

PART 1 - GENERAL

1.01 SUMMARY:

- A. Section Includes: The work covered by this Section consists of furnishing all material, labor and equipment necessary or required to do the trenching, backfilling and compacting needed for the proper and complete installation of underground utilities as shown on the Drawings.
- B. Related Sections: Drawings and General Provisions of the contract, including the General Covenants and Provisions, Supplementary Covenants and Provisions and General Requirements.

Section 02200 - Earthwork
Section 16000 - Electrical

1.02 QUALITY ASSURANCE:

- A. Qualifications: Use adequate numbers of skilled workers who are thoroughly trained and experienced in the necessary crafts, and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
- B. Use equipment adequate in size, capacity, and numbers to accomplish the work in a timely manner.
- C. Codes and Standards: Perform all work of this Section in compliance with applicable requirements of governing authorities having jurisdiction.
 - 1. In addition to complying with the pertinent codes and regulations of other governing agencies, comply with applicable requirements of Iowa Department of Natural Resources Authorized Technical Specifications for Water and Sewer Projects, latest edition.
- D. Safety: All trenching, excavating and methods of construction shall conform to the state of Iowa Bureau of Labor and all OSHA standards.
- E. Where conflicts arise between Contract Documents and Referenced Codes and Standards, the latter shall prevail, unless Contract Documents are more stringent.
 - 1. Bring all conflicts to the attention of the DNR Construction Inspector.

1.03 PROJECT/SITE CONDITIONS:

- A. Environmental Requirements:
 - 1. Protect existing trees and other vegetation indicated or as directed by DNR Construction Inspector to remain in place, against unnecessary cutting, breaking or skinning of roots, skinning and bruising of bark, smothering of trees by stockpiling

construction materials or excavated materials within drip line, excess foot traffic or vehicular traffic, or parking of vehicles within drip line.

2. Provide temporary guards to protect trees and vegetation to be left standing.
3. Repair or replace trees and vegetation indicated to remain which are damaged by construction operations, in a manner acceptable to the DNR Construction Inspector.

B. Existing Conditions:

1. Site information indicated on the Drawings regarding existing conditions, is of a general nature.
 - a. Visit the site and become familiar with existing conditions.
2. Observe weather conditions.
 - a. Attempt no work in frozen conditions without the approval of the DNR Construction Inspector.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. Fill and Backfill Materials:

1. Provide soil materials free from organic matter and deleterious substances, containing no rocks or lumps over 6" in greatest dimension, and with not more than 15 percent of the rocks or lumps larger than 2-3/8" in their greatest dimension.
2. Fill material is subject to the approval of the DNR Construction Inspector, and is that material removed from excavations or imported from off-site borrow areas, predominantly granular, nonexpansive soil free from roots and other deleterious matter.
3. Do not permit rocks having a dimension greater than 1" in the upper 12" of fill.
4. Cohesionless Material Used for Backfill: Provide sand free from organic material and other foreign matter, and approved by the DNR Construction Inspector.

- B. Provide other materials, not specifically described but required for a complete and proper installation, selected by the Contractor subject to the approval of the Project Engineer.

PART 3 - EXECUTION

3.01 PREPARATION:

A. Protection of Persons and Property:

1. Barricade open holes and depressions occurring as part of the work, and post warning lights on property adjacent to or with public access.
2. Operate warning lights during hours from dusk to dawn each day and as otherwise required.
3. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, washout, and other hazards created by operations under this Section.

B. Protection of Utilities:

1. Unless shown to be removed, protect active utility lines shown on the Drawings or otherwise made known to the Contractor prior to trenching.
 - a. If damaged, repair or replace at no additional cost to the Owner.
2. If active utility lines are encountered, and are not shown on the Drawings or otherwise made known to the Contractor, promptly take necessary steps to assure that service is not interrupted.
3. If service is interrupted as a result of work under this Section, immediately restore service by repairing the damaged utility at no additional cost to the Owner.
4. If existing utilities are found to interfere with the permanent facilities being constructed under this Section, immediately notify the Project Engineer and secure instructions.
5. Do not proceed with permanent relocation of utilities until written instructions are received from the Project Engineer.

C. Dewatering:

1. Remove all water, including rain water, encountered during trench and sub-structure work to an approved location by pumps, drains, and other approved methods.
2. Keep trenches and site construction area free from water.

D. Dust Control: Use means necessary to prevent dust becoming a nuisance to the public, at neighbors, and to other work being performed on or near the site.

E. Maintain access to adjacent areas at all times.

3.02 TRENCHING:

- A. Provide sheeting and shoring necessary for protection of the work and for the safety of personnel.
1. Prior to backfilling, remove all sheeting.
 2. Do not permit sheeting to remain in the trenches except when, in the opinion of the DNR Construction Inspector, field conditions or the type of sheeting or methods of

construction such as use of concrete bedding are such as to make removal of sheeting impracticable.

- a. In such cases, the Project Engineer, upon recommendation from the DNR Construction Inspector, may permit portions of sheeting to be cut off and remain in the trench.

B. Open Cut:

1. Excavate for utilities by open cut.
2. If conditions at the site prevent such open cut, and if approved by the Project Engineer, trenching may be used.
3. Short sections of a trench may be tunneled if, in the opinion of the Project Engineer, the conductor can be installed safely and backfill can be compacted properly into such tunnel.
4. Where it becomes necessary to excavate beyond the limits of normal excavation lines in order to remove boulders or other interfering objects, backfill the voids remaining after removal of the objects as directed by the DNR Construction Inspector.
5. When the void is below the subgrade for the utility bedding, use suitable earth materials and compact to the relative density directed by the DNR Construction Inspector, but in no case less than 90 percent.
6. When the void is in the side of the utility trench or open cut, use suitable earth or sand compacted or consolidated as approved by the DNR Construction Inspector, but in no case to a relative density less than 80 percent.
7. Remove boulders and other interfering objects, and backfill voids left by such removals, at no additional cost to the Owner.
8. Excavating for appurtenances:
 - a. Excavate for manholes and similar structures to a distance sufficient to leave at least 12" clear between outer surfaces and the embankment or shoring that may be used to hold and protect the banks.
 - b. Overdepth excavation below such appurtenances, unless directed, will be considered unauthorized.
 - c. Fill unauthorized overdepth excavation with sand, gravel, or lean concrete as directed by the DNR Construction Inspector, and at no additional cost to the Owner.

C. Trench to the minimum width allowed for proper installation of the utility, with sides as nearly vertical as possible.

1. Accurately grade the bottom to provide uniform bearing for the utility.

- D. Depressions:
 - 1. Dig bell holes and depressions for joints after the trench has been graded.
 - a. Provide uniform bearing for the pipe on prepared bottom of the trench.
 - 2. Except where rock is encountered, do not excavate below the depth indicated or specified.
 - 3. Where rock is encountered, excavate rock to a minimum overdepth of 4" below the trench depth indicated.
- E. Where utility runs traverse public property or are subject to governmental or utility company jurisdiction, provide depth, bedding, cover, and other requirements as set forth by legally constituted authority having jurisdiction, but in no case less than the depth shown in the Contract Documents.
- F. Where trenching occurs in existing lawns, remove turf in sections, keep damp and replace turf upon completion of the backfilling.
- G. Cover:
 - 1. Provide minimum trench depth indicated below to maintain a minimum cover over the top of the installed item below the finish grade or subgrade:
 - a. Areas subject to vehicular traffic:
 - (1) Sanitary sewers: 48"
 - (2) Storm drains: 36"
 - b. Areas not subject to vehicular traffic:
 - (1) Sanitary sewers: 30"
 - (2) Storm drains: 18"
 - c. All areas:
 - (1) Water lines: 60"
 - (2) Natural gas lines: 24"
 - (3) Electrical cables: 42"
 - (4) Electrical ducts: 36"
 - d. Concrete encased:
 - (1) Pipe sleeves for water and gas lines: 24"
 - (2) Sanitary sewers and storm drains: 12"

(3) Electrical ducts: 24"

2. Where utilities are under a concrete structure slab or pavement, the minimum depth need only be sufficient to completely encase the conduit or pipe sleeve, and electrical long-radius rigid metal conduit riser, provided it will not interfere with the structural integrity of the slab or pavement.
3. Where the minimum cover is not provided, encase the pipes in concrete as indicated.
 - a. Provide concrete with a minimum 28-day compressive strength of 3,000 psi.

3.03 BEDDING:

- A. Provide bedding as indicated on the Drawings and as specified herein.

3.04 BACKFILLING:

A. General:

1. Do not completely backfill trenches until required pressure and leakage tests have been performed, and until the utilities systems as installed conform to the requirements specified in the pertinent Section of these Specifications.
2. Except as otherwise specified, or directed for special conditions, backfill trenches to the ground surface with selected material approved by the DNR Construction Inspector.
3. Re-open trenches which have been improperly backfilled, to a depth as required for proper compaction.
4. Refill and compact as specified, or otherwise correct to the approval of the DNR Construction Inspector.
5. Do not allow or cause any of the work performed or installed to be covered up or enclosed by work of this Section prior to required inspections, test, and approvals.
6. Should any of the work be so enclosed or covered up before it has been approved, uncover all such work and, after approvals have been made, refill and compact as specified, all at no additional cost to the Owner.

B. Lower Portion of Trench:

1. Deposit approved backfill and bedding material in layers of 6" maximum thickness, and compact with suitable tampers of the density of the adjacent soil, or grade as specified herein, until there is a cover of not less than 14' over sewers and 12' over other utility lines.
2. Take special care in backfilling and bedding operations not to damage pipe and pipe coatings.

C. Remainder of Trench:

1. Except for special materials for pavements, backfill the remainder of the trench with material free from stones larger than 6" or 1/2 the layered thickness, whichever is smaller, in any dimension.
2. Deposit backfill material in layers not exceeding the thickness specified, and compact each layer to the minimum density directed by the DNR Construction Inspector.

D. Adjacent to Buildings: Mechanically compact backfill within ten feet of buildings.

E. Consolidation of backfill by jetting with water may be permitted, when specifically approved by the DNR Construction Inspector, in areas other than building and pavement areas.

3.05 PIPE JACKING:

- A. Unless so or otherwise required, the Contractor may, at his option, install steel pipe casings, tongue-and-groove reinforced concrete pipes, and steel pipes under existing roads or pavements by jacking into place using procedures approved by the governmental agencies having jurisdiction and approved by the DNR Construction Inspector.

3.06 TUNNELING OPERATIONS:

- A. Unless so or otherwise required, the Contractor is allowed the option to tunnel pipes into position using procedures approved by the Project Engineer/DNR Construction Inspector and the governmental agencies having jurisdiction.

3.07 FIELD QUALITY CONTROL:

A. Tests: Test for displacement of sewer and storm drains.

1. Check sewers and storm drains to determine whether displacement has occurred after the trench has been backfilled to above the pipe and has been compacted as specified.
2. Flash a light between manholes or, if the manholes have not yet been constructed, between the locations of the manholes, by means of a flashlight or by reflecting sunlight with a mirror.
3. If the illuminated interior of the pipeline shows poor alignment, displaced pipes, or other defects, correct the defects to the specified conditions and at no additional cost to the Owner.

B. Inspection: The DNR Construction Inspector will inspect and approve open cuts and trenches before installation of utilities, and the following:

1. Assure that trenches are not backfilled until all tests have been completed.
2. Check backfilling for proper layer thickness and compaction.
3. Verify that test results conform to the specified requirements, and that sufficient tests are performed.
4. Assure that defective work is removed and properly replaced.

END OF SECTION 02220

PART 1 - GENERAL

1.01 SUMMARY:

- A. Section Includes: The work covered by this section consists of furnishing all materials, labor, and equipment necessary or required to do the grading, placing and compacting of granular base materials as shown on the Drawings and as specified herein.
- B. Related Sections: Drawings and General Provisions of the contract, including the General Covenants and Provisions, Supplementary Covenants and Provisions and General Requirements.
- C. Measurement: Measure the quantity of material delivered in tons.
 - 1. Weigh on accurate scales designed for weighing loaded trucks.
 - 2. Load vehicles to insure against loss of material between the scales and the point of delivery.
 - 3. No deductions will be made for the weight of moisture naturally occurring in the material.
 - 4. Material will not be deposited and spread until the scale weight ticket is delivered to the DNR Construction Inspector and the weight of material verified.
 - a. Include the Contractor's name, date of delivery, designation of mixture, load identification number, gross, tare, and net weights of load and any other data which would aid in the identification of the load.
 - b. Only weight tickets issued by a state licensed scale will be accepted.
- D. Method of Payments:
 - 1. Contract Unit Price: When payment for the work of this section is so designated, the Contractor will be paid the Contract Unit price per ton.
 - a. Material will not be deposited and spread until the scale weight ticket is delivered to the inspector and the weight of material verified.
 - b. In the event that the estimated quantity is larger than the quantity provided, pay the Owner a deduct for the difference in cost for both quantity and labor.

- c. Additional payments for increased quantities or labor will only be allowed if a change order is warranted due to a change in project scope or for unforeseen conditions, as determined by the Project Engineer, in accordance with the provision of the General Conditions of the Contract.
 2. Lump Sum Payment: If this method of payment is so designated, the Contract Documents provide for payment of a lump sum bid amount for the entire project, part of which is the work of this contract, or a lump sum payment for the work of this section as indicated.
 - a. The quantity of material provided will be verified by scale tickets and compared to the estimated quantity provided as part of the Contractor's Price Breakdown.
 - b. In the event that the estimated quantity is larger than the quantity provided, the Contractor shall pay the Owner a deduct for the difference in cost for both quantity and labor.
 - c. Additional payments for increased quantities or labor will only be allowed if a change order is warranted due to a change in project scope or for unforeseen situations, as determined by the Project Engineer, warranting additional material and labor to accomplish the original work of this section.
 3. The Owner will make no additional payments for additional material or labor to correct deficiencies, shortages or mistakes by the Contractor.

1.02 REFERENCES:

- A. Standards of materials and construction shall conform with the Standard Specifications for Highway and Bridge Construction, Series of 2009 of the Iowa Department of Transportation:

Section 1106 - Control of Material
Section 2111 - Granular Subbase
Section 4109 - Aggregate Gradation

1.03 CONTROL OF MATERIALS:

- A. General: Use only materials as specified for this section and tested and approved for use by the DNR Construction Inspector in accordance with the applicable portions of 2009 Series, I.D.O.T. Section 1106.
- B. Samples and Tests: Submit samples of materials to be used to the DNR Construction Inspector in advance of anticipated use to avoid construction delays.
 - 1. Test and inspect and obtain approval of the DNR for each consignment of material before it is incorporated in the work.
 - 2. Unless otherwise designated elsewhere provide samples, and tests, and apply a basis for acceptance in accordance with the current AASHTO "Standard Specifications for Transportation, Material and Methods of Sampling and Testing" including published interim standards.
- C. Field Testing: Testing of materials and workmanship will continue throughout the project as conducted by the DNR Construction Inspector.
 - 1. Cooperate in these tests in any way needed to obtain the required data and samples.
- D. Unacceptable Materials: Unacceptable materials will be rejected as follows:
 - 1. The DNR field inspector will consider unacceptable and reject any material not conforming to the specified requirements.
 - 2. The DNR Inspector will also reject previously accepted material, delivered to the site, which have become damaged before actual incorporation into the work.
 - 3. Promptly remove from the site all rejected material.
 - 4. Unless otherwise authorized by the Project Engineer, do not incorporate corrected rejected material into the work.

1.05 JOB CONDITIONS:

- A. Survey job conditions prior to commencing work.
 - 1. Bring any discrepancies between existing work and the Drawings and Specifications to the attention of the Project Engineer/DNR Construction Inspector.
 - 2. Attempt no work in frozen conditions without written approval from the DNR Construction Inspector.

PART 2 - PRODUCTS

2.01 MATERIALS:

- A. Provide material in accordance with 2009 Series, IDOT Standard Specifications Section 4121.
- B. Class A Crushed Stone: Provide Class A crushed stone consisting of a uniform mixture of coarse and fine particles produced by crushing ledge rock, predominantly limestone, dolomite, or quartzite.
 - 1. Provide material meeting the requirement of IDOT Standard Specifications Section 4121 for graduation number 11 with a maximum of 4 percent mud balls and a minimum of 4 percent passing No. 200 sieve.
 - 2. The percentage of wear when tested in accordance with AASHTO T96, grading B, shall not exceed 45.
 - 3. Gradation: Provide material, which when tested, will meet the requirements of IDOT gradation No. 11 as follows:

<u>% Passing</u>	<u>Sieve Size</u>
100	1 inch
97-100	3/4 inch
30-75	No. 4
15-45	No. 8
6-16	No. 200

PART 3 - EXECUTION

3.1 GENERAL:

- A. Accomplish the work of this section in accordance with the applicable portions of the 2009 Series, IDOT Standard Specification for Highway and Bridge Construction.

3.02 PREPARATION OF SUBGRADE:

- A. Preparation and correction of Subgrade: Conform to 2009 Series, I.D.O.T. Section 2111.
 - 1. Blade loose granular material present on the roadbed into windrow and store on the shoulder area, then correct the subgrade to required profile and cross section.

- a. Wet and consolidate material moved in this operation so that the subgrade on which the next course is placed is smooth, firm, compacted earth.
2. Profile and Cross section requirements:
 - a. Check the cross section with an accurate template extending at least halfway across the width of the subgrade and correct deviations of more than one (1) inch from the template.
 - b. Remove dips or humps from profile to provide a good riding surface.

3.03 PLACING OF CRUSHED STONE COURSE:

- A. Construct base course using crushed rock top course material as defined by IDOT 2009 Series. Place the course in accordance with applicable sections of the IDOT Standard Specifications for Granular Surfacing, Standard Compaction as defined by the IDOT Standard Specifications.

3.05 CLEAN UP:

- A. Upon completion of construction, remove all excess materials and construction debris, and restore any damage done to existing buildings or landscape.

END OF SECTION 02505

PART 1 - GENERAL

1.01 SUMMARY:

- A. Section Includes: Seedbed preparation and application of seed mixtures and fertilizer to all areas designated on the Drawings or all areas within the boundaries of this project having been disturbed by works of this project and not receiving finished surfacing, as determined by the DNR Construction Inspector and as specified herein.
- B. Related Sections: Drawings and General Provisions of the Contract, including the General Covenants and Provisions, Supplementary Covenants and Provisions and General Requirements as well as, but not necessarily limited to, the following:

Section 02200 - Earthwork

1.02 REFERENCES:

- A. Standards of materials and construction shall conform with the Standard Specifications for Highway and Bridge Construction, 2009 Series of the Iowa Department of Transportation.

1.03 QUALITY ASSURANCE:

- A. Codes and Standards: Perform all work of this section in accordance with the requirements of the "Standard Specifications" 2009 I.D.O.T. Section 2601.

1.04 PROJECT/SITE CONDITIONS:

- A. Environmental Requirement:
 - 1. Weather conditions shall be observed. Seeding shall be performed only during normal application periods, optimum temperature, moisture and climatic condition to promote germination and plan growth. Normal application periods are between March 1 and May 31 and between August 10 and September 30.
- B. Existing Conditions: Survey job conditions prior to commencing work. Bring any discrepancies between existing work and the Drawings and Specifications to the attention of the Project Engineer/DNR Construction Inspector.

1.05 SEQUENCING AND SCHEDULING:

- A. Properly coordinate the work of this section with all other trades.
- B. Do not start the work of this section until the work of all other trades has been completed unless otherwise approved by the DNR Construction Inspector.

PART 2 - PRODUCTS

2.01 MATERIALS:

- A. All topsoil used for seedbed shall be in accordance with Section 02200.
- B. All seeds shall be "redtag" quality or better supplied from the latest available crop, free of noxious weed seed and supplied in the following varieties and percentages of weight.
- C. Provide mixture of types and quantities as specified herein for seeding of areas designated by the Project Engineer, the DNR Construction Inspector as indicated on the Drawings, and as specified herein.

- 1. Class "A" Mixture: For areas to remain in semi-natural state where mowing is required only as a temporary control measure.

Fescue, Kentucky 31	25 lbs. per acre
Switchgrass (Blackwell)	8 lbs. per acre
Alfalfa (Northern Grown)	5 lbs. per acre
Birdfoot Trefoil (Empire)	4 lbs. per acre
Alsike Clover	4 lbs. per acre

- 2. Class "B" Mixture: For same situation as where Class "A" mixture is used but where a lighter mix is preferable.

Fescue, Kentucky 31	20 lbs. per acre
Switchgrass (Blackwell)	3 lbs. per acre
Alfalfa (Northern Grown)	4 lbs. per acre
Birdfoot Trefoil (Empire)	4 lbs. per acre
Alsike Clover	4 lbs. per acre

- 3. Class "C" Mixture: For area designated as fine seeded, lawns or other mowed grass areas.

Bluegrass, Kentucky	70%
Ryegrass, Perennial, Fineleaf	10%
Fescue Creeping Red	20%

- 4. Class "D" Mixture: For all areas, unless otherwise specified, where a prairie grass in natural state is required.

- Big Bluestem 30 lbs. per acre
- Switchgrass (Blackwell) 5 lbs. per acre
- Sideoats Grama 5 lbs. per acre
- Little Bluestem 5 lbs. per acre

- D. Seed is to be delivered on site in separate packaging for each individual type of seed within each mixture and mixed in the presence of the DNR Construction Inspector if required. Commercial mixture in the quantities as specified will be acceptable at the discretion of the DNR Construction Inspector, if these quantities are verifiable.

E. Seed mixture for this project to be Class "C" mixture.

2.02 FUNGICIDE:

- A. All seeds for permanent seeding shall be treated with a non-mercurial fungicide (75% concentration or equivalent) at the rate of 5-1/2 ounces per 100 pounds of seed.

PART 3 - EXECUTION

3.01 EXAMINATION:

- A. Examine the areas and conditions under which work of this section will be performed. Correct conditions detrimental to timely and proper completion of the work. Do not proceed until unsatisfactory conditions are corrected.

3.02 SEEDBED PREPARATION:

- A. The area to be seeded shall be raked or graded to fill washes or gullies. Pick up and dispose of all debris, including stones, boulders, logs, stumps, or other foreign material that will interfere with the seeding operation.

3.03 FERTILIZER APPLICATION:

- A. Spread fertilizer over the area at the rate of 750 pounds per acre of 15-15-15 (or equivalent).
- B. Unless otherwise indicated, spread all fertilizer with a mechanical spreader, which will secure a uniform rate of application.
- C. Spread fertilizer after the preliminary preparation of seedbed and prior to the sowing of any seeds.

- D. Disk the fertilizer and roll the area prior to seeding.
- E. On area inaccessible to field machinery, spread fertilizer after preparation of the seedbed and thoroughly rake into the soil.
- F. Application of fertilizer in combination with seeding by hydraulic seeder as specified in I.D.O.T. Section 2601.04H will be acceptable at the discretion of the DNR Construction Inspector.

3.04 SEED APPLICATION:

- A. Preparation: Mix all seeds specified for this project thoroughly at the project site prior to placing in spreading equipment.
- B. On all areas accessible to field machinery, all grass seeds may be sown with a gravity, cyclone or hydraulic seeder as specified herein. On areas inaccessible to field machinery, the use of hand-cyclone seeder will be permitted.
- C. Apply seed mixture at a rate of four pounds per 1,000 square feet, unless otherwise indicated, during fair, calm weather. One half of the seed mixture shall be sown in one direction and the remainder at right angles to the first sowing.

3.05 SEED APPLICATION IN MAINTAINED LAWNS:

- A. For maintained lawns to be seeded as part of this project, apply fertilizer prior to preparation of the seedbed.
- B. A rotary tiller will be required for preparation of the seedbed. The seedbed after tilling will be raked firm, smooth and free of clods, rocks and other debris.
- C. Roll the seedbed shall both before and after the application of seeds. Apply seeds over damp soil by broadcast seeding.
- D. Roll, seed, and fertilize by hand or with hand operated equipment in areas inaccessible to field equipment.

3.06 SPRING OVERSEEDING:

- A. Seedbed preparation will not be required provided the overseeding is applied when the ground is free from frost action after March 1 and before April 1 or as directed by the DNR Construction Inspector.

3.07 MOWING:

- A. When requested by the DNR Construction Inspector, mowing may be required prior to permanent seeding or anytime during the growing season.

3.08 MULCHING:

- A. All seeded areas are to be mulched unless otherwise designated in the contract documents.
- B. All areas requiring mulch are to be mulched as soon as seed is sown and final rolling is completed.
- C. Mulch is to be evenly and uniformly distributed and anchored into the soil. The application rate for reasonably dry material shall be approximately 1-1/2 tons of dry cereal straw, 2 tons of wood excelsior, or 2 tons of prairie hay per acre, or other approved material, depending on the type of material furnished.
 - 1. All accessible mulched areas are to have mulch consolidated into the soil with a mulch stabilizer, and slope areas are to be tucked on the contour.
 - 2. Crawler type or dual wheel tractors are to be used for the mulching operation. Equipment is to be operated in a manner to minimize displacement of the soil and disturbances of the design cross section.

END OF SECTION 02930

PART 1 - GENERAL

1.01 SUMMARY:

- A. Section Includes: All labor, materials, and equipment required to construct, shore, and remove all forms to accommodate all concrete specified in Section 03300, Cast-In-Place Concrete, as shown on the Drawings, and as specified in other sections of these specifications.
- B. Related Sections: Drawings and General Provisions of the Contract, including the General Covenants and Provisions, Supplementary Covenants and Provisions and General Requirements as well as, but not necessarily limited to, the following:

Section 03200 - Concrete Reinforcement
Section 03300 - Cast-In-Place Concrete

1.02 REFERENCES:

- A. Safety: All formwork and methods of construction shall conform to the requirements of the state of Iowa Bureau of Labor and all OSHA Standards.
- B. A.C.I. 347.

1.03 SUBMITTALS:

- A. Provide concrete mix formula to Construction Inspector.
- B. Manufacturer's Data: Within 30 calendar days after award of the contract, submit manufacturer's data and installation instruction for proprietary materials including form coatings, ties and accessories, and manufacturer's form system if used.
- C. Shop Drawings: When requested by the DNR Construction Inspector or the Project Engineer for the purpose of explaining details or structural integrity, the Contractor shall submit those drawings requested prior to construction of the project.

1.04 QUALITY ASSURANCE:

- A. Formwork: Design of formwork is the responsibility of the Contractor.
- B. Standards: Comply with all applicable provisions of ACI 347.

PART 2 - PRODUCTS

2.01 MATERIALS:

- A. Form Materials:
 - 1. Construct formwork for exposed concrete surfaces with smooth-faced undamaged plywood, undented metal, or other panel-type materials acceptable to the DNR Construction Inspector, to provide continuous, straight, plumb, smooth cast surface, furnish in largest practical sizes to minimize number of joints.
 - 2. Provide form material with sufficient thickness to withstand pressure of newly-placed concrete without reflection or bowing.

- B. Form Ties:
1. Provide factory-fabricated, adjustable length removable or snap-off metal form ties, designed to prevent form deflection and to prevent spalling concrete surfaces upon removal.
 2. Provide ties so that portion remaining within concrete after removal of exterior parts is at least 1-1/2" from the outer concrete surface. Form ties shall not leave a hole larger than 1" diameter in the concrete surface.
- C. Form Coating: Provide commercial formulated form-coating compounds that will not bond with, stain, nor adversely affect concrete surfaces requiring bond or adhesion, nor impede the wetting of surfaces to be cured with water or curing compounds.

2.02 DESIGN OF FORMWORK:

- A. General:
1. Design, erect, support, brace, and maintain formwork so that it will safely support vertical and lateral loads that might be applied, until such loads can be supported by the concrete structure.
 2. Carry vertical and lateral loads to ground by formwork system and in-place construction that has attained adequate strength for that purpose.
 3. Construct formwork so that concrete members and structures are of correct size, shape, alignment, elevation, and position.
 4. Design forms and falsework to include assumed values of live load, dead load, weight of moving equipment operated on formwork, concrete mix, height of concrete drop, vibrator frequency, ambient temperature, foundation pressures, stresses, lateral stability, and other factors pertinent to safety of structure during construction.
 5. Provide shore and struts with positive means of adjustment capable of taking up formwork settlement during concrete placing operations, using wedges or jacks or a combination thereof.
 6. Provide trussed supports when adequate foundations for shores and struts cannot be secured.
 7. Support form facing materials by structural members spaced sufficiently close to prevent objectionable deflection.
 8. Fit forms placed in successive units for continuous surfaces to accurate alignment, free from irregularities, and within allowable tolerances.
 9. Provide camber in formwork as required for anticipated deflections due to weight and pressures of fresh concrete and construction loads.
 10. Provide formwork sufficiently tight to prevent leakage of cement paste during concrete placement. Solidly butt joints and provide backup material at joints as required to prevent leakage and fins.
- B. Earth Forms: Side forms of footings may be omitted and concrete placed directly against excavation only when requested by the Contractor and accepted by the DNR Construction Inspector. When omission of forms is accepted, provide additional concrete 1" on each side of the minimum design profiles and dimensions shown.

PART 3 - EXECUTION

3.01 EXAMINATION:

- A. Examine the substrate and conditions under which work of this section is to be performed, and correct unsatisfactory conditions which would prevent proper and timely completion of the work. Do not proceed until unsatisfactory conditions have been corrected.

3.02 ERECTION:

A. General:

1. Construct forms complying with ACI 347, to the exact sizes, shapes, lines, and dimensions shown, and as required to obtain accurate alignment, location, grades, level, and plumb work in finish structures.
2. Provide for openings, offsets, sinkages, keyways, recesses, moldings, reglets, chamfers, blocking, screeds, bulkheads, anchorages, inserts, and other features required. Use selected materials to obtain required finishes.
3. Forms for openings and construction which accommodates installation by other trades whose materials and products must be fabricated before the opportunity exists to verify the measurements of adjacent construction which effects such installations, shall be accurately sized and located as dimensioned on the Drawings. In the event that deviation from the Drawing dimensions results in problems in the field, the Contractor shall be responsible for resolution of the conditions as approved by the Project Engineer, without additional expense to the Owner.

B. Fabrication:

1. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces where the slope is too steep to place concrete with bottom forms only. Kerf wood inserts for forming keyways, reglets, recesses, and the like, to prevent swelling and assure ease of removal.
2. Provide temporary openings where interior area of formwork is inaccessible for cleanout, for inspection before concrete placement, and for placement of concrete. Brace temporary closures and set tightly to temporary openings on forms in as inconspicuous locations as possible, consistent with design requirements. Form intersecting planes to provide true, clean-cut corners.

C. Falsework:

1. Erect falsework and support, brace and maintain it to safely support vertical, lateral, and asymmetrical loads applied until such loads can be supported by in-place construction. Construct falsework so that adjustments can be made for take-up and settlement.
2. Provide wedges, jacks, or camber strips to facilitate vertical adjustments. Carefully inspect falsework and formwork during and after concrete placement operations to determine abnormal deflection or signs of failure; make necessary adjustments to produce work of required dimensions.

D. Forms for Exposed Concrete:

1. Drill forms to suit ties used and to prevent leakage of concrete mortar around tie holes. Do not splinter forms by driving ties through improperly prepared holes.

2. Provide sharp, clean corners at intersecting planes, without visible edges or offsets. Back joints with extra studs or girts to maintain true, square intersections.
 3. Use extra studs, walers, and bracing to prevent objectionable bowing of forms between studs and to avoid bowed appearance in concrete. Do not use narrow strips of form material which will produce bow.
 4. Assemble forms so they may be readily removed without damage to exposed concrete surfaces.
- E. Corner Treatment: Unless shown otherwise, form chamfers with 3/4" x 3/4" strips, accurately formed and surfaced to produce uniformly straight lines and tight edge joints on exposed concrete. Extend terminal edges to required limit and miter chamfer strips at changes in direction.
- F. Control Joints: Locate as directed by DNR Construction Inspector or as indicated on the Drawings.
- G. Provisions for Other Trades: Provide openings in concrete formwork to accommodate work of other trades. Verify size and location of openings, recesses and chases with the trade requiring such items. Accurately place and securely support items to be built into forms.
- H. Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before concrete is placed. Retighten forms immediately after concrete placement as required to eliminate mortar leaks.

3.03 INSTALLATION:

- A. Embedded Items:
1. General: Set and build into the work anchorage devices and other embedded items required for other work that is attached to, or supported by, cast-in-place concrete. Use setting drawings, diagrams, instructions and directions provided by suppliers of the items to be attached thereto.
 2. Edge Forms and Screeds: Set edge forms or bulkheads and intermediate screed strips for slabs to obtain required elevations and contours in the finished slab surface. Provide and secure units to support types of screeds required.
- B. Shores and Supports: Comply with ACI 347 for shoring construction, and as herein specified. Submit a shore removal and re-shoring schedule and drawings for the DNR Construction Inspector review before proceeding with this work. Do not proceed until schedule and drawings have been reviewed.

3.04 APPLICATION:

- A. Form Coating: Coat form contact surfaces with form-coating compound before reinforcement is placed. Do not allow excess form coating material to accumulate in the forms or to come in contact with surfaces which will be bonded to fresh concrete. Apply in compliance with manufacturer's instructions.

3.05 FIELD QUALITY CONTROL:

- A. Inspection: Concrete shall not be placed in forms until inspected by DNR Construction Inspector and permission is given to start placing concrete.

3.06 CLEANING:

- A. General: Formwork not supporting concrete, such as sides of beams, walls, columns, and similar parts of the work, may be removed after cumulatively curing at not less than 10 degrees C (50 degrees F) for 24

hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form removal operation, and provided that curing and protection operations are maintained.

- B. Formwork: Formwork supporting weight of concrete, such as beam soffits, joists, slabs, and other structural elements may not be removed in less than 14 days, and not until concrete has attained design minimum 28-day compressive strength. Determine potential compressive strength of in-place concrete by testing field-cured specimens representative of the concrete location or members, as specified in other sections.
- C. Form-Facing Material: Form-facing material may be removed four days after placement, only if shores and other vertical supports have been arranged to permit removal of form-facing material without loosening or disturbing shores and supports.
- D. Reuse of Forms: Clean and repair surfaces of forms to be reused in the work. Split, frayed, delaminated or otherwise damaged form-facing material will not be acceptable. Apply new form-coating compound material to concrete contact surfaces as specified for new formwork. When forms are reused for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close all joints. Align and secure joints to avoid offsets.

END OF SECTION 03100

PART 1 - GENERAL

1.01 SUMMARY:

- A. Section Includes: All reinforcing steel, steel mesh, and accessories and the installation of these items for all concrete reinforcement for this project.
- B. Related Sections: Drawings and General Provisions of the contract, including the General Covenants and Provisions, Supplementary Covenants and Provisions and General Requirements as well as, but not necessarily limited to, the following:

- Section 03100 - Concrete Formwork
 - Section 03300 - Cast-In-Place Concrete

1.02 REFERENCES:

- A. Comply with all applicable provisions of the following standards:
 - 1. CRSI "Manual of Standard Practice"
 - 2. ACI 315 "Details and Detailing of Concrete Reinforcement"
 - 3. ACI 318 "Building Code Requirements for Reinforced Concrete"

1.03 SUBMITTALS:

- A. Shop Drawings: Submit complete shop drawings of all materials proposed to be furnished and installed under this section in accordance with ACI "Manual of Standard Practice for Detailing Concrete Structure," ACI 315. Show:
 - 1. Bar schedule, stirrup spacing, diagrams of bent bars, arrangements and assemblies.
 - 2. Review shop drawings requirements with DNR Construction Inspector before ordering shop drawings.
- B. Mill Certificates: Submit steel producer's certificates of mill analysis, tensile and bend tests for reinforcing steel.

1.04 DELIVERY, STORAGE AND HANDLING:

- A. Delivery: Deliver reinforcement to the job site bundled, tagged, and marked. Use metal tags indicating bar size, lengths, and other information corresponding to markings shown on placement diagrams.
- B. Storage: Store reinforcement at the job site in a manner to prevent damage and accumulation of dirt and excessive rust.

PART 2 - PRODUCTS

2.01 MATERIALS:

- A. Steel and Wire Reinforcement: Reinforcing steel shall consist of deformed bars of the size called for on the Drawings. Steel shall conform to ASTM A615 Grade 40. Deformation shall conform to ASTM A305. Mill certificates showing conformity with these requirements shall be furnished to the Project Engineer for each melt. Wire reinforcement shall conform to ASTM A82. Welded wire fabric shall conform to ASTM A185.
- B. Tie Wire: No. 16 double annealed iron wire.
- C. Accessories: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcement in place:
 - 1. Use wire bar-type supports complying with CRSI recommendations, unless otherwise indicated. Do not use wood, brick and other such unacceptable materials.
 - 2. For slabs on grade, use supports with sand plates or horizontal runners where base material will not support chair legs.
 - 3. For exposed-to-view concrete surfaces, where legs of supports are in contact with forms, provide supports with either hot-dip galvanized or plastic protected legs.

PART 3 - EXECUTION

3.01 EXAMINATION:

- A. Examine the substrate, formwork, and the conditions under which concrete reinforcement is to be placed, and correct conditions which would prevent proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected.

3.02 INSTALLATION:

A. General:

- 1. Comply with the specified standards for details and methods of reinforcement placement and supports, and as herein specified.
- 2. Clean reinforcement to remove loose rust and mill scale, earth, and other materials which reduce or destroy bond with concrete.
- 3. Position, support, and secure reinforcement against displacement by formwork, construction, or concrete placement operations. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers, as required.
- 4. Place reinforcement to obtain the minimum coverages for concrete protection. Arrange, space, and securely tie bars and bar supports together with 16 gauge wire to hold reinforcement accurately in position during concrete placement operations. Set wire ties so that twisted ends are directed away from exposed concrete surfaces.
- 5. Bars are to be tied at all intersections except where spacing is less than one foot in each direction, in which case alternate intersections are to be tied.
- 6. Install welded wire fabric in lengths as long as practicable. Lap adjoining pieces at least one full mesh.
- 7. Provide sufficient numbers of supports and of strengths to carry reinforcement. Do not place reinforcing bars more than 2" beyond the last leg of any continuous bar support. Do not use supports as bases for runways for concrete conveying equipment and similar construction loads.

8. Splices: Provide standard reinforcement splices by lapping ends, placing bars in contact, and tightly wrapping tie wire around bars.
9. Galvanized or epoxy coated reinforcement: Weight of reinforcement will be calculated from the theoretical weight of the nominal sizes and actual lengths of the various sizes of reinforcement shown on the plans. No adjustment in weight will be made for galvanizing or epoxy coating.

END OF SECTION 03200

PART 1 - GENERAL

1.01 SUMMARY:

- A. Section Includes: Provisions for all labor and materials required to construct all walls, footings, piers and slabs, and all other work or items classified as cast-in-place concrete.
1. All concrete foundations and slabs as shown on the project plan, floor plans and building sections, as well as all other concrete not specified elsewhere, are classified as cast-in-place concrete.
- B. Related Sections: Drawings and General Provisions of the Contract, including the General Covenants and Provisions, Supplementary Covenants and Provisions and General Requirements as well as, but not necessarily limited to, the following:

Section 03100 - Concrete Formwork
Section 03200 - Concrete Reinforcement

1.02 REFERENCES:

- A. Codes and Standards: Comply with provisions of following codes, specifications and standards except where more stringent requirements are shown or specified.
1. Uniform Building Code, U.B.C., 1985 edition.
2. American Concrete Institute (ACI).
- a. Manual of Concrete Practice.
- b. ACI 301 - Specifications for Structural Concrete for Buildings.
- c. ACI 304 - Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete.
- d. ACI 305 - Hot Weather Concreting.
- e. ACI 306 - Cold Weather Concreting.
- f. ACI 308 - Standard Practice for Curing Concrete.
- g. ACI 318 - Building Code Requirements for Reinforced Concrete.
3. American Society for Testing of Materials (ASTM).
- a. ASTM C33 - Standard specification for concrete aggregates.
- b. ASTM C31 - Making and curing compressive and flexural strength test specimens in the field.
- c. ASTM C94 - Standard specification for ready-mixed concrete.
- d. ASTM C138 - Test for unit weight, yield and air content of concrete.

- e. ASTM C143 - Test for slump test of portland cement concrete.
 - f. ASTM C150 - Standard specification for portland cement.
 - g. ASTM C260 - Standard specification for air-entraining admixture for concrete.
 - h. ASTM C309 - Standard specification for liquid membrane-forming compounds for curing concrete.
 - i. ASTM C494 - Standard specification for chemical admixtures for concrete.
 - j. ASTM D994 - Standard specification for pre-formed expansion joint filler for concrete.
 - k. ASTM D1850 - Standard specification for concrete joint sealer, cold application type.
- 4. Concrete Reinforcing Steel Institute (CRSI).
 - a. Manual of Standard Practice.
 - 5. State of Iowa Building Code, latest edition.

1.03 SUBMITTALS:

- A. Product Data: Submit manufacturer's product data with application and installation instructions for proprietary materials and items, accessories, admixtures, patching compounds, water stops, joint systems, curing compounds, dry-shake finish materials, and others as required by Project Engineer.
- B. Samples: Submit samples of materials specified as requested by Project Engineer including names, sources and descriptions.
- C. Quality Control Submittals:
 - 1. Design Data: Submit data on proposed design mixes when trial batch method is used.
 - 2. Test Reports: Employ, when necessary, at Contractor's expense, a testing laboratory acceptable to the Project Engineer to perform material evaluation tests and submit reports.
 - 3. Material Certificates: Provide materials certificates in lieu of materials laboratory test reports when permitted by Project Engineer. Material certificates shall be signed by Manufacturer and Contractor certifying that each material item complies with or exceeds specified requirements.

1.04 QUALITY ASSURANCE:

- A. Qualifications:
 - 1. During the progress of installation of the work of this section, provide at least one worker who shall be thoroughly familiar with the specified requirements, completely trained and experienced in the necessary skills, and who shall be present at the site and shall direct all work performed under this section.
 - 2. Use adequate numbers of skilled workers to ensure installation in strict accordance with the approved design.

1.05 DELIVERY, STORAGE, AND HANDLING:

- A Protection: Use all means necessary to protect the materials of this section before, during, and after installation and to protect the work and materials of all other trades.
- B Replacement: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Project Engineer and at no additional cost to the Owner.

1.06 PROJECT/SITE CONDITIONS:

- A Environmental Requirements: Weather conditions shall be observed. No work shall be attempted in frozen conditions without written approval from the DNR Construction Inspector.
- B Existing Conditions: Review job conditions prior to commencing work. Bring any discrepancies between existing work and the Drawings and Specifications to the attention of the Project Engineer/DNR Construction Inspector.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

- A Subject to compliance with requirements, products from the following manufacturers can be incorporated into the work of this section.
 - 1. Euclid Chemical Co., 19218 Redwood Road, Cleveland, Ohio 44110.
 - 2. Master Builders Co., Ltd., 79 Kincort Street, Toronto, Ontario M6M3E4.
 - 3. Sika Chemical Corporation, P. O. Box 297, Lyndhurst, New Jersey 07071.
 - 4. Chem-Master Corporation, 477 Industrial Parkway, Chagrin Falls, Ohio 44022.
 - 5. W. R. Grace and Co., 62 Wittemore Avenue, Cambridge, Massachusetts 02140.
 - 6. W. R. Meadows, Inc., P. O. Box 543, Elgin, Illinois 60120.
 - 7. Protex Industries, Inc., 1331 West Evans Avenue, Denver, Colorado 80223.
 - 8. Sonneborn Building Products, 7711 Computer Avenue, Minneapolis, Minnesota 55435.
 - 9. Antihydro Co., 265 Badger Avenue, Newark, New Jersey 07108.
 - 10. L & M Construction Chemicals, Inc., 8316 Blondo Street, Omaha, Nebraska 68134.
 - 11. Glifford-Hill and Co., Inc., Woodland Green, Charlotte, North Carolina 28210.
 - 12. The Celotex Corporation, 1500 North Dale Mabry Highway, Tampa, Florida 33607.
 - 13. J & P Petroleum Products, Tex-Mastic Construction Materials, 2715 South Westmoreland, P. O. Box 4206, Dallas, Texas 75208.

2.02 MATERIALS:

- A Portland Cement: ANSI/ASTM C 150, Type I or Type III, high early-strength cements, unless otherwise acceptable to Project Engineer.

- B. Normal Weight Aggregates: ANSI/ASTM C 33, and as herein specified.
1. Coarse aggregate for concrete shall consist of gravel or crushed stone particles, from a source approved by Iowa D.O.T., or combinations of these materials. The aggregate shall meet these requirements:
 - a. Abrasion loss: The percent of wear, determined in accordance with AASHTO T 96, Grading A or B, shall not exceed 35 for gravel and 50 for other crushed stone.
 - b. Durability: Coarse aggregate durability shall be a minimum of Class 1. Aggregate of Class 2 or Class 3 durability may be furnished by the Contractor, with the Project Engineer's approval, and at no extra cost to the Owner.
 - c. Gradation: Coarse aggregate shall meet requirements of D.O.T. Section 4109, Gradation No. 3, 4, or 5.
 - d. Maximum size of coarse aggregate: Not more than three-fourths minimum clear spacing between reinforcing bars and not more than one-fifth of smallest dimension of slab or member for which concrete is being used. Coarse aggregate for un-reinforced slabs maximum size one-third of slab thickness.
 2. Fine aggregate for concrete shall consist of clean, hard, durable mineral aggregate particles free from injurious amounts of silt, shale, coal, organic matter, or other deleterious material, and shall be from a source approved by Iowa D.O.T. The aggregate shall meet these requirements:
 - a. Gradation: Fine aggregate shall meet the requirements of D.O.T. Section 4109 for Gradation No. 1.
- C. Water: Water for concrete shall be clean, potable and free from injurious amounts of foreign matter.
- D. Water-Reducing Admixtures: ANSI/ASTM, C 494, Type A and contain not more than one percent (1%) chloride ions.
- "Eucon WR-74;" Euclid Chemical Co.
 "Pozzolith 322N;" Master Builders.
 "Plastocrete 160;" Sika Chemical Corp.
 "Chemtard;" Chem-Masters Corp. or approved equal
- E. Air-Entraining Admixture: ANSI/ASTM C 260, added to mixer in lieu of air-entrained cement.
- "Darex (AEA);" W. R. Grace Co.
 "Ad-Aire;" Carter-Waters Corp.
 "Protex AES;" Protex Industries, Inc.
 "Seal-Tight;" W. R. Meadows, Inc. or approved equal
- F. Liquid Membrane-Forming Curing Compound: Liquid type membrane-forming curing compound complying with ANSI/ASTM C 309, Type II, Class A unless other type acceptable to Project Engineer.
- "Masterseal;" Master Builders.
 "A-H 3 Way;" Sealer' Anti-Hydro Waterproofing Co.
 "Ecocure;" Euclid Chemical Co.
 "Clear Seal;" W. R. Grace.
 "Kure-N-Seal;" Sonneborn-Contech.
 "Polyclear;" Upco Chemical/USM Corp.
 "L & M Cure;" L & M Construction Materials.

"LR-151;" Protex Industries.
"Spec City White;" SpecChem or approved equal

1. Curing compound shall form a continuous unbroken membrane which shall adhere to moist concrete and which will not disintegrate, check or peel from the surface, nor show signs of such deterioration within 30 days after application under actual working conditions. The compound shall be sufficiently transparent and free from color so there will be no permanent change in the color of the concrete. The compound shall contain, however, a temporary dye of sufficient color to make the membrane clearly visible for a period of at least four hours after application.

2.03 EQUIPMENT:

- A. Batching, Mixing, and Delivery Equipment: Use transit-mixed concrete from approved batching and mixing plant. Batch, mix, and transport concrete to site in accordance with ANSI/ASTM 94.
- B. When air temperature is between 85°F. (30°C) and 90°F. (32°C), reduce mixing and delivery time from 1 1/2 hours to 75 minutes; and when air temperature is above 90°F. (32°C), reduce mixing and delivery time to 60 minutes.

2.04 ACCESSORIES:

- A. Pre-formed Joint Filler: ASTM D 994 and as herein specified.
 1. Pre-formed non-extruding resilient material, one-half (1/2) inch wide and of the depth required to bring surface to within one-half (1/2) inch of finished surface.
 2. Available Products: Subject to compliance with requirements, products that may be incorporated in the work include, but are not limited to, the following:

"Flexcell;" Celotex Corporation.
"Sealtight;" W. R. Meadows, Inc.
"Tex Mastic;" J & P Petroleum Products. or approved equal
- B. Joint Sealer: ASTM D-1850 Concrete Joint Sealer, cold-application type.
- C. Vapor Barrier: Under slabs on ground, 4 mil polyethylene film, when required by the Drawings.
- D. Storage: Store all cement materials in weather-tight enclosure, clear of ground, and protected from weather with suitable covering.
- E. Embedded Items: Verify and coordinate embedded items furnished by other trades.
- F. Keyways and/or Expansion Tubes: IDOT Section 4191, Series of 2009, or as required by the Drawings.
- G. Admixtures: Use air-entraining admixture in exterior exposed concrete, unless otherwise indicated as determined by IDOT Section 2301.04C. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having air content within following limits:
 1. Concrete structures and slabs exposed to freezing and thawing or subjected to hydraulic pressure:

<u>Maximum Size Aggregate</u>	<u>Amount of Air (%)</u>
1 1/2" or 2"	5% +/-1%
3/4" or 1"	8% +/- 2%
 2. Concrete pavement: Slip form or non slip form, 7.5% plus 1.5% minus 1.0%.

2.05 MIXES:

- A. Prepare design mixes for each type and strength of concrete by either laboratory trial batch or field experience methods as specified in ACI 301. If trial batch method used, use an independent testing facility acceptable to Project Engineer for preparing and reporting proposed mix designs. The testing facility shall not be the same as used for field quality control testing unless otherwise acceptable to Project Engineer.
- B. Design mixes to provide normal weight concrete with the following properties for Class C concrete, or as indicated on drawings and schedules:
 - 1. 4000 psi 28-day compressive strength; 492 lbs. cement per cubic yard minimum; W/C ratio, 0.600 maximum.
- C. Consistency: The quantity of water required for the proper consistency of concrete shall be determined by the slump test in accordance with ANSI/ASTM C 143. Slump allowances shall be as follows:
 - 1. Vertical Wall Sections, Columns -- Maximum slump, 4 inches, plus or minus one inch tolerance.
 - 2. Footings, Beams, Slabs -- Maximum slump, 3 inches, plus or minus one inch tolerance.

PART 3 - EXECUTION

3.01 EXAMINATION:

- A. Coordinate the installation of joint materials and moisture barriers with placement of forms and reinforcing steel.
- B. Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or cast-in. Notify other crafts to permit installation of their work; cooperate with other trades in setting such work. Moistened wood forms immediately before placing concrete where form coatings are not used.

3.02 PREPARATION:

- A. Drain and pump all water from excavations, forms, and any locations where concrete is to be placed. Bottom of excavations shall be undisturbed earth free of frost or debris, level and compacted. Do not place any concrete until the DNR Construction Inspector has inspected and approved forms and soil conditions, and until reinforcing, sleeves, and embedded items have been placed. Clean all dirt and debris from transporting equipment. Clean reinforcement of all foreign matter. Clean forms and oil or wet (except in freezing conditions) surfaces. Compact, level, and dampen base fill material under slabs on grade. Prior to placing concrete, install polyethylene vapor barrier under interior slabs. Do not puncture or otherwise damage vapor barrier or membrane waterproofing.
- B. Transport concrete to prevent separation of materials in accordance with ACI practices. Do not add water to concrete during transporting. Handle from mixer to point of placement with carts, buggies, or conveyors. Do not dump concrete from mixer or from transporting equipment with a free fall of more than three feet. Deposit concrete as nearly to its final position as possible. Clean transporting equipment at frequent intervals during placement. Do not use partially hardened or contaminated concrete.

3.03 PLACEMENT OF CONCRETE:

- A. Place concrete in accordance with ACI 304 "Recommended practice for measuring, mixing, transporting and placing concrete" and as herein specified.

- B. Deposit concrete continuously or in layers of such thickness that no concrete will be placed on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as herein specified. Deposit concrete as nearly as practicable to its final location to avoid segregation.
- C. Place concrete continuously so that fresh concrete is not placed against hardened concrete to form seams or planes of weakness. Work concrete into corners and around reinforcement. Machine vibrate sufficiently to insure thorough compaction and complete embedment of reinforcing. Stop placement at point of no shear, or where directed, and erect tight, plumb dams through forms. Place concrete between construction joints in one continuous operation. Locate construction joints in slabs under partitions. Brush on neat cement when pouring against hardened concrete.
- D. Placing Concrete in Forms: Deposit concrete in forms in horizontal layers not deeper than 24" and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.
 - 1. Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding or tamping. Use equipment and procedures for consolidation of concrete in accordance with ACI recommended practices.
 - 2. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations not farther than visible effectiveness of machine. Place vibrators to rapidly penetrate placed layer and at least six (6) inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing segregation of mix.
- E. Placing Concrete Slabs: Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints, until the placing of a panel or section is completed.
 - 1. Consolidate concrete during placing operations so that concrete is thoroughly worked around reinforcement and other embedded items and into corners.
 - 2. Bring slab surfaces to correct level with straight edge and strike off. Use bull floats or darbies to smooth surface, free of humps or hollows. Do not disturb slab surfaces prior to beginning finishing operations.
 - 3. Maintain reinforcing in proper position during concrete placement operations.
- F. Cold Weather Placing: Protect concrete work from physical damage or reduced strength which could be caused by frost, freezing actions, or low temperatures, in compliance with ACI 306, "Cold Weather Concreting," and as herein specified.
 - 1. When air temperature has fallen to or is expected to fall below 40°F. (4°C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 40°F. (4°C), and not more than 80°F. (27°C) at point of placement, and maintain minimum temperature over the entire work for no less than 72 hours.
 - a. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
 - b. Do not use calcium chloride, salt and other materials containing antifreeze agents or chemical accelerators unless otherwise accepted in mix designs.

- G. Hot Weather Placing: When hot weather conditions exist that would seriously impair quality and strength of concrete, place concrete in compliance with ACI 305, "Hot Weather Concreting," and as herein specified:
1. Cool ingredients before mixing to maintain concrete temperature at time of placement below 90°F. (32°C). Mixing water may be chilled, or chopped ice may be used to control temperature provided water equivalent of ice is calculated in total amount of mixing water.
 2. Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that steel temperature will not exceed the ambient air temperature immediately before embedment in concrete.
 3. Wet forms thoroughly before placing concrete.
 4. Use water-reducing retarding admixture (Type A) when required by high temperatures, low humidity, or other adverse placing conditions.
- H. Construction Joints: Contractor to submit placement and type of construction joints to Project Engineer for review prior to placement of any concrete on the project.
- I. Expansion Joints: Install expansion joint filler where interior slabs abut exterior walls, interior bearing walls and columns, at perimeter of concrete equipment pads, and other necessary locations as determined by the inspector. Omit expansion joint filler and install 15 lb. felt, centered below doors, to break bond at exterior doors with concrete platforms, unless otherwise shown on the Drawings.
- J. Construction Joints: When placing of concrete in any section of a structure must be interrupted, a construction joint shall be located as shown on the drawings in a manner that will not impair the strength or appearance of the structure, or as approved by the Engineer. The surface of the concrete in horizontal joints, except in the area near the form, shall be left rough to increase the bond with concrete that is to be placed later. Keyways shall be embedded not less than 1 ½ inches by 3 inches into the surface of the concrete. Construction joints shall be located in planes perpendicular to the principal lines of stress and at points designated by the Engineer.
- K. Control Joints: Cut control joints in all exposed concrete slabs on grade, as directed by the Inspector. Locate in a uniform pattern throughout parking areas. Verify location and cut to depth of one-sixth (1/6) of slab thickness with minimum of three-fourths (3/4) inch depth. Cut with carborundum saw, approximately six (6) to twenty-four (24) hours after placing concrete and when a minimum amount of raveling occurs in concrete.
1. On exterior walks, score with one-fourth inch by one inch (1/4" x 1") deep control joints. Use straight edge guide when scoring joints. Where required depth of control joint cannot be made by scoring, cut joints with carborundum saw.

3.04 CONCRETE FINISHING:

- A. Finish on Formed Surfaces: All finished or formed surfaces shall conform accurately to the shape, alignment, grades and sections as shown on the Drawings. Surfaces shall be free from fins, bulges, ridges, offsets, honeycombing or roughness, and shall present a finished, continuous, hard surface. All sharp angles, where required, shall be rounded or beveled.
1. Rough Form Finish:
 - a. Provide as-cast rough form finish to formed concrete surfaces that are to be concealed in the finish work or by any other construction.

f. Cut down high spots and fill low spots, uniformly slope surfaces to drains where required.

h. Immediately after leveling, re-float the surface to a uniform, smooth, granular texture.

3. Trowel Finish:

a. Apply trowel finish to monolithic slab surfaces that are to be exposed to view, unless otherwise shown, and to slab surfaces that are to be covered with resilient flooring, carpeting, paint, or other thin-film finish coating system.

b. After floating, begin the first trowel finish operation using a power-driven trowel. Begin final troweling when the surface produces a ringing sound as the trowel is moved over the surface.

c. Consolidate the concrete surface by the final hand troweling operation, free from trowel marks, uniform in texture and appearance, and with a surface plane tolerance not exceeding one-eighth inch (1/8") in ten feet (10'-0") when tested with a ten-foot (10'-0") straight edge.

d. Grind smooth those surface defects which would telegraph through applied floor covering system.

4. Coordinate the required finish with the Project Engineer or DNR Construction Inspector prior to the application.

3.05 CONCRETE CURING:

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

1. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Weather permitting; keep continuously moist for not less than seven (7) days.

2. Begin final curing procedures immediately following initial curing and before concrete has dried. Continue final curing for at least seven (7) days in accordance with ACI 308, "Standard Practice for Curing Concrete." Avoid rapid drying at end of final curing period.

B. Curing Method: Perform curing of concrete by moist curing, by moisture-retaining cover curing, by curing compound, and by combinations thereof as herein specified.

1. Provide moisture curing by the following methods:

a. Keep concrete surface continuously wet by covering with water.

b. Continuous water-fog spray.

c. Covering concrete surface with specified absorbent cover, thoroughly saturating cover with water and keeping continuously wet. Place absorbent cover to provide coverage of concrete surfaces and edges, with four-inch (4") lap over adjacent absorbent cover.

2. Provide moisture-cover curing as follows: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width with sides and ends lapped at least three inches (3") and sealed by waterproof tape or adhesive. Immediately repair any holes and tears during curing period using cover material and waterproof tape.

3. Provide curing compounds for slabs as follows: Apply specified curing and sealing compound to concrete slabs as soon as final finishing operations are complete (within two (2) hours). Apply uniformly in continuous operation by power-spray or roller in accordance with manufacturer's

directions. Re-coat areas subjected to heavy rainfall within three (3) hours after initial application. Maintain continuity of coating and repair damage during curing period.

4. Do not use membrane curing compounds on surfaces which are to be covered with coating material applied directly to concrete, liquid floor hardener, waterproofing, dampproofing, membrane roofing, flooring, painting, and other coatings and finish materials, unless otherwise acceptable to the coating manufacturer.

3.06 MISCELLANEOUS CONCRETE ITEMS:

- A. Filling-In: Fill-in holes and openings left in concrete structures for passage of work by other trades, unless otherwise shown or directed, after work of other trades is in place. Mix, place, and cure concrete as herein specified to blend with in-place construction. Provide other miscellaneous concrete filling shown or required to complete work.
- B. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on the Drawings or required for the machine and equipment actually furnished. Set anchor bolts for machines and equipment to template, at correct elevations, complying with certified diagrams or templates of the manufacturer furnishing the machines and equipment. Provide isolation joints surrounding bases where indicated or required.

3.07 FIELD QUALITY CONTROL:

- A. Test of Materials and Installed Work: Materials and installed work may require testing and re-testing, as directed by Project Engineer, at any time during progress of work. Allow free access to material stockpiles and facilities. Tests, not specifically indicated to be done at Owner's expense, including re-testing of rejected materials and installed work, shall be done at Contractor's expense.
 1. Slump Tests: Take one slump test for each 10 cubic yards, or as directed by Project Engineer, of concrete placed at one operation in accordance with ASTM C 143. Keep job record of test results and location.
 2. Control Tests: During placement of concrete, take three standard 6" test cylinders in accordance with ACI 318-63 and ASTM C 31 for each type of concrete used. Test one at seven (7) days and one at twenty-eight (28) days. Take one set for every 20 cubic yards and any fraction with a minimum of one set of three cylinders for each day's pour. Tag cylinders to show date and location of test cylinder. Have compressive strength tests made by independent laboratory and results sent directly to Project Engineer. Hold remaining cylinders in case of breakage. Should retention at job site delay testing beyond seven (7) days, fourteen (14) day test is acceptable. Keep test cylinders shaded and damp until sent to laboratory.

3.08 REMEDIAL WORK:

- A. General: Reinforce or replace deficient work as directed by the Project Engineer or DNR Construction Inspector and at no additional cost to the Owner.
- B. Patching: Repair defective areas and fill form-tie holes and similar defects in accordance with ACI 301. Where, in the opinion of the DNR Construction Inspector, surface defects such as honeycomb occur, repair the defective areas as directed by the Project Engineer or DNR Construction Inspector.

3.09 PROTECTION OF CONCRETE CONSTRUCTION:

- A. All surfaces shall be protected against injury. During the first 72 hours after placing the concrete, any wheeling, working or walking on the concrete shall not be permitted. All slabs subject to wear shall be covered with a layer of sand or other suitable material as soon as the concrete has set. Sisalcraft paper or

other similar tough waterproof paper may also be used, provided all joints between adjacent strips of paper are carefully sealed. This does not alter the requirements for proper curing.

- B. Do not place concrete slabs or top surfaces of walls during rain unless acceptable protective shelter is provided; and during such weather, all concrete placed within the preceding 12 hours shall be protected with waterproof canvas or other suitable coverings. These shall be provided and kept ready at hand.
- C. All concrete construction shall be protected from excessive loading. Installation of mechanical and electrical equipment shall be accomplished by employing shores, bearing plates, frames, cranes and temporary beams.

END OF SECTION 03300

PART 1 - GENERAL

1.01 SUMMARY:

- A. Section Includes: Furnishing all materials, labor, and equipment necessary or required for all masonry work as indicated on the Drawings and as specified herein.
- B. Related Sections: Drawings and General Provisions of the Contract, including the General Covenants and Provisions, Supplementary Covenants and Provisions and General Requirements as well as, but not necessarily limited to, the following:
 - Section 03300 - Cast-In-Place Concrete
 - Section 07200 - Insulation
 - Section 07600 - Flashing and Sheet Metal
 - Division 8 - Openings
- C. Requirements of this section apply to masonry work specified in Division-4 section "Reinforced Unit Masonry."

1.02 REFERENCES:

- A. Codes and Standards: In addition to complying with all pertinent codes and regulations, comply with the recommendations of the Brick Institute of America (BIA) for Brick Masonry, and the National Concrete Masonry Association (NCMA) for Concrete Block Unit Masonry.

1.03 SUBMITTALS:

- A. Provide submittals in accordance with Section 01300 – Submittal Requirements.
- B. Product Data: Submit manufacturer's product data for each type of masonry unit, accessory, and other manufactured products, including certification that each type complies with specified requirements.
- C. Samples: Submit, for verification purposes, samples of each exposed masonry unit and colored masonry mortar, if any.
 - 1. Include in each set of samples the full range of exposed colors and textures to be expected in completed work.

1.04 QUALITY ASSURANCE:

- A. Qualification of Workers: Use adequate numbers of skilled workers who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this section.
- B. Supervision: Provide one skilled mason who shall be present at all times during execution of this portion of the work and who shall personally direct all work performed under this section.
- C. In the event that product certification for load bearing concrete masonry blocks is deemed insufficient to prove that they meet specified requirements, the Architect/DNR Construction Inspector may require that they be tested in accordance with ASTM Method C140.
- D. Mock-Ups: Prior to proceeding with the remainder of the work of this section, construct a portion of each type of masonry wall to establish for the DNR Construction Inspector's review and approval the general construction and appearance of the installed masonry units.

1. Upon the DNR Construction Inspector's approval of the mock-ups, complete all required masonry construction in strict accordance with the standards reviewed and approved in the mock-ups.

1.05 DELIVERY, STORAGE AND HANDLING:

- A. Mortar Materials: All cementitious mortar materials shall be delivered in unbroken original containers and immediately placed in off-ground storage and adequately covered to fully protect from moisture and the elements.
 1. This will require tight sheds or temporary frame enclosures with watertight covers, and elevated floors, until use can be and is made of portions of the complete structure.
 2. All masonry sand shall be stored in an approved manner to prevent inclusion of contaminants or foreign matter.
- B. Masonry Units: At all times prior to use, concrete masonry units shall be stored off ground in such a manner as to prevent damage, intrusion of foreign matter or wetting by capillary action, and adequately covered to completely protect from the elements.
 1. Stack and cover units in a manner that will permit circulation of air but prevent excessive moisture absorption.
 2. Store all clay masonry units off the ground in such a manner as to prevent damage or intrusion of foreign matter, and keep from becoming saturated.
 3. Use masonry units free from water film or frost on the surfaces when they are laid in the wall.
 4. Do not wet concrete masonry units under any circumstances.
 5. Use no frozen materials or place new work over frozen work.
- C. Reinforcing: Store all reinforcing off the ground.
 1. Place only reinforcement free from dirt, rust, ice, and undesirable coatings that could destroy or seriously reduce bond.

1.06 PROJECT/SITE CONDITIONS:

- A. Protection of Work: During erection, cover top of walls with waterproof sheeting at end of each day's work.
 1. Cover partially completed structures when work is not in progress.
 2. Extend cover a minimum of 24 inches down both sides and hold cover securely in place.
 3. Do not apply uniform floor or roof loading for at least 12 hours after building masonry walls or columns.
 5. Do not apply concentrated loads for at least three (3) days after building masonry walls or columns.
- B. Staining: Prevent grout or mortar or soil from staining the face of masonry to be left exposed or painted.
 1. Remove immediately grout or mortar in contact with such masonry.
 2. Protect base of walls from rain-splashed mud and mortar splatter by means of coverings spread on ground and over wall surface.
 3. Protect sills, ledges and projections from droppings of mortar.

C. Cold Weather Protection:

1. Do not lay masonry units which are wet or frozen.
2. Remove any ice or snow formed on masonry bed by carefully applying heat until top surface is dry to the touch.
3. Remove all masonry determined to be damaged by freezing conditions.
4. Prior to any cold weather construction, obtain the approval of the DNR Construction Inspector and obtain procedures and temperature ranges for conducting cold weather masonry construction work.

1.07 SEQUENCING AND SCHEDULING:

- A. Contact mechanical and electrical trades contractors before starting construction of walls and advise them when walls in various areas will be built so that their work can be completed and properly built into the walls.
- B. Provide openings in walls required by other trades and point up joints between masonry and metal work.
 1. Verify size of openings and recesses where equipment is to be built in with contractor providing equipment.
- C. Extend walls from floor to ceiling or roof construction and, unless specified or shown otherwise, wedge tight to structural surfaces at top.
 1. At labeled openings, provide solid concrete or brick units.

PART 2 - PRODUCTS

2.01 MATERIALS:

- A. General:
 1. Obtain masonry units from one manufacturer, of uniform texture and color for each kind required, for each continuous area and visually related areas.
 2. Provide units complying with standards referenced and requirements indicated.
 3. Do not incorporate blocks in the work of this section which are not yet 30 days old from the date of manufacture.
 4. In the event that the Architect/DNR Construction Inspector requires laboratory testing, hold blocks in storage in manufacturer's yard or on site until receipt of the result of testing.
 5. Certification as to the date of manufacture will be required before blocks may be used.
 6. Blocks must be dry before laying.
 7. Blocks and bricks shall be true to size without cracks, chips, spawls, splits or other defects which may impair their strength, durability, or appearance.
 8. Saw cut block requiring cutting, trimming or mitering to provide perfect joints and to avoid spawling.
- B. Brick:
 1. Face brick shall be made from fire clay, shale or mixture thereof, burned and manufactured to comply with the requirements of the State Building Code and ASTM C216, Grade SW, Type FBS, except where superseded by more stringent requirements mentioned herein.

2. Texture and color will be selected by the Engineer from manufacturer's standard texture and standard color group.
 3. Size: Standard Modular -- 2-1/4" x 3-5/8" x 7-5/8".
 4. For sills, caps, and similar applications resulting in exposure of brick surfaces which otherwise would be concealed from view, provide uncored or unfrogged units with all exposed surfaces finished.
- C. Concrete Masonry Units:
1. Exterior hollow load bearing block units shall conform to ASTM C90, Grade N.
 2. Interior hollow load bearing block units shall conform to ASTM C90, Grade S.
 3. Size: Manufacturer's standard units with nominal face dimensions of 16" long x 8" (15-5/8" x 7-5/8" actual).
 4. Special Shapes: Provide where required for lintels, corners, jambs, sash, control joints, headers, bond blocks, and other special conditions.
 5. Solid load bearing block units shall conform to ASTM C145, Grade N.
 6. Texture and color selected by Engineer.
- D. Glass masonry Units:
- E. Accessories:
1. Trussed Reinforcement: 9 gauge Dur-O-Wall, or Wal-Truss with deformed longitudinal wires and galvanized at exterior cavity walls.
 2. Wire: Cold-drawn conforming to ASTM A82-66.
 3. Tie Bars: Galvanized 1/4" x 1" x 24", with 3" rigid angle bends each end.
 4. Mesh Ties: 3.4 lb. galvanized diamond mesh, not less than 12" long and 1" less than wall thickness in width.
 5. Composition Flashing: Nevastral Seal-Pruf H-D, Wascoseal Type 20 Luxsuco 20 mil Concealed Flashing, or B.F. Goodrich 20 mil vinyl.

2.02 EQUIPMENT:

- A. Furnish, as part of the work of this section, barricades and protection.
- B. Provide and maintain in good condition scaffolding, staging and protective barricades and guardrails as required by the General Conditions and the State Code for use of workers and for the protection of workers and public.
- C. Remove them from the premises when no longer needed.
- D. Permit others providing work as part of this Contract to use scaffoldings for the installation of their related work.

PART 3 - EXECUTION

3.01 EXAMINATION:

- A. Examine the areas and conditions under which work of this section will be performed.
- B. Correct conditions detrimental to the proper and timely completion of the work.

C. Do not proceed until unsatisfactory conditions have been corrected.

3.02 INSTALLATION:

A. General:

1. Thickness: Build masonry construction to the full thickness shown, except, built single-wythe walls (if any) to the actual thickness of the masonry units, using units of nominal thickness shown or specified.
2. Build chases and recesses as shown and as required for the work of other trades.
 - a. Provide not less than 8" of masonry between chase or recess and jamb of openings, and between adjacent chases and recesses.
3. Cut masonry units with motor-driven saw designed to cut masonry with clean sharp, unchipped edges.
 - a. Cut units as required to provide pattern shown and to fit adjoining work neatly.
 - b. Use full units without cutting wherever possible.
 - c. Use dry cutting saws to cut concrete masonry units.
4. Wet clay brick which has ASTM C 67 initial rates of absorption (suction) of more than 30 grams per 30 square inch per minute.
 - a. Use wetting methods which ensure that units are nearly saturated but surface dry when laid.
5. Do not wet concrete masonry units.

B. Pattern Bond - Layout:

1. Lay exposed masonry in the bond pattern shown, or if not shown, lay in running bond vertical joint in each course centered on units in courses above and below.
2. Lay concealed masonry with all units in a wythe bonded by lapping not less than 2". Bond and interlock each course of each wythe at corners, unless otherwise shown.
3. Layout walls in advance for accurate spacing of surface bond patterns, with uniform joint widths and to properly locate openings, movement-type joints, returns and offsets.
4. Avoid the use of less-than-half size units at corners, jambs, and wherever possible at other locations.
5. Lay-up walls plumb and with courses level, accurately spaced and coordinated with other work.

C. Stopping and Resuming Work: Rack back 1/2-masonry unit length in each course; do not tooth.

1. Clean exposed surfaces of set masonry, wet units lightly (if specified to be wetted), and remove loose masonry units and mortar prior to laying fresh masonry.

D. Built-in Work:

1. As the work progresses, built-in items specified under this and other sections of these specifications, and Fill in solidly with masonry around built-in items.
2. Fill space between hollow metal frames and masonry solidly with mortar.
3. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath in the joint below and rod mortar or grout into core.

4. Fill CMU cores with grout 3 courses (24") under bearing plates, beams, lintels, posts, and similar conditions unless otherwise indicated.
- E. Intersecting Load bearing Walls: If carried up separately, block vertical joint with 8" maximum offsets and provide rigid steel anchors spaced not more than 4'0" o.c. vertically, or omit blocking and provide rigid steel anchors at not more than 2'0" o.c. vertically.
1. Form anchors of galvanized steel not less than 1-1/2" x 1/4" x 2'0" long with ends turned up not less than 2" or with cross-pins.
 2. If used with hollow masonry units, embed ends in mortar filled cores.
- F. Non load bearing Interior Partition Walls: Build full height of story to underside of solid structure above, unless otherwise indicated (see Drawings).

3.03 MORTAR BEDDING AND JOINTING:

- A. Lay brick and solid concrete masonry units with completely filled bed, head and collar joints; butter ends with sufficient mortar to fill head joints and shove into place.
1. Do not flush head joints.
- B. Lay hollow concrete masonry units with full mortar coverage on horizontal and vertical face shells.
1. Bed webs in mortar in starting course on footings and foundation walls and in all courses of piers, columns and pilasters, and where adjacent to cells or cavities to be reinforced or to be filled with concrete or grout.
 2. For starting courses on footings where cells are not grouted, spread out full mortar bed including areas under cells.
- C. Joints: Maintain joint widths shown, except for minor variations required to maintain bond alignment.
1. If not otherwise indicated, lay walls with joints no less than 3/8" and no more than 1/2" wide.
 2. Cut joints flush for masonry walls which are to be concealed or to be covered by other materials.
 3. Tool exposed joints slightly concave using a jointer larger than joint thickness.
 4. Rake out mortar in preparation for application of caulking or sealants where shown.
- D. Remove masonry units disturbed after laying; clean and relay in fresh mortar.
1. Do not pound corners at jambs to fit stretcher units which have been set in position.
 2. If adjustments are required, remove units, clean off mortar, and reset in fresh mortar.

3.04 CAVITY WALLS:

- A. Keep cavity clean of mortar droppings and other materials during construction. Strike joints facing cavity, flush.
- B. Tie exterior wythe to back-up with individual metal ties spaced not more than 16" o.c. vertically and 24" o.c. horizontally.

3.05 HORIZONTAL JOINT REINFORCING:

- A. Provide continuous horizontal joint reinforcing as shown and specified.

1. Fully embed longitudinal side rods in mortar for their entire length with a minimum cover of 5/8" on exterior side of walls and 1/2" at other locations.
 2. Lap reinforcement a minimum of 6". Do not bridge control and expansion joints with reinforcing, unless otherwise indicated.
 3. Provide continuity at corners and wall intersections by use of prefabricated "L" and "T" sections.
 4. Cut and bend units as directed by manufacturer for continuity at returns,
 5. offsets, column fireproofing, pipe enclosures, and other special conditions.
 6. Space continuous horizontal reinforcing as follows:
 7. For multi-wythe walls (solid or cavity) where continuous horizontal reinforcing acts as structural bond or tie between wythes, space reinforcing as required by code, but not less than 16" o.c. vertically.
 8. For single-wythe walls, space reinforcing at 16" o.c. vertically, unless otherwise indicated.
 9. For parapets, space reinforcing at 8" o.c. vertically, unless otherwise indicated.
- B. Reinforce masonry openings greater than 1'0" wide, with horizontal joint reinforcing placed in two horizontal joints approximately 8" apart, both immediately above lintels and below sills.
1. Extend reinforcing a minimum of 2'0" beyond jambs of the opening, bridging control joints where provided.

3.06 ANCHORING MASONRY WORK:

- A. Provide anchoring devices of the type indicated.
1. If not indicated, provide standard type for facing and back-up involved.
- B. Anchor masonry to structural members where masonry abuts or faces such members to comply with the following:
1. Provide an open space not less than 1" in width between masonry and structural member, unless otherwise shown. Keep open space free of mortar or other rigid materials.
 2. Anchor masonry to structural members with metal ties embedded in masonry joints and attached to structure. Provide anchors with flexible tie sections, unless otherwise indicated.
 3. Space anchors as shown, but not more than 24" o.c. vertically and 36" o.c. horizontally.
- C. Anchor single-wythe masonry veneer to backing with metal ties as follows:
1. Anchor veneer to structural members with metal anchors embedded in masonry joints and attached to structure. Provide anchors with flexible tie section, unless otherwise indicated.
 2. Anchor veneer to concrete back-up with dovetail anchors.
 3. Anchor veneer to metal studs with flexible two-piece anchors.
 - a. Fasten strap section through sheathing to metal studs with self-tapping screws complying with applicable requirements of Division-9 section in which metal stud construction is specified.
 - b. Embed tie section in masonry joints.
 - c. Provide not less than 1" air space between masonry veneer and face of sheathing applied over studs.

- D. Anchor veneer to wood structures with metal ties embedded in masonry joints and nailed to wood studs or sheathing.
 - 1. Provide not less than 1" air space between masonry veneer and wood construction. Nail anchors through sheathing to studs.
- E. Space veneer anchors as shown, or if not shown, space not more than 16" o.c. vertically and 24" o.c. horizontally.
 - 1. Provide additional anchors within 1'0" of openings and space not more than 3'0" around perimeter.

3.07 LINTELS:

- A. Install loose lintels of steel or other materials where shown.
- B. Provide masonry lintels where shown and wherever openings of more than 1'0" are shown without structural steel or other supporting lintels.
 - 1. Provide precast or formed-in-place masonry lintels. Thoroughly cure precast lintels before handling and installation.
 - 2. Temporarily support formed-in-place lintels.
 - 3. For hollow concrete masonry unit walls, use specially formed "U"-shaped lintel units with reinforcing bars placed as shown and filled with grout of consistency required to completely fill space between reinforcing bars and masonry unit.
- C. Provide minimum bearing of 8" at each jamb, unless otherwise indicated.

3.08 CONTROL AND EXPANSION JOINTS:

- A. Provide vertical expansion, control and isolation joints in masonry where shown.
- B. Build-in related masonry accessory items as the masonry work progresses.

3.09 FLASHING OF MASONRY WORK:

- A. Provide concealed flashings in masonry work at, or above, all shelf angles, lintels, ledges and other obstructions to be downward flow of water in the wall so as to divert such water to the exterior.
 - 1. Prepare masonry surfaces smooth and free from projections which could puncture flashing.
 - 2. Place through-wall flashing on bed of mortar and cover with mortar.
 - 3. Seal penetrations in flashing with mastic before covering with mortar.
 - 4. Extend flashings the full length of lintels and shelf angles and minimum of 4" into masonry each end.
 - 5. Extend flashing from a one 1/2" in from exterior face of outer wythe of masonry, through the outer wythe, turned up a minimum of 4", and through the inner wythe to within 1/2" of the interior face of the wall in exposed work.
 - a. Where interior surface of inner wythe is concealed by furring, carry flashing completely through the inner wythe and turn up approximately 2".
 - b. At heads and sills, turn up ends not less than 2" to form a pan.
 - 6. Provide weep holes in the head joints of the same course of masonry bedded in the flashing mortar.

7. Interlock end joints of deformed metal flashings by overlapping deformations not less than 1-1/2" and seal lap with elastic sealant.
 8. Install flashings in accordance with manufacturer's instructions.
- B. Install reglets and nailers for flashing and other related work where shown to be built into masonry work.

3.10 REPAIR, POINTING AND CLEANING:

- A. Remove and replace masonry units which are loose, chipped, broken, stained or otherwise damaged, or if units do not match adjoining units as intended.
1. Provide new units to match adjoining units and install in fresh mortar or grout, pointed to eliminate evidence of replacement.
- B. Pointing: During the tooling of joints, enlarge any voids or holes, except weep holes, and completely fill with mortar.
1. Point-up all joints at corners, openings and adjacent work to provide a neat, uniform appearance, properly prepared for application of caulking or sealant compounds.
- C. Clean exposed brick masonry surfaces by the bucket and brush hand cleaning method or by high-pressure water method.
1. Comply with requirements of BIA Technical notes No. 20 "Cleaning Brick Masonry."
 2. Use commercial cleaning agents in accordance with manufacturer's instructions.
- D. Clean exposed CMU masonry by dry brushing at the end of each day's work and after final pointing to remove mortar spots and droppings.
1. Comply with recommendations in NCMA TEK Bulletin No. 28.

END OF SECTION 042000

PART 1 - GENERAL

1.01 SUMMARY:

- A. Section Includes: Providing all labor, material and equipment necessary to accomplish all the carpentry work not otherwise included as part of other sections and which is generally not exposed except as otherwise indicated. Types of work in this section include, but are not limited to rough carpentry for:
 - 1. Wood framing
 - 2. Timber for posts and beams
 - 3. Wood grounds, nailers, blocking, and sleepers
 - 4. Wood furring
 - 5. Sheathing
 - 6. Subflooring
 - 7. Underlayment
 - 8. Nails, bolts, screws, and framing anchors
 - 9. Rough hardware
- B. Finish carpentry is specified in another section within Division 6.
- C. Fabricated wood trusses are specified in another Division-6 section.
- D. Related Sections: Drawings and General Provisions of the contract, including the General Covenants and Provisions, Supplementary Covenants and Provisions and General Requirements as well as, but not necessarily limited to, the following:
 - Section 03100 Concrete Formwork
 - Section 06200 Finish Carpentry
 - Section 08700 Hardware

1.02 REFERENCES:

- A. Lumber Standards: Comply with applicable rules of the respective grading and inspecting agencies for species and products indicated, as well as with the latest edition of:
 - 1. PS 20 American Softwood Lumber Standard, National Bureau of Standards
- B. Plywood Product Standards: Comply with applicable America Plywood Standard (APA) Performance Standards for type of panel indicated. Also comply with the latest edition of:
 - 1. PS 1 Plywood Standard (ANSI A 199.1), National Bureau of Standards

1.03 SUBMITTALS:

- A. Provide submittals in accordance with Section 01300.
- B. Submit manufacturer's specifications and installation instructions for materials listed below:
 - 1. Insulating sheathing
 - 2. Underlayment
- C. Material Certificates: Where dimensional lumber is provided to comply with minimum allowable unit stresses, submit listing of species and grade selected for each use, and submit evidence of compliance with specified requirements.
 - 1. Compliance may be in form of a signed copy of applicable portion of lumber producer's grading rules showing design values for selected species and grade.

2. Design values shall be as approved by the Board of Review of American Lumber Standards Committee.
- D. Wood Treatment Data: Submit treatment manufacturer's instructions for proper use of each type of treated material.
1. Pressure Treatment: For each type specified, include certification by treating plant stating chemicals and process used, net amount of preservative retained and conformance with applicable standards.
 2. Fire-Retardant Treatment: Include certification by treating plant that treatment material complies with governing ordinances and that treatment will not bleed through finished surfaces.
 3. For water-borne preservatives, include statement that moisture content of treated materials was reduced to a maximum of 15 percent prior to shipment to project site.

1.04 QUALITY ASSURANCE:

- A. Use adequate numbers of skilled workers who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work in this section.

1.05 DELIVERY, STORAGE, AND HANDLING:

- A. Keep materials dry at all times.
- B. Protect against exposure to weather and contact with damp or wet surfaces.
- C. Stack lumber and plywood, and provide air circulation within stacks.
- D. Deliver the materials to the job site and store, all in a safe area, out of the way of traffic, and shored up off the ground surface.
- E. Identify all framing lumber as to grades, and store all grades separately from other grades.
- F. Protect all metal products with adequate waterproof outer wrappings.
- G. Use extreme care in the off-loading of lumber to prevent damage, splitting, and breaking of materials.

1.06 PROJECT/SITE CONDITIONS:

- A. Fit carpentry work to other work; scribe and cope as required for accurate fit.
- B. Correlate location of furring, nailers, blocking, grounds and similar supports to allow proper attachment of other work.
- C. In the event of damage, immediately make all repairs and replacements necessary to the approval of the Engineer and at no additional cost to the Owner.

PART 2 - PRODUCTS

2.01 MATERIALS:

- A. Lumber, General:
 1. Factory-mark each piece of lumber with type, grade, mill and grading agency, except omit marking from surfaces to be exposed with transparent finish or without finish.
 2. Nominal sizes are indicated, except as shown by detail dimensions.

3. Provide actual sizes as required by PS 20, for moisture content specified for each use.
 4. Identify all plywood as to species, grade, and blue type by the stamp of the American Plywood Association.
 5. Provide dressed lumber, S4S, unless otherwise indicated.
 6. Provide seasoned lumber with 19 percent maximum moisture content at time of dressing.
- B. Materials: All materials, unless otherwise specifically approved in advance by the Engineer, shall meet or exceed the following:

	ITEM	SPECIES	GRADE
1.	2 x 4 Sills	Redwood	Foundation Grade
	2 x 6 Sills	Southern Yellow Pine	Standard or Better
2.	2 x 4 Studs	Douglas Fir Southern Pine	Standard or Better Standard or Better
3.	Joists and Planks	Douglas Fir Southern Pine	Number 2 or Better Number 1
4.	Posts and Beams	Douglas Fir Southern Pine	Number 1 Number 1
5.	All Other Horizontal Framing Members	Douglas Fir Southern Pine	Construction Construction
6.	All Other Vertical Framing Members	Douglas Fir Southern Pine	Standard or Better Standard or Better
7.	Exposed Framing Lumber	Douglas Fir Southern Pine	Appearance Framing Appearance Grade
8.	Exposed Boards	Redwood Cedar	Select Select
9.	Concealed Boards	Redwood Southern Pine	Construction Number 2
10.	Miscellaneous Lumber	Any Species	Construction
	ITEM	SPECIES	GRADE
11.	T & G Decking	Douglas Fir Hemlock	Select V Bevel Select V Bevel
12.	Steel Hardware		ASTM A7 or A 36

1. Water-repellent treated core with water absorption of less than 10 percent by weight after two-hour immersion (ASTM C 473).
 2. Size and Edges: 4' wide, not less than 8' long, with square edges on sides.
- I. Fiberboard Sheathing: Provide regular type complying with ASTM C 208, and the following:
1. Size and Edges: 25/32" thick x 4' wide x 8' or 9' long with square edges.
- J. Miscellaneous Materials:
1. Fasteners and Anchorages: Size, type, material, and finish indicated and recommended by applicable standards and Federal Specifications for nails, staples, screws, bolts, nuts, washers, and anchoring devices.
 - a. Provide metal hangers and framing anchors of the size and type recommended by the manufacturer for each use including recommending nails.
 - b. Where rough carpentry work is exposed to weather, in ground contact, or in area of high relative humidity, provide fasteners and anchorages with a hot-dip zinc coating (ASTM A 153).
- K. Building Paper: Asphalt saturated felt, non-perforated, ASTM 226.
- L. Wood Treatment/Preservative Treatment: Where lumber or plywood is indicated as "Trt-Wd" or "Treated," or is specified herein to be treated, comply with applicable requirements of AWWA Standards C2 (Lumber) and C9 (Plywood) and of AWPB Standards listed below.
1. Mark each treated item with the AWPB Quality Mark Requirements.
 2. Pressure-treat above-ground items with water-borne preservatives complying with AWPB LP-2.
 3. After treatment, kiln-dry to a maximum moisture content of 15 percent.
 4. Treat indicated items and the following:
 - a. Wood cants, nailers, curbs, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
 - b. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
 - c. Wood framing members less than 18" above grade.
 5. Pressure-treat the following with water-borne preservatives for ground contact use complying with AWPB LP-22:
 - a. Wood members in contact with ground.
 - b. Wood members in contact with fresh water.
 6. Complete fabrication of treated items prior to treatment, where possible.
 7. If cut after treatment, coat cut surfaces with heavy brush coat of same chemical used for treatment.
 8. Inspect each piece of lumber or plywood after drying and discard damaged or defective pieces.

PART 3 - EXECUTION

3.01 EXAMINATION:

- A. Examine the substrate surfaces, conditions, and embedded attachments that carpentry work will be applied or attached to.
- B. Any conditions that are incomplete or unsatisfactory shall be brought to the attention of the Engineer or DNR Construction Inspector.
- C. Do not proceed with the work until unsatisfactory conditions have been corrected.

3.02 INSTALLATION:

- A. Discard units of material with defects which might impair quality of work, and units which are too small to use in fabricating work with minimum joints or optimum joint arrangement.
- B. Set carpentry work accurately to required levels and lines, with members plumb and true and accurately cut and fitted.
- C. Securely attach carpentry work to substrate by anchoring and fastening as shown and as required by recognized standards.
 - 1. Countersink nail heads on exposed carpentry work and fill holes.
- D. Use common wire nails, except as otherwise indicated. Use finishing nails for finish work.
 - 1. Select fasteners of size that will not penetrate members where opposite side will be exposed to view or will receive finish materials.
 - 2. Make tight connections between members.
 - 3. Install fasteners without splitting of wood; predrill as required.
- E. Carefully lay out, cut, fit, and install rough carpentry items.
 - 1. Use sufficient nails, spikes, screws, and bolts to ensure rigidity and permanence.
 - 2. Drive nails perpendicular to wood grain in lieu of toenailing, where feasible.
 - 3. Provide for installation and support of plumbing, hearing, and ventilating and electrical work.
 - 4. Take care to isolate acoustically from other members.
 - 5. Install work to true lines, plumb, and level, unless indicated otherwise.
- F. Develop full length and width of bearing intended at all supports.
 - 1. Members cut too short, or for any other reason do not develop this bearing, will have to be replaced.
- G. All sills, plates, and other wood in contact with masonry or under metal flashings shall be pressure preservative treated.
- H. Provide framing members of sizes and on spacing shown, and frame openings as shown, or if not shown, comply with recommendations of "Manual for House Framing" of National Forest Products Association.
 - 1. Do not splice structural members between supports.
- I. Anchor and nail as shown, and to comply with "Recommended Nailing Schedule" of "Manual for House Framing" and other recommendations of N.F.P.A.

- J. Firestop concealed spaces with wood blocking not less than 2" thick, if not blocked by other framing members.
 - 1. Provide blocking at each building story level and at ends of joist spans.
- K. Wood Grounds, Nailer, Blocking and Sleepers:
 - 1. Provide wherever shown and where required for screeding or attachment of other work.
 - 2. Form to shapes as shown and cut as required for true line and level of work to be attached.
 - 3. Coordinate location with other work involved.
 - 4. Attach to substrates as required to support applied loading.
 - a. Countersink bolts and nuts flush with surfaces, unless otherwise shown.
 - b. Build into masonry during installation of masonry work.
 - c. Where possible, anchor to formwork before concrete placement.
 - 5. Provide permanent grounds of dressed, preservative treated, key-bevelled lumber not less than 1-1/2" wide and of thickness required to bring face of ground to exact thickness of finish material involved.
 - 6. Remove temporary grounds when no longer required.
- L. Wood Furring: Install plumb and level with closure strips at edges and openings.
 - 1. Shim with wood as required for tolerance of finish work.
 - 2. Secure to backing with approved-type fasteners.
- M. Stud Framing: Provide stud framing where shown.
 - 1. Unless otherwise shown, use 2" x 4" wood studs spaced 16" o.c. with 4" face perpendicular to direction of wall or partition.
 - 2. Provide single-bottom plate and double-top plates 2" thick by width of studs; except single-top plate may be used for nonloadbearing partitions.
 - a. Nail or anchor plates to supporting construction. Construct corners and intersections with not less than three studs.
 - 3. Provide miscellaneous blocking and framing as shown and as required for support of facing materials, fixtures, specialty items and trim.
 - 4. For loadbearing partitions, provide double-jamb studs for openings six feet and less in width, and triple-jamb studs for wider openings.
 - a. Provide headers of depth shown, or if not shown, provide as recommended by N.F.P.A. "Manual for House Framing."
 - 3. Provide diagonal bracing in stud framing of exterior walls, except as otherwise indicated.
 - a. Brace both walls at each external corner, full story height, at a 45° angle, using either a let-in 1 x 4 or 2 x 4 blocking or metal diagonal bracing.
 - b. Omit bracing where following types of sheathing are indicated.
 - c. Plywood sheathing or corner bracing, 4' wide panels vertically.
 - d. Gypsum sheathing, 4' panels vertically.
 - e. Fiberboard sheathing, intermediate type, 4' panels vertically.

- f. Diagonal board sheathing.
- 3. Frame openings with multiple studs and headers. Provide nailed header members of thickness equal to width of studs.
 - a. Set headers on edge and support on jamb studs.
 - b. For nonbearing partitions, provide double-jamb studs and headers not less than 4" deep for openings 3' and less in width, and not less than 6" deep for wider openings.
- N. Joist Framing: Provide framing of sizes and spacing shown. Install with crown edge up and support ends of each member with not less than 1-1/2" of bearing on wood or metal, or 3" on masonry.
 - 1. Attach to woodbearing members with metal connectors; frame to wood supporting members with wood ledgers as shown, or if not shown, with metal connectors.
 - 2. Fire-cut members built into masonry (if any).
 - 3. Frame openings with headers and trimmers supported by metal joist hangers; double headers and trimmers where span of header exceeds 4'.
 - 4. Do not notch in middle third of joists; limit notches to 1/6-depth of joist, 1/3 at ends.
 - 5. Do not bore holes larger than 1/3-depth of joist or locate closer than 2" from top of bottom.
 - 6. Provide solid blocking (2" thick by depth of joist) at ends of joists unless nailed to header or brand member.
 - 7. Lap framing members from opposite sides of beams, girders or partitions not less than 4" or securely tie opposing members together.
 - 8. Provide solid blocking (2" thick by depth of joist) over supports.
 - 9. Provide bridging between joists where nominal depth-to-thickness ratio exceeds 4, at intervals of 8'.
 - a. Use bevel cut 1" x 4" or 2" x #" wood bracing, double-crossed and nailed both ends to joists, or use solid wood bridging 2" thick by depth of joist, end nailed to joist.
- O. Rafter and Ceiling Joist Framing:
 - 1. Ceiling Joists: Provide member size and spacing shown, and as previously specified for joist framing.
 - a. Face nail to ends of parallel rafters.
 - b. Where principal ceiling joists are at right angles to rafters, frame as indicated with additional short joists from wall plate to first joist; nail to ends of rafters and to top plate and nail to long joists or anchor with framing anchors or metal straps.
 - c. Provide 1 x 8 or 2 x 4 stringers spaced 4' o.c. crosswise over principal ceiling joists.
 - 2. Rafters: Provide member size and spacing shown. Notch to fit exterior wall plates and toe nail or use special metal framing anchors.
 - a. Double rafters to form headers and trimmers at openings in roof framing (if any), and support with metal hangers.
 - b. Where rafters abut at ridge, place directly opposite each other and nail to ridge member or use metal ridge hangers.
 - c. At valleys, provide valley rafter of size shown, or if not shown, provide rafter twice as thick as regular rafters and 2" deeper.

- d. At hips, provide hip rafters of size shown, or if not shown, provide of same thickness as regular rafters and 2" deeper.
 - e. Bevel ends of jack rafters for full bearing against hip rafters and valley rafters.
 - 3. Provide collar beams (ties) as shown, or if not shown, provide 1" x 6" boards every third rafter.
 - a. Locate below ridge member, one-third of distance of ceiling joists.
 - b. Cut ends to fit slope and nail to rafters.
 - 4. Provide special framing as shown for eaves, overhangs, corners and similar conditions, if any.
- P. Timber Framing:
 - 1. Provide wood beams and girders of the size and spacing shown.
 - a. Install with crown edge up and provide not less than 4" bearing on supports.
 - b. Provide continuous members unless shown; tie together over supports if not continuous.
 - 2. Where beams or girders are framed into pockets of exterior concrete or masonry walls, provide 1/2" air space between sides and ends of wood members and supporting wall.
 - 3. Where built-up beams or girders of nominal 2" dimension lumber on edge are shown, fasten together with two rows of 20d nails spaced not less than 32" o.c.
 - a. Locate one row near top edge and other near bottom edge.
 - b. Locate end joints in members over supports; for continuous members, stagger ends at quarter points between supports.
 - 4. Provide wood posts of the sizes shown. Provide metal anchoring and attachment devices as shown.
- Q. Stair Framing: Provide stair framing members of size, space, and shape as shown, or, if not shown, as required to support a minimum uniform live load of 100 psf and a minimum concentrated load of 300 pounds applied to an area of 4 square inches at center of tread.
 - 1. Fabricate stair framing members to provide exact fit with treads and risers with no change in dimensions between landings.
- R. Installation of Plywood: Comply with recommendations in Form No. E 304, "APA Design/Construction Guide- Residential and Commercial," for types of plywood products and applications indicated.
 - 1. Fastening Methods: Fasten panels as indicated below:
 - a. Combination Subflooring-Underlayment: Glue-nail to framing.
 - b. Subflooring: Glue-nail to framing.
 - c. Sheathing: Nail to framing.
 - d. Underlayment: Nail or staple to subflooring.
- S. Particleboard Underlayment: Install in compliance with the recommendations of the National Particleboard Association (NPA) for the type of subfloor involved in work.
 - 1. Fill and sand gouges, gaps, and chipped edges. Sand uneven joints flush.

2. Glue-nail underlayment to subflooring.
- T. Glass Fiberboard Sheathing: Comply with manufacturer's printed directions for application of sheathing.
1. Apply sheathing with long edges parallel to studs and centered over studs with edges contacting.
 2. Fasten to studs by nails. Do not overdrive nails.
 3. Fur out around door or window openings with 3/4" or 1" thick wood spacers to provide base for installation of windows and doors.
- U. Gypsum Wallboard Sheathing: Provide gypsum board sheathing where shown. Fasten to exterior face of stud framing for exterior walls.
1. Use 1-1/2" long 11-gauge galvanized roofing nails with 3/8" head or 15-gauge, divergent point galvanized staples 1/2" wide x 1-1/2" long.
 2. Keep perimeter fasteners 3/8" from edges and ends of board units.
 3. Fit boards tightly against each other and around openings.
 4. Install 4' x 8' or longer sheathing vertically with long edges parallel to and centered over studs.
 5. Provide solid wood blocking wherever end joints do not bear against framing sills or plates.
 6. Nail or staple to each support in accordance with manufacturer's recommended spacing.
- V. Fiberboard Sheathing: Provide fiberboard wall sheathing where shown.
1. Fasten each unit to intermediate supports and then at edges and ends.
 2. Drive fasteners flush with surface of sheathing and locate perimeter fasteners at least 3/8" from edges and ends.
 3. For 25/32" thick sheathing, use 11 gauge galvanized roofing nails with 7/16" or 3/8" heads and a minimum length of 1-3/4" 8d common nails, or 16 gauge galvanized staples with 7/16" crown and a minimum length of 1-1/2".
 2. Install 4' x 8' or longer sheathing vertically with long edges parallel to and centered over studs. Provide solid wood blocking wherever end joints do not bear against framing sills or plates.
 - a. Allow 1/8" open space between edges and ends of adjacent units.
 - b. Stagger horizontal joints, if any. Nail or staple to each support in accordance with manufacturer's recommended spacing, but space fasteners not more than 3" o.c. around perimeter at edge and end supports and 6" o.c. at intermediate supports.
- W. Wood Trusses: Wood trusses may be used in lieu of wood ceiling joists and rafters upon approval.
1. Provide and install prefabricated wood trusses designed in conformance with requirements shown on the drawings.
 2. Shop drawings showing the size and gauge of plates, the size, the species, and grade of lumber, the stress diagram, camber, if any, and the pitch, span, and spacing of trusses shall be submitted to the Engineer for approval before fabrications.
 3. Handle, erect, and fix wood trusses in accordance with good workmanship and good building erection practices.

4. Store in vertical positions, resting on temporary bearing supports and braced.
6. During erection, exercise care to prevent horizontal bending.
7. Use proper erection bracing until permanent bracing and bridging can be solidly nailed in place.
8. Wood trusses and their installation must conform to Iowa State Building Code requirements regarding live loads.
 - a. Roof trusses shall be designed for a minimum 30 psf live load and 10 psf dead load for top chord and 10 psf for bottom chord.
 - b. Live load plus dead load for each truss is 50 psf.
 - c. Deflection for live load only is limited to $L/360$.
 - d. Submit drawings of trusses with certification by a professional engineer registered in the state of Iowa included on the drawings.

END OF SECTION 06100

PART 1 - GENERAL

1.01 SUMMARY:

A. Section Includes:

1. Providing all labor, material and equipment necessary to accomplish all the necessary work not otherwise included as part of other sections and which is non-structural and exposed to view. Types of work of this section include, but are not limited to, finish carpentry for:
 - a. Exterior running and standing trim.
 - b. Interior running and standing trim.
 - c. Siding, board type.
 - d. Plywood soffits and panels.
 - e. Prefinished plywood paneling.
 - f. Prefinished paneling, board type.
 - g. Paneling, board type.
2. Plywood siding is specified in a Division 7 section.
3. Rough carpentry is specified in another section within Division 6.
4. Builders hardware and wood doors are specified in section within Division 8.
5. Architectural woodwork is specified in another section with Division 6.

B. Related Sections: Drawings and General Provisions of the contract, including the General Covenants and Provisions, Supplementary Covenants and Provisions and General Requirements as well as, but not necessarily limited to, the following:

Section 06100 Rough Carpentry
Section 07400 Preformed Roofing and Cladding/Siding
Section 08200 Wood and Plastic Doors
Section 08300 Special Doors
Section 08500 Metal Windows
Section 08600 Wood and Plastic Windows
Section 08700 Hardware

1.02 REFERENCES:

A. Softwood Lumber Standards: Comply with applicable rules of the respective grading and inspecting agencies for species and product indicated. Also comply with latest editions of:

1. PS 20 American Softwood Lumber Standard, National Bureau of Standards.

- B. Plywood Products Standard: Comply with applicable American Plywood Association (APA) Performance Standards for type of panel indicated. Also comply with latest edition of:
 - 1. PS 1 Plywood Standard - National Bureau of Standards.
 - 2. PS 51 Hardwood Plywood Standard - National Bureau of Standards.
- C. Hardwood Lumber Standards: Comply with National Hardwood Lumber Association (NHLA) rules.
- D. Woodworking Standard: Where indicated for a specific product, comply with specified provision of the following:
 - 1. Architectural Woodwork Institute (AWI) "Quality Standards."
- E. In addition to complying with the pertinent codes and regulations of governmental agencies having jurisdiction, as well as the above, comply with the Standard Grading Rules for Western Lumber published by the Western Wood Product Association, wherever applicable, and the Grading Rules of the California Redwood Association.

1.03 SUBMITTALS:

- A. Provide submittals in accordance with Section 1340.
- B. Product Data: Submit manufacturer's specifications and installation instructions for each item of factory-fabricated siding and paneling.
- C. Samples: Submit the following samples for each species and cut or pattern of finish carpentry.
 - 1. Standing and running trim for transparent finish: set of three (3) pieces for boards and for each type of worked product (molding) required, 2'-0" long x full board or molding width, finished on one side and one edge.
 - 2. Standing and running trim for paint finish; set of three (3) pieces for each type of work and product required, 2'-0" long x full board or molding width, unfinished.
 - 3. Bevel siding for transparent finish: Set of three (3) pieces, 2'-0" long, finished on one side and one edge.
 - 4. Bevel siding for painted finish: Set of three (3) pieces 2'-0" long, factory primed.
 - 5. Plywood for transparent finish: Set of three (3) pieces, 2'-0" long x panel width, finish applied to upper half of each piece.
 - 6. Prefinished solid wood paneling: Set of three (3) pieces, 2'-0" long x full board width.
 - 7. Prefinished plywood paneling: set of three (3) pieces, 2'-0" long x panel width.

1.04 QUALITY ASSURANCE:

- A. Grade Stamps: Factory-mark each piece of lumber and plywood with type, grade, mill and grading agency identification; except omit marking from surfaces to receive transparent finish, and submit mill certificate that material has been inspected and graded in accordance with requirements if it cannot be marked on a concealed surface.

- B. Throughout progress of the work of this section, provide at least one person who shall be thoroughly familiar with the specified requirements, completely trained and experienced in the necessary skills, and who shall be present at the site and shall direct all work performed under this section.
- C. In actual installation of the work of this section, use adequate numbers of skilled workers to ensure installation in strict accordance with the approved design and the approved recommendations of the materials manufacturers.

1.05 DELIVERY, STORAGE, AND HANDLING:

- A. Protect finish carpentry materials during transit, delivery, storage and handling to prevent damage, soiling and deterioration.
- B. Do not deliver finish carpentry materials, until painting, wet work, grinding and similar operations which could damage, soil or deteriorate woodwork have been completed in installation areas. If, due to unforeseen circumstances, finish carpentry materials must be stored in other than installation areas, store only in areas meeting requirements specified for installation areas.
- C. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Engineer and at no additional cost to the Owner.

1.06 PROJECT/SITE CONDITIONS:

- A. Conditioning: Installer shall advise Contractor of temperature and humidity requirements for finish carpentry installation areas. Do not install finish carpentry until required temperatures and relative humidity have been stabilized and will be maintained in installation areas.
- B. Maintain temperature and humidity in installation areas as required to maintain moisture content of installed finish carpentry within a 1.0 percent tolerance of optimum moisture content, from date of installation through remainder of construction period. The fabricator of woodwork shall determine optimum moisture content and required temperature and humidity conditions.

PART 2 - PRODUCTS

2.01 MATERIALS:

- A. Nominal sizes are indicated, except as shown by detailed dimensions. Provide dressed or worked and dressed lumber, as applicable, manufactured to the actual sizes as required by PS 20 or to actual sizes and pattern as shown, unless otherwise indicated.
- B. Moisture Content of Softwood Lumber: Provide kiln-dried (KD) lumber having a moisture content from time of manufacture until time of installation not greater than values required by the applicable grading rules of the respective grading and inspecting agency for the species and product indicated.
- C. Moisture Content of Hardwood Lumber: Provide kiln-dried (KD) lumber having a moisture content from time of manufacture until time of installation within the ranges required in the referenced woodworking standard.
- D. Lumber for Transparent Finish: Use pieces made of solid lumber stock.
- E. Lumber for Painted Finish: At Contractor's option, use pieces which are either glued-up lumber or made of solid lumber stock.

- F. For exterior finish carpentry work, use glued-up lumber complying with PS 56 for "wet use" and certified so by respective grading and inspecting agency for species and product indicated.
- G. Exterior Finish Carpentry:
1. Standing and Running Trim for Transparent Finish: Clear all Heart Redwood (RIS), for boards, worked products and dimension lumber.
 - a. Finish: Semi-transparent stain as selected by the Engineer, and urethane varnish.
 2. Standing and Running Trim for Painted Finish: Select Heart Redwood (RIS) of Clear Heart Western Red Cedar (WWPA or WCLB) for boards, worked products, and dimension lumber two inches (2") and thinner in nominal thickness.
 - a. Finish: Exterior oil stain, solid color, as selected by the Engineer.
 3. Bevel Siding for Painted Finish: A Grade Western Red Cedar (WWPA or WCLB) of size, and pattern indicated, factory primed.
 4. Plywood for Transparent Finish: Redwood, Special Exterior Grade, PS-1 with all heartwood face veneer, saw textured, and plain face pattern, of thickness shown, factory coated with manufacturer's standard water repellent.
 5. Plywood for Painted Finish: Any softwood species, exterior type, medium density overlay (MDO/EXT-APA), of thickness indicated.
- H. Interior Finish Carpentry:
1. Standing and Running Trim for Transparent Finish: Plain Sawn Red Oak manufactured to sizes and patterns (profile) shown from select First Grade lumber (NHLA); complying with following grade requirements of referenced woodworking standard, for quality of materials and manufacture:
 - a. Grade: Custom
 - b. Finish: Semi-transparent stain as selected by the Engineer, and urethane varnish.
 2. Standing and Running Trim for Painted Finish: Any Western Pine species graded and inspected by WWPA complying with following requirements:
 - a. Grade for Standard Sizes and Patterns: "C Select" or "Choice" for Idaho White Pine.
- I. Prefinished Plywood Paneling: Provide manufacturer's standard prefinished, V-grooved, hardwood plywood paneling in full-height panels of 4'-0" width, complying with applicable requirements of PS 51, Type III, 3-ply hardwood veneer core.
1. Face Veneer: Plain sliced Cherry, good grade.
 2. Thickness: 1/4" to 5/16" thick.
 3. V-Groove Spacing: Standard random pattern with edge grooves and grooves at center of panel and at third-points of panel.

4. Finish: Clear alkyd urea (conversion varnish), baked on, manufacturer's standard coating weight.
 5. Color and Grain Characteristic: Match Engineer's sample.
- J. Prefinished Paneling, Board-Type: Provide manufacturer's standard tongue-and-grooved end-matched, v-grooved, prefinished, solid hardwood paneling of random widths and lengths, milled from kiln-dried lumber.
1. Species, Cut and Grade: American Walnut, plain sawn, NHLA Colonial grade.
 2. Thickness: 3/4" actual thickness.
 3. Finish: Clear alkyd urea (conversion varnish), baked on, manufacturer's standard coating weight.
 4. Color: Match Engineer's sample.
- K. Paneling, Board-Type: Provide tongue-and-groove for finish, paneling and ceilings, end-matched, v-grooved, solid hardwood, milled from kiln-dried lumber.
1. Species, Cut and Grade: Western Red Cedar, dressed S4S pattern, WWPA A or better.
 2. Thickness: 3/4" actual.
 3. Pattern: Western Wood Product Association WP-4 paneling.
 4. Finish: Semi-transparent stain as selected by the Engineer, and urethane varnish. Finish both exposed and unexposed sides.
- L. Miscellaneous Materials:
1. Fasteners and Anchorages: Provide nails, screws and other anchoring devices of the proper type, size, material and finish for application indicated to provide secure attachment, concealed where possible, and complying with applicable federal specifications.
 - a. Where finish carpentry is exposed on exterior or in areas of high relative humidity, provide fasteners and anchorages with stainless steel nails.
 2. Screen for Soffit Vents: 18 x 16 or 18 x 14 mesh of plastic coated fiber threads, complying with FS L-S-25, with black or dark gray finish.
- M. Wood Treatment/Preservative Treatment: Following basic fabrication, provide 3-minute dip treatment of finish carpentry items in 5 percent solution of pentachlorophenol, with vehicle which will not interfere with finish application and will produce minimum effect upon appearance. Apply brush coat on surfaces cut after treatment.
- N. Other Materials: Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor subject to the approval of the Engineer.

PART 3 - EXECUTION

3.01 EXAMINATION:

- A. Examine the areas and conditions under which work of this section will be performed. Correct conditions detrimental to the proper and timely completion of the work. Do not proceed until unsatisfactory conditions have been corrected.

3.02 PREPARATION:

- A. Pre-Installation Meeting: Meet at project site prior to delivery of finish carpentry materials and review coordination and environmental controls required for proper installation and ambient conditioning in areas to receive work. Include in meeting the Contractor; Engineer and other Owner Representatives (if any); Installers of finish carpentry, wet work including plastering, other finishes, painting, mechanical work and electrical work; and firms and persons responsible for continued operation (where temporary or permanent) of HVAC system as required to maintain temperature and humidity conditions. Proceed with finish carpentry on interior only when everyone concerned agrees that required ambient conditions can be properly maintained.
- B. Condition wood materials to average prevailing humidity conditions in installation areas prior to installing.
- C. Backprime lumber for painted finish exposed on the exterior or, where indicated, to moisture and high relative humidities on the interior. Comply with requirements of section on painting within Division 9 for primers and their application.

3.03 INSTALLATION:

- A. Discard units of material which are unsound, warped, bowed, twisted, improperly treated, not adequately seasoned or too small to fabricate work with minimum of joints or optimum jointing arrangements, or which are of defective manufacturer with respect to surfaces, sizes or patterns.
- B. Install the work plumb, level, true and straight with no distortions. Shim as required using concealed shims. Install to a tolerance of 1/8" in 8'-0" for plumb and level countertops; and with 1/16" maximum offset in flush adjoining 1/8" maximum offsets in revealed adjoining surfaces.
- C. Scribe and cut work to fit adjoining work, and refinish cut surfaces or repair damaged finish at cuts.
- D. Standing and Running Trim: Install with minimum number of joints possible, using full-length pieces (from maximum length of lumber available) to the greatest extent possible. Stagger joints in adjacent and related members. Cope at returns, miter at corners, to produce tight-fitting joints with full surface contact throughout length of joint. Use scarf joints for end-to-end joints.
 - 1. Make exterior joints water-resistant by careful fitting.
- E. Anchor finish carpentry work to anchorage devices or blocking built-in or directly attached to substrates. Secure to grounds, stripping and blocking with countersunk, concealed fasteners and blind nailing as required for a complete installation. Except where prefinished matching fastener heads are required, use fine finishing nail for exposed nailings, countersunk and filled flush with finished surface, and matching final finish where transparent is indicated.
 - 1. Attach siding to framing to comply with siding manufacturer's instructions including requirements for type, size, material, location and spacing of fasteners.

- F. Prefinished Plywood Paneling: Where grain character or color variations are noticeable, select and arrange panels on each wall for best match of adjacent panels. Install with uniform, tight joints between panels.
 - 1. Arrange panels with v-grooves and joints over supports, and nail with type and spacing of fasteners recommended by panel manufacturer, with prefinished heads on fasteners selected to match v-groove color. Apply panel adhesive on supports, immediately prior to panel placement and nailing.
- G. Prefinished Paneling, Board-Type and Paneling, Board-Type: Install in accordance with manufacturer's instructions for concealed nailing. Arrange in random-width pattern suggested by manufacturer, unless boards are of uniform width. Stagger end joints in random pattern for best visual effect (uniformly distributed on each wall). Install with uniform joints, with only tongue-and-groove or end-matched joints within each field of paneling.
 - 1. Where grain character and color of boards vary noticeably, select and arrange boards for best visual effect as directed by the DNR Construction District Inspector.

3.04 ADJUSTING:

- A. Repair damaged and defective finish carpentry work wherever possible to eliminate defects functionally and visually; where not possible to repair properly, replace woodwork. Adjust joinery for uniform appearance.

3.05 CLEANING:

- A. Clean finish carpentry work on exposed and semi-exposed surfaces. Touch-up shop-applied finishes to restore damaged or soiled areas.
- B. Refer to Division 9 sections for final finishing of installed finish carpentry work.

3.06 PROTECTION:

- A. Installer of finish carpentry work shall advise Contractor of final protection and maintained conditions necessary to ensure that work will be without damage or deterioration at time of acceptance.

END OF SECTION 06200

PART 1 - GENERAL

1.01 SUMMARY:

- A. Section Includes:
1. Extent of insulation work is shown on Drawings and indicated by provisions of this section.
 2. Applications of insulation specified in this section include the following:
 - a. Insulation under slabs-on-grade.
 - b. Foundation wall insulation.
 - c. Loose cavity wall insulation.
 - d. Board-type building insulation, concealed.
 - e. Blanket-type building insulation.
 - f. Loose-fill building insulation.
- B. Related Sections: Drawings and General Provisions of the Contract, including the General Covenants and Provisions, Supplementary Covenants and Provisions and General Requirements as well as, but not necessarily limited to, the following:
- Section 06100 Rough Carpentry
Section 07500 Membrane Roofing
Section 15400 Plumbing
Section 15500 Heating, Ventilating, and Air Conditioning

1.02 REFERENCES:

- A. ASTM E 84 - Standard specification for surface burning characteristics of building material.
- B. ASTM C 549 - Standard specification for perlite loose-fill insulation.
- C. ASTM C 516 - Standard specification for vermiculite loose-fill insulation.
- D. FS HH-I-524C - Polystyrene board insulation.
- E. FS HH-I-521 - Mineral fiber blanket insulation.
- F. FS HH-I-574 - Perlite granular insulation.
- G. FS HH-I-1030 - Mineral fiber, loose-fill insulation.

1.03 SUBMITTALS:

- A. Provide submittals in accordance with Section 01300.
- B. Product Data: Submit manufacturer's product specifications and installation instructions for each type of insulation and vapor barrier material required.

1. Certified Tests: With product data, submit copies of certified test report showing compliance with specified performance values, including k-values (aged values for plastic insulations), densities, compression strengths, burning characteristics, perm ratings, water absorption ratings, and similar ratings.

1.04 QUALITY ASSURANCE:

- A. Federal Specifications: Where compliance with FS standard is indicated, specified requirements for marking individual boards/batts/blankets are waived, provided packages of units are labeled to show compliances.
- B. Thermal Conductivity: Thicknesses indicated are for thermal conductivity (k-value at 75øF. or 24øC) specified for each material. Provide adjusted thicknesses as directed for equivalent use of material having a different thermal conductivity.
 1. Where insulation is identified by "R" value, provide thickness required to achieve indicated value.
- C. Fire and Insurance Ratings: Comply with fire-resistance, flammability and insurance ratings indicated, and comply with regulations as interpreted by governing authorities.
- D. Labels: Manufacturer's labels required on each piece or package of insulation.
 1. Do not remove labels or open packages until inspected and approved by the DNR Construction Inspector.

1.05 DELIVERY, STORAGE, AND HANDLING:

- A. General Protection: Protect insulations from physical damage and from becoming wet, soiled, or covered with ice or snow.
 1. Comply with manufacturer's recommendations for handling, storage, and protection during installation.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

- A. Polystyrene Board Insulation: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include, but are not limited to, the following:
 1. Dow Chemical Company; Midland, Michigan
 2. UC Industries/U.S. Gypsum; Chicago, Illinois
 3. or equal as approved by the Architect
- B. Mineral/Glass Fiber Blanket/Batt Insulation: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include, but are not limited to, the following:
 1. Certain-Teed Products Corp.; Valley Forge, Pennsylvania
 2. Manville Bldg. Materials Corp.; Denver, Colorado
 3. Mizell Bros. Co.; Atlanta, Georgia
 4. Owens-Corning Fiberglas Corp.; Toledo, Ohio

2.02 MATERIALS:

- A. Extruded Polystyrene Board Insulation: Rigid, closed-cell, density skin; complying with FS HH-1-524C, Type IV, min. 20 psi compressive strength, k-value of 0.20; 0.3% maximum water absorption; 1.1 perm-inch maximum water vapor transmission; manufacturer's standard lengths and widths.
- B. Mineral/Glass Fiber Blanket/Batt Insulation: Inorganic (nonasbestos) fibers formed with binders into resilient flexible blankets or semi-rigid batts; FS HH-1-521, type as indicated, densities of not less than 0.5 lb. per cubic foot for glass fiber units and not less than 2.5 lb. per cubic foot for mineral wool units, k-value of 0.27; manufacturer's standard lengths and widths as required to coordinate with spaces to be insulated; types as follows:
 - 1. Provide Type I unfaced units where indicated, semi-rigid in vertical spaces and where self-support is required.
 - 2. Provide Type II nonreflective vapor barrier faced units where indicated, with integral nailing flanges; barrier rating of 0.5 perms, other face (if any) with rating greater than 5.0 perms.
 - 3. Provide Type III reflective vapor barrier faced units where indicated, with integral nailing flanges; aluminum foil barrier with rating of 0.5 perms, other face (if any) with rating greater than 5.0 perms.
 - a. Flame-Spread Rating: Provide units with rating of 25, ASTM E 84.
 - b. Fire-Resistance Ratings: Where units are included in rated wall/ceiling/floor construction, provide mineral wool units which have been tested and rated as required for the indicated assembly.
- C. Loose Granular Perlite Insulation: Expanded aggregate; FS HH-1-574, ASTM 516, or ASTM C 549; k-value of 0.33, treated with silicone for water-repellency where used in exterior wall construction.
- D. Loose Mineral Fiber Insulation: Inorganic (nonasbestos) fibers processed to form a loose resilient wool mass (for blowing) or granular nodules (for pouring); FS HH-1-1030; 1.0 lb. minimum in-place density; k-value of 0.30; Class B (or Class A); provide appropriate type (blowing or pouring) as for configuration of space to be insulated, Contractor's option appropriate, unless otherwise indicated.
- E. Polyethylene Vapor Barrier: 4-mil polyethylene film with laboratory-tested vapor transmission rating of 0.2 perms, natural color.

PART 3 - EXECUTION

3.01 EXAMINATION:

- A. Installer must examine substrates and conditions under which insulation work is to be performed, and must notify Contractor in writing of unsatisfactory conditions.
- B. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.02 PREPARATION:

- A. Clean substrates of substances harmful to insulations or vapor barriers, including removal of projections which might puncture vapor barriers.

- B. Close off openings in cavities to receive poured-in-place insulation, sufficiently to prevent escape of insulation.
 - 1. Provide bronze or stainless steel screen (inside) where openings must be maintained for drainage or ventilation.

3.03 INSTALLATION:

- A. Comply with manufacturer's instructions for particular conditions of installation in each case.
 - 1. If printed instructions are not available or do not apply to project conditions, consult manufacturer's technical representative for specific recommendations before proceeding with work.
- B. Extend insulation full thickness as shown over entire area to be insulated.
 - 1. Cut and fit tightly around obstructions, and fill voids with insulation.
 - 2. Remove projections which interfere with placement.
- C. Apply a single layer of insulation of required thickness, unless otherwise shown or required to make up total thickness.
- D. Perimeter and Under-Slab Insulation: On vertical surfaces, set units in adhesive applied in accordance with manufacturer's instructions.
 - 1. Use type adhesive recommended by manufacturer of insulation.
 - 2. Do not place polystyrene foam on solvent base waterproofing until waterproofing is well cured to avoid chemical reaction of foam with solvent.
- E. Granular Insulation: Pour granular insulation into cavities as shown, to completely fill void spaces.
 - 1. Maintain inspection ports to show presence of insulation at extremities of each pour area.
 - 2. Close ports after complete coverage has been confirmed.
 - 3. Limit fall of insulation to one story in height, but not to exceed 20'-0".
- F. General Building Insulation:
 - 1. Apply insulation units to substrate by method indicated, complying with manufacturer's recommendations.
 - 2. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.
 - 3. Set vapor barrier faced units with vapor barrier to warm side of construction, except as otherwise shown.
 - a. Do not obstruct ventilation spaces, except for fire stopping.
 - b. Tape joints and ruptures in vapor barriers, and seal each continuous area of insulation to surrounding construction to ensure vapor-tight installation.

4. Place loose fiber insulation into spaces and onto surfaces as shown, either by pouring or by machine-blowing.
 - a. Level horizontal applications to uniform thickness as indicated, lightly settled to uniform density, but not excessively compacted.
 5. Stuff loose mineral fiber insulation into miscellaneous voids and cavity spaces where shown. Compact to approximately 40% of normal maximum volume (to a density of approximately 2.5 lbs. per cubic foot).
- G. Vapor Barrier Installation: General: Extend vapor barriers to extremities of areas to be protected from vapor transmission.
1. Secure in place with adhesives or other anchorage system as indicated.
 2. Extend vapor barriers to cover miscellaneous voids in insulated substrates, including those which have been stuffed with loose fiber-type insulation.
 3. Seal joints/seams in vapor barriers, seal to objects penetrating barriers, and seal to other surfaces at extremities of coverage by lapping with adhesive or taping to form a continuous barrier.
 4. Repair punctures and tears in vapor barriers, immediately before concealment by other work.
 5. Cover with adhesively applied vapor barrier material or with self-adhesive vapor barrier type.

3.04 PROTECTION:

- A. General: Protect installed insulation and vapor barriers from harmful weather exposures and from possible physical abuses, where possible by nondelayed installation of concealing work or, where that is not possible, by temporary covering or enclosure.
- B. Installer shall advise Contractor of exposure hazards, as well as of possible sources of deterioration and fire hazards.

END OF SECTION 07200

PART 1 - GENERAL

1.01 SUMMARY:

- A. Section Includes: Furnishing all labor, materials, and equipment required to apply roofing shingles, underlayment sheets, metal edge drips, and vents.
 - 1. Extent of shingles is shown on drawings and is hereby defined to include units employed as weather protection for walls as well as for roofs.
 - 2. Types of shingle applications specified in this section include the following:
 - a. Fiberglass-based asphalt shingle roofing.
- B. Related Sections: Drawings and General Provisions of the contract, including the General Covenants and Provisions, Supplementary Covenants and Provisions and General Requirements as well as, but not necessarily limited to, the following:

Section 06100 Rough Carpentry
Section 07600 Flashing and Sheet Metal
Section 07700 Roofing Specialties and Accessories

1.02 SUBMITTALS:

- A. Provide submittals in accordance with Section 01300.
- B. Product Data: Submit technical product data, installation instructions and recommendations from shingle manufacturer, including data that materials comply with requirements.
- C. Samples: Submit full range of samples for color and texture selection.
 - 1. After selection, submit two (2) full-size shingles for verification of each color/style/texture selected.
- D. Maintenance Stock: Two percent (2%) of each type/color/texture shingle used in the work.

1.03 QUALITY ASSURANCE:

- A. UL Listing: Provide labeled materials which have been tested and listed by UL for Class and Rating indicated for each shingle type required.

1.04 DELIVERY, STORAGE, AND HANDLING:

- A. Deliver materials in manufacturer's unopened, labeled containers.
- B. Store materials to avoid water damage, and store rolled goods on end.
- C. Comply with manufacturer's recommendations for job-site storage and protection.

1.05 PROJECT/SITE CONDITIONS:

- A. Substrate: Proceed with shingle work only after substrate construction and penetrating work have been completed.
- B. Weather Conditions: Proceed with shingle work only when weather conditions are in compliance with manufacturer's recommendations and when substrate is completely dry.

1.06 WARRANTY:

- A. Provide shingle manufacturer's warranty on installed work, agreeing to pay for repair or replacement of defective shingles as necessary to eliminate leaks.
- B. Period of warranty is, at a minimum, 20 years from date of substantial completion.

1.07 MAINTENANCE:

- A. Extra Materials: Provide minimum of two percent (2%) of installed quantity of each type/color/texture shingle used in the work.
- B. Provide in unopened clearly labeled bundles or containers.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

- A. This specification is based on the Residential Roofing System described below, by the following:

GAF Building Materials Corporation
- B. Subject to compliance with requirements, provide products as described by the above-mentioned manufacturer or by one of the following:
 - 1. Genstar
 - 2. Certaineed Corporation
 - 3. Georgia Pacific Corporation
 - 4. John-Manville
 - 5. Owens/Corning Fiberglass Corporation
 - 6. Equal products as approved by the Engineer

2.02 MATERIALS:

- A. Square Tab Strip Shingles, UL Class "A," Heavyweight: Mineral-surfaced, self-sealing, three-tab fiberglass--based asphalt strip shingles complying with ASTM D 3018, Type I; D 3462-76, bearing UL Class "A" external fire exposure label and UL "Wind Resistant" label, weighing not less than 240 lbs. per square.
 - 1. Royal Sovereign, GAF Corporation, or equal.

- B. Roofing Underlayment: Glass reinforced, UL listed, 36" wide underlayment. Shingle-Mate, GAF Corporation, or equal.
- C. Ice and Water Barrier: Paper backed, self-adhesive, fiberglass reinforced, polymer modified asphaltic, 36" wide ice and water barrier membrane. Weather Watch, GAF Corporation, or equal.
- D. Hip and Ridge Shingles: Manufacturer's standard factory pre-cut units to match shingles.
- E. Nails: Aluminum or hot-dip galvanized 11 or 12-gauge sharp pointed conventional roofing nails with barbed shanks, minimum 3/8" diameter head, and of sufficient length to penetrate minimum 3/4" into solid decking or to penetrate through plywood sheathing.
- F. Metal Drip Edge: Minimum .024", brown preprimed aluminum sheet, brake-formed to provide 3" minimum roof deck flange, and 1-1/2" fascia flange with 3/8" drip at lower edge.
 - 1. Furnish in 8' or 10' lengths.
- G. Metal Flashing: .024" mill finish sheet aluminum. Job-cut to sizes and configurations required.
- H. Gutters: K style 2 3/8" x 4 1/2" seamless continuous, brown preprimed aluminum, .032" thick.
- I. Downspouts: Corrugated, brown preprimed rectangular shape aluminum, .025" thick.
- J. Asphaltic Cement: In accordance with Federal Specification SSC-153 Type I.

PART 3 - EXECUTION

3.01 EXAMINATION:

- A. Installer of shingles must examine substrate and conditions under which shingling work is to be performed, and must notify Contractor in writing of unsatisfactory conditions.
- B. Do not proceed with shingling work until satisfactory conditions have been corrected in manner acceptable to installer.

3.02 PREPARATION:

- A. Clean substrate of any projections and substances detrimental to shingling work.
- B. Cover knotholes or other minor voids in substrate with sheet metal flashing secured with roofing nails.
- C. Coordinate installation of shingles with flashing and other adjoining work to ensure proper sequencing.
- D. Do not install shingle roofing until all vent stacks and other penetrations through roofing have been installed and are securely fastened against movement.

3.03 INSTALLATION:

- A. General: Comply with instructions and recommendations of shingle manufacturer, except to extent more stringent requirements are indicated.
- B. Install metal drip edges at eaves and rakes.
 - 1. At eaves, install the drip edge directly on the deck.
 - 2. At rakes, install the drip edge over the underlayment.
- C. Ice and Water Barrier: Unless otherwise recommended by manufacturer, install the ice and water barrier directly applied to the roof deck.
 - 1. Cut roll into 18 ft. lengths and reroll. Remove 2-3 ft. of release paper and align the edge of membrane, sticky side down so it overhangs the drip edge by 1/4".
 - 2. Nail along the upper edge of the sheet every 18".
 - 3. Use a hand roller to press into place along the eave edge and adhere the rest of the membrane by hand pressure.
 - 4. Continue peeling release paper and hand adhering membrane.
 - 5. Lap a minimum of 6" and hand roll a second course, if needed, to reach a point 2 feet inside of interior wall line.
 - 6. Cut membrane into 6 to 8 foot lengths for ridges and valleys and remove release paper.
 - a. Center and drape pieces over the valley or ridge and the middle of the membrane first before working toward the edge.
- D. Underlayment: Unless otherwise recommended by manufacturer, install underlayment as follows:
 - 1. Install shingle underlayment over the entire remaining roof area, shingle fashion, lapping horizontally 2" and vertically 4".
 - 2. Overlay the ice and water barrier 6" at all junctures.
 - 3. Begin the application at a lower corner of the roof, positioning several unraveled feet from the roll so that they are parallel with the eave edge of the roof.
 - 4. Drive several nails into the upper corner of the felt and roll out about half way across the roof.
 - 5. Pick up the roll and pull to align the lower edge of the sheet, then fasten with series of nails along top, center and bottom of sheet.
 - 6. Repeat the above procedure for subsequent course up the roof.
 - 7. Trim felt overhanging the rakes, if any.

- E. Install metal valley, if any.
- F. Shingles: Unless otherwise recommended by manufacturer, install shingles as follows:
 - 1. Starter Course: Cut shingle application with starter strip of shingles, cut according to the manufacturer's installation procedures with sealing spots adjacent to the drip edge, nailing along rakes and between adhesive spots along eaves.
 - 2. First Course: Start and continue course with full shingles laid flush with the starter course.
 - a. Nail in accordance with manufacturer's instructions.
 - 3. Subsequent Courses: Fasten shingles in the manufacturer's recommended pattern.
 - a. Use horizontal and vertical chalk line to ensure course alignment.

3.04 FIELD QUALITY CONTROL:

- A. Thoroughly inspect the completed work, replace all shingles that have been damaged and correct any other defects.

3.05 CLEANING:

- A. Dispose of all unused materials, wrappers, containers and any other debris as applicable.

END OF SECTION 07312

PART 1 - GENERAL

1.01 SUMMARY:

A. Section Includes:

1. The extent of each type of flashing and sheet metal work is indicated on the Drawings and by provisions of this section.
2. The types of work specified in this section may include but is not necessarily limited to, the following:
 - a. Metal counter flashing; and base flashing (if any).
 - b. Metal wall flashing and expansion joints.
 - c. Built-in metal gutters and scuppers.
 - d. Gutters and downspouts (rain drainage).
 - e. Miscellaneous sheet metal accessories.
 - f. Integral masonry flashings are specified as masonry work in sections of Division 4.
 - g. Roofing accessories, not including roof accessories, are specified in roofing system sections as roofing work.

B. Related Sections: Drawings and General Provisions of the contract, including the General Covenants and Provisions, Supplementary Covenants and Provisions and General Requirements as well as, but not necessarily limited to, the following:

Section 07310 Asphalt Shingles
Section 07900 Joint Sealers
Section 15400 Plumbing

C. Roof accessories and skylights are specified elsewhere, in division 7.

1.02 REFERENCES:

- A. Standards: Comply with standards specified in this section and the provisions of SMACNA "Architectural Sheet Metal Manual."

1.03 SUBMITTALS:

- A. Provide submittals in accordance with Section 01300.
- B. Product Data: Submit manufacturer's product specifications, installation instructions and general recommendations for each specified sheet material and fabricated product.

- C. Samples: Submit two (2), eight-inch (8") square samples of specified sheet materials to be exposed as finished surfaces.
 - 1. Submit two (2), twelve-inch (12") long completely finished units of specified factory-fabricated products exposed as finished work.
- D. Shop Drawings: Submit shop drawings showing layout, joining, profiles, and anchorages of fabricated work, including major counter flashings, trim/fiscia units, gutters, downspouts, scuppers and expansion joint systems; layouts at one-quarter (1/4") scale, details at three-inch (3") scale.

1.04 QUALITY ASSURANCE:

- A. Qualifications of Installers: Use adequate numbers of skilled workers who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this section.

1.05 PROJECT/SITE CONDITIONS:

- A. Coordinate work of this section with interfacing and adjoining work for proper sequencing of each installation. Ensure best possible weather resistance and durability of the work and protection of materials and finishes.

PART 2 - PRODUCTS

2.01 MATERIALS:

- A. Sheet Metal Flashing/Trim:
 - 1. Zinc-Coated Steel: Commercial quality with 1.20 percent galvanized, mill phosphatized where indicated for painting (Pnt); 0.0359" thick (20 gauge) except as otherwise indicated.
 - 2. Copper: ASTM B 370, cold-rolled except where soft temper is required for forming; 16 oz. (0.0216" thick) except as otherwise indicated.
- B. Miscellaneous Materials and Accessories:
 - 1. Solder: For use with steel or copper, provide 50-50 tin/lead solder (ASTM B 32), with rosin flux.
 - 2. Fasteners: Same metal as flashing/sheet metal or, other noncorrosive metal as recommended by sheet manufacturer.
 - a. Match finish of exposed heads with material being fastened.
 - 3. Mastic Sealant: Polyisobutylene; nonhardening, nonskinning, nondrying, nonmigrating sealant.
 - 4. Adhesives: Type recommended by flashing sheet manufacturer for waterproof/weather-resistant seaming and adhesive application of flashing sheet.

5. Metal Accessories: Provide sheet metal clips, straps, anchoring devices and similar accessory units as required for installation of work, matching or compatible with material being installed, noncorrosive, size and gauge required for performance.
6. Roof Cement: ASTM D 2822, asphaltic.
7. Reglets: Metal of type and profile indicated, compatible with flashing indicated, size and gauge required for performance.

2.02 MANUFACTURED UNITS:

- A. Gutters: "K" style 2 3/8" x 4«" seamless, continuous, preprimed, aluminum, .032" thick.
- B. Downspouts: Corrugated, preprimed, rectangular shape aluminum, .025" thick.
- C. Drip Edge: Preprimed, preshaped aluminum.

2.03 FABRICATION:

- A. Shop-fabricate work to greatest extent possible. Comply with details shown, and with applicable requirements of SMACNA "Architectural Sheet Metal Manual" and other recognized industry practices. Fabricate for waterproof and weather-resistant performance; with expansion provisions for running work, sufficient to permanently prevent leakage, damage or deterioration of the work.
 1. Form work to fit substrates.
 2. Comply with material manufacturer instruction and recommendations.
 3. Form exposed sheet metal work without excessive oil-canning, buckling and tool marks, true to line and levels as indicated, with exposed edges folded back to form hems.
- B. Seams: Fabricate nonmoving seams in sheet metal with flat-lock seams.
 1. For metal other than aluminum, tin edges to be seamed, form seams, and solder.
 2. Form aluminum seams with epoxy seam sealer; rivet joints for additional strength where required.
- C. Expansion Provisions: Where lapped or bayonet-type expansion provisions in work cannot be used, or would not be sufficiently water/weatherproof, form expansion joints of intermeshing hooked flanges, not less than one-inch (1") deep, filled with mastic sealant (concealed within joints).
- D. Sealant Joints: Where movable, nonexpansion-type joints are indicated or required for proper performance of work, form metal to provide for proper installation of elastomeric sealant, in compliance with industry standards.
- E. Separations: Provide for separation of metal from noncompatible metal or corrosive substrates by coating concealed surfaces at locations of contact, with bituminous coating or other permanent separation as recommended by manufacturer/fabricator.

PART 3 - EXECUTION

3.01 EXAMINATION:

- A. Examine the areas and conditions under which work of this section will be installed.
- B. Correct conditions detrimental to the proper and timely completion of the work.
- C. Do not proceed until unsatisfactory conditions have been corrected.

3.02 INSTALLATION:

- A. General: Except as otherwise indicated, comply with manufacturer's installation instructions and recommendations, and with SMACNA "Architectural Sheet Metal Manual." Anchor units of work securely in place by methods indicated, providing for thermal expansion of metal units; conceal fasteners where possible, and set units true to line and level as indicated.
 - 1. Install work with laps, joints and seams which will be permanently watertight and weatherproof.
- B. Form all sheet metal accurately and to the dimensions and shapes required, finishing all molded and broken surfaces with true, sharp, and straight lines and angles and, where intercepting other members, coping to an accurate fit, soldering securely.
- C. Expansion: Form, fabricate, and install all sheet metal so as to adequately provide for expansion and contraction in the finished work.
- D. Underlayment: Where stainless steel or aluminum is to be installed directly on cementitious or wood substrates, install a course of paper slip sheet and a course of polyethylene underlayment.
- E. Bed flanges of work in a thick coat of bituminous roofing cement where required for waterproof performance.
- F. Install reglets to receive counter flashing in manner and by methods indicated.
 - 1. Where shown in concrete, furnish reglets to trades of concrete work for installation as work of Division 3 sections.
 - 2. Where shown in masonry, furnish reglets to trades of masonry work, for installation as work of Division 4 sections.
 - 3. Install counterflashing in reglets, either by snap-in seal arrangement, or by wedging in place for anchorage and filling reglet with mastic or elastomeric sealant, as indicated and depending on degree of sealant exposure.
- G. Weatherproofing:
 - 1. Finish watertight and weathertight where so required.
 - 2. Make all lock seam work flat and true to line, sweating full of solder.
 - 3. Make all lock seams and lap seams, when soldered, at least one-half inch (1/2") wide.

4. Where lap seams are not soldered, lap according to pitch but in no case less than three inches (3").
5. Make all flat and lap seams in direction of flow.

H. Nailing:

1. Whenever possible, secure metal by means of clips or cleats without nailing through the metal.
2. In general, space all nails, rivets, and screws not more than 20 cm (8") apart and, where exposed to the weather, use lead washers.
3. For nailing into wood, use barbed roofing nails 32 mm (1-1/2") long by 11 gauge.

I. Install continuous gutter guards on gutters, arranged as hinged units to swing open for cleaning gutters.

1. Install beehive-type strainer-guard at conductor heads, removable for cleaning downspouts.

J. Embedment: Embed all metal in connection with roofs in a solid bed of sealant using materials and methods approved in advance by the Architect or DNR Construction Inspector.

K. Soldering:

1. Thoroughly clean and tin all joint materials prior to soldering.
2. Perform all soldering slowly with a well-heated copper in order to heat the seams thoroughly and to completely fill them with solder.
3. Perform all soldering with a heavy soldering copper of blunt design, properly tinned for use.
4. Make all exposed soldering on finished surfaces neat, full flowing, and smooth.
5. After soldering, thoroughly wash acid flux with a soda solution.
6. Upon request of the DNR Construction Inspector, demonstrate by hose or standing water that all flashing and sheet metal is completely watertight.

3.03 CLEANING:

- A. Clean exposed metal surfaces, removing substances which might cause corrosion of metal or deterioration of finishes.

3.04 PROTECTION:

- A. Installer shall advise Contractor of required procedures for surveillance and protection of flashings and sheet metal work during construction to ensure that work will be without damage or deterioration, other than natural weathering, at time of substantial completion.

END OF SECTION 07600

PART 1 - GENERAL

1.01 SUMMARY:

- A. Section Includes: Furnish and install all hollow metal doors and frames hollow metal frames for sidelights, and fixed hollow metal windows complete with all hardware and accessories. The extent of metal doors, frames, sidelights, and windows is shown and scheduled on the Drawings.
- B. Related Sections: Drawings and General Provisions of the contract, including the General Covenants and Provisions, Supplementary Covenants and Provisions and General Requirements as well as, but not necessarily limited to, the following:
 - Section 03300 Cast-In-Place Concrete
 - Section 04210 Unit Masonry - Concrete Block
 - Section 08700 Hardware
 - Section 09900 Painting

1.02 REFERENCES:

- A. All door and frame materials shall be fabricated and installed in strict accordance with and approved by the following organizations:
 - 1. Underwriters' Laboratories
 - 2. Steel Door Institute
 - 3. State Building Code

1.03 SUBMITTALS:

- A. Provide submittals in accordance with Section 01300.
- B. Product Data: Submit manufacturer's specifications for fabrications and installation, including data substantiating that products comply with requirements.
- C. Shop Drawings: Submit for fabrication and installation of steel doors and frames. Include details of each frame type, elevations of door design types, conditions at openings, details of construction, location and installation requirements of finish hardware and reinforcements, and details of joints and connections. Show anchorage and accessory items.

1.04 QUALITY ASSURANCE:

- A. Provide doors and frames complying with Steel Door Institute "Recommended Specifications: Standard Steel Doors and Frames" and as specified herein.

1.05 DELIVERY, STORAGE, AND HANDLING:

- A. Deliver hollow metal work cartoned or crated to provide protection during transit and job storage.
 - 1. Provide additional sealed plastic wrapping for factory finished doors.
- B. Inspect hollow metal work upon delivery for damage.

1. Minor damages may be repaired provided finished items are equal in all respects to new work and acceptable to the Engineer; otherwise, remove and replace damaged items as directed.
- C. Store doors and frames at building site under cover.
1. Place units on wood sills at least 4" high, or otherwise store on floors in manner that will prevent rust and damage.
 2. Avoid use of nonvented plastic or canvas shelters which could create humidity chamber. If cardboard wrapper on door becomes wet, remove carton immediately.
 3. Provide 1/4-inch spaces between stacked doors to promote air circulation.

1.06 PROJECT/SITE CONDITIONS:

- A. Verify opening size, exact wall materials and partition thickness prior to frame fabrication.
- B. Fabrication work to provide the following maximum clearances:
1. 1/8 inch between doors and side and head jamb members.
 2. 1/4 inch at meeting edges of pairs of doors.
 3. 3/4 inch maximum between door and floor.
 4. 1/4 inch above carpet.
 5. 3/16 inch between door threshold or saddle or as required for weatherstripping at threshold.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

- A. Provide standard steel doors and frames by a single firm specializing in the production of this type of work.
- B. Provide steel doors and frames by one of the following:
1. Amweld Building Products Div.
 2. CECO Corp.
 3. Curries Mfg., Inc.
 4. DITTCO Products, Inc.
 5. Fenestra
 6. The Kewanee Corporation
 7. Mesker Industries, Inc.
 8. Pioneer Industries
 9. Republic Builders Prod. Corp.
 10. Steelcraft Mfg. Co.

2.02 MATERIALS:

- A. Hot-Rolled Steel Sheets and Strip: Commercial quality carbon steel, pickled and oiled, complying with ASTM A 569 and ASTM A 568.

- B. Cold-Rolled Steel Sheets: Commercial quality carbon steel, complying with ASTM A 366 and ASTM A 568.
- C. Galvanized Steel Sheets: Zinc-coated carbon steel sheets of commercial quality, complying with ASTM A 526, with ASTM A 525, G60 zinc coating, mill phosphatized.
- D. Supports and Anchors: Fabricate of not less than 18 gauge galvanized sheet steel.
- E. Inserts, Bolts and Fasteners: Manufacturer's standard units, except hot-dip galvanize items to be built into exterior walls, complying with ASTM A 153, Class C or D as applicable.
- F. Shop-Applied Paint: Primer-Rust-inhibitive enamel or paint, either air-drying or baking, suitable as a base for specified finish paints.

2.03 MANUFACTURED UNITS:

- A. Steel Doors: Provide metal doors of types and styles indicated on Drawings or schedules and comply with S.D.I. 100 for materials and construction requirements and as modified herein.
 - 1. Doors shall be full flush type with insulated cores.
 - 2. Doors shall have 16 gauge face panels reinforced for locks and surfaced applied hardware.
 - 3. Hinge reinforcement shall be 3/16-inch thick material.
 - 4. Both lock and hinge rail shall be welded, filled and ground smooth the full height of door with no seam showing.
 - 5. Glass and Louvers:
 - a. Glazed Openings: Make provisions for glass where indicated in accordance with standard specifications. Leave stops loose for glazing.
 - b. Louvers: Provide louvers where indicated on Drawings, insert into door panels in accordance with Section 10200. All louvers shall be sight tight.
- B. Steel Frames: Provide metal frames for doors, transoms, sidelights, borrowed lights, and other openings, of types and styles as shown on drawings and schedules.
 - 1. Conceal fastenings, unless otherwise indicated.
 - 2. Fabricate with mitered and welded corners.
 - 3. Form frames of hot dip galvanized steel.
 - 4. Provide additional top channel if necessary so that top of door presents a flush surface.
 - 5. Door Silencers: Except on weatherstripped frames, drill stops to receive two silencers on strike jambs of single-swing frames and two silencers on heads of double-swing frames.
 - a. Manufacturer's "stick-on" silencers will be acceptable in lieu of drilled type.
 - 6. Plaster Guards: Provide 26 gauge steel plaster guards or mortar boxes, welded to frame, at back of finish hardware cutouts where mortar or other materials might obstruct hardware operation.

C. Thermal-Rated (Insulating) Assemblies: At exterior locations and elsewhere as shown or scheduled, provide doors which have been fabricated as thermal insulating door and frame assemblies and tested in accordance with ASTM C 236.

1. Unless otherwise indicated, maximum apparent U factor for thermal-rated assemblies is 0.24 BTU/hr (ft²) øF.

2.04 FABRICATION:

A. Fabricate steel door and frame units to be rigid, neat in appearance and free of defects, warp or buckle.

1. Wherever practicable, fit and assemble units in manufacturer's plant.
2. Clearly identify work that cannot be permanently factory-assembled before shipment, to assure proper assembly at project site.

B. Fabricate exposed faces of doors and panels, including stiles and rails of nonflush units, from only cold-rolled steel.

C. Fabricate frames, concealed stiffeners, reinforcement, edge channels, louvers and moldings from either cold-rolled or hot-rolled steel (at fabricator's option).

D. Fabricate exterior doors, panels, and frames from galvanized sheet steel.

1. Close top and bottom edges of exterior doors as integral part of door construction or by addition of inverted steel channels.
2. Fill seams and ground smooth.

E. Exposed Fasteners: Unless otherwise indicated, provide countersunk flat Phillips heads for exposed screws and bolts.

F. Shop/Factory Finishing:

1. Clean, treat, and paint exposed surfaces of steel door and frame units, including galvanized surfaces.
2. Clean steel surfaces of mill scale, rust, oil, grease, dirt, and other foreign materials before application of paint.
3. Apply shop coat of prime paint of even consistency to provide a uniformly finished surface ready to receive finish paint.
4. Field or shop paint at Contractor option, two finish coats. Field paint as specified in Section 09900.
 - a. Shop paint according to manufacturer's specification for type of door specified.
 - b. Colors as specified or, if not specified, as designated by the Engineer.

PART 3 - EXECUTION

3.01 EXAMINATION:

- A. Installer must examine substrate and conditions under which steel doors and frames are to be installed and must notify Contractor in writing of any conditions detrimental to proper and timely completion of work.
- B. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.02 PREPARATION:

- A. Prepare doors and frames to receive mortised and concealed finish hardware in accordance with final Finish Hardware Schedule and templates provided by hardware supplier.
 - 1. For concealed overhead door closers, provide space, cutouts, reinforcing and provisions for fastening in top rail of doors or head of frames, as applicable.
 - 2. Comply with applicable requirements of ANSI A 115 series specifications for door and frame preparation for hardware.
- B. Reinforce doors and frames to receive surface-applied hardware.
 - 1. Drilling and tapping for surface-applied finish hardware may be done at project site.
- C. Locate finish hardware as shown on final shop drawings or, if not shown, in accordance with "Recommended Locations for Builder's Hardware," published by Door and Hardware Institute.

3.03 INSTALLATION:

- A. General: Install standard steel doors, frames, and accessories in accordance with final shop drawings and manufacturer's data, and as herein specified.
- B. Placing Frames:
 - 1. Comply with provisions of SDI-105 "Recommended Erection Instructions for Steel Frames," unless otherwise indicated.
 - 2. Except for frames located at in-place concrete or masonry and at drywall installations, place frames prior to construction of enclosing walls and ceilings.
 - 3. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set.
 - a. After wall construction is completed, remove temporary braces and spreaders leaving surfaces smooth and undamaged.
 - 4. In masonry construction, locate three wall anchors per jamb at hinge and strike levels.
 - a. Building-in of anchors and grouting of frames is specified in Division 4.
 - 5. At in-place concrete or masonry construction, set frames and secure to adjacent construction with machine screws and masonry anchorage devices.

6. Install fire-rated frames in accordance with NFPA Std. No. 80.
 7. In metal stud partitions, install at least three wall anchors per jamb at hinge and strike levels.
 - a. In open steel stud partitions, place studs in wall anchor notches and wire tie.
 - b. In closed steel stud partitions, attach wall anchors to studs with tapping screws.
- C. Door Installation:
1. Fit hollow metal doors accurately in frames, within clearances specified in SDI-100.
 2. Place fire-rated doors with clearances as specified in NFPA Standard No. 80.

3.04 ADJUSTING:

- A. Prime and Touch-Up: Immediately after erection, sand smooth any rusted or damaged areas of prime coat and apply touch-up of compatible air-drying primer.
- B. Protection Removal: Immediately prior to final inspection, remove protective plastic wrappings from prefinished doors.
- C. Final Adjustment: Check and readjust operating finish hardware items, leaving steel doors and frames undamaged and in complete and proper operating condition.

END OF SECTION 08100

PART 1 - GENERAL

1.01 SUMMARY:

- A. Section Includes: Provide steel window units and aluminum screens for each designated location within the building as specified herein, and as needed for a complete and proper installation.
1. Applications of steel windows on project include the following:
 - a. Individual units set in conventional wall construction.
 2. Glazing: Refer to "glass and glazing" section for glazing all window units, including those specified to be factory preglazed.
- B. Related Sections: Drawings and General Provisions of the contract, including the General Covenants and Provisions, Supplementary Covenants and Provisions and General Requirements, as well as, but not necessarily limited to, the following:

Section 06100 Rough Carpentry
Section 08800 Glass and Glazing

1.02 REFERENCES:

- A. Reference to a technical society, institution, association or government authority is made in this specification with the following abbreviations:
- AAMA American Architectural Manufacturer's Association
ASTM American Society for Testing and Materials
ANSI American National Standard Institute
GSA General Service Administration
USDC U.S. Department of Commerce
FS Federal Specifications

1.03 SUBMITTALS:

- A. Provide Submittals in accordance with Section 01300.
- B. Product Data: Submit to the DNR Construction Inspector manufacturer's specifications, recommendations, and standard details for steel window units, including certified test laboratory reports as necessary to show compliance with requirements.
- B. Shop Drawings: Submit Shop Drawings, including wall elevations at 1/4" scale, typical unit elevations at 3/4" scale, and full-size detail sections of every typical composite member.
1. Show anchors, hardware, operators, and other components not included in manufacturer's standard data. Include glazing details.
- C. Certified test report from an AAMA approved independent testing laboratory indicating that the product meets the requirements of ANSI/AAMA 101-85.

1.04 QUALITY ASSURANCE:

- A. Except as otherwise indicated, requirements for steel windows, terminology and standards of performance, and fabrication workmanship are those specified and recommended in ANSI/AAMA 101-85 "Voluntary Specifications for Prime Windows and Sliding Glass Doors" and applicable general recommendations, standards and specifications published by AAMA, ANSI, ASTM, GSA and USDC.
- B. On each unit, provide AAMA sponsored label certifying compliance with the specified requirements.

1.05 DELIVERY, STORAGE, AND HANDLING:

- A. Packing and Shipping: Deliver to the job site in their manufacturer's original containers, with labels intact and legible.
 - 1. Maintain packaged materials with seals unbroken and labels intact until time of use.
 - 2. Promptly remove damaged material and unsuitable items from the job site, and promptly replace with material meeting the specified requirements, at no additional cost to the Owner.
- B. The DNR Construction Inspector may reject as non-complying such material and products that do not bear identification satisfactory as to manufacturer, grade, quality, and other pertinent information.

1.06 PROJECT/SITE CONDITIONS:

- A. Visit the site and verify all existing conditions.
 - 1. Failure to visit the site will in no way relieve the Contractor from necessity of furnishing any material or performing any work that may be required in accordance with specifications.
- B. Field Measurements: Where possible, check actual window openings in construction work by accurate field measurement before fabrication, and show recorded measurements on final Shop Drawings.
 - 1. However, coordinate fabrication schedule with construction progress as directed by Contractor to avoid delay of work.
 - 2. Where necessary, proceed with fabrication without field measurements, and coordinate installation tolerances to ensure proper fit of window units.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

- A. Drawings are based on steel window units by the following:

Winco Corporation,.
- B. Provide steel window units by manufacturer of those upon which Drawings are based or by one of the following:
 - 1. William Bailey Company
 - 2. EFCO Corporation
 - 3. Hope's Window Division; Roblin
 - 4. Milco Division, Wausau Metal Corporation
 - 5. Marnet Corporation

2.02 MATERIALS:

- A. Steel Extrusions: Alloy and temper recommended by window manufacturer for strength, corrosion resistance, and application of required finish, but not less than 22,000 psi ultimate tensile strength and not less than 0.062" thickness at any location for main frame and sash members.
- B. Fasteners: Nonmagnetic stainless steel, or other materials warranted by manufacturer to be noncorrosive and compatible with metal members, trim, hardware, anchors, and other components of window units.
 - 1. Reinforcement: Where fasteners screw or anchor into steel less than 0.125" thick, reinforce interior with nonmagnetic stainless steel to receive screw threads, or provide standard noncorrosive pressed-in splined grommet nuts.
 - 2. Do not use exposed fasteners except where unavoidable for application of hardware.
 - a. Match finish of adjoining metal.
 - 3. Provide Phillips flat-head machine screws for exposed fasteners.
- C. Anchors, Clips and Window Accessories: Depending on strength and corrosion-inhibiting requirements, fabricate units of nonmagnetic stainless steel, hot-dip zinc coated steel or iron complying with ASTM A 386.
- D. Compression Glazing Strips and Weatherstripping: At manufacturer's option, provide:
 - 1. Molded neoprene gaskets complying with ASTM D 2000 Designation 2BC415 to 3BC620.
 - 2. Molded PVC gaskets complying with ASTM D 2287.
 - 3. Molded expanded neoprene gaskets complying with ASTM C 509, Grade 4.
- E. Wire Fabric (Insect): 18 x 18, 18 x 16, or 18 x 14 mesh of 0.013" diameter aluminum wire, complying with FS RR-W-365, Type VII.
- F. Friction Shoes: Nylon or other nonabrasive, nonmetallic, nonstaining, noncorrosive durable material.
- G. Glass and Glazing: Glass furnished by the manufacturer shall meet or exceed the requirements of a design pressure of 15 lbf/ft² (719 Pa) in accordance with GSA FS DD-G-451D, as specified in ANSI/AAMA 101-85.

2.03 MANUFACTURED UNITS:

- A. Provide window units only from manufacturers who can prove compliance with the requirement of ANSI/AAMA 101-85 unless approved by the Project Engineer.
- B. Comply with air infiltration tests in accordance with ASTM E283-83, and water resistance tests according to ASTM 547-83, uniform load structural test according to ASTM 330-79 as specified in ANSI/AAMA 101-85.
- C. Window Classification (Grade): Except as otherwise indicated, provide window units of each category complying with the requirements of AAMA designation listed below:
 - 1. Awning: A-R15
 - 2. Casement: C-R15
 - 3. Double Hung: DH-R15

- | | | |
|----|---------------------|---------|
| 4. | Horizontal Sliding: | HS-R15 |
| 5. | Projected: | P-R15 |
| 6. | Sliding Glass Door: | SGD-R15 |
| 7. | Fixed: | F-R15 |
| 8. | Jal-Awning: | JA-R15 |
| 9. | Jalousie: | J-R15 |

D. Window Types (Operation): Follow paragraphs defined operating arrangements for types of sash (ventilators) required in window units and specified minimum provisions for each type. Where two or more types of operating sash are included in same window unit, consider the unit a "combination window."

1. Awning: Multiple top-hinged ventilators in a vertical series within a common frame, operated by one control device which swings the bottom edge of all ventilators, outwards.
2. Casement: One or more ventilators projected outward from the plane of the frame, side-hinged or pivoted at the jambs and swinging about the vertical axis.
3. Double Hung: Vertically operated windows, in which the weight of the sash are offset by a counterbalancing mechanism, with locking devices.
4. Horizontal Sliding: One or more horizontally operable sash in a sealing or weathering frame.
5. Projected: One or more ventilators hinged or pivoted at the top or bottom and which project inward or outward from the plane of the window.
6. Sliding Glass Doors: One or more panels of glass, contained in aluminum frames which, in turn are contained within an overall aluminum frame designed so that one or more panels are movable in a horizontal direction.
7. Fixed: Nonoperable glazed frame installed into the opening.
8. Jal-Awning: Multiple top-hinged ventilator in a vertical series within a common frame, operated by one or more control devices which swing the bottom edges of ventilators outward.
9. Jalousie: Series of overlapping, horizontal louvers which pivot simultaneously in a common frame and are actuated by one or more operating devices to swing top edge toward interior and bottom edge toward exterior.

2.04 ACCESSORIES:

- A. General: Provide manufacturer's standard accessories which comply with indicated standards.
 1. Include complete system for assembly of accessories and anchorage of window units.
- B. Provides compression-type weatherstripping at perimeter of each operating sash, except provide sliding weatherstripping at all locations where sash rails slide horizontally or vertically along frame of units.
- C. Provide insect screen unit for each operable exterior sash, except as otherwise indicated.
 1. Locate screen units on either inside or outside of sash, depending upon window type and as shown.
 2. Where possible, design window units and hardware to accommodate screens in a tight-fitting removable arrangement with a minimum of exposed fasteners and latches, and without necessity of wickets for hardware access.

3. Where wickets are necessary, provide either sliding or hinged type, framed and trimmed for durability during handling and for tight fit.

2.05 FABRICATION:

- A. General: Provide manufacturer's standard fabrication and accessories which comply with indicated standards and are reglazable without dismantling of sash framing, except to extent more specific or more stringent requirements are indicated.
 1. Include complete system for assembly of components and anchorage of window units, and prepare sash for glazing except where preglazing at factory is indicated.
- B. Provide "thermo-break" construction of window units so that metal parts exposed on exterior are separated from metal parts exposed on interior by a continuous gasket or filler of rubber or plastic locked into construction.
- C. Sizes and Profiles: Required sizes of window units and profile requirements are shown on Drawings.
 1. Variable dimensions (if any) are indicated along with maximum and minimum dimensions as required to achieve design requirements and coordination with other work.
 2. Details shown are based upon standard details by one or more manufacturers.
 3. Similar details by other manufacturers will be acceptable, provided they comply with size requirements, minimum/maximum profile requirements, and performance standards as shown or specified.
- D. Preglazed Fabrication: Preglazed window units at factory where possible and practical for applications indicated. Comply with requirements of "glass and glazing" section in addition to requirements of ANSI/AAMA 101-85.
- E. Provide means of drainage for water and condensation which may accumulate in members of window units.
- F. Provide mullions and cover plates as shown, matching window units, and complete with anchors for support and installation.
 1. Allow for erection tolerances and provide for movements of window units due to thermal expansion and building deflections.
- G. Fabricate screen frames of either extruded or formed aluminum tubular-shaped members of 0.040" minimum wall thickness, with mitered or coped joints and concealed mechanical fasteners, with removable PVC spline-anchor concealing edge of screen fabric.
 1. Finish frames to match window units, unless otherwise indicated.
- H. Organic Finish: AAMA and AAMA 605 baked-on enamel as follows:
 1. Provide standard baked-on enamel, color to be Dark Green.

PART 3 - EXECUTION

3.01 EXAMINATION:

- A. Examine the areas and conditions under which work of this section will be performed.
- B. Correct conditions detrimental to timely and proper completion of the work.
- C. Do not proceed until unsatisfactory conditions are corrected.

3.02 INSTALLATION:

- A. Comply with manufacturer's specifications and recommendations for installation of window units, hardware, operators, and other components of work.
- B. Set units plumb, level, and true to line without warp or rack of frames or sash.
 - 1. Anchor securely in place.
 - 2. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action.
- C. Set sill members and other members in bed of compound as shown or with joint fillers or gaskets as shown to provide weathertight construction.
 - 1. Refer to Division 7 sealant sections for compounds, fillers and gaskets to be installed with window units.
 - 2. Coordinate installation with wall flashings and other components of work.

3.03 ADJUSTING:

- A. Adjust operating sash and hardware to provide tight fit at contact points and at weatherstripping for smooth operation and weathertight closure.

3.04 CLEANING:

- A. Clean all surfaces promptly after installation of windows, exercising care to avoid damage to protective coatings and finishes.
 - 1. Remove excess glazing and sealant compounds, dirt and other substances.
 - 2. Lubricate hardware and moving parts.
- B. Clean glass of preglazed units promptly after installation of windows; comply with requirements of "glass and glazing" section for cleaning and maintenance.

3.05 PROTECTION:

- A. Initiate and maintain all protection and other precautions required to ensure that window units will be without damage or deterioration (other than normal weathering) at time of acceptance.

END OF SECTION 08510

PART 1 - GENERAL

1.01 SUMMARY:

- A. Section Includes: The furnishing of all materials and labor to install all Builders' Hardware with suitable fastenings for completed work in accordance with the Drawings and Specifications.
1. Quantities listed in each instance are for the Contractor's convenience only and are not guaranteed. Items not specifically mentioned but necessary to complete the work shall be furnished, matching in quality and finish the items specified for similar locations.
 - a. Should any item listed herein be incorrect due to construction details, it shall be the Hardware Supplier's responsibility to furnish the proper item at no additional cost to the Owner.
 2. Types of items in this section may include, but are not necessarily limited to, the following:
 - a. Hinges
 - b. Pivots
 - c. Spring hinges
 - d. Lock cylinders and keys
 - e. Lock and latch sets
 - f. Bolts
 - g. Exit devices
 - h. Push/pull units
 - i. Sliding door equipment
 - j. Bi-fold door hardware
 - k. Closers
 - l. Overhead holders
 - m. Miscellaneous door control devices
 - n. Door trim units
 - o. Protection plates
- B. Related Sections: Drawings and General Provisions of the contract, including the General Covenants and Provisions, Supplementary Covenants and Provisions and General Requirements as well as, but not necessarily limited to, the following.

Section 06200 Finish Carpentry
Section 06400 Cabinet Hardware
Section 01060 Toilet Compartment

1.02 REFERENCES:

- A. Builders' Hardware Manufacturer Association numbers taken from the following BHMA standards. Provide products complying with these standards and requirements specified elsewhere in this section.
1. Butts and Hinges: ANSI A156.1 (BHMA 101)
 2. Locks and Lock Trim: ANSI A156.2 (BHMA 601)
 3. Exit Devices: ANSI A156.3 (BHMA 701)
 4. Door Controls - Closers: ANSI A156.5 (BHMA 501)
 5. Auxiliary Locks: ANSI A 156.5 (BHMA 501)

6. Architectural Door Trim: ANSI A156.6 (BHMA 1001)
 7. Template Hinge Dimensions: ANSI A156.7
 8. Door Controls - Overhead Holders: ANSI A156.8 (BHMA 311)
 9. Mortise Locks and Latches: ANSI A156.13 (BHMA 621)
 10. Sliding and Folding Door Hardware: ANSI A156.14 (BHMA 401)
 11. Spring Hinges: BHMA 1101
 12. Auxiliary Hardware: BHMA 1201
- B. Federal Specification numbers taken from following federal specifications. Provide products complying with these specifications and requirements specified elsewhere in this section.
1. Locks and Door Trim: FS FF-H-106
 2. Hinges: FS FF-H-116
 3. Shelf & Miscellaneous Builders' Hardware: FS FF-H-111
 4. Door Closers: FS FF-H-121
- C. American National Standard Institute (ANSI)
1. ANSI A117.1 - Specifications for making buildings and facilities accessible to, and usable by, physically handicapped people.

1.03 DEFINITIONS:

- A. Definition: "Builders' Hardware" includes items known commercially as builders' hardware which are required for swing, sliding and folding doors, except special types of unique and nonmatching hardware specified in the same section as the door and door frame.

1.04 SUBMITTALS:

- A. Provide submittals in accordance with Section 01300.
- B. Product Data: Submit manufacturer's technical information for each item of hardware, including whatever information may be necessary to show compliance with requirements, and instructions for installation and for maintenance of operating parts and finish.
- C. Hardware Schedule: Submit final hardware schedule in manner indicated below, for coordination of work.
- D. Final Hardware Schedule Content: Based on builders' hardware indicated, organize hardware schedule into "hardware sets" indicating complete designations of every item required for each door or opening, including the following information:
1. Type, style, function, size and finish of each hardware item.
 2. Name and manufacturer of each item.
 3. Fastenings and other pertinent information.
 4. Location of hardware set cross-referenced to indications on Drawings both on floor plans and in door and frame schedule.
 5. Explanation of all abbreviations, symbols, codes, etc. contained in schedule.

6. Mounting locations for hardware.
 7. Door and frame sizes and materials.
 8. Keying Schedule: Submit separate detailed schedule indicating clearly how the Owner's final instruction on keying of locks has been fulfilled.
- E. Samples: Prior to submittal of the final hardware schedule and prior to final ordering of builders' hardware, submit one sample of each type of exposed hardware unit, finished as required, and tagged with full description for coordination with schedule.
1. Samples will be returned to the supplier.
 2. Units which are acceptable and remain undamaged through submittal, review and field comparison procedures may, after final check of operation, be used in the work, within limitations of keying coordination requirements.

1.05 QUALITY ASSURANCE:

- A. Manufacturer: Obtain each kind of hardware (latch and lock sets, hinges, closers, etc.) from only one manufacturer, although several may be indicated as offering products complying with requirements.
- B. Supplier: A recognized builders' hardware supplier who has been furnishing hardware in the project's vicinity for a period of not less than two (2) years, and who is or employs an experienced hardware consultant who is available at reasonable times during the course of the work for consultation about project's hardware requirements to Owner, Architect, and Contractor.
- C. Installer: Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this section.

1.06 DELIVERY, STORAGE, AND HANDLING:

- A. Packaging of hardware on a set-by-set basis is the responsibility of the supplier.
 1. As material is received by the hardware supplier from the various manufacturers, sort and repackage in containers marked with the hardware set number.
 2. Two or more identical sets may be packed in the same container.
- B. Inventory hardware jointly with representatives of the hardware supplier and the hardware installer until each is satisfied that the count is correct.
- C. Provide secure lock-up for hardware delivered to the project, but not yet installed. Control handling and installation of hardware items which are not immediately replaceable so that the completion of the work will not be delayed by hardware losses both before and after installation.

1.07 SEQUENCING AND SCHEDULING:

- A. Coordination: Coordinate hardware with other work. Tag each item or package separately with identification related to the final hardware schedule, and include basic installation instructions in the package.
 1. Furnish hardware items of proper design for use on doors and frames of the thicknesses, profile, swing, security and similar requirements indicated as necessary for proper installation and function.

2. Deliver individually-packaged hardware items at the proper times to the proper locations (shop or project site) for installation.
- B. Templates: Furnish hardware templates to each fabricator of doors, frames, and other work to be factory-prepared for the installation of hardware.
1. Upon request, check the Shop Drawings of such other work to confirm that adequate provisions are made for the proper installation of hardware.

1.08 MAINTENANCE:

- A. Instruct Owner's personnel in proper adjustment and maintenance of hardware and hardware finishes during the final adjustment of hardware.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

- A. Subject to compliance with the requirements, products from, but not limited to, the following can be incorporated in the work of this section:

1. Hager Hinge Co., St. Louis, MO
2. Stanley Hardware, New Britain, CT
3. LCN Closers, Princeton, IL
4. Rixson-Firemark, Division of Conrac Corp., Franklin Park, IL
5. Norton, Yale, Scovill, Charlotte, NC
6. Sargent, Division of Kidde, Inc., New Haven, CT
7. Schlage Lock Company, San Francisco, CA
8. Zero International, New York, NY
9. Reese Enterprises, Inc., Rosemont, MN
10. Sager Weatherstrip Co., Chicago, IL
11. Assa, Downers Grove, IL
12. Baldwin Hardware Manufacturing Corp., Reading, PA
13. Corbin, Berlin, CT
14. Hiawatha Architectural Hardware, Bloomington, MN
15. McKinney, Kidde, Inc., Scranton, PA
16. Combo Aluminum Products, Santee, CA
17. National Guard Products, Memphis, TN
18. Penko, Ventura, CA

- B. Hardware Manufacturer Designation: Listed names of manufacturers and products, names and numbers in "schedule" are used to establish minimum requirements for design, grade, function, finish, size, and other distinctive quality for each type of buildings' hardware specified for this project.

1. Provide the product designated or comparable product from another manufacturer which complies with requirements including those specified elsewhere in this section.

- C. Selected Manufacturers:

1. Butts and Hinges: Stanley Hardware Co.
2. Pivots: Rixson-Firemark
3. Locks: Schlage Lock Co.

4. Bolts: Sargent
5. Push/Pull Units: Russwin
6. Overhead Closers: LCN Closers
7. Door Stripping and Seals: Stanley Hardware Co.
8. Smoke Activated Closers: Rixson-Firemark
9. Door Control Devices: Russwin
10. Door Trim Units: Sargent
11. Thresholds: Stanley Hardware Co.

D. Selected Hardware Designs:

1. Mortise Locks: Yale-Easton
2. Cylindrical Locksets: Yale-Letchfield

2.02 MATERIALS:

A. General:

1. Hand of Door: The Drawings show the direction of slide, swing or hand of each door leaf.
 - a. Furnish each item of hardware for proper installation and operation of the door movement as shown.
2. Base Metals: Produce hardware units of the basic metal and forming method indicated, using the manufacturer's standard metal alloy, composition, temper and hardness, but in no case of lesser (commercially recognized) quality than specified for the applicable hardware units by FS FF-H-106, FS FF-G-111, FS FF-H-116 and FS FF-H-121.
 - a. Do not furnish "optional" materials or forming methods for those indicated, except as otherwise specified.
3. Fasteners: Manufacture hardware to conform to published templates, generally prepared for machine screw installation.
 - a. Do not provide hardware which has been prepared for self-tapping sheet metal screws, except as specifically indicated.
4. Furnish screws for installation with each hardware item.
 - a. Provide Phillips flat-head screws except as otherwise indicated.
 - b. Finish exposed (exposed under any condition) screws to match the hardware finish or, if exposed in surfaces of other work, to match the finish of such other work as closely as possible, including "prepared for paint" in surfaces to receive painted finish.
5. Provide concealed fasteners for hardware units which are exposed when the door is closed, except to the extent no standard units of the type specified are available with concealed fasteners.
 - a. Do not use through bolts for installation where the bolt head or the nut on the opposite face is exposed in other work, except where it is not feasible to adequately reinforce the work.
6. Tools for Maintenance: Furnish a complete set of specialized tools as needed for Owner's continued adjustment, maintenance, and removal and replacement of builders' hardware.

B. Hinges, Butts, and Pivots:

1. Templates: Except for hinges and pivots to be installed entirely (both leaves) into wood doors and frames, provide only template-produced units.
2. Screws: Furnish Phillips flat-head all-purpose or machine screws for installation of units, except furnish Phillips flat-head all-purpose or wood screws for installation of units into wood.
 - a. Finish screw heads to match surface of hinges or pivots.
3. Hinge Pins: Except as otherwise indicated, provide hinge pins as follows:
 - a. Steel Hinges: Steel pins.
 - b. Nonferrous Hinges: Stainless steel pins.
 - c. Exterior Doors: Nonremovable pins.
 - d. Out-Swing Corridor Doors: Nonremovable pins.
 - e. Interior Doors: Nonrising pins.
 - f. Tips: Flat button and matching plug, finished to match leaves, except where hospital tip (HT) indicated.
 - g. Number of Hinges: Provide number of hinges indicated, but not less than three (3) hinges for door leaf for doors 90" or less in height and one additional hinge for each 30" of additional height.

C. Lock Cylinders and Keying:

1. Standard System: Except as otherwise indicated, provide new masterkey system for project.
2. Review the keying system with the Owner and provide the type required (master, grandmaster or great-grandmaster), either new or integrated with Owner's existing system.
3. Equip locks with manufacturer's standard six-pin tumbler cylinders.
4. Comply with Owner's instructions for masterkeying and, except as otherwise indicated, provide individual change key for each lock which is not designated to be keyed alike with a group of related locks.
5. Key Material: Provide keys of nickel silver only.
6. Key Quantity: Furnish three (3) change keys for each lock; five (5) master keys for each master system; and five (5) grandmaster keys for each grandmaster system.
7. Deliver keys to Owner's representative.

D. Locks, Latches and Bolts:

1. Strikes: Provide manufacturer's standard wrought box strike for each latch or lock bolt, with curved lip extended to protect frame, finished to match hardware set.

- a. Provide standard (open) strike plates for interior doors of residential units where wood door frames are used.
 2. Lock Throw: Provide five-eighths inch (5/8") minimum throw of latch and deadbolt used on pairs of doors. Comply with UL requirements for throw of bolts and latch bolts on rated fire openings.
 - a. Provide one-half inch (1/2") minimum throw on other latch and deadlock bolts.
 3. Flush Bolt Heads: Minimum of one-half inch (1/2") diameter rods of brass, bronze or stainless steel, with minimum of twelve-inch (12") long rod.
 4. Exposed Fasteners: Provide manufacturer's standard exposed fasteners for installation; through-bolted for matched pairs, but not for single units.
- E. Closers:
1. Size of Units: Except as otherwise specifically indicated, comply with the manufacturer's recommendations for size of door control unit, depending upon size of door, exposure to weather and anticipated frequency of use.
 - a. Where parallel arms are indicated for closures, provide closer unit one size larger than recommended for use with standard arms.
 - b. Provide parallel arms for all overhead closers, except as otherwise indicated.
 2. Access-Free Manual Closers: Where manual closers are indicated for doors required to be accessible to the physically handicapped, provide adjustable units complying with ANSI A 117.1 provisions for door opening force and delayed action closing.
 3. Provide matching finishes for hardware units at each door or opening to the greatest extent possible and except as otherwise indicated.
 - a. Reduce differences in color and textures as much as commercially possible where the base metal or metal forming process is different for individual units of hardware exposed at the same door or opening.
 - b. In general, match items to the manufacturer's standard finish for the latch and lock set (or push-pull units if no latch-lock sets) for color and texture.
 4. Provide finishes which match those established by BHMA or, if none established, match the Architect's sample.
 - a. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness and other qualities complying with manufacturer's standards, but in no case less than specified for the applicable units of hardware by referenced standards.
 5. Provide protective lacquer coating on all exposed hardware finishes of brass, bronze and aluminum except as otherwise indicated.
 - a. The suffix "-NL" is used with standard finish designations to indicate "No Lacquer."
 6. The designations used in schedules and elsewhere to indicate hardware finishes are those listed in "Materials and Finishes Standard 1301" by BHMA, including coordination with the traditional U.S. finishes shown by certain manufacturers for their products.

PART 3 - EXECUTION

3.01 INSTALLATION:

- A. Mount hardware units at heights indicated in "Recommended Locations for Builders' Hardware for Standard Steel Doors and Frames" by the Door and Hardware Institute, except as specifically indicated or required to comply with governing regulations, and except as may be otherwise directed by the Architect.
- B. Mount hardware units at heights indicated in "Recommended Locations for Builders' Hardware for Custom Steel Doors and Frames" by the Door and Hardware Institute, except as specifically indicated or required to comply with governing regulations and except as otherwise directed by the Architect.
- C. Install each hardware item in compliance with the manufacturer's instructions and recommendations.
 - 1. Wherever cutting and fitting is required to install hardware onto or into surfaces which are later to be painted or finished in another way, coordinate removal, storage and reinstallation or application of surface protections with finishing work specified in the Division sections.
 - 2. Do not install surface-mounted items until finishes have been completed on the substrate.
- D. Set units level, plumb and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.
- E. Drill and countersink units which are not factory-prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.

3.02 ADJUSTING:

- A. Adjust and check each operating item of hardware and each door to ensure proper operation or function of every unit.
- B. Replace units which cannot be adjusted to operate freely and smoothly as intended for the application made.

3.03 SCHEDULES:

- A. Refer to Schedule on Drawings for hardware selection.

END OF SECTION 08700

PART 1 - GENERAL

1.01 SUMMARY:

A. Section Includes:

1. Extent of painting work is shown on Drawings and Schedules, and as herein specified.
 2. The work includes painting and finishing of interior and exterior exposed items and surfaces throughout project, as indicated on the Drawings.
 - a. Surface preparation, priming and coats of paint specified are in addition to shop-priming and surface treatment specified under other sections of work.
 3. Paint exposed surfaces whether or not colors are designated in "schedules," except where natural finish of material is specifically noted as a surface not to be painted. Where items or surfaces are not specifically mentioned, paint same as adjacent similar materials or areas. If color or finish is not designated, Project Engineer will select these from standard colors available for materials systems specified.
 4. Shop Priming: Unless otherwise specified, shop priming of ferrous metal items is included under various sections for structural steel, miscellaneous metal, hollow metal work, and similar items. Also, for fabricated components such as architectural woodwork, wood casework, and factory-built or shop-fabricated mechanical and electrical equipment or accessories.
 5. Prefinished Items: Unless otherwise indicated, do not include painting when factory finishing or installer finishing is specified for such items as (but not limited to) metal toilet enclosures, prefinished partition systems, acoustic materials, architectural woodwork and casework, finished mechanical and electrical equipment including light fixtures, switchgear and distribution cabinets, elevator entrance frames, doors and equipment.
 6. Concealed Surfaces: Unless otherwise indicated, painting is not required on surfaces such as wells or ceilings in concealed areas and generally inaccessible areas, foundation spaces, furred areas, utility tunnels, pipe spaces, duct shafts, and elevator shafts.
 7. Finished Metal Surfaces: Metal surfaces of anodized aluminum, stainless steel, chromium plate, copper, bronze and similar finished materials will not require finish painting, unless otherwise indicated.
 8. Operating Parts and Labels: Moving parts of operating units, mechanical and electrical parts, such as valve and damper operators, linkages, sinkages, sensing devices, motor and fan shafts will not require finish painting, unless otherwise indicated.
 9. Do not paint over any code-required labels, such as Underwriters' Laboratories and Factory Mutual, or any equipment identification, performance rating, name, or nomenclature plates.
- B. Related Sections: Drawings and General Provisions of the contract, including the General Covenants and Provisions, Supplementary Covenants and Provisions and General Requirements.

1.02 DEFINITIONS:

- A. "Paint," as used herein, means coating systems materials including primers, emulsions, epoxy, enamels, sealer, fillers, and other applied materials whether used as prime, intermediate, or finish coats.

1.03 SYSTEM DESCRIPTION:

- A. Exterior Paint System (EPS): Provide following exterior paint systems for various substrates, as indicated.

1. EPS-1: Exterior Acrylic Masonry Water Repellent
2. EPS-2: Exterior Acrylic Emulsion - Concrete Masonry
3. EPS-3: Exterior Oil Stain - Wood Trim and Siding
4. EPS-4: Exterior Acrylic Emulsion - Wood Trim and Siding
5. EPS-5: Exterior Alkyd Enamel - Ferrous Metal
6. EPS-6: Exterior Alkyd Enamel - Galvanized and Aluminum Metals

- B. Interior Paint System (IPS): Provide following interior paint systems for various substrates, as indicated:

1. IPS-1: Interior Acrylic Masonry Water Repellent
2. IPS-2: Interior Latex Emulsion - Concrete Masonry Wallboard
4. IPS-4: Interior Latex Emulsion (Semi-Gloss) - Gypsum Wallboard
5. IPS-5: Interior Alkyd Enamel - Woodwork
6. IPS-6: Interior Urethane Varnish - Protected Wood
7. IPS-7: Interior "Tile Like" Epoxy Finish - Concrete Masonry and Ferrous Metals

1.04 SUBMITTALS:

- A. Provide submittals in accordance with Section 01300, if applicable.
- B. Product Data: Submit manufacturer's technical information including paint label analysis, color selection catalogs and application instructions for each material proposed for use.
- C. Samples: Submit samples for Project Engineer's review of color and texture only. Provide a listing of material and application for each coat of each finish sample.

1.05 QUALITY ASSURANCE:

- A. Qualification of Manufacturer: Products used in the work of this section shall be produced by manufacturers regularly engaged in manufacture of similar items and with a history of successful production acceptable to the Project Engineer.

- B. Qualification of Workers:

1. Provide at least one person who shall be present at all times during execution of the work of this section, who shall be thoroughly familiar with the specified requirements and the materials and methods needed for their execution, and who shall direct all work performed under this section.
2. Provide adequate numbers of workers skilled in the necessary crafts and properly informed of the methods and materials to be used.

3. In acceptance or rejection of the work of this section, the Project Engineer will make no allowance for lack of skill on the part of workers.

1.06 DELIVERY, STORAGE, AND HANDLING:

- A. Deliver materials to job site in original, new and unopened packages and containers bearing manufacturer's name and label, and following information:
 1. Name or title of material.
 2. Fed. Spec. Number, if applicable.
 3. Manufacturer's stock number and date of manufacturer.
 4. Manufacturer's name.
 5. Contents by volume, for major pigment and vehicle constituents.
 6. Thinning instructions.
 7. Application instructions.
 8. Color name and number.
- B. Material delivered damaged, open, or in containers not properly labeled will be rejected by the DNR Construction Inspector.
- C. Promptly remove unacceptable material from the job site, and promptly replace with material meeting the specified requirements, at no additional cost to the Owner.

1.07 PROJECT/SITE CONDITIONS:

- A. Apply water-base paints only when temperature of surfaces to be painted and surrounding air temperatures are between 50øF. (10øC) and 90øF. (32øC), unless otherwise permitted by paint manufacturer's printed instructions.
- B. Apply solvent-thinned paints only when temperature of surfaces to be painted and surrounding air temperatures are between 45øF. (7øC) and 95øF. (35øC), unless otherwise permitted by paint manufacturer's printed instructions.
- C. Do not apply paint in snow, rain, fog or mist; or when relative humidity exceed 85%; or to damp or wet surfaces; unless otherwise permitted by paint manufacturer's printed instructions.
- D. Painting may be continued during inclement weather if areas and surfaces to be painted are enclosed and heated within temperature limits specified by paint manufacturer during application and drying periods.

1.08 SEQUENCING AND SCHEDULING:

- A. Coordinate with other trades. Do not start work of this section until the work of other trades, unless otherwise specified, has been completed in the areas to be painted.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

- A. Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work of this section include:
 1. Glidden Coatings and Resins, Cleveland, OH
 2. Iowa Paint Manufacturing Co., Des Moines, IA
 3. Fuller-O'Brien Paints and Coatings, San Francisco, CA
 4. Diamond Vogel Paint, Marshalltown, IA

5. Sherwin-Williams Co., Cleveland, OH
6. Pittsburg Paints, PPG Industries, Inc., Pittsburg, PA

2.02 MATERIALS:

- A. Provide best quality grade of various types of coatings as regularly manufactured by acceptable paint materials manufacturers. Materials not displaying manufacturer's identification as a standard, best-grade product will not be acceptable.
- B. Provide undercoat paint produced by same manufacturer as finish coats. Use only thinners approved by paint manufacturer, and use only within recommended limits.
- C. Paint Coordination: Provide finish coats which are compatible with prime paints used. Review other sections of these specifications in which prime paints are to be provided to ensure compatibility of total coatings system for various substrates. Upon request from other trades, furnish information on characteristics of finish materials proposed for use, to ensure compatible prime coats are used. Provide barrier coats over incompatible primers or remove and re-prime as required. Notify Project Engineer in writing of any anticipated problems using specified coating systems with substrates primed by others.
- D. Color Pigments: Pure, non-fading, applicable types to suit substrates and service indicated.
 1. Lead content in pigment, if any, is limited to contain not more than 0.5% lead, as lead metal based on the total nonvolatile (dry-film) of paint by weight.
 2. This limitation is extended to interior surfaces and those exterior surfaces, such as stairs, decks, porches, railings, windows, and doors which are readily accessible to children under seven years of age.
- E. Schedules: Paint colors, surface treatments, and finishes are indicated in Section 3.06 of this specification. Except as noted, listed coating names, numbers, and colors are used to establish the quality, type and color of coating.
 1. Proprietary names used to designate colors or materials are not intended to imply that products of named manufacturers are required to exclusion of equivalent products of other manufacturers.
 2. Manufacturer's products which comply with coating qualitative requirements of applicable Federal Specifications, yet differ in quantitative requirements, may be considered for use when acceptable to Project Engineer. Furnish material data and manufacturer's certificate of performance to Project Engineer for any proposed substitutions.

PART 3 - EXECUTION

3.01 EXAMINATION:

- A. Applicator must examine areas and conditions under which painting work is to be applied and notify Contractor in writing of conditions detrimental to proper and timely completion of work. Do not proceed with work until satisfactory conditions have been corrected in a manner acceptable to Applicator.
- B. Starting of painting work will be construed as Applicator's acceptance of surfaces and conditions within any particular area.

- C. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions otherwise detrimental to formation of a durable paint film.

3.02 PREPARATION:

- A. General: Perform preparation and cleaning procedures in accordance with paint manufacturer's instruction and as herein specified, for each particular substrate condition.
- B. Remove hardware, hardware accessories, machined surfaces, plates, lighting fixtures, and similar items in place and not to be finish-painted, or provide surface-applied protection prior to surface preparation and painting operations. Remove, if necessary, for complete painting of items and adjacent surfaces. Following completion of painting of each space or area, reinstall removed items.
- C. Clean surfaces to be painted before applying paint or surface treatments. Remove oil and grease prior to mechanical cleaning. Program cleaning and painting so that contaminants from cleaning process will not fall onto wet, newly painted surfaces.
- D. Cementitious Materials: Prepare cementitious surfaces of concrete, concrete block, cement plaster and cement-asbestos board to be painted by removing efflorescence, chalk, dust, dirt, grease, oils, and by roughening as required to remove glaze.
- E. Determine alkalinity and moisture content of surfaces to be painted by performing appropriate tests. If surfaces are found to be sufficiently alkaline to cause blistering and burning of finish paint, correct this condition before application of paint. Do not paint over surfaces where moisture content exceeds that permitted in manufacturer's printed directions.
- F. Clean concrete floor surfaces scheduled to be painted with a commercial solution of muriatic acid, or other etching cleaner. Flush floor with clean water to neutralize acid, and allow to dry before painting.
- G. Wood: Clean wood surfaces to be painted of dirt, oil, or other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sandpaper smooth those finished surfaces exposed to view, and dust off. Scrape and clean small, dry, seasoned knots and apply a thin coat of white shellac or other recommended knot sealer, before application of priming coat. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood-filler. Sandpaper smooth when dried.
- H. Prime, stain, or seal wood required to be job-painted immediately upon delivery to job. Prime edges, ends, faces, undersides, and backsides of such wood, including cabinets, counters, cases, and paneling.
- I. When transparent finish is required, use spar varnish for backpriming.
- J. Backprime paneling on interior partitions only where masonry, plaster, or other wet wall construction occurs on backside.
- K. Seal tops, bottoms, and cut-outs of unprimed wood doors with a heavy coat of varnish or equivalent sealer immediately upon delivery to job.
- L. Ferrous Metals: Clean ferrous surfaces, which are not galvanized or shop-coated, of oil, grease, dirt, loose mill scale, and other foreign substances by solvent or mechanical cleaning.
 - 1. Touch-up shop-applied prime coats wherever damaged or bare, where required by other sections of these specifications. Clean and touch-up with same type of shop primer.

M. Galvanized Surfaces: Clean free of oil and surface contaminants with non-petroleum based solvent.

N. Material:

1. Mix and prepare painting materials in accordance with manufacturer's directions.
2. Store materials not in actual use in tightly covered containers. Maintain containers used in storage, mixing and application of paint in a clean condition, free of foreign materials and residue.
3. Stir materials before application to produce a mixture of uniform density, and stir as required during application. Do not stir surface film into material. Remove film and, if necessary, strain material before using.

3.03 APPLICATION:

- A. General: Apply paint in accordance with manufacturer's directions. Use applicators and techniques best suited for substrate and type of material being applied.
- B. Apply additional coats when undercoats, stains or other conditions show through final coat of paint, until paint film is of uniform finish, color, and appearance. Pay special attention to ensure that surfaces, including edges, corners, crevices welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.
- C. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Paint surfaces behind permanently fixed equipment of furniture with prime coat only before final installation of equipment.
- D. Paint back sides of access panels, and removable or hinged covers to match exposed surfaces.
- E. Finish exterior doors on tops, bottoms and side edges same as exterior faces, unless otherwise indicated.
- F. Sand lightly between each succeeding enamel or varnish coat.
- G. Unless otherwise indicated, omit primer coat on metal surfaces which have been shop-primed and touch-up painted,
- H. Scheduling Painting: Apply first-coat material to surfaces that have been cleaned, pretreated or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.
- I. Allow sufficient time between successive coatings to permit proper drying. Do not re-coat until paint has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and application of another coat of paint does not cause lifting or loss of adhesion of the undercoat.
- J. Minimum Coating Thickness: Apply materials at not less than manufacturer's recommended spreading rate, to establish a total dry film thickness as indicated or, if not indicated, as recommended by coating manufacturer.
- K. Prime Coats: Apply prime coat on material required to be painted, and which has not been prime coated by others.
- L. Recoat primed and sealed surfaces where there is evidence of suction spots or unsealed areas in first coat, to assure a finish coat with no burn-through or other defects due to insufficient sealing.

- M. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish or repaint work not in compliance with specified requirements.

3.04 CLEANING:

- A. Clean-Up: During progress of work, remove from site discarded paint materials, rubbish, cans and rags at end of each work day.
- B. Upon completion of painting work, clean window glass and other paint-spattered surfaces. Remove spattered paint by proper methods of washing and scraping, using care not to scratch or otherwise damage finished surfaces.
- C. At the completion of work of other trades, touch-up and restore all damaged or defaced painted surfaces.

3.05 PROTECTION:

- A. Protect work of other trade, whether to be painted or not, against damage by painting and finishing work. Correct any damage by cleaning, repairing or replacing, and repainting as acceptable to Project Engineer.
- B. Provide "Wet Paint" signs as required to protect newly painted finishes. Remove temporary protective wrappings provided by others for protection of their work, after completion of painting operations.

3.06 SCHEDULES:

- A. Provide the paint finishes of equal products as specified on the Drawings.

END OF SECTION 09900

PART 1 - GENERAL

1.01 SUMMARY:

- A. Section Includes: Providing all material, tools, equipment, and labor necessary to complete the following:
1. Provide complete and functioning electrical power transmission, services and systems as shown on the Drawings, as specified herein, and as required for a complete and proper installation of a campground electrical system including, but not limited to:
 - a. Electrical service, complete, of size, voltage and type indicated or required to point of connection with utility company's equipment; all conductors shall be copper.
 - b. Service entrance with metering equipment and feed switches or breakers.
 - c. Main distribution panels and distribution panels or boards as needed.
 - d. Complete feeder system, underground, from the main distribution panels to individual campsite power outlets and branch panels.
 - e. Complete branch circuit wiring for receptacles, junction boxes, area lighting, and similar uses.
 - f. Exterior lighting fixtures, lamps and poles, terminal and splice boxes, campsite power outlets, switches, receptacles, controls, and motors, motor starters, detectable tape, and similar items.
 - g. Hangers, anchors, sleeves, bushings, conduits, conduit risers and elbows, supports for fixtures, equipment mounting structures, transformer pads and other electrical materials and equipment in association therewith.
 - h. Trenching and backfilling for underground electrical installation not specified elsewhere.
 - i. Connections to distribution panels in Buildings or existing utility company equipment, as shown on the Drawings.
 2. The omission of direct reference to an essential part, the necessity or use of which is reasonably implied shall not release the Contractor from providing the same.
 3. Inspect the site as necessary to become familiar with all existing conditions affecting the performance of the work under this Contract. Extras will not be allowed for failure to do so.
- B. Related Sections: Drawings and General Provisions of the contract, including the General Covenants and Provisions, Supplementary Covenants and Provisions and General Requirements as well as, but not necessarily limited to, the following:

Section 02220 Trenching, Backfilling and Compacting

- C. Certain material may be provided by others to be installed under this contract. Coordinate with DNR Construction Inspector, utility company and other slated to provide material to be installed as part of this contract.

1.02 REFERENCES:

- A. Codes, Ordinances, and Standards: Comply with all applicable codes and regulations of the following:
 - 1. National Electric Code, latest edition;
 - 2. Local Utility Company Regulations;
 - 3. Underwriter's Laboratories.

1.03 SYSTEM DESCRIPTION:

- A. Power system shall be a 120/240 volt, 60 cycle, single phase 3-wire solid neutral, underground system.
 - 1. Ground circuits at the transformer/main distribution panel with a No.6 AWG continuous copper grounding conductor type THW routed with the circuit conductors.
- B. Verify the exact location of primary service, secondary service, and transformers at the job site.
- C. Underground Service Entrance: Unless otherwise specified elsewhere conductors will be continuous direct burial cable, USE or UF neoprene jacket insulated and moisture resistant non-metallic outer covering.
 - 1. Minimum burial depth 24 inches.
 - 2. Furnish and install number and size of conductors shown or as required by N.E.C.
 - a. All conductors shall be copper.

1.04 SUBMITTALS:

- A. Submit shop drawings, diagrams, and product information, material lists and manufacturer's specifications to Project Engineer before obtaining material, including but not necessarily limited to the following:
 - 1. Panelboards, power outlets, and equipment.
 - 2. Each specialized installation or system, including assembly or coordination Drawings.
- C. Product Data, Submit:
 - 1. Materials list of items proposed to be provided under this section;
 - 2. Manufacturers' specifications and other data needed to prove compliance with the specified requirements;
 - 3. Manufacturers' recommended installation procedures which, when approved by the Project Engineer, will become the basis for accepting or rejecting actual installation procedures used on the work.

- D. Manual: Upon completion of this portion of the work, and as a condition of its acceptance, deliver to the Project Engineer two copies of an operation and maintenance manual, which shall include:
1. Copy of the approved Record Documents for this portion of the work;
 - a. Shop drawings, diagrams, material lists, and product information.
 - b. As-built drawings showing any changes in construction, additions and/or deletions from the Project Engineer's Drawings.
 2. Copies of all circuit directories;
 3. Copies of all warranties and guarantees.

1.05 QUALITY ASSURANCE:

- A. Qualification of Installers: For the actual fabrication, installation, and testing of the work in this section, use only thoroughly trained, licensed, experienced workers completely familiar with the items required and with the manufacturer recommended methods of installation.
1. In acceptance or rejection of installed work, no allowance will be made for lack of skill on part of workers.
- B. Provide only new materials of grade and quality specified. Unless otherwise approved or specified, provide only materials, equipment, devices, fittings, etc., of U.S. manufacture.
- C. Except as otherwise indicated, comply with the provisions of NEC and the standards by NEMA for electrical components.
1. Provide UL listed and labeled products where applicable.

1.06 DELIVERY, STORAGE, AND HANDLING:

- A. Protection: Use all means necessary to protect the materials of this section before, during, and after installation and to protect the work and materials of all other trades.
- B. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Project Engineer/DNR Construction Inspector and at no additional cost to the Owner.

1.07 SEQUENCING AND SCHEDULING:

- A. Coordination of Work: Plan all work so that it proceeds with a minimum of interference with the work of other trades.
1. Coordinate all openings, special frames and sleeves required in the building construction for electrical work with the construction work of others both within and outside of this Contract.
- B. Cooperation with Other Trades: Coordinate the work to be performed in compliance with the requirements of other trades and afford other trades reasonable opportunity for the execution of their work.
1. Coordinate this work shall with the work of other trades at such time and in such a manner as not to delay or interfere with their work.

1.08 WARRANTY:

- A. Guarantee the entire installation, including every part and every specialized system, with the exception of lamps, from the standpoint of workmanship and material for one year after formal acceptance by the Project Engineer.
- B. Correct any defects becoming apparent during the guarantee period at no cost to the Owner.
- C. Do not construe this guarantee requirement as obligating the Contractor to make repair or replacements for equipment failure as a result of improper operation or maintenance by the Owner.

1.09 MAINTENANCE STOCKS:

- A. Provide 5 percent excess over the required amount of spring-loaded nuts, washers, conduit clamps, and other specialized fasteners for mounting electrical equipment.
 - 1. Store where directed by the DNR Construction Inspector.
- B. Prior to the acceptance of the equipment with plug-in receptacles and ground fault interrupters, provide two GFI testers as per Section 2.03(K) of this specification, to be used by the DNR for testing. (To remain the property of the DNR thereafter)

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

- A. Subject to compliance with requirements, manufacturer offering electrical material and components which may be incorporated in the work include, but are not limited to, the following:
 - 1. Square D
 - 2. General Electric
 - 3. ITE
 - 4. Westinghouse
 - 5. Hubbell
 - 6. Bryant
 - 7. Arrow-Hart

2.02 MATERIALS:

- A. Provide only materials that are new, of the type and quality specified.
 - 1. Where Underwriter's Laboratories, Inc. have established standards for such materials, provide only materials bearing the UL label.
- B. Provide only copper conductors as part of permanent installation within this project, from connection with the power company's equipment to connection to fixtures, receptacles or other devices or appliance as specified herein.
 - 1. The Project Engineer will not approve others for use anywhere within this project at any location.

2. Remove any wire or cable used on this project which does not meet this requirement and replace at no cost to the Owner.

C. Temporary Power:

1. In addition to providing temporary power, provide and pay the costs for installing permanent electrical meter or meters as required;
2. When permanent metering is in place and connected, the Owner will pay the costs for electrical power charged against the meter or meters.

2.03 COMPONENTS:

A. Distribution Panels:

1. Circuit breaker type with single main disconnect, solid neutral with voltage and main bus rating equal to or exceeding rating on panel schedule.
2. Boxes: Code gauge steel, galvanized, with surface cover.
3. Trim: Code gauge steel with gray enamel finish and door, complete with directory of circuits and key locked.
4. Branch circuit breakers: Plug-in or bolt-in, of rating and poles indicated, with thermal-magnetic tripping mechanism at each pole, with quick-make and quick-break action, toggle type operating mechanism.
 - a. Provide multiple pole breakers with a common trip.
 - b. Provide breakers with ground fault protection for outlets as required by Code, except for outlets requiring ground fault interruption as indicated on the Drawings for which separate and individual ground fault protection and reset features will be provided integral to the outlet.
5. Provide panels, for 200-Amp or less and 120/240 volt service, with amperage indicated, as manufactured by, but not limited to, one of the following:
 - a. Square D
 - b. General Electric
 - c. ITE
 - d. Westinghouse
6. Provide main distribution panels: For 225-Amp, 400-Amp, or 600-Amp, and 120/240 volt service, as shown on the Drawings, provide main distribution panels with solid neutral and equipment ground bar installed, dead-front enclosed board assembly, NEMA type 3R rain-proof cabinet with concealed door hinge, gasketed door, 3-point vault-type locking mechanism with chrome finish padlock handle, with rust inhibiting primer and a finish coat of standard gray baked enamel, as manufactured by, but not limited to one of the following:
 - a. Square D
 - b. General Electric
 - c. Others as approved by the Project Engineer
7. U.L. approved and N.E.C. rated.

B. Wiring Devices:

1. Receptacles: Specification grade, duplex, 3-pole grounding type, amperage as shown, 125 V AC as manufactured by, but not limited to, one of the following:
 - a. Hubbell
 - b. Bryant
 - c. Leviton

C. Fittings, Boxes, Etc.:

1. All outlet boxes, junction boxes, and switch boxes shall be code gauge galvanized steel.
2. Boxes shall be square, rectangular, or octagonal of a suitable and ample size.

D. Raceways and Fittings:

1. Conduit shall be rigid galvanized steel conduit with compression or tap-on type fittings.
2. Conduit installed in concrete slab or underground shall be rigid galvanized coated with asphaltic paint.
3. All conduit and fittings shall be U.L. approved and N.E.C. rated.
4. No conduit smaller than 3/4" shall be used.
5. Roadway conduit: Unless otherwise noted on the Drawings or elsewhere in the specifications, provide 2-1/2" diameter, schedule 80 PVC, U.L. listed at 90 degrees, UV resistant electrical conduit for the installation of conductors beneath roadways.
6. Provide rigid galvanized steel electrical conduits, threaded at the top to accept rain-tight cap, for mounting of distribution of panels and equipment.
 - a. Rain-tight cap: galvanized steel, threaded fitting suitable for capping open end of rigid steel electrical conduit.
7. Corrugated flexible PVC Conduit: Where direct burial cable is not used provide unspliced, high tensile PVC corrugated flexible conduit to IPS dimensions, suitable for underground secondary distribution and under roadway application for protection of type TW, THW, RHW, or XHHW conductors used underground.
 - a. Provide IPS dimensions, schedule 430 PVC accessories including, but not necessarily limited to, couplings, adapters, end bells and plugs, and PVC solvent cement suited for watertight joints.
 - b. Provide Corrugate flexible PVC conduit and accessories manufactured by Carlon, Cleveland, Oh., or approved equals.

E. Interior Conductors and Conductors Installed in Watertight Underground Conduits:

1. Wire and cable shall be 600 V insulated N.E.C. standard type TW, THW, RHW, or XHHW, and color coded.
2. All wiring shall be copper and No.12 AWG or larger, wires No.8 and larger shall be stranded.

F. Direct Burial Conductors:

1. Wire and Cable: 600 V insulated, NEC standard, type USE or UF, as shown on the Drawings
2. All wiring shall be copper and No.12 AWG or larger, wires No.8 and larger shall be stranded.

G. Grounding devices:

1. Grounding Electrodes: 5/8" diameter, minimum 10 feet long unless otherwise shown, "Copperweld" ground rods.
2. Electrode Conductor: Copper, no.6 AWG or larger, and type THW. Use clamp suitable for burial to fasten grounding conductor to rod.

H. Safety Switches:

1. Provide heavy duty, horsepower rated, quick-make and quick-break design, externally operated with provision for padlocking, fusible or non-fusible as shown on the Drawings.
 - a. Equip with field or factory installed solid neutral assembly and service grounding kit.
2. Provide enclosure clearly marked for maximum voltage and horsepower rating, and:
 - a. Indoor: NEMA type 1.
 - b. Outdoor: NEMA type 3R, rain tight.
3. For dual rated switches, provide rating indicated on a metal plate riveted or otherwise permanently fastened to the enclosure.
4. Provide safety switches for 120/240 volt service, amperage as indicated as manufactured by, but not limited to one of the following:
 - a. Square D
 - b. General Electric
 - c. ITE
 - d. Westinghouse
5. Safety switches shall be UL approved and NEC rated.

I. Campsite Power Outlets:

1. The following are the only approved receptacle to be provided for recreational vehicle use on campsites:
 - a. 5-20-R2, 20 AMP duplex, 125 volts, in accordance with ANSI C73.12, 1972, for tent and pickup camper.
 - b. R-32-U, 30 AMP duplex, 125 volts, in accordance with ANSI C73.13, 1972, for travel trailer.
2. Provide individual recreational vehicle site service entrance equipment, as shown on the Drawings, U.L. listed and labeled "Suitable for Recreational Vehicle Service Equipment", as

manufactured by Midwest Electrical Products, Inc. P.O. Box 910, Manketo, Minnesota, Tel No. 507/625-4414, or approved equal.

3. Metallic R.V. Equipment: Unless otherwise noted on the Drawings, power outlets shall contain the circuit breaker and receptacles as specified herein.
 - a. Single unit Midwest model No.U042GP6, or approved equal.
 - b. Double unit Midwest model No.U042GB6, or approved equal
 - c. Protect 20 AMP and 30 AMP receptacles with 20 AMPS and 30 AMP thermal magnetic circuit breakers with a 30 amp Ground Fault Interrupter main breaker.
 - d. Provide NEMA 3R, light gray baked enamel, uni-post mounted power outlets, completely factory wired and assembled, with loop-feed lugs to accept specified wire size. Power outlet box to be 14-gauge galvanized steel. Post to be 12-Gauge galvanized steel.
 - e. Install stabilizer foot and post extension on pedestal as a footing base unless otherwise shown on the Drawings, or an alternate stabilization method is approved.
4. Nonmetallic R.V. Equipment: Injection Molded, thermoplastic enclosure with Corrosion resistant internal components, factory wired power receptacles in 20 and 30 AMP configuration, protected by a 30 AMP ground fault interrupter main breaker, a hinged cover to protect R.V. plugs. Midwest model No. U71 "Parkmate" or approved equal.
 - a. Terminal lugs will accept 1/0 copper cables.
 - b. The power center will be rated 100 AMP maximum, 120/240 volts, single phase, 3 wire with ground.
 - c. Power to be factory mounted on 12 gauge galvanized steel, gray baked on enamel, vented post for underground services, with loop-feed twin 2-300 MCM terminal per phase lugs.
 - d. Install stabilizer foot and post extension on pedestal as a footing base unless otherwise shown on the Drawings, or an alternate stabilization method is approved.
 - e. Provide a seven watt fluorescent light protected by an in-line fuse circuit protection and molded polycarbonate light cover.
 - f. Provide additional options as shown on the Drawings. Other options may include a light with manual switch or photo electric sensor, single service cable TV jack for type RG-59 coax cable, single service telephone jack type PH6596.
- J. Detectable Warning Tape: 3-inch wide electronically detectable tape with markings: "Caution - Electrical Power Lines Below" provided by, but not necessarily limited to, one of the following:
 1. Terra Tape D, Reef Industries, Inc., Houston, Texas
 2. Dectatape, Allen Systems, Houston, Texas
 3. Detectable Marking Tape III, Lineguard, Inc., Weaton, Illinois

- K. GFCI Testers: Provide GFCI testers capable of indicating wiring errors and faulty GFI equipment.
 - 1. Unitest GFI model No. 5708 manufactured by Beha Corporation, Clearwater, Fl. or approved equals.

- L. Mounting Channels and accessories: Provide 1-5/8" series, galvanized steel channels and accessories for mounting distribution panels, meters, and safety switches, including conduit clamps and spring-loaded nuts, provided by, but not necessarily limited to, one of the following:
 - 1. Unistrut, GTE Products Corp., Wayne, MI.
 - 2. Power-Strut, Elcen Metal Product Co., Franklin Park, IL.

- M. Terminal and Splice Boxes: NEMA type 3R rain proof code approved cabinets, with removable door with stay-open position, provision for padlocking, concentric knockouts, and heavy zinc-coated finish, of sufficient voltages.
 - 1. Include field or factory installed grounding kit.
 - 2. Provide boxes for 120/240 service, U.L. approved and NEC rated, of amperage indicated, as manufactured by, but not limited to, one of the following:
 - a. Square D
 - b. Midwest Electric Products, Inc.

- N. Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor subject to the approval of the Project Engineer.

PART 3 - EXECUTION

3.01 EXAMINATION:

- A. Examine the areas and conditions under which the work of this section will be installed. Correct conditions detrimental to the proper and timely completion of the work. Do not proceed until unsatisfactory conditions have been corrected.
- B. Verify location and configuration of existing facilities in relation to the work of this section before preparing bid.
- C. Verify depths and locations of all existing underground utilities.

3.02 PREPARATION:

- A. Coordination: Coordinate installation of electrical items with the schedules for other work, to prevent unnecessary delays in the total work.
- B. Where electrical items are shown in conflict with locations of structural members and mechanical or other equipment, provide all required supports and wiring to clear the encroachment.
- C. Accuracy of Data: The data indicated on the Drawings and in these Specifications are as exact as could be secured, but their absolute accuracy is not guaranteed.

1. Exact locations, distances, levels, and other conditions will be governed by actual construction.
 2. Use the Drawings and these Specifications for guidance, and secure the DNR Construction Inspector's approval of all changes in locations.
- D. Measurements: Verify all measurements at the site.
1. No extra compensation will be made because of differences between locations shown on the Drawings and measurements at the site, except as provided In the General Covenants and Provisions.
- E. Circuiting: The branch circuits have been designed for maximum economy consistent with sizes for voltage drop and other considerations.
1. Circuits and wire sizes shall be in accordance with the N.E.C. Install circuits as shown on the Drawings unless otherwise approved by The Project Engineer.
- F. Electrical circuit drawings are diagrammatic in nature but are to be followed as closely as made possible by the actual construction and interface with the work of other trade in this or other contracts.
1. Where deviations are approved to conform with actual construction and the work of other trades, make such deviation without additional costs to the Owner, except as provided elsewhere in the Contract Documents.
- G. Trenching and backfilling is required for installation of the work of this section. Perform all such trenching and backfilling in strict accordance with the provisions of Section 02200 of these Specifications.

3.03 INSTALLATION:

A. Conduits:

1. Where conduit is installed in concrete slabs, on the ground, underground, or exposed to the weather, make all joints liquidtight and gastight.
 - a. Bury all underground conduit to a depth of 2'0" below finished grade unless otherwise shown on the Drawings.
 - b. Install necessary sleeves, chases, bushings, and approved sealants where conduits pass through slabs, floors, walls and other structures.
 - c. Make necessary openings and spaces while keeping cutting and patching of work by other to an acceptable minimum.
2. Install bushing at conduit ends, to protect wires from abrasions, where conduit enters box or other fittings.
3. No conduit smaller than 3/4" shall be used for a branch circuit in this project.
 - a. Unless otherwise specified, provide code-size conduit for number and size of wire required by Code.
4. Where conduit is exposed, run parallel to or at right angle with lines of the building.

- a. Make bends free from dents and flattening with standard conduit elbows or conduit bent to not less than the same radius.
- B. Roadway Crossing Electrical conduit:
1. Install specified conduit at location indicated on the Drawings by boring, jacking into place, or trenching, when permitted by the DNR Construction Inspector, into unpaved roadways.
 2. Identify roadway crossing location by placing two 2" P-K nails, one inch apart, six inches from each side of pavement.
 - a. In addition install a 12-inch long reinforcing rod or a 24-inch long treated wood stake at each end of conduit.
 3. Cap each end of conduit placed beneath roadway for future circuit installation.
 - a. Sand fill around each end to aid future location and installation.
 4. Install conduit for primary circuits below the location of conduit for secondary circuits where they are indicated on the Drawings to cross at the same location.
- C. Installation of Conductors:
1. All conductors used for branch circuits will be minimum number 12 protected by 20 ampere circuit breakers.
 - a. Install larger wires where necessary to limit voltage drop or as required by NEC.
 2. Conductors will be installed continuous from outlet to outlet and no splices shall be made except within outlet or junction boxes.
 3. No underground splice will be permitted.
 - a. Conductors will run continuously from the main distribution panel to the terminal bar located in the first R.V. site service entrance equipment post on the circuit and continuously thereafter from terminal bar to terminal bar.
 4. Balance the campsite loads between the two phase conductors by connecting the loads to alternate sides of each 120/240 volt, three wire circuit.
 - a. Follow NEC requirements to provide for coding convention to consistently identify conductors throughout the project.
 3. No more than three circuits will be permitted in one raceway.
 - a. A common neutral may be used as permitted by the National Electric Code.
 4. Terminals and Splices: Stranded conductors shall be terminated with approved copper connecting lugs, accommodating the full diameter of the bare conductor.
 - a. Mains and feeders shall run their entire lengths in continuous sections without joints or splices.
 5. Splices will be permitted only at outlet or junction boxes.

- a. Splices shall be thoroughly cleaned, mechanically and electrically secured without solder, then soldered.
- b. After soldering, wrap rubber and friction tape.
- c. Vinyl plastic tape will be acceptable subject to the approval of local inspection authorities.
- d. Scotch lock type S, M, L, and D connectors will be approved as equal to soldering.

D. Installation of main distribution panels:

- 1. Mount main distribution panels using specified conduit support posts and mounting channels, clamps and accessories as shown on the Drawings.
 - a. Install the rain-tight cap on top of support posts.
- 2. Unless otherwise specified, install copper studs and spade type bushings in utility company transformer, and install secondary connections between transformer and the main distribution panel.
 - a. Seek approval of utility company representative prior, during and after installation.
- 3. Install meter where indicated on The Drawings or as instructed by the utility company.
 - a. Installation subject to approval of utility company.
 - b. Provide utility company approved meter if so instructed by utility company.
- 4. Directories: Mount a typewritten directory behind glass or plastic on the inside of each panel door.
 - a. Show circuit numbers and circuit description for all outlets in each circuit.
- 5. Mounting Heights: To center of box above finished floor for the below-named items, shall be as follows, unless otherwise shown or indicated.
 - a. Flush toggle switches: 48".
 - b. Convenience outlets and similar: 12" - finished areas (unless noted otherwise).
 - c. Convenience outlets and power outlets: 48".
 - d. Safety switches: 54" to operator.
 - e. Motor controllers: 54" or top even with safety switch.
 - f. Panelboards: 72" to top.
 - g. Other mounting heights are indicated on the Drawings by detail or by a plus dimension shown adjacent to the symbol.

E. Grounding System: Ground all equipment including panelboards, transformers, conduits systems, junction and splice boxes, RV site service equipment, motors and other apparatus, by conduit or

conductor to grounding electrode as shown on the Drawings, using grounding clamps suitable to direct burial.

1. Locate grounding electrode in location which will receive ground water regularly, and drive rod to depth of at least 8 feet.
2. Test to measure ground resistance, and provide not more than 5 ohms resistance, adding ground rods as required to achieve that level.

3.04 FIELD QUALITY CONTROL:

- A. Testing: At the conclusion of the work, test each and every circuit to establish the proper operation of electric equipment and freedom from improper ground and to ascertain the insulation values which shall not be lower than those required by the National Electrical Code.
 1. Test of equipment grounding conductors will show a resistance of no more than 25 ohms at any point on the circuit, except for grounding electrode which will show a resistance of no more than 5 ohms.
- B. Carry out final test in the presence of the Project Engineer/DNR Construction Inspector, as well as other required certifications noted in the Iowa Code.
- C. Correct all work not meeting code requirements, and all circuits which fail testing, at no additional cost to the Owner.

3.05 CLEANING:

- A. Exposed conduits, panel boards, fixtures, switches, hangers, and equipment exposed shall be thoroughly cleaned.
- B. Fixture glass and shields shall be cleaned and washed.
- C. Keep premises free from unnecessary accumulation of rubbish and debris resulting from the work of this section.
- D. Dispose of all debris resulting from the work of this contract at no additional cost to the Owner.

END OF SECTION 16000

PART 1 - GENERAL

1.01 SUMMARY:

- A. Section Includes: Furnish and install additional forced air heating and ventilating system and air conditioning, where shown on the Drawings, as specified herein, and as required for complete and proper installation including, but not necessarily limited to:
1. Package heating section with burner, blower, starter, filter rack, filter, automatic vent damper, cooling coil and plenum, isolators, and air cooled condensing unit;
 2. Temperature control system with day-night set back features including low voltage wiring;
 3. Air conditioning supply and return duct work system with grilles, diffusers, and registers;
 4. Exhaust systems including, but not necessarily limited to, toilets and garage, with fans, motors, duct work, grilles, registers, diffusers, controls, and related items;
 5. Motors as required;
 6. Acoustical and thermal insulation of ducts, piping, and equipment.
- B. Related Sections: Drawings and General Provisions of the contract, including the General Covenants and Provisions, Supplementary Covenants and Provisions and General Requirements as well as, but not necessarily limited to, the following:

Section 16000 Electrical

1.02 REFERENCES:

- A. All equipment, apparatus, and systems shall be fabricated and installed in strict accordance with and approved by the following organizations:
1. ASHRAE American Society of Heating Refrigeration and Air Conditioning Engineers
 2. ASME American Society of Mechanical Engineers
 3. ASTM American Society of Testing Materials
 4. NFPA National Fire Protection Association
 5. NEC National Electric Code
 6. NEMA National Electric Manufacturers Association
 7. SMACNA Sheet Metal and Air Conditioning Contractors National Association
 8. UL Underwriters Laboratory
 9. UMC Uniform Mechanical Code
- B. Where conflicts arise between the plans and code requirements, the latter shall prevail, unless plans are more stringent.
1. Bring all conflicts to the attention of the DNR Construction Inspector.

1.03 SUBMITTALS:

- A. Provide submittals in accordance with Section 01300.
- B. Product Data: Within 30 calendar days after the Contractor has received the Owner's Notice to Proceed, submit:
 - 1. Design drawings, signed by a properly licensed engineer and showing proposed layout of equipment, ducts, registers, grilles, controls, and other components of the system;
 - 2. Calculations demonstrating the adequacy of the proposed systems and its compliance with these Specifications;
 - 3. Manufacturers' catalogs, samples, and other items needed to fully demonstrate the quality of the proposed materials and equipment.
- C. Record Drawings:
 - 1. Include a copy of the Record Drawings in each copy of the operation and maintenance manual described below.
- D. Upon completion of this portion of the work, and as a condition of its acceptance, deliver to the DNR Construction Inspector two copies of an operation and maintenance manual.
- E. Operating and Maintenance Manuals:
 - 1. Operating manual and Maintenance Manuals to be provided by the Contractor shall include the following:
 - a. Description of routine maintenance required for each component;
 - b. Suggested frequency of maintenance;
 - c. List of lubricants recommended;
 - d. Parts list.
 - 2. Submit manuals to DNR Construction Inspector at least five working days prior to operating and instruction period of DNR representative.

1.04 QUALITY ASSURANCE:

- A. Use adequate numbers of skilled workers who are thoroughly trained and experienced in the necessary crafts, and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this section.
- B. Without additional cost to the Owner, provide such other labor and materials as are required to complete the work of this section in accordance with the requirements of governmental agencies having jurisdiction, regardless of whether such materials and associated labor are called for elsewhere in these Contract Documents.

1.05 DELIVERY, STORAGE, AND HANDLING:

- A. Manufacturer's Recommendations: Except as otherwise approved by the Architect, determine and comply with manufacturers' recommendations on product handling, storage, and protection.
- B. Deliver products to the job site in their manufacturer's original container, with labels intact and legible.
 - 1. Maintain packaged materials with seals unbroken and labels intact until time of use.
 - 2. Promptly remove damaged material and unsuitable items from the job site, and promptly replace with material meeting the specified requirements, at no additional cost to the Owner.
- C. The DNR Construction Inspector may reject as noncomplying such material and products that do not bear identification satisfactory to the Engineer as to manufacturer, grade, quality, and other pertinent information.

1.06 WARRANTY:

- A. The equipment specified under this division shall be covered by the manufacturer's standard warranty or guarantee on the new equipment.
 - 1. In all cases, the equipment and workmanship shall be guaranteed for a period of one year after acceptance by the DNR Construction Inspector, and as further protected by the manufacturer's standard warranty.

1.07 MAINTENANCE:

- A. Warranty Service: In the event mechanical contractor does not have a service office within 50 miles of the project site, he/she shall engage the services of a local maintenance contractor within that limit to perform any required emergency service on warranty equipment.
 - 1. The service contractor so designated shall be approved by DNR Construction Inspector and shall be authorized in writing by the mechanical contractor to perform emergency service within four (4) hours of given notice.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

- A. Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include, but are not limited to, the following:
 - 1. Carrier Air Conditioning Co.;
 - 2. Lennox Industries, Inc.;
 - 3. Trane Air Conditioning;
 - 4. Glass Insulation Company;
 - 5. Owens/Corning Fiberglas;

6. Johns-Manville;
7. Certaineed;
8. Krueger;
9. Titus;
10. Tuttle and Bailey;
11. Carnes;
12. Nutone;
13. Others as specified or as approved by the Engineer.

2.02 FURNACE AND COOLING SYSTEM:

- A. Furnace shall be an upflow electric unit complete with steel heat exchanger, aluminized steel slotted-port burners, adjustable blower speeds, direct-drive motor, side filter rack and filter, blower door shut-off switch, power interruption protection, combustion air switch, automatic vent damper, accessory plenum for cooling coils, all aluminum A-frame cooling coil, air cooled condensing unit, night setback thermostat as shown on the Drawings and/or as indicated herein.
- B. Acceptable Manufacturers:
 1. Carrier Air Conditioning Co.;
 2. Lennox Industries, Inc.;
 3. Trane Air Conditioning;
 4. Equal product when prior approval is obtained from Architect.

2.04 FLEXIBLE DUCT SYSTEM:

- A. Provide factory fabricated insulated low pressure flexible duct with the following attributes:
 1. Zinc-coated spring steel helix, with 1" thick fiberglass insulation, sheathed in a seamless vapor barrier jacket;
 2. Interior fire-resistive coated to prevent fiber erosion;
 3. Straight run sound absorption of 3 db per ft, and 5 db per ft sound absorption at 45 degree bends;
 4. Composite assembly, including insulation and vapor barrier, meeting Class 1 requirements of flame spread of 25 or less and smoke developed of 50 or less as set forth in NFPA Bulletin 90-A, and bearing UL label as an air duct.
- B. Provide flexible duct in fully extended condition, free from sags and kinks.
 1. Use only the minimum length required to make the connection.
 2. Where horizontal support is required, provide at least 3/4" wide banding material hangers at not more than 36" centers.
 3. Make joints and connections with 1/2" wide positive locking steel straps.

C. Acceptable Products:

1. Insulated low pressure flexible duct "Type S-181" manufactured by Glass Insulation Company, Los Angeles.
2. For toilet exhaust or return air connectors and runouts, aluminum flexible ducts such as "Flexmaster" or "Vanguard" may be used if acceptable to the governmental agencies having jurisdiction.

2.05 INSULATION:

A. General:

1. Provide materials complying with NFPA Bulletin 90-A, as determined by UL method NFPA 225-ASTM E84, and complying with the governing code, with flame spread rating under 25 and smoke developed rating under 50.
2. Where vapor barriers are used, provide intact and continuous throughout.
3. Acceptable Manufacturers:
 - a. Owens/Corning Fiberglas;
 - b. Johns-Manville;
 - c. Certainteed.

B. Concealed Ducts in Nonconditioned Spaces:

1. Insulate supply ducts with 2" thick fiberglass blanket such as Fiberglas "FRK ED-100," or equal approved by the Engineer.
2. Insulate return ducts with 1" thick fiberglass duct wrap blanket.

C. Ductwork and plenums as shown on drawings shall be lined with acoustic material. Thickness shall be 1/2" except where otherwise noted. Acoustic liner shall be Gustin Bacon "Ultralite" ductliner or equal John's Manville, L.O.F. or Owens Corning 1 1/2 lb. density vinyl sprayed. This shall be cemented in place in accordance with the manufacturer's recommendations. Liner shall be further held in place with washers and screws, spaced not over 12" on centers. Duct sizes shown on the drawings are actual sheet metal sizes.

D. Hot Water Piping:

1. Insulate with preformed fiberglass snap-on insulation such as 25 ASL/SSL;
2. For pipes up to 1" diameter, provide 1" thick insulation;
3. For pipes 1" diameter and larger, provide 1«" thick insulation;
4. Where insulation is exposed to the weather, protect with waterproof corrugated aluminum cover.

2.06 DIFFUSERS, GRILLES, AND REGISTERS:

- A. Furnish and install grilles, registers, and diffusers as shown on the Drawings and scheduled below.
- B. All units to be installed as per manufacturers recommendations.
- C. Units scheduled of drawings are by Krueger.
- D. Equal units by Carnes, Titus and Price are approved for bidding.
- E. Schedule:

Supply Diffuser (SD)	Kruger Model C6500 Perforated diffusers with drop-in frame style #23. Provide opposed blade damper. No 49, white finish.
Return Grille (RG)	Kruger Model S80H Steel grille with horizontal deflection vanes set at 35 degrees angle. No 49, white finish.
Supply Register (SR)	Kruger Model 880H Steel grille with horizontal deflection vanes set at 35 degrees angle. No 49, white finish. Provide opposed blade damper.
Supply Grille (SG)	Kruger Model S80H Steel grille with horizontal deflection vanes set at 35 degrees angle. No 49, white finish.

2.07 VIBRATION ISOLATION AND FLEXIBLE CONNECTIONS:

- A. At ducts to equipment, provide vent-fabric flexible connections with a minimum of 6" full length, and approved by the governmental agencies having jurisdiction.
- B. For return air connections at each floor to the return riser, provide fiberglass or lined duct with a minimum of two elbows.
- C. Provide additional sound isolation as required to limit the noise level in conditioned space to a maximum of NC-40.
- D. Mount vibrating equipment on "ThyCurb Vibrocurbs" with a minimum static deflection of 1".
- E. Isolate piping from the structure in a manner to prevent transmission of vibration.

2.10 OTHER MATERIALS:

- A. Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor subject to the approval of the Architect.

PART 3 - EXECUTION

3.01 EXAMINATION:

- A. Examine the areas and conditions under which work of this section will be performed.
- B. Correct conditions detrimental to timely and proper completion of the work.
- C. Do not proceed until unsatisfactory conditions are corrected.
- D. Any unsound or improper conditions are to be brought to the attention of the DNR Construction Inspector.

3.02 FABRICATION:

- A. Sheet metal gauges shall conform to the following minimum requirements:

Duct dimension	US. Gauge
0" - 12	#26
12" - 30"	#24
30" - 48"	#22
Over 48"	#20
Plenums	#18

- B. Ducts up to 18" wide may be made up in 96" long panels, larger ducts shall be made up in 48" long panels or may be made up in 96" panels with reinforcing angles at midpoint of panel.
- C. Drive slip transverse may be used on ducts up to 12" wide, on wider joints standing joints shall be used. Standing joints shall be riveted or slip punched at not over 4" center.
- D. Longitudinal corner seams shall be Pittsburgh Lock type.
- E. All plain panels of ducts, where 12" wide or over, shall be crossbroken for additional rigidity. Plenums and heavy gauge casings, which are to be insulated, need not be crossbroken if sufficiently braced to avoid vibration. Crossbreaking shall be applied to sheet metal between the seams or reinforcing angles. Center of crossbreak shall be of required height to assure that surfaces are rigid.

3.03 PREPARATION:

- A. Openings in Construction:
 - 1. Provide sleeves, accurately dimensioned and shaped to permit passage of items of this section;
 - 2. Deliver all such sleeves, with accurate setting drawings and setting information, to the trades providing the surfaces through which such items must penetrate, and in a timely manner to assure inclusion in the work.

B. Flashing:

1. Where items of this section penetrate the roof, outer walls, or waterproofing of any kind, provide under this section all base flashing and counterflashing required at such penetration;
2. Provide on each pipe passing through the roof a 4 lb. seamless lead flashing and counterflashing assembly.

C. Protection:

1. Protect finished surfaces, including jambs and soffits of openings used as passageways, through which equipment and materials are handled.
2. Provide protection for finished floor surfaces in traffic areas prior to allowing equipment or materials to be moved over such surfaces.
3. Maintain finished surfaces clean, unmarred, and suitably protected until accepted by the Owner.

3.04 INSTALLATION:

A. All equipment shall be installed in strict accordance with manufacturers' specifications and all applicable codes and ordinances.

B. All floor mounted equipment shall be permanently mounted on concrete base, and shall be leveled and aligned at locations indicated on plan.

C. Provide all required shutoff valves, unions, and final connections of piping to the work of this section.

D. Duct Work Installation:

1. Ducts shall conform accurately to dimensions indicated which are net dimensions.
 - a. Proper allowances shall be made for thickness of sound insulation where called for inside of ducts.
 - b. Ducts shall be anchored securely to building and shall be installed so as to be completely free from vibration under all conditions of operation.
2. Drawings do not attempt to show all offsets in duct work.
 - a. Make such necessary offsets in ducts, for installation of work, without additional cost to Owner.
 - b. Where offsets are required, angle of offset shall not be larger than 15 degrees.
3. Duct connections at diffusers, grilles, equipment, fan inlets and outlets shall be constructed and attached to assure smooth air flow.

4. Flexible ducts shall be installed in fully extended condition with no kinks and free of sags using minimum length required to make connection.
 - a. Under no conditions shall length over 10 feet be used. Suspend on 36-inch centers.
 - b. Clamps and duct sealer shall be used.
 5. Duct penetrations through walls shall be furnished with flanged sheet metal closure.
- E. Damper Installation: Damper rods opposite quadrant shall be fitted tightly in duct. Use hub plate.
1. Remote damper operators may be used in lieu of access panels upon approval of Architect.
 2. Dampers shall be provided where indicated and on all branches.
- F. Screen Installation: Screens shall be placed so that they will not be visible from outside of building.
1. Allowance shall be made for removal of screen for cleaning.
 2. Screens shall be installed on all exhaust discharge, out-side air intakes, roof ventilators, and all other openings.
 3. Screen shall be 1/2"-mesh, 14 gauge. Screens with dimensions of over 24" shall be reinforced with U-shaped frame with hemmed edges 2" wide.
- G. Insulation Installation:
1. Wrap insulation firmly around duct work, covering all surfaces including standing seams, and with all joints lapped at least 2" and tape seams in accordance with manufacturer's instructions.
 2. Securely fasten the insulation in place in accordance with manufacturer's instructions.
 3. Take special care to avoid excessive stretching and compressing, and to achieve securing at lapped sections where possible.
- H. Electrical:
1. Power wiring shall be by electrical contractor.
 2. Mechanical contractor shall furnish electrical contractor with a list of all motors and electrical equipment showing all data and requirements, and shall be responsible to verify voltages and phase of mechanical equipment prior to ordering.
 3. All equipment controls shall be furnished by mechanical contractor.

3.05 APPLICATION:

A. Painting:

1. Paint inside of all air outlets and connecting plenums with one coat of black paint, or provide all such items factory prepainted.
2. Touchup scratches to be invisible to the unaided eye from a distance of 5'-0".

3.06 FIELD QUALITY CONTROL:

A. Duct Work Tests: Upon completion and prior to acceptance of installation, Contractor shall subject ventilating system to such operating tests as may be required by Architect/DNR Construction Inspector to demonstrate satisfactory functional and operating efficiency.

1. Functional tests shall be performed prior to balancing.

B. Final Inspection: Upon evidence of an operational test of equipment, and correction of any items on final inspection list, DNR Inspector will recommend acceptance of mechanical heating and cooling system.

3.07 ADJUSTING:

A. Balancing:

1. Upon completion of testing balance system to provide air quantities shown on Drawings.
2. Provide adequate time before completion date so that test and balancing can be accomplished.
3. Contractor shall put all heating, ventilating, and air conditioning systems and equipment into full operation, and shall continue the operation during each day of testing and balancing.

3.08 DEMONSTRATION:

A. Demonstrate to the Owner's representative, designated by the DNR Construction Inspector, all approved operation and maintenance procedures included in operating and maintenance manual.

B. The work of this section shall not be considered complete until all systems and equipment are operational, all record Drawings have been submitted to the Engineer, and all reports, manuals, etc., have been submitted to the DNR Construction Inspector.

END OF SECTION 23000