

DIVISION 7 - THERMAL AND MOISTURE PROTECTION

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Part 1 – General

This General Discussion Section contains information which is critical to successful moisture protection systems in new construction and renovation, but which is not the sole responsibility of any individual trade. In many cases, the issues involved are fundamental to the basic design of the project, and the success or failure of the moisture protection concept is determined at the very outset of the design process. The DP is expressly responsible for incorporating these overall requirements into the project, and for ensuring that its sub-consultants are aware of the requirements and incorporate them into their designs as well.

Reliance on "after-the-fact" material selections to compensate for a problematic design decision is unacceptable.

BELOW GRADE SPACES

Below grade spaces are high-risk, expensive designs. Wherever possible, avoid:

- The use of finished below grade spaces requiring drainage systems and wall waterproofing.
- Planters above or adjacent to basement areas

FACILITY SERVICES Planning, Design and Construction actively discourages below grade elements in University projects. Designs incorporating below grade finished spaces will receive the strongest scrutiny during the programming and conceptual design phases. Be prepared to thoroughly document the unavoidable need for such elements.

Depending on the nature of the soil (refer to Soil Report), moisture contained under the slab, concrete mix design specified for slab-on-grade and type of flooring specified above slab, the DP shall analyze the need for an impermeable moisture barrier under slab-on-grade and provide a written report presenting all findings and recommending which moisture prevention system should be used for the project.

Wherever below grade walls are exposed to naturally flowing groundwater or substantial landscape irrigation water, even if simply foundation walls, include a foundation drainage system in addition to dampproofing or waterproofing the walls.

TRAFFIC DECKS

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Traffic bearing decks are very difficult and expensive to successfully waterproof and maintain. Wherever possible, avoid use of finished spaces with traffic decks exposed to the weather above them.

FACILITY SERVICES Planning, Design and Construction actively discourage use of such elements in University projects. Designs incorporating horizontal traffic decks will receive the strongest scrutiny during the programming and conceptual design phases. Be prepared to thoroughly document the unavoidable need for such elements. Failing such documentation, the Consultant will be directed to revise or even start completely anew the design.

Special attention should be given to ensure that all horizontal traffic surfaces provide appropriate slip resistance, and provide adequate moisture protection and drainage from its surface.

ROOF DESIGN

The DP shall coordinate with NAU Project Manager and NAU Roofing Trades to determine the appropriate roofing system based upon project budget and goals.

The following are the preferred roof systems:

- Sloped roof with standing seam metal roof
- Sloped roof with asphalt shingles
- Flat roof with thermoplastic membrane roofing

Any other roof systems will be subject to high scrutinizing to ensure that the interest of the University in terms of Life Cycle Cost analysis, maintenance and longevity are achieved.

Any of the above roof systems should also incorporate sufficient insulation layers to provide an R-value to meet ASHRAE 189.1 standards, either below or above deck.

Do not design roofs which are intended to serve as walking surfaces for user functions. Activities which must be conducted on the roof top (e.g. astronomical or weather observations, greenhouses, etc.) will require a design which incorporates platforms, penthouses or similar special enclosures.

Similarly, do not design roofs which are required to be used as working platforms for maintenance of mechanical and electrical equipment. Enclose such elements in a penthouse.

Any mechanical or electrical equipment which must be installed on the roof must be installed on either a prefabricated curb or a field fabricated platform. Where the top surface of such curbs and platforms is not completely covered and waterproofed by

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the actual equipment, the top surface must be a solid sheet metal cap. Design must meet OSHA workspace and fall precaution criteria.

Avoid use of conduit and piping installed on top of the roof.

No Electrical or Mechanical Equipment on the roof.

Combine roof penetrations (exhaust ducts) wherever possible to minimize roof penetrations.

Installation of any type of roof top mechanical or electrical equipment on sleepers is not acceptable.

Wherever possible, make the basic roof slope, and the slope of the crickets to the drains, part of the structural system (slope the structure). Avoid as much as possible thicknesses of roof insulation greater than 2" to create a roof slope.

By sloping the structure, it will be possible to eliminate use of lightweight concrete fill altogether.

Dead flat roofs are not acceptable.

Design for a slope of 1/4" per foot, throughout the field of the roof and for all crickets, at the time of construction. Ensure that anticipated deflections and proposed cambers will result in a minimum slope of 1/4" per foot throughout the life of the facility to guarantee positive drainage.

Space drains so that slopes in cricket valleys are at least 1/8" per foot.

Provide metal or 2x4 wood framing and sub-framing for large crickets. Cricket surfaces must be able to accept live loads similar to those of the basic roof deck.

Small cricket up-slope of equipment curbs must maintain 1/8" per foot slope in their valleys, and may be fabricated of tapered insulation, not to exceed 4" thick.

Do not assume that base flashings and counter flashing can be successfully nailed into concrete or masonry. Provide a 3/4" plywood nailer at all parapets.

When possible, provide positive overflow drainage, preferably with a scupper through the parapet wall to daylight, or with a complete separate parallel overflow drain system daylighting.

Design all roof drains and overflow drains in a depressed sump.

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ROOF DESIGN & SNOW

Roof design should accommodate a snow load of minimum 40 lbs/sf.

Provide snow drifting analysis from a Structural Engineer to accommodate increased snow loads at areas where snow accumulation due to drifting might exceed the 40 lbs/sf of minimum required snow load.

Design roof and overhang to prevent formation of icicles. Provide protection for areas susceptible to icicle damage.

Roof drains should be design for the anticipated roof rain load. Design/calculations shall be done by the Design Professional to determine the size, location and quantities of roof drains.

Roof drains shall be provided with leaf screen at the top.

Design all roof drains and overflow in a depressed sump. Use #4 lead for roof drain sump pans.

Do not use exterior roof drains without the specific permission of NAU Project Manager and NAU Roofing Trades. Exterior roof drains should be at least 4 inches in diameter and shall have heat tape all the way down.

Interior roof drains are preferred, with heat tape down into the roof drain leader at least 3'-0" below roof. Installation of heat tapes at roof exposed to sun shall be evaluated on a "case by case basis", with final determination in concurrence with NAU Roofing Trades.

Gutter system should be seamless type 24 gauge minimum. Specify only non-corrosive fasteners, same material as metal being fastened. If straps are used, use #8 screws (min.).

Ensure that the design makes adequate allowance for proper flashing of perimeters and penetrations. Sufficient vertical dimension to install the cant strip, base flashing, counter flashing, and coping, will result in a parapet at least 18" above the finished roof at the highest point of the roof slope. Include a specific detail in the construction documents. This includes:

- Parapet walls
- Partial roof structures
- Equipment curbs and platforms
- Door and window sills

ROOF DESIGN & RE-ROOFING

Design the project to allow for one complete re-roofing without removal of the existing roof system, should the University decide to do so. This includes:

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- Structural load capacity
- Camber and deflection
- Parapet heights
- Joints, drains, and flashings

Re-roofing must comply with the requirements for new installations as much as possible. The DP is responsible for preparing complete details and specifications for the required reroofing work.

Roofing repairs (e.g. installation of a new exhaust fan), must comply with the requirements for new installations as much as possible. The DP is responsible for preparing complete details and specifications for the required repair work. Generic notes such as "flashing as required" are not acceptable. While the University is not interested in telling the DP whether the Architect or the Mechanical Engineer should prepare the details and specifications for this type of repair, the information must be thorough and complete regardless of the author.

On existing re-roofing project, verify if the existing flat area is asbestos containing and if so, it shall be removed from roof deck by Owner-appointed abatement contractor. The Roofing Contractor will be responsible for coordinating with Owner and Abatement Contractor to dry in all exposed area the same day.

ENVELOP DESIGN (ASHRAE 189.1 Climate Zone 5 Recommendations)

All new Buildings shall be designed for LEED Silver, with an emphasis on building envelop efficiency to promote energy reduction.

In climate zones 2 through 8, the recommended construction is standing-seam roofs with two layers of blanket insulation. The first layer is draped perpendicularly over the purlins with enough looseness to allow the second insulation layer to be laid above it, parallel to the purlins.

Through-fastened metal roofs are screwed directly to the purlins and have fasteners that are exposed to the elements. The fasteners have integrated neoprene washers under the heads to provide a weathertight seal. Thermal spacer blocks are not used with through-fastened roofs because they may diminish the structural load carrying capacity by "softening" the connection and restraint provided to the purlin by the metal roof panels. To meet the performance recommendations of this standard, through-fastened roofs will generally require insulation over the purlins in the conventional manner, with a second lay of insulation added to the system. The second layer of insulation can be placed either parallel to the purlins (on top of the first layer) or suspended below the purlins.

ASHRAE 189.1 Envelope Energy Efficiency / Thermal Performance Factors, see below:

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Item	R-Value	U-Value
Roof Insulation	R-25 Continuous R-49 Attic	
Wall	R-13 Cavity + R-10 Cont.	
Fenestration Assembly		U-0.4 wood vinyl, Fiberglass frame U-0.4 Curtainwall U-0.45 Other Metal SHGC-0.35 (Solar Heat Gain Coefficient)
Overhang: Projection Factor = A/B	A=overhang B=opening height under overhang	

Part 2 – Products

Refer to sections below for products requirements & recommendations.

Part 3 – Execution

Refer to sections below for Execution requirements & recommendations.

****END OF SECTION****

07 10 00 CAULKING AND WATERPROOFING

Part 1 – General

This section applies to waterproofing of building components that receive or are in and around areas to receive such treatment. Proper architectural design and detailing of areas exposed to moisture should not rely solely on such treatments as the only barrier to moisture, but rather as a "guarantee" or "second line of defense", in other words, the design and specification of appropriate materials should in itself greatly mitigate a majority of moisture infiltration problems.

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Waterproofing and dampproofing are not interchangeable materials. Project may have one, both, or neither.

Waterproofing is a relatively secure system, and is used on surfaces which enclose habited space and where moisture penetration is not acceptable.

Dampproofing is a less restrictive system, and is used to reduce moisture migration through exterior surfaces such as retaining walls and planters.

Where such surfaces are intended to be subject to foot traffic, and therefore are not "roofs", refer to the requirements of Section 07 59 00 Horizontal Traffic Surfacing. The DP should attempt to specify primary waterproofing materials of each type from a single manufacturer.

The DP should select a manufacturer(s) capable of providing a 5 year warranty on the material(s) being specified and require that materials manufacturer(s) and installer(s) demonstrate 5 years of successful installations of similar systems.

This is a section where the consultant should use a "performance specification".

Do not specify proprietary manufacturer's names or materials, and do not restrict vendors to a limited list.

The DP should require submittal of manufacturer's literature describing the system, and samples of proposed membrane materials.

The DP should pay particular attention to the drainage course against the wall and to perimeter drains. Describe requirements for these elements on the drawings.

The DP should review foreseeable methods and procedures relating to waterproofing materials early on (design development) with a considered manufacture of the product(s) for insights and suggestions that could alter the approach in mind. Cross reference with requirements of Division 2 (exterior finish grades) shall be specified to slope away from buildings.

Specify expanded warranties as follows:

- 5 year warranty from the installer covering defects in installation
- 10 year warranty from the materials manufacturer including defects in materials and installation, and guaranteeing to maintain the system in a waterproof or dampproof condition (as applicable) for the life of the warranty
- Include sealing of all perimeters, joints, and penetrations

Section
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Title

- Renewal option for an additional 10 years from the materials manufacturer
- Full replacement value without proration

Part 2 – Products

Expressly prohibit the use of asbestos-containing materials.

Require that all materials be supplied by a single manufacturer, or approved by the primary materials manufacturer, to ensure single-point responsibility for the installation and warranty.

Part 3 – Execution

Require a pre-installation conference, scheduled after the substrates are complete, and including the Contractor, Architect, Owner, materials manufacturer, and installing subcontractor(s).

Inspection of waterproofing is required prior to covering over the membrane. DP shall specify proper notification time, following NAU's Inspection Process. DP shall provide special inspection services of any caulking and waterproofing systems.

The DP should specify that before covering waterproof membranes on horizontal surfaces with other materials, a leak test be performed with a 2" depth of water maintained for 48 hours. Such test shall be conducted by the contractor or subcontractor and witnessed by a representative of the DP and NAU.

Require that the in-progress installation be observed by the materials manufacturer to ensure that the complete assembly will qualify for the required warranty.

Require that all penetrations be installed in the wall prior to membrane application, so they can be properly sealed by the membrane installer. Avoid the installation of unnecessary sleeves and pay particular attention to the detailing of those that are required.

07 11 00

Dampproofing

Part 1 – General

See above section 07 10 00

Part 2 – Products

Specify a dampproofing system which includes the following:

- Joint preparation
- At least two layers of trowel-grade bituminous coating with interweaved mesh membrane reinforcement

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- Termite-resistant protection board embedded in bituminous coating to prohibit displacement

Part 3 – Execution

See above section 07 10 00

07 13 00 Sheet Waterproofing

Part 1 –General

See above section 07 10 00

Part 2 – Products

Specify a sheet waterproofing system which includes the following:

- Joint preparation
- Continuous self-healing sheet membrane
- Termite-resistant protection board embedded in a fluid-applied coating to prohibit displacement

Part 3 – Execution

See above section 07 10 00

07 14 00 Fluid-Applied Waterproofing

Part 1 – General

See above section 07 10 00

Part 2 – Products

Specify a sheet waterproofing system which includes the following:

- Joint preparation
- Fluid-applied membrane which cures in place to form a continuous monolithic self-healing membrane
- Termite-resistant protection board embedded in a fluid-applied coating to prohibit displacement

Part 3 –Execution

See above section 07 10 00

07 18 00 Traffic Coatings

Part 1 – General

To be completed

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Part 2 – Products

To be completed

Part 3 – Execution

To be completed

07 19 00

Water Repellents Coatings

Part 1 – General

To be completed

Part 2 – Products

To be completed

Part 3 – Execution

To be completed

****END OF SECTION****

Section Number	Title
07 20 00	INSULATION
07 21 00	Thermal Insulation

Part 1 – General

This section applies to all constructed building vertical and horizontal surfaces that are thermal barriers to the environment and also inclusive of demising partitioning acting as acoustical barriers. NAU’s goal for all new and renovation projects is a substantial reduction in energy usage, both campus wide and building specific. All effort should be focused to mitigate thermal and acoustical factors through proper architectural design, detailing, orientation and adjacencies, and utilize applied insulating materials as a further enhancement to the composite performance of the design rather than the sole means of obtaining the desired performance. This is a section where the consultant should use a "performance specification". Do not specify proprietary manufacturer's names or materials, and do not restrict vendors to a limited list. This section includes insulation used for thermal purposes, and which is installed as an independent material. Insulation which is an integral of a specific system (e.g. membrane roofing or exterior insulation and finish systems), is described in the appropriate Sections. Such insulation may be included in the total assembly R-value. However, such insulation must not be the sole source of thermal resistivity for the building. Design building surfaces which experience a significant temperature differential across their thickness to meet the following thermal resistance ("aged R-value") criteria:

- Roofing systems in conjunction with proposed insulation or other exposed horizontal surfaces shall attain a minimum composite R value of 38, and meet ASHRAE 189.1 standards.
- Walls or other exposed vertical surfaces shall attain a minimum R value of 20, and meet ASHRAE 189.1 standards.

DP to specify by type and manufacturer, stating performance characteristics of density, aged average R value per inch, flame spread and fire rating.

Generally, (unless noted otherwise), all corridor, restroom, classroom, laboratory, conference, meeting, lobby, and office walls and ceilings shall be fully sound attenuated.

For Air-borne and Structure-borne sound provide walls, partitions and floor/ceiling assemblies separating spaces from each other with a sound transmission class (STC) of not less than 50 when tested in accordance with ASTM E90. STC ratings higher than STC 60 should be specified in sensitive areas where sound transmission is a concern as determined/coordinated with Project Manager. STC is highly dependent on the construction of the partition. A partition’s STC can be

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increased by:

- Adding mass
- Increasing or adding air space
- Adding absorptive material within the partition

Where blanket type insulation or sound attenuation material is being utilized in open plenum areas, it should be specified as being "kraft" or foil faced and backed (depending on installation). Do not specify any form of insulation to be laid directly on accessible ceilings. Instead, detail horizontal insulation at the top of the cavity, and extend vertical insulation up to that level.

THERMAL INSULATION - Roofs, Attics, and Other Roofs (ASHRAE Design Guide)

Attics and other roofs include roofs with insulation that is entirely below (inside) the roof structure (attics and cathedral ceilings) and roofs with insulation both above and below the roof structure. If attic space is ventilated, provide tempered air and exhausting. Ventilated attic spaces need to have the insulation installed at the ceiling line. Unventilated attic spaces may have the insulation installed at the roof line. When suspended ceilings with removable ceiling tiles are used, the insulation needs to be installed at the roof line. For buildings with attic spaces, ventilation should be provided equal to 1 sq. ft. of open area per 100 sq. ft. of attic space. This will provide adequate ventilation as long as the openings are split between the bottom and top of the attic space. Additional ventilation can further improve the performance of the building. In accordance with ASHRAE Standards, Flagstaff is located in Climate Zone #5. In climate zones 2 through 8, the recommended construction is standing-seam roofs with two layers of blanket insulation. Where R-38 rigid insulation is provided, it shall be provided as 2 layers of blanket insulation held in place with steel banding spaced 30" o.c. Where Vinyl faced insulation is used, facing materials are applied to fiber glass blankets to serve as a vapor retarder as well as a protected cover over the fiberglass. In metal buildings, banding can be used to secure insulation in a roof or walls. Screw attached steel bands to the underside of the metal purlin 30" apart creating a grid system. Ensure that all joints are properly sealed/taped to maintain continuity of vapor barrier.

Part 2 – Products

Expressly prohibit the use of asbestos-containing materials.

Specify only ACFoam II Polyiso (or approved equal) insulation.

Require fiberglass insulation to have an integral kraft paper or foil vapor barrier.

Use of blown-in insulation to be evaluated by Project Team to insure maintenance access to electrical or mechanical equipment. Use blown-in insulations only in remodeling projects where the wall or ceiling/roof assembly is inaccessible for

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installation of board or blanket materials, and only with specific permission of the Project Coordinator.

Part 3 – Execution

Replace all insulation that becomes wet.

Specify mechanical attachment for all insulation. Do not specify insulation to be adhesive applied or installed loose.

All insulation needs to be securely attached.

07 24 00

Exterior Insulation and Finish Systems

Part 1 – General

This section applies primarily to exterior insulation and finish systems that would be considered as the "secondary" skin treatment to a building, soffits, mechanical screen walls, infills, etc. The term "secondary" is used to refer to as NAU's desire for brick masonry to be used as the "primary" skin material.

EIFS is a barrier exterior finish system that combines insulation qualities with a durable and aesthetically adaptable finish, but the main concern that has developed with EIFS is that water might get behind the barrier system and remain trapped.

When designing an exterior Insulation and Finishing System, DP shall ensure that the materials selected and the wall section details will:

Eliminate the possibility of water entry into the system
provide an exit for water or moisture.

In Northern Arizona, where freeze/thaw cycles are very frequent, with high temperature differential between low and high, it is imperative to use materials with high flexibility that will not crack when submitted to the many temperature changes characteristic of our climate. Such system would be referred to as “modified” or “drainable” Exterior Insulated Stucco System. Specify primary products as produced and supplied from a single manufacturer, which has produced that product successfully for not less than 5 years.

Specify installer’s experience & expanded warranties as follows:

Specify a special 5 year guarantee against defects in materials and installation; including attachment failure, delamination, cracking, peeling, and fading. Only those manufacturers that can comply with this warranty shall be specified.

Warranty shall be submitted/verified before NTP.

Specify that a single installer shall perform the work, and have not less than 5 years of successful experience in the installation of exterior insulating finish systems: request

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that the Subcontractor provides a list of projects done within the last 5 years under similar climate and elevation using a system similar to the one specified. Listing of comparable projects shall include references and contact information.

Proof of installer's experience: It becomes contingent upon the General Contractor to provide the installers documentation meeting the requirements of the specifications or risk installer rejection/revise and resubmit. Proof would entail a list of projects and materials used with referenced attached. This information is required before NTP is released.

Proof of installers experience shall be submitted with the successful bidders sub-contractor list intended for use on the project. Require that all materials manufacturer(s) and applicator(s) demonstrate 5 years of successful installation of similar systems under similar climate and elevation.

Require that applicators be approved and licensed by the materials manufacturer. Use an approved applicator system as a test for manufacturer approval.

Concrete masonry units are preferred as the back-up construction, however if budget and/or design considerations deem this inappropriate, fiberglass reinforced gypsum/Portland cement ("Dens Glass" panels, 3/4" thick, over structural steel studs, and with a waterproof membrane is an acceptable substrate).

Composite panels of expanded polystyrene with a minimum composite R value of 20 mechanically attached to the back-up system.

The composite finish system shall consist of heavy duty glass fiber reinforcing (adjacent to any area of pedestrian traffic, to a height of 8'-0" above finish floor), synthetic elastomeric primus layer, minimum 3/8" thick and a elastomeric synthetic finish layer, minimum 1/16" thick. Type PM System is highly preferred (Polymer Modified System, in which the mesh is mechanically attached to the foam and substrate). Use Type PB system (Polymer Base System, in which the mesh is adhesive, applied to the foam) only with specific permission of the NAU Project Manager. Consider alternative exterior cladding systems in areas where the finish may be subject to physical abuse. Indicate all required expansion, control, and design joints on the drawings. DP shall provide all flashing details and installation details on final construction documents. During installation of the EIFS, DP shall perform jobsite to ensure proper installation procedures as recommended by Manufacturers and as designed by DP are followed by all Contractors (this would apply to all Contractors involved with the installation of the system such as Exterior Framing, Drywall, EIFS, Windows, and Roofing Contractors.

NOTE: From NAU's experience, the following Design Specification criteria are to be adhered to at a minimum. DP shall present a detailed system evaluation to NAU

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Project Manager that shall be reviewed in collaboration with NAU Painting Supervisor.

Part 2 – Products

EISS Performance shall comply with the following:

- Weathertightness: resistant to water penetration from exterior into EISS and assemblies behind it or through them into interior of building that results in deterioration of thermal-insulating effectiveness or other degradation of EISS and assemblies behind it, including substrates, supporting wall construction, and interior finish.
- Bond Integrity: free from bond failure with EISS components or between system and supporting wall construction, resulting from exposure to fire, wind loads, weather, or other in-service conditions.

Require that all materials be supplied by a single manufacturer, or approved by the primary materials manufacturer, to ensure single-point responsibility for the installation and warranty. Specify only extruded polystyrene insulation board, with Class A flame spread and smoke developed characteristics.

Specify only acrylic-modified Portland cement adhesive and base coat.

Specify only 100% acrylic, integrally colored finish coat, without the need for additional pigmented coatings. Where the system will be exposed to potential physical abuse, specify only manufacturer's standard "high impact" components.

Show control joint and expansion joint locations and require submittals of same.

Part 3 – Execution

Mock-up required upon NAU request.

Specifically require the system to be installed in accordance with the manufacturer's recommendations.

Require the applicators to maintain a "wet edge" until a natural break point is achieved. Expressly prohibit scaffold lines and cold joints.

Installation of Exterior Sheathing Materials

Panel Selection and Application:

To increase stiffness, panels should be applied with the strength axis across the studs. For stud spacing of 16 inches on center, APA makes the following recommendations:

With the strength axis perpendicular to the studs – 3/8" and 7/16" minimum panel thickness and minimum span ratings of 24/0 and 24/16. With the strength axis parallel

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to the studs – 15/32" and ½" minimum panel thickness and a minimum span rating of 32/16 for OSB or 5-ply/5 layer plywood. Structural 1 Rated Sheathing (OSB) 7/16" thickness and span rated 24/16 may also be used. The above will require sheathing to be installed with the long side horizontal (where strength axis runs in the long panel dimension), with blocking between studs along horizontal panel joints.

Spacing Requirements:

Spacing of 1/8" is required at panel ends and edges. This allows for some minor panel swelling if wetting occurs during the construction process. Greater spacing may be required at locations of expected movement, such as the band joist, particularly when using surfaced green dimensional lumber.

Nailing Pattern/Schedule:

NAU requires nailing 6" o.c. along supported panel edges and 12" o.c. at intermediate supports with 6d common nails, or 16 ga. 7/16" crown 1-3/4" leg staples, or 1-5/8" length nails with a shank diameter of .097"-.099". All fasteners are to be located 3/4" from panel edges. For shear wall applications closer spacing or different sizes will be necessary.

Installation of Weather Resistive Barrier (WRB) or Secondary Drainage Plane

This is a layer, separate from, and in addition to, the paper found immediately behind the stucco lath. While there are several materials that can be used to create a drainage plane, there is similarity in their installation. All are installed in a shingle type fashion, so as to shed water from the upper layer(s), out over the lower layers, and ultimately back to the outside of the wall. Installation starts at the bottom of the wall and works upward, overlapping successive courses. This installation must be continuous and prevent water from finding its way into the wall cavity. As such, special attention must be paid to details of interfaces between the secondary drainage plane and windows, doors, roofs, flashings, etc. With drainage plane installed no sheathing should be exposed and any tears in the drainage plane must be repaired. The drainage plane must run under windows, corner boards, window wraps and around corners.

Acceptable Materials:

Commercial building-wrap. The material must be vapor permeable to allow water vapor to pass thru the wall; however, it must be water resistant.

Installation Methods for Building Paper and Felt:

Paper can be installed prior to, or after, window installation. Special care must be taken at the interface with windows and doors (see Installation of Windows). The installation starts with the bottom course being applied. Subsequent courses are installed horizontally (not at an angle) working upwards, in shingle fashion. The horizontal lap must be at least 2". At end laps there must be at least a 6" lap. At corners (inside or outside, the paper must run at least 6" around the corner. At inside

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corners, care must be taken to keep the weather resistant barrier tight to the corner so lath can later be installed. Where intersecting a roof the paper should overlap the upturned leg of step or headwall flashings. Paper should be fastened with crown staples (at least 1”), cap nails, or large head nails every 12” to 18”. Best practice is to fasten the studs, not sheathing, so the lath installer can locate studs.

Installation Methods for building-wrap:

Commercial building wrap can be installed prior to, or after, window installation. Special care must be taken at the interface with windows and doors (see Installation of Windows). The installation starts with the bottom course being applied. Subsequent courses are installed horizontally (not at an angle) working upwards, in shingle fashion. Some building wraps can be applied in only one direction, some have an inside and outside face. The horizontal lap must be at least 6”. At end laps there must be a 6” lap. At corners (inside or outside), the building-wrap must run 6” around the corner. As previously stated, care must be taken to keep the weather resistant barrier tight to the corner so that lath can later be installed. Where intersecting a roof the building wraps should overlap the upturned leg of step or headwall flashings. Building wraps should be fastened with wide crown staples (at least 1”), cap nails, or large head nails every 12” to 18”. Refer to the manufacturer’s installation instructions for further information. Best practice is to fasten through sheathing to studs, so the lat installer can locate studs.

Installation of Windows, Doors, and Trim & Integration to Drainage Plane

Window Installation:

It is required that the installation of the first layer of protection (the one closest to the sheathing), the weather resistive barrier, be done prior to the windows and doors being installed. Installing windows with brick mold creates additional considerations. Building wraps must be installed before the window is installed. First, building wraps is installed, and then a pan flashing should be installed at the rough sill and integrated with the building wraps. A bead of sealant must be applied to the backside of the brick mold, or on the wall to bed the brick mold on three sides, before installation of the window. Drip cap flashing must be installed at the head of the brick mold. The use of casing bead, backer rod and proper caulk will be used for the head, sides and still.

Door Installation:

When installing doors, which typically have brick mold, the steps outlined for windows will be followed. Extra care should be given to doors that are not protected by some form of overhang. Casing bead, backer rod and proper caulk at the joint between stucco and brick mold will be used.

Window Trims:

When trimming windows with wood trim the contractor must be aware of the

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dissimilar movement between the various materials when changes in temperature and moisture occur. For example, vinyl windows will move more than wood trim, which will move more than stucco. Because of this, backer rod and proper caulk at these joints, along with a properly designed joint will be used.

Drip Cap Flashing Integration:

Drip cap flashing will be installed above all projecting wood trim and above windows that do not have a self-flashing nailing fin. This flashing is installed with the vertical back leg on the outside of the drainage plane. When the paper immediately under the lath is installed, it will overlap the back leg in a shingle type fashion.

Roofing integration to the Drainage Plane

Key Elements:

Roof flashings must provide proper “kick out” from behind all siding, stucco and others. The vertical “back leg” of roof flashings must be installed behind the drainage plane. Stucco must not be installed until proper kick out flashings is achieved.

Roof installation is to be performed in a fashion whereby roof flashings are installed to provide proper “kick out” to divert precipitation (run-off) to the exterior of the siding product.

NAU requires roofing contractors to furnish and install “oversized” kick out flashings at all areas of the roof where flashings must be deliberately drawn out from behind the siding. Specifically, pre-manufactured, oversized kick out flashings are recommended at the 1st course or row of roofing, when the 1st course or row of roofing abuts stucco. The 1st flashing, where abutting a stucco wall, should be an oversized/pre-manufactured kick out flashing to divert water from behind the stucco into gutter.

At all exterior corners where “kick out” is required; flashings must extend sufficiently past the corners. 2-inch minimum extension is recommended. The vertical leg of roof flashings should be a minimum of 3-inches tall, but should be fabricated to only rise 2-inches vertically at the extended portion of the flashing (portion of flashing properly extending past corner). This allows the stucco contractor to then install the casing bead 2-inches above the roof deck, providing an approximately 1-inch overlap of the vertical leg of the roof flashing, without having to modify the roofing contractors work, where flashing extends past the corner. If any modification of roof flashings or roofing materials is believed necessary, it is recommended the roofing contractor be called upon to perform it. With the intent of being able to provide for the future replacement, maintenance, and repair of roof flashings at wall junctures, best practice will insure that flashings are not permanently imbedded behind stucco siding. Two possible means by which this can be achieved include:

- Wall flashings may be covered by wood trim, which is installed with a drip cap.
- The casing bead channel at the bottom of stucco siding can be installed in a

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fashion which allows for roof flashings to be easily maneuvered behind the "J" channel flashing or out from behind the "J" channel flashing.

Roof flashings properly installed behind drainage plane.

Flashings, for the purpose of this discussion shall be defined as those building materials used in effort to provide a watertight "connection" between the roof and any protrusion through, or adjacent to, the roof plane (i.e. sidewalls, chimneys, vent pipes, skylights, etc). Drainage plane, for the purpose of this discussion shall be defined as the inner most water resistive barrier, installed on the exterior of the sheathing for the purpose of protecting the interior from the intrusion of water. The back leg of all roof flashings must be installed with the upturned vertical leg behind the drainage plane. All roof flashings must be installed in a fashion whereby proper "kick out" of flashings from behind the drainage plane is achieved, as necessary to divert precipitation (run-off) to the exterior of siding. Stucco shall not be installed until proper kick out is provided. Those installing stucco siding must be sufficiently knowledgeable in recognizing the proper installation of necessary kick out flashings. The stucco contractor bears responsibility for knowing that application of stucco siding over flashings that do not divert water to the exterior of siding will likely result in water intrusion of the interior and is therefore improper. If there is any question that flashings will not provide proper kick out, the stucco contractor shall not install stucco at questionable areas until the flashing unquestionably provides proper kick out. Under no circumstance should stucco siding be installed over flashings which would fail to properly divert/precipitation/moisture past the exterior surface of the stucco siding.

Integration of Penetrations to the Drainage Plane

Generally, small penetrations through the stucco can be caulked to successfully keep water out of the wall. Several areas that warrant specific attention are listed below.

Plumbing penetrations:

Sillcocks, installed in walls that are to have stucco applied, should be held out of the wall to accommodate the thickness of the stucco. After the stucco has been installed the sillcock should be caulked to the stucco wall.

Electrical penetrations:

Electrical boxes, used in walls that are to have stucco applied, should be held out of the wall to accommodate the thickness of the stucco. After the device is installed, it should be caulked to the stucco wall. Examples include lighting fixtures, weatherproof receptacles, etc.

Electrical Meters:

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Electrical meters, in walls that are to have stucco applied, should be installed over the drainage plane, or installed with a weather resistive barrier behind it, to later interface with the drainage plane. A dripcap flashing should be considered for placement above the meter can. The vertical back leg of the flashing should be on top of the drainage plane. The paper behind the lath should go over this back leg. After installation of the stucco, the meter can sides and bottom should be caulked to the stucco.

Other Penetrations:

Walls may have many other penetrations such as dryer vents, fireplace termination caps, and furnace exhaust. Each of these must be sealed to the stucco wall with an appropriate sealant.

Lath Installation Requirements

Lap metal lath $\frac{1}{2}$ " minimum on sides (the long dimension) and 1" on ends (the short dimension). End laps should occur over studs.

For paper backed lath, the vertical and horizontal joints should be backing-to-backing, and metal on metal. The paper should never extend over the lath and should be shingled. Metal plaster bases should be attached to the framing members (studs) at not more than 7" along framing members. It is intended to have the lath attached to the studs. The attachment should be thru the self-furring mechanism only, i.e. fasten through dimples or v-groove, so as not to reduce embedment of the lath in the stucco. In lieu of wire tying the lath, a limited number of staples may be utilized to secure the lath to the exterior façade. Care should be taken so as to not over staple self-furring lath. Over stapling can depress the lath to a point where it is impossible to get the lath imbedded into the plaster cement. The fasteners used to attach the metal base must penetrate studs $\frac{3}{4}$ ". As staples are prevalent, they would need to be a minimum of 1 $\frac{1}{4}$ " in length (assuming 7/16 inch sheathing), with a crown of not less than $\frac{3}{4}$ ". Metal lath should be applied with the long dimension at right angles to support. For narrow wall panels (less than 24 inches), it is generally acceptable to apply the long dimension parallel to the framing members. It shall be permissible to follow the roof rake on gables. End of adjoining plaster bases should be staggered. Lath will not be continuous through control (expansion and contraction) joints. It will be cut, with the accessory attached over the lath and attached (wire tied or stapled) at each side, not more than 7" o.c. When cutting the lath care must be taken not to damage the weather resistant barrier (the drainage plane closest to the sheathing).

Control/expansion joints should be installed to delineate areas of not more than 144 sq.ft. The distance between control/expansion joints shall not exceed 18ft. in any direction or a 2-1/2 to 1 length to width ratio. Control/expansion joints should be located where movement is anticipated. Where expansion joints intersect in a perpendicular fashion the vertical member shall be installed first and shall be continuous.

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External corner reinforcement shall be used where corner bead is not used. At internal corners, there are various details that one may follow dependent upon the situation. When installing the lath or accessory, extreme caution and care should be taken to avoid damaging the weather resistive barrier (WRB). To avoid tearing, try to keep the WRB tight to the corner. The size of the casing bead and other accessories shall be compatible with the thickness of the plaster that is to be applied. For traditional $\frac{3}{4}$ inch stucco work, these accessories shall be $\frac{3}{4}$ inches. Smaller sizes may be used with listed stucco products. Lath is to terminate above stoops and other concrete flatwork. Framing must be protected from pouring concrete directly against it. NAU requires the use of foundation weep screeds. The purpose of the weep screed is to allow any water that may be flowing across the drainage membrane a means to escape.

Stucco Applications

A three coat stucco system shall consist of a separate scratch, brown, and finishing coat with a total thickness of $\frac{7}{8}$ ". NAU recognizes alternative materials and methods of construction. Products that have received an evaluation report and number from the ICC-Evaluation Service would fall under the category of "alternative materials". There are several proprietary "one coat" products that have an ICC-Evaluation Service listing. Typically, these products come premixed, and when applied according to the manufacturer's installation instructions, they may be applied in one coat with a second topcoat being applied at a later time. Stucco wall covering of any kind shall not be applied until the drywall and roofing materials have been installed. This allows loading of the wall systems as well as eliminating any hammering on the exterior walls that could potentially cause cracking to occur. There are several types of acceptable topcoats. Some are portland based finish, acrylic, elastomeric, and latex. The contractor should be aware of potential incompatibility between some of the finishes and the base coat(s) due to the alkalinity of the stucco.

Weatherproofing and Application of Sealants

Backer rod limits the depth of the caulk. The depth of a caulk joint should not exceed its width. The minimum width of a caulk joint should be $\frac{1}{4}$ ". This is the most watertight type of caulk joint. The ability of the joint to flex and remain adhered is greatly influenced by the type of caulking material used. A good quality acrylic-latex shall be used for some applications that are less critical. For joints where water sealing is critical, or difficult to access, the use of a better material such as urethane or silicon will be used. It is recommended that all joints between dissimilar surfaces in a stucco wall be caulked. This would include, but not limited to, windows to wood trim, wood trim to stucco (wraps, corners, bands, etc.). Do not caulk metal head flashings, z-bar flashing, or anywhere water would normally escape the wall.

07 26 00

Vapor Retarders

Section
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Title

Part 1 – General

Vapor and Air Retarders (ASHRAE Design Guide 90.1)

The Building envelope is a key element of an energy-efficient design. Compromises in assembly performance are common and are caused by a variety of factors that can be easily avoided. Improper placement of insulation, improper sealing or lack of sealing around air barriers, incorrect or poorly performing glazing and fenestration systems, incorrect placement of shading devices, and misinterpretation of assembly details can compromise the energy performance of the building.

Vapor Retarders (ASHRAE Design Guide 90.1)

<http://resourcecenter.pnl.gov/cocoon/morf/ResourceCenter>

The building envelope should be designed and constructed with a continuous air barrier system to control air leakage into or out of the conditioned space. An air barrier system should also be provided for interior separations between conditioned space and space designed to maintain temperature or humidity levels that differ from those in the conditioned space by more than 50% of the difference between the conditioned space and design ambient conditions.

If possible, a blower door should be used to depressurize the building to find leaks in the infiltration barrier.

The air barrier system should have the following characteristics:

It should be continuous, with all joints made airtight

Air barrier materials used in frame walls should have an air permeability not to exceed 0.004 cfm/ft² under a pressure differential of 0.3 in. water (1.57 lb/ft²) when tested in accordance with ASTM E 2178.

The system should be able to withstand positive and negative combined design wind, fan, and stack pressures on the envelope without damage or displacement, and should transfer the load to the structure; it should not displace adjacent materials under full load.

It should be durable or maintainable.

The air barrier material of an envelope assembly should be joined in an airtight and flexible manner to the air barrier material of adjacent assemblies, allowing for the relative movement of these assemblies and components due to thermal and moisture variations, creep, and structural deflection.

Connections should be made between:

- foundation and walls
- walls and windows or doors
- different wall systems

DIVISION 7 - THERMAL AND MOISTURE PROTECTION

Section
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Title

- walls and roof
- walls and roof over unconditioned space
- walls, floor, and roof across construction, control, and expansion joints
- walls, floors, and roof to utility, pipe, and duct penetrations

All penetrations of the air barrier system and paths of air infiltration/ex-filtration should be made airtight.

Note: installation of an under-slab vapor barrier should also be specified in Division 03 30 00 and detailed directly under the concrete slab and on top of any subgrade or sand grading material to minimize moisture transmission through the slab. Barriers shall be specified for all construction.

Vapor Barrier Criteria: Refer to Section 07 00 00 Part 1, General for Vapor Barrier Criteria. If vapor barrier is required then it shall be specified in Section 03 30 00.

Part 2 – Products

To be completed

Part 3 – Execution

To be completed

****END OF SECTION****

Section Number	Title
07 30 00	STEEP SLOPE ROOFING

07 31 13 Asphalt Shingles

Part 1 – General

Systems described in this Section are intended to be installed in situations where the roof slope is at least 4 inches per foot, and where the roofs are not intended to receive regular foot traffic for equipment maintenance.

Specify a complete roofing system, making the materials manufacturer responsible for the roofing and flashing system. Require the materials manufacturer to make periodic inspections of the work in progress to ensure that the completed work will qualify for the required warranties.

Do not use roof deck insulation as the only element in the overall building thermal resistance system. Refer to Section 07 21 00.

This is a section where the consultant should use a "performance specification". Do not specify proprietary manufacturer's names or materials, and do not restrict vendors to a limited list. Shingle specifications should be similar to GAF/Elk.

Shingle roof repairs and modifications which are part of a renovation project (e.g. installation of a new exhaust fan) should follow these standards as much as possible. Existing roof warranties must not be compromised. The consultant must prepare a complete specification and details for the required repair work. Generic "flashing as required" notes (which often appear on engineering details for new exhaust fans) are not acceptable.

Be sure to coordinate specification requirements with roofing, flashing, and parapet wall details.

Require that materials manufacturer(s) and installer(s) demonstrate 5 years of successful installations of exact systems or 5 jobs in Northern Arizona or comparable elevation and weather conditions.

Underlayment for shingles will be 2 layers of wrinkle free underlayment, SBS modified asphalt, fiberglass reinforced, complying with ASTM D226, ASTM D146, ASTM D4601-97A, ASTM D4869-88, ASTM D2626-97, ASTM E96, ASTM E108 (Liberty MA Base sheet 'or written prior approved equal').

Preference is to substitute underlayment with full self-adhesive ice and water shield membrane when budget allows. Consult with NAU Project Manager and NAU Roofing Supervisor to determine best material to be used.

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Metal trim and Flashing:

Where valley transitions occur, a 24 gauge sheet metal valley flashing shall be installed in accordance with industry standards on top of a 2-ply SBS modified sheet. All perimeter eaves must incorporate a minimum of 2"x4", 24 gauge sheet metal flashing. This also includes all rakes.

Metal Drip Edge: Brake-formed sheet metal with a four (4") inch roof deck flange and a four (4") inch fascia flange with a hemmed drip at lower edge. Furnish the material in lengths of 8 or 10 feet (2.5 to 3 m). Make certain face of metal fits firmly over edge, with proper three (3") inch lap at ends.

Metal Flashing: Job-cut to sizes and configuration required, dimensions given are for reference purposes, modify as needed.

Vent Pipe Flashing: Lead conforming to ASTM B 749, Type L51121, at least 4 lbs. lead, unless otherwise indicated. Provide lead sleeve sized extending at least four (4") inches (100 mm) from pipe onto roof. Completely solder all connections according to SMACNA standards.

All Metal Trim and Flashing shall be made of Galvanized-steel sheets.

SBS modified rubberized self-adhered ice shield shall be provided and installed at all eave perimeters and valleys and shall extend 6 feet up from eave edge and 3 feet up the wall.

Check with NAU Project Manager if ice shield installation shall be required at all conditions.

Accessories:

Asphalt Plastic Cement: Non-asbestos fibrated asphalt cement, complying with ASTM D 4586.

Nails: Are "hot-dip galvanized steel", 0.120-inch (3 mm) diameter barbed shank, sharp-pointed, conventional roofing nails with a minimum d inch (9.5 mm) diameter head and of sufficient length to penetrate ¾ inch (19 mm) into solid decking or at least c inch (3 mm) through plywood sheathing.

Where nails are in contact with flashing, prevent corrosion action by providing nails made from the same metal as that of the flashing.

Face Nails/Fasteners for clad metal at tie into shingles will be of proper length to penetrate thru decking. Install fastener with grommet to help seal exposed fastener.

Specify (or detail) 3/4" plywood nailers at all parapet walls.

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Specify penetration sealing system similar to “Chem-Curb” for all roof penetrations
Require submittal of manufacturer's literature describing the system, and samples of proposed shingles.

Specify expanded warranties as follows:

- Manufacturer's standard form, without monetary limitation, in which manufacturer agrees to repair or replace components of shingled roofing system that fails.
- 5-year warranty from the installer covering defects in installation
- 20-year warranty from the materials manufacturer including defects in materials and installation, and guaranteeing to maintain the system in a waterproof condition for the life of the warranty on a 40-year shingle.
- Full replacement value without proration
- Include all components of the roof assembly, from the deck up
- Include sealing of all perimeters, joints, and penetrations

Part 2 – Products

A minimum of 235# Architectural-type heavy duty fiberglass shingles are the preferred roofing material. The DP shall specify a material with a minimum 20-year warranty. Expressly prohibit the use of asbestos-containing materials.

Require that all primary and secondary materials be supplied by a single manufacturer, or approved by the primary materials manufacturer, to ensure single-point responsibility for the installation and warranty.

Specify a manufacturer's standard shingle roofing system as follows (in accordance with current Building codes as adopted by NAU – see Division 1 for applicable code):

- UL Class A fire rating
- UL Class 110 wind uplift rating
- ASTM D 7158-06 Class H, Wind Resistance
- ASTM D 3161 Class F, Test at 110 MPH
- ASTM E108 Class A, Fire Resistance
- Underlayment, shingle, starter shingle
- Minimum 30-mil underlayment
- Peel and stick self adhered 15-mil ice shield

Pre-Approved Manufacturers are Elk Prestique II and Malarkey Legacy.
Limit roof insulation to 2" thick. Specify insulations which provide adequate load-bearing capacity at the 2" thickness.

Quality Assurance: DP to include requirements for the following certificates to be provided prior to contract execution with Roofing Contractor:

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- Installer Certificates: Signed by roofing system manufacturer certifying that Installer is approved, authorized, or licensed by manufacturer to install roofing system. The installer's certification for approved material must be in the state of Arizona.
- Installer Qualifications: A qualified firm with 5-years (minimum) documented experience installing similar shingles. Installer must be approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's warranty for the approved materials.
- Manufacturer Certificates: Signed by roofing manufacturer certifying that roofing system complies with requirements specified in Section 07310, Part 2 Products, and roof system, as indicated in the construction documents, meets requirements for roof system warranty specified in "Warranty" Article.

Part 3 – Execution

Require a pre-installation conference, scheduled after the substrates are complete, and including the Contractor, Architect, Owner, materials manufacturer, and installing subcontractor(s).

Shingle roofing is a finish material, not a staging platform for further construction work. Include the following provisions:

- Require the Contractor to install a "temporary roof" if he desires to "dry-in" the building to allow interior construction to begin or to provide a platform for further exterior construction
- Describe this requirement as a "Contractor's Option", that is, if he wants to dry-in, he must do so only with a temporary roof
- Reference the National Roofing Contractor's Association (NRCA) requirements for temporary roofs, including "sacrificial" insulation on metal decks
- Specifically prohibit "phased roofing"
- Require that finished roofs be protected with plywood sheets for any and all construction traffic, and that all equipment moving be accomplished with rollers.

Inspections as required by NAU roofers.

Inspection Report: Copy of roofing system manufacturer's inspection report of completed roofing installation.

Building renovation design shall remove / relocate conduit, piping and equipment off the roof to limit roof penetration and obstructions.

Specifically require the roof to be installed in accordance with the manufacturer's recommendations. Comply with manufacturer's instructions and recommendations but not less than those recommended by "The NRCA Steep Roofing Manual".

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Roofer shall be certified by manufacturer to enforce warranty in Arizona.

Refer to and describe the appropriate SMCNA details for each edge and penetration condition.

Specifically prohibit:

- Pitch pans
- Guy wires fastened directly to the deck

Examine substrate for compliance with requirements for substrates, installation tolerances, and other conditions affecting performance of asphalt shingles. Do not proceed with installation until unsatisfactory conditions have been corrected.

Commencement of roof application over any section will denote acceptability by Contractor of any section's readiness to receive asphalt shingles and he will be responsible for any corrective work which may be occasioned by his having started over an unsatisfactory surface.

Clean substrate of projections and substances detrimental to application. Cover knotholes or other minor voids in substrate with sheet metal flashing secured with non corrosive roofing nails.

Coordinate installation with flashings and other adjoining work to ensure proper sequencing. Do not install roofing materials until all vent stacks and other penetrations through roof sheathing have been installed and are securely fastened against movement.

For re-roofing projects: Contractor shall remove all existing roofing, flashings, nails, etc. down to the existing roof deck. All tear-off materials shall be removed from the roof on a daily basis and disposed of in accordance with applicable codes and ordinances. Contractor shall not remove more in one day than can be covered the same day and made completely watertight.

Fasten asphalt shingles to roof sheathing by hand using nails (6 nails per shingle). Use of pneumatic/electric nail guns and/or staples is not acceptable.

Felt Underlayment: Apply two layers of felt underlayment horizontally over entire surface to receive asphalt shingles, lapping succeeding courses a minimum of two (2") inches (50 mm), end laps a minimum of four (4") inches (100 mm), and hips and valleys a minimum of six (6") inches (150 mm). Fasten felt with sufficient number of roofing nails to hold underlayment in place until asphalt shingle installation. Do not leave underlayment exposed to the elements for more than thirty (30) days.

Metal Open Valley: Comply with ARMA and NRCA recommendations. Install a second felt underlayment shingle lapped at least twelve (12") inches (300 mm).

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Install 2-ply modified sweat sheet and cover outside of valley metal with 2-ply dry-in.

Flashing: Install metal flashing and trim as indicated and according to details and recommendations of the "Asphalt Roofing" section of the "The NRCA Steep Roofing Manual". Require the roofing installer to receive, accept, and install, all sheet metal flashings.

Install asphalt shingles, beginning at roof's lower edge, with a starter shingle or strip of roll roofing. Fasten asphalt shingles in the desired weather exposure pattern; use number of fasteners per shingle (minimum of 6) as recommended by manufacturer. Use vertical and horizontal chalk lines to ensure straight coursing. Cut and fit asphalt shingles at valleys, ridges, and edges to provide maximum weather protection. Use fasteners at ridges of sufficient length to penetrate sheathing as specified.

Pattern: a shingle spacing offset at succeeding courses.

Repair or replace loading ground area when / if damaged back to original condition at minimum.

****END OF SECTION****

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Title

07 40 00

ROOFING AND SIDING PANELS

Part 1 – General

Systems described in this Section are intended to be installed in situations where the roof slope is at least 2-1/2 inches per foot, and where the roofs are not intended to receive regular foot traffic for equipment maintenance.

Specify a complete roofing system, making the materials manufacturer responsible for the roofing and flashing system. Require the materials manufacturer to make periodic inspections of the work in progress to ensure that the completed work will qualify for the required warranties.

Do not use roof deck insulation as the only element in the overall building thermal resistance system. Refer to Specification Section 07 21 00.

This is a section where the consultant should use a "performance specification". Do not specify proprietary manufacturer's names or materials, and do not restrict vendors to a limited list.

Metal roof repairs and modifications which are part of a renovation project (e.g. installation of a new exhaust fan) should follow these standards as much as possible. Existing roof warranties must not be compromised. The consultant must prepare a complete specification and details for the required repair work. Generic "flashing as required" notes (which often appear on engineering details for new exhaust fans) are not acceptable.

Be sure to coordinate specification requirements with roofing, flashing, and parapet wall details.

Specify (or detail) 3/4" plywood nailers at all parapet walls.

The DP shall ensure that metal roof design addresses potential for excessive snow slides, icicle accumulation and falling area, particularly in the areas of entrances, emergency exits, loading docks, lower roof areas, landscaping and walk-ways. Require that materials manufacturer(s) and installer(s) demonstrate 5 years of successful installations of similar systems.

Require submittal of:

- Manufacturer's literature describing the system
- Shop drawings showing panel layout, and all edge, transition, and penetration details
- Samples of proposed metal panels

Specify expanded warranties as follows:

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- 5 year warranty from the installer covering defects in installation
- 30 year warranty from the materials manufacturer including defects in materials and installation, hail damage, and guaranteeing to maintain the system in a waterproof condition for the life of the warranty
- Full replacement value without proration
- Include all components of the roof assembly, from the deck up
- Include sealing of all perimeters, joints, and penetrations

Part 2 – Products

Require that all primary and secondary materials be supplied by a single manufacturer, or approved by the primary materials manufacturer, to ensure single-point responsibility for the installation and warranty.

Specify a manufacturer's standard preformed metal roofing system as follows:

- UL Class A fire rating
- UL wind uplift rating capable of resisting wind speeds up to 100 miles per hour
- Minimum 15-lb asphalt saturated underlayment
- Factory formed panels, steel, aluminum, or copper
- Concealed fastener installation
- Factory applied polyvinylidene fluoride finish, or natural metal finish intended for exposure to the elements

Limit roof insulation to 2" thick. Specify insulations which provide adequate load-bearing capacity at the 2" thickness.

Coordinate the design of tested roofing assemblies with the supporting roof structural system.

Minimum gauges:

- Roofs 22 ga
- Walls 18 ga

Minimum panel width 12"

Part 3 – Execution

Require a pre-installation conference, scheduled after the substrates are complete, and including the Contractor, Architect, Owner, materials manufacturer, and installing subcontractor(s).

Metal roofing is a finish material, not a staging platform for further construction work. Include the following provisions:

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- Require the Contractor to install a "temporary roof" if he desires to "dry-in" the building to allow interior construction to begin or to provide a platform for further exterior construction
- Describe this requirement as a "Contractor's Option", that is, if he wants to dry-in, he must do so only with a temporary roof
- Reference the National Roofing Contractor's Association (NRCA) requirements for temporary roofs, including "sacrificial" insulation on metal decks
- Specifically prohibit "phased roofing"
- Specifically prohibit all traffic from the finished roof

When 6 inch rigid insulation is designed for the roof system, secondary purlin support framing shall be provided for Pre-Engineered systems.

Specifically require the roof to be installed in accordance with the manufacturer's recommendations.

Refer to and describe the appropriate SMCNA details for each edge and penetration condition.

Require the roofing installer to receive, accept, and install, all sheet metal flashings. Specifically prohibit:

- Pitch pans
- Guy wires fastened directly to the deck

Require a spray test after completion of the roofing system, to be witnessed by the Contractor, Architect, Owner, materials manufacturer, and installing contractor(s).

****END OF SECTION****

Section
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Title

07 50 00**MEMBRANE ROOFING**Part 1 – General

This section applies specifically to membrane roofs, but also pertains to other methods of roofing or those areas effectively acting as “roofs” (decks, overhangs, balconies, etc.). To aid in attaining both the written specification and warranties called for by NAU, the DP should design and detail appropriate roof slopes, drainage system(s), cants, flashing, protection devices or materials and utilize good common sense. Roofing techniques, systems and materials should be utilized that are “time proven” (+5 years) and be designed as “composite” systems instead of appliquéés. Roofing shall be done only by a roofer who is approved by the manufacturer whose materials are used.

DP shall use online roofing system design tools such as RoofNav by FM Approvals, LLC (www.RoofNav.com) or approved equal to establish the values used to calculate the specified roof assembly’s resistance to fire, hail and wind.

Specify primary products, including roofing sheets, as produced and supplied from a single manufacturer, which has produced that product successfully for not less than 5 years *without formulation change*.

Specify that a single installer shall perform the work, and have not less than 5 years of successful experience in the installation of specified roofing systems. This criteria shall be verified prior to NTP. *Contractor must be licensed and certified by manufacturer in the State of Arizona.*

The DP should review the proposed roofing system early on (design development) with a considered manufacturer or installer of the system(s) for insights and suggestions that could alter the approach in mind.

NAU requires a 20 year No Dollar Limit warranty on all membrane roofing systems along with a *1 ½ inch hail rider warranty*. Only those manufacturers that can comply with this warranty should be specified.

NAU requires all membrane roofing systems to resist the uplift forces produced by wind speeds up to 100 miles per hour. Coordinate the design of tested roofing assemblies with the supporting roof structural system.

Roofing systems should be designed and/or specified that will allow occasional foot traffic by maintenance personnel. In areas where there is more frequent foot traffic, additional *walk pads* or elevated pads should be designed and demarcated (TRAFBLOC material).

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DP shall provide protection of membrane roofing where falling icicle damage is possible.

Exterior insulation systems on top of membrane or built-up layers should be avoided due to the extreme difficulty in tracing and repairing roofing leaks.

Part 2 – Products

Refer to sections below for products requirements & recommendations

Part 3 – Execution

Refer to sections below for Execution requirements & recommendations

07 51 00 Built-Up Bituminous Roofing

Part 1 – General

BUR systems are no longer an approved system for Northern Arizona roofs.

Part 2 – Products

To be completed

Part 3 – Execution

To be completed

07 54 00 Thermoplastic Membrane Roofing

Part 1 – General

RELATED DOCUMENTS

Drawings, Roof Drawing Notes, Scope of Work for Base Bid, Submittal requirements After Acceptance of Bid and Prior to Project Close Out and General Provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

This Section includes the following:

- Mechanically fastened or fully adhered membrane roofing system.
- Coated Edge metal flashing materials.
- Insulation & Fire Barrier Board

Section
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PROJECT CONDITIONS

Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements. Owner reserves the right to stop work at any time due to weather.

Any substrate to receive new insulation, membrane or flashing shall be thoroughly dry. Should surface moisture occur the Contractor shall provide adequate equipment to dry the substrate.

Prior to and during application, the Contractor shall ensure that all debris, dirt and dust shall be removed from surfaces where the new roofing is being installed.

Precautions shall be taken to prevent wind blow-off or wind damage during the course of the roofing application. This may necessitate additional securing of temporary construction. Materials stored on the roof shall be secured at all times so that no flying debris may damage the installed roof system.

PERFORMANCE REQUIREMENTS

Provide installed roofing membrane and base flashings that remain watertight; do not permit the passage of water; and resist specified uplift pressures, thermally induced movement, and exposure to weather without failure.

Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by roofing membrane manufacturer based on testing and field experience. *The materials shall meet ASTM 6754 or better.*

Roofing System Design: Provide a membrane roofing system that is identical to systems that have been successfully tested by a qualified testing and inspecting agency to resist the calculated uplift pressure produced by winds speeds of up to 100 miles per hour. *Membrane roofing system shall not be compiled of any asphalt materials.*

Fire-Test-Response Characteristics: Provide membrane roofing materials with the fire-test-response characteristics indicated as determined by testing identical products per test method below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Materials shall be identified with appropriate markings of applicable testing and inspecting agency.

Exterior Fire-Test Exposure: Class A; ASTM E 108, for application and roof slopes indicated.

Provide UL Class A fire rating.

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Number

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SUBMITTALS

Provide a list of 5 locations that the product has been installed at similar altitudes for the last 10 years or longer. *All products shall meet ASTM 6754 or better.*

Product Data: For each type of product indicated.

Samples of all materials to be used that are part of the roofing system.

Field mock-up: minimum 6' x 6' consisting of full installation of roofing system components and demonstrating installation at rigid insulation and fiberglass batt insulation. Provide perimeter edge metal (one rake edge and one ridge edge flashing) conditions for review and approval. Include all accessories such as snow guards and walkpad.

Shop Drawings: include plans, sections, details, and attachments to other Work, including:

- Roof size
- Structural calculations identifying the wind uplift forces to be resisted by membrane roofing system and supporting structural system
- Location and type of penetrations
- Perimeter and penetration details
- Base flashings and membrane terminations.
- Underlayment board installation
- Layout details
- Framing plan and framing fastening patterns.
- Roof drain assemblies

All details provided shall have been accepted by an authorized manufacturer's representative.

Warranties: submit two copies of manufacturer's total system warranty, including special warranties specified in this Section.

Material Safety Data Sheets for all products.

Roofing Contractor's Quality Control program for installation of entire single-ply roofing membrane system.

Maintenance Data: For roofing system to include in maintenance manuals.

Inspection Report: Copy of roofing system manufacturer's inspection report of completed roofing installation.

Section
Number

Title

QUALITY ASSURANCE

Roofing applicator shall be certified in writing by the manufacturer of the specified product as a licensed approved applicator *in the State of Arizona*. *Companies with manufacturer approval outside of the State of Arizona are not deemed in compliance with the NAU Technical Standards.*

All mentioned information below shall be supplied at preconstruction meeting prior to contract execution with roofing Subcontractor:

Installer Certificates: Signed by roofing system manufacturer certifying that Installer is approved, authorized, or licensed by manufacturer to install roofing system.

Installer Qualifications: A qualified firm with 5-years (minimum) documented experience installing the specified product. Installer must be approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's warranty for the approved materials.

Submit the following qualification data: Project Foreman or Superintendent shall have supervised a minimum of five (5) projects of similar size and scope as this Project with the specified product. Contractor shall provide Name and address of these five (5) projects of similar size and scope as this Project. Include contact name and phone number for reference.

Manufacturer Certificates: Signed by roofing manufacturer certifying that roofing system complies with requirements specified in Section 07 54 00 "Performance Specification" Article and roof system, as indicated in the construction documents, meets requirements for roof system warranty specified in "Warranty" Article.

Manufacturer Qualifications: The roofing membrane and system shall be identical to that used for this Project and which can show evidence of these materials being satisfactorily used on at least five (5) projects of similar size, scope and type within the last 5 years. Obtain components for membrane roofing system from or approved by roofing membrane manufacturer.

Pre-installation Conference

Conduct conference at Project site. Review methods and procedures related to roofing system including, but not limited to, the following:

Meet with Owner, Owner's representative, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's technical representative and all Sub-Contractors directly related to the installation of the new roof system.

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Review methods and procedures related to roofing installation, including manufacturer's written instructions. Note: Contractor shall have written manufacturer specifications, roof drawings, roof drawing notes, scope of work and specifications on site at all times during the construction period.

Items of discussion shall include warranty and submittal requirements.

Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays. Review building protection, staging areas, site logistic plan, fall protection, installation procedures and requirements.

Review structural loading limitations of roof deck during and after roofing.

Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing system.

Review governing regulations and requirements for insurance and certificates if applicable.

Review Contractor's Risk Management Plan and OSHA approved Safety Program.

Review Contractor's Quality Control program.

Review weather conditions.

Review roof observation and repair procedures after roofing installation.

DELIVERY, STORAGE, AND HANDLING

Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storing and mixing with other components.

Membrane rolls shall be stored lying down on pallets and fully protected from the weather with clean canvas tarpaulins. Unvented polyethylene tarpaulins are not accepted due to the accumulation of moisture beneath them in certain weather conditions that may affect the ease of membrane weldability.

Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight. All flammable materials shall be stored in a cool, dry area, away from sparks and flames.

Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.

Section
Number

Title

Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.

Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.

WARRANTY

Special Warranty: Manufacturer's standard form, without monetary limitation ("No Dollar Limit" NDL warranty), in which manufacturer agrees to repair or replace components of membrane roofing system that fail in materials or workmanship within specified warranty period. Failure includes roof leaks.

Special warranty shall include all materials and installation from the structural deck up including, but not limited to, substrate board, expansion joints, roof insulation, roofing membrane, base flashings, roofing membrane accessories, fasteners, cover boards, walkway products and other components of membrane roofing system.

Warranty Period: 20 years from date of Substantial Completion.

Warranty shall include 1 ½" hail warranty and shall not include exclusions for ponding water.

Part 2 – Products

MANUFACTURERS

Products: Available Manufacturers: Subject to compliance with performance specifications.

Inter-ply Reinforcement to be reinforced polyester knit fabric coated with an adhesive coat to promote a molecular bond between the base fabric and the front and back coats.

Manufacturers: Subject to compliance with requirements, substitution request must be 7 days prior to bid date. Provide products by the manufacturers specified that meet or exceed stated manufacturer qualifications, performance requirements, fire test requirements, physical properties requirements and warranty requirements.

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Number Title

Pre -Approved Manufacturers:

- Fibertite/Seaman Corporation 50XT *or approved equal*

PERFORMANCE SPECIFICATION

Thickness: 50 mils (1.1 mm), nominal. Manufactured in 56” X 100’

Color: Beige or White.

Inter-ply Reinforcement to be 18 x 21 / 1,100 x 1,100 denier weft reinforced polyester knit fabric coated with an adhesive coat to promote a molecular bond between the base fabric and the front and back coats.

Mil Thickness Substitution request must comply with the following Minimum Physical Properties:

PROPERTY	TEST METHOD	RESULTS
Thickness	ASTM D-751	.050 minimum
Tear Resistance	ASTM D-751	125 lbs x 50 lbs (8” x 10” sample)
Seam Strength	ASTM D-751	500 lbs
Breaking Strength	ASTM D-751	600 lbs
Tensile Strength	ASTM D-882	9500 psi
Elongation		20% X 30%
Peel Strength		no peel
Scrim Size		18 X 18
Water Vapor Transition		1.3
Water Absorption		<5%
Dimensional Stability	ASTM D-1204	0.5%
Low Temperature Flexibility	ASTM D-2136	-40F
Puncture Resistance	Fed. Std. 101B	30 joules pass Method 2031
Hydrostatic Resistance	Mil-C-20696C	No swelling, cracking or leaking
Oil Resistance	Mil-C-20696C	No swelling, cracking or leaking
Coating Adhesion	ASTM D-751	Cannot initiate coating peel
Accelerated Weathering		Carbon Arc with 5,000 hours – no cracking, blistering or crazing.

AUXILIARY MATERIALS

General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with membrane roofing.

Liquid-type auxiliary materials shall meet VOC limits of authorities having jurisdiction.

Section
Number

Title

Sheet Flashing: Manufacturer's standard sheet flashing of same material, type, reinforcement, thickness, and color as *KEE* sheet membrane.

Bonding Adhesive: Manufacturer's standard solvent-based bonding adhesive for membrane, and solvent-based bonding adhesive for base flashings.

Metal Termination Bars: Manufacturer's standard predrilled aluminum bars with anchors, approximately 1 by 1/8 inch thick; with anchors.

Metal Battens: Manufacturer's standard aluminum-zinc-alloy-coated or zinc-coated steel sheet, approximately 1 inch wide by 0.05 inch thick, pre-punched.

Fasteners: designed for fastening membrane to substrate, and acceptable to membrane roofing system manufacturer. Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening membrane to substrate, and acceptable to membrane roofing system manufacturer.

Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, termination reglets, cover strips, and other accessories.

Laminated Metal Pre-Finished Coated Metal: Provide pre-finished, weldable coated metal as provided by the roofing system manufacturer, Gauge 24 galvanized steel laminated with polymeric coating.

Color: White

Wood Nailers: As required by roofing manufacturer

INSULATION & FIRE BARRIER BOARD

General: Provide preformed roof boards that comply with requirements and referenced standards, selected from manufacturer's standard sizes and of thicknesses indicated.

Fire Barrier Cover Board: ASTM C 1177, glass-mat, water-resistant gypsum substrate, 1/2" thick.

Product (mechanically attached surfaces): "Dens-Deck" by Georgia-Pacific Corporation (or approved equal). *Asphalt is not an approved adhesive.*

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INSULATION ACCESSORIES

General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatible with membrane roofing.

Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening roof insulation to substrate, and acceptable to roofing system manufacturer.

Part 3 – Execution

Examine substrates, areas, and conditions, with Installer present, for compliance with the following requirements and other conditions affecting performance of roofing system.

Verify that roof openings and penetrations are in place and set and braced.

Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and at terminations and verify that nailers match thicknesses of insulation.

Proceed with installation only after unsatisfactory conditions have been corrected.

MECHANICALLY FASTENED AND FULLY ADHERED ROOFING MEMBRANE INSTALLATION

Install roofing membrane over area to receive roofing according to roofing system manufacturer’s written instructions. Unroll roofing membrane and allow it to relax before installing it.

Start installation of roofing membrane in presence of roofing system manufacturer’s technical personnel.

Accurately align roofing membranes and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.

Mechanically fasten or fully adhered roofing membrane securely at terminations, penetrations, and perimeter of roofing.

Apply roofing membrane with side laps shingled with slope of roof deck where possible.

Seams: Clean seam areas, overlap roofing membrane, and hot-air weld side and end laps of roofing membrane according to manufacturer’s written instructions to ensure a watertight seam installation.

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Title

Test lap edges with probe to verify seam weld continuity.

Apply lap sealant to seal cut edges of roofing membrane.

Verify field strength of seams a minimum of twice daily and repair seam sample areas. Repair tears, voids, and lapped seams in roofing membrane that does not meet requirements.

In-Splice Attachment: Secure one edge of roofing membrane using fastening plates or metal battens centered within membrane splice and mechanically fasten roofing membrane to roof deck. Field-splice seams.

BASE FLASHING INSTALLATION

Install sheet flashings and preformed flashing accessories and adhere to substrates according to membrane roofing system manufacturer’s written instructions.

Apply solvent-based bonding adhesive to substrate and underside of sheet flashing at required rate and allow to partially dry. Do not apply bonding adhesive to seam area of flashing.

Flash penetrations and field-formed inside and outside corners with sheet flashing. Clean seam areas and overlap and firmly roll sheet flashings into the adhesive. Weld side and end laps to ensure a watertight seam installation.

Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.

FIELD QUALITY ASSURANCE

Pre-Installation Conference: Contractor shall include in their bid, the cost for roofing system manufacturer’s technical personnel to attend the Pre-Installation Conference.

Final Roof Inspection: Contractor shall include in their bid, the cost for the roofing system manufacturer’s technical personnel to inspect roofing installation on completion and submit final inspection report to the Owner’s representative.

Notify Owner’s representative 48 hours in advance of date and time of inspection.

Repair or remove and replace components of membrane roofing system where test results or inspections indicate that they do not comply with specified requirements.

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Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

PROTECTING AND CLEANING

Protect membrane roofing system from damage and wear during the remaining construction period so as not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Owner.

Correct deficiencies in or remove membrane roofing system that does not comply with requirements, repair substrates, and repair or reinstall membrane roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

****END OF SECTION****

Section
Number

Title

07 60 00 FLASHING AND SHEET METAL

Part 1 – General

No building design shall include uncapped parapets.
Parapet caps shall be metal, not masonry.

Part 2 – Products

To be completed

Part 3 – Execution

To be completed

07 61 13 Standing Seam Sheet Metal Roofing

Part 1 – General

To be completed

Part 2 – Products

To be completed

Part 3 – Execution

To be completed

07 62 00 Sheet Metal Flashing and Trim

Part 1 – General

To be completed

Part 2 – Products

To be completed

Part 3 – Execution

To be completed

07 63 00 Sheet Metal Roofing Specialties

Part 1 – General

To be completed

Part 2 – Products

To be completed

DIVISION 7 - THERMAL AND MOISTURE PROTECTION

Section
Number

Title

Part 3 – Execution
To be completed

****END OF SECTION****

Section
Number

Title

07 70 00 ROOF AND WALL SPECIALTIES AND ACCESSORIES

07 71 00 Roof Specialties

Part 1 – General

To be completed

Part 2 – Products

To be completed

Part 3 – Execution

To be completed

07 72 00 Roof Accessories

Part 1 – General

Roof Hatch

Preference is given to a full size door (3'-0" x 7'-0") to access roof.

All roofs shall be accessible for maintenance purposes, regardless of presence of mechanical or electrical equipment on the roof. Annual maintenance includes cleaning downspout and gutters and NAU Roofing personnel should be able to accomplish such task without the help of a lift.

When a hatch is provided, it shall be a self-flashing hatch. Minimum dimensions shall be such that any piece of equipment located on the roof can be removed from the roof through the hatch. If no equipment on the roof, use a minimum 24" x 36" clear opening.

Fall prevention system shall be installed on the roof to allow for maintenance.

Ridge Vents: To be completed

Scuppers, downspouts and overflow drains shall not be installed in such a manner as to allow the water to run down the face of the building wall or across sidewalks. All roof curbs to be a minimum of 12 inches above finished roof membrane

Part 2 – Products

To be completed

Part 3 – Execution

To be completed

Section
Number

Title

07 76 00

Roof Pavers

Part 1 – General

Roof pavers or reinforced single ply membrane material shall be installed to provide access from roof door /hatch to any pieces of equipment that will require access to perform maintenance.

Part 2 – Products

To be completed

Part 3 – Execution

To be completed

****END OF SECTION****

Section
Number

Title

07 80 00 FIRE AND SMOKE PROTECTION

Part 1 – General
To be completed

Part 2 – Products
To be completed

Part 3 – Execution
To be completed

07 82 00 Board Fireproofing

Part 1 – General

Indicate on the drawings the UL Listing Number and fire resistance rating which is required for each condition of structural fireproofing.

The use of spray applied fireproofing is prohibited unless all other methods of fire protection (above ceiling sprinkler systems, plaster enclosure, troweled application, etc.) are found to be unfeasible. DP must receive approval prior to the Design Development Phase Submittal.

Fireproofing systems which are part of a renovation project (e.g. repair of damaged or missing systems, or removal and replacement of existing systems) should follow these standards. Existing fire resistance ratings must not be compromised. The consultant must prepare a complete specification and details for the required repair work. Generic "repair fireproofing as required" notes are not acceptable.

This is a section where the Consultant should use a "performance specification". Do not specify proprietary manufacturer's names or materials, and do not restrict vendors to a limited list.

Require that all materials manufacturer(s) and applicator(s) demonstrate 5 years of successful installation of similar materials.

Require submittal of manufacturer's literature describing all materials, and the specific systems to be applied for this project.

Part 2 – Products

Specifically prohibit the use of asbestos containing materials.

When re-fireproofing structural elements where asbestos-containing fireproofing has been abated by the University, specify only materials which are known to be

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compatible with asbestos encapsulates.

Part 3 – Execution

Describe requirements for protection of completed fireproofing.

Describe specific requirements for repair of fireproofing in the event of damage.

When re-fireproofing structural elements where asbestos-containing fireproofing has been spot-abated by the University, specifically describe precautions which the Contractor must take to protect adjoining asbestos containing fireproofing which remains.

07 84 00

Firestopping

PART 1 – GENERAL

RELATED DOCUMENTS

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Section, apply to work specified in this section.

DEFINITIONS

Firestopping: Material or combination of materials used to retain integrity of fire-rated construction by maintaining an effective barrier against the spread of flame, smoke, and hot gases through penetrations in, or construction joints between, fire rated wall and floor assemblies.

GENERAL DESCRIPTION OF THE WORK OF THIS SECTION

Only tested firestop systems shall be used in specific locations as follows:

- A. Penetrations for the passage of duct, cable, cable tray, conduit, piping, electrical busways and raceways through fire-rated vertical barriers (walls and partitions), horizontal barriers (floor/ceiling assemblies), and vertical service shaft walls and partitions.
- B. Safing slot gaps between edge of floor slabs and curtain walls.
- C. Openings between structurally separate sections of wall or floors.
- D. Gaps between the top of walls and ceilings or roof assemblies.

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Title

- E. Expansion joints in walls and floors.
- F. Openings and penetrations in fire-rated partitions or walls containing fire doors.
- G. Openings around structural members which penetrate floors or walls.

RELATED WORK OF OTHER SECTIONS

- A. Coordinate work of this section with work of other sections as required to properly execute the work and as necessary to maintain satisfactory progress of the work of other sections, including:
 - 1. Cast-In-Place Concrete
 - 2. Joint Sealers
 - 3. Masonry Work
 - 4. Lath and Plaster
 - 5. Gypsum Drywall Systems
 - 6. Sound, Vibration and Seismic Control
 - 7. Fire Suppression and Supervisory Systems
 - 8. Basic Mechanical Materials and Methods
 - 9. Mechanical Insulation
 - 10. Fire Protection
 - 11. Plumbing
 - 12. Basic Electrical Materials and Methods

THROUGH-PENETRATION UL CLASSIFICATION SYSTEM

Fire Stopping Systems UL Classification System

Construction Type of System - Penetrated Construction Identification

- 1. No Penetrating Items: F, W, C A, B, J, K, L 0001-0999
- 2. Metallic Pipes, Conduit or Tubing: F, W, C A, B, J, K, L 1001-1999
- 3. Nonmetallic Pipe, Conduit or Tubing: F, W, C A, B, J, K, L 2001-2999
- 4. Electric Cables: F, W, C A, B, J, K, L 3001-3999
- 5. Cable, Trays with Electric Cables: F, W, C A, B, J, K, L 4001-4999
- 6. Insulated Pipes: F, W, C A, B, J, K, L 5001-5999
- 7. Electrical Bussduct Penetrations: F, W, C A, B, J, K, L 6001-6999
- 8. Mechanical Ductwork Penetrations: F, W, C A, B, J, K, L 7001-7999
- 9. Multiple Penetrations through Common Openings: F, W, C A, B, J, K, L 8000-8999

Construction Penetration

Section
Number

Title

F - Floor penetration
W - Wall penetration
C - Either floor or wall penetration

Type of Construction

A – Concrete floors equal to or less than 5-inches thick
B – Concrete floors greater than 5-inches thick
J – Concrete or masonry walls equal to or less than 8-inches thick
K – Concrete or masonry walls greater than 8-inches thick
L – Framed walls

JOINT UL CLASSIFICATION SYSTEM

Fire-Resistant Joint Systems UL Classification System

Joint
System
Movement
Capability Joint Width
1. Floor-to-Floor FF D 0000-0999
2. Wall-to-Wall WW D 0000-0999
3. Floor-to-Wall: FW D 0000-0999
4. Head of Wall: HW D 0000-0999

Movement Capability

D=Dynamic Has movement capability
S=Static which does not require movement capability

Joint Width

0000-0999 Less than or equal to 2”
1000-1999 Greater than 2” Less than or equal to 6”
2000-2999 Greater than 6” Less than or equal to 12”

QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: Provide through-penetration fire stop systems and fire- resistive joint systems that comply with specified requirements of tested systems.
- B. Fire stop System installation must meet requirements of ASTM E 814, UL 1479 or UL 2079 tested assemblies that provide a fire rating equal to that of construction being penetrated.

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- C. Proposed fire stop materials and methods shall conform to applicable governing codes having local jurisdiction.
- D. Fire stop Systems do not reestablish the structural integrity of load bearing partitions/assemblies, or support live loads and traffic. Installer shall consult the structural engineer prior to penetrating any load bearing assembly.
- E. For those firestop applications that exist for which no qualified tested system is available through a manufacturer, an engineering judgment derived from similar qualified tested system designs or other tests will be submitted to local authorities having jurisdiction for their review and approval prior to installation. Engineering judgment documents must follow requirements set forth by the International Firestop Council.
 - 1. Contractors will be responsible to check with STI and or Hilti to verify that either manufacturer does not have a tested assembly for a given application prior to submission of any Engineering Judgment.

SUBMITTALS

- A. Submit Product Data: Manufacturer's specifications and technical data for each material including the composition and limitations, documentation of qualified tested firestop systems to be used and manufacturer's installation instructions to comply with Section 1300.
- B. Manufacturer's engineering judgment identification number and document details when no qualified tested system is available for an application. Engineering judgment must include both project name and contractor's name who will install firestop system as described in document.
- C. Submit material safety data sheets and certificates of compliance provided with product delivered to job-site.
- D. VOC Content Limitations: For firestop system products, submit documentation of conformance with LEED EQ Credit 4.1 "Low-Emitting Materials, Adhesives, and Sealants."

INSTALLER QUALIFICATIONS

- A. Engage an experienced Installer who is certified, licensed, or otherwise qualified by the firestopping manufacturer as having been provided the

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Title

necessary training to install manufacturer's products per specified requirements. A supplier's willingness to sell its firestopping products to the Contractor or to an Installer engaged by the Contractor does not in itself confer qualification on the buyer.

- B. Installation Responsibility: assign installation of through-penetration firestop systems and fire-resistive joint systems in Project to a **single source SPECIALTY FIRESTOP CONTRACTOR**.
- C. The work is to be installed by a contractor with at least one of the following qualifications:
 - 1. UL Approved Contractor
 - 2. FM 4991 Approved Contractor
- D. Firm with not less than 3-years experience with complete fire stop installations.
- E. Successfully completed not less than 3 comparable scale projects using similar systems.

DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials undamaged in manufacturer's clearly labeled, unopened containers, identified with brand, type, and UL label where applicable.
- B. Coordinate delivery of materials with scheduled installation date to allow minimum storage time at job-site.
- C. Store materials under cover and protect from weather and damage in compliance with manufacturer's requirements, including temperature restrictions.
- D. Comply with recommended procedures, precautions or remedies described in material data safety sheets as applicable.
- E. Do not use damaged or expired materials.

PROJECT CONDITIONS

- A. Do not use materials that contain flammable solvents.
- B. Schedule installation of firestopping after completion of penetrating item

Section
Number

Title

installation but prior to covering or concealing of openings.

- C. Verify existing conditions and substrates before starting work and correct unsatisfactory conditions before proceeding.
- D. Weather conditions: Do not proceed with installation of firestop materials when temperatures exceed the manufacturer's recommended limitations for installation printed on product label and product data sheet.
- E. During installation, provide masking and drop cloths to prevent firestopping materials from contaminating any adjacent surfaces.

PART 2 – PRODUCTS

FIRESTOPPING, GENERAL

- A. Provide firestopping composed of components that are compatible with each other, the substrates forming openings, and the items, if any, penetrating the firestopping under conditions of service and application, as demonstrated by the firestopping manufacturer based on testing and field experience.
 - 1. The use of multiple manufacturers' materials within the context of the same opening voids all warranties and will not be accepted.
- B. Provide components for each firestopping system that are needed to install fill material. Use only components specified by the firestopping manufacturer and approved by the qualified testing agency for the designated fire-resistance-rated systems.
- C. Firestopping Materials are either "cast-in-place" (integral with concrete placement) or "post installed." Provide cast-in-place firestop devices prior to concrete placement.
- D. Seal all openings or voids made by penetrations to ensure an air and water resistant seal.
- E. Consult with mechanical engineer, project manager, and damper manufacturer prior to installation of through-penetration firestop systems that might hamper the performance of fire dampers as it pertains to duct work.
- F. Protect materials from damage on surfaces subjected to traffic.

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G.	Apply a suitable bond-breaker to prevent three-sided adhesion in applications where this condition might occur such as the intersection of a gypsum wallboard/steel stud wall to floor or roof assembly where the joint is backed by a steel ceiling runner or track.
H.	Where joint application is exposed to the elements, fire-resistive joint sealant must be approved by manufacturer for use in exterior applications and shall comply with ASTM C-920, "Specification for Elastomeric Joint Sealants".

ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with through penetration firestop systems (XHEZ), joint systems (XHBN), and perimeter firestop systems (XHDG) listed in Volume 2 of the UL Fire Resistance Directory; provide products of the following manufacturers as identified below:
 1. Specified Technologies Inc. STI Somerville, New Jersey 800.992.1180/www.stifirestop.com
 2. Hilti, Inc., Tulsa, Oklahoma 800-879-8000/www.us.hilti.com
 3. Or approved equal, as approved in writing from Owner

PERFORMANCE REQUIREMENTS

- A. Provide products that upon curing do not re-emulsify, dissolve, leach, breakdown or otherwise deteriorate over time from exposure to atmospheric moisture, sweating pipes, ponding water or other forms of moisture characteristic during and after construction.
- B. Provide firestop sealants sufficiently flexible to accommodate motion such as pipe vibration, water hammer, thermal expansion and other normal building movement without damage to the seal.
- C. Pipe insulation shall not be removed, cut away or otherwise interrupted through wall or floor openings. Provide products appropriately tested for the thickness and type of insulation utilized.
- D. Fire rated pathway devices shall be the preferred product and shall be installed in all locations where frequent cable moves, add-ons and changes will occur.
- E. When mechanical cable pathways are not practical, openings within walls and floors designed to accommodate voice, data and video cabling shall be provided with re-enterable products specifically designed for retrofit.

Section Number	Title
F.	Penetrants passing through fire-resistance rated floor-ceiling assemblies contained within chase wall assemblies shall be protected with products tested by being fully exposed to the fire outside of the chase wall. Systems within the UL Fire Resistance Directory that meet this criterion are identified with the words "Chase Wall Optional".
G.	Provide fire-resistive joint sealants sufficiently flexible to accommodate movement such as thermal expansion and other normal building movement without damage to the seal.
H.	Provide fire-resistive joint sealants designed to accommodate a specific range of movement and tested for this purpose in accordance with a cyclic movement test criteria as outlined in Standards, ASTM E-1399, ASTM E-1966 or ANSI/ UL 2079.
I.	Provide through-penetration firestop systems and fire-resistive joint systems subjected to an air leakage test conducted in accordance with the Standards, ANSI/ UL1479 for penetration and ANSI/UL2079 for joint systems, with published L-Ratings for ambient and elevated temperatures as evidence of the ability of the firestop system to restrict the movement of smoke.
J.	Provide T-Rating Collar Devices tested in accordance with ASTM E-814 or ANSI/UL1479 for metallic pipe penetrations requiring T-Ratings per the applicable building code.

MATERIALS

- A. Use only firestop products that have been UL 1479, ASTM E 814 or UL 2079, ASTM E 1966 tested for specific fire-rated construction conditions conforming to construction assembly type, penetrating item type, annular space requirements, and fire-rating involved for each separate instance.
- B. Pre-installed firestop devices for use with noncombustible and/or combustible pipes (closed and open systems), conduit, and/or cable bundles penetrating concrete floors, the following products are acceptable:
 - 1. STI Cast-In Place Devices
 - a. CD200, CD300, CD400, CD600 Cast-In Place for combustible OR non-combustible penetrants, or CD200M, CD300M, CD400M, CD600M Cast-In Place for non-combustible penetrants
 - b. Add metal deck adapter kit/s CD200DK, CD300DK, CD400DK, CD600DK

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- on any corrugated metal deck to bridge flutes
 - c. Add height adapter CD200X, CD300X, CD400X, CD600X for concrete slabs which exceed 8" overall thickness
 - d. Add tub box kit CD200T for use with tub installations
 - 2. Hilti CP 680P or CP 680M Cast-In Place Firestop Devices:
 - a. Add Aerator adapter when used in conjunction with an Aerator (Sovent system)
 - b. Add metal deck adapter kit if utilizing CP 680P or M on corrugated metal deck.
 - c. Add height extension if utilizing CP 680P or M in concrete slabs thicker than 8".
 - d. Add Hilti Water Module (2" up to 6") to achieve UL W-Rating
 - e. Add Hilti TOP SEAL (1/2" up to 2") to achieve UL W-Rating
 - 3. Hilti CP 681 Tub Box Kit for use with bath tub installations.
 - 4. Hilti Toilet Flange for use with floor outlet water closets.
 - 5. Hilti coupling sleeve for use with floor, shower or general purposes drains
- C. Fire rated cable pathway devices shall be used for ALL low-voltage, video, data and voice cabling, optical fiber raceways and certain high-voltage cabling where frequent cable moves, adds and changes may occur. Pathways required for high voltage cabling will be detailed on the prints. Such devices shall:
 - 1. Meet the hourly fire-rating of fire rated wall and or floor penetrated.
 - 2. Be tested for the surrounding construction and cable types involved.
 - 3. Have UL Systems permitting cable loads from; *"Zero to 100% Visual Fill."* This requirement eliminates need for fill-ratio calculations to be made by cable technicians to ensure cable load is within maximum allowed by UL System.
 - 4. Not have inner fabric liner that tightens around and compresses cables tightly together encouraging alien cross-talk interference.
 - 5. Be "Zero-Maintenance", zero-maintenance is defined as; No action required by cabling technician to open and/or close pathway for cable moves, adds or changes, such as, but not limited to:
 - a. Opening or closing of doors.
 - b. Spinning rings to open or close fabric liner.

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- c. Removal and or replacement of any material such as, but not limited to, firestop caulk, putty, pillows, bags, foam muffins, foam, foam plugs, foam blocks, or foam closures of any sort.
 - d. Furnish letter from manufacturer certifying compliance with this definition of "Zero-Maintenance".
 - 6. Pathways shall be engineered such that two or more devices may be ganged together for larger cable capacities.
 - 7. Pathways shall be engineered to be re-enterable so they can be retrofitted and removed from around existing cables without cutting and re-splicing them.
 - 8. Cable Pathway Devices passing vertically through floors shall have equal F & T Rating. (See UL System # F-A-3037, Item #4 "EZ-PATH Grid T-Rating Kit" Part # TRK444)
 - 9. Affix adhesive wall label immediately adjacent to devices to communicate to future cable technicians, authorities having jurisdiction and others the manufacturer of the device and the corresponding UL System number installed.
- D. As an alternate to using a fire-rated cable pathway device for single low voltage cables (up to 0.27 in. (7 mm) O.D) penetrating one or two-hour, gypsum board/stud wall assemblies, either as a through-penetration or as a membrane-penetration, a fire-rated cable grommet may be substituted. The firestop shall consist of a molded, two-piece, plenum-rated grommet having a foam fire and smoke sealing membrane that conforms to the outside diameter of the individual cable. The grommet product shall be capable of locking into place to secure the cable penetration within the wall assembly. The grommet shall be UL Classified and tested to the requirements of ASTM E814 (UL1479) and CAN/ULC S115.
- E. Sealants, caulking materials, or foams for use with non-combustible items including steel pipe, copper pipe, rigid steel conduit and electrical metallic tubing (EMT), the following products are acceptable:
 - 1. STI Triple S Intumescent Firestop Sealant
 - 2. STI LCI Intumescent Firestop Sealant
 - 3. STI LC Endothermic Firestop Sealant
 - 4. STI AS Elastomeric Firestop Spray
 - 5. STI PEN or PENSL Silicone Firestop Sealant
 - 6. Hilti FS-ONE Intumescent Firestop Sealant

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7. Hilti CP 604 Self-leveling Firestop Sealant
8. Hilti CP 620 Fire Foam
9. Hilti CP 606 Flexible Firestop Sealant
10. Hilti CP 601S Elastomeric Firestop Sealant

F. Sealants or caulking materials for use with sheet metal ducts, the following products are acceptable:

1. STI Triple S Intumescent Firestop Sealant
2. STI LCI Intumescent Firestop Sealant
3. STI LC Endothermic Firestop Sealant
4. STI AS Elastomeric Firestop Spray
5. STI PEN or PENSL Silicone Firestop Sealant
6. Hilti CP 601S Elastomeric Firestop Sealant
7. Hilti CP 606 Flexible Firestop Sealant
8. Hilti FS-ONE Intumescent Firestop Sealant

G. Sealants, caulking or spray materials for use with fire-rated construction joints and other gaps, the following products are acceptable:

1. STI AS Elastomeric Firestop Spray
2. STI Fast Tack Firestop Spray
3. STI ES Elastomeric Firestop Sealant
4. STI LC Endothermic Firestop Sealant
5. STI Speed Flex Joint Solution System
6. STI PEN or PENSL Silicone Firestop Sealant
7. Hilti CP 672 Speed Spray
8. Hilti CP 672 FC "FAST CURE" Speed Spray
9. Hilti CP 601 S Elastomeric Firestop Sealant
10. Hilti CP 606 Flexible Firestop Sealant
11. Hilti CP 604 Self-leveling Firestop Sealant

H. Pre-formed mineral wool designed to fit flutes of metal profile deck and gap between top of wall and metal profile deck; as a backer for spray material.

1. Hilti CP 777 Speed Plugs
2. Hilti CP 767 Speed Strips
3. Any manufacturer who can provide a 4PCF or greater mineral wool such as Thermafiber, Roxul etc. tested to all applicable standards

I. Intumescent sealants, caulking materials for use with combustible items (penetrants consumed by high heat and flame) including insulated metal pipe, PVC jacketed, flexible cable or cable bundles and plastic pipe, the following

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products are acceptable:

1. STI Triple S Intumescent Firestop Sealant
2. STI LCI Intumescent Firestop Sealant
3. Hilti FS-ONE Intumescent Firestop Sealant

J. Foams, intumescent sealants, or caulking materials for use with flexible cable or cable bundles, the following products are acceptable:

1. STI Triple S Intumescent Firestop Sealant
2. STI LCI Intumescent Firestop Sealant
3. STI SSP Intumescent Firestop Putty
4. STI CS105 Cable Spray
5. STI FS Ready Sleeve or FSR Split Sleeve Pathway Devices
6. Hilti FS-ONE Intumescent Firestop Sealant
7. Hilti CP 620 Fire Foam
8. Hilti CP 601S Elastomeric Firestop Sealant
9. Hilti CP 606 Flexible Firestop Sealant

K. Non-curing, re-penetrable intumescent putty or foam materials for use with flexible cable or cable bundles, the following products are acceptable:

1. STI SSP Intumescent Firestop Putty
2. STI FP200, FP400 Intumescent Firestop Plug
3. STI SSB Intumescent Firestop Pillows
4. STI FS Ready Sleeve or FSR Split Sleeve Pathway Devices
5. Hilti CP 618 Firestop Putty Stick
6. Hilti CP 658T Firestop Plug

L. Wall opening protective materials for use with U.L. listed metallic and specified nonmetallic outlet boxes, the following products are acceptable:

1. STI SSP4S or SSP9S Intumescent Putty Pad
2. STI EP44 or EP45 Intumescent Box Insert
3. Hilti CP 617 Firestop Putty Pad
4. Hilti Firestop Box Insert
5. Hilti FS 657 FIRE BLOCK

M. Firestop collar or wrap devices attached to assembly around combustible plastic pipe (closed and open piping systems), the following products are acceptable:

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1. STI LCC Intumescent Firestop Collars
2. STI RTC Intumescent Range Taking Collars
3. STI SSWRED or SSWBLU Intumescent Wrap Strips
4. Hilti CP 643 N Firestop Collar
5. Hilti CP 644 Firestop Collar
6. Hilti CP 648E Endless Wrap Strips
7. Hilti CP 648S Single Wrap Strips

N. Materials used for large openings and complex penetrations made to accommodate cable trays and bundles, multiple steel and copper pipes, electrical busways in raceways, the following products are acceptable:

1. STI SSM Firestop Mortar
2. STI SSB Intumescent Firestop Pillows
3. STI CS Intumescent Composite Sheet
4. STI Triple S Intumescent Firestop Sealant
5. STI LCI Intumescent Firestop Sealant
6. Hilti CP 637 Firestop Mortar
7. Hilti FS 657 FIRE BLOCK
8. Hilti CP 620 Fire Foam
9. Hilti CP 675T Firestop Board

O. Non-curing, re-penetrable materials used for large size/complex penetrations made to accommodate cable trays and bundles, multiple steel and copper pipes, electrical busways in raceways, the following products are acceptable:

1. STI SSB Intumescent Firestop Pillows
2. STI CS Intumescent Composite Sheet
3. Hilti FS 657 FIRE BLOCK
4. Hilti CP 675T Firestop Board

P. Sealants or caulking materials used for openings between structurally separate sections of wall and floors, the following products are acceptable:

1. STI AS Elastomeric Firestop Spray
2. STI ES Elastomeric Firestop Sealant.
3. STI LC Endothermic Firestop Sealant
4. STI Fast Tack Silicone Firestop Spray
5. STI PEN or PENSL Silicone Firestop Sealant
6. Hilti CP 672 Speed Spray
7. Hilti CP 601S Elastomeric Firestop Sealant
8. Hilti CP 606 Flexible Firestop Sealant

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9. Hilti CP 604 Self-Leveling Firestop Sealant

Q. For blank openings made in fire-rated wall or floor assemblies, where future penetration of pipes, conduits, or cables is expected, the following products are acceptable:

1. STI SSP Intumescent Firestop Putty
2. STI FS Ready Sleeve or FSR Split Sleeve Pathway Device
3. STI FP Intumescent Firestop Plug
4. STI SSB Intumescent Firestop Pillow
5. Hilti FS 657 FIRE BLOCK
6. Hilti CP 658T Firestop Plug

R. Provide a firestop system with a "F" Rating as determined by UL 1479 or ASTM E814 which is equal to the time rating of construction being penetrated.

S. Provide a firestop system with an Assembly Rating as determined by UL 2079 or ASTM E 1966 which is equal to the time rating of construction joint assembly.

T. Provide a firestop system with a "T" Rating where applicable as determined by UL 1479 or ASTM E814 which is equal to the "F" Rating of construction being penetrated. Please note "T" Ratings are not required in walls or when a penetration through the floor exists within a wall cavity.

PART 3 – EXECUTION

PREPARATION

A. Verification of Conditions: Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion.

1. Verify penetrations are properly sized and in suitable condition for application of materials.
2. Surfaces to which firestop materials will be applied shall be free of dirt, grease, oil, rust, laitance, release agents, water repellents, and any other substances that may affect proper adhesion.

B. Provide masking and temporary covering to prevent soiling of adjacent surfaces by firestopping materials.

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- C. Comply with manufacturer's recommendations for temperature and humidity conditions before, during and after installation of firestopping.
- D. Do not proceed until unsatisfactory conditions have been corrected.

COORDINATION

- A. Coordinate construction of openings, penetrations and construction joints to ensure that the fire stop systems are installed according to specified requirements.
- B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate through-penetration fire stop systems. Coordinate construction and sizing of joints to ensure that fire-resistive joint systems are installed according to specified requirements.
- C. Coordinate fire stopping with other trades so that obstructions are not placed in the way prior to the installation of the fire stop systems.
- D. Do not cover up through-penetration fire stop and joint system installations that will become concealed behind other construction until each installation has been examined by the building inspector, per requirements of Section 109, IBC 2000.

INSTALLATION

- A. Regulatory Requirements: Install firestop materials in accordance with UL Fire Resistance Directory or Omega Point Laboratories Directory.
- B. Manufacturer's Instructions: Comply with manufacturer's instructions for installation of through penetration and construction joint materials.
 - 1. Seal all holes or voids made by penetrations to ensure an air and water resistant seal.
 - 2. Consult with mechanical engineer, project manager, and damper manufacturer prior to installation of UL firestop systems that might hamper the performance of fire dampers as it pertains to duct work.
 - 3. Protect materials from damage on surfaces subjected to traffic.

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FIELD QUALITY CONTROL

- A. Examine sealed penetration areas to ensure proper installation before concealing or enclosing areas.
- B. Keep areas of work accessible until inspection by applicable code authorities.
- C. Inspection of through-penetration firestopping shall be performed in accordance with ASTM E 2174, "Standard Practice for On-Site Inspection of Installed Fire Stops" or other recognized standard.
- D. Perform under this section patching and repairing of firestopping caused by cutting or penetrating of existing firestop systems already installed by other trades.
- E. Manufacturer's Field Services: During Installation, provide periodic destructive testing inspections to assure proper installation/application. After installation is complete, submit findings in writing indicating whether or not the installation of the tested system identified was installed correctly.

IDENTIFICATION & DOCUMENTATION

- A. The firestop contractor is to supply documentation for each single application addressed. This documentation is to identify each penetration and joint location on the entire project.
- B. Copies of these documents are to be provided to the general contractor at the completion of the project.
- C. Identify through-penetration firestop systems with self-adhesive, preprinted labels. Attach labels permanently to surfaces of penetrated construction on both sides of each firestop system installation where labels will be visible to anyone seeking to remove penetrating items or firestop systems. Include the following information on labels:
 - 1. Installer/Contractor's Name, address, and phone number.
 - 2. Through-Penetration firestop system designation of applicable testing and inspecting agency.
 - 3. Date of Installation.
 - 4. Through-Penetration firestop system manufacturer's name.
- D. Fire Stop systems must not be concealed from view before being inspected and approved.

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- E. Walk through visual inspections should be made during the firestop installation.
- F. When necessary or required, destructive evaluation will be made on various types of firestop systems.
- G. Construction documents detailing the firestop locations and systems must be kept on site to assist in the conduct of the inspection.
- H. Certificate of installation shall be provided from the installing Contractor.

ADJUSTING AND CLEANING

- A. Remove equipment, materials and debris, leaving area in undamaged, clean condition.
- B. Clean all surfaces adjacent to sealed holes and joints to be free of excess firestop materials and soiling as work progresses.

LABOR USE TO INSTALL FIRESTOP SYSTEMS

- A. To ensure complete harmony on the project site, the installation of each scope of work is to be performed jurisdictionally correct per existing trade agreements.

07 84 13

Penetration Firestopping

Part 1 – General

Describe in this Section all requirements for firestopping wall penetrations, floor penetrations, ceiling penetrations, and joints. Do not rely on general references in the sealants section. This includes boards, blankets, modules, pillows, tapes, caulks, foams, intumescent, and other similar materials.

Specifically describe on the drawings all requirements for installation of firestopping. Generic notes such as "firestopping as required" are not acceptable. Reliance on the Contractor understanding the building code and "complying at no additional cost" is similarly not acceptable.

This is a section where the Consultant should use a "performance specification". Do not specify proprietary manufacturer's names or materials, and do not restrict vendors to a limited list.

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Require that materials manufacturer(s) and installer(s) demonstrate 5 years of successful installations of similar materials.
Require submittal of complete manufacturer's literature, including UL test results for each material-and application system required for the project.
It is desirable to have all trades use the same product.

Part 2 – Products

Specify each type of firestopping material required in the project.
Product shall be trowallable and paintable.

Part 3 – Execution

Provide a schedule identifying location and type of firestopping. Require installation of sleeves at all wall, floor, and ceiling penetrations.

Specifically require firestopping materials to be installed in accordance with the manufacturer's recommendations.

Specifically require that all firestopping be observed as complete prior to being covered by other work.

07 86 00

Smoke Seals

Part 1 – General

To be completed

Part 2 – Products

To be completed

Part 3 – Execution

To be completed

07 87 00

Smoke Containment Barriers

Part 1 – General

Smoke containment barriers such as automated fire curtains are highly discouraged on Campus due to lack of reliability, frequent operating issues and higher maintenance requirements encountered on previous projects.

DP shall incorporate smoke containment barriers in the design in such ways that minimize the use of any moveable barriers.

The preferred smoke containment barriers would be a solid wall (gypsum board on

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metal studs or masonry) with doors kept open using magnetic door holders tied to the fire alarm system.

Part 2 – Products

To be completed

Part 3 – Execution

To be completed

****END OF SECTION****

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07 90 00

JOINT PROTECTION

Part 1 – General
To be completed

Part 2 – Products
To be completed

Part 3 – Execution
To be completed

07 92 00

Sealants and Caulking

Part 1 – General

Due to the Freeze/Thaw cycles in Northern Arizona, DP is highly encouraged to minimize the use of caulk joints in design.

Sealants and Caulking shall not be more than 3/4" in width.

Describe all requirements for installation of sealants required to prohibit the penetration of moisture and dust, and required to seal joints between dissimilar materials, in this Section.

Specify certain specialized sealants which are ordinarily part of a "complete in place" installation by a particular trade (e.g. glazing sealants and painting) in the appropriate sections.

Reliance on caulking which might (or might not) be provided by a painter as part of that finish operation, as the moisture- or dust-seal, is unacceptable.

Pay particular attention in sealant system design to expected joint movement, joint dimensions, sealant position (horizontal, vertical, or overhanging), and potential for physical abuse of the sealed joint.

Specifically describe and detail on the drawings all joints requiring installation of sealants. Generic notes such as "sealant as required" are not acceptable.

This is a section where the Consultant should use a "performance specification". Do not specify proprietary manufacturer's names or materials, and do not restrict vendors to a limited list.

Require that all materials manufacturer(s) and installer(s) demonstrate 5 years of successful installations of similar materials.

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Require submittal of the following:

- Manufacturer's literature documenting compliance with specification requirements
- Actual sealant samples for color selection
- Sample joints, where unique conditions require

Maximum allowable exterior joint width, for caulking/sealant, shall not exceed 1".

Part 2 – Products

Specify each particular type of sealant and sealant system required, including:

- Primers
- Backers
- Fillers
- Colors

Expressly prohibit the use of latex and butyl sealants.

Specify only non-staining materials.

Part 3 – Execution

Provide a sealant schedule identifying location and type of sealant.

Specifically require sealants to be installed in accordance with the manufacturer's recommendations.

Specifically require all joints to be observed by the Owner prior to installation of sealants.

07 95 00 Expansion Control

Part 1 – General

To be completed

Part 2 – Products

To be completed

Part 3 – Execution

To be completed

****END OF SECTION****