-welding pipe. All solvent weld joints shall be first primed with P-70 (purple) PVC primer or approved equal. The pipe fittings shall be thoroughly cleaned of dirt, dust, and

moisture before applying solvent.

3.05 PIPE CONNECTIONS

A. The Contractor is cautioned to exercise in handling, loading, unloading, and storing plastic pipe fittings. All plastic pipe and fittings will be stored under cover before using, and will be transported in a vehicle with a bed long enough to allow the length of pipe to lay flat so as not to be subject to undue bending or concentrated external load at any point. Any section of pipe that has been dented or damaged will be discarded until said section of pipe is cut out and rejoined with a coupling. All foreign matter or dirt shall be removed from the inside of the pipe before it is lowered into position in the trench, and it shall be kept clean by approved means during and after laying of pipe.

3.06 MAIN LINE PIPING

A. Main line piping shall be installed to a depth of 18-in. and shall have all rocks and debris removed from trenches. No rocks larger than 1/2-in. in diameter will be permitted in the trenches. Sand bedding material shall be used for fill around the pipe, to a depth of 3 in. below the pipe and to at least 3 in. above the pipe. Allow a 4 in. minimum separation between pipes laid in common trench.

3.07 LATERAL LINE PIPING

A. Lateral line piping shall be laid to a depth of 12 in., unless otherwise specified, and shall have the same consideration given to it as to the main line piping in regards to backfill material.

3.08 ELECTRIC REMOTE CONTROL VALVES AND WIRES

A. Irrigation Contractor to lay wires in trench with irrigation supply main. The Owner reserves the right to install additional wires in the same trench. Coordinate with Owner during installation prior to backfilling. Contractor must lay wires so that they are not damaged during backfilling. Electrical control valves shall be located next to paving or curbs or adjacent planting bed. Leave 12 in. of slack wire at all bends and connection points. Seal all wire connections, underground, with 3M DBY wire connectors.

3.09 SPRINKLER HEADS

A. Locate all heads shown adjacent to paving, 2 in. from edge. Installation of all other sprinkler heads shall be as detailed.

3.10 SLEEVING

A. All PVC sleeving shall be CL-200 psi rating and sized on drawings. Coordinate with General Contractor the location of all sleeving. Provide one (1) extra sleeve where all sleeves are indicated.

END OF SECTION

SECTION 32 93 00
PLANTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contracts, including General and Supplementary Conditions and Division 1 Specification sections apply to work specified in this Section.

1.02 DESCRIPTION OF WORK

A. Provide all landscape related materials shown on the planting plan and specified herein.

1.03 EXAMINATION OF SITE AND DOCUMENTS

A. Before submitting a proposal, the bidder shall:

1. Visit the site of work.

2. Carefully examine and acquaint himself with all portions of the drawings and specifications.

3. Fully inform himself of existing conditions and limitations.

4. Include in his bid, sums sufficient to cover all items required by the contract and the conditions of the site and shall rely entirely upon his own examination in making the proposal.

1.04 INTERPRETATIONS

A. Should bidder find discrepancies in, or omissions from, the drawings or specifications, or be in doubt as to their meaning, he should at once notify the Landscape Architect, who will send written instructions or addenda to all bidders. Neither Owner or Landscape Architect will be responsible for oral interpretations. All addenda issued during the time of bidding shall become part of the contract document.

1.05 LABOR AND MATERIALS

A. The Contractor shall provide and pay for all labor and materials and all equipment and transportation required by such labor and materials for the complete and efficient construction and finishing of the project work as shown on the drawings herein specified.

1.06 SUBSTITUTIONS

A. No substitutions will be permitted that have not been submitted for prior approval to the Landscape Architect. Sufficient descriptive literature must be furnished for any materials submitted as equal substitutes. If standardization of products is required by the Owner, no substitutions will be permitted. Owner and Landscape Architect has right of refusal for proposed substitutes.

B. General

1. Provide submittals per Division 1 of the specifications.

C. Plant Material Location List

1. Within two (2) weeks of award of bid to the General Contractor, submit to Landscape Architect a list of located plant materials or substitutions.

2. Within one (1) month of award of bid to the General Contractor, submit to Landscape Architect confirmed orders for plant material and provide the quantity, location, phone number, and address of the grower.

D. Manuals

1. Prior to substantial completion, provide four (4) copies of written maintenance instructions for care of installed landscaping through full growing season. Include a yearly calendar divided into weeks with all maintenance activities required and identified.

E. Warranty

1. Provide one (1) year written warranty on all workmanship and materials covered in contract.

F. Certification

1. Provide a letter signed by an officer or the Construction Superintendent of the General Contractor's company certifying that the following products to be incorporated into the work meets the requirements specified.

2. Products

a. Trees, shrubs, and groundcover

b. Fertilizer

c. Topsoil

d. Mulch

e. Wood fiber mulch

f. Tackifier and liquid soil bonding agent

G. Product Data

1. Furnish supplier's compliance statement and/or manufacturer's data sheets and other associated information for each product listed. Conform to the following:

a. General Contractor shall submit all items required within this section under on submittal.

b. Contractor's signature and statement that products proposed to be incorporated into the work meet the project requirements.

c. Submittals not complying with these provisions shall not be reviewed by the Landscape Architect and will be returned to the Contractor for compliance.

1.07 **QUALIFICATIONS**

A. The Contractor must have minimum five (5) years documented experience in landscape installation approved by the Landscape Architect.

1.08 **PRODUCT DELIVERY, STORAGE, AND HANDLING**

A. Delivery

1. Deliver fertilizer to site in manufacturer's unopened container with chemical analysis intact.

2. Notify Landscape Architect two (2) weeks in advance of plant material delivery schedule so plants may be inspected upon arrival to site.

B. Inspection

1. Plant material shall not be installed until it has been approved.

2. All plant material shall be placed in one isolated location on the project site and provide unrestricted access for visual inspection. All plant material shall be sufficiently spaced to observe overall growth habit. Trees shall be untied and branches separated.

3. If all plant material is not available upon inspection, the Contractor shall pay all expenses and the standard hourly rate for the project Landscape Architect to and from point of departure for reinspection of plant material prior to installation.

C. Storage

1. Heel-in balled and burlapped plant material not planted the day they were delivered to the site.

2. Store plant material on-site in the shade to protect from dehydration and protect plants from harmful weather until planted.

3. Water and maintain plant material delivered to job site.

D. Handling

1. Use proper horticultural practices while handling plant material.

2. Avoid dropping plants.

3. Avoid picking up plants by their stems or trunks.

4. Plant trees, shrubs, and groundcover within one (1) week of delivery to the site.

1.09 **PROTECTION**

A. Existing Utilities

1. Verify location of existing utilities before beginning work.

2. Repair damage to service lines or site improvements caused by planting operations. Obtain Owner's Representative and Landscape Architect's approval of repairs prior to covering.

3. Take necessary precautions to protect pedestrians, workmen, equipment, and adjacent property.

1.10 **JOB CONDITIONS**

A. Inspection of Finish Grades

1. Prior to beginning planting or seeding operations, obtain approval of finish grades by Owner's Representative and/or Landscape Architect.

B. Weather Conditions

1. Plant only between the temperatures of 38 and 80 degrees F. Avoid planting when ground is saturated, frozen, or wind velocity exceeds 30 mph. Plants installed after September 1st, which are damaged by winter freeze or wind chill factor, will be replaced at no expense to the Owner.

1.11 **MAINTENANCE**

A. Procedure

1. During the period between planting and erosion control installation, and sixty (60) days after substantial completion, provide water, fertilizer, weeding, spraying, resetting unstable plants, and other maintenance necessary to assure healthy growth. Plants and erosion control areas to be in healthy vigorous conditions; weed, disease, and infestation free. Provide written notification to Landscape Architect two (2) weeks before Owner assumes maintenance responsibility.

1.12 **COMPLETION & GUARANTEE**

A. Procedure

1. Provide written notification to Landscape Architect two (2) weeks prior to final inspection. Work will be reviewed upon substantial completion of all items in this contract, by the Landscape Architect.

1.13 **GUARANTEE**

A. Plant Material Guarantee

1. Guarantee plant material for one (1) full year or one (1) full growing season, whichever is longer.

2. Upon notification, make replacements of dead or dying plant material within one (1)

week during the guarantee period.

3. Plant material stolen or vandalized shall not be covered by this guarantee after installation.

1.14 **RECORD DRAWINGS**

A. Contractor shall procure mylar copy of the Landscape Plan and mark on them the built arrangement of all plant material and site improvements. After final inspection and prior to final payment, the mylar shall be delivered to the Landscape Architect who will forward it to the Owner. Any changes made shall have the written approval of the Landscape Architect prior to being changed.

1.15 **ALTERNATES**

A. See Section 01 23 00 for bidding alternates affecting the work of this Section.

1.16 **COLORS**

A. Colors are specified on Colors and Materials Schedule on drawings.

PART 2 - PRODUCTS

2.01 **GENERAL PLANT REQUIREMENTS**

A. Plant Quality

1. Provide healthy nursery stock, well branched and rooted, full foliaged, free of disease, injury, insects, weeds, and weed roots. Landscape Architect to inspect and accept plant material prior to installation.

B. Root Protection

1. Provide large plants balled and burlapped with natural ball of size to insure healthy growth. Provide container-grown plants that have been in the container for longer than three (3) months, but less than two (2) years, with roots filling the container, but not in a root-bound condition.

C. Plant Names

1. Provide plants in each lot tagged with the common and botanical name and size of the plants in accordance with the standards of practice of the American Association of Nurseryman and conforming to *Standardized Plant Names*, published by J. Horace McFarland Company.

2.02 **MATERIALS**

A. Plant Materials

1. As identified on planting plan(s).

B. Fertilizer for Groundcover and Erosion Control Areas

1. Fertilizer shall be Wilbur-Ellis applied at the following application rates below per 1,000 sf to provide nitrogen as noted below:

Application	N-P-K	1.5 lbs/N per 1,000 sf
Start	25-5-14	6 lbs
6 - 8 weeks	28-7-14	8 lbs

C. Fertilizer for Trees and Shrubs

1. Use planting tablets by Agriform (20-10-5) or Woodace slow release tablets (14-3-3) with micronutrients by Fran-Cher Chemicals.

D. Topsoil

1. Mixed soil for trees, shrubs, and groundcover beds shall be sandy loam (per the USGA soils classification) amended with 25% Nutramulch compost, a Washington State Classified “Recycled Content Product” manufactured at a permitted facility that meets the minimum standards established by Washington State Department of Ecology as defined in WAC 173-304-300 and 400. The mixed soil shall be screened through a 5/8 in. screen and have a pH of 5.5 to 7.

2. Composition

a. From 5 to 15% organic matter as determined by the topsoil composition tests of the Organic Carbon, 6A, Chemical Analysis Method described in DOA SSIR. Maximum particle size, 3/4 in., with maximum 3% retained on 1/4 in. screen. Topsoil shall be free of sticks, stones, roots, and other debris and objectionable material. Other components shall conform to the following limits:

pH	5.5 to 7.0
Soluble Salts	600 ppm maximum
Silt	25 to 50
Clay	10 to 30
Sand	20 to 35

3. Place topsoil to depths outlined in Article 3.1.

E. Soil Conditioners

1. Soil conditioner(s) shall be nontoxic to plants.

2. Provide singly or in combination as required to meet requirements for amended topsoil. Soil conditioners shall be nontoxic to plants

3. Composted Wood/Clean Green Derivatives with Biosolids

a. Compost shall be a Washington State Classified “Recycled Content Product” screened through a 5/8 in. trommel screen and manufactured at a

permitted facility that meets the minimum standards established by Washington State Department of Ecology as defined in WAC 173-304-300 and 400. Compost shall be Nutramulch as manufactured by Northwest Cascade or approved equal.

4. Sand

   a. Clean and free of materials harmful to plants.

5. Perlite

   a. Horticultural grade.

6. Lime

   a. Commercial grade ground dolomitic limestone containing not less than 50% of total oxides, 50% calcium oxide, and 50% magnesium oxide, gradation as follows: minimum 75% passing 100-mesh sieve, and 100% passing 20-mesh sieve.

F. Seed

1. Seed of the type specified shall conform to the standards for "Certified" grade seed or better as outlined by the State of Washington Development of Agriculture Rules for Seed Certification", latest edition. Seed shall be furnished in standard containers on which shall be shown the following information:

   a. Common name of seed

   b. Lot number

   c. Net weight

   d. Percentage of purity

   e. Percentage of germination (in case of legumes, percentage of germination to include hard seed)

   f. Percentage of weed seed content and inert material clearly marked for each kind of seed in accordance with applicable State and Federal Laws

2. Upon request, the Contractor shall furnish to the Landscape Architect duplicate copies of a statement signed by the vendor certifying that each lot of seed has been tested by a recognized seed testing laboratory within six (6) months before date of delivery on the project. Seed that has become wet, moldy, or otherwise damaged in transit, or storage will not be accepted.

3. Provide the following seed mix by species/percentages by weight in areas shown on the drawings:

Lawn Seed Mix

Kind and Variety of Seed	% by Weight	Minimum & Pure Seed	Minimum Germination	Minimum % Weed Seed

Edge Perennial Rye	22%	98%	90%	0.5%
Express Perennial Rye	22%	98%	90%	0.5%
Dasher Perennial Rye	22%	98%	90%	0.5%
Pennlawn Creeping Fescue	17%	98%	90%	0.5%
Victory Chewings Fescue	17%	98%	90%	0.5%

G. Wood Fiber Mulch

1. Wood fiber mulch shall be 100% wood fiber manufactured by the deliberating process, from fir, hemlock, or alder. The mulch shall have a minimum of 17% of fibers 8.5 mm or longer and 40% of the total fiber exceeding 3.5 mm in length.

2. Wood fiber mulch shall be in uniform weight with the unit weight displayed clearly on each package. Fiber shall be dyed to provide visual metering of application.

H. Tackifier and Liquid Soil Bonding Agent

1. Tackifier shall be J-Tac or approved equal.

I. Hydroseeding Equipment

1. A commercially produced hydroseeder with a minimum 80 horse power engine, tank size of 1,500 gallons and mechanical agitation shall be used. Mechanical agitation system shall be capable of operating in two (2) directions to insure proper mixing. Should the hydroseeding equipment provide recirculation in addition to mechanical agitation, the recirculation shall be limited to not more than 50 gallons per minute. Homemade equipment, or equipment with agitation by recirculation only, shall not be permitted. Hydroseeding Contractor and equipment shall meet all federal, state, and local codes for backflow prevention during loading operations.

J. Herbicide

1. Provide ‘Round-Up’ non-selective herbicide as manufactured by Monsanto Corporation.

K. Pre-Emergent Herbicide

1. Provide ‘Casoron’ pre-emergent herbicide.

L. Mulch for Planting Beds

1. Soil cover/finish dressings shall be fir or hemlock 3/4 in. minus.

M. Tree Staking Materials

1. Provide pressure treated wood stakes 2 in. x 2 in. x 8 ft 0 in. Douglas Fir, construction grade or better.

N. Tree Chain

1. Provide 1 in. wide rubber tree chain.

PART 3 - EXECUTION

3.01 SOIL PREPARATION OF TREE, LAWN, SHRUB, AND GROUNDCOVER AREAS

A. Procedure

1. Kill and remove existing vegetation. Remove rock, concrete, asphalt, and debris larger than 1 in. that would restrict plant life from the top 4 in. of subgrade.

2. Place 4 in. depth minimum of topsoil for lawn areas.

3. Place 12 in. depth minimum of topsoil for tree, shrub, and groundcover bed areas.

4. Scarify top 4 in. of existing subgrade with spring tooth harrow rototiller or other approved method prior to topsoil placement.

5. Spread and water in commercial fertilizer at the rate specified for 1,000 sq. ft.

6. Thoroughly mix in cross directions. Smooth to finish grades.

3.02 FINISH GRADING LANDSCAPE AREAS

A. Compacting and Floating

1. Compact and float planting beds to 2 in. below finish grade.

2. Compact and float grass seed areas flush with finish grade, 1/2 in. below adjacent walks or curbs.

3. Grade landscape areas to drain. Grading to be smooth and consistent with no undulations or low areas that trap water, unless shown on civil drawings.

4. Obtain Owner's representative approval of finish grades before beginning seeding or planting.

B. Final Grading and Drainage

1. The Contractor shall bear final responsibility for proper surface drainage of the site and the features thereon. Any discrepancy in the drawings or specifications, obstructions on the site, or prior work done by another party that the Contractor feels precludes establishing proper drainage, shall be brought to the attention of the Landscape Architect in writing for correction or relief of said responsibility.

3.03 PLANTING

A. Tree and Shrub Planting Pits

1. Dig planting holes for shrubs and trees circular and with vertical sides, two (2) times larger and 6 in. deeper than the rootball. Scarify subgrade soil for drainage.

2. Remove rock, concrete, asphalt, and debris larger than 6 in. diameter that becomes evident after such hole is dug.

3. Set plants plumb and face for best appearance with crown of rootball slightly higher

than adjacent soil level. When plant is set, remove container of rootball slightly higher than adjacent soil level. When plant is set, remove container or burlap.

4. Backfield with mixture of 50% native soil and 50% imported topsoil to finish grade. Add planting tablets into hole at manufacturer's recommended rate. Flood hole with water. After water has drained away, finish backfilling with remaining soil mixture.

5. Thoroughly water plant material immediately after planting.

B. Planting Groundcover

1. Install groundcover using triangular spacing at a distance indicated on plan, creating a systematic pattern. Water thoroughly after planting.

3.04 MULCH FOR PLANTING BEDS

A. Procedure

1. Provide 3 in. depth of fine mulch specified over shrub bed and tree wells and 2 in. depth for groundcover areas.

3.05 SEEDING OPERATIONS

A. Alternative Methods

1. The Contractor has the option to perform seeding operations by other means other than what is described herein i.e., drill seeding with organic mulches applied. The Contractor shall submit alternative method in writing to Landscape Architect for approval. Hand broadcasting will not be allowed.

3.06 HYDROSEEDING APPLICATION

A. Mixing Procedures

1. Fill hydroseeder tank with water to the center of first agitator. Seed shall be added first, then additives before adding wood fiber. Add one half of the hydroseeders wood fiber capacity before adding fertilizer. Continue to load wood fiber while agitating to ensure all wood fiber is thoroughly mixed in slurry before seeding application.

B. Application

1. Hydroseeding shall be applied by an applicator with a minimum of three (3) years hydroseeding experience.

2. Hydroseed application rates per acre are as follows:

Lawn (Rates per Acre)

2000 #	Wood Fiber Mulch
220 #	Seed Mix
435 #	10-20-20
150 #	Sulfur Coated Urea
40 #	Tackifier to prevent rippling
30 - 60 #	STAY MOIST if unirrigated

3.07 STAKING TREES

A. Positioning Stakes

1. Stake deciduous trees from two (2) directions parallel to the prevailing wind direction.

2. Stake deciduous trees parallel to flow of traffic.

B. Tree Chain

1. Connect to stake and tree ensuring stability through tension.

2. Connect flagging to tree chain for large evergreens.

3.08 GENERAL CLEAN-UP

A. Remove all cans, surplus materials, and other debris from site. Neatly dress and finish all planting areas. Flush walks, paved areas, and the like clean to the satisfaction of the Landscape Architect.

B. Rinse foliage of all plant materials within the construction area as often as necessary to keep the foliage free of dust from work of this contract.

3.09 ESTABLISHING MAINTENANCE PERIOD

A. The Landscaping Contractor shall notify the Landscape Architect two (2) weeks in advance of the planting completion date. A preliminary inspection will be conducted to determine the condition of the planting and overall site improvements.

B. Upon review of the work by the Landscape Architect, the sixty (60) day maintenance period shall begin if all work is substantially completed.

3.10 MAINTENANCE OPERATIONS

A. Continuously maintain all planting in areas included in the contract from the beginning of contract work, during the progress of work, and for a period of sixty (60) days after completion of all work and acceptance of all contract work by the Landscape Architect.

B. Scope: New Plantings

1. Continuous operations of watering, weeding, cultivating, mowing, trimming, edging, rolling, fertilizing, spraying, insect, pest, fungus and rodent control, and any other operations to assure good normal growth.

C. Fertilizing

1. In addition to fertilizing of trees, shrubs, groundcovers, and lawns herein specified, furnish and apply any additional fertilizers necessary to maintain plantings in a healthy, green, vigorous growing condition during the maintenance period.

D. Weeding, Cultivating, and Cleanup

1. Planting areas shall be kept neat and free from debris at all times and shall be

cultivated and weeded at not more than ten (10) day intervals.

E. Insect, Pest, and Disease Control

1. Insects and diseases shall be controlled by the use of approved insecticides and fungicides.

2. Moles, gophers, and other rodents shall be controlled by traps, approved pellets inserted by probe gun or other approved means.

F. Pruning

1. Prune new trees and shrubs removing damaged and dead branches. Use uniform coat of tree paint as required on all cuts.

2. Shape branching structure and thin out foliage. Avoid removing more than 10% of the foliage.

3. Do not remove lower branches from low branching or multi-trunk trees unless directed to do so by the Landscape Architect.

G. Protection

1. Work under this section shall include complete responsibility for maintaining adequate protection for all areas. Any damaged areas shall be repaired at no additional expense to the Owner.

H. Condition of Plantings at the End of the Maintenance Period

1. All plant materials shall be live, healthy, undamaged, and free from infestations.

2. All lawn, native grass, and wildflower areas shall be completely covered at the time of final acceptance, and lawns shall be free of all weeds (broadleaf and grass weeds).

3. Groundcover, shrub areas, and other planting areas shall be free of all weeds (broadleaf and grass weeds).

4. Plantings that do not conform to specifications shall be replaced and brought to a satisfactory condition before final acceptance of the work can be made.

3.11 REPLACEMENTS

A. Immediately replace any plant materials that die or are damaged. Lawns that do not properly germinate or grow shall be reseeded or resodded as specified. Replacements shall be made to the specifications as required for original plantings.

3.12 GUARANTEE

A. Guarantee all plants for a minimum of one (1) year to be alive and in vigorous growing condition at the end of the Contract guarantee period. Remove unsatisfactory plants and replace with plants of the same kind, quality, and size as specified in the Planting Schedule. Furnish and plant as specified under PLANTING.

B. Replacements

1. Immediately replace any plant materials that die or are damaged. Replacements shall be made to the Specifications as required for original plantings.

C. Guarantee all plant replacements to be alive and in vigorous growing condition one (1) year after replacement. Replacement shall be at Contractor's sole expense, except for possible replacements resulting from: (1) removal, (2) loss or damage due to occupancy of project in any part, (3) vandalism, (4) acts of neglect on part of others, or (5) extreme weather phenomena.

1. Extreme Climatic Conditions: Include fire, floods, and winds in excess of 75 mph or winter weather exceeding the average monthly low temperature by at least 15 degrees F for a period of seventy-two (72) hours or longer.

D. Any trees or other plant materials that die back and lose the form and size originally specified, shall be replaced, even though they have taken root and are growing after the die-back.

E. Within fifteen (15) days of written notification by the Owner, remove and replace all guaranteed plant materials that, for any reason, fail to meet requirements of guarantee. Make plant replacements under the guarantee as required every month during the planting season as defined in Article PLANTING, paragraph Time of Planting. Replacements shall be made to same Specifications required for original materials and shall carry the same guarantee from the time they are replaced.

3.13 INSPECTIONS FOR ACCEPTANCE OF WORK

A. Acceptance for Start of Maintenance

1. The Contractor shall notify the Landscape Architect in writing of completion of construction. Within fifteen (15) days after completion of work, an inspection for acceptance to start the maintenance period will be made. When the work is accepted, the maintenance period will begin and continue until final acceptance.

B. Final Acceptance

1. The Contractor shall notify the Landscape Architect within three (3) weeks, twenty-one (21) days, of the date for final inspection at the end of the maintenance period and an inspection will be arranged within fifteen (15) days of this date. Before final acceptance, the terms of the plant guarantee must be met and project site must be in the condition stipulated under MAINTENANCE OPERATIONS.

END OF SECTION

PAGE LEFT BLANK INTENTIONALLY

SECTION 20 02 00
OPERATION AND MAINTENANCE MANUAL FOR MECHANICAL

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.

B. Requirements of Section 20 05 00 apply to this Section.

1.02 WORK INCLUDED

A. Operation and Maintenance Manual.

1.03 SUBMITTALS

A. General: Comply with Section 20 05 00 and Division 01.

B. Preliminary O&M: Submit preliminary review O&M manual for review.

C. Final O&M: Submit Final O&M manuals per Division 01.

PART 2 - PRODUCTS

2.01 GENERAL

A. General Contents: A maintenance manual shall be compiled containing maintenance and operating information and maintenance schedules for all project mechanical systems. See Division 01 for quantities, organization, format, and other requirements; meet additional requirements as specified herein.

B. CD Electronic Copy: Shall contain pdf open format copies of the entire O&M manual, pdf open format copies of record drawings, and ACAD files for record drawings where ACAD shop drawings or ACAD record drawings are required (see individual specifications Sections for requirements). Files shall be bookmarked by section and by product. Drawings shall be bookmarked and labeled by sheet number and name.

2.02 SUBMITTAL DATA AND TECHNICAL O&M DATA

A. Submittal Data:

1. General: Provide a copy the submittal data (clearly identified and marked to suit each item). Note: The submittals are not retained by the Owner and a copy is therefore required in the O&M.

2. Product Data: Manufacturer’s technical product data, with manufacturer's model number, description of the equipment, equipment capacities, equipment options, electrical power voltage/phase, special features, and accessories. Label data sheets with same designation as used on contract documents. Provide for all items

requiring maintenance and for items that may require replacement over a 30-year period or be revised due to an Owner building improvement.

3. Shop Drawings: Provide copy of final shop drawings as approved for each area where shop drawings were required to be submitted.

B. Technical O&M Data: Provide for each equipment or item requiring maintenance. Label O&M data to clearly indicate which equipment on the project it applies to (use same designation as used in the Contract Documents). Data to include:

1. Manufacturer's operating and maintenance manuals and instructions.

2. Itemized list of maintenance activities and their scheduled frequency.

3. Maintenance instructions for each maintenance activity.

4. Manufacturer's parts list.

5. Manufacturer's recommended lubricants.

6. Size, quantity and type of filters required (as applicable).

7. Size, quantity and type of fuses (as applicable).

8. Control devices calibration information.

9. System wiring diagrams and schematics.

10. Control sequence descriptions with setpoints and range of adjustments.

11. Description of unique devices/controls/programs specific to this system.

C. Sources: Provide names, addresses, and phone numbers for local manufacturer's representative, service companies, and parts sources for mechanical system components.

D. Start-Up Reports: Include copies of all equipment and system start-up reports.

E. Balancing Report: Include a full copy of the balancing report under a dividing tab for the specification section (or building system) where this work is specified. Where balancing is provided by others, obtain from the balancer a copy of the report to insert in the O&M's.

2.03 MAINTENANCE SCHEDULES

A. General: Provide Maintenance schedules with an itemized list of maintenance activities and their scheduled frequency (i.e., weekly, monthly, semi-annually, etc.) for item requiring maintenance. This is to be a Contractor prepared listing derived from the manufacturer's operation and maintenance data and practical considerations.

B. Special Maintenance: List any critical maintenance items or areas requiring special attention.

C. Start-Up/Shut-Down: Provide normal start-up, operating, and shut-down procedures; emergency shut-down procedures; and (where applicable) seasonal shut-down procedures.

2.04 REDUCED RECORD DRAWINGS

A. Reduced As-Built Drawings: Provide reduced as-built construction drawings for fire suppression, plumbing, HVAC, Controls. Drawings' size shall be 11" x 17", except where such size precludes the reading of portions of the drawing, a larger size may be used.

2.05 **PHOTOGRAPHS**

A. Photographs: Provide project photographs, as required by Section 20 05 00.

B. Photographs Index: Provide index listing all photographs included. Organize index by building area or systems (i.e. underground photographs, building wings or areas, HVAC system, etc.)

PART 3 - EXECUTION

NOT USED

END OF SECTION

SECTION 20 05 00
COMMON WOR RESULTS FOR MECHANICAL

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.

B. Division 22 - Plumbing Systems.

C. Division 23 - Heating, Ventilation, and Air Conditioning (HVAC) Systems.

D. Division 25 - Integrated Automation.

1.02 WORK INCLUDED

A. General Mechanical System Requirements.

B. Mechanical System Motors.

C. Identification and Labeling.

1.03 DEFINITIONS

A. Abbreviations and Terms: Where not defined elsewhere in the Contract Documents, shall be as defined in RS Means Illustrated Construction Dictionary, Fourth Addition and in the ASHRAE Handbook of Fundamentals, latest edition.

B. "As required" means "as necessary to form a safe, neat, and complete working installation (or product), fulfilling all the requirements of the specifications and drawings and in compliance with all codes."

C. "Concealed" means "hidden from view" as determined when areas are in their final finished condition, from the point of view of a person located in the finished area. Items located in areas above suspended ceilings, in plumbing chases, and in similar areas are considered "concealed." Items located in cabinet spaces (e.g. below sinks) are not considered concealed.

D. "Coordinate" means "to accomplish the work with all others that are involved in the work by: directly discussing the work with them, arranging and participating in special meetings with them to discuss and plan the work being done by each, obtaining and completing any necessary forms and documentation required for the work to proceed, reaching agreement on how parts of the work performed by each trade will be installed relative to each other both in physical location and in time sequence, exchanging all necessary information so as to allow the work to be accomplished with a united effort in accordance with the project requirements".

E. "Finished Areas" means "areas receiving a finish coat of paint on one or more wall surface."

F. “Mechanical”, where applied to the scope of work, includes all project plumbing systems, HVAC systems, and controls for these systems and all work covered by specification Divisions 20, 22, and 23. Such work is shown on multiple drawings and is not limited to a particular set of sheets, or sheets prefaced with a particular letter.

G. The term "related documents" (as used at the beginning of each specification section), and the Specification Divisions and Sections listed with it, is only an indication of some of the specification sections which the work of that section may be strongly related to. Since all items of work relate to one another and require full coordination, all specification sections, as listed in the Table of Contents, shall be considered as being "related documents", and shall be considered (by this reference) in the same manner as if they had all been listed under the term "related documents" in each specification section.

H. "Work included" (as used at the beginning of each specification section), and the items listed with it, is only an indication of some of the items specified in that Section and is in no way limiting the work of that Section. See complete drawings and specifications for all required work.

I. "Verify" means "Contractor shall obtain, by methods independent of the project Architect/Engineer and Owner, the information noted and the information needed to properly perform the work".

J. “Substitution”: As applied to equipment means “equipment that is different than the ‘Basis of Design’ equipment scheduled on the drawings (or otherwise indicated in the contract documents)”.

1.04 GENERAL REQUIREMENTS

A. Scope: Furnish all labor, materials, tools, equipment, and services for all mechanical work. This section applies to all Division 20, 22, and 23 specifications and to all project mechanical work. All mechanical equipment and devices furnished or installed under other Divisions of this specification (or by the Owner) which require connection to any mechanical system shall be connected under this division of the Specifications.

B. General: All work shall comply with Division 00, General Conditions, Supplementary Conditions, Division 01, and all other provisions of the Contract Documents.

C. Code:

1. Compliance: All work shall be done in accordance with all applicable codes and ordinances. Throughout the Project Documents, items are shown or specified in excess of code requirements; in all such cases, the work shall be done so that code requirements are exceeded as indicated. Comply with code accessibility requirements.

2. Documentation: Maintain documentation of all permits and code inspections for the mechanical work; submit documentation showing systems have satisfactorily passed all AHJ inspections and requirements.

3. Code Knowledge: Contractor and workers assigned to this project shall be familiar and knowledgeable of all applicable codes and ordinances. Code requirements are typically not repeated in the Contract Documents. By submitting a bid, the Contractor is acknowledging that the Contractor and workers to be utilized on this project have such knowledge.

4. Proof of Code Compliance: Prior to final completion, satisfactory evidence shall be furnished to show that all work has been installed in accordance with all codes and that all inspections required have been successfully passed. Satisfactory evidence includes signed inspections by the local code authority, test lab results, qualified and witnessed field tests, and related acceptance certificates by local code authorities, and field notes by the Contractor as to when all inspections and tests occurred.

D. Complete Systems: Furnish and install all materials, appurtenances, devices, and miscellaneous items not specifically mentioned herein or noted on the drawings, but which are necessary to make a complete working installation of all mechanical systems. Not all accessories or devices are shown or specified that are necessary to form complete and functional systems.

E. Review and Coordination:

1. General: To eliminate all possible errors and interferences, thoroughly examine all the Drawings and Specifications before work is started, and consult and coordinate with each of the various trades regarding the work. Such coordination shall begin prior to any work starting, and continue throughout the project.

2. Suppliers: Suppliers of products shall review the documents to confirm that their products are suitable for the application and that all manufacturers requirements and recommendations have been satisfactorily addressed in the Contract Documents. Where not addressed the supplier shall notify bidders and the Engineer prior to bidding to resolve any issue or include in their bid an adequate amount to resolve the issue.

F. Conflicts and Discrepancies: Notify the Architect/Engineer of any discrepancies or conflicts before proceeding with any work or the purchasing of any materials for the area(s) of conflict until requesting and obtaining written instructions from the Architect/Engineer on how to proceed. Where conflicts occur, the most expensive and stringent requirement (as judged by the Architect/Engineer) shall prevail. Any work done after discovery of such discrepancies or conflicts and prior to obtaining the Architect/Engineer's instructions on how to proceed shall be done at the Contractor's expense.

G. Drawings and Specifications: Drawings and specifications are complementary and what is called for in either is binding as if called for in both. The drawings are diagrammatic and show the general arrangement of the construction and therefore do not show all offsets, fittings and accessories which are required to form a complete and operating installation. Mechanical work is shown on multiple drawings and is not limited to a particular set of sheets, or sheets prefaced with a particular letter.

H. Offsets/Fittings:

1. Piping Systems: Include in bid all necessary fittings and offset to completely connect up all systems, maintain clear access paths to equipment, and comply with all project requirements. Offsets are required to route piping around building structural elements, roof slopes, mechanical systems, electrical systems, and numerous other items. Due to the schematic nature of the plans such offsets are typically not shown. Contractor is responsible to determine the quantity of offsets and fittings required, and the labor involved. No added payment or “extras” will be granted for the Contractor’s failure to correctly estimate the number of offsets and fittings and labor required. Contractor is advised that equipment and fixture connections may require more than 20 elbows per plumbing fixture and coil per pipe line.

2. Duct Systems: Include in bid all necessary fittings, offsets, and transitions to completely connect all systems, maintain clear access paths, and comply with all project requirements. Offsets are required to route piping around building structural elements, roof slopes, mechanical systems, electrical systems, and numerous other items. Due to the schematic nature of the plans such offsets are typically not shown. Contractor is responsible to determine the quantity of offsets and fittings required, and the labor involved. No added payments or "extras" will be granted for the Contractor's failure to correctly estimate number of offsets, fittings, transitions and labor required. Contractor is advised that transitions are required at connections to all equipment, to all air inlets/outlets, crossing of beam lines, at crossing with piping, and similar locations.

I. Design: The level of design presented in the documents represents the extent of the design being furnished to the Contractor; any additional design needed shall be provided by the Contractor. All design by the Contractor shall be performed by individuals skilled and experienced in such work, and where required by local code (or elsewhere in the documents) shall be performed by engineers licensed in the State where the project is located. Include in bid the costs of all such project design; including engineering, drafting, coordination, and all related activities and work. Such designs services are required for many building systems; including but not limited to ductwork at equipment, piping at fixtures and equipment, hanger/support systems, temporary duct/piping systems, mechanical offsets/adjustments to suit other system, and for methods/means of accomplishing the work.

J. Special Tools: Furnish to the Owner one complete set of any and all special tools such as odd size wrenches, keys, etc. (allen wrenches are considered odd), which are necessary to gain access to, service, or adjust any piece of equipment installed under this contract. Each tool shall be marked or tagged to identify its use. Submit a written record listing the special tools provided, date, and signed by the Owner's representative receiving the tools.

K. Standards and References: Shall be latest edition unless a specific edition, year, or version is cited, or is enforced by the AHJ.

L. Warranties:

1. General: Products and workmanship shall be warranted to be free from all defects, capable of providing satisfactory system operation, and conforming to the requirements of the Contract Documents. Include in the project bid all costs associated with project warranties to ensure that the warranty extends for the required period; possible project delays and failure by others to complete their work may cause the start of the warranty period to be delayed. The Contractor shall be responsible for increasing the warranty dates by corresponding amounts to provide the required warranty periods.

2. Basic Project Warranty: As described in the General Conditions, Supplementary Conditions, and Division 01. See individual specification sections for specific warranty requirements. Start date and duration are as indicated in General Conditions, Supplementary Conditions, and Division 01. Where not indicated otherwise, the basic project warranty shall start at project substantial completion and be for one year.

3. Special Warranties: See individual specification sections for special warranty requirements and extended warranty periods beyond the basic project warranty.

N. Permits and Fees:

1. Obtain and pay for all permits, licenses, fees and inspections as required by the Code and as specified herein (unless noted otherwise).

2. Pay all charges made by any utility company or municipality for material, labor or services incident to the connection of service (unless noted otherwise).

O. Commissioning: All mechanical systems are to be commissioned per Section 20 08 00. The Contractor has specific responsibilities for scheduling, coordination, startup, test development, testing and documentation. At a minimum, the Contractor shall provide a documented and signed record to verify that all equipment and systems installed under this contract have been inspected and functionally tested to verify full compliance with the contract specifications. In many cases, this shall require the Contractor to create or otherwise provide procedures and checklists for approval by the Commissioning Consultant prior to the start of functional testing. Reference Division 01 and coordinate all commissioning activities with the Commissioning Consultant.

1.05 SUBSTITUTIONS

A. General: See Division 00 and 01 for information and requirements regarding substitutions. Manufacturers not scheduled on the plans or listed as “Acceptable Manufacturers” require prior approval and shall submit a substitution request form (see Division 01 for requirements and limitations). See Paragraph 2.01 this specification section regarding “Acceptable Manufacturers”.

B. Redesign:

1. The Contract Documents show design configurations based on particular manufacturers. Use of other manufacturers' products (i.e. substitutions) from what is shown (or specified) may require redesign of mechanical, plumbing, controls, fire protection, electrical, structural, and general building construction to accommodate the substitution.

2. Review the installation requirements for substitutions and provide redesign of all affected construction. The redesign shall be equal or superior in all respects to the Architect/Engineer's design (as judged by the Architect/Engineer), including such aspects as equipment access, ease of maintenance, utility connection locations, unit electrical requirements, noise considerations, unit performance, and similar concerns.

3. Redesign shall be done by the Contractor and shall meet the requirements and have the approval of the Architect/Engineer prior to beginning work. Apply for and obtain all permits and regulatory approvals.

C. Construction Modifications: Provide all required construction modifications to accommodate the substituted products; this includes all mechanical, plumbing, controls, fire protection, electrical, structural, and general building construction. Construction modification shall comply with code, specifications, and be equal to designed construction.

D. Costs: Cost of redesign, construction costs, and all additional costs incurred to accommodate substituted equipment shall be borne by the Contractor.

E. Submittals: In addition to other required submittals, submit shop drawings showing the redesign for substituted equipment; submittal shall include installation plans and sections, connecting services (i.e. ducts, piping, electrical) locations and routing, required service

clearances, and related installation details. Submit data required by other disciplines to allow review of the impact of the substitution (i.e. weights, electrical).

1.06 QUALITY ASSURANCE

A. Experience: All work shall be performed by individuals experienced and knowledgeable in the work they are performing, and experienced with the same type of systems and building type as this project. By virtue of submitting a bid, the Contractor is acknowledging that workers to be utilized on this project have such experience and knowledge. Upon request of the Engineer, submit resumes showing the work history, training, and types of projects worked on, for individuals assigned to this project.

B. Code: Utilize workers experienced and knowledgeable with codes pertaining to their work; verify code compliance through-out the project.

C. Quality Assurance Checks: Prior to ordering products and making submittals, confirm the following for each:

1. General: Product is suitable for the intended purpose and complies with the Contract Documents.

2. Manufacturer: Product's manufacturer is listed as an acceptable manufacturer in the Contract Document's or a substitution request (where allowed) has been submitted and the manufacturer has been listed as acceptable.

3. Electrical (for products requiring electrical power):

   a. Product is for use with the voltage/phase as indicated on the electrical plans (or for the electrical circuit the item will be connected to).

   b. Product's ampacity requirements (MCA) do not exceed that indicated on the electrical plans (or for the electrical circuit the item will be connected to).

4. Weight: Product's weight is no greater than that indicated.

5. Space Verification: Product will fit in the space available, and along the path available to install the item, will have adequate service clearances, and will not impede on any clearances required for other items in the space the item will be located.

6. Installation: A suitable method for installing the product has been selected which meets the project schedule and other requirements.

7. Lead Time: The product's fabrication, shipping, and delivery period meets the project schedule requirements.

8. Substituted Equipment: Where equipment is not the basis of design confirm all requirements for substituted equipment have been met and shop drawings of construction revisions have been (or are being) prepared.

9. Controls: Item is compatible with the controls it will be connected to and has been coordinated with the firm providing the project control work.

10. Listing: Item is Listed when required to be as such. And if the item is to be installed as part of a Listed system or assembly, it is compliant with the Listing of the overall system or assembly.

E. Check-Out: The Contractor shall be responsible to verify that proper installation and proper connections have been provided for all mechanical work. Contractor shall provide installation checkout, start-up services, and perform a thorough check of all mechanical systems to verify proper installation and operation. Contractor shall operate all items multiple times under varying conditions to confirm proper operation. Contractor shall submit a checklist listing all equipment, fixtures, and similar items furnished on this project, with a date and initials indicating when the item was checked, a list of what was checked, and by whom. Such check shall, as a minimum utilize documents provided by the equipment manufacturer. Such a check-out is in addition to any commissioning activities specified (unless noted otherwise).

1.07 SUBMITTALS - GENERAL

A. Variations: Only variations that are specifically identified as described herein will be considered. Provide with the submittal (in addition to other information required): description of the proposed variation, entity who is proposing the variation, why the variation is being proposed, any cost changes associated with the variation, and any other pertinent data to allow for review. Failure to submit information on the variation as described will result in the submittal review being conducted without considering the variation.

B. Quality Assurance: By submitting an item for review, the Contractor is claiming that all “Quality Assurance Checks” (see paragraph 1.06 this specification Section) have been performed and satisfactorily passed and no further comment from the submittal reviewer is required for the “Quality Assurance Checks”.

C. Product Submittals - Information Required:

1. Manufacturer's catalog information, containing product description, model number, and illustrations. Mark clearly to identify pertinent information and exact model and configuration being submitted.

2. List of accessories and options provided with product.

3. Product dimensions and clearances required.

4. Product weight.

5. Submittal identified with product name and symbol (as shown on the drawings or written in the specifications) and specification Section and paragraph reference.

6. Performance capacity and characteristics showing compliance with the Contract Documents.

7. Manufacturer's and local manufacturer's representative names, addresses, and phone numbers.

8. For equipment requiring piping or duct connections:

a. Type of connections required.

b. Size and locations of connections.

9. For electrically operated equipment:

    a. Number and locations of electrical service connections required.

    b. Voltage required.

    c. Fuse or circuit breaker protection requirements.

    d. Motor starter requirements; if motor starter is furnished with the equipment, submit product information on motor starter.

10. For equipment requiring control connections:

    a. Type of control signals required.

    b. Control communication protocol.

    c. Information on control devices furnished with equipment.

    d. Location of control connections.

11. Manufacturer's installation instructions.

12. See each specification Section for additional submittal requirements.

D. Shop Drawing Submittals: Provide for the following systems:

1. HVAC control systems.

2. For any parts of any system which are to be installed differently than as shown on the drawings.

3. Construction revisions to accommodate Substituted Equipment.

4. Other areas/work as noted in the Contract Documents.

5. For those systems requiring shop drawings, reference system's specification Section for additional requirements.

1.08 SCHEDULE OF VALUES

A. Breakdown: Provide schedule of values for the following categories (as a minimum); provide a materials and labor breakdown for each category.

1. Mobilization.

2. General Project Management, General Design, General Coordination, Submittals.

3. Insulation.

4. Plumbing:

    a. Underground.

b. Aboveground.

c. Fixtures and Trim.

5. HVAC System:

a. Equipment.

b. HVAC Ductwork and Accessories.

6. Controls:

a. Engineering and shop drawings.

b. Rough-in.

c. Trim.

7. Balancing.

8. Commissioning.

9. O&M Manual, Record Data.

10. Punchlist, Closeout, Owner Training.

B. Closeout: The dollar value for "Punchlist, Closeout, and Owner Training" shall in no case be less than 3% of the total dollar value of the mechanical work.

C. Proof of Operation: In addition to payments held out for retainage and project final completion as specified above and in Division 01, the Owner reserves the right to withhold a percentage of the funds for any of the above categories until the systems (of that category) have been proven to operate as specified and have been completely tested, adjusted, commissioned, and balanced.

1.09 RECORD DOCUMENTS

A. Field Record Drawings: Maintain a set of full size contract plans at the project site upon which all changes from the as-bid plans are noted. Plans shall be maintained clean, dry and legible; with information recorded concurrent with construction progress. These plans shall also include actual locations (with dimensions) of all underground and concealed mechanical systems. Connection points to outside utilities shall be located by field measurements and so noted on these record drawings. All addenda, change order, field orders, design clarifications, request for information, and all other clarifications and revisions to the plans shall also be made a part of these record drawings. Plans shall be available for weekly review by the Architect/Engineer. Label drawing “As-Builts” with date, name of Contractor, and name of individual overseeing the work.

B. Final Field Record Drawings Submittal: Deliver to the Architect/Engineer the original Field Record drawings and one full size copy.

C. ACAD Record Drawings: Upon completion of the project, the Contractor shall transfer all the data from the field record drawings to electronic drawing files using ACAD *.dwg format; latest

release or next earlier version. Obtain from the Architect/Engineer's office the original electronic drawing files and revise these originals. Prior to incorporating the field record drawing data into ACAD, the Contractor shall submit and obtain the Architect/Engineer's comments of the field record drawings and incorporate any corrections into the electronic files. Label files "AS-BUILT," along with date and name of Contractor.

D. ACAD Record Drawings Submittal: Submit 2 CD's, each having ACAD and pdf files of the field record drawings and 3 full size paper plots.

E. Photographs: Photograph with minimum 10 megapixel digital camera (or better) all concealed utilities located below ground, under floors, and in building. Photographs shall be taken prior to any insulation being installed, and with multiple views so as to allow clear understanding and locations of the systems from the photographs. Furnish prints on 8-1/2 x 11 paper, with two 5 x 7 photographs per page. Label each photograph, as to location photographs are taken and system(s) indicated, and provide two sets of 3-ring notebooks with photographs. Provide divider tabs in notebook, and organize photographs in logical groupings; provide table of contents listing all photographs. Provide a labeled CD's containing all photographs, one with each notebook.

1.10 PRODUCT HANDLING, PROTECTION AND MAINTENANCE

A. Protection:

1. Protect all products from contamination, becoming unclean, and from damage of any kind and whatever cause; when being handled, in storage, and while installed, until final project acceptance.

2. Completely cover fixtures, motors, control panels, equipment, and similar items to protect from becoming unclean and damage of any kind.

3. Protect premises and work of other trades from damage due to Mechanical work.

B. Openings: Cap all openings in pipe, ductwork and equipment to protect against entry of foreign matter until all work that could cause unclean conditions or damage is complete (including work that has dust or fumes associated with it). Caps shall be of sufficient strength and seal integrity to prevent entry of water or fumes for the most extreme conditions they may be exposed to (i.e. high velocity water spray, high winds, concrete splash, etc.)

C. Storage: Provide properly conditioned and sheltered storage facilities for products to prevent damage of any kind and to maintain new condition. Provide adequate venting arrangements to avoid condensation damage.

D. Operation and Maintenance:

1. General: Inspect products periodically to confirm conditions and maintenance needs. Keep records of inspections and (upon request) forward to the Architect/Engineer prior to project final acceptance. Operation and Maintenance shall be in accordance with manufacturer's written procedures and recognized best maintenance practices. Keep records of maintenance and (upon request) forward to the Architect/Engineer prior to project final acceptance.

2. Stored Products: Provide maintenance (i.e. equipment rotation, lubrication, flush, cleaning, etc.) and inspection on products while stored to maintain new condition.

3. Installed Products: Provide maintenance and inspection of products and operate mechanical systems until project final acceptance. Maintenance shall include all labor and materials and all manufacturers' recommended maintenance (i.e. strainer cleaning, filter changes, bearing lubrication, belt tensioning, etc.). In addition to scheduled maintenance, review all equipment periodically to allow detection of improper operation or any special maintenance needs; review shall be consistent with best practices for the product but in no case less than a site visit every two weeks. Document all maintenance activities.

E. Damaged Products: Damaged products shall be replaced with new. Where damage is limited to paint (or similar finish), the product may remain if the finish is restored to a new condition (as judged by the Architect/Engineer).

1.11 ENGINEER FIELD REVIEWS AND TEST WITNESSING

A. General: Arrange construction schedule and notifications to the Engineer to accommodate Engineer's schedule and the possibility of review times occurring up to 14 days after notification, and for the possible failure to satisfactorily pass Engineer's reviews requiring revisions and re-reviews.

B. Notification: Notify Engineer at least 7 days in advance of readiness for reviews; arrange mutually agreed upon times for the reviews to occur.

C. Access: Provide ladders, any special tools and safety equipment to allow Engineer's access to areas and equipment. Remove and reinstall ceiling tiles, access panels, and similar items where requested to allow for reviews.

D. Review of Systems with Equipment:

1. Prior to Engineer's review, system's equipment shall have received specified start-up and be substantiated by a written report.

2. Prior to Engineer's review, systems shall have been operating properly for at least five consecutive days prior to the scheduled review date.

3. Personnel shall be present to operate the system's equipment and controls, and to vary system settings as directed by the Engineer to allow for a review of operation over a range of settings.

E. Re-Review Fees: The project budget allows for one review by the Engineer for specified reviews and witnessing. See Division 00 and 01 for compensation to the Engineer for required re-reviews.

1.12 REFERENCES

A. ASME A13.1: Scheme for the Identification of Piping Systems.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. General: Any reference in the Specifications or on the Drawings to any article, device, product, material, fixture, form or type of construction by manufacturer, name, make, model number, or catalog number shall be interpreted as establishing a standard of quality and shall not be construed as limiting competition. The manufacturers listed as Acceptable Manufacturers may bid the project for the items indicated without submitting a substitution request; however that does not relieve the products from having to comply with the Contract Documents.

B. Substitutions: Products by manufacturers listed as "Acceptable Manufacturers" (other than those listed as the "Basis of Design") are considered substitutions and shall comply with the requirements for substitutions. See Paragraph titled "Substitutions" in Part 1 of this specification section.

C. Considerations: In reviewing a manufacturer for acceptance, factors considered (as compared to the specified item) include: engineering data showing item's capacity, performance, proper local representation of manufacturer, likelihood of manufacturer's future local support of product, service availability, previous installations, previous use by Owner/Engineer/Architect, product quality, availability/quality of maintenance and operation data, electrical requirements, capacity/performance, acoustics, physical dimensions, weight, items geometry and access requirements, utility needs, and similar concerns.

D. Limitations of the Term "Acceptable Manufacturer": The listing of a manufacturer as an Acceptable Manufacturer does not necessarily mean that the products of that manufacturer are equal to those specified. The listing is only an indication of those manufacturers which have represented themselves as being capable of manufacturing, or have in the past manufactured, items equal to those specified. The burden to review products to confirm equivalency with the specified products is on the Contractor. The Architect/Engineer shall be the final judge as to whether an item is equal to that specified.

E. Quality: Products provided by Acceptable Manufacturers shall be equal to or superior to the specified manufacturer's item in function, appearance, and quality, and shall fulfill all requirements of the Contract Documents. The Architect/Engineer shall be the judge as to whether an item meets these requirements or not.

F. Manufacturer: To be considered as being made by a particular manufacturer, the product must be made directly by the manufacturer and have the manufacturer's name (or nameplate with name) affixed to the product (or on the product container where direct labeling is not possible). Example: manufacture "A" is listed as an acceptable manufacture; manufacturer "B" is not listed as an acceptable manufacturer; manufacturer "A" owns "B"; products from "B" do not qualify as being made by an acceptable manufacturer by virtue of ownership.

2.02 PRODUCTS - GENERAL

A. Standard Products: Products shall be standard products of a manufacturer regularly engaged in the manufacture of such products. The standard products shall have been in satisfactory commercial or industrial use for two years prior to bid opening. The two year use shall include applications of equipment and materials under similar circumstances and of similar size. The two year's experience must be satisfactorily completed by a product which has been sold or is offered for sale on the commercial market through advertisements, manufacturers' catalogs, or brochures. Except that equipment changes made solely to satisfy code requirements, to improve unit efficiency, or to comply with unique project requirements are not required to have two year prior operation.

B. Latest Design: Products shall be the latest design and version available from the manufacturer, including software. Discontinued products shall not be used.

C. Service Support: Qualified permanent service organizations for support of the equipment shall be located reasonably convenient to the equipment installation and able to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

D. Manufacturer's Nameplate: Equipment shall have a manufacturer's nameplate bearing the manufacturer's name, address, model number, serial number, and additional information as required by code. Nameplate shall be securely affixed in a conspicuous place. The nameplate of the distributing agent will not be acceptable. Nameplate shall be of durable construction, easily read, with lettering minimum size 12 font.

E. Compatibility: All components and materials used shall be compatible to the conditions and materials the items will be exposed to. All items exposed to the weather shall be galvanized, or be of stainless steel or similar corrosion resistant material.

F. Sizes: Sizes indicated for products manufactured to standardized sizes (e.g. pipe, pipe fittings, valves, material gauges, etc.) are minimums. During bidding confirm that the sizes are available and meet project requirements. Where indicated sizes are not available provide the next larger available size; confirm this larger size will suit the construction and meet Contract Document requirements prior to ordering. Such size revisions are subject to Engineer’s review; indicate size revisions on the product submittal and why the size is being revised.

G. Non-Specified Items: Materials shown on the drawings but not specified shall be provided as shown and as required to suit the application illustrated and intended and shall be of commercial quality, consistent with the quality of similar type items provided on the project. Not all items shown on the drawings necessarily have a corresponding specification; such items shall be provided per this paragraph and so as to provide complete, finished, fully functioning mechanical systems.

H. Weights: Do not exceed the weights shown unless added structural supports are provided. Such supports shall meet the requirements of the project Structural Engineer. The Contractor shall bear all costs for all redesign and added supports to accommodate heavier equipment. The Contractor shall reimburse the Engineer for all time associated with all review and analyses regarding the use of equipment heavier than that indicated.

I. Temperature/Pressure Rating: All materials and components furnished shall be suitable for the temperature and pressures they will be exposed to. Contractor shall consider possible operating modes to ensure proper material ratings.

J. Standardization: All products of the same type shall be by the same manufacturer and have the same characteristics and features to allow for Owner's standardization.

K. Model Numbers: Any reference to a manufacturer’s "model number" is a reference to a manufacturer’s series number or type of product, and is not a complete "model number" in having all the necessary numbers/letters to convey all of the features, accessories, and options that are required. These series numbers are only meant to convey a type of product that may meet the project requirements. Where conflicts or discrepancies occur regarding a listed manufacturer’s series or “model” number and specified capacities or features, the more stringent and expensive shall prevail.

L. Application and Suitability: Products shall be designed and intended for: commercial and institutional application, for the use indicated, and be suitable for the operating conditions they will be exposed to. Firms supplying the products shall review the documents and related site and environmental data to confirm compliance. By making product submittals and using products they are being represented as appropriate for the project and application shown.

M. Lead Free: All solder, valve components, drinking fountain components, and other items in contact with potable water shall be lead free.

2.03 ELECTRICAL

A. General: All electrical devices, wiring, products, and work shall comply with the Division 26 specifications and code. See drawings for building occupancy type, types of construction, and areas which may require special wiring methods or other electrical work.

B. Equipment: All equipment requiring power shall be factory wired to an equipment mounted junction box (or an accessible compartment with power terminals or electrical device) arranged to allow for connection of electrical power.

C. Overcurrent protection: Circuit breakers, circuit breaker disconnects, fuses, and other current limiting devices indicated to be provided, shall be rated to suit the maximum overcurrent rating of the item served, and have other ratings, as required by code. Circuit breakers for HVAC and refrigeration unit equipment shall be UL listed by HACR type.

D. Short Circuit Current Rating (SCCR): All equipment (or components) requiring the use of electrical power shall have a SCCR value to comply with code. The minimum rating shall be 65,000 Amps RMS Symmetrical unless a lower value is indicated on the plans or allowed by code. Where the Contractor wishes to utilize equipment having a lower rating, the Contractor shall be responsible to provide calculations substantiating that a lower SCCR is acceptable (and complies with code), or make revisions to the electrical system to accommodate the proposed equipment (or components).

E. Product Certification (Listing): Products which require connection to electrical power shall be certified (i.e. listed) by a Nationally Recognized Testing Laboratory (NRTL) and be labeled (in a conspicuous place) with such certification (or certification mark). Certification shall comply with code, OSHA Standards, and Authority Having Jurisdiction (AHJ) requirements. NRTL's shall be recognized as such by OSHA and the AHJ. Certification shall be for the complete assembly (approval of individual components is not acceptable). Field evaluations to obtain certification shall be performed by accredited product testing laboratories acceptable to the AHJ and Engineer, be performed in accordance with code, NFPA 791, recognized practices, and be labeled to identify the certification.

2.04 MOTORS

A. General: Where a piece of equipment specified includes an electric motor, the motor shall be factory installed and mounted. Motor starters and motor electrical disconnect switches shall be provided by the Contractor doing the work of the Section where the item was specified, unless specifically shown to be provided by Division 26 (or another Division). Wiring from the motor to motor starters and to electrical disconnects shall be by the Contractor doing the work of the Section where the item was specified, unless specifically shown to be provided by Division 26.

B. Acceptable Manufacturers: General Electric, TECO-Westinghouse, Reliance, Gould, Century, Baldor, U.S. Motors, Marathon, and acceptable manufacturers for the equipment (see individual specification sections).

C. Type: Motor type shall comply with code and applicable standard requirements and be configured to suit the application. Motors located indoors shall be open frame, drip-proof type, unless indicated otherwise. Motors located outdoors exposed to weather shall have corrosion resistant finish and shall be totally enclosed fan cooled (TEFC) or totally enclosed non-ventilated (TENV) type, unless indicated otherwise.

D. Listing: All motors shall be UL listed.

E. Efficiency: Motor efficiencies shall comply with code. Fractional horsepower motors shall be the electronically commutated (EC) type with speed control where noted and where non-EC motors are not available which comply with code efficiency requirements. Motor power factor shall comply with code, local utility requirements, and as indicated. Provide added power factor correction devices as necessary to comply.

F. Sizing: Motors shall not be smaller than indicated and of adequate size to start and drive the respective equipment when handling the quantities specified without exceeding the nameplate full load current at the conditions indicated and for the expected operating conditions. If it becomes evident that a motor furnished is too small to meet these requirements as a result of the Contractor using substituted equipment or having revised the system arrangement, the Contractor shall replace it with a motor of adequate size at no additional cost to the Owner. Contractor shall also arrange with the Electrical Contractor to increase the size of the wiring, motor starter and other accessories as required to serve the larger motor at no additional cost to the Owner.

G. Service Factor: Minimum 1.15.

H. Variable Frequency Drive (VFD) Applications: Motors used with Variable Frequency Drives (VFD's) shall be rated for such use per IEEE standards and have shaft grounding protection.

I. EC Motors (ECM):

1. General: Electronically commutated type with integral inverter to convert AC power (of voltage/phase indicated) to DC power, and solid state circuitry to vary output power and speed of motor. Motor shall have permanently lubricated bearings with an L10 life of 100,000 hours at expected operating conditions. Motor shall have rotor position and rotation detection as required for operation.

2. Speed Range: Motor speed shall be controllable down to 25% of full speed.

3. Manual Speed Control: Provide with manual speed adjustment dial for motor speed control. Dial shall be motor mounted unless indicated otherwise, operable by a screwdriver or by hand. Motor mounted controls shall be factory wired. Remote mount dials shall be hand operable (i.e. no tools required), shall be for mounting on a standard 2 x 4 electrical junction box, and be able to be located up to 100 feet remote from the motor. Motor control wiring for remote mount dials shall be factory wired from the motor to an equipment mounted junction box (with field supplied wiring from this J-box to the remote dial).

4. EMCS Control: Motor speed shall be adjustable via a remote 0-10V input signal (unless noted otherwise) from the building EMCS. Control wiring shall be factory

wired from the motor to an equipment mounted junction box. EMCS control is not required where not indicated to be provided or where not utilized as part of the control sequence.

5. Control Power: Provide with integral transformer, factory wired, as needed to power motor controls. Locate transformer at motor or equipment.

2.05 IDENTIFICATION AND LABELS

A. General: All piping, valves, and mechanical equipment shall be labeled. Labels in concealed accessible spaces shall be reviewed and verified by Architect/Engineer prior to being concealed.

B. Piping:

1. Type: Self-sticking colored identification markers, lettered to identify the pipe contents, and banded at each end with arrow tape indicating the direction of flow. Markers shall be similar and equal to Brady "System 1" and Seton "Opti-Code" markers. Spray painted stencil labeling is not acceptable. Some labels may be special order.

2. Identification Colors: Comply with ASME A13.1, and as follows:

Conveyed Material/System	Background	Letters
Flammable	Yellow	Black
Potable Water	Green	White
Compressed Air	Blue	White
Refrigeration	Black	White
Waste/Vent	Gray	White
Non-Potable Water	Yellow	Black

3. Lettering: Lettering shall identify the material conveyed in each pipe and shall match the designation used on the plans, but without abbreviations. Systems which have supply and return piping shall have piping labeled as such (i.e. heating water return, heating water supply, etc.). Systems that have different pressures shall be labeled to indicate such (i.e. Steam-Low Pressure, Steam- Medium Pressure, Natural Gas-Low Pressure, Natural Gas-Medium Pressure, etc.).

4. Size: Size of letters and color field shall comply with ASME A13.1, repeated here for convenience:

Outside Diameter of Pipe or Covering	Length of Color Field	Size of Letters
3/4 to 1-1/4 Inches	8 Inches	1/2 Inches
1-1/2 to 2 Inches	8 Inches	3/4 Inches
2-1/2 to 6 Inches	12 Inches	1-1/4 Inches

5. Applications: Install on all exposed piping adjacent to each shut-off valve, at branches to indicate changes of direction, where pipes pass through walls and floors, on 20 foot centers or at least one in each room on each pipe. Markers shall be installed on all concealed accessible piping (i.e., piping above suspended ceilings, behind access doors, in accessible chases, etc.) near the point of access. For piping above suspended ceilings, markers shall be installed the same as if the piping was exposed (i.e., same as if the suspended ceiling was not in place). Markers shall be

installed so as to be easily read by a person standing on the floor. Provide additional flow arrows at each pipe connection at valves having more than 2 ports (i.e. 3-way control valves).

6. Other Requirements: See other specification Sections for additional requirements.

C. Valves:

1. Labels: Laminated plastic or phenolic material, at least 1/16-inch thick, with black surface layer and white (unless other color indicated) sub-layer for letter engraving to expose sub-layer. Labels shall not be less than 3" x 1" in size. Label shall be pre-drilled at one end for attachment to valve. Attach to valve with No. 6 polished nickel-steel jack chain of sufficient length to allow label to hang free.

2. Lettering: Engrave label with valve size, name of system served (cold water, heating water supply, chilled water supply, etc.) and purpose of valve. Lettering size 3/16-inch, except where needed to be smaller to fit label size.

3. Application: Labels shall be installed on all valves except valves at hydronic system coils and equipment where the valve purpose is readily obvious.

4. Valve Charts: Valve charts shall be provided for each mechanical room providing valve data for emergency, main building, and main area shut-off valves. Valve charts shall be neatly typed on 8-1/2" x 11" paper and framed under plastic with an aluminum (or wood) frame and posted in the appropriate room at a visible location acceptable to the Architect/Engineer. Sample chart organization:

"PROJECT NAME"
MAIN VALVE CHART

Valve Size	Service	Location	Purpose
6 Inch	HWS Main	Mechanical Room 101 NW Corner	Main HWS Shut-off
3 Inch	HWS	Above Ceiling NE Corner, Room 151	North Wing HWS Shut-off

D. Equipment:

1. Labels: Laminated plastic (or phenolic) material, 1/16-inch thick, with black surface layer and white (unless other color indicated) sub-layer, with engraving through to expose white sub-layer. Minimum 2-inch high (unless indicated otherwise or required due to equipment size) with length to contain required lettering. Label shall be pre-drilled and be mechanically fastened to the equipment. Prior to making labels, submit a list of all proposed labels.

2. Lettering: All caps, engraved on label, with equipment designation (same designation as used on Contract Drawings; e.g. HVAC-101, EF-22, CP-1A). Air handling equipment (i.e. VAV terminal units, fans, etc.) labels shall include the room names and numbers or area of building served (use final installed room designations). Where systems serve portions of the building (i.e. wings or floors), include on label the area served. Lettering shall be in multiple rows, with equipment label on top row. Equipment lettering to be 5/8-inch high; area served lettering to be 3/8-inch high (except that smaller lettering may be used if necessary to fit label size).

3. Application: All scheduled mechanical equipment shall be labeled. The label shall be located on a side of the equipment so as to be easily read, with the marking visible to a person standing at the access level near the equipment (assuming any necessary access to a concealed unit has been made).

E. Electrical Devices:

1. Labels: Minimum 1/4-inch high (unless indicated otherwise) lettering, all caps, engraved on laminated plastic or phenolic material, at least 1/16-inch thick. Laminated plastic (or phenolic) shall have black surface layer and white (unless other color indicated) sub-layer, with engraving through to expose white sub-layer. Label shall be pre-drilled and be mechanically fastened to the item; where mechanical fastening is not possible use 3M VHB double sided specialty tape No. 4945. Prior to making labels, submit a list of all proposed labels.

2. Lettering: Label shall identify the item served (using the same designation as indicated on the Contract Drawings), the source of power (by panel and circuit breaker), and comply with code.

3. Application: Variable frequency drives, motor starters, disconnects, contactors, relays and similar items which control power to equipment and system components shall be labeled. The label shall be located so as to be easily read. See Division 25 Section 23 09 33 for labeling of low voltage control components.

F. Duct Access Doors:

1. Labels: Minimum 1-inch high (unless indicated otherwise) lettering, engraved on laminated plastic or phenolic material, at least 1/16th inch thick. Laminated plastic (or phenolic) shall have red surface layer and white (unless other color indicated) sub-layer, with engraving through to expose white sub-layer. Label shall be pre-drilled and be mechanically fastened to the duct access door. In lieu of laminate type, self-adhesive vinyl signs may be used.

2. Lettering: Label shall comply with code, and indicate the item being accessed (i.e. Fire/Smoke Damper, Fire Damper, CO2 Sensor, etc.).

G. Concealed Items: Equipment, valves, dampers and similar items concealed above accessible ceilings shall have the ceiling marked below the item to identify the item and its location. The marking system shall consist of printed labels made by a professional labeling machine, black lettering on clear self sticking tape, with minimum 1/2-inch high lettering using Arial font. Apply labels to ceiling grid below concealed item. Labels shall identify equipment using the same designation indicated on the plans; valves shall be identified by size and system (e.g. EF-1, VAV-101, VALVE 4" CW). Prior to making labels, submit a list of all proposed labels.

PART 3 - EXECUTION

3.01 **GENERAL**

A. Workmanship: Furnish and install products to provide complete and functioning systems with a neat and finished appearance. If, in the judgment of the Architect/Engineer, any portion of the work has not been installed in accordance with the Contract Documents and in a neat workmanlike manner, or has been left in a rough, unfinished manner, the Contractor shall be

required to revise the work so that it complies with the Contract Documents, at no increase in cost to the Owner.

B. Coordination: Coordinate the work with all trades that may be affected by the work to avoid conflicts and to allow for an organized and efficient installation of all systems.

C. Examination and Preparation: Examine installation conditions and verify they are proper and ready for the work to proceed. Verify compatibility of materials in contact with other materials, and suitability for conditions they will be exposed to. Do not proceed with the work until unsatisfactory conditions have been corrected. Prepare area to accept the work and prepare products for the installation.

D. Field Conditions: Check field conditions and verify all measurements and relationships indicated on the drawings before proceeding with any work. In verifying existing conditions, the Contractor shall verify by direct physical inspection, complete tracing out of systems, by applying test pressures, by excavation and inspection, use of pipeline cameras, and other suitable absolute certain methods to confirm the actual physical conditions that exist.

E. Openings and Cutting and Patching in New Construction:

1. Openings - General: The General Contractor shall provide all required spaces and provisions in structures of new construction for the installation of work of all other contractors or subcontractors.

2. Coordination: The Contractors doing work subject to Division 20 shall furnish to the General Contractor (in a timely manner) all needed dimensions and locations of openings to allow for these openings to be provided as the construction adjacent to the opening is being done.

3. Cutting and Patching: Cutting and patching of structures in place made necessary to admit work, repair defective work, or by neglect of contractors and subcontractors to properly anticipate their requirements, shall be done by the General Contractor at the expense of the contractors or subcontractors responsible. Work shall be done in a fashion to duplicate the results that would have been obtained had the work been properly sequenced.

4. Patching Materials: Patching shall be with materials of like kind and quality of the adjoining surface by skilled labor experienced in that particular trade.

F. Site Work: All trenching, backfilling, compacting, and similar groundwork for utilities shall comply with specification, code, manufacturer, best construction practices, and WSDOT Standard Specifications for Road, Bridge, and Municipal Construction. Provide minimum 6-inch deep sand bedding, minimum 6-inch thick surrounding sand backfill, and 6-inch deep compacted backfill at buried items, unless noted otherwise or required otherwise. Washed 3/8-inch minus pea gravel may be used where allowed by product manufacturer and code. Subsequent backfill shall be in 6-inch lifts, and be compacted to 95% maximum density. Backfill material (above initial 6-inch sand) shall be free of organic material, and rocks larger than 3-inches in any direction.

3.02 INSTALLATION

A. General: Work shall be in accordance with manufacturer's written installation instructions, code, applicable standards, and best construction practices.

B. Space Verification: Prior to ordering materials verify that adequate space exists to accept the products, along the installation path, and to allow for proper maintenance access. Select products that will fit the space available; some optional materials (i.e. valve types, fitting types, substitutes manufacturer's etc.) may not be suitable. Verification shall be by direct field measurement of the actual space available and use of manufacturer's final submittal dimensions. Where the project involves new construction and long lead items and a time schedule not allowing for such direct field measurements, confirm in writing with all trades associated with building the space that adequate room is available. Review maintenance and service access space required and confirm requirements will be met. No submittals shall be made until such space verification work has been performed, and confirmed that adequate space is available. By virtue of making a submittal that Contractor affirms he has completed this verification.

C. Installation Locations:

1. General: Unless dimensioned locations for items are shown, select the precise location of the item in accordance with the Contract Documents, coordinated with other trades and item connection locations, and subject to the Architect/Engineer's review. No allowances will be granted for failure to obtain the Architect/Engineer's review, failure to coordinate the work, and failure to comply with Contract Document requirements.

2. Manually Operated Components: Valves, damper operators, on/off switches, keypads, controls, and other devices which are manually adjustable or operated shall be located so as to be easily accessible by a person standing on the floor adjacent to the item. Any such items which are not in the open shall be made accessible through access doors in the building construction. See individual specification sections for additional requirements.

3. Monitoring Components: Gauges, thermometers, instrumentation, and other components which display visual information (i.e. operating conditions, alarms, etc.), shall be located and oriented so as to be easily read by a person standing on the floor. Provide necessary brackets, hangers, remote read devices and accessories as needed. Equipment control panels and graphic displays furnished with equipment (or integral to equipment) shall be located to be easily accessible by a person standing on the floor adjacent to the equipment, and be located between 4-feet and 6-feet above the finished floor.

4. Installation Issues: If circumstances at a particular location make the accessible installation of an item difficult or inconvenient, the situation shall be discussed with the Architect/Engineer before installing the item in a location that will result in poor access.

5. ADA Accessibility: Locate items which are required to be ADA accessible in accordance with code (including but not limited to IBC, ICC A117.1 and local amendments) for accessibility; verify accessibility requirements with the AHJ.

D. Replacement and Maintenance: Install mechanical equipment to permit easy access for normal maintenance, and so that parts requiring periodic replacement or maintenance (e.g. coils, heat exchanger bundles, sheaves, filters, bearings, etc.) can be removed. Relocate items which interfere with access or revise item installation location, orientation, or means of access.

E. Building Access Doors: Provide access doors where indicated and where needed to provide access to valves, drains, duct access doors, and similar items requiring service or access that would otherwise be inaccessible. Consult architectural drawings and coordinate location and installation of access doors with trades which are affected by the installation. Access doors are typically not shown on the drawings. The Contractor shall review all construction details and types and locations of items requiring access to determine quantity and sizes of access doors required.

F. Rotating Parts: Belts, pulleys, couplings, projecting setscrews, keys and other rotating parts which may pose a danger to personnel shall be fully enclosed or guarded in accordance with Code, and so as not to present a safety hazard.

G. Equipment Pads: All ground and slab mounted mechanical equipment shall be installed on a minimum 4-inch thick concrete pad, (unless indicated otherwise).

H. Dissimilar Metals: Provide separations between all dissimilar metals. Where not specified in another way, use 10 mil plastic tape wrapped at point of contact or plastic centering inserts.

I. Electrical Offsets: Provide offsets around all electrical panels (and similar electrical equipment) to maintain space clear above and below electrical panels to structure, and clearance of 3.5 feet directly in front of panel, except where indicated otherwise or required by code to be more. Such required offsets are typically not shown on the plans but are to be provided per this paragraph. Include in bid offsets for all systems near electrical panels.

J. Piping Through Framing: Piping through framing shall be installed in the approximate center of the member. Where located such that nails or screws are likely to damage the pipe, a steel plate at least 1/16-inch thick shall be installed to provide protection. At metal framing, wrap piping to prevent contact of dissimilar metals. At metal and wood framing, provide plastic pipe insulators at piping penetrations through framing nearest each equipment connection and on at least 32-inch centers.

K. Safety Protection: All ductwork, piping and related items installed by this Contractor that present a safety hazard (i.e., items installed at/near head height, items projecting into maintenance access paths, etc.) shall be covered (at hazardous area) with 3/4" thick elastomeric insulation and reflective red/white self-sticking safety tape. All sharp corners on supports and other installed items shall be ground smooth.

L. Equipment Access: Access to equipment is of utmost importance. Contractor shall apply extra attention to the location of pipe and duct routings and in coordinating all work so that equipment access and a clear maintenance pathway to equipment is maintained. Poor maintenance access will not be accepted. Contractor shall note that in essentially all areas piping and ducts need to run with slopes parallel to the roof (or floor above), in necessitating elbows/fittings/transitions at crosses of ducts/pipes and at all connections to mains and branches; and requiring added fittings to maintain a clear walking path.

M. Pressure Tests: Maintain documentation of all pressure (and leakage) tests performed on systems and submit with project closeout documents. Records shall contain (as a minimum): date of test, system name, description portion of system being tested, method of test, initial and final test pressures (or of measured leakage rates, as applicable), indication of test pass or fail, name and signature of individual performing (or documenting) the test, initials of independent witness of test.

3.03 PAINTING

A. General: Painting shall comply with Division 09 specifications regarding painting. Colors, in all cases, shall be as selected by the Architect/Engineer. Color samples shall be submitted to the Architect/Engineer for approval prior to painting.

B. The following painting shall be provided under Division 20:

1. All exposed metallic surfaces (includes piping, ducts, hangers, conduits, etc.) provided by this Contractor (except equipment with factory finish or items specifically excluded) shall receive one coat of rust inhibiting primer and two (2) coats of selected finish paint.

2. All exposed insulated surfaces provided by this Contractor (except where specifically excluded) shall receive one coat of primer and two coats of selected finish paint.

3. The inside of all ductwork (including visible dampers, roof vents, insulation pins, and any visible metal) behind grilles, registers, diffusers, and louvers shall be painted flat black.

C. Items to be painted under Division 09:

1. Exposed duct work in finished areas.

2. Exterior mechanical equipment.

3. Exposed piping in finished areas.

3.04 PENETRATION PROTECTION

A. Exterior and Watertight Penetrations: Where any work pierces the building exterior (or construction intended to be watertight) the penetration shall be made watertight and weatherproof. Provide all necessary products (e.g. caulking, flashing, screens, gaskets, backing materials, siding, roofing, trim, etc.). Where not detailed or indicated how to install submit shop drawings of the proposed methods. Flashing arrangements shall be per SMACNA Architectural Sheet Metal Manual unless noted otherwise. Caulking alone is not an acceptable means of sealing penetrations.

B. Equipment: Equipment or products located outdoors shall be watertight (except for provisions designed to intentionally accept water and having drain provisions) and shall be designed and intended by the manufacturer to be used outdoors at the project location. Where any work pierces the unit casing exposed to the outdoors the penetration shall be made watertight and weatherproof; provide all necessary products (e.g. caulking, flashing, gaskets, backing materials, etc.).

3.05 START-UP

A. General: Provide inspections, start-up and operational checks of all mechanical systems and equipment. Maintain documentation of all start-up work and submit with project closeout documents. See individual specification Sections for additional requirements.

B. Personnel: Inspection and start-up services shall be done by individuals trained in the operation, and knowledgeable with, the systems being started-up. Equipment start-up shall be by the manufacturer's authorized service representative where indicated (see individual specification Sections).

C. Scheduling and Agenda: Submit a proposed detailed start-up schedule with proposed dates and times at least 30 days prior to the earliest proposed system start-up. Revise dates and times as mutually agreed upon with trades involved, and witnesses, before submitting a final start-up schedule.

D. Witnessing: Start-up may be witnessed by the Engineer and Owner's representative (at their option). Notify the Engineer and Owner 7 days prior to the proposed start-up time.

3.06 OWNER INSTRUCTION

A. General: Provide instruction to the Owner on the operation and maintenance of all installed mechanical systems.

B. Personnel: Instruction on the operation and maintenance of products shall be by individuals trained and experienced in the installation, operation and maintenance of these products. Instruction shall be by the product manufacturer's authorized service representative where indicated (see individual specification Sections).

C. Scheduling and Agenda: Submit a proposed instruction schedule (with proposed dates and times) and an instruction agenda at least 30 days prior to the earliest proposed instruction period. Coordinate Owner and Architect/Engineer review and arrange mutually agreed upon instruction schedule and the instruction agenda, and submit a final instruction schedule and agenda. Organize instruction by sub-systems corresponding to the project specifications (or similar logical grouping).

D. Instruction: Demonstrate and explain normal start-up, normal shut-down, normal operation, normal settings, adjustments, signs of abnormal operation, emergency shut-down, safety concerns, and related information. Demonstrate and explain system maintenance requirements with references to the O&M Manual. Show how maintenance is performed, including how items are accessed, maintenance procedures, tools and parts required, and related information. Review typical repairs and explain how performed.

END OF SECTION

20 05 19
PIPING SPECIALTIES FOR MECHANICAL

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.

B. Requirements of Section 20 05 00 apply to this Section.

1.02 WORK INCLUDED

A. Thermometers.

B. Pressure Gauges.

C. Strainers.

D. Unions.

E. Access Doors.

1.03 SUBMITTALS

A. General: Comply with Section 20 05 00.

B. Product Data: Submit product information data for all items to be used.

1.04 REFERENCES

A. ANSI Z21.24: Connectors for Gas Appliances.

B. ASME B16.18: Cast Copper Alloy Solder Joint Pressure Fittings.

C. ASME B16.39: Malleable Iron Threaded Pipe Unions: Classes 150, 250, and 300.

D. ASME B40.100 - Pressure Gauges and Gauge Attachments.

E. IMC: International Mechanical Code.

F. UPC: Uniform Plumbing Code.

1.05 GENERAL REQUIREMENTS

A. Domestic (Potable) Water Systems: All items in contact with potable water shall be lead free in accordance with ANSI/NSF 61. Plastic piping system components shall comply with ANSI/NSF 14.

B. System Requirements: Products shall comply with additional requirements cited for the specific systems the products are being installed in; see specific system specification sections.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Products shall comply with Section 20 05 00, Paragraph 2.01, Acceptable Manufacturers.

B. Thermometers: Trerice, Weiss, Winters.

C. Pressure Gauges: Trerice, Weiss, Winters.

D. Strainers: Watts, Keckley, Mueller, Sarco, Taco, Paco, Bell & Gossett, Armstrong, Wilkins.

E. Unions: Anvil, Nibco, Watts, Epco, Victaulic, Ward, Jefferson Union.

F. Dielectric Connecters: Victaulic Precision Plumbing Products, Elster Perfection.

G. Access Doors: J. R. Smith, Zurn, Josam, Acudor, Elmdoor, Kees, J.C. Industries.

H. Escutcheons: Selected by Contractor.

2.02 THERMOMETERS - INDUSTRIAL

A. Type: 7 inch scale, adjustable angle, red reading mercury, industrial thermometer.

B. Construction: Aluminum or polyester case, acrylic plastic or heavy glass window, aluminum face, stem of brass or aluminum construction, with separate brass socket (i.e. thermowell). Bulb chambers tapered to match taper in thermowell to give metal to metal contact. Scale case adjustable over a minimum 180° range, with locking fastener.

C. Stem Length: Stem insertion length approximately one-half of pipe diameter. Where installed on tanks, minimum insertion length is 5". Where installed on insulated piping systems, provide a longer stem thermometer and extended neck socket (thermowell) to extend thermometer base past the insulation.

D. Display: White background with bold black numerals and Fahrenheit degree markings, red or blue reading spirit.

E. Accuracy: Plus or minus 1% of full scale.

F. Ranges: Plus or minus 50% of systems normal operating temperature (at point of measurement), with figure intervals approximately 1/20th of range. For systems with multiple operating temperatures wider ranges may be used to allow the same thermometer type through-out the system.

2.03 PRESSURE GAUGES

A. General: 4-1/2" round dial, stem mounting, black impact resistant phenolic (or fiberglass reinforced polypropylene) flangeless case, white face with black numerals, phosphor bronze bourdon tube rated to minimum 250 psi, brass socket, acrylic window, and 1/4" npt (or 1/2" npt) bottom connection. Shut off cock not allowed (use ball valve). Rated for use with the system pressures and temperatures to be exposed to, but be rated for no less than 250° F. Accuracy shall be 0.5% per ASME B40, 100 Grade 2A.

C. Pressure Gauge Ranges: 0 to 1.5 times systems normal operating pressure (at point of measurement), with numeral figures on 5 psig for gauges reading to 100 psi, and 10 psig on gauges reading to higher values.

2.04 STRAINERS

A. Water Systems:

1. Copper Piping Systems 2-1/2" and Smaller: Bronze body, "Y" type, screwed or solder type end connections, 125 lb class (rated 125 psi steam working pressure at 350 deg F minimum) and 400 psi (WOG) rated working pressures at 210 deg F, stainless steel 20 mesh wire screen, and gasketed retainer cap. Reinforce wire mesh with perforated stainless steel sheet for sizes 2" and 2-1/2". Ratio of net free area of screen to pipe free area greater than 3.5. Provide with blowdown valve, ball type, with 3/4" NPT male end connection. Valve manufacturer shall be listed as an "Acceptable Manufacturer" in the hydronic piping system specification section.

2. Copper Piping Systems 3" and Larger: Bronze or ductile iron body, "Y" type, flanged end connections, 150 lb class (rated 150 psi steam working pressure at 400 deg F minimum), brass or stainless steel screen with 3/64" perforations for 3" and 3/32" perforations for larger sizes; with gasketed threaded retainer cap. Ratio of net free area of screen to pipe free area greater than 3. Provide with blowdown valve, ball type, with 3/4" NPT male end connection. Valve manufacturer shall be listed as an "Acceptable Manufacturer" in the hydronic piping specification section.

2.05 UNIONS

A. Dielectric Unions: Shall not be used. Provide "dielectric connector" with standard union where union is required at connection point of dissimilar materials.

B. Unions on Copper Pipe:

1. General: Pressure and temperature ratings to match (or exceed) piping system being installed in; minimum Class 125.

2. 2-Inch Pipe and Smaller: Wrought copper solder joint copper to copper union, complying with ASTM B16.18.

3. 2-1/2-Inch Pipe and Larger: Brass flange unions.

C. Dielectric Connector: Schedule 40 steel pipe nipple, zinc electroplated, with internal thermoplastic lining which is NSF/FDA listed and meeting all code requirements for potable water applications. Suitable for continuous use up to 225 deg F and 300 psi. "Clearflow" dielectric waterway (or approved). For systems operating at temperatures greater than 225 deg F provide flanged connections with insulating gaskets.

2.06 ACCESS DOORS

A. Hinged lockable steel access door, for mounting on face of wall, with minimum 16 gauge frame and 16 gauge door, concealed hinge, cam and cylinder lock, and anchor straps or anchor frame with mounting holes. Provide Type 304 stainless steel construction with No. 4 finish where used in restrooms, locker rooms, kitchens, and similar "wet" areas. Provide steel construction with prime coated finish in other areas. Door shall have rounded corners, and concealed pivoting rod hinge. Size shall be 12" x 12" (unless indicated otherwise) but shall be large enough to allow necessary access to item being served and sized to allow removal of the item (where access door is the only means of removal without disturbing fixed construction).

B. Fire Rating: Door shall maintain fire rating of element installed in; reference drawings for required rating.

C. Access doors shall all be keyed alike. Provide two (2) keys for each door.

2.07 ESCUTCHEONS

A. Type: Circular metal collar to seal pipe penetrations at building elements (i.e. walls, floors, cabinets, and ceilings); one piece type except that split hinge type may be used for applications on existing piping.

B. Construction: Constructed of chrome plated brass or polished stainless steel, sized to tightly fit pipe exterior surface (or pipe insulation where insulated) and to fully cover the building element penetration.

C. Projection: Shallow face type with maximum projection from wall not to exceed 1.2 times inner diameter of escutcheon.

D. Special Applications: For sprinkler heads and similar special applications see items' specification Section.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Thermometers: Install thermometers and thermal wells in piping at locations indicated, and so as to be easily read. B. Pressure Gauges: Install pressure gauges at inlet and outlets of all pumps; at each side of pressure reducing valves; and as indicated. Provide with ball-type isolation valves.

C. Strainers: Install strainers ahead of each control valve and as indicated. Provide valve in blow-off connection on strainers, valve shall be same size as blow-off tapping.

E. Unions: Install unions in pipe connections to control valves, coils, regulators, reducers, all equipment, and where it may be necessary to disconnect the equipment or piping for repairs or maintenance; and as indicated. Where flanged connections occur at equipment additional unions are not required unless indicated otherwise. Dielectric unions shall not be used.

F. Dielectric Connectors: Install connectors between all connections of copper and steel piping (or equipment), and other dissimilar metals. Where flanged connections occur use insulating type flanges. Dielectric unions shall no be used.

G. Access Doors: Provide access doors where indicated on the drawings and where needed to provide access to trap primers, water hammer arresters, cleanouts, valves, coils, controls, mechanical spaces, and similar items requiring service or access that would otherwise be inaccessible. Consult architectural drawings and coordinate location and installation of access doors with trades which are affected by the installation. Access doors are typically not shown in the plans. Review ceiling and wall types and locations of items requiring access to determine quantity and sizes of access doors required.

H. Escutcheons: Provide at all pipe penetrations through building elements, except where penetration is concealed (unless specifically noted otherwise). Items located in accessible cabinet spaces (e.g. below sinks) are not considered concealed.

END OF SECTION

SECTION 20 05 29
HANGERS AND SUPPORTS FOR MECHANICAL

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.

B. Requirements of Section 20 05 00 apply to this Section.

1.02 WORK INCLUDED

A. Pipe Hangers and Supports.

B. Duct Hangers and Supports.

C. Mechanical Equipment Anchors and Supports.

1.03 QUALITY ASSURANCE

A. Pipe Hanger Standards: Manufacturers Standardization Society (MSS) Standards SP-58, SP-89, SP-69, and SP-90.

B. General: All methods, materials and workmanship shall comply with Code; including IBC, IMC, UPC, NFPA Standards, and ASME standards.

1.04 SUBMITTALS

A. General: Submittals shall comply with Section 20 05 00.

B. Product Data: Submit product data for all hangers, supports, and anchors. Data to include finish, load rating, dimensions, and applicable agency listings. Indicate application for all items by system type, size, and other criteria as appropriate to project.

C. Shop Drawings:

1. General: Shop drawings shall clearly indicate dimensions, anchor and support type, anchor and support size, anchor and support spacing, finish, configuration, and systems/equipment to be applied to.

2. Attachments: Submit shop drawings for proposed attachment methods to building structure where the method of attachment has not been shown on the drawings, or where attachment methods other than those shown on the drawings are desired to be used.

3. Fabricated Supports: Submit shop drawings for all fabricated supports.

4. Finished Areas: Submit shop drawings for all supports that will be exposed in finished areas.

1.05 GENERAL REQUIREMENTS

A. Seismic: Provide adequate hangers, supports, anchors, and bracing to serve as seismic restraints. Seismic anchoring and bracing methods shall comply with SMACNA SRM, Mason SRG, and code. Seismic restraints system shall be able to withstand seismic forces as required by code; provide seismic restraint calculations as required by the AHJ.

B. Design and Manufacture: All pipe hangers and supports shall be designed and manufactured in accordance with MSS-SP 58.

1.06 REFERENCES

A. ADC: Air Duct Council - Flexible Duct Performance and Installation Standard, 5th Edition.

B. ASHRAE-F: American Society of Heating, Refrigeration, and Air Conditioning Engineers, Handbook of Fundamentals.

C. ASME B31.1: Power Piping.

D. ASME B31.9: Building Services Piping.

E. ASTM A36: Standard Specification for Carbon Structural Steel.

F. ASTM A108: Standard Specification for Steel Bar, Carbon and Alloy, Cold - Finished.

G. ASTM A123: Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

H. ASTM A153: Standard specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

I. ASTM A653: Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc Iron Alloy-Coated (Galvannealed) by the Hot Dip Process.

J. ASTM A907: Standard Specification for Steel, Wire, Epoxy - Coated.

K. ASTM A924: Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot Dip Process.

L. IBC: International Building Code.

M. IMC: International Mechanical Code.

N. Federal Spec QQ-W-461H: Wire, Steel, Carbon (Round, Bare, and Coated).

O. Mason SRG: Mason Industries Seismic Restraint Guidelines for Suspended Piping, Ductwork, Electrical Systems and Floor Mounted Equipment, 6th Edition.

P. MSS SP-58: Pipe and Hangers and Supports - Materials, Design and Manufacture.

Q. MSS SP-69: Pipe and Hangers and Supports - Selection and Application.

R. MSS SP-89: Pipe Hangers and Supports - Fabrication and Installation Practices.

S. MSS SP-90: Guidelines on Terminology for Pipe Hangers and Supports.

T. SMACNA-DCS: HVAC Duct Construction Standards, 3rd Edition.

U. SMACNA SRM: Seismic Restraint Manual Guidelines for Mechanical Systems, 2nd Edition.

V. UPC: Uniform Plumbing Code.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Products shall comply with Section 20 05 00, Paragraph 2.01, Acceptable Manufacturers.

B. Hangers and Supports: Grinnell, B-Line Systems, Unistrut, Erico, PHD, Basic-PSA, Pate, Caddy, Unisource, Metraflex, American Insulation Sales, Thermal Pipe Shields, Miro Industries.

C. Anchors: Rawplug, Phillips, Hilti, Michigan, Simpson, Fastenal, Grinnell, B-Line Systems, Unistrut, PHD, Basic-PSA, Metraflex.

2.02 GENERAL

A. Finish:

1. Indoor Applications: Electro-plated zinc in accordance with ASTM B 633, or hot-dip galvanized after fabrication in accordance with ASTM A 123; except that hanger straps may be formed from pre-galvanized steel.

2. Outdoor Applications: Hot-dip galvanized after fabrication in accordance with ASTM A 123, ASTM A 153, or ASTM A 653 (as applicable to item).

B. Identification: Steel pipe hangers and supports shall be stamped with the manufacturer's name, part number, and size.

C. Hanger Rods: Threaded hot rolled steel. Hanger rods shall be sized so that the total load imposed (including pipe or duct, insulation, hangers, and fluid) does not exceed the following:

Nominal Rod Diameter	Maximum Load
1/4 Inch	240 Pounds
5/16 Inch	440 Pounds
3/8 Inch	610 Pounds
1/2 Inch	1130 Pounds
5/8 Inch	1810 Pounds
3/4 Inch	2710 Pounds
7/8 Inch	3770 Pounds
1 Inch	4960 Pounds

D. Hanger Straps: Galvanized steel, minimum 1" x 22 gauge (except where required by Code to be heavier or noted otherwise), of lock-forming grade conforming to ASTM A924, G90 (minimum) galvanized coating conforming to ASTM A 653. Minimum yield strength of 30,000 psi. Straps shall be sized so that the total load imposed does not exceed the following:

Strap Size	Maximum Load
1" x 22 Gauge	230 Pounds
1" x 20 Gauge	290 Pounds

1" x 18 Gauge	380 Pounds
1" x 16 Gauge	630 Pounds
1-1/2" x 16 Gauge	990 Pounds

E. Beam Attachments: Constructed of malleable iron or steel, MSS standard types designed for clamping to building structural support beam. "C" clamp type shall have cup point set screws with locknuts and retaining straps. Center loaded type beam clamps shall have horizontally adjustable clamping bolt (or rod with nuts).

F. Concrete Anchors: Wedge type expansion anchors, with hex nut and washer, and stainless steel split expansion rings. Tested to ASTM E 488 criteria, UL listed, with exposed anchor head stamped with code to identify anchor length.

G. General Anchors (Screws, Nuts, Bolts, Fasteners):

1. General: Constructed of materials suitable for the conditions exposed to and materials being joined, with minimum 50 year service life. Stainless steel construction where exposed to corrosive conditions. Configuration, size and grade to suit application, accommodate expected forces, and provide anchoring to structural element (or allow for proper fastening of items). Minimum safety factor of 2.5 (or as required by code, whichever is greater). Comply with ASTM A307, SAE J429, SAE J78, or ASTM A 563; bolts and nuts shall have unified inch screw threads (course, UNC).

2. Test Reports: Provide independent test report indicating fastener strength (pullout and shear) as installed in the materials and applications of this project (when required by the Engineer or AHJ).

3. Finish: In finished areas, the portion of fastener exposed to view shall match the exposed finish of item being fastened.

H. Manufactured Strut Systems:

1. Channels: Minimum 12 gauge, 1-5/8 x 1-5/8" (unless noted otherwise), with slots/holes to suit application.

2. Accessories: Channel nuts press formed, machined and hardened with gripping slot, fabricated from steel conforming to ASTM A 108 or ASTM A 36. Fittings fabricated from steel in accordance with ASTM A 907.

3. End Caps: Vinyl cap, capable of withstanding high temperatures without degradation, manufactured specifically for use with manufactured strut. Unistrut Series P2859 or P2860 (or approved).

I. Steel: Structural steel per ASTM A 36.

J. Wood: Only allowed to be used where building structural elements are of wood construction same type, grade used for building structural members. Where located outdoors shall be the pressure treated type; with all cut portions of wood painted with wood preservative.

K. Field Galvanizing Compound: Brush or spray applied galvanizing treatment; consisting of a premixed ready to apply liquid organic zinc compound, with 95% metallic zinc content by weight in dry film. ZRC worldwide "ZRC Cold Galvanizing Compound".

2.03 PIPE HANGERS AND SUPPORTS

A. Copper Pipe: All hangers used directly on copper pipe shall be copper plated or have a factory applied 1/16-inch thick (minimum) plastic coating on all contact surfaces.

B. Cushion Clamps: Pipe clamps with a vibration dampening insert between the pipe and clamp, with a nylon inserted lock-nut on clamp. Insert shall be constructed of a thermoplastic elastomer, designed to tightly fit and match pipe size and clamp used with; suitable for system temperatures.

C. Type: Shall be MSS type selected in accordance with MSS-69; except that MSS type 24, 26, and 34 shall not be used.

D. Trapeze Hangers: Shall be constructed of carbon steel angles, manufactured strut channels, or other structural shapes with flat surface (or installed saddle) for pipe support. Provide steel washer where hanger rod nuts bear on trapeze hanger. Pipe anchors shall be two piece clamp type designed for use with trapeze style (i.e. inserted into strut channel opening) or one piece type designed for welded or bolted attachment to trapeze; shaped to match pipe size (or pipe size plus insulation thickness on insulated systems). Pipe guides shall comply with paragraph titled “Alignment Guides”; or be steel angles with vertical leg height equal to pipe diameter (or pipe diameter plus insulation thickness on insulated systems); or be two piece clamp type pipe anchors sized and installed to serve as a guide.

E. Insulated Pipe Supports:

1. Insulation material at pipe support shall consist of expanded perlite, calcium silicate or high density phenolic. Where located outdoors or used on chilled water piping, insulation material, shall be water resistant. Insert shall have a flame resistant jacket of nylon reinforced kraft paper bonded to aluminum foil cover on insulation, with galvanized steel shield. Insulation material shall have no more than 5% deformation at 100 psi and a thermal conductivity no more than 0.32 Btu/hr-sf-deg F-inch (rated at 75 deg F). Insulation shall be suitable for temperatures and conditions it will be exposed to without degradation over a 30 year life.

2. All insulation and materials shall have a fire hazard rating not to exceed 25 for flame spread and 50 for smoke development, as tested by ASTM E84.

3. Insert shall be same thickness as adjoining pipe insulation, sized to match pipe diameter used on.

4. Minimum insulation and shield lengths, and minimum shield gauge:

Nominal Pipe Diameter In Inches	Insulation Length In Inches	Shield Length In Inches	Minimum** Shield Gauge
1/2 to 1	*	4	20
1-1/4 to 2	6	4	20
2-1/2 to 6	6	4	18
Larger Sizes	9	6	16

* Insert not required; shield at insulation is acceptable.
** Provide with 360° shield where pipe is clamped (or has a 360° anchor).

F. Expansion Joints:

1. General: Type to suit application (i.e. where located in middle of pipe run provide type to accept expansion/contraction in both directions; where installed at end of pipe run provide type to accept pipe expansion/contraction in one direction). Size to

match piping installed in. Provide with axial movement as noted, or (where not noted) as Contractor calculated plus 25 percent excess travel, and in accordance with expansion joint manufacturer's sizing recommendations.

2. Systems Below 200 deg F:

a. Bellows Type - Steel Piping: Corrugated bellows type, suitable for 150 psi working pressure at 380 degree F temperature. Bellows shall be of type 304 or 316 stainless steel construction. Able to accept expansion in either direction longitudinally. Metraflex Series MNLC or MN (or approved).

b. Bellows Type - Copper Piping: Externally pressurized, packless, bellows type, suitable for 150 psi working pressure at 500 degree F temperature, copper construction. Able to accept expansion in either direction longitudinally. Hyspan Series 8500 (or approved).

c. Mechanically Coupled Slip Type: Where mechanically coupled joint systems are allowed on steel piping systems; slip type expansion joint providing up to 3-inch axial end movement, with mechanically coupled pipe ends, rated for 150 psi working pressure and 230 degrees F. Victaulic Style 150 (or approved).

d. Mechanically Coupled Systems: Where mechanically coupled joint systems are allowed, and system expansion/contraction can be accommodated by pipe joints having appropriate end gaps and appropriate quantity of mechanically coupled joints. See Section 23 21 15.

G. Alignment Guides: Steel "spider" type alignment guides, with anchoring legs. Provide with calcium silicate insulation where used on cold pipe lines. Metraflex “Style IV”, “PG-PRE” (or approved).

H. Pipe Anchors - Expansion: For use on pipe runs having expansion/contraction devices.

1. Contractor Fabricated: Anchors shall consist of riser clamp and welded pipe or steel angles anchored to structure, or similar arrangement (unless indicated otherwise). Provide with calcium silicate insulation insert rated for 900 psi compressive strength, and vapor barrier where used on cold pipe lines.

2. Factory Fabricated: Carbon steel anchors to force pipe expansion into system expansion/contraction devices, with paint finish. Provide with calcium silicate insulation insert rated for 900 psi compressive strength, and vapor barrier, where used on cold pipe lines. Metraflex “PA”, “PAPI” (or approved).

2.04 DUCT HANGERS AND SUPPORTS

A. Hangers: As shown in SMACNA-DCS except that wire shall not be used and all materials used shall comply with these specifications.

B. Vertical Duct Supports at Floor: 1-1/2" x 1-1/2" x 1/8" (minimum) galvanized steel angle and to support ducts, maximum 12 foot on center, and as shown in SMACNA-DCS. For ducts over 30 inches wide provide riser reinforcing with hanger rods between the riser support and riser reinforcing.

C. Vertical Duct Supports at Wall: 1-1/2" x 1/8" (minimum) strap or 1-1/2" x 1-1/2" x 1/8" (minimum) angle bracket and as shown in SMACNA-DCS.

D. Hanger Attachments to Structure: As shown in SMACNA-DCS to suit building construction and as allowed on structural drawings. Provide washers at all fasteners through hanger straps (regardless of SMACNA-DCS allowances). Where C-clamps are provided, retainer clips shall be used. Friction beam clamps shall not be used.

E. Hanger Attachments to Ducts: As shown in SMACNA-DCS except that wire shall not be used as any form of support or attachment for ducts.

F. Flexible Duct Strap: Woven polypropylene hanging strap, minimum tensile strength of 400 lbs, minimum 1.75-inches wide, designed and intended for flexible duct support.

G. HVAC Support Wire: Steel, minimum 12 gauge, soft-annealed wire, complying with Federal Specification QQ-W-461H, and IBC for support of ceilings and accessories installed in ceilings.

PART 3 - EXECUTION

3.01 INSTALLATION - GENERAL

A. General: Provide all necessary bolts, nuts, washers, fasteners, turnbuckles, hanger rods, rod connectors, stanchions, wall/roof/floor backing and attachments, bridging between structural members, and any other miscellaneous accessories required for the support and anchoring of all pipes, ducts, and mechanical equipment. All supports, whether from floor, walls, or hung from structure, are Contractor's responsibility. Anchors and supports shall be adequate to accommodate forces equipment will be exposed to. Any field cut pieces of galvanized materials shall be hot-dip galvanized after cutting; or be solvent and wire brushed clean and receive field applied galvanizing treatment. This field applied galvanizing (only allowed with prior permission for minor localized cuts) shall use multiple coats to provide as near equal protection as possible to factory (or hot-dip) applied coatings.

B. Backing: Install steel or wood backing in walls (anchored to studs) and in ceiling (anchored to joists or trusses), as required to provide support for items.

C. Installation: Install all inserts, anchors, and supports in accordance with manufacturer's instructions, code requirements, and best professional practices. The most restrictive criteria governs.

D. Welded Assembly Finish: All welded steel support assemblies shall have a power wire brush and primer paint finish where installed indoors and be have factory applied hot-dip galvanized finish where installed outdoors (or subject to moisture); unless another finish is specified.

E. Attachments: Attach to anchoring element (i.e. building structure, concrete pads, etc.) as shown on drawings (reference structural drawings). Where not detailed on the drawings, the Contractor shall design and submit shop drawings of proposed attachment methods to the Engineer for review.

F. Application:

1. Where not detailed on the drawings (or otherwise indicated), the selection and design of supports is the Contractor’s responsibility, in compliance with code and Contract Document requirements; subject to submittal review and acceptance by the Engineer.

2. Exposed supports in finished areas shall be arranged to minimize their visibility; be free of dents, scratches and labels, and be configured in a manner to match the

decorum and finish of the room they are installed in. Exposed supports in finished areas shall be cleaned to allow for field painting (unless a chrome, stainless steel, or similar finish has been indicated).

3. HVAC Support wire and flexible duct strap shall only be used for support of ceiling air inlets and outlets, or at flexible duct supports.

G. Manufactured Strut ("Unistrut"): Provide end caps on all strut ends at the following locations:

1. Where exposed to view in finished areas.

2. Where near maintenance access paths.

3. Where personnel injury could occur if the ends were not covered.

H. Seismic: Provide hangers, supports, anchors and bracing as required by code and as necessary to accommodate forces in a seismic event. Seismic bracing is not required for piping sized 2-inch and less, or for horizontal piping where the distance from the top of the pipe to the support attachment point to the building structure is less than 12-inches (unless noted otherwise). Seismic bracing is not required for ductwork less than 28-inch in diameter or having across sectional area less than 6 square feet, or for horizontal ductwork where the distance from the top of the duct to the support attachment point to the building structure is less than 12-inches (unless noted otherwise). All equipment shall be seismically anchored.

3.02 INSTALLATION OF PIPE HANGERS AND SUPPORTS

A. General: Aboveground pipe shall be anchored to the structure to prevent sagging, to keep pipe in alignment, and to resist the forces the pipe will be exposed to; piping shall be supported independent of equipment so that no loads bear on the equipment.

B. Adjustment: All pipe supports shall be provided with a means of adjustment for the aligning and leveling of the pipe after installation.

C. Applications: Selection, sizing, and installation of pipe supports and accessories shall be in accordance with the manufacturers recommendations, standards MSS SP-89 and MSS SP-69, UPC, and IMC. Refrigerant piping and similar piping subject to vibration (i.e. high pressure tubing) shall be installed with cushion clamps.

D. Support Spacing: Provide piping support spacing according to the most restrictive of the following: UPC, IMC, ASME B31.1, B31.9, local codes, manufacturers recommendations or Contract Documents specific requirements. Provide supports at each change in direction of piping and at each side of concentrated loads (such as in-line pumps, valves greater than size 5", and similar items).

E. Trapeze Hangers: Four or more pipes running parallel may be supported on trapeze hangers provided the slopes of such pipes allow use of common trapeze. Suspend trapeze hanger from the building structure using hanger rods; attach to the building structure using concrete inserts, beam clamps, or other approved methods. Where trapeze width exceeds 30 inches, and where building attachment restrictions require more anchor points, provide three (or more) hanger rod supports. Provide pipe anchors to secure piping to trapeze on minimum 20 foot spacing; size and install pipe anchor to allow longitudinal movement of pipe (unless noted otherwise) with minimal vertical and transverse movement; where pipe is subject to expansion/contraction provide anchoring and alignment guides per paragraph titled "Thermal Expansion/Contraction".

F. Vertical Piping Supports: Support piping at each floor line with pipe clamps and at intermediate points as required so that hanger spacing does not exceed allowable spacing and as required to prevent excessive pipe movement and so as to comply with the maximum spacings cited above. Support all pipe stacks at their bases with a concrete pier or suitable support. For vertical pipe drops which occur away from a wall or similar anchoring surface, provide angled bracing from nearest structure on two sides of drop to provide rigid anchoring of pipe drop.

G. Pre-Insulated Pipe Supports: Protect all insulated pipe at point of support with pre-insulated pipe supports. Such supports shall be in place at time of installing pipe.

H. Underground Pipe: Shall be evenly supported on approved bedding materials, as appropriate for the type of piping being used. Such bedding and backfilling shall be as specified in Section 20 05 90.

I. Thermal Expansion/Contraction:

1. General: All expansion devices and associated system features to accommodate pipe thermal expansion/contraction shall be Contractor designed (except where a specific design has been provided), in accordance with MSS SP-69, ASME B31.9, ASME B31.1, ASHRAE-F, and expansion joint manufacturer's guidelines. See Section 20 05 48 for requirements to accommodate building movement and system vibration.

2. Locations: Where straight pipe runs exceed 50 feet in length, and where piping is subject to expansion and contraction of 1/2-inch lengthwise or more, provide expansion joints or expansion loops (use specific type where indicated) to accommodate system expansion/contraction.

3. Expansion: Unless expansion/contraction lengths have been indicated, calculate expansion contraction using worse case temperatures system will be exposed to (e.g. installed seasonal temperature of system versus high/low operating temperature, or system high/low operating values, etc.) and pipe expansion factors from ASHRAE-F.

4. Supports, Guides, Anchors: Pipe shall be supported with roll type or anti-friction plate type supports to allow movement relative to expansion devices without imparting movement to hangers; brace hangers as needed in order to prevent movement. On systems operating below 125 deg F roll type or anti-friction plate type supports are not required provided the required expansion/contraction can be accommodated by direct movement of the pipe (or pipe insert) on the installed supports. Provide alignment guides on each side of expansion devices and at intermediate points to maintain pipe alignment as recommended by alignment guide manufacturer. Provide pipe anchors at the end of runs to ensure pipe expansion into expansion devices.

3.03 INSTALLATION OF DUCT HANGERS AND SUPPORTS

A. General: Provide anchors and supports for all ductwork. Supports and hangers shall comply with SMACNA-DCS, except that hanger spacing and hanger maximum loads shall be governed by whichever is more restrictive between these specifications or SMACNA-DCS.

B. Hanger Spacing -- Rectangular Duct:

Duct Area	Maximum Spacing
Up to 4 Square Feet	8 Feet
4.1 to 10 Square Feet	6 Feet
10 Square Feet and Up	4 Feet

C. Hanger Spacing -- Round Duct:

Duct Area	Maximum Spacing
Up to 24 Inch Diameter	8 Feet
25 Inch to 48 Inch Diameter	6 Feet
49 Inch Diameter and Up	4 Feet

D. Hanger Spacing - Flexible Duct: 4 feet, and at changes of direction as needed to maintain duct elevation and smooth airflow.

E. Vertical Ducts: Support at each floor level, but in no case less than on 12 foot intervals.

F. Flexible Duct: Support with methods shown in ADC. Metal strap in contact with the flexible duct shall have minimum 1.5-inch width.

G. Fittings: Provide supports at each change in direction of duct for ducts with 4 square foot area or more, or for ducts larger than 24 inch diameter. Locate hangers at inside and outside corners of elbows–or at each end of fitting on each side.

H. Concentrated Loads: Provide additional supports at each side concentrated loads such as modulating dampers (24" x 24" and larger), duct heaters (18" x 18" and larger), sound attenuators (all sizes), and similar items.

I. End of Duct: At end of duct run, hangar shall be located no more than 1/2 the allowed hangar spacing from the end of the run.

3.04 CEILING SERVICES

A. Less than 20 Pounds: Ceiling mounted services, air inlets/outlets, and accessories weighing less than 20 pounds shall be positively attached to the ceiling suspension main runners (or ceiling support members) or to cross runners with the same carrying capacity as the main runners (or support members).

B. 20 to 56 Pounds: Ceiling mounted services, air inlets/outlets, and accessories weighing 20 pounds but not more than 56 pounds, in addition to the above, shall have two No. 12 gauge wire hangers (or minimum 1” x 22 gauge hangar straps) connected from the terminal or service to the ceiling system hangers or to the structure above. These added hangers may be slack.

C. Greater Than 56 Pounds: Ceiling mounted services, air inlets/outlets, and accessories weighing more than 56 pounds shall be supported directly from the building structure by approved hangers.

3.05 MECHANICAL EQUIPMENT ANCHORS AND SUPPORTS

A. General: Provide anchoring and supports for all mechanical equipment. All equipment shall be anchored to (or supported from) the building structure. In lieu of anchoring to the building, anchor outdoor equipment to the concrete pad serving the equipment.

B. Suspended Equipment: Support as indicated on the plans. Where not indicated use the methods shown (or consistent with) Mason SRG and SMACNA-DCS; submit shop drawings of the proposed methods to the Engineer for review.

C. Roof Mounted Equipment: Install on roof curbs or roof sleepers as indicated. Anchor equipment to the curb (or sleeper), with the curb (or sleeper) in turn anchored to the building structure.

D. Vibration Isolation: Equipment shall be supported and anchored in such a way so that no equipment vibration is transmitted to the building structure.

E. Seismic: Coordinate with requirements of Section 20 05 48; provide anchors and bracing to resist seismic forces.

END OF SECTION

SECTION 20 05 30
SLEEVES AND SEALS FOR MECHANICAL

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.

B. Requirements of Section 20 05 00 apply to this Section.

1.02 WORK INCLUDED

A. Pipe Sleeves.

B. Duct Sleeves.

C. Duct Closure Collars.

D. Firestop Seals.

E. Non-Firestop Seals.

1.03 DEFINITIONS

A. Firestop System: Specific firestop materials or combination of materials installed in a specific way in openings in a specific rated assembly to restore (or maintain) the fire rating and smoke passage resistance properties of the assembly.

B. Firestop Seal: Same as “Firestop System”.

C. Rated Assembly: Wall, floor, roof, ceiling, roof/ceiling or other construction which is required (by code or the Contract Documents) to have a fire-resistance rating, be a smoke barrier, or to limit the passage of smoke.

1.04 SUBMITTALS

A. General: Shall comply with Section 20 05 00.

B. Product Data: Provide product data on all material to be use. Provide MSDS for all sealants, caulks and similar materials.

C. Shop Drawings – General: Shop drawings of proposed sealing/flashing assembly for roof and exterior wall penetrations.

D. Shop Drawings – Firestop: Provide firestop system shop drawings showing:

1. Listing agency’s detailed drawing showing opening, penetrating items, and firestop materials. Drawing shall be identified with listing agency’s name and number or designation, fire rating achieved, and date of listing for each firestop system.

2. Identify where each firestop system is to be used on the project.

3. Manufacturer's installation instructions.

4. For proposed systems that do not conform strictly to the listing, submit listing agency's drawing marked to show modifications and stamped approval by the firestop system manufacturer's fire protection engineer.

5. Other data as required by the AHJ.

1.05 **REFERENCES**

A. ASTM A 36: Standard Specification for Carbon Structural Steel.

B. ASTM C534: Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.

C. ASTM E 84: Standard Test Method for Surface Burning Characteristics of Building Materials.

D. ASTM E 814: Standard Test Method for Fire Tests of Through-Penetration Fire Stops.

E. UL 1479: Standard for Fire Tests of Through-Penetration Firestops.

F. UL 723: Surface Burning Characteristics of Building Materials.

G. SMACNA-DCS: SMACNA HVAC Duct Construction Standards, 3rd Edition.

H. SMACNA-ARCH: SMACNA Architectural Sheet Metal Manual, 7th Edition.

1.06 **GENERAL REQUIREMENTS**

A. Corrosion Protection: All sleeves exposed to water, moisture, chemicals, or subject to corrosion shall be constructed of corrosion resistant materials suitable for the exposure. Steel sleeves shall be hot dip galvanized after assembly. Provide additional coatings as noted or as required to resist corrosion.

PART 2 - PRODUCTS

2.01 **ACCEPTABLE MANUFACTURERS**

A. Products shall comply with Section 20 05 00, Paragraph 2.01, Acceptable Manufacturers.

B. Firestop Seal Materials: 3M, Dow Corning.

C. Non-Firestop Seal Materials: 3M, GE, Dow Corning, Tremco, Pecora, Sonneborn, Pipeline Seal & Insulator.

2.02 **PIPE SLEEVES**

A. Diameter:

1. Belowground: Inside diameter of belowground pipe sleeves shall be at least 2 inch larger than the outside diameter of the pipe or pipe covering (for covered piping systems), so as to allow free movement of piping.

2. Aboveground: Inside diameter of aboveground pipe sleeves shall be at least 1-inch larger than the outside diameter of the pipe or pipe covering (for covered piping systems), so as to allow free movement of piping.

3. Large Movement: Provide larger sleeves where a larger space around pipe exterior is required by code, where specifically noted, where pipe movement will occur (i.e. expansion/contraction or seismic), at expansive soils, other unusual conditions are present, and where required to accommodate large piping movement.

B. Length: Horizontal sleeves through finished areas (where sleeve is exposed to view) shall be sized to be flush with finished surfaces; other horizontal sleeves may terminate flush to 2-inches past the element being penetrated. Vertical sleeves shall be sized to extend one inch above the final floor elevation.

C. Structural Type: Fabricated from schedule 40 steel pipe. Waterstop shall consist of fully welded 2-inch larger diameter collar, minimum 1/4 inch thick steel, located on sleeve so as to be centered within the element being penetrated. Provide waterstop on sleeves where sleeves are installed in the following locations: in cast-in-place concrete, where any part of the sleeve ends are exposed to water, where installed in floors with water-proofing or water stopping membranes, in rooms with floor drains, and where needed for anchoring/support purposes. Prime paint all surfaces with rust-inhibiting paint.

D. Flexible Type: Flexible cellular elastomeric insulation, complying with ASTM C 534, Type 1, minimum 1/2-inch thick. Water vapor permeance shall not exceed 0.08 perms. Operating Temperature Limits -20 degrees F to 180 degrees F. Provide in sheet or pre-fabricated pipe size; provide multiple wraps as required.

2.03 DUCT SLEEVES

A. Size: Inside dimension of duct sleeves shall be at least 1-inch larger than the outside dimension of the duct or duct covering (for covered duct systems). For duct system conveying air or gases operating above 200 deg F provide sleeve dimension minimum 2-inch larger than duct or duct covering (for covered duct systems). Provide larger sleeves where a larger space around duct exterior is required by code, by duct or flue system manufacturer, to provide required thermal clearances, where specifically noted, where unusual conditions are present and where required to accommodate large movement.

B. Length: Horizontal sleeves through finished areas (where sleeve is exposed to view) shall be sized to be flush with finished surfaces; other horizontal sleeves may terminate flush to 2-inches past the element being penetrated. Vertical sleeves shall be sized to extend one inch above the finished floor.

C. Structural Type: Fabricated from schedule 40 steel pipe for round openings and 3" x 3" x 3/8" welded steel angles for other openings (unless noted otherwise). Prime paint all surfaces with rust-inhibiting paint.

D. Flexible Type: Flexible cellular elastomeric insulation, complying with ASTM C 534, Type 1. Water vapor permeance shall not exceed 0.08 perms. Operating Temperature Limits -20 degrees F to 180 degrees F. provide in sheet or pre-fabricated pipe size.

2.04 DUCT CLOSURE COLLARS

A. General: Closure collars shall provide closure of opening between duct and opening in element penetrated and shall abut tight up to and overlap duct and shall consist of rolled angle material (for round ducts) and welded framed angles (for rectangular and round ducts).

B. Size: Closure collars shall be sized to match duct and opening applied to and shall have minimum 2-inch overlap on duct side and 2-inch overlap at opening/penetrated element side but shall completely cover opening in element penetrated with minimum 1-inch overlap to undisturbed element (i.e. wall, floor, etc.).

C. Material: Closure collars shall be fabricated of 20 gauge galvanized steel for ducts 15 inches diameter and less and shall be fabricated of 18 gauge galvanized steel duct for all larger ducts and all square and rectangular ducts.

2.05 FIRESTOP SEALS

A. General: Commercially manufactured through-penetration and membrane-penetration firestop systems to prevent the passage of fire, smoke and gases, and to restore the original fire-resistance rating of the barrier penetrated.

B. Listing: Firestopping shall be listed by UL in “Fire Resistance Directory” (category to match the application), or be qualified by another independent agency acceptable to the AHJ.

C. Rating: Firestop system and devices shall be tested in accordance with ASTM E 814 or UL 1479, with “F” and “T" ratings as required to maintain the fire-resistance rating of the barrier penetrated, and as required by code.

D. Fire Hazard: Materials shall have a flame spread of 25 or less, and a smoke development rating of 50 or less; when tested in accordance with ASTM E 84 or UL 723.

E. Cabling Applications: Firestop systems used with loose electrical cabling shall be the type that allows for removal of the cable or installation of new cables without damage to the firestop system, or the need to replace or repair firestop materials.

F. Insulation: Firestop system shall be applicable to insulated systems to allow the insulation to run continuous through the firestop system (unless noted otherwise).

2.06 NON-FIRESTOP SEALS

A. Indoor Sealants:

1. Smoke or Sound Sealant Applications: For use where a firestop seal is not required, but smoke or sound seal is required. Single component, elastomeric or acrylic latex type sealant with STC ratings per ASTM E90. Sealants shall be of the following types, or approved equal:

    a. 3M “Smoke and Sound Sealant SS100”.

    b. Tremco “Tremstop”.

2. Other Areas - Dry (Not Normally Exposed to Water/Moisture): Single component, latex sealant complying with requirements of ASTM C834. Sealants shall be of the following types, or approved equal:

    a. Tremco Corporation “Tremflex 834”.

    b. Pecora Corporation “AC-20 Arylic Latex”.

    c. Sonneborn Building Products “Sonolac”.

3. Other Areas - Wet (Exposed to Water/Moisture): Single component, mildew resistant silicone sealant complying with requirements of ASTM C920, Type S, Grade NS, Class 25. Color white. Sealants shall be of the following types, or approved equal:

    a. Dow Corning “786 Mildew Resistant Silicone”.

    b. Pecora Corporation “898 Silicone Sanitary Sealant”.

    c. Tremco “Tremsil 200”.

B. Outdoor Sealants:

1. General: Single component, non-sag, low modulus, silicone elastomeric sealant conforming to requirements of ASTM C920, Type S, Grade NS, Class 100/50. Sealant shall be of the following types, or approved equal.

    a. Dow Corning “790 Silicone Building Sealant”.

    b. Pecora Corporation “890 Silicone”.

    c. Tremco “Spectrem 1”.

2. Adjacent to Aluminum: Single component, non-sag, medium modulus, silicone elastomeric sealant conforming to requirements of ASTM C920, Type S, Grade NS, Class 50. Sealant shall be primer-less type for use in joints adjacent to fluoropolymer coatings. Sealants shall be of the following types, or approved equal:

    a. Dow Corning “795 Silicone Building Sealant”.

    b. GE Silicones, Momentive, SCS2000 and SCS7000.

    c. Pecora “895 Silicone”.

    d. Tremco “Spectrem 2”.

C. Expanding Foam Sealant:

1. General: Single component, polyurethane insulating sealant with flame spread index of 25 or less and smoke development rating of 50 or less. Shall expand and fully cure within 24 hours to a semi-rigid, closed cell, water and air resistant foam. Sealant shall be of the following types, or approved equal.

    a. DAP “Kwik Foam”.

    b. Fomo Products “Handi-Foam”.

    c. Todol Products “EZ Flo Gun Foam”.

D. Full Water Immersion Sealant: Polysulfide or Polyurethane; ASTM C920, M or Type S, Grade NS, Class 25, uses M and A; approved by manufacturer for “continuous water immersion”, single or multi-component.

1. Tremco “Vulkem 116”.

2. Sonneborn “Sonalastic Polysulphide Sealant”.

E. Link Seal: Seals shall consist of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe and wall opening. The seal assembly shall expand when mechanically tightened to provide an absolute water-tight seal between the pipe and wall opening. Sizing shall be per manufacturer's recommendations. Seal shall be Pipeline Seal and Insulator, "Link-Seal" (or approved).

F. Specialty: Packed fiberglass or wool insulation; with silicone sealant rated for use with temperatures and other conditions encountered.

G. Grout: ASTM C 1107, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout. Nonshrink; recommended for interior and exterior applications. Design mix shall provide 5000-psi, 28-day compressive strength. Premixed and factory packaged.

PART 3 - EXECUTION

3.01 **PIPE SLEEVES**

A. General: Provide sleeves for all piping passing through walls, floors, partitions, roofs, foundations, footings, grade beams, and similar elements. Except that sleeves are not required at core drilled penetrations through solid concrete or where formed openings equivalent to a core drilled opening are provided. Sleeves shall be the following type (horizontal/vertical refer to position of sleeve):

1. Horizontal, Belowground: Structural Tripod.

2. Horizontal, Aboveground:

a. Concrete and Masonry Walls: Structural type.

b. Other Walls: No sleeve required unless needed as part of the seal system or specifically noted to be provided (i.e. for acoustic, thermal, seal retention, or other purposes). Provide clearances around pipe same as sleeve would provide (see specified sleeve size).

3. Vertical, Slab on Grade: Structural type; except at piping serving individual fixtures or individual heating units in finished areas, the flexible type may be used. Where not installed to be concealed (as in a plumbing chase) install height of flexible type so it is concealed by the floor finish, cabinet base, or an escutcheon.

4. Vertical, Not Slab on Grade:

a. Concrete Floors/Roofs: Structural type.

b. Other Floors/Roof: No sleeve required unless needed as part of the seal system or specifically noted to be provided (i.e. for acoustic, thermal, seal retention, or other purposes). Provide clearances around pipe same as a sleeve would provide (see specified sleeve size).

B. Installation: Set sleeves plumb or level (or sloped as required for sloped pipes) in proper position, tightly fitted into the work. Set sleeves properly in element for specified projection past adjacent surfaces (see sleeve product specification); cut ends of sleeve as necessary.

C. Insulation: Insulation shall run continuous through sleeves (unless noted otherwise).

3.02 **DUCT SLEEVES**

A. General: Provide sleeves for all ducts passing through walls, floors, partitions, roofs, foundations, footings, grade beams, and similar elements, except that sleeves are not required at core drilled penetrations through solid concrete or where formed openings equivalent to a core drill and provided and where no floor drain serves the room where the penetration occurs. Sleeves shall be the following type aboveground:

1. Horizontal, Aboveground:

a. Concrete and Masonry Walls: Structural type.

b. Other Walls: No sleeve required unless needed as part of the seal system or specifically noted to be provided (i.e. for acoustic, thermal, seal retention, or other purposes). Provide clearances around pipe same as sleeve would provide (see specified sleeve size).

3. Vertical, Other than Slab on Grade:

a. Concrete Floors/Roofs: Structural type.

b. Other Floors/Roof: No sleeve required unless needed as part of the seal system or specifically noted to be provided (i.e. for acoustic, thermal, seal retention, or other purposes). Provide clearances around pipe same as a sleeve would provide (see specified sleeve size

B. Installation: Set sleeves plumb or level (or sloped as required for sloped duct) in proper position, tightly fitted into the work. Set sleeves properly in element for specified projection past adjacent surface (see sleeve product specification); cut ends of sleeve as necessary.

C. Insulation: Insulation shall run continuous through sleeves (unless noted otherwise).

3.03 DUCT CLOSURE COLLARS

A. General: Closure collars shall be provided for all exposed ducts on each exposed penetration where the duct passes through any floors, walls, ceilings, roofs, partitions, and similar elements. Closure collars shall additionally be provided where so noted on the drawings and at all duct penetrations into mechanical rooms, boiler rooms, and rooms housing mechanical equipment (on both sides of the penetration).

B. Installation: Collar shall be installed tight against surfaces and shall fit snugly around the duct or duct covering. Sharp edges of the collar around insulated duct shall be ground smooth to preclude tearing or puncturing the insulation covering or vapor barrier of insulated ducts. Collars shall be anchored to element penetrated, with fasteners appropriate to material fastening to, on maximum 6 inch centers.

3.04 FIRESTOP SEALS

A. General: At each through-penetration and membrane-penetration in rated assemblies, where required to limit the passage of smoke, and as required by code or in the Contract Documents, provide a firestop system. Firestop system shall be installed in accordance with the manufacturer's instructions and listing.

B System Selection: Contractor is responsible to select the firestop systems to be utilized, corresponding to the construction of the assembly penetrated, and types of penetrations. Contractor shall submit proposed firestop systems to be utilized, shall also review such systems with the AHJ and obtain AHJ approval.

C. Preparation: Prepare surfaces as recommended by firestop material manufacturer. Examine and confirm that conditions are acceptable to proceed with the installation. Provide maskings and temporary coverings to prevent contamination or defacement of adjacent surfaces.

D. Installation Review:

1. Notify Architect/Engineer when firestopping work is complete and ready for review. Provide minimum 7 days notice to allow scheduling of review. An independent testing agency may be utilized to perform an inspection.

2. Notify AHJ when firestopping work is complete and ready for inspection. Provide sufficient advance notice to allow scheduling of the inspection without adversely impacting project schedule.

3. Do not cover or conceal firestopping until all inspections have been satisfactorily completed.

3.05 NON-FIRESTOP SEALS

A. General: Provide seals around all ducts, conduit, and piping passing through sleeves, walls, floors, roofs, foundations, footings, partitions, and similar elements. Seals shall be watertight where the penetration may be exposed to water or moisture. Provide type of sealant to suit the application. Provide smoke and sound type at all penetrations of rooms which contain mechanical equipment on both side of element penetrated to a depth of 5/8-inch (unless noted otherwise).

B. At Sleeves:

1. Between Sleeve and Penetrated Element: Fill openings around outside of pipe sleeve with same material as surrounding construction, or with material of equivalent fire and smoke rating and properties that allow a tight seal between the sleeve and the surrounding construction. Seal full depth of sleeve for vertical penetrations.

2. Between Pipe and Inside of Sleeve: Provide sealant between outside of pipe or pipe covering (for covered piping systems) and inside of sleeve. Seal depth shall be minimum 1-inch each side. Provide Link Seal type for belowground penetrations, vault wall penetrations, and slab-on-grade penetrations (not required where flexible type sleeves are used).

C. No Sleeves: Provide “Link-Seal” type for belowground penetrations, vault wall penetrations, and slab-on-grade penetrations. Provide sealant at other areas, type to suit the application. Fully seal between outside of pipe or pipe covering (for covered piping systems) and surrounding construction. Seal depth shall be minimum 1-inch each side.

D. Plumbing Fixtures: Provide sealant between fixture and abutting building surfaces. Seal so no water or overspray from fixture can enter building construction. See Section 22 40 00.

E. High Temperature Systems: On piping systems operating above 200 deg F, use “Specialty” seal; pack full depth of penetration with silicon type sealant applied 1/2-inch depth over packing, each end.

F. Preparation: Remove loose materials and foreign matter impairing adhesion of seal. Perform preparation in accordance with recognized standards and sealant manufacturers recommendations. Protect elements surrounding area of work from damage or disfiguration due.

G. Installation: Install sealants immediately after joint preparation. Install sealants free of air pockets, foreign embedded matter, ridges, and sags. Tool exposed joint surface concave and with a neat finished appearance.

END OF SECTION

SECTION 20 05 48
VIBRATION AND SEISMIC CONTROL FOR MECHANICAL

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.

B. Requirements of Section 20 05 00 apply to this Section.

1.02 WORK INCLUDED

A. Vibration Isolation.

B. Seismic Restraints.

1.03 DEFINITIONS

A. "Equipment" is defined to mean any item with power connections (fans, HV units, AHU units, etc.), and also to include all hoods; but does not include pumps less than 3 hp.

B. "Equipment Requiring Vibration Isolation" is defined to be any equipment (as defined above) with rotating components (e.g. pumps, fans, etc.).

1.04 SUBMITTALS

A. General: Submittals shall comply with Section 20 05 00.

B. Product Data:

1. Submit product data on all items to be used.

2. Submit calculations showing vibration isolation selection for all isolation devices provided under this specification section (i.e. where isolation is not furnished integral with the equipment or by the manufacturer of the equipment).

C. Shop Drawings: Submit shop drawings for all fabricated support assemblies.

D. Submit calculations showing seismic restraint calculations, restraint selection, proposed locations of all seismic control bracing, and details of bracing construction.

1.05 GENERAL REQUIREMENTS - VIBRATION ISOLATION

A. General:

1. Select and provide all vibration isolation devices for all equipment requiring vibration isolation so as to provide complete installed mechanical systems free of the transmission of vibration and vibration generated noise to the structure.

2. Vibration isolation is shown on the drawings for various items but is not shown for all items requiring isolation. Provide all isolation as indicated and specified herein.

B. Supplier: Where not provided by the equipment manufacturer, all vibration isolation devices and support assemblies shall be supplied as a coordinated package by a single vibration isolation manufacturer, under this specification section.

C. Equipment Manufacturer Items: Isolation devices furnished by equipment manufacturer shall comply with this specification section and be selected by the manufacturer to suit, and provide satisfactory performance, for the applications of this project.

1.06 GENERAL REQUIREMENTS - SEISMIC RESTRAINTS

A. General: Mechanical equipment, piping, and ductwork seismic restraints are typically not shown on the drawings but are to be provided as specified herein. Contractor is responsible to select and provide all seismic anchoring devices for all mechanical equipment, all piping, and all ductwork.

1.07 REFERENCES

A. IBC: International Building Code.

B. IMC: International Mechanical Code.

C. MASON: Mason Industries Seismic Restraint Guidelines for suspended piping, Ductwork, Electrical Systems and Floor Mounted Equipment, 2005 6th Edition.

D. OSHPD: Office of Statewide Health Planning and Development, State of California, Fixed Anchorage.

E. SMACNA/SRM: Seismic Restraint Manual Guidelines for Mechanical Systems, 2nd Edition.

F. UPC: Uniform Plumbing Code.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Products shall comply with Section 20 05 00, Paragraph 2.01, Acceptable Manufacturers.

B. Products: Mason, Peabody, Kinetics Noise Control, Vibration Eliminators, VMC Group.

C. Expansion Devices/Flexible Connectors: Unisource Manufacturing, Twin City Hose, and as specified in Section 20 05 19, 23 21 13, and 23 33 00.

2.02 NEOPRENE ISOLATORS

A. Suspension Isolators: Double deflection neoprene type, with isolator encased in open steel bracket, and sized for minimum 0.30-inch deflection. Hanger rod shall be isolated from steel bracket with neoprene grommets. Mason Series HD (or approved).

B. Washer Bushings: Bridge bearing neoprene washer insert to provide isolation between anchor bolt and washer from support member/equipment. Mason Series HG (or approved).

2.03 SPRING ISOLATORS

A. General: The load carried by each isolator shall be carefully calculated and isolators selected so that the static deflection will be the same and the supported equipment will remain level. Isolators shall be so designed that the ends of the springs will remain parallel during and after deflection to operating height. At operating height, springs shall have additional travel to complete (solid) compression equal to at least 50 percent of the operating deflection. Suspension isolator springs shall have a static deflection not less than 1-inch (unless noted otherwise), except that for units with components rotating at 1000 rpm and less, the static deflection shall be not less than 2-inches (unless noted otherwise). Floor isolator springs shall have deflection of not less than 1-inch. All isolators shall provide at least 95% isolation efficiency. Deflections other than these may be used where circumstances warrant and more optimum isolation results can be achieved; provided that a written explanation is submitted for Engineer review and approval.

B. Suspension Type Spring Isolators: Shall consist of a rigid steel frame with a stable steel spring in the bottom part of the frame, and double deflection neoprene (or rubber) isolating pad at the top of the frame. Where supporting rods pass through the frame, a clearance of not less than one-half rod diameter shall be provided all around the rod and neoprene bushings provided to prevent steel to steel contact. Mason Series DNHS or Series 30N (or approved).

2.04 SEISMIC RESTRAINTS

A. General: Comply with code, SMACNA-SRM and MASON.

B. Materials:

1. Steel shall be per ASTM A36; hangers and other devices shall be per Section 20 05 29 and as shown in SMACNA-SRM or MASON. Sheet metal used for bracing shall be no less than 16 gauge. Material for straps shall be galvanized steel, no less than 18 gauge.

2. Cabling: Cables shall be minimum 1/8" diameter, 7 x 19 strand, galvanized steel with clear vinyl coating. Provide with galvanized thimble, clamps, and accessories. End termination and clamping/application shall comply with SMACNA-SRM.

PART 3 - EXECUTION

3.01 VIBRATION ISOLATION

A. General: Provide vibration isolators for all rotating equipment so that no vibration is transmitted to the structure. Isolators shall be the type indicated; except where not shown, type shall be as selected by vibration isolation manufacturer (or equipment manufacturer) to provide adequate isolation.

B. Installation: Install all vibration isolators in accordance with isolator manufacturer's instructions and isolated equipment manufacturer's recommendations.

C. Inadequate Isolation: Should vibration isolators prove inadequate to prevent transmission of vibrations to the building structure or limit equipment vibration generated noise, such isolators shall be replaced with isolators having the largest deflection that can be practically installed or otherwise modified/replaced to produce satisfactory isolation. Such replacement shall be at no additional cost to the Owner.

D. Equipment with Rotating Components not Requiring Isolation:

1. Split system ductless air conditioning and heat pump units; indoor portion.

2. Grade mounted condensers.

3.02 SEISMIC RESTRAINTS

A. General: Provide seismic restraints as required by code and as specified. Comply with SMACNA-SRM, and MASON. Anchoring system and restraints shall be able to withstand anticipated seismic forces. Coordinate with equipment manufacturers for proper equipment anchor attachments to withstand anticipated forces. Coordinate with project structural engineer for attachment of seismic restraints to building.

B. Piping: Longitudinal and transverse bracing shall be required for all piping 2-1/2-inch diameter and larger. Bracing shall be applied as follows:

1. Transverse bracing shall occur at maximum intervals of 40 feet, except on fuel gas piping on maximum intervals of 20 feet.

2. Longitudinal bracing shall occur at maximum intervals of 80 feet, except on fuel gas piping on maximum intervals of 40 feet. Transverse bracing for one pipe section may also act as a longitudinal bracing for a pipe section connected perpendicular to it, if the bracing is installed within 2 feet of the elbow or tee of similar size. Piping conveying fluids at 100 degrees F and higher shall have expansion devices provided in-between longitudinal braces to allow for thermal expansion.

3. Bracing may be omitted when the top of the pipe is suspended 12 inches or less from the supporting structural member and the pipe is suspended by an individual hanger.

C. Equipment:

1. Equipment Not Requiring External Vibration Isolation:

a. General: Shall be rigidly connected to the structure per Section 20 05 29. Restraints (where required) shall utilize welded steel frames, steel braces, straps, or cables. Provide elastomeric (or neoprene) pads (1/4" thick) between seismic straps and equipment.

b. Base Mounted Equipment:

1) Provide anchorage per Section 20 05 29 and bracing as needed to maintain equipment anchorage with anticipated seismic forces.

2) All equipment shall have seismic bracing where the height of the equipment is 3 or more times the smallest base dimension and where the equipment anchorage alone is not adequate to maintain equipment anchorage with anticipated seismic forces.

3) All water heaters shall have seismic bracing. Equipment which utilizes (or contains) flammables, combustibles, or hazardous materials shall have seismic bracing where the equipment anchorage alone is not adequate to resist anticipated seismic forces.

c. Other Equipment: All equipment located 31" or more from the point of attachment to the supporting structure shall have seismic bracing.

Equipment which utilizes (or contains) flammables, combustibles, or hazardous materials shall have seismic bracing.

2. Equipment with External Vibration Isolation:

a. General: Restraints shall not impede operation of vibration isolators, and shall use methods complying with SMACNA-SRM or MASON.

b. Other Equipment:

1) All equipment located 31" or more from the supporting structure shall have seismic bracing. Equipment which utilizes (or contains) flammables, combustibles, or hazardous materials shall have shall have seismic bracing.

2) Utilize slacked cable bracing to accommodate equipment movement due to vibration isolator operation but installed so as to prevent more than 2-inch movement in any direction.

D. Bracing Arrangements:

1. Do not use branch ducts or piping to brace main runs or consider as braces for equipment.

2. Do not brace items to dissimilar parts of a building or dissimilar building systems that may respond in a different mode during an earthquake. (Examples: wall and roof, solid concrete wall and lightweight roof, existing building structure and new isolated building structure.)

3.03 TEST AND INSPECTION

A. Field Inspections: Prior to initial operation, the vibration isolators and seismic devices shall be inspected for conformance to drawings, specifications, and manufacturer's data and instructions. Check all flexible connectors/expansion devices for proper location, guiding, and end anchoring.

B. Vibration Isolator Inspection: After installation of isolators and seismic restraint devices, remove all shipping blocks and other items that may prevent proper isolator operation. Inspect isolators to verify that the machinery moves freely on its spring isolators within limits of stops or seismic restraint devices. Eliminate or correct interferences.

C. Tests: Check for vibration and noise transmission through connections, piping, ductwork, foundations, and walls. Adjust, repair, or replace isolators as required to reduce vibration and noise transmissions to specified levels. Re-balance, adjust, or replace machinery with noise or vibration levels in excess of those given in the machinery specifications or machinery manufacturer's data. Check for proper operation of expansion devices and associated items during system warm-up.

END OF SECTION

SECTION 20 05 90
UNDERGROUND UTILITIES EVACUTATION AND FILL FOR MECHANICAL

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.

B. Requirements of Section 20 05 00 apply to this Section.

1.02 WORK INCLUDED

A. Excavation.

B. Trenching.

C. Shoring and Trench Protection.

D. Bedding.

E. Backfilling.

F. Compaction.

G. Verification of Existing Utilities.

H. Protection of Utilities.

I. Dewatering.

J. Identification Warning Tape.

1.03 DEFINITIONS

A. “Utility Bedding” is defined to mean “material placed beneath the utility for utility support, and material placed adjacent to the utility to the centerline of the utility.”

B. “Utility Zone Backfill” is defined to mean “backfill material that is placed in the area from the centerline of the utility up to the specified height above the top of the utility, and is located above the utility bedding and below the final backfill material.”

C. “Trench Backfill” is defined to mean “backfill material that is placed above the utility zone backfill, and up to rough or finished grade.”

D. “Unstable Material” is defined to mean “material that depresses more than 1/4-inch under a load of 2000 pound/square foot, is not firm and stable, or in any way appears incapable of supporting the loads to be imposed.”

1.04 QUALITY ASSURANCE

A. Inspection of Job Conditions: Prior to starting work and during work, the installer shall examine the work by others, site and job conditions under which excavation, trenching, and backfilling for underground mechanical utilities work will be performed, and not proceed with work until unsatisfactory conditions have been corrected.

B. Codes and Standards: Comply with all applicable codes and standards. Grading of materials shall be done in accordance with ASTM C136 or WSDOT Standards (unless noted otherwise).

C. Experience: Only contractors fully experienced and entirely knowledgeable in the type of work required shall work on this project. By providing bids for this project the Contractor is acknowledging that he has such expertise, and will staff the project with personnel experienced and knowledgeable in the work to be performed.

1.05 **GENERAL REQUIREMENTS**

A. Safety: Contractor is solely responsible for worker safety and for selecting and designing all trench shoring methods, trench protection methods, site utility protection means and other aspects of the work. All such means, methods, and safety measures shall comply with applicable codes and standards, and the requirements of the Contract Documents.

B. Coordination: Coordinate all work with other trades. Coordinate with other Divisions the location and termination of all work of other trades and interconnections with Division 20 work.

C. Scheduling: Schedule work to avoid impacts to other trades due to open trenches, dewatering, and other activities.

D. Discrepancies: Notify the Architect/Engineer of any discrepancies or conflicts within the Contract Documents or between the Contract Documents and field conditions. Do not proceed with any work or purchasing of any materials for the area(s) of conflict until obtaining written instruction from the Architect/Engineer on how to proceed. Any work done after discovery of such discrepancies or conflicts and prior to obtaining the Architect/Engineer's instructions on how to proceed, shall be done at the Contractor's expense. In case of a conflict between Division 20 requirements and other project requirements, the most stringent and expensive (as judged by the Architect/Engineer) shall prevail.

1.06 **REFERENCES**

A. ASTM C136: Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.

B. ASTM D1557: Laboratory Compaction Characteristics of Soil Using Modified Effort.

C. ASTM D2419: Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate.

D. ASTM D2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System).

E. WSDOT Standard Specifications: Washington State Department of Transportation, Specifications for Road, Bridge, and Municipal Construction.

PART 2 - MATERIALS

2.01 GENERAL MATERIALS

A. General: All materials used for bedding, backfill, and drainage purposes shall be free of debris, roots, wood, vegetation, refuse, soft unsound material, frozen material, deleterious or other objectionable material.

B. Sand: Clean, free flowing, coarse grade sand, with sand equivalent per ASTM D2419 of 25 (minimum), and meeting the following for grading:

Sieve Size	Percent Passing (By Weight)
3/8" Square	100
U.S. No. 4	90-100
U.S. No. 50	10-40
U.S. No. 100	3-15
U.S. No. 200	0-7

C. Pea Gravel: 3/8-inch washed pea gravel; durable particles composed of small, smooth, rounded stones or pebbles meeting the following for grading and quality:

Sieve Size	Percent Passing (By Weight)
1/2" square	100
3/8" Square	85-100
5/8" Square	50-100
U.S. No. 4	10-30
U.S. No. 8	0-10
U.S. No. 16	0-5

2.02 BEDDING MATERIALS

A. Standard: Gravel backfill material, with characteristics of size and shape to allow for compaction, no dimension exceeding 1-1/2 inches, and meeting the following for grading and quality:

Sieve Size	Percent Passing (By Weight)
1-1/2" Square	100
1" Square	75-100
5/8" Square	50-100
U.S. No. 4	20-80
U.S. No. 40	3-24
U.S. No. 200	10.0 max.
Sand Equivalent	35 min.

B. Special: Pea gravel or sand (per paragraph titled “General Materials”).

C. Bedding Material Application:

Utility	Bedding Material	Minimum Thickness*
Cast Iron Piping	Standard (or Special)	4"
Steel Piping/Conduit	Standard (or Special)	4"
Ductile Iron Piping	Sand (or Special)	4"

Plastic Piping/Conduit	Sand	4"**
Copper Piping	Special	4"

* Below bottom of utility (unless noted otherwise).
**Except that HDPE piping shall use sand bedding with minimum 6-inch thickness (unless noted larger elsewhere).
.

2.03 UTILITY ZONE BACKFILL MATERIALS

A. Standard: Same as specified for standard bedding materials.

B. Special: Minus 3/8"-inch washed gravel, or sand.

C. Utility Zone Backfill Material Application:

Utility	Backfill Material	Minimum Thickness***
Cast Iron Piping	Standard (or Special)	4"
Steel Piping/Conduit	Standard (or Special)	4"
Ductile Iron Piping	Standard (or Special)	4"
Plastic Piping/Conduit	Sand	4"****
Copper Piping	Special	4"

*** Above top of utility (unless noted otherwise).
****Except that HDPE piping shall use sand backfill with minimum 6" thickness above utility (unless noted larger elsewhere).

2.04 PIPE TRENCH BACKFILL

A. Standard: Gravel backfill material, with size and shape to allow for compaction, no dimension exceeding 3 inches, and meeting the following:

Sieve Size	Percent Passing (By Weight)
2-1/2" Square	75-100
U.S. No. 4	22-100
U.S. No. 200	0-10
Dust Ratio	2/3 max.
Sand Equivalent	30 min.

B. Satisfactory Native Material: Excavated material from trenching (or other excavation on site), complying with 2.01 A., having no clods or rocks greater than 3 inches in any dimension.

C. Material Application: Either standard or satisfactory native materials may be used (unless noted otherwise).

2.05 GENERAL BACKFILL MATERIALS

A. Utility Foundation Backfill: Class A per WSDOT 2014, 9-03.12 (1) A.

B. Drain Backfills: Gravel backfill for drains shall conform to the following gradings:

Sieve Size	Percent Passing (By Weight)
1" Square	100
3/4" Square	80-100
3/8" Square	10- 40
U.S. No. 4	0-4
U.S. No. 200	0-2

2.06 BURIED UTILITY WARNING AND IDENTIFICATION TAPE

A. General: Polyethylene plastic tape manufactured specifically for warning and identification of buried utility lines. Tape shall be minimum 6" wide, acid and alkali resistant.

B. Detectable Type: Minimum 0.004 inch thick, with integral wire, foil backing, or other means to allow detection of tape location. Encase metallic element in protection jacket or other means to provide corrosion protection.

C. Non-Detectable Type: Minimum 0.003 inch thick.

D. Labeling: Tape shall be imprinted with bold black capital letters continuously and repeatedly over the entire tape length. Warning shall read "CAUTION BURIED (utility type) BELOW" or similar wording. Lettering identifying the utility type shall match as closely as possible the designation noted on the plans. Tape lettering shall be permanent and be unaffected by moisture or other materials contained in trench backfill.

E. Tape Colors:

Utility	Color
Electric	Red
Fire/Water	Blue
Sewer	Green
Storm	Green
Gas	Yellow
Oil	Yellow
Water	Blue
Heating Water	Yellow
Chilled Water	Yellow
Non-Potable Water	Yellow
Reclaimed Water	Purple

PART 3 - EXECUTION

3.01 GENERAL

A. Shoring and Trench Protection: Contractor is responsible to design and provide all necessary trench shoring and trench protection to:

1. Provide safe conditions.

2. Provide conditions that comply with applicable codes and AHJ requirements.

3. Prevent undermining of pavement, foundation, slabs, utilities, and other structures.

4. Prevent movements in adjacent slopes or banks.

B. Workmanship: Work shall abide by best professional practices as described in referenced standards, and as recognized by accredited professionals.

C. Compaction: Provide compaction to percent indicated per ASTM D 1557, of laboratory maximum density. Compact to 95 percent (unless noted otherwise). Compaction shall be accomplished by approved tamping rollers, pneumatic-tired rollers, three-wheel power rollers, or other approved compaction equipment.

D. Grading: Provide grading to prevent surface water from flowing into areas of work to maintain the stability of the work area, and suitable working conditions.

E. Dewatering: Provide dewatering system for the collection and disposal of surface and subsurface water encountered during construction in order to maintain conditions suitable for the work. Provide all pits, drainage conveyances, pumps, dikes, etc. as required to accomplish the work.

F. Underground Utilities: Location of utilities indicated is approximate. Verify the location of all existing utilities prior to beginning work; utilize field electronic detection equipment, pipe cameras, visual site surveys, and careful exploratory digging at key locations. Coordinate with other trades routing and locations of all new utilities to avoid conflicts and ensure proper connections.

G. Machinery and Equipment: Movement of construction machinery and equipment over buried and backfilled pipes during construction shall be at the Contractor's risk. Repair, or remove and provide new pipe for existing or newly installed pipe that has been displaced or damaged. Pressure testing of piping before final Owner acceptance is required to verify no damage has occurred.

H. Protection: Protect all areas of work from traffic, erosion, weather, settlement or other damaging effects. Protect all existing utilities from damage.

I. Jacking, Boring and Tunneling: Unless otherwise indicated, excavation shall be by open cut, except that sections of a trench may be jacked, bored or tunneled if the utility can be safely and properly installed and backfill can be properly tamped in such sections.

J. Buried Warning and Identification Tape: Provide buried utility lines with utility identification tape. Bury tape 12 inches below finished grade. Provide detectable type over non-metallic piping systems. Piping systems installed within the building footprint does not require identification tape.

3.02 EXCAVATION - GENERAL

A. General: Provide all excavation as necessary to allow for the work indicated. Excavations for underground mechanical structures shall be sufficient to provide a minimum of 12 inches clearance between their surfaces and the sides of the excavation.

B. Excavated Material:

1. Stockpiles: Stockpile materials satisfactory for backfilling in an orderly manner at a safe distance from the excavation to avoid overloading the sides of the excavated area and to prevent slides or cave-ins.

2. Protection: Protect stockpiles from contamination with unsuitable backfill materials. Provide adequate drainage at stockpiled areas to prevent water retention in material. If the Contractor fails to protect the stockpiles and any material becomes unsatisfactory as a result, such material shall be removed and replaced with satisfactory on-site or imported material from approved sources at no additional cost to the Owner.

3. Disposal: Excavated material not required or not satisfactory for backfill or other uses on site shall be removed and disposed off site.

3.03 TRENCH EXCAVATION

A. General: Excavate trenches to accommodate utility, required utility slopes, depths of connecting utility, existing and new utilities, required cover depth, and site conditions.

B. Removal of Unsuitable Material:

1. Unstable Material: Where unstable material is encountered in the bottom of the trench, such material shall be removed by over excavation of the trench bottom 4 inches below the depth otherwise required. Contractor is responsible for reviewing the soils report and overall site conditions and, for all costs associated with removal and replacement of unstable materials. For bidding purposes, assume that a minimum of 10% of all excavated bottom utility bearing areas will have unstable material.

2. Rocks and Stones: Stones of 6 inches or greater in any dimension, and any rock or stone of any size/orientation that may disrupt the pipe bedding thickness or pipe supports shall be removed. Rock shall be removed to 4 inches below the bottom of the pipe bearing elevation. Review soils report and Civil drawings notes for special rock conditions that exist.

3. Other: Any wood, refuse, waste, organic material, or other material which would adversely affect pipe support shall be removed. For bidding purposes, assume that 5% of all trench bottom area will have objectionable material as described in this paragraph.

4. Replacement Material: Replace removed unsuitable material with “Utility Foundation Material” as specified under paragraph titled “General Backfill Materials”, or with bedding material specified for the piping to be placed in the trench.

C. Bottom Preparation: Bottoms of trenches shall be accurately graded to provide uniform bearing and support for each section of pipe (or other utility) after bedding placement, and proper slope of piping.

D. Depth: Trench shall be adequate to provide a minimum depth of cover required to meet connecting utilities; but minimum 1 foot of cover (unless indicated otherwise) ***OR*** as follows:

1. Water Lines: 3.5 feet (or deeper if required by the AHJ); except that branch piping to fixtures within the building footprint shall have a minimum of 1 foot of cover.

2. Other: As required to meet connecting utilities; but minimum 1 foot of cover (unless indicated otherwise).

D. Depth: Trench shall be adequate to provide a minimum depth of cover as required to meet connecting utilities; but minimum 1 foot of cover (unless indicated otherwise).

3.04 BEDDING

A. Pipe Bedding: Provide even bedding placement along the entire length of the pipe to support pipe on a uniformly dense unyielding foundation, without load concentration at joint collars or bells. Bedding shall be installed and compacted prior to installing pipe. Bedding located beneath piping shall have minimum thickness specified in Part 2 of specifications, and be compacted to 90% maximum density. Recesses shall be excavated as necessary at each joint or coupling to eliminate point bearing and to allow uniform pipe support by the bedding material the entire pipe length. Haunching shall be installed in maximum 4 inch lifts, hand placed and carefully worked under the pipe haunches and then compacted to 90% maximum density. All adjustment to line and grade shall be made by scraping away or filling in with bedding material under the body of the pipe and not by blocking or wedging. Bedding disturbed by pipe movement, or by removal of shoring movement of a trench shield or box, shall be reconsolidated prior to backfill.

B. Other Utility Bedding: Provide even bedding to allow for full support of the installed item on a uniform dense unyielding foundation. Bedding shall be installed and compacted before installing ducts or underground mechanical structures. Bedding shall have minimum of thickness specified in Part 2 of specifications, and be compacted to 95% maximum density.

3.05 BACKFILLING

A. General: Provide backfill of all trenches and underground mechanical structures to grade. Provide adequate initial backfill to allow proper pressure tests, and inspections by AHJ and Architect/Engineer. Leave joints and couplings uncovered as necessary to discover pipe leaks. Do not conceal underground utilities until AHJ and Architect/Engineer have reviewed utilities.

B. Utility Zone Backfilling: Backfill shall be placed in loose layers and compacted to 90 percent maximum density. Backfill shall be placed in horizontal layers no more than 6-inches thick. Backfill shall be brought up simultaneously on each side of the utility to the top of the utility, and onto the specified height above the utility (see Part 2 of specifications). Backfill and compact in a manner to avoid damaging or disturbing the completed utility.

C. Pipe Trench Backfilling: Backfill above the pipe zone backfill shall be accomplished in such a manner that the pipe will not be shifted out of position nor damaged by impact or overloading. Where pipe is outside the building footprint, backfill shall be placed in horizontal layers no more than 6 inches thick and compacted to 95 percent maximum density. Where pipe is inside the building footprint, backfill shall be placed in horizontal layers no more than 6 inches thick and be compacted to 85 percent maximum density.

D. Other Utility Backfill: Backfill shall be accomplished in such a manner that the utility will not be shifted out of position nor damaged by impact or overloading. Backfill shall be placed in horizontal layers no more than 6 inches thick and be compacted to 95 percent maximum density.

END OF SECTION

SECTION 20 05 93
TESTING, ADJUSTING, BALANCING FOR MECHANICAL

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.

B. Requirements of Section 20 05 00 apply to this Section.

1.02 WORK INCLUDED

A. Air Balancing.

B. Report.

1.03 SUBMITTALS

A. General: Comply with Section 20 05 00.

B. Company: Submit name of Company proposed to do the balancing and sample balancing forms. Where the Company has not been pre-qualified, and substitutions are allowed after bidding (see Division 00 and 01), submit information regarding firm qualifications.

C. Personnel: Submit list of personnel that will be assigned to the project and their qualifications, and list of past projects.

D. Reports: Preliminary and final balancing reports.

1.04 REFERENCES

A. AABC-NS: Associated Air Balance Council, National Standards for Field Measurements and Instrumentation.

B. ASHRAE: Handbook of Fundamentals.

C. ACGIH-IV: American Conference of Governmental Industrial Hygienists, Industrial Ventilation, A Manual of Recommended Practice.

D. NEEB-PS: National Environmental Balancing Bureau Procedural Standard for Testing, Adjusting and Balancing Environmental Systems.

1.05 GENERAL REQUIREMENTS

A. General: Balancing shall be done by a company which specializes in this type of work and is totally independent and separate from the Company which has installed the systems to be balanced.

B. Balancers Qualifications:

1. General: Work of this Section shall be performed by balancing firms meeting the

following and having prior approval from the Engineer:

a. Professional Affiliation: Firm shall be an Associated Air Balance Council (AABC) member balancer or National Environmental Balancing Bureau (NEBB) certified balancer.

b. Experience: Firm shall have satisfactorily completed the balancing work for at least 5 similar projects in the last 3 years. Similar is defined to mean: within 10% of the same quantity of units and air inlets/outlets, involve same type of systems, be the same type of facility (i.e. school, hospital, etc.). The lead field balancer (i.e. the individual who will be on site directing and participating in the balancing efforts) shall have at least 5 years of experience performing balancing work on similar projects.

c. References: Have five references for similar projects which have been completed in the last three years that will give a good or better performance rating. References shall be engineers, architects, or building owners. As part of the qualification process at least three of these references will be contacted and a rating obtained for the following: timeliness of work (i.e. able to complete work on schedule), cooperative nature of balancer's staff (i.e. ability to work well as a team with other project trades and professionals), overall quality of balancing work, quality of balancing report. Each item will be rated on a scale of 1 to 5 (5 being excellent), with the result averaged, score must be of 4 or better.

2. Pre-Qualified Balancers: As a convenience to the Contractor, the following balancing firms have been pre-qualified. This is not in any way intended to limit competition or prevent other firms from submitting qualifications, but is intended as an aid to Contractors by identifying firms that have been confirmed as meeting the qualification requirements.

a. Hardin and Sons

b. Test Comm

d. Advanced Mechanical Services

e. Testing and Commissioning (TAC) Services

f. AccuABC

3. Qualification Process: Firms not pre-qualified who desire to perform the balancing work shall submit a substitution request form in accordance with Contract Document requirements (reference Division 00 and 01). In addition to the information required on the substitution request form, submit: Company information, resumes of staff to be assigned, lists of projects, and references (with name of project, staff assigned to project, and contact name and phone number).

C. Balancing Issues: Notify the Engineer in writing of all problems or discrepancies between actual conditions and what design documents show as work proceeds.

D. Engineer's Authority: The Balancer shall be directly responsible to the Engineer and shall perform this work and make system adjustments as directed by the Engineer.

E. Lead Balancer: The Balancer shall assign an individual as "lead balancer" to work in the field to directly supervise the balancing work and field technicians. This lead field balancer shall

have at least 5 years of experience performing balancing work on similar projects.

G. Added Site Visits:

1. Trade Coordination Purposes: The Balancer shall include in his bid one extra site visit (beyond those otherwise included) and associated added time to assess system readiness for balancing, resolve system issues, coordinate balancing work, and perform other activities related to balancing and commissioning.

2. Engineer Directed: Include in bid one added site visit and 4 hours of field balancing work (each visit), plus report amendment time, to provide added balancing as directed by the Engineer. Such work may occur during the project's construction period or during the warranty period and is solely at the Engineer's discretion.

H. Commissioning: See Division 01 and Section 20 08 00 for commissioning efforts required by the Balancing Contractor.

PART 2 - PRODUCTS

2.01 GENERAL INSTRUMENTATION

A. General: Balancing equipment shall comply with Associated Air Balance Council recommendations for field measurement instrumentation.

B. Calibration: All measuring instruments shall be accurately calibrated and maintained in good working order. Calibration dates and certifications shall be available at Engineer's request.

C. Instruments: Shall be capable of:

1. Air velocity instruments, direct reading in feet per minute with 2% accuracy.

2. Static pressure instruments, direct reading in inches water gauge with 2% accuracy.

3. Tachometers, direct reading in revolutions per minute with 1/2% accuracy; or revolution counter accurate with 2 counts per 1,000.

4. Thermometers, direct reading in degrees Fahrenheit with 1/10 of a degree accuracy.

5. Pressure gauges, direct reading in feet of water or psig with 1/2% accuracy.

PART 3 - EXECUTION

3.01 GENERAL

A. Workmanship: All measurements and adjustments shall be in accordance with AABC-NS, NEEB-PS, and ACGIH-IV and recognized best balancing procedures. Measurements and adjustments of equipment shall be executed in a manner consistent with the manufacturer's recommendations.

B. Flow Rates:

1. General: All air systems shall be completely balanced and adjusted to provide the flow rates indicated (within tolerances indicated in this specification Section), and to

produce an even heating and cooling effect and control response.

2. Balancer Determined: Where flow rates have not been indicated the balancer shall determine such flow rates using acceptable practices in accordance with AABC-NS, NEEB-PS, and ASHRAE standards and submit the proposed flow rates to the Engineer for review.

3. Confirmation: Prior to beginning balancing confirm any flow rate changes since design with the submittals and flow rates indicated therein, and with the Engineer to confirm changes made since design. Assume that new flow rates will be issued.

C. Controls: Consult and coordinate with the Control Contractor for the adjustment and setting of all control devices to allow for the balancing work, and for proper system operation and proper flow rates. Set all controls and valves as required to maintain design flow rates and temperatures as shown on the drawings. Make measurements and provide data to the Control Contractor to allow for proper control of items.

D. Comfort Adjustments: Make final adjustments for flow rates in order to optimize each space's comfort, including such considerations as temperature, drafts, noise, pressurization, and air changes. Where variances are made from design values, state reasons in report (e.g., "too noisy", "too drafty," etc.). All such variances are subject to approval by the Architect/Engineer.

E. Deficiency Reports: Submit deficiency reports where the work does not allow balancing to occur or balancing issues develop. Indicate date, system and equipment involved, location, description of deficiency, and related information to allow for diagnosing the problem. Provide suggestions for resolution where possible.

3.02 AIR BALANCING

A. Pre-check of System: Prior to beginning balancing, perform, as a minimum, the following:

1. Verify that clean filters have been installed, that system is free from debris, and that all inlets/outlets are not obstructed.

2. Check all fans and equipment to verify that proper start-up and system preparation has been done by the installing contractor.

3. Check all door/window and similar building opening status to insure building is ready and proper pressurization can be obtained.

4. Open all dampers to full flow position, check positions and operation of all motorized dampers to allow full system flows.

5. Review controls and sequences of operation.

B. Tolerances: All air flow rates (supply, return, and exhaust) shall be adjusted to within plus 5 percent and minus 5 percent of the values shown in the contract documents, except that relative space-to-space pressure relationships shall always be maintained (e.g., restrooms shall be negative relative to other areas, general offices shall be positive, etc.).

C. Draft and Noise Adjustments: All diffusers, grilles, and registers shall be adjusted to minimize drafts and to eliminate objectionable noise.

D. Filters: Air balancing shall be done with new, clean air filters installed. Adjust air deliveries so that design quantities will be obtained when filters are half dirty. This condition shall be simulated by covering a portion of the filter area.

E. Fan Speeds and Drives:

1. Adjust fan speeds and fan drives (adjustable sheaves) as required to produce design flow rates.

F. Marking: Upon completion of flow readings and adjustments permanently mark the balanced position of all balancing valves by stamping the indicator plate of the valve.

G. Duct Traverse: Rectangular duct traverses shall measure the center of equal areas in the air flow stream, with centers not more than 6 inches apart. Round duct traverses shall measure at least 20 locations, with locations being the centers of equal annular area. Reference ACGIH Industrial Ventilation Manual.

H. One Open Run: Balance each branch run so that there is at least one wide open run; balance branches relative to one another so that at least one branch damper is wide open (except that where unique conditions exist, and the Engineer gives prior approval, one open damper on runs or branches is not required).

I. Data: Data to be measured/recorded and provided in report for all air handling systems and equipment:

1. Floor plans clearly showing and identifying all diffusers, grilles, OA louvers, ducts and all other items where air flow rates were measured.

2. Identify manufacturer, model number, size, and type of all air inlets/outlets.

3. Initial, trial, and final air flow measurements for all diffusers, grilles, OA louvers, ducts, and all other items where air flow rates were measured.

4. Design air flow rates and percentage final air flow rates are of design values.

5. Final damper (or other balance device) final position (as a percentage of full open).

6. The connected voltage and corresponding nameplate full load amps, and the initial and final amperages of all fan motors.

7. Initial and final RPMs of all fans.

8. Static pressures on inlet and outlet of all fans.

9. Fan initial and final CFMs.

10. Outdoor air CFMs (record minimum and maximum values).

11. Entering and leaving air temperatures across coils with coils operating at 100% capacity.

12. Static pressure drop across each filter bank and coil.

13. Final position of any speed controls (as percent of full).

14. In addition to data noted elsewhere, provide the following for all equipment which are part of balanced systems:

a. Equipment name and number (as used on drawings).

b. Service.

c. Equipment manufacturer and model number.

d. Sheave and belt sizes (where applicable).

e. Filters sizes and quantities (where applicable).

f. Motor manufacturer and complete nameplate data.

g. Design operating conditions.

h. Actual operating conditions (flows, pressure drops, rpm, etc.).

3.03 BALANCING REPORT

A. General: A balancing report shall be submitted as specified herein, documenting all balancing procedures and measurements.

B. Report Organization: The report shall be divided into logical sections consistent with the building or system layout (i.e. by floors, building wings, air handling units, or other convenient way). Tabulate data separately for each system. Describe balancing method used for each system.

C. Preliminary Report: Two preliminary review copies of the balancing report shall be submitted to the Architect/Engineer when the balancing work is 90% complete (or as near 90% complete as possible due to uncompleted work of other trades). In addition to containing all the information required of the final report, the preliminary report shall contain a list of all the work required of other trades in order to allow the balancing work to be completed. The Architect/Engineer will review the preliminary report and inform the Contractor of any additional items or revisions required for the final report. Preliminary reports may be omitted where the Architect/Engineer grants approval.

D. Final Report: Shall be included in the Operation and Maintenance Manual. Submit reports to Contractor for inclusion in Manuals (or, when manuals have been already sent to Engineer, send report to Engineer who will insert report into Manual). Provide number of reports as required to match quantity of O&M Manuals, but in no case less than five.

E. Format: 8-1/2" x 11" size, neat, clean copies, drawings accordion folded. Report shall be typed, shall have a title page, table of contents, and divider sheets with identification tabs between sections. Information shall be placed in a three hole notebook, with the front cover labeled with the name of the Job, Owner, Architect/Engineer, Balancing Contractor, and Report Date.

F. Electronic Copy: Provide copy of reports in *.pdf format; submit final report with closeout documents per Divisions 00 and 01. Provide two CD's with each having an electronic copy of the report in pdf file format. Label CD neatly same report labeling. Provide electronic pdf files to others for inclusion in electronic record documents.

G. General Balancing Information Required:

1. At the beginning of the report, include a summary of problems encountered, deviations from design, remaining problems, recommendations, and comments.

2. List of instruments used in making the measurements and instrument calibration data.

3. Names of personnel performing measurements.

4. Explanation of procedures used in making measurements and balancing each system.

5. List of all correction factors used for all diffusers, grilles, valves, venturi meters, and any other correction factors used.

6. Areas where difficulties were encountered in obtaining design flow rates, or where unstable operating conditions may exist.

7. Note any parts of the system where objectionable drafts or noises may be present and efforts made to eliminate same and why they may still be present.

8. Note where variances from design values occur; explain why.

9. All specified measurements, balancing data, any additional recorded data, and observations.

END OF SECTION

SECTION 20 07 00
MECHANICAL INSULATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.

B. Requirements of Section 20 05 00 apply to this Section.

1.02 WORK INCLUDED

A. Duct Insulation.

B. Pipe Insulation.

C. Equipment and Specialties Insulation.

1.03 DEFINITIONS

A. R: Thermal resistance of insulation, in units of hr-sf-deg F/Btu.

B. Subject to Damage: Items installed exposed less than 8 feet above the walking surface (i.e. floor, platform, roof, grade, etc.) adjacent to the item.

C. Cold Surfaces: Surfaces that will have operating temperatures below the temperature of the surrounding air by at least 5 deg F or more; includes chilled water piping, cooling condensate piping, air conditioning ductwork, outdoor air ductwork, and similar systems. Surfaces shall be considered a cold surface unless specifically indicated otherwise.

1.04 QUALITY ASSURANCE

A. All insulation and materials shall have a fire hazard rating not to exceed 25 for flame spread and 50 for smoke development, as tested by ASTM E 84, NFPA 255, and UL 723.

1.05 SUBMITTALS

A. General: Comply with Section 20 05 00.

B. Product Data: Provide product data on all insulation materials to be used. Indicate thicknesses to be used.

1.06 GENERAL REQUIREMENTS

A. Code Compliance: Contractor shall insulate all systems with the materials and thicknesses as required by code, but in no case shall the insulation be less than that specified herein. In some cases the specified insulation exceeds code, and shall be provided as specified. Not all systems requiring insulation by code are specified, but shall be provided with insulation where required by code.

B. Insulation at Hangers: Insulation shall be continuous through hangers on all insulated systems (except ductwork). Inserts at hangers are specified in Section 20 05 29 and are considered as part of the hanger and support system. Inserts are required to be installed at the time of pipe installation and are intended to be installed by the Contractor installing the pipe hangers/supports. See Section 20 05 29.

1.07 REFERENCES

A. ASTM A 653: Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot Dip Process.

B. ASTM B 209: Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

C. ASTM C 411: Standard Test method for Hot-Surface Performance of High Temperature Thermal Insulation.

D. ASTM C 547: Standard Specification for Mineral Fiber Pipe Insulation.

E. ASTM C 1136: Standard Specifications for Flexible, Low Permeance Vapor Retarders for Thermal Insulation.

F. ASTM C 1290: Standard Specification For Flexible Fibrous Glass Blanket Insulation Used to Externally Insulate HVAC Ducts.

G. ASTM E 84: Standard Test Method for Surface Burning Characteristics of Building Materials.

H. NCIIS: National Commercial & Industrial Insulation Standards, published by Midwest Insulation Contractors Association, 5th Edition.

I. NFPA 255: Standard Method of Test of Surface Burning Characteristics of Building Materials.

J. UL 723: Tests for Surface Burning of Building Materials.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Products shall comply with Section 20 05 00, Paragraph Part 2.01, Acceptable Manufacturers.

B. Insulation: Johns Manville, Armacell, Owens-Corning, Knauf, Rubatex, Aeroflex, Pittsburgh Corning, GLT, Halstead, Gilsulate, Manson.

C. Accessories: Johns Manville, Armacell, Owens-Corning, Knauf, Rubatex, Aeroflex, Pittsburgh Corning, GLT, Halstead, Duro Dyne, Gustin Bacon, Childers, RPR, Tee Cee, Lewco Specialty Products, JPS, Buckaroos, Manson.

2.02 DUCT INSULATION

A. Flexible Glass Fiber:

1. Type: Flexible blanket type, constructed of inorganic glass fibers bonded by a thermosetting resin, complying with ASTM C 1290, Type III. Johns Manville "Microlite" (or approved).

2. Jacket: FSK type, vapor proof, consisting of an aluminum foil cover reinforced with glass fiber mesh, and laminated to kraft. Water vapor permeance shall not exceed 0.05 perms. Provide with joint sealing tape, minimum 2 inches wide, constructed of jacket material with adhesive to seal all joints.

3. Thermal Conductivity: Shall not exceed 0.27 Btu-in/hr-sq ft-deg F at 75 deg F.

4. Operating Limits: 40 degrees F to 250 deg F.

B. Duct Insulation Types: Flexible glass fiber.

C. Duct Insulation Thickness:

1. General: Provide insulation densities and thicknesses to achieve the R values cited below. R values are for the insulation only, in their installed thickness, considering installed duct wrap stretch and in accordance with code.

2. Lining: Where ducts have internal lining, the insulating properties of the lining may be credited toward meeting the required insulation R value; use R-3.65 per inch of installed liner.

3. Supply Air Ductwork:

   a. Inside Building and Within Building's Thermal Envelope: R-3.3 (except where ran exposed in conditioned spaces, no insulation is required).

4. Return Air Ductwork:

   a. Inside Building and Within Building's Thermal Envelope: No insulation required; except where duct contains air that may vary by 10 deg F or more from the space the duct passes through, R-3.3 insulation shall be provided.

5. Outside Air Ductwork: Shall be insulated same as required for the building envelope; except where allowed by code to be insulated less than the building envelope, shall be R-8; insulation is not required where duct run outside the building.

6. Exhaust, Relief, and Special Ductwork:

   a. Inside Building and Within Building's Thermal Envelope:

      1) Temperature of Air in Duct within 10 Deg F of Temperature of Air in Spaces Duct Passes Through: No insulation required except ductwork from the system's backdraft damper (or motorized damper) to outside the building shall be insulated same as required for the building envelope.

      2) Temperature of Air in Duct more than 10 Deg F Different from temperature of Air in Spaces Duct Passes Through: R-8.3; except ductwork from the system's backdraft damper (or motorized

damper) to outside the building shall be insulated same as required for the building envelope (but no less than R-8.3).

2.03 **PIPE INSULATION**

A. Glass Fiber:

1. Type: Rigid molded type, constructed of glass fibers bonded by a thermosetting resin, complying with ASTM C 547 Type I. Insulation factory molded to match pipe size applied to. Johns Manville “Micro-Lok” (or approved).

2. Jacket: ASJ type, vapor proof, consisting of a white kraft paper cover reinforced with glass fiber and bonded to aluminum foil, with longitudinal self sealing closure system. Provide with butt strips constructed of jacket material with adhesive to seal all joints. Water vapor permeance shall not exceed 0.02 perms.

3. Thermal Conductivity: Shall not exceed 0.24 Btu-in/ hr-sq ft-deg F at 75 deg F.

4. Operating Temperatures: 0 deg F to 850 deg F.

B. Elastomeric Insulation:

1. Type: Flexible cellular elastomeric insulation, factory formed to match pipe sizes applied to, complying with ASTM C 534, Type 1. Armacell “AP/Armaflex SS” (or approved).

2. Thermal Conductivity: Shall not exceed 0.27 Btu-in/ hr-sq ft-deg F at 75 deg F.

3. Water Vapor Transmission: Water vapor permeance shall not exceed 0.08 perms.

4. Operating Temperatures: -200 deg F to 220 deg F; shall be able to withstand 250 deg F temperatures for 96 hours per ASTM C 411 without damage or deformation.

5. Weather Protection: Where installed outdoors provide with metal jacketing to protect from UV and weather exposure.

C. Pipe Fittings: Shall be covered using any one of the following methods of the Contractor's choice:

1. Prefabricated segments of pipe insulation of same materials and thickness as the adjoining pipe insulation, formed to match pipe fitting.

2. Pre-cut fiberglass insulation and pre-molded high impact, gloss white, UV resistant, minimum 20 mil thick, PVC covers suitable for the pipe size and insulation thickness application, PVC cover shall be Johns Manville "Zeston 2000 PVC" (or approved).

3. Insulating plastic cement brought up the full height of the adjacent covering.

D. Metal Jacket: Aluminum roll jacketing, factory formed to match pipe size and insulation application, with smooth surface, manufactured from 3003 or 5005 aluminum alloy, H-14 temper, conforming to ASTM B 209. Shall be minimum 0.020 inches thick, with an integrally bonded interior 1 mil thick heat bonded polyethylene moisture barrier over the entire surface

in contact with the insulation. Fitting covers shall be fabricated of same material as pipe runs, factory formed to match fitting.

E. Pipe Insulation Types:

1. Aboveground-Inside Building:

a. Cooling Coil Condensate: Glass fiber or elastomeric.

b. Refrigerant Piping: Elastomeric.

c. Other Systems: Glass fiber.

2. Aboveground-Outside Building: Same as specified above, with metal jacket.

3. Metal and PVC Jacketing: See "Part 3 - Execution".

F. Pipe Insulation Thickness:

1. General: Provide minimum piping insulation thickness indicated, in inches.

INSULATION THICKNESS (INCHES)

Nominal Pipe Diameter (Inches)					
Fluid Design Operating Range, deg F	<1	1< to 1-1/2	>1-1/2 to <4	4 to <8	≥8
Above 350	4.5	5.0	5.0	5.0	5.0
251 - 350	3.0	4.0	4.5	4.5	4.5
201 - 250	2.5	2.5	2.5	3.0	3.0
141 - 200	1.5	1.5	2.0	2.0	2.0
61 - 140	1.0	1.0	1.5	1.5	1.5
40 - 60	0.5	0.5	1.0	1.0	1.0
Below 40	0.5	1.0	1.0	1.0	1.5

2. Varying Temperatures: Where a system operates over temperature ranges calling for different insulation thicknesses, the thicker insulation requirements shall be met.

3. Condensate: Cooling system condensate piping (i.e. from a cooling coil) shall be considered to operate at 50 deg F.

4. Refrigerant Piping: Refrigerant piping (RG or RS piping) returning from an evaporator (i.e. cooling coil) to a compressor shall be considered to operate at 40 deg F. Refrigerant piping (RL piping) from a condenser to an evaporator does not require insulation (unless noted otherwise).

5. Outdoor Piping: Piping exposed to outside air or, located outside the building/thermal envelope, shall have insulation thickness increased by 0.5 inch from that indicated above. Elastomeric insulation may be used in lieu of fiberglass, provided the insulation is manufacturer approved for temperature of the insulated piping system and application.

6. Cold Water: Cold water piping shall be considered to operate at 56 deg F (unless noted otherwise).

2.04 EQUIPMENT AND SPECIALTIES INSULATION

A. P-traps and HW/CW Lines on ADA Compliant Sinks and Lavatories: Prefabricated insulation specially designed for p-trap application, with white elastomeric insulation, white high gloss pvc cover, and velcro closure. Provide section for insulating HW stop and CW stop and associated piping of same material. McGuire "Pro-Wrap" (or approved).

B. Removable Insulation Blankets:

1. Type: Flexible blanket insulation pads, for insulating valves, unions, strainers and similar items. Constructed of exterior fabric enclosure sewn around interior insulation, held in position with a closure system that allows for removal of the blanket. Contractor or factory fabricated.

2. Insulation: Thermal insulating wool, 1-inch thick, complying with ASTM C 553. Maximum thermal conductivity 0.22 Btu-in/ hr-sq ft-deg F at 75 degrees F. Provide in layers to give equivalent R value to the adjacent insulated piping. Owens Corning "Fiberglas Brand TIW, Type II".

3. Closure System: Velcro, zipper or steel lacing. Steel lacing anchors shall have spindles and self-locking washers, fabricated of minimum 14 gauge stainless steel, with stainless steel wire ties. AGM Industries "Series NLA" (or approved). Closure shall be configured to allow for complete coverage and closure of the insulation around the object being insulated. Closure for cold surfaces (surfaces that operate below ambient air temperature) shall provide a sealed vapor barrier so that no surfaces are exposed to ambient air and so that no condensation can occur; overlap enclosure ends (or any vapor barrier penetrations, as caused by suing steel lacing anchors) with an added vapor barrier cover, minimum 2-inches past the vapor barrier penetration; with Velcro (or equivalent) closure.

C. Metal Jacket:

1. Steel: Minimum 24 gauge galvanized steel complying with ASTM A 653. Provide with longitudinal slip joints and 2-inch laps.

2. Aluminum: Minimum 0.020-inch thick aluminum, alloy 3003 or 5005, complying with ASTM B 209. Provide with longitudinal slip joints and 2-inch laps.

D. Equipment and Specialties Insulation Types and Thickness:

1. Control Valves: Removable blanket insulation.

2. All equipment and specialties where access is required shall have removable insulation blankets; other removable insulation materials per NCIIS may be used where pre-approved by the Engineer. Items requiring such removable insulation include, but are not limited to, the following:

a. Strainers.

b. Balancing valves.

c. Pressure/temperature/flow measuring devices.

2.05 ACCESSORIES

A. Adhesive, Caulks, Mastics, and Coatings: As recommended by insulation material manufacturer and suited for the application.

B. Bands: 1/2-inch wide, of stainless steel, galvanized steel, or aluminum construction, to match with materials used with.

C. Weld-Attached Anchor Pins and Washers: Copper-coated steel pin for capacitor-discharge welding and galvanized speed washer. Pin length shall be as required for insulation thickness used with. Welded pin holding capacity 100 lb, for direct pull perpendicular to the attached surface. Style and type to suit application.

D. Adhesive-Attached Anchor Pins and Speed Washers: Galvanized steel plate, pin, and washer manufactured for attachment to duct and plenum with adhesive. Pin length sufficient for insulation thickness used with. Adhesive as recommended by the anchor pin manufacturer as appropriate for surface temperatures and materials used with, and to achieve a holding capacity of 100 lb for direct pull perpendicular to the adhered surface. Style and type to suit application.

PART 3 - EXECUTION

3.01 GENERAL

A. Pre-Insulation Review: No covering materials shall be applied until systems to be covered have had all tests satisfactorily completed, have had all required inspections, and have been satisfactorily reviewed by the Architect-Engineer. All systems shall be examined by the Contractor to confirm cleanliness and other conditions are appropriate to allow for insulation installation.

B. Insulation Work Review: No insulated items shall be concealed in the building structure or buried until the insulation work has been satisfactorily reviewed by the Architect-Engineer, and has had all required inspections.

C. Standards: Materials shall be installed in accordance with manufacturer's written instructions, NCIIS, and shall comply with materials and methods specified herein. The more stringent requirements govern.

D. Joints/Seams: Joints shall be staggered on multi layer insulation. Locate seams and joints in least visible location.

E. Insulation Protection: Insulation shall be kept clean and dry and shall be protected from dirt, damage, and moisture. Insulation that becomes dirty, damaged, or wet and cannot be restored to like new condition will be rejected, and shall immediately be removed from the jobsite.

F. Insulation Interruptions: Insulation shall be neatly finished at all supports, protrusions and interruptions. Provide adhesive and tape seal to maintain vapor barrier integrity.

G. Equipment and Floor Protection: Cover existing equipment and finished floors to protect such items from insulation fiber and dust. Keep all such existing areas in a "broom clean" condition at the end of each day. Take precautions in these areas to prevent glass fiber and insulation dust from entering ventilation systems or areas adjacent to the work.

H. Glass Fiber Insulation - General:

1. Finish all insulation ends with joint sealing tape or vapor barrier mastic, no raw edges allowed.

2. Joints: Tightly butt adjacent insulation sections together without any voids. Provide overlap of jacket material over all joints.

I. Items To Be Insulated: Provide insulation on all ductwork, all piping, all items installed in these duct and piping systems, all air and liquid energy conveying systems and components, all air and liquid energy storage, all equipment, and all energy consuming devices, except where such insulation has been specifically excluded.

J. Items Excluded From Being Insulated:

1. Sanitary sewer drain lines (except traps at handicap accessible fixtures).

2. Stops and risers at plumbing fixtures (except at handicap accessible fixtures).

3. Factory insulated water heaters (except for base on electric water heaters).

4. Electric motors.

5. Fans.

6. Factory insulated or factory lined HVAC, AHU, and AC units.

7. Relief Valves and associated drain piping.

8. Hose bibbs (except where used as drains hot water systems).

9. Water meter.

10. Underground cold water piping and associated underground items.

3.02 DUCT INSULATION INSTALLATION

A. Types and Thickness: Insulate all ducts with insulation type and thickness (to provide the required R value) as specified in “Part 2 - Products”.

B. General: Insulation shall be firmly butted at all joints. All longitudinal seams for flexible insulation shall overlap a minimum of 2 inches. All joints and seams shall be finished with appropriate joint sealing tape. Installation shall provide a continuous sealed vapor barrier over all surfaces; seal all jacket penetrations with vapor barrier mastic or vapor barrier jacket tape.

C. Attachment: For rectangular ducts over 24 inches wide, duct insulation shall be additionally secured to the bottom of the ductwork with mechanical fasteners on 18 inch centers to

reduce sagging. Washers shall be applied without compressing the insulation. Protruding ends or fasteners shall be cut off flush after washers are installed. All seams, joints, penetrations, and damage to the facing shall be sealed with joint sealing tape or vapor retardant mastic or appropriate joint sealing tape.

3.03 PIPE INSULATION INSTALLATION

A. Types and Thickness: Insulate all piping with insulation type and thickness as specified in "Part 2 - Products". All piping shall be insulated except where specifically excluded.

B. General: All ends shall be firmly butted together and secured with joint sealing tape. All jacket laps and joint sealing tape shall be secured with outward clinch staples at 4 inch spacing, or by use of a suitable adhesive. Installation shall provide a continuous sealed vapor barrier over all surfaces; seal all jacket penetrations with vapor barrier mastic or vapor barrier jacket tape.

C. Elastomeric Pipe Insulation: Install with seams and joints sealed with rubberized contact adhesive. Insulation with pre-applied adhesive is not permitted. A brush coating of adhesive shall be applied to both butt ends to be joined and to both split surfaces to be sealed. Adhesive shall be allowed to set until dry to touch but tacky under slight pressure before joining the surfaces. Insulation seals at seams and joints shall not be capable of being pulled apart one hour after application. Provide added tape wrap around insulation to ensure seam and joint closure. Insulation that can be pulled apart one hour (or more) after adhesive installation shall be replaced. Provide metal jacketing over outdoor exposed insulation.

D. Pipe Hangers: Provide insulation tight up to pre-insulated pipe supports at pipe hangers, seal all joints with joint sealing tape. Pre-insulated pipe supports are specified in Section 20 05 29.

E. Pipe Sleeves: Run insulation continuous full size through sleeve. Coordinate work with fire seals and confirm fire seal system is approved for use with insulated pipes; see Section 20 05 30.

F. Metal Jacketing:

1. Applications: Provide metal jacket over piping insulation for the following:

   a. Outdoor exposed piping.

2. Outdoor Installation: Where installed on outdoor piping locate seams on bottom side of horizontal piping. Seal all jacket seams to provide a completely weatherproof enclosure; water tight.

3.04 EQUIPMENT AND SPECIALTIES INSTALLATION

A. Types and Thickness: All equipment and items installed in insulated duct and piping systems shall be insulated except where specifically noted not to be; reference paragraph 3.01. Insulation type and thickness shall be as specified in "Part 2 - Products".

B. General: Apply insulation as close as possible to equipment by grooving, scoring, and beveling as necessary. As required, secure insulation to equipment with studs, pins, clips, adhesive, wires or bands. Fill joints, cracks, seams, and depressions with bedding compound to form smooth surface. Comply with NCIIS.

C. Removable: All equipment and specialties where access is required for maintenance, repair, service, or cleaning shall have insulation installed so that it can be easily removed and reinstalled without being damaged and without requiring new insulation. Removable insulation shall completely cover the item being insulated with an overlap over adjacent insulation to cover all joints. Insulation on cold surfaces shall provide a sealed vapor barrier so that no surfaces are exposed to ambient air and so that no condensation can occur; overlap enclosure ends minimum 2-inches.

D. ADA Compliant Lavatories and Sinks: Insulate P-trap and HW/CW supplies below lavatory and sink where exposed.

E. Nameplates: Do not insulate over nameplates or ASME stamps; bevel and seal insulation around.

F. Jacketing: Provide all equipment insulation with vapor retardant jackets.

END OF SECTION

SECTION 20 08 00
COMMISSIONING OF MECHANICAL SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.

B. Requirements of Section 20 05 00 apply to this Section.

1.02 WORK INCLUDED

A. Commissioning of Mechanical Systems.

B. Documentation.

1.03 SUBMITTALS

A. General: Comply with Section 20 05 00.

B. Qualifications: Submit qualifications of the firm proposed to perform the commissioning work and for the individuals that will be assigned.

C. Commissioning Data:

1. Commissioning plan.

2. Commissioning preliminary report.

3. Commissioning final report.

1.04 GENERAL REQUIREMENTS

A. General: Commissioning shall be done by a Company which specializes in this work and independent and separate from the Companies installing the systems to be commissioned.

B. Company Experience: The Company providing the commissioning work shall be experienced in commissioning HVAC control systems, and have commissioned at least five similar projects in the last three years. Company shall be certified for such work by AABC, NEBB, AEE, BCA, or ASHRAE.

C. Individual Experience: The individuals performing the commissioning work shall have at least five years experience in commissioning, with the individual in the field in charge or the work having commissioned at least five similar projects in the last three years.

D. Deferred Test: Tests may be deferred to allow for proper climatic or other conditions.

1.05 REFERENCES

A. AABC: Associated Air Balance Council.

B. AEE: Association of Energy Engineers.

C. BCA: Building Commissioning Association.

D. NEBB: National Environmental Balancing Bureau.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

3.01 GENERAL

A. General: Provide commissioning as required by code and as specified herein.

B. Building Occupancy: Building or portions thereof, required by code to be commissioned, shall not be considered ready for occupancy until such time that the Engineer and building official determine that the preliminary commissioning report required by this Section has been completed.

3.02 HVAC SYSTEMS

A. General: HVAC equipment and HVAC control systems shall be tested to ensure that control devices, components, equipment and systems are calibrated, adjusted and operate in accordance with approved plans and specifications.

B. Sequences: Sequences of operation shall be functionally tested to ensure they operate in accordance with approved plans and specifications.

C. Conditions: Testing shall affirm operation during actual or simulated winter and summer design conditions and during full outside air conditions.

D. HVAC Equipment: Equipment functional performance testing shall demonstrate the installation and operation of components, systems, and system-to-system interfacing relationships in accordance with approved plans and specifications such that operation, function, and maintenance serviceability for each of the commissioned systems is confirmed. Testing shall include all modes and sequence of operation, including under full-load, part-load and the following emergency conditions:

1. All modes as described in the sequence of operation.

2. Redundant or automatic back-up mode.

3. Performance of alarms.

4. Mode of operation upon a loss of power and restoration of power.

E. HVAC Controls: HVAC control systems shall be tested to document that control devices, components, equipment, and systems are calibrated, adjusted, and operate in accordance

with approved plans and specifications. Sequence of operation shall be functionally tested to document they operate in accordance with approved plans and specifications.

3.03 DOCUMENTATION

A. Format:

1. Hard Copy: Provide reports in 8-1/2 x 11 format, in 3 ring notebooks, with labeled cover and spine, clean legible, and logically organized with table of contents, divider tabs, and names of companies involved in the project, commissioning company name, commissioning personnel, and contact information. Provide 3 copies per Divisions 00 and 01.

2. Electronic: Provide copy in *.pdf format; submit with closeout documents per Divisions 00 and 01.

B. Test Plan: Prepare a written commissioning test plan and submit for approval prior to beginning commissioning work. Test plan to include:

1. Equipment and systems to be tested.

2. Roles and responsibilities of individuals performing the commissioning and of others involved in the project.

3. Functional test procedures and forms.

4. Conditions under which the test shall be performed (for example, winter design conditions, full outside air, etc.).

5. Expected systems' response or acceptance criteria for each procedure.

6. Time schedule for performance of the work; including any deferred tests.

7. Forms as required by the WSEC or AHJ.

C. Preliminary Commissioning Report:

1. General: A preliminary report shall be issued to identify issues preventing the commissioning work from being completed. If all commissioning work can be fully completed and the final report completed, a preliminary report is not required.

2. Report: Compile all system and commissioning data; including all reviews, inspections, test procedures, and tests. Report shall include field notes of commissioning activities, equipment and system data, test procedures, tests performed, actual results as compared to expected (or specified) results, WSEC and any AHJ required commissioning forms (completed to the extent possible).

3. Items to Complete: The preliminary report shall identify items needed in order to complete the commissioning, including:

a. Deficiencies found during testing required by this Section, which have not been corrected at the time of report preparation.

b. Deferred tests which cannot be performed at the time of report preparation due to climatic (or other) conditions.

c. Climate (or other) conditions required for performance of the deferred tests, and the anticipated date of each deferred test.

d. Proposed schedule for completion of report.

D. Final Commissioning Report: Complete all commissioning work not previously completed and included in the preliminary report. Provide a complete final report with all systems and commissioning data; including test plan, all reviews, inspections, test procedures, tests, and results. Final report shall include all documentation required for the preliminary report and documentation regarding resolution of previous coted deficiencies.

END OF SECTION

SECTION 22 11 00
FACILITY WATER DISTRIBUTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.

B. Requirements of Section 20 05 00 apply to this Section.

1.02 WORK INCLUDED

A. Domestic Water Piping.

B. Non-Potable Water Piping.

C. Valves.

D. Water Hammer Arrestors.

E. Trap Primers.

F. Backflow Preventers.

G. Electric Heat Trace.

H. Water Service Connections.

I. Testing and Inspection.

J. Flushing and Disinfection.

1.03 DEFINITIONS

A. "Lead-Free" means not containing more than 0.2% lead in solder and flux; and not more than a weighted average of 0.25% lead in wetted surfaces of pipes, pipe and plumbing fittings and fixtures.

1.04 SUBMITTALS

A. General: Submittals shall comply with Section 20 05 00.

B. Product Data: Submit manufacturer's product information on all items to be used.

C. System Tests and Inspections: Submit documentation showing systems have satisfactorily passed all pressure tests and code inspections.

D. Cleaning and Disinfection: Submit documentation regarding completion of flushing, disinfection, bacteriological tests, and Health Department's acceptance of tests and system.

1.05 GENERAL REQUIREMENTS

A. ANSI/NSF Compliance: All items in contact with potable water shall be lead free in accordance with ANSI/NSF 61. Plastic piping system components shall comply with ANSI/NSF 14. Only lead-free solder shall be used.

B. Valves: Shall be dezincification resistant, and shall not contain more than 15% zinc in their chemical composition.

1.06 **REFERENCES**

A. ASME B16.15: Cast Bronze Threaded Fittings: Classes 125 and 250.

B. ASME B16.18: Cast Copper Alloy Solder Joint Pressure Fittings.

C. ASME B16.22: Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.

D. ASME B16.24: Cast Copper Alloy Pipe Flanges and Flanged Fittings: Classes 150, 300, 400, 600, 900, 1500, and 2500.

E. ASTM E84: Standard Test Method for Surface Burning Characteristics of Building Materials.

F. ASTM A312: Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes.

G. ASTM A403: Wrought Austenitic Stainless Steel Piping Fittings.

H. ASTM A530: General Requirements for Specialized Carbon and Alloy Steel Pipe.

I. ASTM A774: As-Welded Wrought Austenitic Stainless Steel Fittings for General Corrosive Service at Low and Moderate Temperatures.

J. ASTM A 778: Welded, Un-annealed Austenitic Stainless Steel Tubular Products.

K. ASTM B16.18: Seamless Copper Water Tube.

L. ASTM B32: Solder Metal.

M. AWS A5.8: Filler Metals for Brazing and Braze Welding.

N. AWWA B300: Hypochlorites.

O. AWWA B301: Liquid Chlorine.

P. AWWA M20: Water Chlorination and Chlorination Practices and Principles, 2nd edition.

Q. ANSI/NSF Standard 14 Plastics Piping System Components and Related Materials.

R. ANSI/NSF Standard 61 Drinking Water System Components – Health Effects.

PART 2 - PRODUCTS

2.01 **ACCEPTABLE MANUFACTURERS**

A. Products shall comply with Section 20 05 00, 2.01, Acceptable Manufacturers.

B. Pipe and Fittings: Domestic Manufacturers only.

C. Press-Fit Fittings: Nibco, Viega.

D. Valves: Conbraco/Apollo, Nibco, Stockham, Milwaukee, Red-White, Watts, Hammond.

E. Electric Heat Trace: Raychem, Chromalox.

F. Pressure Reducing Valves: Conbraco/Apollo, Watts, Cla-Val, Bell & Gossett, Zurn/Wilkins.

G. Thermostatic Mixing Valves: MCC Powers, Leonard, Symmons, Lawler.

H. Backflow Preventers: Conbraco/Apollo, Febco, Watts, Ames, Zurn/Wilkins.

I. Balancing Valves: Bell & Gossett, Taco, Armstrong, Red-White.

J. Additional manufacturers are as listed for each individual item.

2.02 PIPE AND FITTINGS - MATERIALS

A. Copper Pipe and Fittings:

1. Pipe: Seamless copper water tube, hard temper (unless noted otherwise), type K or L as indicated, per ASTM B88.

2. Fittings:

a. Solder-Joint: Wrought copper and bronze fittings per ASME B 16.22 and cast copper alloy fittings per ASME B16.18, cast bronze threaded fittings per ASME B16.15.

b. Flanged: Cast bronze fittings per ASME B16.24.

c. Solder Material: 95/5 tin-antimony solder per ASTM B32 or “Silvabrite 100" (95.5 tin/4 copper/0.5 silver) solder; lead free.

d. Brazing Material: AWS A5.8, BCuP-5.

e. Press-Fit Fittings.

B. Stainless Steel Pipe and Fittings:

1. Pipe: Seamless or welded stainless steel per ASTM A778 or A312, type 304L or 316L, tolerances per ASTM A 530. Schedule 40 unless indicated otherwise.

2. Fittings:

a. Threaded: Constructed of same material as piping, per ASTM A774 or A403, suitable for 150 psi swp.

b. Welded: Constructed of same material as piping, weld fittings, per ASTM A774 or A403, suitable for 150 psi swp.

c. Flanged: Constructed of same material as piping, 150 pound class.

2.03 PIPE AND FITTINGS - APPLICATIONS

A. Domestic Water Piping - Above Ground: Type L or K copper with flanged, soldered, or press-fit joints or stainless steel; except where run exposed in finished areas shall be stainless steel, or be chrome plated copper, or be copper piping with a chrome plated sleeve.

B. Domestic Water Piping - Below Ground: Type K copper tubing with silver brazed joints; except that piping within the building footprint serving individual fixtures may be type L (soft or hard temper) copper..

C. Non-Potable Water Piping: Type L copper with solder or flanged joints.

D. Trap Primer Piping: Type L or K "soft" or "hard" (bending temper) copper, with compression fittings or soldered joints.

2.04 VALVES

A. Ball Valves:

1. 2 Inches and Smaller: 600 psi non-shock cold working pressure, 100 psi at 300 deg F, bronze body, full port, 2 piece construction, anti-blowout stem, reinforced PTFE seats, stainless steel or chrome plated brass or silicon bronze ball, lever handle, solder or threaded connections. Provide with extended lever handle where valve is installed in systems with insulation thickness greater than 0.5 inch. Nibco S-585-66-LF, T-585-66-LF, Nibco S-585-80-LF, T-585-80-LF (or approved).

2. 2-1/2 Inches and Larger:

a. Cold Water Applications - Copper Alloy: 400 psi non-shock cold working pressure copper alloy body, full port, anti-blowout stem, PTFE seats, stainless steel or chrome plated brass ball, plated steel lever handle. Nibco T-FP-600A-LF (or approved).

b. Stainless: Class 150 stainless steel body, split-body full bore design, anti-blowout stem, carbon filled TFE seats, stainless steel ball, stainless steel trim, plated steel lever handle. Nibco F-515-S6-F-66-FS (or approved).

c. Cast Iron: Class 125 psi-swp, cast iron body, split-body full port, anti-blowout stem, PTFE seats, stainless steel ball and stem. Conbraco/Apollo 6P Series (or approved).

B. Check Valves:

1. 2 Inches and Smaller:

a. Horizontal: 125 psi-swp bronze body horizontal swing check valve, regarding type, y-pattern, renewable seat and disc, solder or threaded connection. Nibco S-413-LF or T-413-LF (or approved).

b. Vertical: 125 psi-swp bronze body vertical inline check valve, stainless steel or bronze disk holder, Buna-N disk, stainless steel spring actuated, solder or threaded connection. Nibco S-480-LF or T-480-LF (or approved).

2. 2-1/2 Inches and Larger:

a. Horizontal: 125 psi-swp iron body vertical inline “silent” check valve, wafer or flanged style, renewable seat and disk, stainless spring actuated, bronze disk. Nibco W-910 (or approved).

b. Vertical: 125 psi-swp iron body vertical inline “silent” check valve, wafer or flanged style, renewable seat and disk, stainless spring actuated, bronze disk. Nibco W-910, F-910 (or approved).

C. Balancing Valves - Manual: Calibrated balance valve, ball or globe type, bronze body, with brass readout valves with integral EPT insert and check valve to minimize fluid loss during balancing. Valve shall have calibrated nameplate and memory stop. Rated for 200 psig working pressure at 250 degrees F. Valve shall be same size as pipe installed in. Bell & Gossett "Circuit Setter" (or approved).

D. Drain Valves: Bronze ball valve, minimum 125 psi-swp, anti-blowout stem, stainless steel or chrome plated brass ball, reinforced TFE seat, solder or threaded inlet connection, male 3/4 inch hose thread outlet connection, with brass cap and chain. Nibco S-585-70-HC, T-585-70-HC (or approved).

E. Pressure Reducing Valves:

1. 2 Inches and Smaller: Bronze body construction, renewable nickel alloy or stainless steel seat, lead free, with integral strainer and union inlet connections. Adjustable range 25 to 75 lbs, suitable for inlet pressures up to 300 psi. Watts Series LFU5B (or approved).

2. 2-1/2 Inches and Larger: Ductile iron or bronze body, bronze trim, 150 pound pressure class, with flanged or screwed ends. Valve shall be globe type, with adjustment range from 15 to 75 psi. Valve shall be a hydraulically operated, diaphragm-actuated pressure reducing valve. Diaphragm shall consist of a nylon fabric bonded with a synthetic rubber and shall not be used as a seating surface. Packing glands and/or stuffing boxes are not permitted, and there shall be no pistons operating the valve or pilot controls. All necessary repairs shall be possible without removing valve from the line. The pilot control shall be a direct-acting, adjustable, spring-loaded, normally open, diaphragm valve, designed to permit flow when controlled pressure is less than the spring setting. The control system shall include a fixed orifice, flow strainer, and speed control. Cla-Val Series 90-01 (or approved).

2.05 ACCESSORIES

A. Water Hammer Arrestors: All metal, factory pre-charged with inert gas, sealed internal bellows; 125 psi working pressure. All wetted parts shall be type 300 stainless steel, brass or copper. PDI (Plumbing and Drainage Institute) sizes as indicated. Where not sized, provide sizes in accordance with PDI standards. Zurn "Shoktrol", Wade "Shokstop", or J.R. Smith "Hydrotrol".

B. Trap Primer Valve:

1. Pressure Drop Type: Activated by drop-in water pressure. Constructed of corrosion resistant brass with integral backflow preventor, vacuum breaker ports, distribution manifold to suit number of drains served, adjustable to line pressure for water delivery. Precision Plumbing Products Model P-1 and P-2 (or approved).

2. Water Flow Type: Activated by flow of water in line through the trap primer valve. Brass construction with integral air-gap backflow preventor, stainless steel screen, delivering 0.84 ounces of water at 20 psi with 5 seconds of water flow. Precision Plumbing Products "Prime-Pro" (or approved).

2.06 BACKFLOW PREVENTERS

A. Reduced Pressure Type:

1. General: Washington State approved, with air gap drain fitting and resilient seated full flow shutoff valves and test cocks. Same size as connecting pipe. Configuration to suit application. Conforming to AWWA C511.

2. 2 Inches and Smaller: Bronze body, stainless steel springs, bronze ball valves, 175 psi working pressure, threaded end connections.

3. 2-1/2 Inches and Larger: Ductile iron body, internal and external epoxy coating per AWWA C550, OS & Y gate isolation valves, bronze trim, stainless steel springs, 175 psig working pressure, Class 125 flanged end connections (grooved connections allowed where mechanically coupled piping systems are allowed).

4. Discharge: Discharge from intermediate relief valve assembly shall not exceed 190 gpm for 2-inch and smaller backflow preventers, and not exceed 560 gpm for larger backflow preventers (rated at 75 psig inlet pressure).

2.07 ELECTRIC HEAT TRACE

A. Type: Electric self-regulating heat tracing strip, specifically designed for freeze protection. Raychem "XL-TRACE" (or approved).

B. Construction: Heater shall consist of a flat, flexible, low heat density electric heater strip of parallel circuit construction, with a radiation cross-linked inner core of self-regulating conductive polymer material. Core shall be insulated with a radiation cross-linked polyolefin jacket and a flexible metal over-shield. Heater bus wires shall be 16 AWG. Heater strip shall be capable of being cut to desired length in the field.

C. Operation: Heater shall be for operation with voltage as shown on plans (or available) and shall provide 5 watts/foot output (unless noted otherwise). The heater shall be self-regulating type and shall vary its output in proportion to varying localized temperatures along the pipe without reliance on thermostat controls.

D. Accessories:

1. Power Connection Kit and Thermostat: Shall include junction box, terminal connectors and accessories allowing connection of power wiring to heater. Thermostat shall sense ambient temperatures and allow heat trace operation when

temperature falls below 40 deg F, and to be off with higher temperatures.

2. Tee/Splice/End Kits: Shall allow for connection of tee heater wiring, splicing connections and end seal termination of heater.

3. Labels: Provide label reading, "Electric Traced"; minimum one (1) per 50 feet of heater. Locate labels at power connection kit location, end terminations, and other in-between locations as appropriate.

4. Tape: Fiberglass tape for attaching heater to pipe.

PART 3 - EXECUTION

3.01 **GENERAL**

A. Workmanship:

1. Installation of all items shall comply with code, best professional practices, manufacturers written installation instructions, and to allow for proper functioning of items being connected to.

2. Install all piping parallel to the closest wall and in a neat, workmanlike manner. Horizontal exposed straight runs of piping shall not deviate from straight by more than 1/4-inch in ten feet. Vertical piping shall not deviate from plumb by more than 1/8-inch in ten feet.

3. Do not run any piping above electrical panels (and similar electrical equipment). Provide offsets around such panels as necessary.

B. Complete System: Provide all piping as indicated and as required to allow supply connections to each fixture and equipment item requiring water supply. Provide offsets as required to accommodate building construction and access requirements per Section 20 05 00. For multistory buildings include costs to offset vertical piping at each floor level since structural member locations will not be the same on each floor.

C. Coordination: Coordinate installation of items with all trades that are affected by the work to avoid conflicts.

D. Expansion and Contraction: Install piping to accommodate system expansion and contraction; provide necessary offsets, expansion devices, anchors, guides and related accessories. See Section 20 05 29.

E. Openings for Piping: See Section 20 05 30 for sleeves and seals; provide openings in building construction sized to accommodate required sleeve size. Where sleeves are not required provide openings sized as follows:

1. Belowground Penetrations: Inside diameter of opening shall be at least 2-inch larger than the outside diameter of the pipe or pipe covering (for covered piping systems), and so as to allow free movement of piping.

2. Aboveground Penetrations: Inside diameter of opening shall be at least 1-inch larger than the outside diameter of the pipe or pipe covering (for covered piping systems),

and so as to allow free movement of piping.

3. Large Movement: Provide larger sleeves where a larger space around pipe exterior is required by code, where specifically noted, where pipe movement will occur (i.e. expansion/contraction or seismic), at expansive soils, other unusual conditions are present, and where required to accommodate large piping movement.

F. Equipment by Others: Provide piping connections to equipment furnished by others in accordance with Section 20 05 00.

3.02 PIPE AND FITTINGS

A. Concealed: All piping in finished areas shall be installed concealed unless specifically noted otherwise. Provide escutcheons where piping is allowed to be exposed and pipe passes through building elements (i.e. walls, floors, ceilings, etc.).

B. Non-Obstructing: Install piping at such heights and in such a manner so as not to obstruct any portion of windows doorways, passageways, or access to any items requiring routine service, maintenance, or inspection. Offset or reroute piping as required to clear any interferences which may occur.

C. Drawing Review: Consult all drawings for location of pipe spaces, ducts, electrical equipment, ceiling heights, door openings, window openings, and other details and report discrepancies or possible conflicts to Architect/Engineer before installing pipe.

D. Insulation: Allow sufficient clearances for installation of pipe insulation in thickness specified. If interferences occur, reroute piping to accommodate insulation.

E. Drainage: Slope all piping to low points to allow the system to be drained. Provide added drain valves where system cannot be drained through fixtures.

F. Preparation for Joining: Prior to the joining of any section of pipe to a pipe run, the section shall be thoroughly cleaned inside and out, the ends shall be reamed to remove any cutting burrs and piping prepared as recommended by piping and fitting manufacturer.

G. Threaded Connections: Cut piping carefully, ream, thread and work into place without springing. Use TFE tape or lead and graphite lubricant (on male threads only).

H. Soldered Connections: Polish contact surfaces of fittings and pipes with emery cloth before fluxing male and female surfaces of joints. Steel wool and sandpaper not permitted for polishing.

I. Unions: Install unions in pipe connections to valves, coils, and any other equipment where it may be necessary to disconnect the equipment or piping for repairs or maintenance; and as indicated. Where flanged connections occur at equipment additional unions are not required unless indicated otherwise.

J. Insulating Unions: Install dielectric insulating connectors between all connections of copper piping and steel piping of steel equipment. Where flanged connections occur use insulating type flanges.

3.03 VALVES

A. Type: Ball type only.

B. General: Provide isolation valves as shown on the drawings. In addition to those shown, provide added valves to allow for the isolation of each group of fixtures, all water heaters, and all individual equipment items (e.g. dishwashers, heat exchangers, etc.).

C. Installation: Install valves so as to be easily accessible and oriented to permit ease of operation. Valve stem shall be directed toward operator in either the vertical or horizontal direction. Provide access doors for valves not otherwise accessible.

D. Pressure Reducing Valves: Provide with by-pass line, isolation valves, unions (on valves with threaded connections), and pressure gauges. Set initial pressure and adjust as required so that all fixtures/devices served have sufficient water pressure.

E. Drain Valves: Provide drain valves at the base of all risers (except not required where risers can be drained through plumbing fixtures or equipment drains). Provide drain valves at piping low points where the piping cannot be drained through fixtures, hose bibs, or equipment drains.

F. Balancing Valves: Provide balancing valves in hot water circulation piping where indicated and where required to allow for equal distribution of hot water circulation flows.

3.04 ACCESSORIES

A. Water Hammer Arrestors: Install per manufacturer's instructions, just upstream of last fixture on branch line. Provide water hammer arrestors on branch water lines serving fixtures with flush valves, washer machines, solenoid valves, and similar quick-acting valves. Water hammer arrestors are typically not shown on the plans, but shall be provided per this paragraph. Provide ball isolation valve in piping to arrestor. Where access cannot be provided at water line location, the water hammer arrestor piping may be extended vertically and the water hammer arrestor located above ceiling outside of plumbing chase.

B. Trap Primers: Provide trap primers to all vented floor drains, floor receptors, and where required by the code. Install with an isolation valve in the branch line to the trap primer valve.

C. Access Doors: Provide access doors to all valves, water hammer arrestors, trap primers, backflow preventers, and any other piping accessories which would otherwise be inaccessible. See Section 20 05 19 for access door specifications.

D. Backflow Preventers:

1. General: Provide backflow preventers as indicated in the Contract Documents and as required by code. Backflow preventers with threaded connections shall be installed with unions for ease of removal. Install to be accessible for testing and service. Pipe air gap drains to nearest floor drain or point of drainage.

2. Inspection: Arrange and pay for inspection of backflow preventers as required by the local AHJ and obtain installation acceptance from the AHJ.

3 Certification: Following inspection arrange and pay for testing of backflow preventers by certified individuals in accordance with applicable portions of the Washington Administrative Code, other applicable regulations as set forth by the Washington State Department of Social and Health Services, and as required by the AHJ.

E. Heat Tracing: Install heat tracing as shown on drawings and in accordance with manufacturer's instructions and code. Label piping with self-sticking labels clearly reading “HEAT TRACED”.

3.05 WATER SERVICE CONNECTIONS

A. Provide connection to water main outside the building as shown on the drawings.

B. Provide sleeve in floor for entrance of service main into building, seal watertight; anchor service main firmly to building. See Section 20 05 30 for sleeves and seals.

3.06 TESTING AND INSPECTION

A. All piping shall be tested, inspected, and approved by the local authority having jurisdiction prior to being concealed or covered.

B. Testing shall be witnessed by the plumbing inspector and the Architect/Engineer (at his option). Notify Architect/Engineer minimum 72 hours prior to date of testing, and mutually agreed upon times arranged.

C. Piping shall be hydrostatically tested for a period of 2 hours (or as required by local authority having jurisdiction), during which time no drop in pressure or leakage shall occur.

D. Test pressure shall be not less than 150 percent of the maximum to which the pipe will ordinarily be subjected; but in no case less than 75 psig.

E. Any leaks or defective piping disclosed by testing and inspection shall be repaired with new materials and the system re-tested.

F. Provide documentation to the Engineer indicating that the system has been completely pressure tested, and all portions inspected and accepted by the local authority having jurisdiction.

3.07 FLUSHING AND DISINFECTION

A. System Flushing: After tests are completed, all water piping shall be flushed. In general, sufficient water shall be used to produce a minimum water velocity of 2.5 feet per second through piping being flushed. Flushing shall be continued until discharge water shows no discoloration. System shall be drained at low points. Strainer screens shall be removed, cleaned, and replaced in line. System valves and fixture faucets shall be opened and re-closed to completely flush system. After flushing and cleaning, systems shall be prepared for disinfection service by immediately filling water piping with clean, fresh potable water. Any stoppage, discoloration, or other damage to the finish, furnishings, or parts of the building during this process shall be repaired by the Contractor.

B. Disinfection:

1. Upon completion of the job and prior to final acceptance, the plumbing system shall be disinfected with Chlorine solution. Review procedures and disinfection with the authority having jurisdiction to insure that all work complies with code requirements. Verify any deviations from specified procedures with the Architect/Engineer prior to proceeding. The chlorinating material shall be either liquid chlorine conforming to AWWA B301 or hypochlorite conforming to AWWA B300 (or as otherwise required by

the authority having jurisdiction). Water chlorination procedure shall be in accordance with AWWA M20 (or procedure acceptable to AHJ and to the Architect/Engineer). The chlorinating material shall provide a dosage of not less than 50 parts per million and shall be introduced into the system in an approved manner. The treated water shall be retained in the pipe long enough to destroy all non-spore-forming bacteria.

2. The retention time shall be at least 24 hours and shall produce not less than 10 ppm of chlorine at the extreme end of the system at the end of the retention period. All valves in the system being sterilized shall be opened and closed several times during the contact period. The system shall then be flushed with clean water until the residual chlorine is reduced to less than 1.0 ppm. During the flushing period all valves and faucets shall be opened and closed several times.

C. Bacteriological Tests: The Contractor shall employ an approved agency to take test samples at several points of the system (i.e. end of each wing, each floor of building, etc.) in properly sterilized containers and arrange with the Health Department (or a test agency acceptable to the Health Department) having jurisdiction to test the samples. Test for coliform and other items as required by the AHJ. Should the samples not test satisfactory, the system shall be re-flushed and disinfected again until satisfactory samples are obtained.

D. Submittal: Submit documentation stating that flushing and disinfection has been completed, copies of the bacteriological test results, and certification from the Health Department having jurisdiction stating that system has been found acceptable.

END OF SECTION

SECTION 22 13 00
FACILITY SANITARY SEWERAGE

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.

B. Requirements of Section 20 05 00 apply to this Section.

1.02 WORK INCLUDED

A. Soil, Waste and Vent Piping.

B. Condensate, Overflow, Miscellaneous Drains.

C. Cleanouts.

D. Testing and Inspection.

E. Accessories.

1.03 SUBMITTALS

A. General: Submittals shall comply with Section 20 05 00.

B. Product Data: Submit product information on all items to be used.

1.04 REFERENCES

A. ASME B 16.12: Cast Iron Threaded Drainage Fittings.

B. ASME B 16.15: Cast Bronze Threaded Fitting Classes 125 and 250.

C. ASME B 16.18: Cast Copper Alloy Solder Joint Pressure Fittings.

D. ASME B 16.22: Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.

E. ASME B 16.23: Cast Copper Alloy Solder Drainage Fittings.

F. ASME B 16.29: Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings (DWV).

G. ASTM A 53: Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.

H. ASTM A 74: Cast Iron Soil Pipe and Fittings.

I. ASTM A 888: Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications.

J. ASTM B 32: Solder Metal.

K. ASTM B 88: Seamless Copper Water Tube.

L. ASTM B 306: Copper Drainage Tube (DWV).

M. ASTM C 564: Rubber Gaskets for Cast Iron Soil Pipe and Fittings.

N. ASTM C 1277: Shielded Couplings Joining Hubless Cast Iron Soil Pipe and Fittings.

O. ASTM D 1785: Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.

P. ASTM D 2321: Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.

Q. ASTM D 2466: Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.

R. ASTM D 2564: Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems.

S. ASTM D 2665: Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings.

T. ASTM D 2843: Density of Smoke from the Burning or Decomposition of Plastics.

U. ASTM D 3034: Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

V. ASTM D 3311: Drain, Waste, and Vent (DWV) Plastic Fittings Patterns.

W. CISPI 301: Hubless Iron Soil Pipe and Fittings for Sanitary and Drain, Waste, and Vent Piping Applications.

X. CISPI 310: Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and for Sanitary and Storm Drain, Waste, and Vent Piping Applications.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Products shall comply with Section 20 05 00, 2.01, Acceptable Manufacturers.

B. Pipe and Fittings: Domestic Manufacturers only.

C. No Hub Couplings: ANACO, Mission Rubber, Tyler, MG Coupling, Fernco, Clamp-All, Mifab. Ideal-Tridon.

D. Cleanouts: Josam, Zurn, J.R. Smith, Wade.

2.02 PIPE AND FITTINGS - MATERIALS

A. No-Hub Cast Iron Pipe and Fittings:

1. Pipe and Fittings: Service weight no-hub cast iron pipe and cast iron fittings, per CISPI 301 and ASTM A 888, for use with mechanical no-hub couplings.

2. Couplings: Per CISPI 310 or ASTM C 1277, with a cast iron or stainless shield, and neoprene gasket per ASTM C 564.

3. Heavy Duty Couplings:

a. Heavy duty clamp type coupling, with stainless steel shield minimum 0.015-inch thick, stainless steel clamps, stainless steel screws minimum 0.375-inch nominal diameter, gasket per ASTM C 564, and minimum 4 clamps each coupling. ANACO Husky SD 4000.

b. Heavy duty cast iron constructed clamp, two piece, with stainless nuts/bolts, neoprene gasket per ASTM C 564. MG Piping Products "MG Coupling".

B. Hub and Spigot Cast Iron Pipe and Fittings: Service weight hub and spigot cast iron pipe and cast iron fittings per ASTM A 74, for use with compression gaskets. Gaskets shall conform to ASTM C 564.

C. Copper DWV Pipe and Fittings: Copper drainage tube per ASTM B 306. Wrought copper and wrought copper alloy solder joint fittings per ASME B 16.29; or cast copper alloy solder joint fittings per ASME B 16.23.

D. Galvanized Steel DWV Pipe and Fittings: Schedule 40 galvanized steel pipe per ASTM A 53, Grade B, Type 5. Cast iron drainage fittings, threaded, per ASME B 16.12; and cast iron screwed fittings per ASME B 16.4.

E. Copper Pipe and Fittings: Seamless copper water tube, tube L or M, per ASTM B 88. Solder joint wrought copper and bronze fittings per ASME B 16.22 cast copper alloy fittings per ASME B 16.18, and cast bronze threaded fittings per ASME B 16.15 with 95/5 tin-antimony solder per ASTM B 32.

F. PVC DWV Pipe and Fittings: Polyvinyl chloride drain pipe, solid wall pipe per ASTM D 1785 and ASTM D 2665 with solvent cement joints. Foam (i.e. cellular) core pipe NOT allowed. Polyvinyl chloride DWV fittings conforming to ASTM D 2665 or ASDTM F 1866, with solvent cement joints. Solvent cement shall comply with ASTM D 2564.

G. PVC Pipe and Fittings: Polyvinyl chloride pipe, schedule 40, per ASTM D 1785. Polyvinyl chloride solvent cement socket type fittings conforming to ASTM D 2466. Solvent cement shall comply with ASTM D 2564.

2.03 PIPE AND FITTINGS – APPLICATION

A. Waste and Vent:

1. Piping 2-1/2 Inches and Smaller Located Above Ground: Galvanized steel DWV, no-hub cast iron, copper DWV, PVC DWV.

2. Piping 3 Inches and Larger Located Above Ground: No-hub cast iron, bell and spigot cast iron, copper DWV.

3. All Piping Located Below Ground: No-hub cast iron, bell and spigot cast iron, copper DWV, PVC DWV.

4. High Temperature: Waste piping serving fixtures that may receive waste greater than 120 degree F. shall be no-hub cast iron, bell and spigot cast iron, or copper DWV for

minimum 40 feet downstream of fixture (i.e. dishwasher, three compartment sink, drains/receptors serving water heater and boiler, and similar items).

5. Piping Exposed to Temperatures Above 130 deg F: Galvanized steel DWV or no-hub cast iron.

6. No-Hub Couplings: Couplings on below ground piping shall be the heavy duty type.

B. Cooling Condensate Drains: Copper DWV, copper, PVC DWV, or PVC. See Section 23 21 28.

C. Miscellaneous Drains: Copper DWV, copper, PVC DWV, or PVC.

D. Piping Exposed in Finished Areas: Chrome or nickel plated brass; piping 2 inches and larger may be provided with chrome or nickel plated brass sleeves to conceal pipe and fittings.

2.04 CLEANOUTS

A. General:

1. All cleanouts shall have cast iron bodies with bronze countersunk rectangular slotted plugs, lubricated with a non-hardening teflon base thread lubricant and having a gasket seal.

2. Cleanouts located in waterproof membrane floors shall be provided with an integral cast flange and flashing device.

3. All cleanouts shall be the same size as the pipe which they are intended to serve (but not larger than 4-inch).

4. Pipe fittings for cleanouts which turn through walls or up through floors shall use long sweep ells or a "Y" and 1/8 bend.

5. All cleanouts and access covers shall be provided with vandal proof screws.

B. Floor Cleanouts:

1. Areas With Floor Tile (or Linoleum): J.R. Smith No. 4140 Series adjustable floor cleanout with round heavy duty nickel bronze top with tile recess.

2. Areas With Bare Concrete Floors: J.R. Smith No. 4100 Series adjustable floor cleanout with round heavy duty nickel bronze top.

3. Areas With Terrazzo (and Similar Poured Floors): J.R. Smith No. 4180 Series adjustable floor level cleanout with round heavy duty nickel bronze top with terrazzo recess.

4. Areas With Carpet: J.R. Smith 4020-X Series adjustable floor level cleanout with round heavy duty nickel bronze top and carpet clamp.

C. Wall Cleanouts: Cast iron ferrule with cast bronze taper threaded plug, with plug tapped 1/4-inch, 20 thread, to accept access cover screw; with stainless steel access cover and vandal proof screw.

D. Outside Cleanouts: Heavy duty, round, cast iron, double-flanged housing, having scoriated

cast iron cover with lifting device, ferrule and bronze closure plug. Housing and

2.05 ACCESSORIES

A. Vent Flashing:

1. General: Style and type to suit roofing system, match vent pipe size, and provide waterproof building penetration. Provide with adequate base size for proper flashing into roof system.

2. EPDM or compression molded rubber; suitable for temperatures from -60 deg F to 270 deg F; resistant to ozone and UV light. Flashing shall have aluminum or galvanized steel base for flashing or attachment to roof (style to suit roof type). Provide stainless steel clamp.

3. 2.5 lb sheet lead, extending as a sleeve all around vent pipe with base extended out minimum 10 inches all around; top counter-flashing overlap 2" and turned down inside vent pipe.

PART 3 - EXECUTION

3.01 GENERAL

A. Installation of all items shall comply with code, best professional practices, manufacturers written installation instructions, and to allow for proper functioning of items being connected to.

B. Provide all piping as indicated and as required to allow complete and proper waste, drain, and vent connections to each fixture and equipment item requiring connection. Provide offsets as required to accommodate building construction and access requirements per Section 20 05 00. For multistory buildings include costs to offset vertical piping through each floor level since structural member locations will not be the same on each floor.

C. Coordinate installation of items with all trades that are affected by the work to avoid conflicts.

D. The work of this section shall include all waste (sanitary sewer), drain, and vent lines inside of the building and 5-feet outside of the building (unless indicated otherwise), to the point of and including connections to outside sanitary sewer lines or sanitary sewer manholes.

E. Consult manufacturers data and architectural drawings for information on plumbing fixtures before beginning rough-in.

F. Verify points of connection, invert elevations, and grade requirements before beginning installation or ordering materials.

G. Stub all piping for all items requiring connections through wall or floor; cap and protect until connection to items is complete.

H. Vents extending through roof shall terminate at least 10 inches above roofing; and not less than 10 feet from and 3 feet above any building opening. Provide vent flashing at each vent through roof; utilize water-proof method as required to best suit roofing material and roofing system manufacturer.

J. Trap all fixtures and equipment items as required by governing code; provide proper venting for each trap.

K. Provide drain piping for all drip pans, unit condensate drains, unit P-traps, etc. Run piping to nearest point of drainage, or as shown on drawings. Where routing is not shown, route to nearest point of proper drainage.

L. Provide piping connections to equipment furnished by others in accordance with Section 20 05 00.

M. All excavation, trenching and backfilling shall comply with code and pipe manufacturers recommendations.

3.02 PIPE AND FITTINGS

A. All piping in finished areas shall be installed concealed unless specifically noted otherwise.

B. Install piping so as not to obstruct access to any items requiring routine service, maintenance, or inspection. Offset or reroute piping as required to clear any interferences which may occur. Prior to running any piping, confirm with Architect/Engineer (unless is clearly noted to be ran exposed). Install exposed piping so as not to obstruct any portion of windows, doors, doorways, passageways, or items requiring service or access.

C. Consult all drawings for location of pipe spaces, ducts, electrical equipment, structural elements, ceiling heights, door items requiring access, openings, window openings, and other details and report discrepancies or possible conflicts to Architect/Engineer before installing pipe.

D. Install all horizontal soil or waste lines with a slope of 1/4-inch per foot unless noted otherwise. Coordinate with AHJ if written approval is required for exceptions to 1/4-inch per foot slope.

E. Make all changes of direction and junctions with Y fittings and 1/8 bends; use sanitary tee fittings in vertical pipe only.

F. Provide escutcheons where exposed pipe passes through walls, floors, or ceilings.

G. Install all piping parallel to the closest wall and in a neat, workmanlike manner. Horizontal straight runs of piping shall not deviate from straight by more than 1/4-inch in ten feet. Vertical piping shall not deviate from plumb by more than 1/8-inch in ten feet.

H. Do not run any piping above electrical panels (and similar electrical equipment). Provide offsets around such panels as necessary. Such offsets are typically not shown on the plans, but are required per this paragraph.

I. Prior to the joining of any section of pipe to a pipe run, the section shall be thoroughly cleaned inside and out, the ends shall be reamed to remove any cutting burrs and piping prepared as recommended by piping and fitting manufacturer.

J. Threaded Connections: Cut piping carefully, ream, thread and work into place without springing. Use TFE tape or lead and graphite lubricant (on male threads only).

K. Soldered Connections: Polish contact surfaces of fittings and pipes with emery cloth before fluxing male and female surfaces of joints. Steel wool and sandpaper not permitted for

polishing.

L. PVC Pipe:

1. Solvent Joints: The outside of the PVC pipe shall be chamfered to a minimum of 1/16-inch at approximately 22 degrees. Chemicals used must penetrate the surface of both pipe and fitting which will result in complete fusion at the joint. Use solvent and cement only as recommended by the pipe manufacturer.

2. Plastic to Metal Connections: Work the metal connection first. Use a non-hardening compound on threaded connections. Use only light wrench pressure. Connections between metal and plastic are to be threaded utilizing female threaded adapters only, not male adapters.

3. Expansion/Contraction: Provide offsets and expansion couplings to accommodate system expansion/contraction and for changes in building due to building shrinkage or other shifts. For wood framed construction of four stories or more; provide expansion couplings at each floor in waste and vent pipe risers.

3.03 INSTALLATION OF CLEANOUTS

A. General: Install cleanouts in all soil and waste piping:

1. As shown on drawings.

2. At no more than 100 foot intervals on horizontal runs (whether shown on drawings or not).

3. At the end of all piping runs.

4. At the base of all vertical risers.

5. At all changes of direction for a run of 10 feet or over.

6. Where needed to correct possible stoppage.

7. As required by Code.

B. Elevations:

1. Floor cleanouts shall be installed so as to be flush with the finished floor; where recessed cleanout covers are used the recess shall be filled flush with material to match the surrounding finished floor.

2. Wall cleanouts in finished areas shall all be installed at the same height for a uniform appearance throughout the facility. Heights shall be selected so as not to interfere with base molding or other trim work; verify with other trades.

C. Clearances and Access: Install cleanouts so as to assure proper clearances as required by governing code. Where cleanouts occur in concealed spaces provided extensions to floors above or to walls to allow access. Provide wall access covers or access doors for all wall cleanouts. See Section 20 05 19 for access doors.

D. Outside Building: All cleanouts located outside shall be provided with an access housing

located in a 24" x 24" x 6" thick concrete pad, flush with (or up to 1/4" above) the adjacent finished grade. The pipe and cleanout shall be independent of this access housing and pad.

3.04 TESTING AND INSPECTION

A. All piping shall be tested, inspected and approved prior to being concealed or covered.

B. Testing shall be by water or air, and comply with code.

C. Testing shall be witnessed by the code official, the Owner's representative (at their option), and the Engineer (at their option). Prior to beginning testing confirm with the Owner and Engineer their level of involvement in the testing process and extent of witnessing; where they will be witnessing the testing notify them at least 72 hours in advance of the test and confirm their availability; coordinate and reschedule as necessary and arrange mutually agreed upon times for the tests and witnessing to occur.

D. Water Testing:

1. Fill system with water so that there is no less than 10 feet of head above the highest system section being tested.

2. System shall hold pressure for a period of at least 15 minutes with no leakage before the inspection starts.

3. The system shall be inspected and shall hold tight with no leakage at all points.

E. Air Testing:

1. Pressurize system with air so that there is no less than 5 psig of air pressure in the system.

2. System shall hold pressure for a period of at least 15 minutes without the introduction of additional air before the inspection starts.

3. The system shall be inspected and shall hold tight with no leakage at all points.

F. All leaks shall be eliminated and the system re-tested before proceeding with work or concealing pipe.

G. All repairs to piping shall be with new material and no caulking of screwed joints or holes is allowed.

END OF SECTION

SECTION 22 40 00
PLUMBING FIXTURES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.

B. Requirements of Section 20 05 00 apply to this Section.

1.02 WORK INCLUDED

A. Plumbing Fixtures and Trim.

B. Installation/Connection of Equipment Specified Elsewhere.

C. Adjustment and Cleaning.

1.03 DEFINITIONS

A. "Plumbing Brass" means "P-traps, stops, strainers, tailpieces, flanges, and other brass fittings and accessories NOT including faucets or stops."

B. "Trim" includes all plumbing brass items, faucets, and any fixture accessories.

C. "Accessible" refers to the American's with Disabilities Act, and infers that these fixtures will meet Federal and local code requirements.

D. "Lead-Free" means not containing more than 0.2% lead in solder and flux; and not more than a weighted average of 0.25% lead in wetted surfaces of pipes, pipe and plumbing fittings and fixtures.

1.04 REFERENCES

A. UPC: Uniform Plumbing Code.

B. NSF/ANSI Standard 61: Drinking Water System Components – Health Effects.

1.05 SUBMITTALS

A. General: All submittals shall comply with Section 20 05 00.

B. Product Data: Submit product data for all plumbing fixtures, plumbing trim, and water heaters.

1.06 GENERAL REQUIREMENTS

A. Fixture Quality: Provide new fixtures and fittings, approved, free from flaws and blemishes

with finished surfaces clear, smooth and bright. Visible parts of fixture brass and accessories, and all items located in accessible cabinet spaces, shall be heavily chrome plated. All stops, P-traps and items exposed to view shall be chrome plated (except where specifically noted otherwise).

B. Code Compliance: All products and connections shall be in compliance with code, local Utilities Department standards, and Health Department requirements.

C. Off-The-Floor Mounted Fixtures - Movement:

1. General: Off-the-floor (i.e. wall) mounted fixtures shall be supported, anchored, and braced in a manner so that the fixture does not move more than the values indicated below with the imposed forces as indicated; nor shall the fixture or associated fittings leak or suffer damage of any kind. Deflection shall be measured at the front most part of the fixture (i.e. the point on the fixture furthest away from the wall containing the fixture supports), with the load imposed at the same location as the measured deflection. Deflection shall not be exceeded in any direction with the force imposed in any direction.

2. Other Fixtures: 1/16-inch with a 150 pound force.

D. Spare Parts: Provide two spare stop valves.

1.07 QUALITY ASSURANCE

A. General: Provide quality assurance checks specified in Section 20 05 00 prior to submitting product data. By submitting products for Engineer's review, the Contractor is confirming that such checks have been performed and that the products are suitable for the intended installation and use.

B. Fixtures:

1. Types: Verify specified fixture types with the Architectural and Plumbing drawings to confirm the requirements are consistent (e.g. fixtures are wall mounted versus floor mounted type, locations of ADA fixtures match, etc.). Where conflicts occur clearly identify the issue on the fixture submittal along with a proposed resolution; or resolve prior to making the submittal by the project RFI process.

2. Space Verification: Prior to ordering any fixtures or making submittals, Contractor shall check the drawings and verify that all fixtures will fit the space available (i.e. fixtures fit any cabinets fixtures are to be installed in; fixtures have adequate access clearances for proper use; etc.).

C. Lead-Free Requirement: All items in contact with potable water shall be lead free. Fixtures used to dispense potable water for drinking shall meet the requirements of NSF/ANSI 61.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Products shall comply with Section 20 05 00, Paragraph 2.01, Acceptable Manufacturers.

B. Water Closets: Kohler, American Standard, Eljer, Mansfield.

C. Vitreous china (other than water closets) and enameled cast iron fixtures: American Standard; Kohler, Eljer, Mansfield.

D. Water Closet Seats: Church; Beneke; Olsonite; Kohler; Bemis.

E. Carriers: Josam; J.R. Smith; Wade; Zurn.

F. Stainless Steel Sinks: Just; Elkay, Franke.

G. Hydrants and Hose Bibbs: J.R. Smith; Zurn; Josam; Mifab.

H. Floor Drains and Floor Receptors: J.R. Smith; Zurn; Josam; Mifab.

I. Plumbing Brass: McGuire; American Standard; Brasscraft; Dearborn Brass; Chicago Faucet; Crane; Eljer; Frost; Kohler; Speakman; Symmons; T & S Brass; Elkay.

J. Faucets: Chicago Faucet .T&S Brass; Speakman; Kohler; American Standard; Delta; Grohe; Moen.

K. Stops: McGuire; Brasscraft; ProFlo.

L. Flush Valves: Sloan, Zurn..

M. Hot Water Temperature Limiting Valve: Symmons, Watts, Chicago Faucet, Acorn Controls, Leonard, Cash Acme.

2.02 PLUMBING FIXTURES

A. General:

1. Plumbing Fixtures are listed below by reference numbers, corresponding to the reference number adjoining these items on the drawings.

2. All vitreous china and enameled cast iron fixtures shall be finished white unless specifically noted otherwise.

3. All stainless steel sinks shall be sound deadened, and shall have faucet ledge (except where noted specifically without ledge).

4. In interests of Owner's Standardization, fixtures of similar type shall be product of one manufacturer; trim of similar type shall be product of one manufacturer.

B. Water Closets:

P-1A Water Closet - Floor Mount - ADA:

Water Closet: Kohler “Highcliff”, No. K-36057, vitreous china, elongated bowl, floor mounted, siphon jet action bowl with 1-1/2" top spud, and 1.28 gallon flush.

Flush Valve: Sloan "Ecos” 8111-1.28 chrome-plated low consumption sensor operated flush valve with vacuum breaker, quiet-action, and screw driver stop.

Seat: Kohler “Lustra”, No. K-4670-SC, white plastic elongated seat, open-front and stainless steel self-sustaining check hinge.

ADA: Configure and install for ADA access. Verify with Architectural drawings for mounting heights and off-center stall dimensions. Provide with flush valve so that handle is on wide side of stall.

C. Lavatories:

P-3A Lavatory - Wall Hung - ADA:

Lavatory: Kohler “Greenwich”, No. K-2032, 20" x 18", vitreous china lavatory with 4" faucet centers, for use with concealed arm carrier.

Plumbing Brass: Kohler No. K-7131 offset lavatory drain with perforated grate and 1-1/4" tailpiece; Kohler No. 9000 1-1/4" cast brass "P" trap; stops and risers per “Specialties” in this specification section.

Faucet: Sloan No. ETF-600 sensor operated faucet, deck mount, 4” centers with trim plate, 0.5 GPM, chrome plated finish, hard wire power connection with transformer.

Cover: TrueBro Model Series 2018 ADA-compliant, high-impact UV-protected vinyl cover, custom factory pre-cut to fit lavatory.

Hot Water Temperature Limiting Valve: See Paragraph 2.04 this section. Provide 1 for each faucet.

D. Sinks:

P-5A Sink:

Sink: Elkay No. LRAD2219, multi-hole drill, 18 gauge, type 304 stainless steel, 19-1/2” front to back x 22” left to right x 6-1/2” deep self–rimming sink with rear faucet ledge.

Plumbing Brass: Elkay stainless steel cup strainer with 1-1/2” stainless steel tailpiece and 1-1/2” cast brass “P” trap; stops and risers per “Specialties” in this specifications section.

Faucet: Chicago Faucet No. 1100-HA8XKABCP deck mount sink faucet on 8” centers, with No. 1000 handles, No. HA8 swing spout, ceramic cartridges, and Chicago E34VP vandal resistant “Softflo” 1.5 gpm aerator.

E. Hydrants and Hose Bibbs:

P-10A Wall Hydrant - Non-Freeze:

J.R. Smith No. 5519 recessed box type wall hydrant, non-freeze type, with polished bronze box and bronze hinged cover, bronze hydrant and casing, integral vacuum breaker, "T" handle key and 3/4" inlet, 3/4" hose outlet, and overall depth to suit wall thickness and provide suitable freeze protection.

F. Floor Drains:

P-11A Floor Drain:

J.R. Smith No. 2010-A cast iron body floor drain, with nickel bronze adjustable strainer head, round nickel bronze grate, vandal proof screws, reversible flashing collar, and trap primer connection. Size drain outlet to match pipe size shown on drawings.

P-11B Funnel Floor Drain:

Same as P-11A but with 6" diameter nickel bronze top funnel (No. 3581). Cut out strainer inside of funnel to prevent splashing.

P-11C Floor Receptor:

J.R. Smith Figure 3100 series, enamel coated floor receptor, 10" deep, with 12" square nickel bronze half grate and rim, sediment bucket, trap primer connection, vandal-proof screws. Size outlet to match pipe size noted on drawings. Where used at dishwasher, provide with 1/2 grate. Where serving boilers leave grate off (turn over to Owner).

2.03 OFF-THE-FLOOR FIXTURE SUPPORTS (CARRIERS)

A. General: Type to suit fixture and building construction, with added anchors, bracing, wall backing and accessories to comply with maximum specified fixture movement. Concealed in wall. Provide with all hardware and accessories for proper fixture support to suit the application. See Section 20 05 29 for hangers and supports.

B. Lavatories: Steel construction, with 1-inch x 3-inch rectangular steel uprights welded to 4-inch square steel base plates for floor anchoring, and arms for lavatory support. J.R. Smith Figure 700 and 710 with added anchors, bracing, wall backing and accessories to comply with maximum specified fixture movement.

C. Other Fixtures: Manufacturers' standard carrier to suite fixture and application, steel construction with anchors, bracing, wall backing and accessories to comply with maximum specified fixture movement.

D. Non-Standard Fixtures: For fixtures that standard carriers are not manufactured for provide 3/16" thick steel back plate for block walls and wood stud walls; or a 2" x 2" x 1/4" angle welded to at least four studs for metal stud walls, with through bolts and fasteners to support fixture and comply with maximum specified fixture movement.

2.04 SPECIALTIES

A. General: Unless indicated otherwise, the following fittings and materials (i.e. specialties) shall be used.

B. Fixture Traps: 17 gage seamless chrome plated cast brass tubing, with 2 inch minimum seal, cast brass slip nuts, size as required by Uniform Plumbing Code (unless a larger size is indicated), and configured to suit the application. Provide with cleanout where indicated or required by code.

C. Exposed Piping and Fittings: In finished areas and in accessible cabinets, provide piping with chrome plating or sleeved with chromed sleeves or of stainless steel construction/finish; all chrome to have a bright polished finish. No exposed copper allowed (includes accessible cabinet areas).

D. Stops: Quarter turn ball valve type, chrome plated, UPC compliant, with low lead brass body, rated for minimum 125 psi operating pressure and temperature of water used with plus 20 deg F. Size and configuration to suit application. Provide with loose key where installed in areas with public access.

E. Risers: Flexible braided steel type; rated for 125 psig.

F. Escutcheons: See Section 20 05 19.

G. Hot Water Temperature Limiting Valve: Thermostatic water temperature mixing valve with integral checks, complying with ASSE 1070 and UPC Chapter 4. Brass body with brass and stainless steel internal components. Leonard “ECO-Mix” 270 or Symmons “Maxline” Model 5-210.

H. Sealant: See Section 20 05 30. Sealant at fixtures shall be the silicone type, color to match fixture.

PART 3 - EXECUTION

3.01 INSTALLATION OF FIXTURES

A. General: All fixtures shall be completely connected to piping as needed to make a complete and operable installation.

B. Fixture Locations: Mounting heights and locations of fixtures shall be as shown on the Architectural drawings and in accordance with Contract Document requirements. Locations shall be verified and coordinated with the various trades affected by the installation of these fixtures. When none indicated or shown, obtain mounting location and heights from the Architect/Engineer prior to installation. Floor drains shall be installed in proper locations and coordinated with floor slopes so that drains are set at low points to allow for floor drainage. Floor receptors (or floor sinks) shall be set flush with floors to allow drains to serve as both indirect drain receptors and as floor drains (unless noted otherwise or required to be elevated by code).

C. Rough-In: Determine rough-in location of fixture utilities to suit fixture location, fixture dimensions, elements of construction (i.e. beams, studs, electrical, ducts, etc.), access requirements, casework dimensions, items which may drain/connect to fixture, use of fixture, and related considerations. The fixture rough-in locations indicated on the plans is schematic, and is not to be used for final rough-in purposes. Coordinate fixture locations with other systems so that either conflicting items are relocated or fixture locations are adjusted to suit.

D. Offsets: Provide offsets in piping to fixtures to accommodate building systems. Such offsets shall include off-setting waste piping into cabinet bases (in kick space where possible) to accommodate beams located directly below walls behind fixtures.

E. Carriers: All off-the-floor (i.e. wall) mounted fixtures shall be installed with supporting carriers and additional anchors, bracing and supports to transmit fixture loads to the floor and building structure without exceeding the maximum specified fixture movement. Prior to concealing carrier and associated supports review adequacy of support system with Architect/Engineer.

F. Fixture Sealant: Where fixtures abut to walls, floors, and cabinets seal all joints with a uniform fillet bead of sealant. Provide at other locations as recommended by fixture manufacturer.

G. Protection: Protect fixtures against use and damage until project substantial completion; provide guards and/or boxing to protect.

3.02 INSTALLATION OF SPECIALTIES

A. Escutcheons: Provide escutcheons at each point where an exposed pipe or other fitting passes through walls, floors, backs of cabinets, or ceilings.

B. Stops: Provide stops in water connections to all fixtures/equipment, except where a stop valve is integral to the fixture (e.g. flush valves) and in water connections to all items not served by another valve.

C. Hot Water Temperature Limiting Valve: Install on all lavatories, hand wash sinks, bathtubs, showers, whirlpools, bidets and at fixtures required by Code (reference UPC Chapter 4); set for 115 deg F maximum delivery temperature. Test and adjust for proper operation and submit written report documenting work performed.

3.03 INSTALLATION OF EQUIPMENT SPECIFIED ELSEWHERE

A. General: Refer to the drawing schedules, architectural specifications and related information in the Contract Documents. Under this section of the specifications provide and install and/or connect all plumbing services indicated to be by Mechanical (M), Plumbing (P), or by Divisions 20, 22, or 23.

B. Installation: Comply with installation requirements for fixtures and specialties per this specification Section.

C. Complete Connections: Provide all water supply stops and appurtenances necessary to make a complete installation of items. All lines between the stops and fixtures/equipment shall be hard piped, chrome plated and sized as indicated (or, where not sized, size per the UPC or manufacturer).

D. Exposed: All waste, drain, indirect drain, and traps exposed to view shall be chrome plated or sleeved with chromed sleeves.

3.04 ADJUSTMENT AND CLEANING

A. Cleaning: After completion of installation remove all labels and thoroughly clean all fixtures, trim and fittings.

B. Adjustment: Adjust all flush valves, fixture stops, faucets, valves, and associated plumbing items as necessary for the proper operation of all fixtures and equipment.

3.05 COMMISSIONING

A. The Products referenced in this section are to be commissioned per Section 20 08 00 Commissioning. The Contractor has specific responsibilities for scheduling, coordination, startup, test, development, testing and documentation. At a minimum, the Contractor shall provide a documented and signed record to verify that all equipment and systems installed under this contract have been inspected and functionally tested to verify full compliance with the contract specifications. In many cases, this shall require the Contractor to create or otherwise provide procedures and checklists for approval by the Commissioning Consultant prior to the start of functional testing. Reference Section 01810 and coordinate all commissioning activities with the Commissioning Consultant.

END OF SECTION

SECTION 23 09 33
ELECTRIC AND ELECTRONIC CONTROL SYSTEM FOR HVAC

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.

B. Requirements of Section 20 05 00 apply to this Section.

1.02 WORK INCLUDED

A. Control System Design.

B. Control System for Building Heating, Ventilation, Air Conditioning, Exhaust.

C. Control Devices, Components, and Wiring.

D. Testing, Adjustment, and Commissioning.

E. Owner Training.

1.03 SUBMITTALS

A. General: Shall comply with Section 20 05 00.

B. Product Data: Submit product information on all items to be used.

C. Shop Drawings: Submit a complete set of shop drawings prior to installation containing the following information: interconnect drawings showing all wiring and control connections; control panel details; arrangement of devices in panels; schedule of dampers with sizes and where used; sequence of operation for all equipment; location of all control devices on scaled building plans; and list of actuators with sizes and where used.

D. Labeling: Submit list of proposed component labeling.

E. Operation and Maintenance Manuals: See Section 20 02 00. In addition to the information required by that Section and Division 01, provide (for inclusion in the Manual) the following:

1. System description.

2. Complete sequence of operation.

3. Reduced size (11" x 17") copies of record drawings.

4. Submittal data on all products.

F. Commissioning Plan and Report: See Section 20 08 00. Provide commissioning plan; including a checklist of control items to be reviewed and method of testing sequence of operation. Submit final report documenting tests performed and results.

1.04 GENERAL REQUIREMENTS

A. Design and Installation: The control system is design/build type; all design is by the contractor with the system providing the features and sequences specified. The entire control system shall be designed and installed by skilled control system designers, electricians and mechanics, all of whom are properly trained and qualified for the work they perform.

B. Sole Responsibility: One single Contractor shall be responsible to design, furnish and install the complete Section 23 09 33 control system.

C. Sequence: System shall have sequence of operation as specified in Section 23 09 93.

1.05 WARRANTY

A. Warranty: After completion of the installation of the control system and acceptance by the Owner, the system shall be warranted as free against defects in manufacturing, workmanship and materials for a period of two years from date of substantial completion. In addition, the system shall be warranted to provide the sequence of operation and basic features specified, with the accuracy and flexibility also specified. The system shall be repaired or replaced, including materials and labor, if in Owner's and Engineer's reasonable opinion, system is other than as warranted.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Products shall comply with Section 20 05 00, Acceptable Manufacturers.

B. Thermostats and Time Clocks (Non DDC): Honeywell, Paragon.

C. Actuators: Belimo, Honeywell, Siemens, Johnson Controls.

D. Dampers: Ruskin, Greenheck.

E. Control Accessories: Idec, Hoffman, McDonnell, Tridelta, Edwards, Mamac, Penn, Belimo, Honeywell, Johnson Controls, Leviton, Arrow-Hart, Alerton.

2.02 BASIC SYSTEM

A. System Type: The system shall be an electronic or electric type.

2.03 THERMOSTAT AND TIMECLOCK

A. Programmable Thermostat: Shall be 7-day programmable solid state type, specifically designed for commercial use. Unit (and related relay module, and controls) shall allow for 1st-stage economizer cooling, 2nd stage unit cooling, 1st stage heating, 2nd stage heating and provide other features as required by the sequence of operation. Thermostat shall have means to bypass time clock, have Auto-Cool-Off-Heat switching, setpoint adjustments, and time/day adjustments. Unit shall also have capability for averaging multiple remote

thermostat sensors. Honeywell T7351 Series, other Honeywell series (as required to provide sequence and match unit furnished), or approved.

B. Thermostat Sensor: Remote temperature sensor for use with programmable thermostat, specifically designed for commercial use. Unit shall have space temperature sensor, unoccupied mode pushbutton override with LED, and temperature setpoint adjustment. Honeywell T7771 Series, or approved.

C. Logic module: Solid state control package to provide economizer functions. Shall include logic module, sensors, and accessories necessary to provide a complete and operational system, and shall be compatible for use with specified HVAC equipment and programmable thermostat.

D. Accessories: Provide duct temperature sensors required for mixed air applications; shall be the averaging type with a sensor element type so as to sense a representative sample of the medium being controlled. Provide sensors as required to work with economizer controls.

E. General Time Clock: 365 day programmable timeclock, for control of up to four independent loads each with a different schedule, with 50 setpoints of programming. Each output able to be programmed as a maintained or momentary contact closure with duration of 1 to 59 seconds. Features shall include: Time of day scheduling, holiday programming, daylight savings time adjustment, leap year correction, manual override, and battery back-up (for one month operation without power). Unit shall have a NEMA 1 enclosure. Paragon EL74 (or approved).

2.04 CONTROL DAMPERS

A. Type: Dampers shall be parallel blade or opposed blade type, as selected by contractor to best suit application (unless a specific type is indicated).

B. Leakage: Class 1A leakage rated in accordance with AMCA 511 (or better, as required by Code).

C. Construction: Construct of galvanized steel, except where installed in ducts of stainless steel or aluminum construction or handling corrosive air, shall be of stainless steel or aluminum construction (to match duct material). All materials in contact with the airstream shall be suitable for the conditions without deterioration. Provide special coatings as necessary to provide corrosion resistance. Frame shall be minimum 16 gauge.

D. Blades: Single blade type, not exceeding 6 inches in width,16 gauge, with neoprene, extruded vinyl or butyl rubber edge seals and flexible metal jamb seals; linkage interconnecting all blades and actuator axle.

E. Bearings: Nylon, molded synthetic or oil impregnated sintered metal bearings (or other materials as conditions require).

2.05 ACTUATORS

A. Type: Actuators shall be a brushless DC motor type controlled by a microprocessor.

B. Operation: Shall be compatible with control devices used with to provide specified sequence and system features. Run time shall be constant, independent of torque. Actuator shall have manual positioning mechanism and control direction of rotation switch accessible on its cover. Provide with auxiliary switches as required for sequence of operation. Actuator shall be proportional or two position type, as required for application.

C. Sizing: Provide actuator with sufficient power and torque to suit items being controlled and allow proper operation against system pressures liable to be encountered. Actuator shall be capable of driving controlled items from full closed to full open in less than 15 seconds.

D. Spring Return: All actuators shall spring return upon power interruption: The spring return position shall be a “fail safe" position as dictated by freeze, fire, temperature protection, energy saving, or safe operating requirements. Outside air dampers shall spring return closed; return air dampers shall spring return open. VAV terminal units and zone dampers do not require spring return actuators.

E. Accessories: Units shall be complete with all linkages, brackets, and hardware required for mounting and to allow for proper control and operation.

2.06 SWITCHES

A. Wall On/Off Switch: Standard wall box type switch, single or double pole, and contact type as required to suit application; with illuminated switch for when controlled item is on; volt/ampere ratings to suit application. Provide with stainless steel wall plate; label as to function.

B. Wall Hand/Off/Auto Switch: Standard wall box type switch, single or double pole, three position, center off position, maintained contact. Hubbell HBL 1381, 1382.

C. Interval Timer: 4 hour (unless specified longer) spring operated interval timer with wall plate indicating timer setting, and control knob. Timers shall not have a permanent HOLD position.

D. Emergency Wall Switch: Red mushroom head push button, minimum 1.5-inch diameter with sustained position, contact type and configuration to suit application. Where indicated, provide with hinged clear plastic guard protecting against accidental activation but allowing emergency access.

2.07 ACCESSORIES

A. Wiring and Conduit: Shall comply with Division 26 specifications and with code. Wiring that performs code required life safety shutdown of equipment or fire alarm interface shall comply with NFPA standards and local codes for fire alarm system wiring.

B. Control Cabinet: Wall mounted, NEMA construction type to suit application, minimum 14 gauge sheet metal, hinged front door with latch. Size as required to house controls.

C. Relays: Shall be rated for the application, with a minimum of two sets of Form C contacts, enclosed in a dust-proof enclosure. Relays shall have Hand-Off-Auto switch, and LED’s (or pilot lights) to indicate the energized mode. Relays shall be rated for a minimum life of one million cycles. Operating time shall be 20 milliseconds or less, with release time of 10 milliseconds or less. Relays should be equipped with coil transient suppression devices to limit transients to 150% of rated coil voltage. Contact rating, and configuration selected to suit application.

D. Thermowells: Bronze or brass with NPT threads, sized to match device used with. All wells to be installed by the trade installing the piping system the well installs in.

E. Condensate Overflow Switch: Overflow switch to detect high condensate level to stop unit operation and indicate an alarm, low voltage, PVC or ABS construction, with switch rated for voltage/amperage used with. Style to best suit application (i.e. in drain pan type, in drain line

type, or type that installs in unit auxiliary drain outlet); selected by Contractor subject to Engineer review. Little Giant Nos. ACS-2, -3, -4, or -5 (or approved equal).

F. Miscellaneous Components/Sensors/Transmitters/Transformers: Shall be manufacturer's standard, designed for application in commercial building HVAC control systems, compatible with other components so as to provide sequence of operation specified.

PART 3 - EXECUTION

3.01 INSTALLATION

A. General: Provide all devices, sensors, relays, switches, dampers, actuators, conduit, tubing, wiring, motor starters and all other devices required to provide a complete integrated control system with the sequence of operation and features as specified. It is the Contractor's responsibility to coordinate with other trades for the installation of control devices in systems installed by others.

B. Installation: Install all control components in accordance with manufacturer's instructions and recommendations and best professional practices.

C. Coordination: Coordinate work with other trades to ensure that all trades have the information necessary so that they may properly install any necessary control components, interconnect with control components, and install their work to accommodate controls. Identify all items requiring ceiling or wall access doors (or other special requirements) to trade installing access doors or performing related work.

D. Space Requirements and Locations: Carefully check space requirements and coordinate with other trades to ensure that items can be installed in the allotted spaces, including above finished suspended ceilings. Adjust locations of panels, equipment, devices, and the like, to accommodate work and prevent interferences. Determine the exact route and location of wiring, conduit and other control devices prior to beginning work.

E. Mounting: Mount controls adjacent to associated equipment on vibration free elements on free standing fabricated supports; mount and locate for best access.

F. Control Cabinets: All electrical devices, relays, and components shall be installed in protective covers (i.e. control cabinets), except where installed concealed above ceilings a cover is not required. Controls/devices shall be logically assembled in cabinet, with all devices and cabinet labeled.

G. Thermostats: Room thermostats shall be mounted 4'-6" above finished floor unless indicated otherwise. Thermostats shall connect to the HVAC unit serving the space the thermostat is located in, unless indicated otherwise. Not all thermostats are shown on the drawings and those shown are preliminary only. Contractor shall indicate all final thermostat locations on submittal drawings. Contractor is responsible to coordinate locations to avoid tackboards, casework, and other interferences.

H. Power: It shall be the responsibility of this Contractor to provide power for all control devices requiring power. Coordinate with the Division 26 Contractor to arrange for necessary power circuits. All control devices shall obtain power from circuits dedicated to control power.

I. Wiring, Conduit and Electrical:

1. General: Provide all electrical wiring and devices in accordance with applicable codes and Division 26 requirements.

2. Conduit: All wiring shall be installed in conduit and in accordance with Division 26 specifications, except that low voltage wiring within ceiling plenum spaces, mechanical mezzanines, and attics may be installed without conduit. Wiring in walls shall be in conduit.

3. Wire Labeling: Label or code wiring at each end to show location of the opposite end. Each point of all field terminal strips shall be permanently labeled or coded to show the instrument of item served. Color coded cable with cable diagrams may be used to accomplish cable identification and terminal strip.

4. Service Loop: Provide minimum of 6" extra wiring at all wiring terminations for ease of future maintenance/servicing. Such extra wiring shall be neatly coiled/bundled to allow for uncoiling when the connected equipment is serviced.

5. Workmanship: Install all conduit and wiring parallel to building lines, in neat bundles, supported at not less than 5 foot intervals.

J. Component Labeling: All control components, except regular room thermostats, shall be equipped with name plates to identify each control component. Components in finished rooms shall be labeled as to generic item controlled for better user understanding; other devices shall be labeled with the same designation which appears on the Control Diagrams. Contractor shall submit list of proposed labeling prior to installing. Reference Section 20 05 00.

K. Thermostat Setpoints: Thermostat Setpoints (all adjustable) shall be as follows unless indicated otherwise:

Occupied Heating	70 degrees F
Unoccupied Heating	65 degrees F
Occupied Cooling	75 degrees F
Unoccupied Cooling	85 degrees F

L. Motor Starters: Shall be by Division 26; except for loads 1/2 hp and less which shall be by this Section.

M. Device Duct Installation: All control devices installed in ductwork shall be positively anchored and attached to the ductwork by mechanical means (fasteners, straps, unistrut, etc).

N. Miscellaneous Controls: Provide all miscellaneous control items as noted in the Contract Documents. Provide all necessary control wiring between items for proper control.

O. Condensate Overflow: Provide all cooling coils (except not required for room exposed wall mounted AC units) with field installed condensate overflow switches wired to stop cooling unit operation upon detection of a high condensate level.

3.02 INSTALLER COMMISSIONING

A. General: The commissioning specified in this paragraph is independent and separate of the commissioning work of Section 20 08 00 and is to be provided by the Section 23 09 33 system installer.

B. Commissioning:

1. General: Check all system connections and control components for proper installation. Provide testing of the control system to verify proper system operation and that the specified sequences of operation are provided. Commissioning shall include checking system under all modes of operation, documenting system performance, making corrections as required for proper operation, and re-testing as needed to obtain final proper operation.

2. Dampers: Verify all dampers operate through their full range of motion and in the proper direction in response to controls signals.

3. Sensors/Thermostats: Check measurements of temperature sensors, thermostats, pressure sensors and other devices against independent readings to confirm proper operation and sensor locations. Readjust sensor locations as necessary to account for field conditions that may cause inaccurate measurements.

4. Calibration: Calibrate items as necessary to allow for their proper operation.

5. Adjustments: Adjust system settings as needed to allow for best system operation, consistent with the specified sequences and for facilities of the type the system serves.

C. Start-Up: Coordinate all system and equipment start-up with other trades. Start-up systems in accordance with equipment manufacturer's instructions and in conjunction with trades that installed the items being controlled, so that they (or manufacturer's representatives) are present at start-up. Operate and configure the controls for safe equipment start-up and so that equipment operates in a controlled manner. See equipment specification sections for equipment start-up requirements. Test and observe all equipment being controlled during start-up to confirm proper controls operation.

3.03 OWNER INSTRUCTION

A. Owner Instruction: Provide instruction to Owner on the operation and maintenance of the control system. Provide field demonstrations and show Owner the locations of all control devices; explain and demonstrate how system adjustments are made; explain and demonstrate system sequences of operation.

END OF SECTION

SECTION 23 09 93
SEQUENCE OF OPERATION FOR HVAC CONTROLS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.

B. Requirements of Section 20 05 00 apply to this Section.

1.02 WORK INCLUDED

A. Sequence of Operation.

1.03 SUBMITTALS

A. General: Shall comply with Section 20 05 00.

B. Sequence: Submit complete description of sequence of operation. Sequence submitted shall not be a direct copy of the sequence specified herein, but shall be written to reflect the actual control sequence provided.

C. Shop Drawings: Provide complete control system shop drawings; see Section 23 09 33.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

3.01 GENERAL

A. General: Provide complete system with sequences of operation as specified herein.

B. Time Control: Control system shall provide time control (i.e. occupied/unoccupied/ warm-up modes switching) for all HVAC and exhaust equipment. Provide independent occupied/unoccupied schedules and optimum start (i.e. warm-up) cycle for each HVAC unit (unless noted otherwise), all fans having time clock control, and all heaters. Except that exhaust fans serving adjacent restroom areas may share time schedules.

C. Warm-up Control: Control system shall provide warm-up switching for all HVAC units and items indicated as having a warm-up cycle.

D. Adjustability: All temperature setpoints and time control settings shall be adjustable.

E. Thermostats: Various thermostats are not shown on the drawings but are required per the sequence of operation specified. Coordinate with Engineer for location of all such thermostats prior to installing. Indicate proposed locations on submittals.

F. Miscellaneous Items: See plans for units with motorized dampers in the ducts and miscellaneous other items requiring control.

3.02 DUCTLESS SPLIT SYSTEM MULTI-ZONE HEAT PUMPS

A. General:

1. System shall use manufacturer's controls to control all space indoor units and outdoor unit system components as a unified system. System shall provide the sequence of operation specified.

2. System shall operate in either heating or cooling mode. Initially the indoor units' heating/cooling mode shall be determined and set based on outside air enthalpy conditions. Once all indoor units are satisfied and/or are in the same heating/cooling mode, the outdoor unit will switch between heating and cooling to satisfy the indoor units.

B. Occupied Mode:

1. Fan shall run continuously.

2. Unit shall cycle in heating or cooling operation as required to satisfy space thermostat.

3. Heating: Heat pump shall operate in heating.

4. Cooling: Heat pump shall operate in cooling.

C. Unoccupied Mode: Unit's fan and heating/cooling shall cycle on and off as required to maintain setback temperatures.

D. Mode Control: Units' mode of operation shall be determined by system central controller time schedule and local thermostat time schedule override.

3.03 EXHAUST FANS

A. General: See "Control" column on Fan Schedule for which of the following control methods apply to each fan.

B. Wall Switch: Fan shall be controlled by wall mounted on/off wall switch.

C. Interval Timer: Fan shall be controlled by wall mounted interval timer; fan shall be on when timer is activated and off otherwise.

D. Time Clock Control: Fan shall run from time clock control schedule; fan shall be on for the scheduled occupied period and be off otherwise.

3.04 ELECTRIC HEATERS

A. General: Heater shall be controlled by heater's integral thermostat wall thermostat and integral night set-back relay or by contactor in power wiring to unit; with HVAC unit's thermostat that serve the area or central timeclock providing occupied/unoccupied mode control.

B. Occupied Mode: Heater shall be on once space temperature has fallen below setpoint, and shall be off once temperature has risen 2 deg. F or more above setpoint.

C. Unoccupied Mode: Heater shall be off.

D. Warm-Up Mode: Heater shall be off.

3.05 ELECTRIC DUCT HEATERS

A. General: Heater shall be controlled by a duct mounted temperature sensor to vary the heater capacity to satisfy duct temperature setpoint (initially set for 70 deg. F). Heater shall have staged or proportional control as indicated.

B. Operation: Heater shall be on once space temperature has fallen below setpoint, and shall be off once space temperature has risen 2 deg. F or more above setpoint (with proportional or staged control between on/off limits).

C. Interlock: Shall be hard-wire interlocked with the supply fan on the unit which serves the heater, to only allow heater operation when the unit's fan is proven on. Provide differential pressure switch or CT's at unit fan to provide proof of operation.

3.06 MISCELLANEOUS CONTROLS

A. Fire Alarm System Shutdown: Shut-down all air handling equipment when the building fire alarm system goes into alarm. Zone contacts in the fire alarm system are available for this purpose. This added shut-down may be accomplished by use of control logic and is not required to be hardwired but shall be of a fail-safe nature so as to provide the necessary shut-down in case of control failure.

3.07 ENERGY RECOVERY VENTILATORS

A. General: unit shall operate based on time control (occupied, unoccupied).

B. Occupied Mode: Unit shall run.

C. Unoccupied Mode: Unit shall be off.

END OF SECTION

SECTION 23 31 00
HVAC DUCT AND CASINGS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.

B. Requirements of Section 20 05 00 apply to this Section.

1.02 WORK INCLUDED

A. Environmental Ductwork Systems.

B. Flexible Duct.

C. Preparation of Duct for Service.

D. Duct Pressure Testing.

1.03 DEFINITIONS

A. Duct Sizes: All duct dimensions shown are inside clear dimensions. Where inside duct lining is specified or indicated, duct dimensions are to the inside face of lining.

1.04 QUALITY ASSURANCE

A. All work and materials shall comply with SMACNA-DCS, NAIMA-DLS, ASHRAE-F, IBC, IMC, NFPA-90A, NFPA-90B, and code. The most restrictive criteria governs.

B. Leakage Criteria: Duct system shall be constructed and sealed so that leakage does not exceed the following:

1. All Systems - Supply Duct: From fan to connection to air outlet 5%.

2. All Systems - Return Duct: 5%.

3. All Systems - Exhaust Duct: 5%.

C. Fabrication Proximity: The Contractor performing the work of this section shall have fabricating facilities located within 100 miles of the project site.

D. Drawing Review: Prior to beginning any work review all drawings, duct routing, duct connections, equipment configuration, equipment connection locations, and other work details to discover conflicts in anticipated duct arrangement and improper or incomplete connections. Review shall include the following: supply ducts not connected into return (or exhaust) ducts, ducts not crossed and improperly connected in shafts, air outlets/inlets connected to ducts, unit configuration compatible with planned duct connections, louver

locations match architectural plans. Submit resolutions of such possible conflicts as submittals with shop drawings of proposed solutions; written description in lieu of shop drawings is acceptable for minor issues.

1.05 SUBMITTALS

A. General: Comply with Section 20 05 00.

B. Product Data: Submit product data for duct lining, flexible duct, and factory fabricated items.

C. Shop Drawings: Submit shop drawings for all HVAC ductwork which is to be installed differently than as shown on the drawings.

D. Conflict Resolution: Submit additional shop drawings showing proposed resolution of conflicts after review of documents and again after review of actual field conditions.

1.06 DUCT PRESSURE CLASS

A. Constant Volume Systems: Ductwork shall be constructed to the pressure class corresponding to the static pressure indicated for the fan which serves the duct system or 1-inch pressure class (plus or minus as appropriate), whichever is higher; unless noted otherwise.

1.07 REFERENCES

A. ADC-FLEX: Air Diffusion Council Flexible Duct Performance and Installation Standards.

B. ASHRAE-F: ASHRAE Handbook of Fundamentals.

C. ASTM A 653: Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot Dip Process.

D. ASTM A 924: General Requirements for Steel Sheet Metallic-Coated by the Hot-Dip Process.

E. ASTM E 84: Standard Test Method for Surface Burning Characteristics of Building Materials.

F. IMC: International Mechanical Code.

G. NAIMA-DLS: North American Insulation Manufacturers Association Fibrous Duct Liner Standards, 1st Edition.

H. NFPA 90A: Standard for the Installation of Air Conditioning and Ventilating Systems.

I. NFPA 90B: Standard for the Installation of Warm Air Heating and Air Conditioning Systems.

J. SMACNA-DCS: SMACNA HVAC Duct Construction Standards, 3rd Edition.

K. UL 181: Underwriter Laboratories Factory-Made Air Ducts and Air Connectors.

L. UL 181A: Underwriter Laboratories Closure Systems for Use with Rigid Air Ducts.

M. UL 181B: Underwriter Laboratories Closure Systems for Use with Flexible Air Ducts and Air Connectors.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Products shall comply with Section 20 05 00, Paragraph 2.01, Acceptable Manufacturers.

B. Sheet Metal: All domestic manufacturers.

C. Spin-in Fittings and ATTO: Sheet Metal Connectors Inc., United McGill, Royal Metal Products, Airflow Products Inc.

D. Gasketing: Preson, Insulfab, Duraco.

E. Duct Sealant and Tape: Carlisle (Hardcast), Ductmate, Benjamin Foster, Grace Construction Products, United McGill, Polymer Adhesives Sealant Systems, RCD Corporation, Nashua, 3M.

F. Flexible Duct: Flexible Technology Inc., JP Lamborn Co.; Hart & Cooley, Thermaflex.

G. Acoustical Duct Lining: Johns-Manville.

2.02 GENERAL MATERIALS

A. Ducts: Construct of galvanized sheet steel, suitable for lock forming without flaking or cracking, conforming to ASTM A653 and A924, having a zinc coating of 0.90 ounces total per square foot for both sides of a sheet, corresponding to coating G90.

B. Fasteners: Steel construction, electroplated zinc coated, having strength properties adequate for the application, compatible with materials being joined, and in accordance with SMACNA-DCS. Where exposed to corrosive conditions shall be of Type 304 or 316 stainless steel. Type to meet duct pressure class and duct leakage requirements. Where used for the support and anchorage of ducts shall comply with Section 20 05 29, with independent test reports regarding strength.

C. Spin-in Fittings: Factory fabricated of galvanized steel with die-formed mounting groove and damper with raised damper quadrant where ducts are to be insulated. Collar length for flexible duct attachment shall be at least 2" long.

D. Air-Tight Take-Off Fittings (ATTO): Factory fabricated branch duct connector, of galvanized steel. Flange shall be 1-1/2” wide with 1/8” self-adhesive gasket and pre-drilled fastener holes. Collar length for flexible duct attachment shall be at least 2” long. Where used on round duct mains, shall be saddle type appropriately sized for main duct diameter.

E. Draw Bands:

1. Metal: Worm gear type clamp, constructed of galvanized steel, stainless steel, or aluminum; minimum 1/2-inch wide band; suitable for 200 pound loading.

2. Non-Metal: Nylon “zip-tie” with self-locking ability, designed for flexible duct usage, minimum 1/4 inch wide, rated for 175 pound load, suitable for temperatures from 0 to 185 deg F; listed per UL181B and labeled “UL181B-C”.

F. Gasketing: Vinyl nitrile, vinyl neoprene, or neoprene nitrile PVC blend; designed for HVAC use with size to suit the application having minimum 1.5-inch width at equipment roof curb

applications. Fire hazard rating not to exceed 25 for flame spread and 50 for smoke development per ASTM E 84.

G. Duct Sealant/Mastic: Water based duct sealant, listed per UL 181B-M and UL 181A-M, suitable for indoor and outdoor use. Fire resistant with a flame spread rating of 5 or less, and a smoke developed rating of 0. Sealant shall be resistant to ultraviolet radiation and ozone. Fiberglass mesh shall be minimum 0.006-inches thick, with minimum 9 x 9 weaves per inch, and 2-inch width; for use with mastic in sealing ductwork. Sealant system shall be suitable for duct system pressure class and materials used with. Carlisle Hardcast “Versa-Grip 181”.

H. Foil Tape: Foil back adhesive tape, listed per UL181A-P and UL181B-FX, with listing labeled on tape outer foil face. Minimum 3-inch width for metal-to-metal applications; minimum 2-inch width for flexible duct applications. 3M No. 3340 or Nashua No. 324A.

2.03 DUCT FABRICATION

A. Duct Gauge and Reinforcement: Shall be as shown in SMACNA-DCS according to the pressure classification of the system and the duct dimensions; with heavier gauge duct used as required to minimize duct reinforcement to suit space available and other project constraints. In no case shall ducts be constructed of less than 26 gauge material.

B. Joints and Seams: Construct in accordance with SMACNA -DCS, code requirements, and these specifications (more stringent governs). Ducts shall be constructed and sealed so that the leakage criteria is not exceeded. Round ducts shall be the spiral seam type; except that branch ducts to individual air inlets/outlets less than 16" diameter may be of other types as allowed by SMACNA-DCS. Coordinate joint spacing with duct reinforcement requirements so that transverse joints having the required stiffness may be incorporated in the reinforcement spacing schedule. Round duct transverse joints shall be made with beaded sleeve joints or flanged connections in accordance with SMACNA-DCS; except that branch ducts to individual air inlets/outlets less than 16" diameter may use other joining methods as are allowed by SMACNA-DCS.

C. Elbows and Tees: Shall be long-radius type with a center-line radius not less than 1-1/2 times the width or diameter of the duct. Where space does not permit the use of long-radius elbows, short-radius or square elbows with turning vanes may be used. Elbows in round duct systems with duct pressure class above 2-inches shall be stamped type, welded segmented type, or standing seam segmented type.

D. Transitions: Increase duct sizes gradually. Transitions for diverging air flow shall be made with each side pitched out not more than 22.5 degrees. Transitions for converging air flow shall be made with each side pitched in not more than 30 degrees. Except that eccentric transitions for round to flat oval may have up to a 45 degree pitch.

E. Branch Connections: Shall comply with SMACNA-DCS, and as required herein.

1. Rectangular-to-Rectangular: Rectangular take-off with 45 degree angle on “inside” of take-off, minimum 4" length. Reference SMANCA-DCS Figure 4-6. Close corner openings.

2. Rectangular-to-Round:

a. Serving Individual Air Inlet/Outlet: Spin-in type connector or air-tight take-off (unless a different fitting type is specifically noted).

b. Serving Branch Duct: Rectangular to round transition, with maximum degree pitch as specified for transitions. Rectangular end size shall have free area no less than round end. Rectangular connection to rectangular main shall be made as specified for “Rectangular-to-Rectangular” connections.

3. Round-to-Round:

a. All Connections: Air-tight take-off or constructed in accordance with SMACNA-DCS and recognized professional practices.

4. Other Connections: In accordance with SMACNA-DCS and recognized professional practices.

F. Ductmate Systems:

1. Rectangular Duct: Transverse duct joints may be made with Ductmate System, or approved equal. System shall consist of companion flanges of 20 gauge galvanized steel with an integral polymer mastic seal; corner pieces of 12 gauge G90 galvanized steel; 20 gauge G90 galvanized cleats; closed cell, high density gasket type; and galvanized carriage bolts with hex nuts. The flanges shall be securely fastened to the duct walls using self-drilling screws, rivets or spot welding. Fastener spacing shall be as recommended by the manufacturer for the size of duct and the pressure class. The raw duct ends shall be properly seated in the integral mastic seal. A continuous strip of gasket tape, size 1/4" x 3/4", shall be installed between the mating flanges of the companion angles at each transverse joint; and the joint shall be made up using 3/8-inch diameter x 1-inch long plated bolts and nuts. Galvanized drive-on or snap-on cleats shall be used at spacing recommended by the manufacturer.

2. Round Duct: Transverse duct joints may be made with Ductmate “Spiralmate” system, or approved equal. System shall consist of galvanized steel round connector flanges (fitting inside each duct section to be joined) and an exterior galvanized steel closure ring with tightening bolt to form an airtight duct connection and join flanges together. Duct connector flanges shall have non-hardening integral mastic to seal between flanges and duct, and a neoprene gasket to seal flange faces.

G. Lined Ductwork:

1. Rectangular Ducts: Contractor Fabricated ductwork with interior duct lining. Duct fabrication and liner installation shall comply with NAIMA-DLS. Lining material shall comply with paragraph titled “Duct Lining” in this specification section.

2. Round and Oval Ducts: Shall consist of acoustic insulation in between a perforated interior duct liner and solid exterior duct. Acoustic insulation shall be 1-inch thick, except where noted to be greater. Duct sections shall connect by mechanical means to maintain positive concentricity of liner with duct. All fittings and transitions shall have perforated inner liner (except where noted otherwise). Lining material shall comply with paragraph titled “Duct Lining” in this specification section. United McGill "Acousti-k27" (or approved).

2.04 FLEXIBLE DUCT

A. Type: Factory insulated fully lined flexible duct.

B. Construction: Double-ply neoprene coated polyester fabric hose, reinforced with a steel wire helix. Black color. Fire hazard rating not to exceed 25 for flame spread and 50 for smoke development, as tested by ASTM E84.

C. Thermal Characteristics: Certified thermal resistance "R" of 4.2 Hr-SF-deg F/Btu, rated in accordance with ADC-FLEX. Except where duct is installed in an unconditioned area (and where required by code) provide certified thermal resistance "R" of 8 Hr-SF-deg F/Btu, rated in accordance with ADC-FLEX.

D. Working Pressure: As required to suit maximum pressure to be encountered on system, but no less than 4-inch wc positive, 0.5-inch wc negative.

E. Length: Shall not exceed 5 feet.

F. Code Compliance: Comply with code and applicable standards; including NFPA 90A, NFPA 90. Shall be UL listed and labeled as a Class 1 connector per UL 181.

2.05 DUCT LINING

A. Material: Flexible, inorganic glass fiber material, bonded with thermosetting resin, maximum thermal conductivity of 0.24 Btu-inch/hr-sq. ft.-degree F at 75 degrees F, coated to prevent erosion, conforming to NAIMA-DLS and exceeding that standard as specified herein. Suitable for air temperatures to 250 degrees F, and duct velocities to 6000 feet per minute. Surface shall be coated with an acrylic coating having anti-microbial agents and factory applied edge coating. Johns-Manville "Permacote Linacoustic" (or approved).

B. Thickness: Lining shall be 1-inch thick except where noted otherwise.

C. Adhesives and Fasteners: Shall conform to NAIMA-DLS, and as suitable for the duct liner material and ductwork.

D. Fungi and Bacteria Resistance: Conform to ASTM C 1338 and ASTM G21 for fungi resistance and ASTM G 22 for bacteria resistance.

PART 3 - EXECUTION

3.01 DUCTWORK INSTALLATION

A. General: Install all ductwork with all accessories and connections to provide complete and operable duct systems, in accordance with plans and specifications. See Section 20 05 29 for hangers and supports. Provide quality assurance review of all drawings prior to beginning work (see paragraph titled Quality Assurance, this specification Section and see Section 20 05 00). Provide duct and plenum sizes and locations as shown on the drawings; except as adjusted for field conditions and work of other trades, and with prior approval of the Engineer. See Section 20 05 00 for offsets and transitions to be included in project.

B. Coordination: The Contractor shall fully coordinate the work of all trades to avoid interferences and conflicts. Due to the extremely tight spaces in portions of the building, the Contractor shall coordinate duct reinforcement spacing and supports with other trades as necessary to avoid interferences. In addition, the Contractor shall select duct gauge and reinforcement types to avoid interferences. Changes required due to lack of coordination between trades, improper spacing or selection of hangers, or improper duct gauge and reinforcement selection, shall be done at no additional cost to the owner.

C. Field Measurements: Prior to fabricating any duct materials, the Contractor shall field measure all areas where ducts will be installed to verify room available and all offsets and fittings required. Field verify connection sizes and locations to equipment, louvers, and similar items.

D. Workmanship: All work shall comply with code, SMACNA-DCS, and other applicable standards. Ducts shall be installed level (unless noted otherwise) and in neat lines with the building construction using best professional practices.

E. Exposed Ducts:

1. All ducts are to be installed concealed unless indicated otherwise. Ducts that are exposed shall be carefully fabricated, stored, and installed for best appearance. All dents, dings, scratches and other damage shall be repaired for a high quality finished look; all dirt, debris, labels, stickers, lettering, and marks removed; and the duct completely cleaned. Any sealant shall be cleaned to form a straight and even seam adjacent to joints, have no overlap onto duct areas not needing sealant, and have all excess sealant removed (mask off adjacent areas as necessary).

2. Outdoor exposed ducts shall have “hat” type channels installed over all joints (top and sides) to prevent entry of water.

F. Flexible Duct: May only be used where specifically shown on the plans. Attach flexible duct inner core to sheet metal duct (or connector) with draw band. For insulated type, pull insulation and outer jacket completely over the inner core (at the connection to the sheet metal duct) with outer jacket covering the inner core and tucked back at its end to provide a continuous vapor barrier cover; install draw band to secure the outer jacket and insulation. Use metal type draw bands on duct systems where duct pressure class exceeds 3-inches or where temperature or other conditions do not allow the non-metal type and where indicated; use type of metal suitable for the conditions without corrosion or other deterioration. Install flexible duct with a centerline turning radius not less than one duct diameter. Where this turning radius cannot be maintained with the flexible duct use sheet metal elbows or (at air inlets/outlets) provide a plenum having a side connection.

G. Spin-in Fittings/ATTO’s: May be used for branch ducts to individual outlets only. Apply a bead of duct sealant to all spin-in fittings where fitting seals against sheet metal duct.

H. Sealing:

1. General: Use materials listed and approved for the specific application. Foil tape may only be used at duct connections to air inlets/outlets (unless specifically noted otherwise). Clean surfaces to be sealed of moisture and all contaminants. Seal joints in accordance with SMACNA-DCS, sealant manufacturer’s instructions, and UL 181.

2. Ductwork: Seal to meet duct leakage criteria as follows:

a. Ducts Upstream of VAV Terminal Units: Seal Class A.

b. Ducts Downstream of VAV Terminal Units: Seal Class C.

c. Ducts with Pressure Class 3" and Greater: Seal Class A.

d. Ducts with Pressure Class 2": Seal Class B.

e. Ducts with Pressure Class 1" and Less: Seal Class C.

3. Flexible Duct: Coat connection of flexible duct to metal duct with duct sealant prior to installing the flexible duct.

4. Air Inlets/Outlets: Seal duct connections (including “cans” or plenums) at air inlets and air outlets with duct sealant or foil tape; except at louvers and exposed ducts only sealant shall be used.

I. Ductmate: All "Ductmate" and similar systems shall be installed in strict accordance with manufacturer's instructions.

J. Protective Caps: Provide temporary sheetmetal caps or heavy visqueen covers over all open portions of ductwork to prevent debris, dirt, and dust from entering the ductwork. Such covers shall be installed at the end of each work shift, and shall remain in place until all work activities or events that may cause duct contamination will no longer occur.

3.02 ACOUSTICAL DUCT LINING INSTALLATION

A. General: Install acoustical duct lining in ducts to extent shown on drawings, covering all interior surfaces. Round ducts shall use factory fabricated double-wall ducts as specified.

B. Installation: Installation shall comply with NAIMA-DLS and these specifications. The liner shall be cut to assure tightly butted joints.

C. Liner Attachments: The duct liner shall be applied with a 100% coverage of adhesive. Mechanical Fasteners shall be installed flush with the liner surface, and shall be spaced in accordance NAIMA-DLS.

D. Horizontal Duct Runs: Tops of ducts over 12" wide and sides of duct over 16" high shall have liner additionally secured with mechanical fasteners.

E. Vertical Duct Runs: Any side of duct over 12" in size shall have liner additionally secured with mechanical fasteners.

F. Exposed Edges: All joints, exposed edges and any damaged areas of the liner, shall be heavily coated with fire resistant adhesive/mastic.

G. Metal Nosing: Install metal nosings on the leading edges of the liner in ducts where the velocity exceeds 4000 feet per minute.

3.03 PREPARATION FOR SERVICE

A. Cleaning: All ducts shall be wiped or blown clean of all dust and debris prior to the installation of grilles or diffusers. Notify the Engineer to allow for an inspection prior to installing grilles or diffusers.

B. Contaminated Ducts: Where ducts have been contaminated by dirt or debris during the construction process, the affected duct systems shall be cleaned by an independent firm specializing in the vacuum cleaning of ductwork. All costs associated with such cleaning shall be the responsibility of the Contractor.

3.04 DUCT PRESSURE TESTING

A. Tested Systems: All supply air duct systems shall be tested.

B. Duct Pressure Class ≤ 2-inches: Air balancers readings will be used to determine percent leakage of ductwork. Where leakage exceeds allowable by 25% or less, sealing shall be provided at all potential leak spots. Where leakage exceeds allowable by more than 25%, the system shall be re-sealed and the Sheetmetal Contractor shall pay the Balancer to re-measure and determine the new leakage rate.

3.05 COMMISSIONING

A. The Products referenced in this section are to be commissioned per Division 01 and Section 20 08 00 - Commissioning. The Contractor has specific responsibilities for scheduling, coordination, startup, test, development, testing and documentation. At a minimum, the Contractor shall provide a documented and signed record to verify that all equipment and systems installed under this contract have been inspected and functionally tested to verify full compliance with the contract specifications. In many cases, this shall require the Contractor to create or otherwise provide procedures and checklists for approval by the Commissioning Consultant prior to the start of functional testing. Reference Division 01 and Section 20 08 00 and coordinate all commissioning activities with the Commissioning Consultant.

END OF SECTION

SECTION 23 33 00
DUCT ACCESSORIES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.

B. Requirements of Section 20 05 00 apply to this Section.

1.02 WORK INCLUDED

A. Manual Dampers.

B. Backdraft Dampers.

C. Turning Vanes.

D. Flexible Connectors.

E. Duct Access Doors.

1.03 QUALITY ASSURANCE

A. General: Comply with Section 20 05 00.

B. Workmanship: Construction and installation of all duct accessories shall comply with applicable SMACNA-DCS, and exceed those standards as noted.

1.04 SUBMITTALS

A. General: Submittals shall comply with Section 20 05 00.

B. Product Data: Submit product information on all items to be used.

1.05 REFERENCES

A. SMACNA-DCS: SMACNA HVAC Duct Construction Standards, 3rd Edition.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Products shall comply with Section 20 05 00, Paragraph 2.01, Acceptable Manufacturers.

B. Manual Damper Hardware: Duro-Dyne, Young Regulator Co., Ventfabrics, Krueger, Rossi.

C. Backdraft Dampers: Air Balance, Ruskin, Greenheck.

D. Turning Vanes: Duro-Dyne, Aero-Dyne, Oil Capital Sheet Metal, Airsan.

E. Flexible Connections: Ventfabrics, Duro-Dyne Elgen.

F. Duct Access Doors: National Controlled Air, Ventfabrics, United-McGill, Kees, Ruskin, Vent Products, Duro-Dyne.

G. Building Access Doors: J.R. Smith, Zurn, Acudor, Elmdoor, Kees, J.C. Industries, Milcor.

2.02 MANUAL DAMPERS

A. Type: Manually adjustable volume dampers.

B. Blades: Damper blades shall be fabricated of galvanized steel or stainless steel (unless a specific material is indicated), two gages heavier than duct in which installed, and in accordance with SMACNA-DCS. Maximum blade width 12 inches; fabricate multi-blade dampers with opposed blade pattern for ducts larger than 12" x 48".

C. Regulators: Damper regulator sets shall have quadrant dial regulator with locking nut, square end bearing one side, and spring round end bearing other side (small sizes) or open end square bearing (larger sizes), axis of blade the long dimension. Multiple blade dampers shall have individual quadrants for each blade or one quadrant with interconnected blades. Regulator sets shall be Duro-Dyne model numbers (or approved equal) as follows:

Max. Blade Dimension	Duro-Dyne Regulator Set	Shaft Size
10" and less	KS-145, 145L	1/4"
11" to 14"	KSR-195, 195L	3/8"
15" to 23"	SRS-388, SB-138, KP105	3/8"
24" and larger	SRS-128, SB-112, KP105	1/2"

2.03 COUNTERBALANCED BACKDRAFT DAMPERS - LOW PRESSURE DROP

A. Type: Airflow and gravity operated backdraft dampers with adjustable counterbalance weight. Ruskin CBD6.

B. Frame: Shall be constructed of minimum 18 gauge galvanized steel or stainless steel or minimum 0.125-inch thick 6063T5 extruded aluminum (unless a specific material is indicated).

C. Blades: Shall be constructed of minimum 0.07-inch thick extruded aluminum, or formed stainless steel (unless a specific material is indicated), with extruded vinyl edge seals. Seals shall prevent any noise due to damper opening/closing. Bearings shall be synthetic polycarbonate or acetal or zytel type. Damper linkage shall be with aluminum or galvanized steel tiebar. Counterbalance weights shall be attached to blades, be of galvanized steel construction, and be adjustable.

D. Configuration: Horizontal or vertical airflow as indicated on plans.

E. Performance:

1. General: Dampers shall be tested in accordance with AMCA standards.

2. Temperature Rating: -40 to 200 degrees F.

3. Closed Position: Withstand maximum back pressure of 16 inches w.g.

4. Open Position: Withstand maximum air velocity of 2,500 feet per minute.

5. Operation of Blades: Start to open at 0.02 inch w.g.; fully open at 0.05 inch w.g.

6. Pressure Drop: Maximum 0.025 inch w.g. at 700 feeet per minute, maximum 0.15 inch w.g. at 1,500 feet per minute.

7. Dampers used to prevent the entry of outdoor air shall have air leakage no greater than 20 cfm/sf at 1-in w.g. where not less than 24-inches in any dimension, and no greater than 40 cfm/sf where less than 24 inches in any dimension; as tested in accordance with AMCA 500D.

F. Depth of Operation: Depth required to operate shall not exceed 10-inches.

2.04 TURNING VANES

A. Type: Galvanized steel turning vanes to guide airflow through duct elbows to minimize pressure drop.

B. Construction: Turning vanes shall comply with SMACNA-DCS. Vanes shall be fabricated of minimum 26 gauge galvanized steel; rails shall be fabricated of minimum 24 gauge galvanized steel. For duct widths less than 12 inches, vanes may be single wall construction; for widths 12” and greater, vanes shall be double wall "airfoil" type.

C. Spacing: Turning vanes shall be equally spaced in accordance with SMACNA-DCS, parallel to each other, and securely attached to runners.

D. Unequal Elbows: For elbows where the inlet and outlet dimensions are not the same, modify vane shape or angle to provide optimum turning.

2.05 FLEXIBLE CONNECTORS

A. Type: Flexible fabric type connectors, to provide vibration isolation at equipment duct connections and to allow for movement in duct systems.

B. Fabric:

1. Width: Minimum 3” wide except at equipment 3 hp or larger with external vibration isolators fabric shall be minimum 6” wide.

2. Indoor Applications: Flexible woven glass fiber fabric with neoprene coating, minimum 22 oz/sq. yard, 500 lbs x 450 lbs tensile strength. Suitable for temperatures from -40 to 200 deg F.

3. Outdoor Applications and Where Exposed to Chemicals: Flexible woven glass fiber fabric with hypalon coating, ozone resistant, 24 oz/sq. yard, 225 lbs x 300 lbs tensile strength. Suitable for temperatures from -40 to 250 deg F.

4. High Temperature Applications: Fiberglass/satin weave with Teflon coating; temperature rating of minimum 500 deg F and to suit application, 400 lbs x 300 lbs

tensile strength.

C. Metal Collars: Minimum 24 gauge galvanized steel 3” wide metal edge connectors, each side of fabric, connected to fabric by folded over metal seam. Fabricate of same material as ducts connected to.

D. Fire/Smoke Rating: Flame spread rating not over 25, and smoke developed rating not higher than 50; complying with IMC requirements and NFPA standards.

2.06 DUCT ACCESS DOORS

A. Construction: Access doors shall be of double wall construction, made with minimum 24 gage galvanized steel, tight fitting, with sealing gasket, and cam locks (or may be hinged type with latches).

B. Size:

1. General: Access doors shall be of sufficient size so that items concealed in duct can be serviced and inspected, and shall be adequately sized to allow complete removal of the item being served (where removal cannot be made without disturbing fixed ductwork).

2. Minimum size: Doors shall be minimum 14" x 14". Where duct size will not accommodate this size door, the doors shall be made as large as practicable.

3. Large Sizes: Doors larger than 14" x 14" shall have a minimum of 4 cam locks (or where hinged type is used, have a minimum of two (2) latches).

C. Insulation: Doors in insulated ducts shall be insulated type, with minimum 1 inch thick fiberglass insulation.

D. Round Ducts: Access doors on round ducts shall use either lined rectangular tap off with rectangular access door or curved insulated access door (for insulated duct); or curved type un-insulated access door (for un-insulated duct).

2.07 BUILDING ACCESS DOORS

A. Type: Hinged lockable steel access doors, for wall or ceiling installation.

B. Construction: Minimum 16 gauge frame and 14 gauge door, concealed hinge, cam and cylinder lock, anchoring provisions, and 1” wide frame to conceal rough building opening. Provide of 18-8 stainless steel construction with No. 4 finish where used in restrooms, locker rooms, kitchens, and similar "wet" areas. Provide of steel construction with prime coated finish in other areas.

C. Size: Size shall be 12" x 12" (unless indicated otherwise) but shall be large enough to allow necessary access to item being served and sized to allow removal of the item (where access door is the only means of removal without disturbing fixed construction).

D. Fire Rating: Door shall maintain fire rating of element installed in; reference drawings for required rating.

E. Keys: Access doors shall all be keyed alike. Provide two (2) keys for each door.

PART 3 - EXECUTION

3.01 MANUAL DAMPERS

A. General: Dampers shall be fabricated and installed in accordance with SMACNA-DCS requirements for volume dampers.

B. Locations: Install dampers at locations shown on the drawings in branch ducts to all air inlets/outlets, and at all other locations as required by the Balancer to allow for the balancing of the system. Locate dampers at a point where the damper is most accessible; orient damper regulator for best access.

C. Non Accessible Dampers: Provide flush-mounted concealed type damper quadrants for ducts concealed in walls or non-removable ceilings and where a remote damper operator has been indicated.

D. Initial Setting: Set and lock all dampers in the full open position prior to balancing.

E. Extractor Fittings: Provide where indicated on the plans and at wall type inlets/outlets where such outlets cannot be served by a manual damper in the branch duct.

F. Identification: Provide orange surveyor's tape, approximately 18" long tied to each damper regulator (except not required on dampers in ducts exposed to view in finished areas).

3.02 BACKDRAFT DAMPERS

A. General: Install in accordance with manufacturer's instructions.

B. Application: Use counterbalanced type at all non-fan powered building exhausts and reliefs; all others shall be the standard type.

C. Adjustments: Adjust counterbalanced backdraft dampers to be open at 0.07" building pressure (unless noted otherwise), or as necessary for proper space pressurization and building air balance. Coordinate work and settings with air balancer.

D. Access Doors: Provide access doors to backdraft dampers, except that where damper is installed immediately behind a ceiling or wall grille, and is accessible by removing this grille, an access door is not required.

3.03 TURNING VANES

A. General: Install turning vanes in all duct elbows and "T" fittings, and at locations shown on the drawings.

B. Attachment: Securely attach turning vane runners to ductwork.

3.04 FLEXIBLE CONNECTORS

A. General: Provide flexible connectors at all duct connections to all equipment, where ducts of dissimilar metals are connected, and where shown on the drawings. Except that flexible connectors are not required on internally spring isolated fans where the fan is located in a separate mechanical room and a flexible connector has not been shown.

B. Round: For round ducts, the flexible material may be secured by zinc-coated, iron clinch type

draw bands directly to adjoining duct; or with normal duct joining methods and using metal collars furnished with flexible connectors.

C. Slack: Install flexible connections with sufficient slack to permit 1 inch of horizontal or vertical movement of ducts or equipment at flexible connection point without stretching the flexible material. At building expansion joints install sufficient flexible material to allow for 2 inch movement in any direction; provide two flexible connectors separated by a 12 inch section of duct.

3.05 DUCT ACCESS DOORS

A. General: Provide duct access doors at all automatic control dampers, fire dampers, fire/smoke dampers, smoke dampers, backdraft dampers, all duct coils, thermostats, filters, control devices, and any other components in the duct system that require service or inspection. Coordinate with Section 23 09 33/Control Contractor to confirm quantity and location of control devices.

B. Size and Location: Access doors shall be of sufficient size and so located so that the concealed items may be serviced and inspected or completely removed and replaced.

3.06 BUILDING ACCESS DOORS

A. General: Provide access doors in walls, floors, ceilings, etc. as indicated on the drawings and where needed to provide service access or maintenance to duct access doors, backdraft dampers, damper actuators, automatic dampers, coils, control devices, fans, HVAC equipment and similar items.

B. Coordination: Consult architectural drawings and coordinate location and installation of access doors with trades which are affected by the installation.

END OF SECTION

SECTION 23 34 00
FANS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.

B. Requirements of Section 20 05 00 apply to this Section.

1.02 WORK INCLUDED

A. In-Line Exhaust Fans.

B. Fan Accessories.

1.03 SUBMITTALS

A. General: Comply with Section 20 05 00.

B. Product Data: Submit manufacturer's product data for all items to be used. Submit fan curves showing SP vs. CFM and BHP vs. CFM with system operating point clearly marked.

1.04 QUALITY ASSURANCE

A. AMCA: Fans shall bear the AMCA certified seal unless indicated otherwise.

1.05 GENERAL REQUIREMENTS

A. Spare Parts: Provide two complete sets of spare belts for all belt driven fans.

1.06 REFERENCES

A. AMCA 210: Laboratory Methods of Testing Fans for Ratings.

B. IMC: International Mechanical Code.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. General: Products shall comply with Section 20 05 00. See Section 20 05 00, paragraph 2.01 for Acceptable Manufacturer requirements.

B. Exhaust Fans: Greenheck, Twin City, Penn Barry, Cook, Carnes.

C. Accessories: Fan manufacturers listed, NCA, Ruskin, Thybar, RPS.

2.02 GENERAL

A. Guards: All belt drives shall be equipped with belt guards, or enclosed within fan casing. Guards shall be factory fabricated and furnished with equipment, and comply with OSHA and WISHA regulations. Exposed openings into fan housings shall be protected with substantial metal screens or gratings.

B. Drives: Shall be sized for not less than 150% of the rated motor horsepower.

C. Motors:

1. General: Comply with Section 20 05 00. Motors on belt drive fans shall have adjustable supports for adjusting belt tension. Motor speed controllers shall be VFD type except where solid state speed controllers are provided or EC motors with integral speed controller. VFD's shall be as specified in Division 25.

2. Fractional Horsepower Motors: Shall be the electronically commutated (EC) type with speed control where noted and where non-EC motors are not available which comply with code motor efficiency requirements. Unless noted otherwise, provide with manual speed control mounted at the motor for air balancers use. Motors shall be specifically designed for fan applications, have permanently lubricated ball bearings, speed controllable down to 20%, and have internal thermal overload protection.

D. Performance: Fan capacity shall not be less than the values listed on the drawings. Fan performance shall be based on laboratory tests conducted in accordance with AMCA 210.

E. Outlets and Inlets: Fans shall be furnished with attachment angles and/or flanges as required for attaching ductwork and/or flexible connections indicated.

F. Fan Types: The type of each fan is indicated on the Fan Schedule, under the "Type" column, and corresponds to the types specified herein.

G. Fan Arrangement and Drive: Shall be as indicated. Select motor and drive access side to allow best access and to suit available space.

H. Electrical: Fan disconnects and motor starters shall comply with Division 26 specifications. Disconnects furnished with fan shall come factory wired to motor or shall be field wired by Division 23.

I. Finish: All fans shall have factory applied enamel finish (manufacturer's standard color, unless noted otherwise) over a rust inhibiting primer base coat; except a painted finish is not required on rooftop type fans of aluminum or equivalent corrosion resistant construction.

J. Backdraft Dampers:

1. General: Provide all exhaust fans with backdraft dampers.

4. All Fans:

a. General: Multi-blade backdraft damper, to close automatically to prevent airflow in the opposite direction than intended, aluminum or galvanized steel construction, except shall be of stainless steel construction where duct system served is constructed of stainless steel. May be "butterfly" type where used on fans with round connections. Provide with flanges where needed for installation. Provide with coating where fan has internal coating (same type as indicated for the fan served).

b. Where Duct Velocity is Under 1000 Feet per Minute: Frame minimum 18 gauge thick, with minimum 0.025-inch thick blades, synthetic bearings, concealed linkage connecting all blades, vinyl or felt blade edge seals, and rated velocity of 2500 feet per minute or duct velocity at point of application (whichever is higher). Provide with counterbalanced and adjustable weights as required by the application in order to have proper damper operation.

c. Where Duct Velocity is Equal or Greater Than 1000 Feet per Minute: Frame minimum 0.125-inches thick, with minimum 0.070-inch thick blades, synthetic bearings, concealed linkage connecting all blades, vinyl or felt blade edge seals, and rated velocity of 2500 feet per minute or duct velocity at point of application (whichever is higher). Provide with counterbalanced and adjustable weights as required by the application in order to have proper damper operation. Leakage less than 15 cfm at 1-inch w.g. pressure differential for a 36-inch square damper.

2.03 IN-LINE FANS

A. Type: Square housed, in-line centrifugal fan. Greenheck SQ, BSQ (or approved).

B. Housing: Shall be constructed of galvanized steel, minimum 20 gauge for fans with up to 14" diameter fan wheels, minimum 18 gauge 14" to 29" fan wheels, and minimum 16 gauge for 30" diameter fan wheels and larger. Housing shall be of square shape, with inlet and outlet square duct mounting collars. Housing shall have removable or hingeable access covers providing complete access to fan internals. Housing shall be lined with minimum 1" thick 1-1/2 lb per cubic foot fiberglass duct liner.

C. Fan Wheel: Shall be aluminum, backward inclined, non-overloading, centrifugal type; dynamically and statically balanced.

D. Drive: Fan shall be direct or belt drive as indicated on the Fan Schedule.

1. Belt Drive: Fan bearing and drive components shall be isolated from the air stream. Motor shall be located outside the housing and cooled by ambient air. Provide motor position indicated on drawings. Wheel shaft shall be ground and polished and mounted in permanently lubricated, sealed ball bearing pillow blocks, with a minimum average bearing life over 200,000 hours. Provide with belt tensioner.

2. Direct Drive: Fan wheel shall be directly connected to motor.

E. Supports: Fans shall be provided with supports for horizontal base mounted, horizontal ceiling suspended, or vertical mounting as shown on the drawings. Provide spring type vibration isolators for horizontal suspended fans and neoprene type for base mounted units. Vibration isolators shall be sized to match fan weight.

F. Electrical Connections: Fans shall be factory wired to an external junction box and disconnect switch. Fan shall have flexible wiring for units where fan motor swings out of way for housing access.

G. Accessories: Provide the following accessories where indicated on the Fan Schedule.

1. Speed Controls: Solid state speed controller, allowing speed reduction down to 50% of maximum. Controller shall be for mounting in a standard wall box. Where motor type is not available for use with a solid state speed controller, provide with variable frequency drive.

77 69 73 68 56 55 48 49

PART 3 - EXECUTION

3.01 **INSTALLATION**

A. General: Comply with Section 20 05 00. Install in accordance with manufacturer's written installation instructions, code, applicable standards and best construction practices.

B. Locations: Install fans at locations indicated and in accordance with the Contract Documents.

C. Speed Controls: Fans with speed controllers shall have the speed controller mounted on the fan housing unless another location is indicated on the drawings (for use by Balancer).

D. Connections: Provide flexible connections in ductwork connections to all fans.

E. Vibration Isolation: Install all fans with vibration isolators so that no sound or vibration is transmitted to the structure; except not required for rooftop type fans

F. Operation and Maintenance:

1. General: Operation and Maintenance shall be in accordance with manufacturer's written procedures and recognized best maintenance practices. Keep records of maintenance and (upon request) forward to the Architect/Engineer prior to project final acceptance.

2. Stored Products: Provide maintenance (i.e. equipment rotation, lubrication, cleaning, etc.) and inspection on products while stored to maintain new condition.

3. Installed Products: Provide maintenance and inspection of products and operate fan systems until project final acceptance. Maintenance shall include all manufacturer's recommended maintenance (i.e. bearing lubrication, belt tensioning, etc.). In addition to scheduled maintenance, review all equipment periodically to allow detection of improper operation or any special maintenance needs; review shall be consistent with best practices for the product but in no case less than every two weeks.

4. Fans shall not be operated until all construction activities that generate dust, dirt, fumes, or odors are complete. Fans shall not be placed into service until start-up has been completed.

G. Owner Instruction: Instruct Owner on the operation of each fan, including: system start-up, shut-down, emergency shut-down, normal control operation, safety aspects, maintenance and repair instructions.

H. Start-Up: Prior to start-up inspect fans and installation to confirm proper installation and system is ready for start-up. Arrange other trades to be present as needed (i.e. balancer, electrician, etc.). Check fans for correct rotation, tighten belts to proper tension, adjust fan speeds to provide required performance, verify proper electrical and control connections, check vibration isolation (as applicable) for correct operation, and lubricate bearings per manufacturer's recommendations.

END OF SECTION

SECTION 23 37 00
AIR OUTLETS AND INLETS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.

B. Requirements of Section 20 05 00 apply to this Section.

1.02 WORK INCLUDED

A. GRD Outlets.

B. GRD Inlets.

C. Roof Caps.

D. Roof Vents.

1.03 DEFINITIONS

A. GRD's: Grilles, Registers, and Diffusers.

1.04 REFERENCES

A. AHRI 885: Procedure for Estimating Occupied Space Sound Levels in the Application of Air Terminals and Air Outlets.

B. AMCA 500: Laboratory Methods of Testing Louvers for Rating.

C. ASHRAE 70: Method of Testing the Performance of Air Outlets and Air Inlets.

D. ASHRAE-F: ASHRAE Handbook of Fundamentals.

E. SMACNA-DCS: HVAC Duct Construction Standards, 3rd Edition.

1.05 SUBMITTALS

A. General: Comply with Section 20 05 00.

B. Product Data: Submit product information for all items to be used.

C. Operation and Maintenance: Submit operation and maintenance data and submittal data for inclusion in project O&M Manuals.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Products shall comply with Section 20 05 00, Paragraph 2.01, Acceptable Manufacturers.

B. Grilles, Registers and Diffusers: Titus, MetalAire, Krueger, Price, Tuttle & Bailey, Kees, Carnes.

C. Wall and Roof Caps: Greenheck, PennBarry, Nutone, Carnes.

E. Roof Vents: PennBarry, Greenheck, Carnes, Cook “TRE” Series.

2.02 GENERAL REQUIREMENTS

A. Type: Air outlets and inlets shall be of the size, type, and with number of throws as shown on the drawings; and shall match the appearance and performance of the manufacturers' models specified and scheduled on the drawings.

B. Performance: Air outlet and outlet performance shall be based on tests conducted in accordance with ASHRAE 70.

C. Sound Level: Air outlets and inlets shall not exceed a sound level of NC 30 for the size indicated and airflow rate application. Sound levels shall be determined in accordance with AHRI 885 and ASHRAE-F.

D. Finish: Grilles, Registers and Diffusers shall have factory applied finish, color as selected by Architect/Engineer. Finish shall be an anodic acrylic paint, baked on, with a pencil hardness HB to H. Pint shall pass a 90 hour ASTM B117 salt spray test, 250 hour ASTM D870 water immersion test, and an ASTM D2794 reverse impact test with at least a 50 inch-pound force applied.

E. Frame Style: Provide air outlets and inlets with frame style to match ceiling or wall construction installed in. Where supply air outlets or inlets are installed in T-bar ceiling systems, they shall be factory installed in 2' x 2' or 2' x 4' metal panel to match ceiling layout. Where installed against gypsum board surface, brick or similar hard surface, or where exposed, provide with 1-1/4-inch wide outer border. Where space does not permit installing 2' x 2' metal panel, provide outlets or inlets with 1-1/4-inch wide outer border. Where air outlets are installed adjacent to surface mounted light fixtures, outlets shall have 4-inch deep drop frames. (See reflected ceiling plan and/or electrical lighting plan for ceiling and lighting types).

F. Transfer Grilles: Ceiling transfer grilles shall be same as ceiling exhaust grilles (CEG) unless noted otherwise; wall transfer grilles (WTG) shall be same as wall exhaust grilles (WEG) (unless noted otherwise).

G. Construction: Air outlets and inlets shall be of steel or aluminum construction except that:

1. Where noted to be constructed of a specific material, shall be as noted.

2. In wet areas or subject to condensation (i.e., locker rooms, restrooms, kitchens, exterior soffits, etc.), where not used in fire rated assemblies, shall be of aluminum construction.

3. Air outlets and inlets in the same room, area, or within common view shall be constructed of the same material.

2.03 SUPPLY AIR OUTLETS

A. Ceiling Diffuser (CD): Aluminum or steel construction, modular core, with multiple curved (or angled) discharge blades, and square neck. Cores shall consist of four separate sections which can be repositioned to allow for one, two, three or four way discharges. Cores shall be easily removed with no tools required. Krueger 1240 Series, Titus MCD, MCD-AA Series (or approved equal).

B. Wall Supply Grille (WSG): Aluminum or steel construction, double deflection type, with horizontal face bars and vertical rear bars. Unit shall have outer frame borders 1-1/4-inch wide, with mitered corners, and perimeter gasket to prevent air leakage. Frame shall be constructed of minimum 22 gauge steel or minimum 0.032-inch thick aluminum. Deflecting bars shall be rigid extruded aluminum of semi-air-foil design, on 3/4-inch centers. Vertical and horizontal bars shall have friction pivots at each end to allow for blade angle adjustment without blade loosening or rattling. Krueger 5880H, 880H Series; Titus 300FL, 300FS Series (or approved equal).

2.04 RETURN AIR INLETS

A. Ceiling Return Grille (CRG): Aluminum construction, "cube-core" or "egg-crate" type, with 0.025-inch thick x 1/2-inch deep strips mechanically joined to form 1/2" x 1/2" x 1/2" cubes. Krueger Series EGC5. Titus Series 50F.

B. Wall Return Grille (WRG): Shall be of aluminum or steel construction, with 35 degree angular horizontal face bars. Unit shall have outer frame border, 1/4-inch wide, gasketed to prevent air leakage and minimize smudging. Deflecting bars shall be rigid extruded aluminum of semi-air-foil design, on 3/4-inch centers. Krueger Model No. S580H or S80H. Titus Series 350RL.

2.05 EXHAUST AIR INLETS

A. Ceiling Exhaust Grille (CEG): Same as CRG.

B. Wall Exhaust Grille (WEG): Same as WRG.

2.06 ROOF CAPS

A. Sloped Roofs: Low profile rectangular roof cap, steel construction, with flashing base flange, downward facing outlet, outlet bird screen and spring loaded integral backdraft damper. Steel shall have an electrically bonded black finish or be of galvanized steel construction with black enamel finish. Throat area no less than the connecting duct free area. Flashing flange shall be minimum three inches larger all around than hood portion or as required by roofer to properly flash into roof; coordinate with Roofing Contractor and provide base flashing size as required. Greenheck RJ Series custom modified with larger base (or approved equal).

B. Flat and Low Slope Roofs:

1. Cap: Round roof cap, aluminum construction, with bird screen and curb cap for installation on roof curb. Throat area no less than the connecting duct free area.

2. Roof Curb: Shall be constructed of minimum 18 gauge galvanized steel or 0.063-inch thick aluminum, of all-welded construction, with top wooden nailer (as required by roof/flashing type) held in place by metal wrap-around. Size of curb shall match roof cap used with, with minimum 8-inch high extension above the roof. Provide curb type (i.e., with built-in cant, base flashing, step height to allow for roof insulation, etc.)

as required to match roof type (coordinate with Roofing Contractor). Greenheck Model GPR, GPS, GPF (GRS, (or approved equal).

C. Dampers:

1. General: Provide all roof caps handling exhaust air with motorized dampers; provide all relief roof vents with motorized dampers and backdraft dampers. Backdraft dampers shall be the counter balanced type (unless noted otherwise). Size shall match roof cap connecting duct size (unless noted otherwise) and be for installation in the duct connecting to the roof cap.

2. Gravity Type: Shall be of aluminum construction with neoprene or felt lined edges, interconnected with linkage.

3. Counter-balanced Type: Shall be as specified in Section 23 33 00.

4. Motorized Type: Shall be as specified in Division 25. Actuator shall be provided by Division 25; where used as relief shall have modulating control.

2.07 ROOF VENTS PENTHOUSE LOUVER TYPE (RVI, RVR)

A. Type: Penthouse louvered type; custom fabricated size to meet pressure drop requirements. Titus Model TRE

B. Construction: Roof vents shall be constructed of galvanized steel, or aluminum and shall be designed for mounting on factory fabricated roof curbs. Roof vents shall have 1/2-inch mesh wire bird screen. Shall include mitered corners such that louver lines are continuous around vent.

C. Size: Roof vents shall have throat size as indicated on the plans (or size to match the connecting duct sizes indicated). Roof vents shall have number of tiers (or combination of larger throat size and added tiers) so that pressure drop does not exceed 0.05-inch wc for relief applications and 0.10-inch wc for intake applications when handling fro full airflow (cfm) of the system served.

D. Roof Curb: Shall be constructed of minimum 18 gauge galvanized steel or 0.064-inch thick aluminum, of all-welded construction, with top wooden nailer held in place by metal wrap-around, and internally insulated with minimum 1/2-inch thick rigid fiberglass. Size of curb shall match roof vent. Provide curb type as required to match roof type (i.e., with built-in cant and step height to allow for roof insulation; sloped base; etc.). Greenheck Model GPR, GPS, GPF, or approved equal.

E. Dampers:

1. General: Provide all intake roof vents with motorized dampers; provide all relief (and exhaust) roof vents with motorized dampers and backdraft dampers. Backdraft dampers shall be the counter balanced type (unless noted otherwise). Size shall match roof vent throat size (unless noted otherwise).

2. Counter-balanced Type: Shall be as specified in Section 23 33 00.

3. Motorized Type: Shall be as specified in Section 23 09 33.

2.08 MISCELLANEOUS

A. Screen: 1/2-inch mesh, constructed of either 0.051-inch aluminum wire or 19 gauge galvanized steel wire.

PART 3 - EXECUTION

3.01 INSTALLATION

A. General: Install air outlets and inlets in locations indicated and so as to conform with building features and coordinated with other work. See hangers and supports specification Section for supports and additional requirements.

B. Location Verification: Verify all air inlet/outlet locations with building features and other trades prior to installing any duct systems that will connect to the air outlets/inlets. For locations where air inlet/outlet location is noted to be verified, or location is not clear, develop shop drawings showing the proposed location, or the location that best suits field conditions, and submit for review.

C. Connections: Furnish all necessary screws, clips, duct collars, and transitions required to allow for the installation and connection of ductwork to all air outlets/inlets. Connect all ductwork to air inlets and outlets with fasteners, minimum one each side and in compliance with SMACNA-DCS. See ductwork specification Section for sealing and additional requirements.

D. Painting:

1. Paint ductwork and accessories which are visible behind air outlets and inlets flat black. Painting to include ductwork, duct liner, turning vanes, liner attachments, and all visible items (including fastening pins for duct lining).

2. Coordinate with the Division 09 Contractor for any necessary painting of air outlets/inlets/louvers prior to installation.

E. Weather Exposure: All outlets and inlets exposed to the weather shall be adequately flashed and installed in a manner to assure complete weatherproofness. Sealing and caulking of all outlets and inlets exposed to the weather shall conform to Division 07 and Section 20 05 30.

F. Screened Openings: Provide screened openings (SO) on all duct openings where indicated and where openings do not have grilles or registers.

G. Louver and Wall Caps: Slope bottom of all ducts within 18 inches of connecting to louvers and wall caps at minimum 1% slope toward bottom of louver; seal all joints within 6-inches of bottom of ductwork water tight.

END OF SECTION

SECTION 23 72 23
ENERGY RECOVERY VENTILATOR

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.

B. Requirements of Section 20 05 00 apply to this Section.

1.02 WORK INCLUDED

A. Energy Recovery Ventilators

B. Start-up

1.03 SUBMITTALS

A. General: Submittals shall comply with Section 20 05 00.

B. Product Data: Submit product information on unit including fan curves, coil performance, unit construction details, wiring diagram, data showing energy recovery, filter data, and weight.

C. Shop Drawing: Submit drawings of unit showing all dimensions, locations of unit components, and point of connection of all utilities.

D. Operation and Maintenance: Submit Operation and Maintenance data and submittal data for inclusion in project O&M Manuals.

1.04 GENERAL REQUIREMENTS

A. Standardization: All units of the same type shall be the product of the same manufacturer.

B. Substituted Equipment: The drawings show design configuration based on a particular manufacturer's equipment (i.e. basis of design). Use of another manufacturer's equipment (i.e. substituted equipment) that is configured different from what is shown will require redesign of mechanical ductwork, piping, electrical, structural, unit support systems, and general building construction to accommodate the substituted equipment. Such redesign shall meet the requirements and have the approval of the Architect/Engineer prior to fabrication. Contractor shall submit complete shop drawings showing all alternate unit installation plans and details; shop drawings shall comply with Section 20 05 00. The redesign shall be equal or superior in all respects to the Architect/Engineer's design (as judged by the Architect/Engineer), including such aspects as equipment access, ease of maintenance, duct connection locations, unit electrical requirements, noise considerations, vibration unit performance, and similar concerns. Cost of redesign and all additional costs incurred to accommodate the substitutional equipment shall be borne by the contractor. Contractor is cautioned that certain aspects of the equipment cannot be fully evaluated until

items are installed and operational, and all added costs after installation to make units equal to the basis of design shall be by the Contractor.

1.05 REFERENCES

A. AMCA 230: Laboratory Methods of Testing Air Circulating Fans for Rating and Certification.

B. AHRI 1060: Standard for Performance Rating of Air-to-Air Exchangers for Energy Recovery Ventilation Equipment.

1.06 WARRANTY

A. General: See Division 00 and Section 20 05 00 for basic warranty requirements.

B. Extended Warranty: The ERV core shall be warranted to be free of manufacturing defects and to retain its functional characteristics, under circumstances or normal use, for a period of ten years from the date of purchase. The balance-of-unit shall be warranted to be free of manufacturing defects and to retain its functional characteristics, under circumstances of normal use, for a period of two years from the date of installation.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Products shall comply with Section 20 05 00, Paragraph 2.01, Acceptable Manufacturers.

B. Energy Recovery Ventilator: RenewAire.

2.02 GENERAL

A. Guards: Exposed openings into fan housings shall be protected with substantial metal screens or gratings. Electrical components with shock potential shall be physically protected and labeled (label as to hazard and items being accessed).

B. Fan Balancing: The shaft and fan wheel(s) shall be factory statically and dynamically balanced.

C. Motors: Shall be UL listed and comply with Section 20 05 00. Motor efficiency shall comply with Code. Motors shall have integral thermal protection with automatic reset.

D. Outlets and Inlets: Equipment shall be furnished with attachment angles and/or flanges to allow for attaching external ductwork.

E. Fan Performance: Shall be based on laboratory tests conducted in accordance with AMCA 230. Fan capacity shall not be less than the values scheduled on the drawings and shall be constructed to be able to operate with total pressures 20% higher than that indicated.

F. Controls: Coordinate with Division 25 Contractor for required interfaces between air handling equipment and building control system.

G. Gasketing: Where units are furnished in sections, unit manufacturer shall furnish unit with gasketing to allow sealing of adjoining sections.

H. Sound Tests: Shall be done by fan manufacturer in an AMCA certified sound testing laboratory. Sound tests shall be conducted in accordance with AMCA 300. Provide necessary testing and calculations to develop required sound data. Tested sound power levels shall not exceed specified levels by more than 3 dB in any octave band.

I. Factory Tests: Every unit shall be factory tested prior to shipping. Tests shall include (as a minimum): Motor dielectric voltage-withstand test, unit dielectric voltage-withstand test, continuity of internal control circuits test, unit amperage test, proper fan operation.

2.03 ENERGY RECOVERY VENTILATOR

A. Type: Indoor energy recovery ventilator using fixed plate enthalpy heat exchanger.

B. General:

1. Unit shall be complete single package, self contained factory assembled unit, requiring only electrical, duct, and control connections to operate.

2. Capacity: Shall be as scheduled at the conditions noted.

3. Unit configuration shall be as shown on plans.

C. Cabinet:

1. General: Constructed of minimum 20 gauge G-90 galvanized steel, reinforced and constructed for maximum anticipated static pressures involved, but no less than 4" w.c. with cabinet leakage less than 1% of scheduled airflow.

2. Liner: Interior of cabinet shall be insulated with minimum 1-inch thick, 4 pound per cubic foot density foil scrim faced fiberglass insulation to provide a cleanable surface. Double-wall construction with foam injected insulation and interior 20 gauge G-90 galvanized steel is also acceptable.

3. Access Doors: Constructed same as cabinet, size to access unit internals, with full perimeter gasket. Doors shall be opened by releasing multiple latches or similar method requiring no tools.

D. Fan(s): Integral supply and exhaust fans, direct drive, steel or aluminum construction, multi-blade centrifugal type. Motors shall be ECM type.

E. Energy Recovery Core:

1. General: Total enthalpy type, capable of transferring both sensible and latent energy between airstreams. Latent energy transfer shall be accomplished by direct water vapor transfer from one airstream to the other, without exposing transfer media in succeeding cycles directly to the exhaust air and then to the fresh air. No condensate drains shall be required.

2. Certifications: The energy recovery cores used in these products shall be third party Certified by AHRI 1060 for Energy Recovery Ventilators. AHRI published certifications shall confirm manufacturer’s published performance for airflow, static pressure, temperature and total effectiveness, outdoor air (OACF) and exhaust air leakage (EATR). OACF shall be no more than 1.02 and EATR shall be a 0% against balanced airflow.

F. Filters: Unit shall be provided with filter racks for accommodating 2" thick filters (unless noted otherwise), with minimum filter area (or sizes) as scheduled. Access to filters shall be through unit access doors.

G. Electrical:

1. General: Unit shall be for use with single point electrical power connection. Unit shall be furnished with all necessary wiring, raceway, transformers, contactors, relays, motor starters, and accessories with power and controls connected to all unit devices for unit operation and with the specified sequence. Electrical shall comply with NEC and local code requirements. Unit shall have a main fused power disconnect. Disconnects shall comply with NEC, and be accessible from outside unit enclosure.

H. Controls: Unit control shall be by Section 23 09 33 (unless otherwise noted); unit shall have limited factory controls to provide necessary safeties and to allow for control by Section 23 09 33. Section 23 09 33 shall enable unit fans when "run" terminals are connected. Unit shall be furnished with all necessary relays, starters, wiring terminal strips, timers, safety devices, etc. to allow for the sequence of operation as specified in Section 23 09 33 using the Section 23 09 33 control system. Unit wiring shall be color coded and numbered corresponding to unit's wiring diagram. Access panels to unit controls shall be hinged with latches (or equivalent device), requiring no tools to open.

PART 3 - EXECUTION

3.01 INSTALLATION

A. General: Install the units as shown on the drawings, in accordance with manufacturer's instructions, Code, and best construction practices.

B. Locations: Install at locations indicated, to allow for maintenance access and proper clearances.

C. Duct Connections: Provide flexible connections in ductwork connections to units.

3.02 START-UP

A. Initial Checks: Prior to operating units, checks shall be made to insure that adequate voltage, duct connections, electrical connections, control connections, and other items as listed by the manufacturer are properly provided/connected and ready to ensure safe and proper unit operation.

B. Testing and Adjustment: Operate unit to test for proper operation, including fan rotation, and correct interface to other controls.

END OF SECTION

SECTION 23 81 44
SPLIT-SYSTEM HEAT PUMPS – DUCTLESS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.

B. Requirements of Section 20 05 00 apply to this Section.

1.02 WORK INCLUDED

A. Split-System Air Source Heat Pumps.

B. Refrigeration Piping and Accessories.

C. System Leak Testing and Charging.

D. Start-Up.

1.03 SUBMITTALS

A. General: Shall comply with Section 20 05 00.

B. Product Data: Provide complete product information on all units; include cooling performance capacities as a function of indoor and outdoor coil db/wb temperatures and indoor coil air flow rates, fan performance (cfm vs. esp), unit efficiencies, dimensions and information on all filters and accessories. Provide information showing dimensions and location of refrigerant, power, and control connections.

C. Installation: Submit manufacturer's installation instructions.

D. Submit air conditioning unit inspection and start-up report.

1.04 QUALITY ASSURANCE

A. Listing: Units shall be listed by an approved testing laboratory for the use and application intended.

B. Rating and Certification: Cooling performances shall be tested and rated in accordance with AHRI 210/240.

C. Applications: Units shall be intended for commercial use and shall include all manufacturers recommended accessories for proper operation for the application intended.

D. Code Compliance: Units shall be rated in accordance with recognized standards and meet code requirements for energy efficiencies. Units shall be constructed and designed to conform to applicable codes and standards.

E. Standardization: In interests of Owner's standardization, all equipment of the same type shall be the product of the same manufacturer.

F. Operating Conditions: Unless more extreme temperatures are noted elsewhere, or required by local conditions or the specific application, unit shall comply with the following:

1. Unit and all components exposed to ambient conditions shall be able to withstand ambient temperatures from -10 deg F to 125 deg F, plus direct exposure to sun and weather elements without adverse affects.

2. Unit shall be able to operate and produce cooled air between ambient temperatures of 45 deg F and 115 deg F. Unit shall be able to operate and produce heated air between ambient conditions of 0 deg F and 70 deg F. Unit shall be able to operate with supply air temperatures between 50 deg F and 125 deg F; and with room temperature setpoints between 65 deg F and 85 deg F.

G. Alternate Manufacturers: The project has been designed around units by the manufacturer scheduled on the drawings. Alternate manufacturers may be used (see Acceptable Manufacturers, Paragraph 2.01 and Section 20 05 00); however, any redesign (from what is shown on the drawing) to mechanical, electrical, structural or general construction to accommodate such an alternate manufacturer shall be provided by the Contractor. Furthermore, such redesign shall meet the requirements and have the approval of the Architect/Engineer prior to fabrication. Contractor shall submit complete shop drawings showing all alternate unit installation plans and details; shop drawings shall comply with Section 20 05 00. The redesign shall be equal or superior in all respects to the Architect/Engineer's design, including such aspects as equipment access, ease of maintenance, duct connection locations, unit electrical requirements, noise considerations, unit performance, and similar concerns. Cost of redesign and all additional costs incurred to accommodate alternate manufacturers shall be borne by the Contractor.

H. Commissioning: See Division 01 and Section 20 08 00 for commissioning efforts required.

1.05 WARRANTY

A. General: Entire unit shall be warranted to be free of all manufacturing defects and meeting all Contract Document requirements for a period of one year after Owner project acceptance.

B. Compressors: Unit compressors shall be warranted by the manufacturer for five years after Owner project acceptance. All labor and materials associated with compressor replacement and repair shall be warranted.

1.06 REFERENCES

A. AHRI 210/240: Performance Rating of Unitary Air-Conditioning & Air-Source Heat Pump Equipment.

B. ASME B16.22: Standard for Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.

C. ASME B16.26: Standard for Cast Copper Alloy Fittings for Flared Copper Tubes.

D. ASTM B280: Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.

E. ANSI/AHRI 270: Sound Rating of Outdoor Unitary Equipment.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. All products shall comply with Section 20 05 00, Paragraph 2.01; Acceptable Manufacturers.

B. Air Conditioning Units: Mitsubishi, Trane, Carrier, Daikin, LG.

C. Refrigerant Pipe and Fittings: Domestic manufacturers only.

2.02 HEAT PUMP UNIT

A. Type: Split system ductless heat pump.

B. Indoor Unit: Wall (or ceiling) suspended unit (configuration as indicated on plans), with fan, adjustable discharge outlet, air filter, evaporator coil, refrigerant metering device, heavy gauge steel chassis, white plastic enclosure, controls, condensate pan and drain connection, and related accessories to operate properly with outdoor unit. Unit shall have dip switches adjusting fan speeds during different operating modes and when thermostat is satisfied.

C. Outdoor Unit: Outdoor condenser and compressor unit, with high efficiency rotary compressor, condenser coil, condenser fan, accumulator, refrigerant piping, wind baffle accessory, heavy gauge steel chassis, baked enamel finish steel cabinet, controls, coil guard, mounting legs, and related accessories to provide capacity indicated. Outdoor unit shall be for use with multiple indoor units.

D. Capacity: As scheduled on drawings at the conditions indicated. Unit shall provide cooling down to 0 deg F ambient. Unit shall be able to operate with refrigerant runs up to 164 feet long. Shall be rated in accordance with AHRI standards.

E. Refrigerant: Units shall be for use with refrigerant R-410A or R-407C.

F. Electrical and Controls: Indoor and outdoor units shall be provided with all contactors, relays, wiring terminals, safety controls, microprocessor devices, dip switches, and accessories to allow for specified sequence of operation requiring only connection of room controller, power, and interconnection between indoor and outdoor units. Room controller shall be the electronic type, with liquid crystal display, room temperature sensor, on/off/auto functions, temperature setpoint, fan speed indicator, and self diagnostic display.

G. Condensate Pump: Provide unit with condensate pump. Where not available internal to unit, provide external type, with holding tank, controls, and gpm capacity at least 4 times unit condensate rate, at 10 feet of head. Provide mounting assembly and accessories for completely connected and functioning unit.

2.03 REFRIGERANT PIPING AND ACCESSORIES

A. Piping: Hard drawn ACR copper tubing per ASTM B280, Type L, with silver brazed joints and wrought copper fittings per ASME B16.22. Use only long radius elbows. Flared fittings (at equipment connections only) shall comply with ASME B16.26. Soft copper tubing may only be used on runs less than 50-feet or where necessary (i.e. when routing through sleeves, or similar poor access areas).

B. Sight Glass: Sight glass shall allow visual inspection of refrigerant flow and indicate refrigerant moisture content. Shall be double port type, solder end connections, for use with type of refrigerant of system being installed in, same size as tubing installed in. Henry type

3103 or equal.

C. Isolation Valves: Brass ball valve, full port, rated for 700 psig and -40 deg F to 300 deg F. Compatible with refrigerant used with, UL listed, with rupture proof encapsulated stem, extended copper connections for ease in brazing. Provide in configuration (i.e. angle, straight, with access port) as required to suit application.

PART 3 - EXECUTION

3.01 INSTALLATION

A. General: Install in strict accordance with manufacturer's written instructions and code.

B. Location and Arrangement: Install all equipment at locations and as shown on the drawings. Install so as to allow maximum access to unit. Prior to selecting unit final location, confirm that: proper unit clearances and access will be provided; no adverse airflow conditions are present; confirm location and installation details with other trades. Units shall be level and aligned with building walls. Set outdoor unit on concrete pad (or roof sleepers); anchor to pad (or sleepers).

C. Complete Connections: Connect and install all items shipped loose with units; provide and connect all utilities and accessories as required for proper unit operation. See Section 23 21 28 for cooling coil condensate drain piping.

D. Refrigerant Piping: Shall be silver brazed. Bleed dry nitrogen through piping during brazing to minimize oxidation. Keep all open ends of piping capped when not being worked. Soft copper shall have long radius bends; install without kinks or excess bends. Piping shall be routed concealed, except where routed outdoors and where noted. Piping shall be ran plumb and square to building walls, and in a neat professional manner. Provide sight glass in refrigerant liquid piping at outdoor unit.

E. Refrigerant Valves: Provide isolation valves on refrigerant piping connections at the outdoor unit (unless unit has integral service valves). Provide valve with access port on larger volume systems to aid in system vacuum testing (or as required for other purposes).

F. Refrigerant Charge: Units shall be checked for proper refrigerant charge and oil level and charged to proper levels after all leak testing and evacuation work has been completed. Refrigerant to be added to the system shall be delivered to the site in factory charged containers and charged into the system through a filter/drier.

G. Cleaning: Units shall be thoroughly cleaned of all debris prior to operation. Units shall be clean and in new condition prior to Owner acceptance.

H. Operation: Units shall not be operated until all construction activities that generate dust, dirt, fumes, or odors are complete; system checkout has occurred; and the Engineer has reviewed the system and granted approval.

3.02 LEAK TESTING AND EVACUATION

A. Disconnect and isolate from the system any controls, relief valves, or other components that may be damaged by the test pressure.

B. Connect oil-pumped, dry nitrogen to the system through a pressure reducing gauge manifold. Charge enough nitrogen into the system to raise the pressure to 140 psig (or as required by

the local Code authority).

C. Test all joints for leaks with a glycerin soap solution. Check the manifold gauge for any drop in pressure. Tap all solder/brazed connections with a rubber or rawhide mallet sufficiently hard to start any leak that might subsequently open from thermal expansion/contraction or vibration.

D. Repair any leaks found by completely disassembling the connection, cleaning the fitting and remaking the connection. Re-test the system after repairs are made.

E. When the above tests are successfully completed, allow the system to remain under test pressure (140 psig or as required by the local code authority) for 24 hours. Note the initial pressure and temperature. If the system pressure has not changed (when corrected to account for any change in temperature) the system may be considered free of leaks.

F. When all testing is completed the system shall be completely evacuated of all air and moisture. Connect a vacuum pump to the system and evacuate the system to 500 microns, and let stand for a minimum of 12 hours. If the vacuum reading remains unchanged, the system may be charged with refrigerant.

3.03 START-UP

A. Initial Checks: Prior to unit operation, the system shall be inspected to ensure all equipment and controls are properly connected and ready to operate. As a minimum, the following items shall be checked.

1. Adequate refrigerant charge.
2. Gauges installed to read suction and discharge pressure.
3. Proper voltage at outdoor unit.
4. Proper voltage at indoor unit.
5. Unit safeties properly set and connected.
6. Fan motors lubricated and ready to operate.
7. Temperature controls connected.
8. Pipe leak testing completed.
9. Condensate drain installed.
10. System service valves in proper position.
11. Controls properly connected and powered.

B. Initial Operation: After start-up, check unit for proper unit operation including: proper fan rotation, no excessive vibration, no unusual noises, proper unit cycling in response to room temperature, no excessive room temperature swings, no safeties or electrical devices tripping out.

C. Written Report: Submit written report detailing all inspection procedures and findings leak test results, amount refrigerant charge installed, and final start-up/operation results.

3.04 COMMISSIONING

A. The Products referenced in this section are to be commissioned per Division 01 Section 23 08 00. The Contractor has specific responsibilities for scheduling, coordination, startup, test, development, testing and documentation. At a minimum, the Contractor shall provide a documented and signed record to verify that all equipment and systems installed under this contract have been inspected and functionally tested to verify full compliance with the contract specifications. In many cases, this shall require the Contractor to create or otherwise provide procedures and checklists for approval by the Commissioning Consultant prior to the start of functional testing. Reference Division 01 Section 23 08 00 and coordinate all commissioning activities with the Commissioning Consultant.

END OF SECTION

SECTION 23 82 46
ELECTRIC HEATERS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.

B. Requirements of Section 20 05 00 apply to this Section.

1.02 WORK INCLUDED

A. Electric Heaters.

1.03 SUBMITTALS

A. General: Comply with Section 20 05 00.

B. Product Data: Submit product information on all items.

1.04 GENERAL REQUIREMENTS

A. Listing: All heaters shall be listed by an independent testing laboratory for the application indicated.

B. Installation Verification: Prior to ordering units confirm finishes at heater location and type of installation and associated trim required; i.e. fully recessed, semi recessed, surface mount, etc.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Products: Shall comply with Section 20 05 00 Part 2.01 - Acceptable Manufacturers.

B. Unit Heaters: Q-Mark, Chromalox, Aztec, Berko.

C. Duct Heaters: Indeeco, RenewAire.

2.02 UNIT HEATERS

A. Type: Fan forced, horizontal discharge unit heater. Q-mark “MUH” series or approved.

B. Casing: Shall be die formed heavy gauge steel with factory baked enamel finish. Casing shall entirely enclose unit, and have adjustable louvers on unit discharge side.

C. Heat Elements: All steel or aluminum finned copper clad/steel type.

D. Motor and Fan: Draw through fan design; motor shall have permanently lubricated sealed bearings with built in overload protection. Airflow rate shall be such that the temperature rise is no less than 30 deg F and no more than 50 deg F.

E. Controls: Safety controls shall include automatic reset high temperature cut-out and fusing (element, motor, and transformer primary) as required by the NEC. Unit shall include all contactors, relays and accessories to automatically operate fan or heater upon a call for either by a remote mounted thermostat (thermostat by Division 25).

F. Accessories:

1. Support: Steel support bracket for wall mounting.

2. Control: Low voltage thermostat, wall mounting type, adjustable 40 to 55 deg F.

2.03 DUCT ELECTRIC HEATERS

A. Type: Open coil type electric duct heaters; of size and capacity as shown on the drawings.

B. Listing: Heaters shall be UL listed for zero clearance to combustibles, and shall be built to meet all requirements of the National Electric Code and NFPA.

C. Construction: Heating coils shall be made of 80% nickel and 20% chromium coiled resistance wire. Coils shall be supported in an aluminized steel frame and insulated by floating ceramic bushings. Heaters shall be of the configuration to suit the application as shown on the drawings.

D. Overtemperature Protection: All heaters shall be equipped with primary and secondary overtemperature safety devices. The primary safety device shall be a disc or liquid filled bulb type with automatic reset; the secondary device shall be a disc type with manual reset, wired in series with each heater stage, set to trip at a higher temperature than the primary safety device.

E. Overcurrent Protection: Fuses shall be provided for overcurrent protection; fuse capacities shall be rated for at least 125% of the circuit amperage.

F. Proof of Air Flow: Where project's control system is the DDC type, and heater is controlled by the DDC, proof of airflow is to be provided via the DDC system; no proof of airflow devices are required to be furnished integral with the heater. For non-DDC control systems or where the DDC control system is not providing heater control, provide heater with differential air pressure device and sensing tube (or sail flow switch), interlocked with the heater to prevent heater operation in case of insufficient airflow across the coil. Differential air pressure device (or sail flow switch) shall have sufficient sensitivity to suit velocity and duct pressures of the application. Configure and arrange differential air pressure device (or sail flow switch) for proper operation as the application requires. Air differential air pressure device shall have a pitot tube on high pressure side installed to sense duct total air pressure; except where heater is used on the suction side of a fan, the air differential air pressure device shall be connected to the low pressure side and be configured sensor to measure static pressure only. Where sensitive enough differential air pressure devices (or sail flow switches) are not available, provide heater with 24 volt relay for interlocking to a fan proof device (i.e. motor starter auxiliary contacts, fan start relay, or equivalent).

G. Terminal Box: All heater controls shall be mounted in a side mounted terminal box, unless a separate remote mounted terminal box is shown on the drawings. Terminal box shall be

insulated from the heater casing.

H. Disconnect: Heaters shall be provided with a built-in power disconnect switch, having a terminal door interlock.

I. Controls: Heaters shall be furnished with 24 volt transformer and shall be for use with 24 volt controls unless indicated otherwise. Transformer shall have secondary fusing, and transformers which are not class 2 shall have primary fusing. Mercury control contactors shall be used for controlling heater stages unless indicated otherwise. Where SCR control has been indicated the heater shall be furnished with a solid state proportional power controller allowing modulation of heater capacity from 0 to 100% of full capacity. The SCR control shall energize the heater only for the number of AC cycles necessary to produce the amount of heat required. For heaters with loads greater than 90 amps SCR control combined with a step controller in a vernier configuration (still providing full proportional control) is acceptable. (Backup or safety contactors - where used - shall be magnetic type).

J. Electrical: Heaters shall be for use with electricity of the voltage and phase indicated, and provide the output and number of control stages indicated. Three phase heaters shall have equal balanced three phase circuits. Heater element circuits shall be subdivided so that no circuit load exceeds 48 amperes. All internal wiring shall be suitable for 220 degrees.

K. Pressure Plate/Baffle: Provide plate to allow for uniform flow across heater; fabricate of galvanized steel; pressure drop shall not exceed 0.20" wc.

PART 3 - EXECUTION

3.01 INSTALLATION

A. General: Comply with Section 20 05 00. Install in accordance with manufacturer's written instructions, code, applicable standards and best construction practices.

B. Coordination: Coordinate heater power and control requirements with other trades; confirm location of any required heater contactors, relays, thermostats, and similar devices. Provide any required wiring for proof of fan operation between fan devices and heater; wiring shall comply with the HVAC control portion of the specifications and Division 26.

C. Location and Trim Verification: Install equipment at locations indicated in accordance with the Contract Documents. Review and confirm installation locations, that proper clearances are provided, unit controls are accessible, and installation has been coordinated with other trades.

D. Complete Connections: Connect and install all items shipped loose with units; provide and connect all contactors, relays, wiring, interconnections and accessories as required for proper unit operation.

E. Cleaning: Units shall be thoroughly cleaned (internally and externally) of all debris prior to operation. Units shall be clean and in new condition prior to Owner acceptance.

F. Owner Instruction: Instruct Owner on equipment operation and maintenance.

3.02 START-UP

A. Pre Start-Up Inspection: Inspect equipment and connecting systems to confirm equipment and connecting systems to confirm equipment has been installed properly and is ready for start-up. As a minimum, check for: proper voltage and phases, correct electrical connections, complete control connections, all unit safety devices properly set and connected, coils clear of obstructions, and other items as listed by the manufacturer are properly provided/connected and operating to ensure safe and proper start-up. If items are discovered that prevent start-up to be completed, notify the installing Contractor and Engineer of issues. Coordinate and re-schedule start-up after items are corrected.

B. Start-Up: Perform start-up in accordance with manufacturers written start-up procedures. Observe proper operation of all unit components.

C. Adjustments: Adjust and set unit components to allow for proper operation. Observe unit to detect any unusual vibration, leakage, loose wiring, or other situations that could affect unit operation.

3.03 COMMISSIONING

A. General: The Products referenced in this section are to be commissioned. The Contractor has specific responsibilities for scheduling, coordination, testing, and documentation of the commissioning. The Contractor shall provide a documented and signed record to verify that all equipment and systems installed under this contract have been inspected and functionally tested to verify full compliance with the contract specifications. See Section 20 08 00.

END OF SECTION

SECTION 26 01 00
ELECTRICAL GENERAL REQUIREMENTS

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.

B. Division 27 - Communications.

C. Division 28 - Electronic Safety and Security.

1.02 SECTION INCLUDES

A. General requirements specifically applicable to Division 26.

B. General requirements of this section also apply to Divisions 27 and 28.

1.03 SCOPE OF ELECTRICAL WORK

A. Provide electrical systems and Work described, identified, specified, referenced, and shown in the Project Documents that are covered under Divisions 26, 27, and 28 of the Construction Specifications Institute (CSI) and/or as otherwise regulated by national, state, and local electrical codes. Electrical Work includes providing all equipment, materials, devices, appurtenances, and accessories necessary to provide complete and operating systems according to the intent of Project Documents.

B. Electrical work is not limited to Division 26, 27 and 28 specifications and what is shown on the electrical drawings. The Contractor is responsible to review all Project Documents for additional Electrical Work and requirements and to include this work as part of their scope under the Contract.

1.04 REGULATORY REQUIREMENTS

A. Comply with requirements of the following codes as adopted and supplemented by authority having jurisdiction:
ANSI/NFPA 70 - National Electric Code (NEC)
NFPA 101 - Life Safety Code
International Building Code (IBC)
International Mechanical Code (IMC)
WAC 296-46B - Washington State Electrical Safety Standards, Administration, and Installation
Washington State Energy Code (WSEC)

B. Comply with additional codes and regulations referenced in other sections.

C. Comply with additional codes and regulations required by authority having jurisdiction.

D. Obtain and pay for permits, and inspections from authorities having jurisdiction over work included under applicable Division Sections.

E. Include all testing, shop drawings, and documentation required by the inspection authorities for permitting and final approval.

1.05 SUBMITTALS

A. Comply with requirements of Division 01. Unless otherwise specified, furnish product data and shop drawings to Architect/Engineer within 30 calendar days from date of contract signing as follows:

1. Product information sheets shall be neat, readable, 8.5 x 11 inch, submitted in PDF format. Generic product sheets with multiple products or product descriptions shall clearly highlight or otherwise indicate which product is being furnished. Product sheets shall be reasonably limited to not include entire catalog sections.

2. Furnish product submittals with a cover sheet and table of contents. Furnish a separate submittal and number for each section of the specifications. Cover sheet shall indicate name of the Project, Owner, Architect, Engineer, Contractor, and Date of Submittal. Product table of contents shall list each item submitted. Bookmark each submittal to facilitate browsing according to the type of products.

3. Furnish systems design shop drawings in PDF format. Title block shall include Project, Owner, Contractor, and Date of Submittal.

4. Furnish product data and shop drawings specifically indicating any conflict or deviation from requirements of contract documents.

B. Confirm dimensions, ratings, and specifications of electrical materials, devices, fixtures, and equipment conform to project requirements prior to furnishing submittals. Coordinate electrical requirements with utilization equipment submitted under other sections and verify that voltage, phase, and rating are compatible with work shown in the electrical project documents.

C. Provide shop drawings showing proposed feeder and branch circuit wiring plan required under Section 26 05 00.

D. Do not order materials or commence Work until applicable submittal has been reviewed and the Architect/Engineer has approved or taken other appropriate action.

1.06 SUBSTITUTIONS

A. Comply with requirements of Division 01. Products specified by naming one or more manufacturers establishes a basis for quality, styling, capacity, and function. Unless otherwise specified, written requests for substitution must be received at least 14 days prior to Bid Opening by Architect/Engineer who will determine acceptability of proposed substitution. Written acceptance must be obtained from Architect/Engineer prior to Bid Opening.

B. Substitution requests may be submitted for any manufacturer or named product unless specified as "no substitute".

C. Substitution approval does not relieve the Contractor of complying with the work requirements or the concept and intent of the project documents. Pay for any and all additional project costs that may be caused by Contractor requested substitutions, regardless of whether or not additional costs are overlooked, missed, or unforeseen, and regardless of when substitutions may be approved.

1.07 RECORD DOCUMENTS

A. Comply with requirements of Division 01. Maintain at project site one set of clean, dry, and legible red-lined record drawings for submittal at Contract Close-out. Record information concurrently with construction progress.

B. Indicate electrical changes in the contract documents. Include change orders, revised branch circuit and feeder wiring layouts, revised circuit identification, pull & junction boxes added during construction, and actual dimensioned location and routing of each underground conduit on record drawings.

C. Record branch circuit routing, switch legs, equipment connections, and home runs on the power and lighting plans. Indicate conduit size, wire counts, and conductor size if greater than a #12 2-wire branch circuit or feeder.

1.08 LABELING

A. Where labeling that includes room names and numbers is required for any system to identify devices or for programming purposes, use final room names and numbers determined during construction. Verify room names and numbers with Architect prior to manufacturing labels or programming software.

1.09 OPERATION AND MAINTENANCE MANUALS

A. Comply with requirements of Division 01. Unless otherwise specified, furnish one labeled CD in PDF format and two duplicate hard copy printed sets of Operation and Maintenance Manuals prior to completion of contract. Submit hard copy manuals in labeled and indexed 3-ring binder(s).

B. Include the following information as applicable:

1. Names, addresses, and telephone numbers of the contractor, the installing sub-contractor, and the local representative for each system or equipment.

2. All approved product data and shop drawings.

3. Identify all manufacturer warranties which exceed one year.

4. Model number and serial number of each piece of equipment provided.

5. Data from test results performed under the Contract.

C. Operation and maintenance data shall include complete parts lists, installation and maintenance instructions, safety precautions, operation sequence describing start- up, operation, and shut-down, internal and interconnecting wiring and control diagrams with data to explain detailed operation and control, and testing methods for each system and item of equipment.

D. Furnish a draft copy of Operations and Maintenance Manual for Architect/Engineer review and incorporate comments prior to final submittal. Allow 14 days for Architect/ Engineer review.

1.10 CONFLICTS

A. Notify the Architect/Engineer of any conflicts or discrepancies before proceeding with any work or the purchasing of any materials related to the conflict or discrepancy until requesting and obtaining written instructions from the Architect/Engineer on how to proceed. Where

conflicts occur, the most expensive and stringent requirement as judged by the Architect/Engineer shall prevail. Any work done after discovery of such discrepancies or conflicts and prior to obtaining the Architect/Engineer's instructions on how to proceed shall be done at the Contractor's expense.

1.11 WARRANTY

A. In addition to requirements covered under General Conditions or Division 01, include manufacturer product warranties that exceed one year. Assemble or list warranties that exceed one year in Operation and Maintenance Manuals indicating start date. Certificates of extended warranty shall identify the Owner as the beneficiary.

B. If the Electrical Contractor does not have offices located within 150 miles of the project, provide a service/warranty work agreement with a local electrical subcontractor approved by the Owner. The service/warranty work agreement shall extend for the contract warranty period, and a copy shall be included in the Operation and Maintenance Manuals.

1.12 INTENT OF PROJECT DOCUMENTS

A. Drawings and specifications are complementary and what is called for in either is binding as if called for in both.

B. The drawings are diagrammatic and show the general arrangement of the construction and do not attempt to show all features of work, exact construction details, or actual routing of conduit and cable. Provide all necessary supports, off-sets, bends, risers, fittings, boxes, wiring, and accessories which are required for a complete and operating installation. Determine locations for required electrical outlets and connections prior to rough-in base on equipment product and installation submittal data and/or review of equipment on site.

C. The level of design presented in the documents represents the extent of the design being furnished to the Contractor; any additional design needed to perform the Work shall be provided by the Contractor. All design by the Contractor shall be performed by individuals skilled and experienced in such work, and where required by local code (or elsewhere in the documents) shall be performed by engineers licensed in the State where the project is located. Include in bid the costs of all such project design; including engineering, drafting, coordination, and all related activities and work. Contractor provided design services shall be included for but not limited to bidder design specifications, temporary electrical systems, layout routing to install the Work and share project space with other building systems, hanger and support systems, seismic bracing, preparation of shop drawings, locating and identifying requirements for equipment and fixture terminations, and methods/means of accomplishing the work.

1.13 COORDINATION

A. Examine architectural, civil, structural, and mechanical drawings and specifications and consult with other trades, as required to coordinate use of Project space and sequence of installation.

B. Arrange wiring and equipment to avoid interference with other work and to maximize accessibility for maintenance and repairs.

C. Coordinate with suppliers and installers to obtain product electrical data, shop drawings, and installation requirements for systems, equipment, and products furnished by Owner and/or other trades as required perform electrical work.

D. Contractor is responsible ensure that equipment, fixtures, and devices being furnished and

installed shall fit the space available, taking into account connections, service access, and clearances required by product manufacturer and/or Code. Contractor shall make the necessary field measurements to ascertain the space requirements for proper installation, and shall furnish and/or install equipment so that final installation meets the intent of the Project Documents. If approval is received by Addendum or Change Order to use other than the originally specified items, Contractor shall be responsible for specified capacities and for ensuring that items to be furnished will fit the space available.

E. Contractor is responsible to review all the Project Documents and approved shop drawings provide under other divisions to identify and resolve conflicts between electrical systems and building construction, equipment, cabinets, counters, trim, and special finishes, prior to rough-in.

F. Facilitate coordination between low voltage system sub-contractors during construction. Include time for a minimum of one meeting with all sub-contractors prior to building rough-in to review requirements for each system per Section 26 05 30. Include a second meeting with all sub-contractors to review requirements for all systems utilizing IP structured cabling prior to cover.

1.14 REQUIREMENTS FOR EQUIPMENT FURNISHED UNDER OTHER SECTIONS OR BY OWNER

A. Provide power wiring, disconnect switches, electrical connection of equipment, installation of furnished electrical controllers, parts, and accessories, and field wiring for systems, equipment, and products furnished under other divisions or by Owner. Install controllers, operator stations, and control devices such as limit and temperature switches furnished with equipment.

B. Review equipment submittals prior to electrical rough-in and installation. Verify location, rating, size, type of connections, and required space requirements. Coordinate field wiring requirements and details with supplier and installer. Notify Architect/Engineer of conflicts between requirements for actual equipment being furnished and equipment indicated in contract documents prior to commencing Work.

C. Provide motor controllers and operator stations unless otherwise indicated on the project drawings.

D. Make final connections to equipment. Provide cord and plug where required for plug-in connection.

E. Integrated automation systems covered under Division 25 are not included as part of electrical work.

1.15 DEFINITIONS

A. Electrical terms used in these specifications are as defined in NEC Art. 100 unless otherwise noted.

B. Abbreviations: Where not defined elsewhere in the Contract Documents, shall be as defined in RS Means Illustrated Construction Dictionary.

C. Accessible Ceiling: Signifies access that requires the removal of an access panel or similar removable obstruction.

D. As Required: As necessary to form a safe, neat, and complete working installation (or product), fulfilling all the requirements of the specifications and drawings and in compliance with all codes.

E. Concealed: Hidden from view as in walls, trenches, chases, furred spaces, crawl spaces, unfinished attics, and above suspended ceilings.

F. Conduit: Includes conduit and tubing raceways.

G. Coordinate: Accomplish the work with all others that are involved in the work by directly discussing the work with them, arranging and participating in special meetings with them to discuss and plan the work being done by each, obtaining and completing any necessary forms and documentation required for the work to proceed, reaching agreement on how parts of the work performed by each trade will be installed relative to each other both in physical location and in time sequence, exchanging all necessary information so as to allow the work to be accomplished with a united effort in accordance with the project requirements.

H. Equipment Connection: Make branch circuit connection, mount and connect control devices as required. Provide disconnect and overcurrent protection when required by NEC and IMC, if not otherwise indicated or furnished with equipment.

I. Exposed: Exposed to view in any room, hallway, passageway or outdoors.

J. Finished Areas or Spaces: Areas and/or spaces receiving a finish coat of paint on one or more wall surface.

K. Furnish: Obtain and/or prepare and deliver to the project.

L. Indicated: Shown, scheduled, noted, or otherwise called out on the drawings.

M. Install: Enter permanently into the project complete and ready for service.

N. Open Cable or Wiring: Conductors above grade not installed in conduit or raceway.

O. Panel: Distribution panelboard, lighting and appliance panelboard, load center, and/or low voltage cabinet.

P. Provide: Furnish and install complete and ready for service.

Q. Wiring: Conductors in raceway or an approved cable assembly.

R. Verify: Obtain, by a means independent of the project Architect/Engineer and Owner, the information noted and the information needed to properly perform the work.

1.16 SCHEDULE OF VALUES

A. Provide Schedule of Values for use by Architect/Engineer to evaluate progress payment requests during construction.

B. Submit Schedule of Values using the line items included at the end of this Section. Submit Schedule of Values for review and approval. Include additional line items as requested.

PART 2 – PRODUCTS

2.01 MATERIALS, EQUIPMENT

A. General: Furnish only products that are new and free from defects with a manufacture date that is less than six months from date of installation. Where product and applicable software

updates or upgrades are available from the manufacturer, furnish the latest version unless otherwise specified. Furnishing discontinued products and/or products of manufacturers who are no longer in business is not permitted.

B. Listing and Labeling: Furnish and install only products that are listed and labeled by one or more of the following testing laboratories as approved by the Authority Having Jurisdiction:
Underwriter's Laboratories, Inc. (UL)
ETL Testing Laboratories, Inc. (ETL)
Factory Mutual (FM)

C. Each specified product and system to be furnished shall be from a single approved manufacturer. Providing multiple product brands or manufacturers for each type or category, or for multiple units of the same specified product and/or system, is not permitted.

D. Products shall be delivered, handled, and stored per manufacturer recommendations. Protect fixtures, materials, and equipment from rain, water, dust, dirt, snow, and damage. Do not install products that have marred, scratched, deformed, or otherwise damaged. Do not install products that have been wet or exposed to the weather prior to assembly and/or installation.

PART 3 – EXECUTION

3.01 WORKMANSHIP

A. Electrical work shall conform to requirements of ANSI/NECA 1-2015, Standard Practice of Good Workmanship in Electrical Construction.

3.02 INSTALLATION

A. Provide all electrical work as specified and shown in the Project Documents. Provide all labor, equipment, material, accessories, and testing for electrical systems complete and operating. Include all scaffolding, rigging, hoisting, and services necessary for delivery and installation of materials and equipment.

B. Include all required software applications, licensing and associated system programming for electronic products. Provide all software to owner for onsite programming and interfacing.

C. Provide as part of the Electrical Work all hangers, brackets, supports, framing, backing, accessories, incidentals, not specifically identified the project documents, but required to complete the system(s) in a safe and satisfactory working condition.

D. Quantity of materials and layout of the Work shall be provided based on field measurement of the actual project conditions and shall not be based on plan dimensions.

E. Provide all testing and documentation of electrical systems as required to demonstrate compliance with the Project Documents.

F. Provide testing, documentation, and filing required to comply with commissioning requirements of Section C408 of the Energy Code. Include documentation in Operation and Maintenance Manuals.

3.03 CUTTING AND PATCHING

A. Provide cutting and patching to complete electrical work and to provide openings in elements of Work for electrical penetrations. Comply with requirements of Division 01.

B. Locate and execute cuts so as not to damage other work or weaken structural components. Core drill or saw cut rigid materials.

C. Patch to restore to original condition. Refinish surfaces to match adjacent finishes. For continuous surfaces, refinish to nearest intersection; for an assembly, refinish entire unit.

Division 26 Schedule of Values

Division 26 Mobilization and Temporary Facilities
Utility Company Charges
Electrical Demolition
Electrical Site Work
- Lighting Systems Rough-in (Conduit, Handholes, Wire, Pole Bases - Material & Labor)
- Lighting Fixtures & Poles (Material & Labor)
- Power & Signal Rough-in (Conduit, Vaults, Wire - Material & Labor)
- Transformers, Switchgear (Material & Labor)

Lighting Systems
- Fixtures & Lamps Material
- Fixtures & Lamps Labor
- Branch Circuit Rough-in (Conduit and Wire - Material & Labor)
- Devices and Trim (Material & Labor)
- Performance Lighting System (Material & Labor)

Power Systems
- Distribution Equipment Material (Switchgear, Panels, Transformers, Starters, TVSS, Disconnects)
- Distribution Equipment Labor
- Feeder Rough-in (Distribution Conduit and Wire - Material & Labor)
- Branch Circuit Rough-in (Conduit and Wire for Devices - Material & Labor)
- Devices and Trim (Material & Labor)
- Equipment Circuit Rough-in (Conduit and Wire for Scheduled Equipment - Material & Labor)
- Equipment Connections (Material & Labor)

Electric Space Heating
- Heating Equipment Materials
- Heating Equipment Labor
- Heating Circuit Rough-in (Conduit & Wire - Material & Labor)

Signal Systems
- Fire Alarm Rough-in (Conduit and Wire - Material & Labor)
- Fire Alarm Trim (Equipment, Devices, Testing - Material & Labor)
- Telecommunications Pathway (Material & Labor)
- Telecommunications Premises Wiring (Material & Labor)

Electrical Closeout (Punchlists, O&M Manuals, Record Drawings, Training)

END OF SECTION

SECTION 26 05 00
BASIC MATERIALS AND METHODS

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.

B. Excavation and Backfill for Underground Conduit: Comply with Division 02 - Site Work Division 31 - Earthwork.

C. Concrete for Encased Conduit: Comply with Division 03 - Concrete.

D. Materials and Methods for Utility Services: Comply with Section 26 05 80.

1.02 SECTION INCLUDES

A. Conduit and Fittings.

B. Building Wire and Cable.

C. Wiring Connections and Terminations.

D. Boxes.

E. Wiring Devices.

F. Supporting Devices.

G. Single Station Smoke Detectors.

H. Requirements for Fire Rated Construction.

I. Earthwork for Underground Electrical.

1.03 SUBMITTALS

A. Submit product data for conduit fittings, wire and cable, watertight connectors, wiring devices, floor boxes, cord reels, smoke detectors, and cable tray.

B. Submit shop drawings for installation of cable tray, including wire basket type.

C. Submit reports for tests required under Part 3 of this section.

1.04 OPERATION AND MAINTENANCE DATA

A. Include data for wiring devices, floor boxes, smoke detectors, and cable tray in Operation and Maintenance Manuals.

PART 2 – PRODUCTS

2.01 CONDUIT

A. Rigid Steel Conduit (RGS): ANSI C80.1; hot dipped galvanized.

B. Intermediate Metal Conduit (IMC): Hot dipped galvanized.

C. Electric Metallic Tubing (EMT): ANSI C80.3; galvanized tubing.

D. Liquid Tight Flexible Metal Conduit: Galvanized steel, PVC jacket.

E. Non-Metallic Conduit: NEMA TC 2; EPC-40-PVC and EPC-80-PVC.

2.02 FITTINGS

A. RGS and IMC Conduit: ANSI/NEMA FB 1; threaded type. Provide bushings, hubs and connectors with insulated throat, for conduit terminations.

B. EMT Conduit: ANSI/NEMA FB 1; steel, compression type. Crimp-on, drive-on, indenter, and set screw type prohibited. Provide connectors with insulated throat for conduit larger than 3/4-inch diameter. Provide raintight fittings for conduit installed outdoors.

C. Liquid Tight Flexible Conduit: ANSI C33.84, steel. Provide PVC coated fitting where installed outdoors.

D. PVC Conduit: NEMA TC 3; solvent welded type, same manufacture as conduit. Provide bushings, hubs and connectors with insulated throat, for conduit terminations.

E. Water and Vapor Conduit Sealants: Hydra-Seal S-50 conduit sealing putty or approved; Tyco/Rachem/TE blank duct plug or approved; Polywater FST conduit sealing foam system or approved.

F. Expansion Fittings for PVC Conduit: Same manufacture as conduit.

G. Corrosion Protection: Zinc plated minimum indoors and hot dipped galvanized minimum outdoors and indoor wet locations for all metal fittings and accessories.

2.03 WIRE AND CABLE

A. Copper Building Wire, Interior: Type THWN-2, 600 volt insulation; conductors 8 AWG and larger shall be stranded. Type XHHW-2 may be substituted for conductor sizes 4 AWG and larger.

B. Copper Building Wire, Outdoors: Type RHW/USE-2, 600 volt insulation; conductor 8 AWG and larger shall be stranded.

2.04 WIRE CONNECTORS

A. Connectors for Wire Size 10 AWG and Smaller: Insulated steel spring twist-on pressure connector with plastic cap. Outdoors use watertight type with prefilled sealant gel.

B. Connectors for Wire Size 8 AWG and Larger: Solderless mechanical or compression type with pre-formed or shrink sleeve insulated cover. Outdoors make watertight using shrink sleeve or pigtail cap and sealing mastic.

C. Gutter/Wireway Taps for Wire Size #6 AWG and Larger: Ilsco type PDB series AL/CU lug type distribution block, number of poles and quantity/size of primary/secondary lug ports as required for the application.

D. Connectors at Pole Bases: WSDOT Spec 9-29.7; waterproof quick-disconnect. Provide fused type for ungrounded conductors.

2.05 BOXES

A. Outlet Boxes: ANSI/NEMA OS 1; galvanized sheet steel, with 1/2-inch male fixture studs or plaster rings as required.

B. Surface Outlet Boxes Below 8 Feet: Cast aluminum or malleable iron, threaded hubs.

C. Surface Outlet Boxes for Outdoor and Wet Locations: Cast aluminum with baked enamel or epoxy finish, gasketed cover, stainless steel hardware. Outlet boxes shall have threaded hubs.

D. Concrete and Masonry Boxes: Galvanized steel, suitable for the purpose.

E. Junction and Pull Boxes: Outlet box with blank cover except boxes larger than 4 inch square shall be screw cover type, galvanized steel with grey enamel finish, NEMA 1 indoors and NEMA 3R outdoors, unless otherwise indicated.

F. In-Ground Boxes: Concrete type with locking cover. Provide traffic ratings, dimensions, features, and installation requirements indicated.

G. Work Station Outlets: SMI Spider/Hubbell Multi-Connect System recessed wall box with almond (ivory) trim plate and one internal movable barrier. Provide 4 or 6 gang outlet as indicated.

H. Fire Rated Construction: Recessed outlet boxes and rough-in cans that are installed in 2 hour rated area separation walls shall be UL listed with 1-1/2 hour rating label.

I. Barriers: Provide permanent barriers in outlet boxes to separate adjacent wiring devices where voltage exceeds 300 volts. Provide permanent voltage separation barriers in outlet and junction boxes to separate wiring above 100 volts from wiring below 100 volts and where otherwise required by Code.

J. Color Coding of Device and Junction Boxes for Special Systems: Field painted or otherwise manufactured in the specified color, both inside and outside of box and cover. Provide color identification for the following electrical systems: Fire Alarm System - RED, Emergency Systems (NEC 700) - ORANGE.

K. Sound Attenuation Wrap: UL listed, 0 VOC, sound attenuating wrap for sealing around outlet boxes. SpecSeal SSP Putty Pad or approved.

2.06 WIRING DEVICES

A. Wall Switches: Hubbell 1221, Leviton 1221, Pass & Seymour 20AC1, Cooper 2221; specification grade, 20 ampere, 277 volt, quiet type. Single pole, double pole, 3-way, 4-way as required. Color: Ivory.

B. Wall Switches, Key Type: Leviton 1221 with 55500 key, no substitute.

C. Receptacle assemblies face up located in Counter Tops and Work Surfaces: Same manufacturer, rating, and style as specified for duplex or GFCI receptacles except receptacle assemblies shall be listed for the application.

D. Duplex Receptacles, Controlled: Same manufacturer, rating, and style as specified for duplex receptacles except devices shall have special purpose identification symbol and permanently

marked with the word “controlled” visible on face of each receptacle automatically controlled. Color: as selected. Automatic control devices for receptacles are specified under Section 26 09 20, Lighting Controls.

E. Ground Fault Circuit Interrupter (GFCI) Receptacles: Same manufacture, rating, and color as duplex receptacles except devices shall comply with UL 943, Class A, with self test.

F. Duplex Receptacles, Weather Resistant for Damp and Wet Locations: Same manufacture, rating, and color as duplex and GFCI receptacles except devices shall be UL listed as weather resistant and permanent special purpose identification shall be visible on the device.

G. Flush Mounted Device Plates: Super heavy duty for high abuse application, rigid high impact thermoplastic, smooth finish, color to match device. Thermoset, phenolic, urea, nylon, and flexible polycarbonate not approved. Cooper PJ series manufacture or approved.

H. Surface Mounted Device Plates: Raised galvanized steel on steel boxes; cast or stamped sheet aluminum on cast boxes.

I. Damp and Wet Location Device Plates: ANSI/UL 514D; Commercial grade, low profile, lockable, die cast metal cover assembly, listed as weatherproof when in use and identified as extra duty. Hubbell/TayMac MX series or approved.

J. Work Station Outlet Plates: Provide one manufactured system device plate for each outlet gang position (power, signal, or blank) as indicated, color to match outlet trim. Coordinate signal plate configuration with Owner.

2.07 SUPPORTING DEVICES

A. Metal Conduit Clamps and Straps: Steel, screw type; zinc or cadmium plated minimum indoors, hot dipped galvanized minimum outdoors.

B. Support Channel: Slotted 12-gauge steel channel with fittings, fasteners, brackets, clamps, floor plates, and accessories required; Pre-galvanized zinc coated (G90) indoors, ASTM 123 hot dipped galvanized outdoors.

C. Fasteners: Expansion anchors in concrete and solid masonry; toggle bolts in hollow masonry, plaster, or gypsum board wall construction; sheet metal screws in metal construction; wood screws in wood construction; set screw type beam clamps on steel columns and beams; U.L. listed clips for metal studs. Metal parts and accessories to be zinc or cadmium plated minimum indoors and hot dipped galvanized minimum outdoors.

D. Support Wires: Support wires above accessible ceiling grids, steel #12 AWG minimum.

E. Roof Supports: Do not install conduit exposed on roofs.

2.08 ACCESSORIES

A. Air-Vapor Barriers:

1. Pre-molded polyethylene box installed in all exterior framing walls (thermal envelope) around recessed outlet boxes.

2. Foam electrical outlet gaskets for installation between device plate and finished outlet. Conceal behind device plate.

B. Pulling Wire:

1. Interior; continuous fiber pulling line, 190# tensile strength.

2. Below grade; Polyester measuring pulling tape 5/8 inch wide, 1800# tensile strength. Muletape.

C. Warning Tape: 6 inch wide detectable underground warning tape, black lettering, on red background for high voltage, yellow background for medium voltage and general utility, orange background for low voltage, with wording to describe buried installation.

D. Corrosion Protection Metal Conduit Tape: 3M Scotchrap 10 mill PVC All Weather Corrosion Protection 50 tape and pipe primer system, or approved.

2.09 SINGLE STATION SMOKE AND CARBON MONOXIDE (CO) DETECTORS

A. UL 217, UL 2034; 120 VAC direct wired combination ionization smoke and CO detector with battery back-up, integral horn rated 80 dB minimum at 10 feet, power-on LED, test switch, automatic reset, and white housing. Detector shall be capable of interconnecting with additional units for common alarm. Non combination devices may be used when approved or otherwise required. BRK/First Alert, Kidde, or approved.

2.10 FIRE RATED CONSTRUCTION

A. Products for Fire Stopping to Seal Around Enclosures and Annular Space between Conduit and Building Construction at Conduit Penetrations: ANSI/UL 1479; Comply with requirements of Division 07.

B. Conduit Sleeves for Open Cable: ANSI/UL 1479; Fire stop conduit sleeve kit, with mounting escutcheons, gaskets, end bushings, warning labels, and non-hardening fire stop putty. SpecSeal READY SLEEVE, FS100 (1 inch diameter sleeve) and FS200 (2 inch diameter sleeve), or approved.

C. Pathway Sleeves for Open Cable, Greater than 2 Inch Diameter: ANSI/UL1497; Fire stop rectangular sleeve kit, 3-inch wide by 3-inch high by 10.5-inch length, expandable in 6-inch increments, self-contained integral fire sealing system that automatically adjusts to the installed cable loading. Provide radius control modules (each end of pathway), single or multiple gang wall kits, and expansion modules as required. Specified Technologies, Inc., EZ-Path System Series 33 or approved.

PART 3 – EXECUTION

3.01 WIRING METHODS

A. General:

1. Fixed wiring shall be conductors installed in conduit.

2. Conceal all wiring within construction unless otherwise noted on drawings or specifically authorized by the Architect/Engineer.

3. Where contractor wiring methods require the application of conductor ampacity adjustment or correction factors under NEC 310.15, the contractor shall submit calculations that show Code compliance, except the adjusted ampacity of the conductors installed shall not be less than the circuit overcurrent device rating shown or specified.

4. Conduit sizes shall not be reduced to smaller size than shown or otherwise noted on plans.

5. Feeders shown or otherwise noted on plans shall not be combined to share a common conduit homerun. Branch circuit homeruns shown or otherwise noted on plans shall not be combined to share a common conduit with other circuits.

6. Device Plates: It is the electrical contractor's responsibility to ensure that all line voltage and low voltage system faceplates and visible trim pieces are the same color. Exception: Where stainless steel device plates are used for line voltage systems, low voltage systems may use non-metallic plates of the same color.

B. Conduit Requirements:

1. Rigid Steel Conduit (RGS): May be used in all areas. Required at penetrations thru fire rated construction rated greater than 1 hour.

2. Intermediate Metal Conduit (IMC): May be used in all areas except where RGS is required or indicated.

3. Electrical Metallic Tubing (EMT): May be used in dry and damp locations where not subject to damage. May not be used in concrete, where in contact with earth, or where RGS is required or indicated. May not be used for service entrance conductors inside a building. Maximum trade size 2 inches.

4. Flexible Conduit: May be used concealed in casework up to 1 inch maximum trade size. Required for final equipment connections (maximum length 36 inches), to recessed lighting fixtures from an outlet box (maximum length 72 inches), and where raceway passes thru seismic joints. Use liquid tight in damp or wet locations.

5. Rigid Non-Metallic Conduit (PVC): May be used underground. May be used within buildings where encased in not less than 2 inches of concrete. Terminate inside building using RGS or IMC elbow and riser to first coupling above slab on grade.

C. Wire and Cable Requirements: Use copper conductors.

3.02 SUPPORT – GENERAL

A. Support wiring, conduit, raceways, boxes, equipment, and fixtures from building structural members. Provide additional framing, channel, or listed support attachments as required to span or support between structural members and to avoid interference from pipes, ducts, and other equipment.

B. Do not install support anchors to penetrate thru roof deck.

C. Do not violate the integrity or exceed the capacity of the building structure used for support. Provide/fabricate additional support elements to transmit loads to the floor or other parts of the building structure that can carry the load as approved by the Architect/Engineer.

3.03 CONDUIT SIZING, ARRANGEMENT, AND SUPPORT

A. Minimum conduit trade size 1/2-inch diameter except all homeruns and where installed below grade outdoors conduits shall be 3/4-inch minimum diameter. Prewired 3/8 inch diameter flexible conduit not to exceed 72 inches in length may be used for fixture whips from an outlet box to recessed light fixture.

B. Arrange conduit to maintain headroom and present a neat appearance.

C. Route conduit parallel and perpendicular to walls and adjacent piping.

D. Maintain 12-inch clearance between conduit and heat sources such as flues, steam pipes, and heating appliances.

E. Locate holes in joists within center third of member depth measured from the edge and at least 24 inches from load bearing points. Maximum hole diameter one inch.

F. Support conduits from building structure with conduit straps or rods and hangers. #8 solid wire and CADDY clips may be used to hang 3/4-inch diameter conduit and smaller above accessible ceiling spaces.

G. Group conduit in parallel runs where practical and use conduit rack constructed of steel channel with conduit straps or clamps. Provide space for 25 percent additional conduit.

H. Do not support conduit with perforated pipe straps or tie wraps. Remove all wire used for temporary conduit support during construction, before conductors are pulled.

I. Do not bore holes in truss members or notch structural members.

J. Steel conduit installed as part of a 2 hour fire rated wiring assembly shall be supported 5 feet on center where required by the cable system installation requirements.

3.04 CONDUIT INSTALLATION

A. Use conduit hubs or sealing locknuts for fastening conduit to cast boxes and for fastening conduit to sheet metal boxes in damp locations.

B. Use conduit bodies to make sharp changes in direction, as around beams.

C. Use factory elbows for PVC conduit and for bends in metal conduit larger than 1 inch. Conduit bends for signal systems that are greater than 45 degrees shall be minimum radius sweeps as follows:

Under 2 inches	Standard radius
2 inches - 3 inches	24 inch radius
Over 3 inches	36 inch radius

D. Use factory RGS elbows for PVC conduit runs below grade.

E. Install insulated bushings on each end of conduit larger than 1 inch.

F. Use suitable conduit caps to protect installed conduit against entrance of dirt and moisture.

G. Install pull wire in empty conduits.

H. Conduit in Concrete Slabs Above Grade: Do not install in concrete slabs above grade except where written approval and installation requirements are provided by the Architect/Engineer.

I. Metal Conduit Installed Below Grade: Provide 20 mil thick factory PVC coating or field wrapped using corrosion protection tape and primer system with 50 percent wrap overlap; extend 8 inches above grade at risers.

J. Conduit Below Concrete Slabs On Grade: Install at minimum depth required for vertical penetration of radius bend at conduit risers, except install at minimum 48 inch depth for power systems above 600 volts and for feeders below 600 volts and rated 1000 amps and

larger. See paragraph Earth Work for Underground Electrical under this section for thermal backfill requirements.

K. Underground Conduit for Site Power (Below 600 Volts) and Signal Systems: Install to provide 24 inches minimum cover up to final grade unless otherwise indicated or specified. Maintain minimum 7.5 inch on center spacing between power conduits; maintain minimum 12 inch spacing between power conduits and signal conduits; maintain minimum separation from public utilities established by regulation. See paragraph Earth Work for Underground Electrical under this section for thermal backfill requirements.

L. Conduits at Roof Decks: Conduit installed within 1.5 inches of the nearest surface of metal corrugated roof decks and conduit concealed within roofing systems on top of roof decks shall be RGS or IMC conduit.

M. Install flexible conduit thru oversized bushed sleeve or cored opening where conduit crosses building wall expansion or seismic joints. Provide up to 54 inches of flexible wiring with 6 inches minimum of conduit slack each side of the wall assembly to allow for free movement across the joint.

N. Do not install conduit in concrete slab on grade.

O. Do not install conduit in direct contact with underside of roof deck.

P. Seal all underground conduits entering and terminating within a building or structure using approved non hardening duct seal putty or a sealing bushing. Seal spare conduits using a watertight blank plastic duct plug. Seal all underground conduits entering and terminating below grade, such as in a crawl space or basement, using an approved closed cell foam sealant system.

3.05 CONDUIT PENETRATIONS

A. Roof Penetrations: Provide flashing around each conduit which penetrates a roof. Materials and installation shall comply with applicable provisions of Division 7 [Division 07] for roofing. Seal top of flashing around conduit with a weatherproof non-hardening mastic.

B. Exterior Walls: Core drill or cast sleeve for each conduit one size larger than conduit diameter. Seal all openings at each penetration with acrylic weatherproof caulking suitable for painting. Below grade seal with "Chase-Foam" silicone sealant or other approved method acceptable to Architect/Engineer.

C. Interior Walls and Partitions: Cut one size larger than conduit diameter. Seal all openings at each penetration with low VOC level general purpose interior sealant as specified in Division 07.

D. Fire Rated Construction: Comply with requirements of paragraph, FIRE RATED CONSTRUCTION, this specification.

3.06 CONDUCTOR INSTALLATION

A. Minimum Conductor Size: #12 AWG, except #10 AWG minimum for outdoor and exterior building lighting circuits and #14 AWG minimum for control circuits and for lighting fixture taps not to exceed 72 inches.

B. Splice conductors only in junction or outlet boxes and handholes.

C. Arrange conductors neatly at termination such that a clamp-on ammeter may be used.

D. Clean conduit free of debris before conductor installation; install conductors using pulling lubricant.

3.07 CONDUCTOR IDENTIFICATION

A. Provide non-metallic wire markers on each conductor in panelboards and in junction boxes having more than 6 conductors. Identify branch circuit or feeder number for power and lighting circuits.

B. Color Coding of Insulated Equipment Ground: Solid green.

C. Color Coding of 208/120 Volt System: Phase A - black, Phase B - red, Phase C - blue, Neutral - white.

D. Color Coding of 480/277 Volt System: Phase A - brown, Phase B - orange Phase C - yellow, Neutral - gray.

E. Color Coding of Switch Legs: Pink.

F. Color Coding of Travelers (3-Way and 4-Way Switching): Purple.

G. Provide color tracers on neutrals to differentiate circuits on multi-wire branch circuits with separate neutrals.

3.08 BOX LOCATIONS

A. Provide electrical boxes for outlets, junctions and equipment connections as shown and as required for splices, taps, wire pulling, and code compliance.

B. Electrical box locations shown are approximate unless dimensioned. Obtain equipment outlet locations from equipment manufacturer prior to rough-in. Coordinate outlet and wall switch locations with casework and finish elements shown on Architectural drawings. Install to fit conditions or as directed.

C. Change location of wall outlets, wall switches, and lighting outlets up to fifteen feet without charge when requested by Architect/Engineer prior to installation.

D. Height of outlets unless otherwise directed: See Drawings.

3.09 BOX INSTALLATION

A. Set wall outlet and wall switch boxes vertically.

B. Support boxes independently of conduit, piping, and ductwork; securely fasten in place.

C. Provide recessed outlet boxes in finished areas. Flush front edge of box or plaster ring even with finished surface.

D. Provide blank cover plate over all boxes that do not contain devices or are not covered by equipment.

E. Do not install flush boxes on opposite sides of a wall within the same stud space. Maintain 24 inch minimum box separation in fire rated wall assemblies.

F. In-Ground Boxes: Set on 9 inch minimum deep gravel base extending 6 inches minimum beyond each side. Set flush with final grade.

3.10 WIRING DEVICES

A. Ground Fault Circuit Interrupter (GFCI) Protection: Provide for receptacles located outdoors, within 6 feet of sinks, in bathrooms, kitchens, indoor wet locations, locker rooms with associated shower facilities, elevator pits, elevator machine rooms, crawl spaces, garages, service bays, rooftops, at counters and work surfaces where food and/or beverage preparation occurs, water coolers, and as otherwise indicated. GFCI receptacles are not required where branch circuit is protected by GFCI circuit breaker.

3.11 SINGLE STATION SMOKE DETECTORS

A. Install in accordance with manufacturer's instructions.
B. Interconnect all detectors with-in single dwelling or apartment unit for common alarm.

3.12 FIRE RATED CONSTRUCTION

A. Verify location of fire rated walls and ceilings with Architectural plans prior to rough-in.

B. Installation of boxes, rough-in cans, conduits, and sleeves that result in membrane or through penetrations shall comply with IBC 712.1 through 712.4 as required to maintain fire rating of construction assembly. Coordinate locations and construction requirements with General Contractor.

C. Provide approved conduit and/or pathway sleeve kits for installation of open cable through fire rated construction.

3.13 EARTHWORK FOR UNDERGROUND ELECTRICAL

A. Locating and Protecting Existing Utilities: Existing utilities in areas of new construction must be identified and located by the Contractor prior to commencing Work. Location of underground utilities shown on plans are diagrammatic and shall not be considered as a complete representation of all utilities that may exist on site.

1. Coordinate with Owner to identify and locate existing underground utilities including landscape irrigation in areas of Work.

2. Prior to excavation, contact and coordinate with local Utilities Underground Location Center to identify and locate existing underground public utility services in areas of Work, including power, water, sewer, telephone, gas, and cable TV.

3. Prior to excavation, obtain services of a utility locator service to scan areas of Work and to locate and mark where known and unknown private underground utilities or other interfering obstructions exist.

4. Existing active utilities damaged or interrupted by the Contractor during construction shall be replaced at the Contractor's expense. Repairs to power and signal systems using junction boxes or splices will not be accepted.

B. Excavation and Backfill:

1. Saw cut and remove pavement and hard surfaces along straight parallel lines.

2. Dig trenches of uniform width and depth. Provide uniform grade at bottom of trenches and excavations free of rocks, debris, and soft spots. Over depths shall be filled with sand.

3. Tree Roots: Hand excavate near trees to expose roots. Tree roots 2" to 5" in dia. are to be cut with a sharp saw and tree root heal material applied. For roots 5" in dia. and larger, do not cut. Tunnel under to install conduit.

4. Backfill materials shall be soil free of debris, roots, wood, refuse, and of rocks exceeding 3 inches in largest dimension. Bedding and backfill up to 12 inches of cover shall be select fill consisting of building sand or backfill material free from particles that would be retained on a 3/8-inch sieve.

5. Place backfill in 6 inch loose lifts and compact to 95% of maximum density in accordance with ASTM D1557, except the first 6 inches of backfill material above PVC conduit shall not be compacted.

6. Removed material, excess material, and excavated material not suitable for use as backfill shall be removed and legally disposed off Owner's property.

7. Provide de-watering of trenches and excavations as required to perform work.

8. Barriers, Trench Covers, Safety Guards, Warning Lights: Provide protection against damage and injury to the public and to those persons using premises while work is in progress. Comply with applicable law and ordinance.

C. Thermal Resistivity of Bedding and Backfill Around Cable and Conduit Not Concrete Encased: Provide suitable materials that have a maximum thermal resistivity (Rho) of 90 when compacted and moist .Native or imported materials shall be approved by the Civil Engineer to verify thermal compliance. Man made and/or mixed materials shall be provided with a certification by the manufacturer verifying thermal compliance.

D. Finish Operations:

1. Restore all surfaces disturbed by new construction to its original grade and condition unless otherwise indicated. Comply with requirements of Divisions 31 and 32.

2. Landscape materials shall be similar type and quality as that removed. New topsoil shall be three-way mix (50% black silt sand, 30% peat moss, 20% chicken manure), 2-inch minimum depth. Top dress and seed damaged turf areas using approved seed mix and application rate. Repair paved surfaces as indicated.

3. Correct settling that occurs during the project warranty period. Restore grade, appearance, quality, and condition of surface or finish to meet original Contract requirements.

3.14 LABELING

A. Outlets: Identify panel and circuit number on faceplate of convenience and special purpose outlets. Use self-adhesive, polyester or vinyl laminated labels with machine generated alpha-numeric circuit identification, 1/4-inch high black letters on clear background. Exception: Use white letters on black or brown color device plates.

B. Junction Boxes: Label or mark cover with panel and circuit number. Locate on inside of cover except locate on outside of junction box cover in attics, crawl spaces, equipment rooms and above accessible ceilings.

3.15 TESTS

A. Perform continuity test on all feeder and branch circuit conductors. Verify proper phasing and that no short circuits or accidental grounds exist.

B. Check all convenience outlets for correct wiring connections using a polarity circuit tester. Test AFCI and GFCI circuits for proper operation with an approved tester.

C. Torque test conductor lug terminations to manufacturers recommended values.

END OF SECTION

SECTION 26 05 26
GROUNDING AND BONDING

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.

1.02 SECTION INCLUDES

A. Power System Grounding.

B. Electrical Equipment and Raceway Grounding.

C. Communication System Grounding.

1.03 SUBMITTALS

A. Submit reports for tests required under Part 3 of this section.

1.04 OPERATIONS AND MAINTENANCE DATA

A. Include data on testing procedures, obtained test values, and correction of deficiencies in the Operation and Maintenance Manuals.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Ground Rods: Copper-clad steel, 3/4 inch diameter, 10 feet long unless otherwise indicated.

B. Mechanical Connectors at Accessible Ground Rods: Tin-plated, heavy duty, high strength, corrosion resistant copper alloy, hex head bolt and clamp.

C. Mechanical Connectors at Ground Connections: Heavy duty, solderless, bolted pressure or compression type connectors or clamps labeled as being suitable for the purpose. Manufacturer's standard grounding lug when furnished as part of panelboards and other equipment.

D. Exothermically Welded Connections: Copper Thermit weld process conforming to manufacturer's instructions; use molds, weld material, tools, and accessories supplied by the manufacturer. ERICO CADWELD or equal.

E. Ground & Bonding Conductors: Bare, soft drawn copper; stranded for 8 AWG and larger, unless otherwise indicated or specified. Equipment grounding conductors may be insulated with green color identification per Code.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Ground electrical service system neutral per Code. Size grounding electrode conductor, main bonding jumper, equipment bonding jumpers, and supplemental electrode bonding connections per applicable paragraphs of NEC Article 250 except when larger size is shown or specified. Minimum of two (2) NEC 250.52 permitted grounding electrodes must be installed and shall include a concrete encased electrode where concrete building foundation is provided.

B. Make grounding connections which are buried or otherwise inaccessible using exothermic welds. Where installed outdoors, bury ground conductors with minimum 18 inches of cover unless otherwise indicated.

C. Driven Electrodes: Drive ground rods full depth unless otherwise indicated or specified. Provide 15 feet minimum separation between driven electrodes.

D. Equipment Grounding Conductor: Provide separate insulated green equipment grounding conductor in feeders and in branch circuits to plug-in outlets. Provide equipment grounding conductor in non-metallic conduits and flexible conduit. Size equipment grounding conductors per NEC 250.122 unless larger size is shown or specified.

E. Provide grounding locknuts on each end of feeder conduits serving panelboards. Exception: Provide grounding bushing with bonding jumper where conduit is used as equipment ground.

F. Provide conduit sleeves where ground conductors pass through concrete slabs. Metal conduit sleeves shall have threaded end extending above slab to accommodate a grounding bushing or conduit hub per NEC 250.64(E).

G. Provide minimum 1/0 AWG conductor for communications service grounding. Leave 10 feet slack conductor at terminal board. Connect conductor to building ground electrode system.

H. Ground exposed non-current carrying metal parts of equipment fastened in place or connected by permanent wiring and likely to become energized per Code. In MDF and in IDF rooms, bond cable trays and equipment racks to terminal board ground bus using #6 minimum AWG conductor.

3.02 REMOTE BUILDINGS AND STRUCTURES

A. Provide equipment grounding conductor with circuit conductors between buildings and/or structures. Size equipment grounding conductor per NEC 250.122 unless larger size is shown or specified.

B. Ground electrical system per Code. Size grounding electrode conductor, equipment bonding jumpers, and supplemental electrode bonding connections per applicable paragraphs of NEC Article 250 except when larger size is shown or specified. Minimum of two (2) NEC 250.52 permitted grounding electrodes must be installed and located at least 10 feet apart and shall include a concrete encased or a driven electrode.

C. Provide isolation of grounded circuit conductor (neutral) at the disconnecting means and/or main panelboard as required.

3.03 TESTS

A. Service Entrance Ground Electrode System: ANSI/IEEE 81; measure and record ohmic value by performing fall of potential tests using a ground testing megger. Tests shall be performed with the ground electrode system disconnected/isolated from neutral and with the test current probe located at least 100 feet from the nearest ground system electrode.

END OF SECTION

SECTION 26 05 30
LOW VOLTAGE ELECTRICAL SYSTEMS PATHWAY

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.

B. Section 26 05 00 - Basic Materials and Methods.

C. Section 26 05 26 - Grounding and Bonding.

D. Section 26 09 20 - Lighting Controls.

E. Section 27 10 01 - Telecommunications Structured Cabling System.

1.02 SECTION INCLUDES

A. Conduit sleeves, risers, and horizontal pathways and outlet rough-in for structured cabling and other low voltage systems to include lighting control, audio video (AV), television (TV), amplified sound, intrusion alarm, access control, video surveillance (CCTV), master clock, and intercom.

B. Telecommunications Terminal Boards.

PART 2 – PRODUCTS

2.01 OUTLETS

A. Work Station Outlets: Comply with requirements of Section 26 05 00.

2.02 MATERIALS

A. Boxes, Conduit, Raceway, Device Plates,: Comply with section 26 05 00.

B. Fire Rated Sleeves: Comply with section 26 05 00.

2.03 TELECOMMUNICATIONS TERMINAL BOARDS

A. 3/4 inch plywood mounting board with Class A fireproofing, locations and size as indicated. Paint white with two (2) coats of fire retardant paint. At least one fire retardant stamp or permanent label shall be visible on each sheet of plywood.

PART 3 - EXECUTION

3.01 INSTALLATION

A. General: Comply with Section 26 05 00.

B. Outlets:

1. Mounting height unless otherwise directed: See Drawings.

2. Do not install signal outlets on same side of wall stud common with electrical outlets or vertical power wiring.

3. Conduit: Comply with requirements of Section 26 05 00. Unless otherwise indicated, provide conduit concealed inside wall or casework from each outlet up to nearest accessible ceiling space of same floor. Terminate conduit with plastic bushing. Install maximum two 90 degree equivalent bends between raceway terminations. Minimum conduit sizes unless otherwise indicated:

Voice and/or Data	1 inch diameter
All Other Systems	3/4 inch diameter

C. Install nylon pull cord in each conduit longer than 20 feet. Leave 18 inches of slack minimum each end. Tag end of pull cord at conduit termination to identify outlet location at other end.

D. Sleeves: Provide conduit sleeves for installing open signal cables through draft stops and partition walls in attics, crawl spaces, and accessible ceiling spaces. Use specified fire rated sleeves through fire rated construction. Locate and size sleeves per approved shop drawings provided under related sections and as otherwise indicated.

E. Device Plates: It is the electrical contractor's responsibility to ensure that all line voltage and low voltage system faceplates and visible trim pieces are the same style and finish.

END OF SECTION

SECTION 26 05 80
UTILITY SERVICES

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.

1.02 SECTION INCLUDES

A. Electrical Service Requirements.

B. Telephone Service Requirements.

C. Wide Area Network Service Requirements.

1.03 REGULATORY REQUIREMENTS

A. Contact and coordinate with PUD regarding electrical service requirements, including entrance fittings, meter enclosures and socket arrangement, and current transformer provisions.

C. Contact and coordinate with Owner regarding wide area network (WAN) service requirements.

D. Obtain, prepare, and file application forms required by the serving utilities for obtaining temporary and permanent services.

E. Do not install any equipment or service entrance rough-in prior to contact, coordination, and obtaining all requirements from the applicable serving utilities.

1.04 UTILITY CHARGES

A. Obtain and pay all utility company charges for installing power, telephone, and cable television service.

PART 2 – PRODUCTS

2.01 MATERIALS AND EQUIPMENT

A. Materials and Equipment: Conform to requirements of the Utility companies.

B. Raceway: Schedule 40 PVC below grade; rigid galvanized steel for sweeps, risers, and for conduit above grade.

C. Pull Rope: 1/4 inch polypropylene.

PART 3 – EXECUTION

3.01 INSTALLATION, ELECTRICAL SERVICE

A. Make arrangements with Utility Company to obtain temporary and permanent electrical service to the Project. Coordinate and arrange for scheduling of Utility Work.

B. Installation: Comply with Utility Company rules, regulations, and installation requirements.

C. Maintain minimum 7.5 inch on center spacing between underground parallel electrical service conduits. Install conduits for electrical service rate above 600 volts with 36 inches minimum cover.

D. Where utilities share common trench or routing, maintain minimum 12 inch clear separation between power and other utility systems. Electric utilities and services shall not share a common trench with sewer lines, water mains, and storm drain systems.

E. Provide meter bases, metering conduit, current transformer (CT) enclosure, and service entrance conduit and wire. Leave sufficient service conductor length at transformers for terminations by Utility.

F. Install current transformers (CT's) furnished by Utility.

G. Provide excavation, trenching, and backfill for utility company transformer vault and primary service duct from property line to transformer location(s). Allow for installation of gas service to share trench with primary service conduit. Provide trench width and depth per Utility requirements. Exact routing of primary service conduits shall be determined by the Utility. Quantity and location of junction and pull vaults shall be determined by the Utility. Obtain written approval from Utility prior to commencing Work.

END OF SECTION

SECTION 26 09 20
LIGHTING CONTROLS

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.

B. Section 25 05 00 - Integrated Automation.

C. Section 26 50 00 - Lighting Fixtures.

1.02 SECTION INCLUDES

A. Manual Controls.

B. Occupancy Sensors.

C. Time Switches.

D. Low Voltage Control Panels.

E. Daylight Sensors.

F. Room Controllers.

G. Emergency Transfer Devices.

H. Factory Start Up Requirements.

1.03 SUBMITTALS

A. Submit product data for all products and associated components specified under Part 2 of this section.

1.04 OPERATION AND MAINTENANCE DATA

A. Include submittal data, shop drawings, installation and operating instructions, commissioning and test reports, and warranties that exceed one year in Operations and Maintenance Manuals.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. 0-10 VDC Wall Box Dimmers: Lutron Diva series or approved.

B. Line Voltage Photocells: General Electric, Intermatic, Tork.

C. Occupancy Sensors: Greengate, Sensor Switch, WattStopper.

D. Outdoor Occupancy Sensors: Sensor Switch SBOR/ODP series or approved.

E. Time Switches: BRK Electronics, Intermatic, Tork.

F. Low Voltage Control Panels, Sensors and Switches: Douglas, LC&D, Crestron, WattStopper.

G. Digital Room Controllers, Sensors, and Wall Stations: Douglas, LC&D, nLight, WattStopper.

2.02 MANUAL CONTROLS

A. Line Voltage Switches: Provide as specified under Section 26 05 00 for wiring devices.

B. Low Voltage Switches: Heavy duty, 3-position, momentary contact, toggle switch, rated 3 amperes at 25 VAC. Two wire, single relay control switches shall include integral diodes for transformer/relay operation as required. Color: Match wiring devices specified under Section 26 05 00.

C. 0-10VDC Wall Box Dimmer: Architectural line voltage on/off switch with low voltage preset linear slide dimming control feature, 120/277 volt, 8 amp minimum switching load capacity, 50 milliamp minimum 0-10VDC sink capacity, UL listed for use with fixture type, driver, and/or dimming ballast provided, single pole or 3-way as indicated, suitable for use with decora style wall plates Color: Match wiring devices specified under Section 26 05 00.

D. Digital Wall Stations: Low voltage, local network, manual switch station with feed thru RJ45 ports, suitable for use with decora style wall plates. Provide On/Off, On/Off/Dim, and/or multi-pushbutton On/Off/Scene/Dim switch stations as indicated. Color: Match wiring devices specified under Section 26 05 00.

E. Switch Plates: Match material and finish of device plates specified in Section 26 05 00.

2.03 OCCUPANCY SENSORS

A. Room Sensors:

1. Dual technology (ultrasonic/passive infrared) 24VDC occupancy detector, adjustable sensitivity and time delay, manual override, LED motion indicator, compatible with fluorescent electronic ballasts. Rated area coverage shall conform to manufacturer's recommendation for complete room coverage without gaps, using single or multiple sensors as required. Sensors may be wall or ceiling mounted type. Exception: In restrooms and toilets with privacy partitions or showers, provide ultrasonic type without passive infrared feature.

2. Provide low temperature sensors (-4 degree F/-20 degree C) where installed in unheated spaces and in refrigerated spaces. Provide high humidity sensors where installed in damp locations, refrigerated spaces, and adjacent to shower stalls.

3. Wire Guard: Provide in public restrooms, gymnasiums, locker rooms, and similar areas where sensor may be subject to abuse.

B. Transformer/Relay Pack: 120/277 volt control interface providing NEC class 2 input/output to occupancy sensor(s) and automatic line voltage switch control. Relay contacts shall be isolated, normally open, rated 20 amperes for ballast loads and 1 HP. Provide auxiliary isolated dry contact set to allow for air temperature control (ATC) interface with the occupancy sensor control system; a slave relay may be provided for this purpose.

C. Wall Switch Sensors:

1. Passive infrared occupancy sensor, automatic OFF, manual ON/OFF, continuous self adapting sensitivity and time delay, LED motion indicator, compatible with magnetic ballast, electronic ballast, and motor loads, 170 degree minimum field of view. Minimum load rating shall be 600 VA and 1/6 HP at 120 volts and 1000 VA and 1/3 HP at 277 volts. Minimum rated area coverage shall be 900 square feet.

2. Provide low temperature sensors (-4 degree F/-20 degree C) where installed outdoors, in unheated spaces, and in refrigerated spaces. Provide high humidity sensors where installed in damp locations, refrigerated spaces, and adjacent to shower stalls.

3. Two Level Switching: Where indicated, provide wall switch sensor with independent dual switching control, user selectable for control of one or two switch legs to provide two levels of room illumination.

4. Finish: Match wiring devices and plates specified under Section 26 05 00.

2.04 TIME SWITCHES

A. 7-Day Electronic Time Switch: Two (2) circuit, 7-day programmable, 8 on/off events per day minimum, field replaceable battery back-up, 30 amp rated contacts.

2.05 LOW VOLTAGE RELAY CONTROL PANELS

A. Transformers: ANSI/NFPA 70; Class 2 energy limited, 120/277:15-24 volt, sized for load.

B. Low Voltage Relays: Mechanical or magnetic latching remote control relays rated 20 amperes at 120/277 volts and suitable for HID lighting. Shall have isolated pilot contacts where required.

C. Master Controllers: Solid state device allowing group control of more than 3 relays by a momentary and/or maintained contact input from manual switch, photo controller, or time controller. Installed configuration shall have 20% minimum spare relay capacity. Separate modules may be used for momentary and maintained contact switch control. Include programmable enable/disable of any relay function, and flick warn option with off sweep 2 hour override enabled from local or master switch control during 5 minute warning period. Provide with RS485 networking between controls panels within a building. Provide RS232 port and ethernet interface module and associated software for local and remote PC programming, control, and troubleshooting. Provide modem for offsite factory trouble shooting and programming over a standard telephone connection when this support service available from the system manufacturer.

D. Photo/Time Controllers: Programmable solid state 365 day astronomic time/photo controller, membrane key pad entry with LCD graphic display, 8 time/photo control programmable outputs, remote photo sensor input, indefinite program and 72 hour minimum time backup on power loss, 600 events per week with week day and holiday scheduling. Any output can be time, astronomic, photo or combination controlled.

E. Photo Controllers: Solid state device for operating relays and/or auxiliary contacts to control remote master controllers using a remote low voltage photo sensor. An override input shall allow a remote switch or time clock to enable or disable the photo control function.

F. Relay Control Cabinets: NEMA ICS6 Type 1; shop fabricated and wired sheet metal box with screw on flush cover, side hinged flush locking door, and painted enamel finish. Assembly shall include labeled terminal blocks, line voltage - low voltage separation barriers, mounting

provisions for 20% or more additional relay and associated transformer capacity, and removable circuit index card inside protective pocket on inside of front cover. Key all relay cabinets alike. Furnish two keys. Cabinets shall be flush mounted where indicated.

G. Flush Switch Cabinets: NEMA ICS6 Type 1; shop fabricated sheet metal box with screw on flush cover, side hinged flush locking door, and painted enamel finish. Keys shall match relay cabinets. Size cabinets to accommodate switch layouts indicated.

H. Remote Time Controllers: Programmable solid state 365 day, 600 events per week with week day and holiday scheduling, provided under Section 25 05 00, Integrated Automation. Provide master controller that accepts both remote momentary and maintained timed inputs. Allow for 8 time control groups minimum.

2.06 DAYLIGHT SENSORS

A. Indoor Digital Daylight Sensors: Multi-zone photo sensor with RJ45 network connection, infrared (IR) transceiver for calibration using a handheld remote programmer, and suitable for semi-flush ceiling mount or for surface mounting in skylight wells. Sensor measures room daylight contribution and communicates with a compatible room controller to automatically dim or switch up to three separate zones of lighting, raising and lowering light fixture illumination in response to available daylight.

B. Low Voltage Photo Sensors, Outdoors: Weather proof, water tight sensor head suitable for outdoor mounting to an outlet box, auto ranging 1 to 10,000 FC, + or - 5%, compatible with control panel controller for off-day/on-night operation of outdoor light fixtures.

C. Line Voltage Photocell: Weatherproof, off-day/on-night, 2000 watt tungsten rated, SPST with time delay, adjustable 2-50 footcandles.

D. Line Voltage Photocell, Flush Mounted: Weatherproof, off-day/on-night, button type, thermal relay, 1000 watt, SPST, with stainless steel cover plate and gasket.

2.07 DIGITAL ROOM CONTROLLERS

A. General: UL listed low voltage network lighting and power controller, 120/277 volt, 20 ampere rated, three (3) on/off relay outputs, four (4) minimum RJ45 digital input/outputs.

B. Dimming: Where manual and/or automatic daylight control is indicated, provide three (3) 0-10Volt DC Class 2 dimming control outputs. Controls shall be configured to completely shut off all controlled lights in the control zone.

C. On/Off Receptacle Load Control: Where automatic switch control of receptacles is indicated, provide a UL listed low voltage network 20 ampere plug load rated standalone controller.

D. Sensors, Devices, and Accessories: Provide compatible sensors, wall stations, interface device, and cabling for a complete control system.

E. Emergency Lighting: Controllers with dimming control shall be programmed or otherwise designed to ensure 100% full light output of controlled dimmable emergency lights upon loss of normal power.

F. Provide hand held wireless configuration device for remote programing of system sensor, control, and dimming functions. Furnish two (2) hand held devices.

G. Provide required software and PC USB interface device for programming and managing the digital lighting control system using a personal computer.

2.08 MATERIALS

A. Low Voltage Wire: UL Type CL2, NEC Class 2 or better; multi-conductor, stranded copper cable, #20 AWG minimum, color coded.

B. RS 485 Communications and Digital Control: UL type CMR Category 5 extended frequency (350MHz), 24 AWG solid copper, 4-pair unshielded twisted pair, jacket overall, color coded, listed for use in ducts, plenums, and other air handling spaces . Cable installed below grade shall have a water blocking core and be suitable for wet locations in conduit.

C. Conduit and Outlet Boxes: As specified under Section 26 05 00.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install lighting controls in accordance with manufacturer's instructions and approved shop drawings. Provide programming, setup, and calibration for complete operation of each control system.

B. Install low voltage wiring in conduit except cable may be installed without conduit above accessible ceilings. Install open cable parallel and perpendicular to building lines; support cable from structure at intervals not to exceed 4.5 feet on center. Do not splice open cable.

3.02 OCCUPANCY SENSORS

A. Room Sensors: Provide number and location required for complete coverage within room (including toilet and shower stalls) and to minimize false activation thru open doors as recommended by manufacturer. Ceiling mounted sensors shall not be used above 12 feet. Provide additional transformer/relays or room controllers as required where multiple branch circuits are controlled.

B. On/Off Operation: Wall switches and occupancy sensors shall be wired or otherwise programmed to provide manual on, manual off, and automatic sensor off control of room lighting unless otherwise indicated.

C. Time Delay: Set manual time delay for automatic off at 15 minutes unless otherwise directed or indicated.

3.03 TIME CONTROLS

A. Provide initial and final programming and testing, scheduled at the convenience of the Owner. Arrange for an Owner representative to be present for each programming session. Coordinate time schedules and programming with Division 25 Contractor. Start up control sequence shall be as scheduled on drawings. Final control sequence shall be as directed by Owner.

3.04 LOW VOLTAGE CONTROL PANELS

A. Provide typewritten circuit index in each relay cabinet identifying relay numbers, line voltage, circuit numbers, loads controlled, and master/local/special sensor switch control information.

B. Arrange with Owner's voice/data system installer to provide one phone line and one data line terminated with required jacks for modem and ethernet connections.

3.05 DAYLIGHT SENSORS

A. Locate daylight sensors per plan and/or instructions shown on approved shop drawing.

B. Provide calibration of daylight sensing controls after substantial completion. Calibrate indoor daylight sensors to lower fixture illumination when daylight zone ambient illumination is above 80FC unless otherwise indicated.

3.06 DIGITAL ROOM CONTROLLERS

A. Areas with Accessible Ceiling Space: Locate controller above ceiling within 6 feet of first lighting outlet serving lights to be controlled unless otherwise indicated. Low voltage wiring between sensor and relay may be installed without conduit.

3.07 FACTORY STARTUP

A. General: Field start-up, testing, and adjustment for low voltage control panels and for digital room control systems shall be performed under the supervision of a factory trained manufacturer's representative.

B. Low Voltage Control Panels: Include programming, calibration, and testing, as part of commissioning specified under Section 26 08 00. Allow separate site visits for initial and final programming. Start up control sequence shall be as scheduled on drawings. Final control sequence shall be as directed by Owner. Arrange for an Owner representative to be present for each programming session.

C. Digital Room Control Systems: Include initial programming, calibration, and testing, as part of commissioning specified under Section 26 08 00.

3.08 COMMISSIONING

A. Provide all tools, equipment, materials, services, and labor required to test lighting control system in each space per manufacturer’s installation instructions. Verify settings, coverage, and operation. Correct deficiencies, replace malfunctioning devices, and retest as required. Submit test reports indicating compliance with specifications and manufacturer’s installation requirements.

3.09 DEMONSTRATION AND INSTRUCTIONS

A. Demonstrate operation and maintenance of system to Owner's personnel prior to contract closeout. Allow one site visit and two hours of total instruction scheduled at convenience of Owner.

B. Use operation and maintenance manuals as basis of instruction, reviewing contents of manual with personnel in detail.

C. Follow-Up Training: Include a second site visit for training and programming adjustments between 6 months to one year of substantial completion scheduled at convenience of Owner.

END OF SECTION

SECTION 26 20 00
ELECTRICAL DISTRIBUTION

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.

B. Concrete for Equipment Pads: Comply with Division 03 - Concrete.

1.02 SECTION INCLUDES

A. Switchboards.

B. Panelboards and Circuit Breakers.

C. Disconnect Switches.

D. Fuses.

E. Motor Controllers.

F. Contactors.

G. Dry Type Transformers.

H. Busway.

I. Enclosed Circuit Breakers.

J. Nameplates.

K. Compression Lugs.

1.03 SUBMITTALS

A. Submit product data for switchboards, panelboards, circuit breakers, motor controllers, contactors, dry type transformers, busway, and enclosed circuit breakers. Dry type transformer submittal must indicate compliance with minimum efficiency requirements specified.

B. Submit shop drawings for switchboards, panelboards, busway, and dry type transformers. Include installation requirements for anchoring and bracing meeting requirements of the International Building Code for Seismic Design Category F.

C. Coordinate dimensions of equipment with site and project space dimensions to verify equipment will fit, conform to indicated layout, and meet NEC and manufacturer clearance requirements.

D. Submit reports for tests required under Part 3 of this section. Submit manufacturer's performance testing instructions and signed written performance test records for equipment ground fault protection systems.

E. Submit product data and shop drawings for service switchboard to serving utility for review and approval in addition to Architect/Engineer submittal requirements.

F. Submit short circuit, protective device coordination, and arc flash hazard study.

1.04 OPERATION AND MAINTENANCE DATA

A. Include data for switchboards, panelboards, circuit breakers, motor controllers, transformers, fuses, contactors, busway, studies, and tests in Operation & Maintenance Manuals.

1.05 SPARE PARTS

A. Fuses: Furnish to Owner 3 spare fuses of each type and rating installed.

B. Fuse Pullers: Furnish 2 fuse pullers to the Owner.

1.06 SHORT CIRCUIT, PROTECTIVE DEVICE COORDINATION, AND ARC FLASH HAZARD STUDY

A. Provide an engineering analysis and report with one line distribution and impedance diagrams, calculations, results, conclusions, and recommendations. Study to include symmetrical and asymmetrical short circuit current calculations, overcurrent protective device time/current coordination curves, trip settings for each main and distribution device, arc flash hazard analysis, and arc flash labeling information. Calculations shall be based on source impedance, X/R ratios, and motor contribution.

B. Overcurrent protective devices installed on the NEC 700 distribution system shall selectively coordinate with supply side overcurrent protective devices to 0.1 seconds.

C. Where arc flash hazard/risk category classifications are calculated to exceed hazard category 1, they shall be identified in the Arc flash study along with distribution design recommendations for reducing hazard/risk to 1. Final report shall address Owner approved system changes.

D. Study and report shall be prepared, stamped, and signed by a professional engineer licensed in the state of Washington and submitted by the equipment manufacturer.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Switchboards, Panelboards, Circuit Breakers and Disconnects: Square 'D', Siemens, Cutler-Hammer, General Electric - ABB.

B.. Motor Controllers and Contactors: Allen-Bradley, Square 'D', General Electric - ABB, Furnas, Cutler-Hammer.

C. Fuses: Bussman and Littelfuse.

D. Dry Type Transformers: Square 'D', General Electric - ABB, Siemens, Cutler-Hammer, Federal Pacific.

E. Busway: Square 'D', General Electric - ABB, Siemens, Cutler-Hammer.

2.02 SWITCHBOARDS

A. Switchboards: NEMA PB2; factory assembled, dead front, front accessible, metal-enclosed, free standing, service entrance label. Distribution section devices may be group mounted. Vertical switchboard sections having overcurrent device(s) with ARMS feature shall be so designed that the overcurrent device or the section is separately enclosed from any sub-fed distribution switchboard sections within the same lineup.

B. Electrical Ratings, Configuration, Special Features: As shown on project drawings. The indicated ampere interrupting capacity (AIC) shown on the project drawings is the full RMS symmetrical equipment short circuit rating of bussing and of all overcurrent devices installed. Series rating between overcurrent devices within the switchboard and with load side distribution panelboards is not approved. Series rating with load side lighting and appliance panelboards, load centers, and enclosed circuit breakers may be provided when indicated on the project drawings.

C. Switchboard Dimensions: 90 inch nominal height excluding base channels, lifting members, and pull boxes; length and depth not to exceed dimensions as scaled on drawings. Align sections so that back of complete structure may be placed flush against wall.

D. Finish: Manufacturer's standard enamel over rust inhibitor on exterior surfaces; minimum one coat corrosion-resisting paint or zinc coating on interior surfaces.

E. Main Overcurrent Protective Device(s): UL 489; molded case circuit breaker with thermal magnetic trip fixed mounted, single handle common pole operation, AIC rating greater than available symmetrical short circuit amperes. Circuit breakers rated 1000 amps or larger for solidly grounded wye electrical systems rated more than 150 volts to ground shall have ground fault protection. Circuit breakers rated or otherwise adjustable to 1200 amperes and larger shall have an arc energy reducing maintenance switch (ARMS) with electronic trip and status indication to reduce clearing time.

F. Fusible Switches: NEMA KS 1; quick make, quick break, handle lockable in OFF position, Class J fuse provisions unless otherwise required for short circuit protection of circuit breakers. Fuses must comply with NEC 240.86 series rating requirements for load side circuit breakers that are not rated for the available fault current.

G. Fusible Switches, 800 Amperes and Larger: Bolted pressure contact type, Class L fuse provisions. Switches rated 1000 amps or larger for solidly grounded wye electrical systems rated more than 150 volts to ground shall have ground fault protection.

H. Circuit Breakers: UL 489; molded case, thermal magnetic trip, AIC rating greater than available symmetrical short circuit amperes. Multi-pole breakers shall be single handle with common pole operation. Feeder circuit breakers required to selectively coordinate shall have LI or LSI solid state trip.

I. Bussing: Copper with full neutral and ground bus.

J. Future Provisions: Provide spaces fully equipped for future devices with bussing, device supports, and bus connections. Include provisions for extension of bussing when future distribution section is indicated.

K. Where surge protective device (SPD) is indicated, coordinate requirements with Section 26 43 00.

L. Switchboard Instrumentation (Microprocessor Based): UL 1244, ANSI C37.90; digital multi-function metering with peak demand, monitoring, and control device, ANSI C12.16 revenue accuracy, panel mounted, with alpha-numeric LED and/or LCD displays.

1. Metering Functions - displayed value (% accuracy): AC phase current (1%), AC phase voltage (1%) phase-phase and phase to neutral, watts (2%), VAR's (2%), power factor

(4%), watt demand (2%) with 5, 10, 15, or 30 minute selected interval, watt hours (2%), and frequency (0.5%). Demand functions shall have zero reset feature.

2. Protective Functions: Phase loss, phase reversal, under voltage, and over voltage. Functions shall have adjustable settings and include adjustable time delay feature for abnormal voltage conditions. Provide separate Form C (SPDT) trip and alarm output contacts.

3. Instrument Transformers: ANSI C57.13; current and potential transformers as required. Provide multi-ratio transformers when indicated. Voltage input shall be fused and include a disconnecting means.

4. Remote Monitoring: Include RS232 data output port.

5. Power Loss: Retain all pre-set parameters, accumulated watt hours, and watt demand without battery back-up.

M. Utility Metering: Include provisions for utility company transformer metering. Comply with Utility Company requirements.

N. Outdoor Switchboards: Provide NEMA ICS 6 Type 3R, non walk-in enclosure with roof sloping downward toward rear, pad locking doors, and stainless steel hardware. Provide a NEMA 5-20R convenience receptacle and thermostatically controlled space heater(s) in switchboard sections with adequate wattage to prevent the accumulation of moisture. Power for space heaters and receptacle shall be obtained from a control power transformer within the switchboard. All devices, instrumentation, and accessories shall be suitable for the environmental conditions associated with outdoor switchgear.

2.03 POWER DISTRIBUTION PANELBOARDS

A. Panelboards: UL 67, NEMA PB 1; circuit breaker type with provision for 600 amp frame branch breakers, suitable for use as service equipment.

B. Electrical Ratings, Switch Arrangement, Special Features: As indicated on drawings. Indicated ampere interrupting capacity (AIC) is the full rms symmetrical integrated equipment short circuit rating of bussing and of overcurrent devices without series rating.

C. Cabinet: ICS 6; Type 1 for dry locations, Type 3R for damp or outdoor locations; surface mounted, with gutter space for metering current sensors shown on one line diagram and specified under Section 25 50 00. Coordinate maximum dimensions with room layout shown on plans.

D. Finish: Manufacturer's standard enamel over rust inhibitor.

E. Circuit Directory: Index card under plastic with metal frame holder on each branch switch.

F. Main Overcurrent Protective Device(s): UL 489; molded case circuit breaker with thermal magnetic trip LSI solid state trip unit fixed mounted, single handle common pole operation, AIC rating greater than available symmetrical short circuit amperes.

G. Circuit Breakers: UL 489; molded case, thermal magnetic trip, AIC rating greater than available symmetrical short circuit amperes. Multi-pole breakers shall be single handle with common pole operation. Feeder circuit breakers required to selectively coordinate shall have LI or LSI solid state trip. Circuit breakers rated 1000 amps and larger shall have LSI solid state trip.

H. Bussing: Copper with full neutral and ground bus.

I. Future Provisions: Provide fully equipped spaces for future devices with bussing, device supports, and bus connections.

J. Where surge protective device (SPD) is indicated, coordinate requirements with Section 26 43 00.

2.04 BRANCH CIRCUIT PANELBOARDS

A. Panelboards: UL 67, NEMA PB 1; bolt-on circuit breaker type.

B. Electrical Ratings, Circuit Breaker Arrangement, Special Features: As indicated on drawings. Indicated ampere interrupting capacity (AIC) is the rms symmetrical integrated equipment short circuit rating of the complete assembly. Indicated AIC rating shall be base upon manufacture listed series rating with the panelboard main device or the line side overcurrent protective device, as applicable, unless otherwise indicated.

C. Cabinet: Concealed trim clamps, concealed hinge Lockable door-in-door (one lockable latched door over interior and one lockable latched door which exposes gutter) with flush locks all keyed alike, 6" deep x 20" wide. Provide two keys for each panelboard furnished.

D. Finish: Manufacturer's standard enamel over rust inhibitor for exposed surfaces; galvanized steel for recessed boxes.

E. Circuit Directory: Index card under plastic with metal framed holder on inside door.

F. Main Overcurrent Protective Device(s): UL 489; molded case circuit breaker with thermal magnetic trip fixed mounted, single handle common pole operation, AIC rating greater than available symmetrical short circuit amperes. Main circuit breakers required to selectively coordinate shall have LI or LSI solid state trip.

G. Circuit Breakers: UL 489; molded case, thermal magnetic trip. Multi-pole breakers shall be single handle with common pole operation.

1. Provide type SWD circuit breakers for lighting circuits.

2. Provide type HACR circuit breakers for air conditioning equipment, refrigeration equipment, and surge protection devices (SPD).

3. Provide approved manufacturer handle ties between single pole circuit breakers serving branch circuits sharing a common neutral (disconnecting means for multiwire branch circuits).

4. Provide approved manufacturer handle padlock attachment on circuit breakers serving branch circuits for permanently connected appliances without local disconnecting means and where otherwise indicated.

5. Provide combination-type arc-fault circuit interrupter protection (AFCI) circuit breakers for branch circuits where indicated.

6. Provide ground fault circuit interrupter protection (GFCI) circuit breakers for branch circuits where indicated.

7. Provide ground fault equipment protection (GFEP) circuit breakers for pipe heat trace and for deicing and snow melting equipment.

8. Circuit breakers used as mains (back-fed) shall be suitable for the purpose and shall include an auxiliary fastener listed and approved by the panelboard manufacturer where plug-in type device is used.

H. Bussing: Copper with full neutral and ground bus. Provide separate ground bus isolated from cabinet where isolated grounding requirements are indicated.

I. Where surge protective device (SPD) is indicated, coordinate requirements with Section 26 43 00.

J. Where fusing is required to comply with selective coordination requirements of NEC 700 and 701, provide lighting and appliance panelboard that includes UL listed, special purpose, low peak branch circuit fuses with Class J performance in series with each branch circuit breaker or disconnect. Fuses shall be IP20 finger-safe with neon open fuse indication, single and multi-pole as scheduled. Cooper Bussmann QSCP, Eaton PRL1aF or 2aF, or approved.

K. Provide flush mounted panelboards with bullnose trim where full recessed depth is not available.

L. Provide sheet metal skirt with matching panelboard finish from bottom of surface mounted panelboards to floor.

2.05 ENCLOSED CIRCUIT BREAKERS

A. Circuit Breakers: UL 489; molded case circuit breaker with thermal magnetic trip LSI solid state trip unit fixed mounted, single handle common pole operation, AIC rating greater than available symmetrical short circuit amperes. Circuit breakers rated 1000 amps or larger for solidly grounded wye electrical systems rated more than 150 volts to ground shall have ground fault protection. Circuit breakers rated or otherwise adjustable to 1200 1000 amperes and larger shall have an arc energy reducing maintenance switch with electronic trip and status indication to reduce clearing time.

B. Electrical Ratings, Configuration, and Special Features: As shown on drawings. The indicated ampere interrupting capacity (AIC) shown on the drawings is the full rms symmetrical equipment short circuit rating of bussing and of all overcurrent devices installed.

C. Enclosures: NEMA ICS6; Type 1 for dry locations, Type 12 for industrial locations, Type 3R for damp or outdoor, with pad locking provisions, and suitable for use as service equipment. Include neutral and/or ground kits as required.

2.06 DISCONNECT SWITCHES

A. Safety Switches: NEMA KS 1; heavy duty, quick make, quick break, handle with lock out / tag out provisions. Provide rating, number of poles, and fusing required for load served.

B. Safety Switches for Variable Frequency Drives (VFD): Safety switches installed on the load side of VFD controllers shall include an interlock to disable controller operation when the safety switch handle is operated to the open positon.

C. Toggle Switches for Small Motors and Appliances: NEMA WD 1; horsepower rated 20 ampere general use snap switch with lock-out attachment.

D. Switch Enclosures: NEMA ICS 6; Type 1 for dry locations, Type 3R for damp or outdoor locations.

2.07 FUSES

A. Approved Fuses, 600 Amperes and Less, for Branch Circuits and Power Distribution:

1. ANSI/UL 198C Class J low peak with time delay unless otherwise indicated except ANSI/UL 198E Class RK5 may be used in safety switches for protection of motors and transformers.

2. For Protection of Circuit Breakers: Fuses must comply with NEC 240.86 series rating requirements for load side circuit breakers that are not rated for the available fault current. Coordinate series rating requirements with published manufacturer's listings for circuit breakers installed.

B. Approved Fuses, Over 600 Amperes, for Branch Circuits and Power Distribution:

1. ANSI/UL 198C Class L low peak with time delay unless otherwise indicated.

2. For Protection of Circuit Breakers: Fuses must comply with NEC 240.86 series rating requirements for load side circuit breakers that are not rated for the available fault current. Coordinate series rating requirements with published manufacturer's listings for circuit breakers installed.

2.08 MOTOR CONTROLLERS

A. Manual Motor Starters: NEMA ICS 2; AC general purpose Class A manually operated full-voltage controller for fractional horsepower induction motors, with thermal overload unit, green neon pilot light, and toggle operator.

B. Magnetic Motor Starters: NEMA ICS 2; full voltage non- reversing (FVNR) type, hand reset solid state overload relay with phase loss protection, green 20,000 hour "ON" pilot light, one normally open and one normally closed auxiliary contacts, fused 120 volt control transformer, 120 volt operating coil; additional features as indicated. Provide cover mounted "Hand-Off-Auto" selector switch unless operator station is indicated.

C. Two Speed Motor Starters: Provide consequent pole or separate winding starter to match requirements of motor provided. Verify motor type prior to ordering. Provide pilot lights for each speed. Other features and starter options shall comply with requirements for magnetic motor starters specified above.

D. Overload Relay: Installed relay shall have an adjustable current range up to 140% of NEC rated motor full load amperes.

E. Combination Motor Starters: Combine Magnetic Motor Starter and fused disconnect switch with Class R fuse provisions in common enclosure.

F. Fire Alarm Shutdown: Provide magnetic starters with auxiliary control relay for fire alarm shutdown interface where indicated.

G. Operator Stations: NEMA ICS 2; heavy duty oil tight, operator and legend plate indicated.

H. Enclosures: NEMA ICS 6; Type 1 for dry locations, Type 12 for industrial locations, Type 3R for damp or outdoor locations.

I. Enclosure Finishes: Manufacturer's standard enamel over rust inhibitor on all interior and exterior surfaces.

2.09 CONTACTORS

A. Lighting Contactors: NEMA ICS 2; mechanically held, 100% continuous rating for tungsten and ballast lighting and resistance loads, 120 volt control coil, fused control circuit. Contact rating and number of poles as indicated on drawings. 20 ampere contacts shall be convertible type.

B. General Purpose Contactors: NEMA ICS 2; mechanically held, 100% continuous rating for lighting, resistance, and motor loads, 120 volt control coil fused control circuit. Contact rating and number of poles as indicated on drawings.

C. Emergency Stop Station (Kill Switch): NEMA ICS 2; red 50mm mushroom head pushbutton, push- pull maintained operation with normally closed contact rated 10 amps at 300 volts (minimum) and yellow device plate, flush surface mounted. Furnish with EMERGENCY STOP labeling engraved on mushroom head or device plate. Square D ,Siemens, Cutler-Hammer, or approved.

D. Remote Operator Station: NEMA ICS 2; key operated two or three position momentary selector switch with contacts rated 10 amps at 300 volts (minimum), flush mounted in finished spaces. Furnish with legend plate or engraving on device plate to indicate function(s). Provide as key operated station where indicated. Square D, Siemens, Cutler-Hammer, or approved.

E. Enclosures: NEMA ICS 6; Type 1 for dry locations, Type 3R for damp or outdoor locations.

2.10 DRY TYPE DISTRIBUTION TRANSFORMERS

A. Two Winding Transformers: ANSI/NEMA ST 20, NEMA TP-1 Class 1 compliant; general purpose, air cooled; ratings as shown on drawings. Transformers shall meet the minimum efficiency requirements of Washington State Energy Code (WSEC) International Energy Conservation Code (IECC).

B. Insulation System and Average Temperature Rise: Class 220 degree C insulation, 115 degree C rise above 40 degree C ambient.

C. Primary Winding Taps: Six (6) 2-1/2% taps, 2 above and 4 below normal.

D. Sound Levels: Not to exceed ANSI/NEMA ST 20 standards.

E. Nonsinusoidal Load Rating: When indicated by K rating, provide transformers with 200% neutral bus and UL listed for nonsinusoidal load currents having a maximum K factor of 4 (offices) or 13 (data processing).

F. Isolate core and coil from enclosure using vibration absorbing mounts.

G. Install weather shields on transformers installed in indoor locations common with water piping and/or fire sprinklers.

2.11 NAMEPLATES AND LABELS

A. Nameplates: Engraved three-layer laminated plastic, white letters on black background, affixed with stainless steel screws, adhesive acceptable in dry locations. Use black letters on yellow background for series combination rating identification.

B. Letter Height: 1/2 inch for series combination rating identification. 1/4 inch for switchboards, panelboards, motor control centers, circuit breakers, switches, and disconnecting means; 1/8 inch for motor starters, contactors, time switches, and equipment served.

C. Arc Flash Hazard Warning at Service Equipment Rated 1200 Amps and Larger: ANSI Z535.4; Self adhesive vinyl label factory installed by the equipment manufacturer to read WARNING, Electrical Arc Flash Hazard, Appropriate PPE Required, and informational text to indicate

system voltage, available fault current at the service overcurrent protective devices, clearing time of service overcurrent protective devices based on the available fault current, and date the label was applied.

D. Arc Flash Protection Labels: ANSI Z535.4; Self adhesive vinyl label factory installed by the equipment manufacturer with ANSI header to read WARNING or DANGER and informational text to include:
Electric Arc Flash Hazard
Turn off all power before opening.
Follow all requirements in NFPA 70E for safe work practices and for Personal Protective Equipment.
Failure to comply can result in death or injury.

E. Arc Flash Protection Labels for Switchgear, Panelboards, and Motor Control Centers: ANSI Z535.4, NFPA 70E; Self adhesive vinyl labels consisting of arc flash information based on the approved hazard study. Labels shall include Flash Category, Arc Flash Rating (cal/cm^2), Hazard Boundary, and required Personal Protective Equipment (PPE).

2.12 COMPRESSION LUGS (ALUMINUM CONDUCTOR)

A. Where aluminum conductor is substituted for copper conductor under Section 26 05 00, compression lugs shall be provided in lieu of mechanical lugs for terminating conductors.

PART 3 – EXECUTION

3.01 SWITCHBOARDS

A. Install in accordance with manufacturer's instructions and NEMA PB 2.1.

B. Seismic Restraint: Comply with requirements of the International Building Code (IBC). Obtain anchoring plans from equipment manufacturer indicating size and location of anchors suitable for Seismic Design Category F. Secure floor mounted equipment to concrete floor or pad with corrosion proof 1/2 inch -13 SAE Grade 5 wedge anchors having a minimum embedded depth of 5 inches unless otherwise approved or recommended by manufacturer.

C. Provide initial programming and set up for microprocessor based switchboard instrumentation. Coordinate with Owner to verify requirements for User selected programming inputs.

3.02 PANELBOARDS

A. Install in accordance with NEMA PB 1.1.

B. Height: 78 inches maximum measured from finish floor to top of enclosure; 78 inches maximum measured from finish floor to highest device handle for panelboards over 66 inches high.

C. Provide typewritten circuit directory for each panelboard listing load description for each circuit. Use final room names and numbers as verified with the Owner.

D. Fire Rated Construction: Recessed rough-in cans that penetrate fire rated wall assemblies shall comply with requirements of Section 26 05 00. Verify location of fire rated assemblies with Architectural plans prior to rough in.

3.03 DISCONNECTS

A. Provide a disconnect in addition to the controller disconnecting means at installed motor loads that are not in sight of motor controller as required by NEC 430.102(B).

B. Safety Switches for Variable Frequency Drives (VFD): Provide two (2) #12 600 volt rated conductors with the motor feeder between VFD and load side motor disconnect interlock to disable controller operation when the safety switch handle is operated to the open position.

3.04 FUSES

A. Install fuses in fusible switches.

B. Size fuses for motor loads at 150% of nameplate full load amperes; size fuses for air conditioning and refrigeration equipment at maximum recommended nameplate rating.

3.05 CIRCUIT BREAKERS

A. Install circuit breakers in accordance with manufacturer instructions and recommendations.

B. Set adjustable breakers to comply with the approved protective device coordination study or as directed by the Engineer.

3.06 MOTOR CONTROLLERS

A. Adjust solid state overload relay to match installed motor characteristics and ambient conditions. Initial setting shall not exceed 125% of nameplate full load amps.

3.07 DRY TYPE TRANSFORMERS INDOORS

A. Connect raceway to transformer case using flexible conduit.

B. Mounting: Floor, wall, or trapeze mount as required. Mount transformers on 1/2 inch minimum oil resistant neoprene vibration isolating pads with cross-ribbed or waffle design and located at each anchor point.

C. Seismic Restraint: Comply with requirements of the International Building Code (IBC). Obtain required anchoring plans from equipment manufacturer indicating size and location of anchors suitable for Seismic Design Category F. Provide seismic bracing for trapeze mounted equipment. Secure floor mounted equipment to concrete floor or pad with corrosion proof 1/2 inch -13 SAE Grade 5 wedge anchors having a minimum embedded depth of 5 inches unless otherwise approved or recommended by manufacturer.

D. Disconnecting Means: Comply with NEC 450.14 and as otherwise shown on plans.

3.08 NAMEPLATES AND LABELS

A. Switchboards, Panelboards: Provide nameplate to identify equipment designation, voltage, and source of supply for each, e.g. Panel A, 208/120V, Fed from Panel M. Provide arc flash protection label. Provide series combination rating nameplate where such rating is applicable.

B. Individual Circuit Breakers, Switches, and Motor Starters Installed in Switchboards, Distribution Panelboards Without Circuit Index: Provide nameplate to identify circuit source, circuit number, and load served.

C. Motor Starters and Contactors: Provide nameplate to identify load served. May be deleted when load is immediately adjacent and obvious as determined by Architect/Engineer. Provide arc flash protection label.

D. Individual Enclosed Circuit Breakers, Safety Switches, and Disconnecting Means: Provide nameplate to identify load served and circuit source and circuit number.

E. Equipment Served: Provide nameplate to identify equipment designation corresponding with nameplate of serving overcurrent device, disconnect switch, or controller when there is more than one of same type of equipment being served, e.g. Air Handler No. 2. Coordinate with Architect/Engineer to assign numbers when not designated in equipment schedules.

F. Emergency-Stop Pushbutton: Engraved three-layer laminated plastic, white letters on red background, affixed with stainless steel screws, adhesive acceptable in dry locations. Letter height 1/2 inch to read: "EMERGENCY POWER OFF".

G. Nameplate and Label Location: Secure to equipment fronts, except recessed panelboards in finished locations secure nameplates and labels to inside face of door.

H. Service Equipment: Provide label identifying short circuit rating indicated along with date of construction documents.

3.09 EQUIPMENT PADS

A. Switchboards, Transformers - Indoors: Provide concrete equipment (housekeeping) pads, 3-1/2 inches high and 4 inches larger than the footprint of the equipment.

B. Switchboards, Transformers - Outdoors: Provide concrete slab foundation, 5-1/2 inch thick reinforced with 6 inch x 6 inch No. 6 welded steel fabric uniformly centered in slab. Slab shall be placed on a well compacted 9 inch deep gravel subbase so that the top is 3 inches above grade. All edges shall have 1/2 inch chamfer. Pad dimensions shall extend at least 6 inches beyond the enclosure footprint on all sides of the equipment unless otherwise indicated. Conduit entrance dimensions and location shall comply with equipment manufacturer's recommendations.

3.10 TESTS

A. Motors and Compressors: Record all nameplate data. Measure actual voltage and running amperes for each phase. Record manufacturer and catalog number of overload thermal units installed.

B. Dry Type Transformers: Measure primary and secondary voltages after loads are connected and systems are energized. Adjust taps for -1% to +2% of rated secondary voltage.

C. Equipment Ground Fault Protection Systems: Test prior to being placed into service to verify proper installation and operation of the system as determined by the equipment manufacturer's published instructions. Set pick up for 300 amps and time delay for zero (instantaneous) unless otherwise indicated or directed. Record test results.

END OF SECTION

SECTION 26 43 00
AC SURGE SUPPRESSION BELOW 600 VOLTS

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.

B. Section 26 20 00 - Electrical Distribution.

1.02 SECTION INCLUDES

A. Surge Protective Devices (SPD's) for electrical distribution equipment.

1.03 SUBMITTALS

A. Submit product data for all items specified under Part 2 of this Section. Include product installation requirements. Include test data demonstrating compliance with specified performance and peak surge withstand ratings.

1.04 OPERATION AND MAINTENANCE DATA

A. Include data for each device type in Operation and Maintenance Manuals.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Integral SPD: Distribution equipment manufacturer's standard products that meet or exceed the minimum requirements of this specification.

B. Remote SPD: Standard products of the following manufacturers that meet or exceed the minimum requirements of this specification: Innovative Technologies, Joslyn TPS series, Eaton SPD series.

2.02 SPD PRODUCT DESIGN

A. General: UL 1449, 3rd Edition, Type 2 Devices; MOV hybrid circuit design with EMI/RFI noise rejection filter. For wye configured systems provide line to neutral (L-N), line to ground (L-G), and neutral to ground (N-G) suppression. For delta configured systems provide line to line (L-L) and line to ground suppression. Designs incorporating replaceable modules are not approved.

B. Diagnostics: LED circuit status indication for each phase. Provide the following additional diagnostics at distribution panels where indicated.

Audible Alarm
Form C Contacts for Remote Alarm
Transient Counter

C. Enclosure (Remote Devices): NEMA ICS 6; Type 12 or type 4X, unless otherwise indicated. Provide flush trim plate for recess mounting at flush mounted panelboards.

D. Overcurrent Protection: Comply with UL 1449 standard. Coordinate requirements with distribution equipment supplier. Size protection based on wire size of the SPD conductor leads using RK5 fusing or high inrush rated circuit breaker.

E. Disconnecting Means: Provide a disconnecting means for each switchboard and panelboard SPD regardless of whether it is integral or remote mounted. Coordinate requirements with distribution equipment supplier.

F. Product Warranty: 10 year minimum.

2.03 SPD ELECTRICAL REQUIREMENTS (MINIMUM)

A. Voltage Rating: Conform to nameplate of distribution equipment.

B. Ampere Interrupting Capacity (AIC) Rating: Meet or exceed rating of highest rated overcurrent device in the distribution equipment.

C. UL 1449 3rd Edition Voltage Protection Rating (VPR):

System Volts	L-N (Normal Mode)	N-G (Common Mode)	L-L
120 to Ground	700 volts	700 volts	700 volts
277 to Ground	1200 volts	1200 volts	1200 volts

D. UL 1449 VPR Voltage Let Through:

System Volts	L-N	L-G	L-L	N-G
480/277 Wye	1100	1100	1900	1100
208/120 Wye	700	700	1000	700
120/240 1-Phase	700	700	1000	700

E. Peak Surge Withstand Rating per Phase (8 x 20 microsecond impulse wave form):

Service Entrance	160,000 Amps
Distribution Switchboards and Panels	65,000 Amps
Branch Circuit Panelboards	40,000 Amps

F. Noise Attenuation: 55 dB minimum at 100 kHz using MIL-STD-220A insertion loss test method.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Provide SPD where indicated.

B. Provide factory mounted SPD integral with distribution equipment except remote mounted SPD may be used for panelboard construction.

C. Remote Mounted SPD Installation Requirements:

1. Provide SPD next (close nippled) to equipment enclosure near panelboard overcurrent device provided for the purpose. Wiring leads for remote device shall be as short and straight as possible, but in no case shall exceed 12 inches in length.

2. Comply with manufacturer's recommendations for overcurrent protection.

3. Provide additional equipment grounding terminal in panel for SPD ground connection where required to comply with maximum lead length specified for remote mounted SPD.

4. Provide recessed mounting with flush trim plate where SPD is installed at flush mounted panelboards. Obtain rough-in inspection by the Architect/Engineer prior to cover of recessed installation.

END OF SECTION

SECTION 26 50 00
LIGHTING FIXTURES

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.

B. Concrete for Bases: Comply with Division 03 - Concrete.

C. Section 26 09 20 - Low Voltage Lighting Controls.

1.02 SECTION INCLUDES

A. Interior Luminaires and Accessories.

B. Exterior Luminaires and Accessories.

C. Lamps.

D. Ballasts and LED Drivers.

E. Poles and Concrete Bases.

F. Emergency Lighting Equipment.

1.03 COORDINATION

A. Confirm luminaire type, mounting, and recessed depth is compatible with ceiling system prior to ordering. Coordinate with architectural reflected ceiling plans, sections, and details.

B. Determine final luminaire locations according to architectural reflected ceiling plans and elevations. In spaces open to structure, coordinate final luminaire locations and mounting heights with ductwork, piping, and structural members and submit final plan to Architect/Engineer for approval.

C. Coordinate dimensions and mounting of under-cabinet and other casework lighting with the cabinet and/or casework product vendor(s) prior to ordering light fixtures.

1.04 SUBMITTALS

A. Submit product data for all items specified under Part 2 of this section and scheduled on the drawings. Include in submittal and in Operations and Maintenance Manual a coversheet listing each fixture type with corresponding LED/lamp and driver/ballast data.

B. Submit shop drawings for Emergency Lighting System UPS equipment.

1.05 OPERATION AND MAINTENANCE DATA AND TRAINING

A. Submit all data in Operation and Maintenance Manuals.

B. Provide onsite training on driver and LED board replacement for each type of luminaire installed.

C. Lighting Inverter: Include instructions for normal operation, routine maintenance requirements, service manuals and testing procedures in Operation and Maintenance Manual. Provide onsite Owner training.

D. Include documentation from system start up.

1.06 WARRANTY

A. LED Luminaires and Fixture Ballasts: Provide five year comprehensive warranty.

B. Lighting Inverters: Provide two year extended warranty with factory start up and onsite service.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Luminaires and Accessories: Identified in Fixture Schedule.

B. Transfer Relays: LVS or compatible with lighting control system or as identified on drawings.

C. Unit Emergency Battery Packs: LVS, Bodine or compatible with luminaire or as identified on drawings.

2.02 LED LUMINAIRES

A. Indoor luminaires shall comply with following requirements unless otherwise scheduled on the drawings: UL listed, Reduction of Hazardous Substance (ROHS) compliant, 3500K color temperature, 80 CRI minimum, listed for 25 degree C minimum ambient operation, integral driver, integral surge, open circuit, short circuit, and overload protection, L70 at 50,000 hours or better per IESNA LM-80. Provide dimmable driver for low voltage 0-10 volt control to 10% of lumen output except dimming drivers that have daylight responsive control shall dim to completely OFF.

B. Outdoor luminaires shall comply with following requirements unless otherwise scheduled on the drawings: UL listed, Reduction of Hazardous Substance (ROHS) compliant, IP66 rated, 3000K color temperature, 70 CRI minimum, listed for -20 degree C to 40 degree C ambient or better operation, integral driver, integral surge, open circuit, short circuit, and overload protection, rated L70 at 50,000 hours or better per IESNA LM-80. Provide dimmable driver suitable for 0-10 volt control.

C. Recessed LED luminaires shall have drivers, modules, and reflectors accessible, serviceable, and replaceable from below the ceiling.

2.03 FIXTURE WHIPS

A. 3/8 inch flexible conduit or approved MC cable assembly with circuit and equipment ground conductors; 72 inch maximum length.

B. Where fixtures are provided with pre-installed whips, verify wiring arrangement, termination location, and installation clearances prior to ordering.

2.04 FIXTURE ACCESSORIES

A. Provide necessary hangers, brackets, plates, anchors, and other mounting accessories required by construction features and ceiling conditions. Comply with requirements of Section 26 05 00, Basic Materials and Methods.

B. Allow sufficient length for pendants, cables, chains, conduit, or rods as specified to install hanging fixtures at 8 feet above finished floor or 36 inches below the ceiling, whichever is lower, unless otherwise indicated in the construction documents.

2.05 LIGHTING POLES

A. Wind Load Rating: 100 mph with luminaires and brackets installed.

B. Anchor Bolts: As recommended by pole manufacturer. Provide template, flat washers, lock washers, and hex nuts for each pole.

2.06 LIGHTING FIXTURE SCHEDULE

A. See Drawings.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Provide LED modules/lamps in luminaires provided under this Section.

B. Provide wiring, installation, and lamps for lighting fixtures furnished under other Sections or by Owner, including fixtures furnished as part of hoods and equipment (e.g. range hoods, kitchen hoods, fume hoods, and walk-in HVAC equipment). Incandescent lamps shall be maximum listed wattage of fixture except when smaller wattage is indicated.

C. Set lighting fixtures plumb, square, and level; measure mounting heights to center of fixture for wall mounted and to bottom of fixture for pendant hung.

D. Support lighting fixtures from building structural members; provide metal channels or additional blocking and framing as required for fixture support between structural members or to avoid interference from mechanical pipes and ducts. Conceal supports within building construction in finished spaces.

E. Recessed and surface mounted lighting fixtures weighing less than 56 lbs (25.4 kg) may be supported from metal ceiling suspension systems when auxiliary support from structural members using two #12 AWG wire hangers at diagonal corners are provided (hangers may be slack). Fixtures weighing 56 lbs or more must be supported directly from the structure by approved hangers.

F. Light fixtures hung below suspended ceilings by pendants, cables, chains, conduit, rods, or other means shall be supported from structure above using #9 AWG wire hanger or alternate support approved by Inspection Authorities.

G. Securely fasten recessed and surface fixtures in place; provide seismic clips (one each corner) for lay-in fixtures; attach surface fixtures tight to ceilings and walls, and secure fluorescent fixtures within 12 inches of each end.

H. Mounting height for wall mounted fixtures and for hanging fixtures supported by pendants, cable, chain, conduit, rods, or other means shall be determined by the architect/engineer during construction unless otherwise indicated in the construction documents.

I. Install suspended fixtures so that no obstruction is located within the swing range.

3.02 RELAMPING

A. Relamp luminaires which have failed lamps at completion of work.

3.03 ADJUSTING AND CLEANING

A. Align and tighten luminaires and clean reflectors, lenses and diffusers at completion of work. Clean paint splatters, dirt, and debris from installed luminaires.

B. Make final aiming adjustment of directional luminaires as directed by Architect/Engineer at completion of work.

3.04 EMERGENCY LIGHTING EQUIPMENT

A. Exit, Self-Contained Emergency, Night lights: Connect ahead of switch control on local lighting circuit.

B. Integral Emergency Lighting Pack: Install in ballast channel with charging indicator light and test switch separately mounted on or adjacent to fixture so as to be visible and accessible. Connect emergency pack to unswitched conductor ahead of local switch control. Connect fixture ballast so that lamps are switched in normal mode unless fixture is indicated as Night Light.

3.05 THERMAL AND SOUND INSULATION

A. Coordinate with General Contractor to ensure provisions are made to support insulation materials minimum of 3 inches clear of recessed lighting fixtures that are not IC rated.

3.06 CONCRETE BASES

A. General: Provide concrete bases for anchor base poles and for pathway lights.

B. Pole Bases: Size and construction as indicated. Install anchors using template obtained from pole manufacturer. Install poles on bases plumb; provide double nuts or shims for adjustment. Grout around pole bases.

C. Bollard Bases: 12 inches square x 36 inches deep, flush with hard surface finish grade except in landscape or unfinished areas set 2-inch above final grade. Provide 1/2-inch chamfer on all exposed edges.

3.07 EMBEDDED POLES

A. Hole Auguring: Provide round hole to depth indicated. Hole width shall be sufficient to allow mechanical compaction around pole base.

B. Backfill and Compaction: Backfill hole with 8-1 dry mix of fine crushed stone and Portland cement, compacted in 12-inch lifts.

3.08 TRAINING

A. Coordinate with Architect to arrange onsite training for luminaire and lighting inverters. Allow 20 minutes per each type of installed luminare to review driver and LED board replacement. Allow four hours of factory training for the lighting uninterruptible power supplies (inverters).

END OF SECTION

SECTION 27 10 01
TELECOMMUNICATIONS STRUCTURED CABLING

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Cable and Accessories.

B. Station Outlets.

C. Cross-Connect Components.

D. Equipment Mounting.

E. Structured Cabling System Design.

1.02 RELATED SECTIONS

A. Section 26 01 00 - Electrical General Requirements.

B. Section 26 05 00 - Basic Materials and Methods.

C. Section 26 05 26 - Grounding and Bonding.

D. Section 26 05 30 - Low Voltage Signal Systems Pathway.

1.03 REGULATORY REQUIREMENTS

A. Conform to requirements of the latest revisions of the following standards:

TIA/EIA-569	Commercial Building Standard for Telecommunications Pathways and Spaces.
TIA/EIA-568-B-1,2,3	Commercial Building Telecommunication Standard, including all addendums.
TIA/EIA-455-61	FOTP-61, Measurement of Fiber or Cable Attenuation Using An OTDR.
EIA/TIA-606	Administration Standard for the Telecommunications Infrastructure of Commercial Buildings.
EIA/TIA-607	Commercial Building Grounding and Bonding Requirements for Telecommunications.

1.04 SYSTEM DESCRIPTION

A. Provide design and installation of a structured cabling system consisting of horizontal station wiring using unshielded twisted pair (UTP) cabling, with UTP backbone for voice PDS and fiber optic backbone for data PDS.

B. Data (computer) Network: Conform to TIA/EIA Category 5 enhanced requirements. Terminate each station data jack to a patch panel at the nearest Distribution Frame or wiring closet located on same floor unless otherwise indicated.

C. Data Network Backbone: Provide multi-strand fiber optic cable from each Intermediate Distribution Frame (IDF) to the Main Distribution Frame (MDF). Each fiber cable shall be terminated at a fiber patch panel each end.

1.05 SUBMITTALS

A. Submit product data for all items specified under Part 2 of this section.

B. Submit shop drawings showing floor plans with room numbers, station outlet locations, horizontal station cable routing, backbone cable routing, and alpha numeric identification of terminals and jacks. Include elevation plans showing layout of cross-connect and wire management hardware. Show location and size of conduit sleeves for open cable routing.

C. Submit terminal labeling plan.

D. Submit documentation for tests required under Part 3 of this section.

1.06 OPERATION & MAINTENANCE DATA

A. Include data for complete structured cabling system in Operation and Maintenance Manual.

B. Include cable certification test results for each UTP [and Fiber Optic] cable.

1.07 QUALIFICATIONS

A. Company: Contractor specializing in the design, installation, and testing of high speed data and voice network systems for a minimum of five years.

B. Installers: Trained and experienced technicians of the company, certified by the product manufacturer and by Building Industry Consulting Service International (BICSI) for the PDS cabling, hardware, and accessories being installed, shall perform the work.

1.08 WARRANTY

A. Provide 5 year minimum product warranty and 15 year minimum link/channel transmission warranty.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURER

A. UTP Cable: Leviton Berk-Tek, CommScope Systimax, Superior Essex.

B. UTP Station Outlets and Cross-Connect Components: Leviton, CommScope, Legrand/Ortronics.

C. Fiber Optic Cable, Equipment, and Accessories: Superior Essex, CommScope, Berk-Tek, Ortronics, Siecor.

D. Equipment Racks and Cabinets: Chatsworth Products, Black Box, Great Lakes, Hubbell.

E. Uninterruptible Power Supplies: APC, Tripp Lite.

2.02 GENERAL REQUIREMENTS

A. All products provided under Part 2 shall meet or exceed TIA/EIA-568-B.1 Category 5 enhanced TIA/EIA-568-B.3-1 Optical Fiber, unless specifically indicated otherwise.

2.03 CABLE

A. Station Cable, Data: UL type CMP [CMR] , Category 5 extended frequency (350MHz), 24 AWG solid copper, 4-pair unshielded twisted pair, jacket overall, color coded, listed for use in ducts, plenums, and other air handling spaces [non plenum rated]. Cable installed outdoors shall have a water blocking core and be suitable for installation below grade in conduit.

B. Multi-Mode Riser Rated Fiber Optic Cable (Data Backbone): UL listed OFNR twelve (12) strand multi-mode 50/125 micron, high performance laser core, 10 GB certified for 300 meters at 850nm., indoor/outdoor rated, loose buffer.

2.04 CABLE ACCESSORIES

A. Cable Support: Extra wide base J hooks, with plenum rated tie wraps. Caddy cable cat system or equal. Staples, straps, bridle rings, and similar supports are prohibited.

B. Fiber Protection, Inside Plant: Non-metallic corrugated flexible raceway, 3/4 inch minimum diameter, orange color, UL listed for use with OFNR fiber cable. Carlon Riser-Gard or equal [UL listed for use with OFNP plenum rated fiber cable. Carlon Plenum-Gard or equal] .

C. Fiber Protection, Outside Plant: Non-metallic corrugated flexible raceway, 1 inch diameter, orange color, UL listed for use as an innerduct within conduit systems.

D. Wire Management: Provide vertical wire management channels each side of equipment racks for strain relief, bend radius, and cable routing. Include cable trough for station cable routing and front mounted wire management rings for patch cords.

2.05 STATION OUTLETS

A. Data Jacks: TIA/EIA - T568A/B RJ45, 8-position/8-conductor, keyed modular jack, with symbol or color code to identify use.

B. Faceplates: Thermoplastic with identification strip top and bottom; 3 module/6 port capacity; color to match wiring devices. Provide blank modules for unused plate opening.

2.06 CROSS-CONNECT COMPONENTS

A. Data: Printed circuit board patch panels, 6-port modular construction with RJ45 keyed 8-position jacks, AT&T 110 connector system, T568A/B wiring, identification strips, and 19 inch rack mounting, unless otherwise indicated. Provide sufficient panels and quantity of ports equal to the number of terminated stations cables plus 20%.

B. Fiber: Twelve (12) port ST style panel installed in locking protective cabinet with provisions for fiber storage, fiber routing, and connector identification; 19 inch rack mounting, unless otherwise indicated.

C. Data Patch Cords: UL type CM, 4-pair cable with RJ45 plug each end, length not to exceed 4 meters, quantity equal to total installed station jacks plus 10 %. Provide 25% 3-feet, 50% 5-feet, and 25% 7-feet long, color blue unless otherwise directed.

D. Fiber Optic Connectors: Multi-mode ST style. Quick cure epoxy adhesive. Bayonet style coupling with multi-mode ceramic or glass-in-ceramic ferrule, keyed for repeatable performance.

E. Multi-Mode Fiber Patch Cords: Preassembled single fiber, multi-mode 62.5/125 micron/ULTRA grade jumper cord with connectors each end, length 3 meters. Provide one patch cord for each terminated/assigned fiber patch panel port plus 10%, with ST to ST or ST to SC connectors as required (verify).

2.07 EQUIPMENT MOUNTING AND ACCESSORIES

A. Equipment Racks, Wall: Steel or aluminum one piece wall bracket with hinged swing out panel mount feature, 19 inches wide by 6 inch nominal deep.

B. Equipment Cabinets, Wall: Wall mounted, vented side panels, hinged steel door with lock, 48H X 21W X 20D inch minimum, hinged swing out panel mounting frame with EIA provisions for rack mounted 19 inch wide equipment. Provide with integral 250 CFM minimum ventilation fan and two equipment shelves and mounting hardware. Locks shall be keyed to match branch circuit panelboards. Finish: grey or black enamel.

C. Wire Management, Equipment Racks: Provide vertical wire management channels each side of equipment racks for strain relief, bend radius, and cable routing. At each patch panel provide rear mounted strain relief bar for station cable routing and front mounted wire management rings or cable trough for patch cords.

D. Power Supplies: Rack mounted, 120 VAC, line interactive, uninterruptible power supply (UPS) with surge protection and filtering, (6) NEMA 5-15R receptacle outlets (minimum), USB connectivity, status display for On Line/On Battery/Replace Battery/Overload, and low battery/on battery alarms. VA rating indicated. APC Smart UPS SUA series or approved.

E. Plug Strips: Rack mounted, 120 VAC power strip, with (8) NEMA 5-15R rear mounted 90 degree receptacle outlets, power switch, UL 1449 surge protective device, and 20 amp 6-foot cord & plug input.

PART 3 – EXECUTION

3.01 PREPARATION

A. Provide location and size of conduit sleeves for routing open cables thru fire rated construction, draft stops, and partition walls in attics, crawl spaces, and accessible ceiling spaces. Size sleeves with 25% minimum space capacity. Indicate on shop drawings for coordination with Section [16710] 27 05 28.

3.02 INSTALLATION

A. Comply with product manufacturer installation instructions. Conform to requirements of TIA/EIA 568 and TIA/EIA 569 for specified Category.

B. Label cross connect terminals sequentially using an numeric or alpha-numeric identification plan submitted for approval. Label cable at each end with a permanent cable marker to match the corresponding terminal number. Label each station jack using polyester film adhesive pre-labeled markers to indicate corresponding terminal number.

C. Conceal wiring in suspended ceiling spaces, attic spaces, crawl spaces, and in wall construction. Utilize conduit rough-in specified in Section [16710] 27 05 28 and shown on

drawings. Install cable in neat parallel runs within cable trays and down to cross-connect hardware without rolls, twists, or loops.

D. Install cables continuous without splicing. Install open cable above accessible suspended ceilings parallel and perpendicular to building lines. Bundle cables with nylon tie wraps and support cable in tray, conduit sleeves, or from structure using specified J hooks at intervals not to exceed 4-1/2 feet. Where bundled cable exceeds 6 cables, provide separate voice and data bundles, 48 cables maximum per bundle.

E. Leave 10 feet of cable slack at MDF/IDF. Leave 12 inch cable slack at outlets.

F. Seal conduit sleeves thru fire rated construction using silicone foam system, Chase-Foam CTC PR-855, 3M CP 25, or Dow Corning RTV.

G. Maintain a minimum 6 inch separation from parallel power wiring. Do not share bore or knock out holes thru wall studs and other structural members with power wiring.

H. Data PDS shall provide termination of each station cable to a single 8-position /8-conductor data jack. Color coding and pin number termination sequence for each PDS shall conform to established standards approved by Architect/Engineer.

I. Provide fiber optic cable within protective non-metallic raceway system. Install raceway to within 18 inches of fiber termination.

J. Equipment Cabinets: Provide equipment cabinets for IDF and MDF racks located in attic spaces and where otherwise indicated.

3.03 TESTING

A. UTP Cabling:

1. Perform continuity test on each wire/pair prior to cover. Verify no open circuits, short circuits, or accidental grounds exist.

2. The system shall be certified to meet or exceed the specifications as set forth in TIA/EIA TSB40 and TIA/EIA 606-A for specified Category compliance. Certifications shall include the following parameters for each pair of each cable installed:

a. Wire map (pin to pin connectivity).

b. Length (in feet).

c. Attenuation to Crosstalk Ratio (ACR).

d. DC Loop Resistance.

e. Ambient noise.

f. Near-End Crosstalk (NEXT).

g. Equal-Level Far-End Crosstalk (ELFEXT).

h. Return Loss (RL).

3. Use test equipment such as the Ideal LANTEK 6 or approved equal to measure all essential cable parameters specified by TIA/EIA and UL thru Category 6. Provide a written record of these tests.

4. Correct malfunctions when detected and proceed with testing. Record test results on a "UTP Cable Test Results" form showing frequency tested and PASS/FAIL results.

B. Fiber Optic Cabling

1. OTDR Acceptance Tests: Test fiber optic cable for continuity, normalized fiber loss, and overall length verification, using an Optical Time Domain Reflectometer (OTDR). Attenuation measurements in dB/km shall be performed for each fiber at 850 nm and 1300 nm wavelength. Perform tests of cable both on reel when delivery of cable is taken, and after cable is installed and before connectorizing. Attenuation of mufti-mode fibers shall be no greater than 3.0 dB/km at 850 nm and no greater than 1.0 dB/km at 1300 nm. Installed cables with any damaged fibers shall be removed and replaced at Contractor expense.

2. Visual Inspection Reports: Visual inspection of each field installed fiber optic connector shall be documented to include report on end face quality, polish, and informational comments.

3. Optical Loss Tests: Fibers shall be loss tested in both directions at 850 nm and 1300 nm wavelengths after connectorization. Acceptable attenuation shall be any value less than the fiber attenuation plus 1 dB (0.5 dB per connector).

4. Use test equipment such as the Ideal FIBERTEK or approved equal to measure all essential parameters specified. Provide a written record of these tests.

5. Correct malfunctions when detected and proceed with testing. Record test results on a "Fiber Optic Cable Test Results" form showing PASS/FAIL results.

3.04 DOCUMENTATION

A. Documentation includes the following and shall be delivered to the Architect/Engineer within 20 working days after the wiring is completed.

1. Certification documents and test results.

2. Record drawings.

3. Permanent ID record at each MDF and IDF location.

END OF SECTION

PAGE LEFT BLANK INTENTIONALLY