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NATIONAL IRANIAN OIL REFINING & DISTRIBUTION COMPANY
NATIONAL IRANIAN OIL ENGINEERING
& CONSTRUCTION COMPANY

NIOEC SP

SPECIFICATION

FOR

**WORK TO BE DONE AND MATERIALS TO BE USED IN MASONRY
BUILDINGS**

FIRST EDITION

JULY 2005

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IN THE NAME OF GOD**FOREWORD**

By their very nature, technical standard specifications are continuously subject to modifications and revisions. To strengthen their merit and usefulness, continuous improvements, addendum, deletion of disparate information and consequently provision of updated revisions are to be made in order to ascertain that such standard specifications meet the current requirements, inclusive of Iranian Petroleum Standards (IPS) and the recognized and acceptable national and international standards, as well as the optimal codes and practices based on the accumulated in-house know-how and plant knowledge and experiences.

However, in reality, due to several reasons, not to mention the complexity of the matter, the ultimate goal of continuous direct embedment of the required changes on the relevant standard specifications may be far reaching. Therefore, in the interim periods between the officially issued revisions, the required changes will appear in other documents related to the engineering and design work of the on going projects.

In response to the initiative of the Design Division of the Engineering and Construction Directorate, and considering that the task of the execution of several important and mega projects for the realization of the new oil refineries, pipelines and oil terminals as well as improvements of the existing facilities, has been assigned to NIOEC, it was decided to update the NIOEC Specifications and to issue new official revisions.

The Design Division of the Engineering and Construction Directorate was itself entrusted to carry out this important task, and as such by forming several special technical committees, working in close co-operation and cohesion and sharing their expertise and knowledge, the updated and revised NIOEC Specifications were successfully prepared and complied.

These Specifications are intended to be used for Oil Refineries, Distribution Depots, Oil Terminals, Pipelines and Pump Stations within NIOEC's projects, and have been proven to be of high value for such purposes. It must however be appreciated that these Specifications represent the minimum requirements and should in no way be interpreted as a restriction on the use of better procedures, engineering and design practices or materials.

We encourage and highly appreciate the users and other clear sighted and experts to send their comments on the Specifications to the Design Deputy of the Engineering and Construction Director of NIOEC for evaluation and consideration.

S. R. KASAEIZADEH



EXECUTIVE DIRECTOR

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NOTES:

- 1) THIS SHEET IS A RECORD OF ALL REVISIONS TO THIS SPECIFICATION.
- 2) REMARKS RELATED TO EACH REVISION SHOW A BRIEF DESCRIPTION. THESE REMARKS SHALL BE INTERPRETED IN CONJUNCTION WITH THE REVISED TEXT MARKED BY REVISION NUMBERS.
- 3) WHEN APPROVED EACH REVISION SHALL BE CONSIDERED AS A PART OF THE ORIGINAL DOCUMENT.
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1. SCOPE

NIOEC specifications cover the general requirement for detailed engineering, procurements, testing inspection & construction of refinery/oil plant, distribution depots, pump stations and pipelines.

The intent of this specification is to include all labor, material, equipment, temporary utilities and transportation necessary for the proper execution and completion of the work for masonry buildings. The electrical work is not included herein.

This specification Contain references to some materials and products of Japanes and European Manufacture but other may be substituted upon approval of the Employer's. The substituted materials shall be of equivalent quality and characteristics to the materials described in the following sections of the specification and shall be approved by the Employer's .

All materials used in the construction of the buildings shall be new and the best of their respective kind.

Guarantee, binds and certificates required by this specification shall be submitted to the Employer.

2. REFERENCES

Throughout this specification the following dated and undated standards/codes are referred to these referenced documents shall, to the extent specified here in, form a port of this specification. For undated references, the latest edition of the referenced document (including any supplements and amendments) applies. For dated references, the edition cited applies. The applicability of changes in dated references that occur after the cited date , shall mutually be agreed upon by NIOEC and the Vender / Contractor.

NIOEC –SP (NIOEC SPECIFICATIONS)

NIOEC-SP-00-10	“ NIOEC specification for units ”
NIOEC-SP-00-05	“ NIOEC specification for Excavation and Backfill for concrete ”
NIOEC-SP-10-01	“ NIOEC specification for concrete ”
NIOEC-SP-10-02	“ NIOEC specification for High temperature protection for concrete ”
NIOEC-SP-10-03	“ NIOEC specification for low temperature protection for concrete”
NIOEC-SP-20-01	“ NIOEC specification for structural steel Erection ”
NIOEC-SP-20-02	“ NIOEC specification for Heating, ventilation, Air Conditioning and pressurizing”
NIOEC-SP-30-05	“ NIOEC specification for plumbing piping ”
NIOEC-SP-00-01	“ NIOEC specification for civil Design Criteria ”
NIOEC-SP-30-03	“ NIOEC specification for HVAC Design ”
NIOEC-SP-30-06	“ NIOEC specification for HVAC Erection ”
NIOEC-SP-30-05	“ NIOEC specification for Plumbing design and installation ”
NIOEC-SP-00-05	“ NIOEC specification for Excavation & Back filling ”

ASTM (AMERI CAN INSTITUTE OF STEEL CONSTRUCTION)

ASTM C129	“ Concrete Masonry ”
ASTM C150	“ Portland Cement ”
ASTM C 90	“ Bearing Concrete Masonry ”
ASTM C 331	“ Light Weight aggregate”
ASTM C 207	“ Hydrated Lime ”
ASTM C 144	“ Sand ”
ASTM C 161	“ Mortar and grout ”
ASTM D 312	“ Roofing & Asphalt ”
ASTM C1240-98	“ Flat silica Fume ”
ASTM C 36	“ Gypsum wallboard ”
ASTM C 93	“ Carbon Steel of Uniform quality ”
ASTM C 220	“ Product Unlaminated ”
ASTM C 221	“ Product Unlaminated monolithic sheets”

UBC (UNIFORM BUILDING CODE)

UBC-1997 edition

3. UNITS

International system of units (SI) shall be used in accordance with [NIOEC SP-00-10](#), unless otherwise specified.

SECTION A**BRICK MASONRY AND BRICK VENEER****1. SCOPE**

1.1 This specification includes:

1.1.1 Reinforcing, grout and mortar.

1.1.2 Install anchors, bolts, pipe sleeves, etc., for attaching other materials.

1.1.3 Instruct the concrete foreman as to the required positioning of dowels.

1.1.4 Submit samples of brick to the Employer for approval.

2. MATERIALS**2.1 Facing Brick**

2.1.1 Standard commercial Iranian manufactured brick. The maximum absorption shall be 16% by 24 hours submersion in cold water or 19% by 5 hour boiling, and the minimum compressive strength shall be 2500 psi, tested according to the ASTM C67.

2.1.2 Sizes shall be as locally manufactured and used in commercial building construction and as approved by the Employer's Representative.

2.1.3 Brick sizes shall be such that the thickness of grout or mortar between masonry units and reinforcement will not be less than 6mm (1/4 inch)

2.1.4 Surface texture and color shall be approved by the Employer.

2.1.5 Surface texture and color shall match the brick that has been used on any other newly constructed buildings on the site.

2.2 Common Brick

Same as facing brick except that the minimum compressive strength shall be 2000 psi and that the contractor is permitted to use different color than the facing brick.

2.2.1 Hollow Load-Bearing Concrete Masonry Units - ASTM Specification C90, Grade N-I, latest edition, using lightweight aggregate conforming to ASTM Specification C331, latest edition and graded so that not more than 25% passes through 8 sieve and 80-90% passes through a 3.8 in. sieve, or using normal aggregate conforming to ASTM C33 latest edition and graded as above.

2.2.2 Hollow Non-Load-Bearing Concrete Masonry Units-ASTM Specification C129 Type I, latest edition. Color - gray.

Aggregate may be both normal aggregate or lightweight aggregate conforming to ASTM standards as per point 2.2.1.

Cement – Type I Portland Cement conforming to ASTM Specification C – 150, latest edition.

2.3 Lime and Lime Putty

2.3.1 Lime for all mortar and “shefteh” shall be superior quality, freshly burnt quick lime. Live lime shall be stored in a dry place and protected from dampness. No lime shall be used within twenty four (24) hours of slaking

2.3.2 Lime Putty used for mortar shall be washed and shall be protected against drying in the lime pool.

2.4 Hydrated Lime – ASTM Specification C – 207, latest edition, Type S.

2.5 Sand – ASTM Specification C – 144, latest edition, except that not less than 5% shall pass the #100 sieve.

2.6 Pea Gravel – Graded with not more than 5% passing the #8 sieve and with 95% to 100% passing the 9.6mm (3/8 inch) sieve.

2.7 Water – Taken from a supply distributed for domestic purposes, clean when used.

The use of admixtures for mortar and grout shall not be permitted, except that inert coloring pigments may be used, when shown on the drawings. Material weight shall not exceed 6% by weight of the cement.

2.8 Reinforcing Steel – Refer to Specification SP-10-01 “Concrete”.

2.9 Mortar and Grout – ASTM Specification C – 161, latest edition.

2.9.1 All bricks except facing shall be laid with a shove joint in a full mortar bed and shall be thoroughly slushed up with mortar at every course. Facing brick shall be laid on full mortar beds and shall have all vertical joints completely filled with mortar.

2.9.2 Mortar shall consist of a mixture of sand and cement with the following proportions:

1 Part by volume of cement	50 Kilograms
3 Part by volume of sand	0.105 cu. M.

2.9.3 Ingredients for mortar shall be mixed in approved gauge boxes to give a consistent mix of correct proportions. The ingredients shall be turned over twice dry and twice while water is added through a hose. Only sufficient water shall be added to give a good workable mortar, as approved by the Employer’s Representative. Alternatively, mixing may be by means of an approved mechanical batch mixer.

2.9.4 All mortar shall be used within one hour of mixing. No mortar which has commenced to set shall be “knocked up” and used again.

2.9.5 Grout shall consist of mortar into which sufficient additional water has been incorporated to cause the mixture to flow readily.

2.9.6 Hydrated lime or lime putty may be added to the mortar or grout (before thinning) shall be not less than 11.27 N/mm² at 7 days, and 17.5N/mm² at 28 days.

3. GENERAL

The Contractor shall provide all the labor, material, transportation, and equipment required to completely furnish and install all brick work shown on the drawing as specified herein.

4. MASONRY CONSTRUCTION

4.1 Workmanship

4.1.1 All work shall be executed in the best workmanlike manner and in full compliance with the Uniform Building Code, Latest edition.

4.1.2 All masonry walls shall be laid true, level and plumb in accordance with the drawings. All units shall be free of chipped corners and edges.

Brickwork shall not use more than 30 cm of standard brick for four courses and no portion of the walling shall rise more than 90 cm above other portion during construction.

4.1.3 Brick shall be cut accurately to fit all plumbing sleeves, openings, electrical work, etc., and all voids shall be slushed fully.

4.1.4 Required pipe sleeves shall be set and securely anchored by the mason, with sleeve ends flush with the wall.

4.1.5 No bricklaying (or mortar mixing) shall take place when temperature is 3°C on a falling temperature unless special precautions are taken.

4.2 Wetting.

- The amount of wetting will depend on the rate of absorption of the brick at time of laying. When being laid, brick shall have suction sufficient to hold the mortar and to delete the excess water from the grout, and shall be sufficiently damp so that the mortar will remain plastic enough to permit the brick to be leveled and plumbed after being laid, without breaking the mortar bond.

4.3 Bonding

4.3.1 Where no bond pattern is shown, the wall shall be laid up in straight uniform course with common bond.

4.3.2 Intersecting walls and partitions shall be fully bonded with steelties in every fourth course. Around window and door framers, masonry shall be kept back a sufficient distance to permit a caulked joint.

4.3.3 Where stacked bond is indicated on the drawings, the centerline of vertical joints shall be plumb, with 1/8 inch maximum variation in the width of vertical joints. Approved metal ties shall be used, with each tie supporting not more than two square feet of wall area and spaced not more than 24 inches on center horizontally.

4.3.4 For bonding of brick to the foundation the top surface of the concrete foundation shall be thoroughly cleaned with laitance removed and aggregate exposed before masonry construction is started.

4.4 Joints

4.4.1 Mortar joints shall be straight, clean and with 9.5mm² (3/8") uniform thickness.

4.4.2 Exposed unpainted walls shall have joints tooled with a round bar to produce a dense, slightly concave surface well bonded to brick at the edges.

4.4.3 Tooling shall be done when the mortar is partially set but still sufficiently plastic to bond. All tooling shall be done with a tool which compacts the mortar, pressing the excess mortar out of the joint rather than dragging it out.

4.4.4 Where walls are to receive plaster, the joints shall be struck flush, and left rough to provide bond.

4.4.5 Where certain joints are to be concealed under paint, these joints shall be filled flush and given a sacked joint effect by using a hard rubber ball or a rubber heel which produces a slightly concave joints, leaving a sanded surface without smearing the brick.

Sack rubbing or wiping finished masonry with rags will not be permitted.

4.4.6 The mortar of brick veneer joints shall be raked and left rough for cement pointing. Pointing mortar shall be struck flush, and be tooled to a hard smooth finish.

4.4.7 Units shall be full-bedded in flat un urrowed bed or mortar and shoved into place, with head joints completely filled. If resetting of a unit becomes necessary, for alignment, the joint shall be cleaned thoroughly and new mortar used.

4.5 Reinforcing

4.5.1 Reinforcing steel shall be lapped do to SP-10-01 clause 6.9

4.5.2 Vertical bars shall be held in position at top and bottom and at intermediate intervals as per SP-10-01.

4.5.3 Brick veneer ties shall be installed as shown on the drawings.

4.6 Grouting

4.6.1 Reinforcing steel shall be in place and inspected before grouting is begun.

4.6.2 All debris and projecting mortar shall be cleaned out before pouring grout.

4.6.3 Grouting of beams over openings shall be done in a continous operation.

4.6.4 All bolts, anchors, etc., inserted in the wall shall be solidly grouted in place.

4.6.5 All grout spaces shall be filled with grout and immediately puddled or swished sufficiently to cause the grout to flow into all voids, and to fully encase the reinforcing steel.

4.7 Wall Care

34.7.1 Where masonry walls are to be left bare or painted, extreme care shall be taken to prevent mortar splashes.

4.7.2 All forms shall be made tight (special attention is necessary for bottom forms of beams) and grout spilled on walls shall be washed off before it can set up.

4.7.3 After the wall is constructed it shall not be saturated with water for curing or any other purposes.

4.7.4 In hot weather and when the atmosphere is dry, the wall shall have its surface dampened with a light fog spray during a mortar curing period of three days.

4.7.5 The masonry work shall be protected against rain, frost, or freezing during construction.

4.7.6 All exposed brick surfaces shall be left completely clean of all foreign substances or stain upon completion of the work.

4.8 Flashing

The contractor shall set and built all window and door frames, lintels, anchors, tie rods etc., chases, openings and reveals in masonry to receive frames, pipes, sleeves, conduit, wiring etc., as shown on the drawing.

4.9 Embedding Frames

Metal door frames shall be bedded solid in cement mortar, with the lugs properly built in to brick work or partitions as the work proceeds. Metal window frames shall be bedded on cement mortar and pointed externally with approved non-hardening mastic compound.

4.10 Block out

The contractor shall provide all block outs, required ties etc., in all wall lintels, sills, steps etc., for door and window frames, hand rails etc., block out shall be packed with a rich mortar mix.

4.11 Waterproofing

Waterproofing when called for on the drawings, shall be applied on well cleaned and brushed surface. Upon the cleaned and brushed surface a two (2) millimeter thick coat of hot 85/25 bitumen shall be brushed on. On this mopping while still hot, one (1) layer of superior quality new gunny fabric or burlap, with ten (10) centimeters lapse on each direction shall be placed. A second coat of hot bitumen shall then be mopped on the gunny fabric as specified for the first coat. A second layer of the same quality of gunny fabric shall then be applied while the bitumen is still hot with main laps running in opposite directions. A third mopping of hot bitumen shall then be mopped on the second layer of gunny. Any pipes, drains, or other interruptions passing through waterproofing shall be properly sealed, and all water proofing shall be turned up or down on walls or other surfaces.

Where specified or shown on the drawings the contractor shall install waterproofing with three (3) layers of gunny fabric.

Passing through waterproofing shall be properly sealed, and all water proofing shall be turned up or down on walls or other surfaces. Where specified or shown on the drawings the contractor shall install waterproofing with three (3) layers of gunny fabric.

4.12 Cleaning

At the conclusion of the masonry work, all masonry shall be cleaned, all stains removed with acid, and the acid washed off with water.

5. TYPES of MASONRY WALLS

5.1 Brick masonry faced both sides.

This masonry shall be composed of two (2) header exposed masonry made of facing bricks minimum total thickness 27cm. The space in between will be filled with grout. Facing bricks shall be standard, commercial Iranian manufactured facing bricks as per clause 2.1 of this Specification. Reinforcement of masonry and connection to structural elements shall conform to the UBC-1997 edition for non-load bearing masonry. This type of masonry will be used in external walls of steel framed bldgs, and/or as shown on approved drawings.

5.2 Brick masonry faced one side.

This masonry shall be composed of one (1) header exposed brick masonry made of facing bricks on the external side, plus a 20 cm. thk hollow concrete block, masonry on the internal side. Total thickness of the perimetral wall shall be 35 cm, being the cavity between the inside block wall and outside brick wall filled with grout. Hollow concrete masonry units. 20×20×40 cm., shall conform to ASTM C129, type I (non-load bearing, normal weight units). Reinforcement of masonry and connection to structural elements shall conform to UBC-1997 edition for non-load-bearing masonry.

This type will be used for standard buildings with reinforced concrete frame.

5.3 Hollow concrete masonry (load-bearing, normal weight units).

Perimetral walls shall be made of hollow load-bearing concrete units 20×20×40 cm. Thickness of the wall shall be 20 cm. Properly spaced vertical stiffening will be obtained by filling with grout the block cavity. Material shall conform to ASTM C90-1997 and related standards. Reinforcement, horizontal and vertical, shall be provided in accordance with results of analysis and conforming to the requirement of UBC-1997 edition for load-bearing hollow concrete units masonry. This type will be used for small building with no reinforced concrete frames.

5.4 Hollow concrete masonry (non-load-bearing, normal weight units)

This walls shall be made of hollow non-load-bearing concrete units 20×20×40 cm. (wall thk 20 cm.) or 10×20×40 cm. (wall thk 10 cm.). Material shall conform to ASTM C129, type I. Anchoring and reinforcement shall conform to UBC-1997 edition. This type will be used for interior partitions.

SECTION B**ROOFING****1. SCOPE**

The contractor shall provide all the labor, material, transportation and equipment required to completely furnish and install all the work in connection with roofing as shown on the drawings or as specified herein, to the complete satisfaction of the Employer's Representative.

1.1 Roof and Floor Structures

Roof and Floor structures shall be cast-in place or pre-cast concrete joists with concrete slabs.

1.2 Light Weight Concrete

Light weight concrete for roof covering when called for on the drawing, shall be of "Choecolite" light weight concrete (Foam Concrete) with density of 650 kg. per cubic meter as approved by the Employer's Representative, or approved equal. Light weight concrete shall be built according to roof slopes as shown on the drawings and shall have a minimum thickness of 2 Centimeters.

1.3 Concrete with Light Weight Aggregates

Concrete with light weight aggregates, when called for on drawings, shall be prepared as specified herein and shall be evenly spread to levels shown on the drawings. The weight of the aggregate shall not exceed 900 kg. per cubic meter, and shall consist of an assortment of hard clean sea shells (Gooshmahei, etc.) containing some clean hard natural sand as approved by the Employer's Representative, or a similar approved material.

The aggregate as described above shall be mixed with 100 Kg. of cement per cubic meter of aggregate with sufficient amount of water to form a workable mix, as directed by the Employer's Representative.

The concrete as prepared above shall be placed to line and grades shown on the drawings and shall be allowed to cure in a manner acceptable to the Employer's Representative.

Material and mix proportioning of comparable quality may be used subject to prior approval of the Employer.

1.4 Roof Waterproofing

Waterproofing shall consist of two polyester reinforced bituminous elastomeric membranes, 4 mm minimum thickness, each.

The membranes shall be laid over the primer recommended by the Manufacturer.

Overlapping shall be minimum 8 cm. and shall be hot welded.

Water proofing membranes shall be extended to vertical edge and top of parapet. All sharp angles shall be rounded.

The exposed membrane shall be topped with a built-in slate flakes layer allowing for pedestrian access for inspection and acting as protection from U.V. rays. The membrane shall have the following minimum requirements :

- weight : 4.5 Kg/sq.m.
- cold flexibility : - 25°C

- hot stability : over 100°C
- punching strength : Ps4
(static)
- fatigue strength : over 500 cycles (at -10°C)

Sample shall be submitted to the Employer for approval.

A galvanized and painted steel flashing shall be provided on top of perimetral parapet (and at expansion joints also) min. thk 0.8 mm.

1.5 Cleaning

On completion, all roofs shall be swept clean of dirt and debris and any caves, gutters, and drain leaders shall be cleaned out to the entire satisfaction of the Employer's Representative, the roofs shall be waterproof and watertight.

1.6 Roof drainage and downspout pipes.

1.6.1 Roof drainage: main roof drain shall be "High Velocity" roof drain duracoated cast iron body or heavy PVC complete of aluminum or galvanized steel strainer.

1.6.2 Downspout pipes: shall be made of galvanized and painted steel sheet, 0.8 mm thk. Number and size of downspout pipes shall be in accordance with hydraulic calculations. However, diameter shall not be less than 100 mm.

SECTION C**ROOF INSULATION AND VAPOR BARRIER OVER CONCRETE DECK OR METAL DECK.****1. SCOPE OF WORK****1.1 Roof Insulation and Vapor Barrier**

All roof insulation and vapor barrier in accordance with drawings and this specification, including items listed below.

1.1.1 Asphalt for bedding vapor barrier and insulation.**1.1.2 Cant strips.****2. MATERIALS**

- Materials must be approved by the Employer.

2.1 Insulation

Roof insulation shall be Fiberglas and having a top surface faced with a glass fiber reinforced, asphalt and kraft mopping surface. For size and thickness see drawing.

2.2 Primer

Asphaltic primer, conforming to ASTM Specification D41, latest edition.

2.3 Vapor Barrier

Fiberglass Perma Ply No. 11.

2.4 Asphalt

Roofing asphalt shall conform to ASTM Specification D312, latest edition with a softening point in accordance with roofing manufacturer's recommendation, considering the climatic conditions and roof slope.

2.5 Cant Strips

Cant strips shall be of rigid fiberboard material with 10.0 cm. vertical and horizontal dimensions and a face incline of not more than 45 degrees with the roof surface.

2.6 Roof Tape

Roof tape shall be Fiberglass Roof Tape having 15.0 cm width.

2.7 Mechanical Fastener

- Leksuco clips with tin dieses for attaching insulation to metal deck.

3. APPLICATION

- Treated wood insulation stops of the same thickness as the insulation shall be secured to the roof deck adjoining. all eaves and around all projections through the deck, and as shown on the drawings. Stops must be 15.0 cm wide or minimum 2.5 cm wider than the flanges being nailed to them.
- Surface of deck shall be smooth, clean and dry.

- Primer shall be applied to the surface of the entire deck at the rate of 0.41 liters per square meter. Primer shall be allowed to dry thoroughly before application of roofing. Keep primer several centimeters back from joints of precast panels.
- If the metal deck surface is such that a satisfactory bond cannot be obtained between the deck and the adhesive, coat the deck with concrete primer and allow to dry.
- One layer of Fiberglass Perma Ply vapor barrier lapped 5.0 cm on sides and 15.0 cm on ends shall be applied to a solid mopping of hot steep asphalt applied at a nominal rate of 1.5 Kilograms per square meter. Edges of vapor barrier shall be turned up on, but not cemented to, all vertical surfaces to a height of 15.0 cm and shall overhang all roof edges 15.0 cm.
- In the metal deck vapor barrier shall be strip mopped to the deck in such a manner that the principal direction of the vapor barrier is parallel with the flutes of steel deck. Lap all side joints 10 cm and all end joints 15 cm and seal-with hot asphalt. Sealed side laps shall be located so as to be supported by the steel deck corrugations. A second ply of vapor barrier shall be embedded in a solid mopping of hot asphalt applied at the rate of 1.5 Kilograms per square meter. Edges of vapor barrier shall be turned up on, but not cemented to, all vertical surfaces to a height of 15 cm and shall overhang all roof edges 15 cm.
- Over vapor barrier roof insulation shall be embedded in a solid mopping of hot asphalt applied at a nominal rate of 1.5 Kilograms per square meter.
 - a. In the metal deck over vapor barrier embed insulation in 0.6 -0.7 Kilograms of hot asphalt per square meter of deck in ribbons 15 cm on center with contact surface of deck. Insulation shall be laid in courses parallel to edges and at right angles with flutes of steel deck, with joints continuous in both directions to facilitate the insulation of roof tape.
 - b. End and side joints shall be butted with joints continuous in both directions.
 - c. Edges of insulation boards running parallel to the flutes of steel decks shall bear on the deck and not terminate unsupported over a channel.
 - d. Edges of insulation boards shall be metered at ridges and elsewhere to prevent open joints or irregular surfaces.
- Roof tape shall be centered over all insulation joints and edges, embedded in hot steep asphalt applied at the rate of 0.75 - 1.0 Kilograms per square meter of tape. End laps shall be 10.0 cm. Care is to be taken to assure smooth application of tape and that the tape is in full contact with the asphalt.
- Where more than one layer of insulation is indicated on the drawings, the top surface of the first layer shall be coated with 1.5 Kilograms of hot asphalt per square meter and successive layers of insulation shall be applied so that joints are continuous in both directions, with no joints failing on top of joint below.
- Nail cant strips to wood insulation stops at intersections of vertical walls and roof projections.
- Before application of the roofing, the projecting 15.0 cm of felt at vertical surfaces and at all edges shall be turned over the insulation and mopped solidly with the asphalt. The insulation shall be applied than can be completely covered or applied over with Perma Ply.

- At the end of each day's work all exposed edges of insulation must be sealed off with hot asphalt and a 30.5 cm wide strip Perma Ply No. 11 installed as a water cut off.
- On roof slopes of $\frac{1}{6}$ to $\frac{1}{3}$ treated wood insulation stops 5.0 cm wide and the same thickness as the insulation, shall be installed on the top of the vapor barrier and at right angles to the direction of the roof slope. These insulation stops shall be spaced 122.5 cm apart (face to face) and secured mechanically using drive screws or nails to the concrete deck.
The insulation shall be placed between the stops with the long dimension at right angles to the roof stops. Roof insulation shall then be taped to wood insulation stops.

4. VARIANCES

- Materials of equivalent or better quality and characteristics may be submitted for approval.
- Any modification or amendments to these specifications must have the approval of the Employer.