CONSOLIDATED EDISON COMPANY OF NEW YORK, INC.
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DISTRIBUTION ENGINEERING
DISTRIBUTION EQUIPMENT

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MEMBRANE METHOD OF WATERPROOFING ELECTRICAL DISTRIBUTION STRUCTURES

FILE: CONSTRUCTION STANDARDS MANUAL NO. 3

TARGET AUDIENCE	**REGIONAL CONSTRUCTION**
NESC REFERENCE	**NONE**

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1.0 PURPOSE

This specification covers preparation and application requirements for membrane waterproofing materials that can be used to provide a continuous, watertight protective coating on concrete and masonry structures housing facilities of the electrical distribution system. This specification also prescribes the method of installing such membranes over roof slabs of network protector compartments housing 265/460V equipment.

2.0 APPLICATION

This specification applies to all Con Edison districts.

3.0 GENERAL

Membrane waterproofing material can be applied to newly constructed or existing concrete or masonry structures housing facilities of the electrical distribution system.

For new construction, the membrane waterproofing material shall be applied to both the inside floor and lower wall surfaces and outside floor and walls to ensure complete water tightness. For outside waterproofing work, the contractor shall be responsible for selecting and properly installing the material on suitable substrate by following appropriate application recommendations from the waterproofing material manufacturer. For waterproofing application inside structures, the contractor shall follow the application steps outlined on this specification.

For maintenance waterproofing work on existing structures, the contractor shall prepare the inside surfaces to be waterproofed and apply the material as indicated on this specification.

Membrane waterproofing work is to be done on structures located adjacent to a customer's premises. The membrane waterproofing is intended to prevent fluid (water, vapor, transformer liquid, etc.) penetration between the inside of the structure and the surrounding outside areas. Fluid infiltration through the concrete roof slabs of structures housing moisture-sensitive electrical equipment can also be prevented by the proper application of membrane waterproofing.

4.0 APPROVED MEMBRANE WATERPROOFING PRODUCTS

Purchase and Test Recommendation EO-100,642 lists approved membrane waterproofing products for system use.

5.0 GENERAL REQUIREMENTS

5.1 Material Storage and Handling

The fabrics used for hot-asphalt application shall be stored in a dry, protected place. The rolls shall not be stored on end. Asphaltic compounds shall be kept in air-tight containers plainly marked with the manufacturer's name and product identification. Flexible membrane waterproofing material shall be carefully handled and stored to prevent damage or waste. Cement and aggregates used for the protection mortar shall be properly packaged to avoid deterioration or intrusion of foreign matter. Ensure manufacturer's recommendation on material handling is followed.

5.2 Application Temperature Requirement

In order to assure proper curing and/or bonding of the waterproofing material to the inside or outside substrate surface, the temperature of the substrate and surrounding areas must be between 40 degrees and 90 degrees Fahrenheit. The contractor may provide a source of heat (such as electric heaters) to maintain the required temperature for a period of no less than 3 hours before application of the waterproofing, and 6 hours after its application.

5.3 Surface Preparation

All concrete or masonry surfaces to be membrane waterproofed shall be properly cleaned (by suitable mechanical means) prior to applying the waterproofing material.

The surface to be waterproofed shall be reasonably smooth and free from projections (to prevent puncture of the waterproofing membrane) or holes. Any voids, spalled areas, or other surface defects shall be repaired as per EO-5227 prior to applying the waterproofing material. The surface shall be dry to prevent the formation of steam when the hot asphalt or any other material is applied. Contaminants such as grease, oil, dust, and loose material shall be removed from the exposed concrete or masonry surface immediately prior to application of membrane waterproofing.

5.4 Damage and Patching

Care shall be taken to prevent damage to the finished membrane. Any damage that occurs to the newly applied asphalt-saturated fabric membrane shall be repaired by patching. Patches shall be done with three layers of felt. The first ply layer shall extend at least 12" beyond the edge of the outermost damaged area. The second ply layer shall extend at least 3" beyond the first, and the third ply 3" beyond the second. If any existing waterproofing is disturbed, it shall be replaced with no less than a 12" lap over existing undisturbed sections. The area of the existing waterproofing that is to be lapped shall be cleaned and heated when the new waterproofing is placed. Repairs of flexible membranes must be done as recommended by the membrane manufacturers.

6.0 PREPARATION AND APPLICATION

6.1 Preparation of Waterproofing Material

Preparation, proportioning, and curing, if any, of all material used for membrane waterproofing shall be done as per manufacturer's recommendations.

6.2 Application of Membrane Waterproofing Material

No waterproofing shall be done during inclement weather. No moisture, dew, frost, snow, or ice shall be present on the substrate prior to waterproofing. The surface temperature must be within the limit specified by the waterproofing system manufacturer. To ensure a proper and lasting bond of each waterproofing system to the substrate surfaces, the following instructions shall be adhered to:

6.2.1 Asphalt-Saturated Fabric Membrane

Note that this material shall not be used over the vault's floor. Typical application of asphalt-saturated fabric (a minimum of 3 ply layers of fabric) membrane waterproofing shall be done as per specification EO-6188-C and EO-16563-D. The asphalt shall be heated to a temperature of not less than 300°F and not more than 350°F with frequent stirring to avoid local overheating. After an initial mopping of asphalt has been applied to the substrate, strips of fabric shall be laid, pressing them well into place in the hot asphalt to eliminate all air bubbles and to obtain close conformity with the surface. Under no circumstances shall one layer of fabric touch another layer or the concrete or masonry structure at

any point without an intervening mopping of asphalt.

In all cases, the mopping shall be sufficiently thorough and heavy so that on masonry surfaces no bare spots will appear, and that the cloth weave will be completely concealed. The work shall be so regulated that, at the close of a day's work, all cloth that is laid shall have received the final mopping of asphalt. Special care shall be taken at all laps to see that they are thoroughly sealed down.

6.2.2 Flexible, Trowelable-Applied Membrane Waterproofing

Elastomeric, flexible, brush or trowel-applied membrane waterproofing system shall be installed as per specification EO-16563-D. The system shall maintain its continuity and sealing property when exposed to the normal operating temperature range (As recommended by the waterproofing system manufacturer).

6.3 Details of Waterproofing Application

At the edges of the membrane waterproofing system and at any point where it is punctured by drains, pipes, etc., tight adhesion shall be made to the concrete or masonry substrate to prevent water or other fluids from getting between the waterproofing and the surface being waterproofed. Firm bonding shall be accomplished by rolling and pressing the fabric into the newly installed hot asphalt or by forcefully troweling the flexible membrane material onto the surface and through its reinforcing sheets if applicable. All flashing against girders, spandrel walls, etc., shall be done with separate fabric sheets lapping the main membrane not less than 12". Corner laps in vaults or manholes are to be made with both vertical and horizontal strips for complete protection. Flashing shall be closely sealed with a bonding agent compatible with the substrate and waterproofing system being applied.

If application of the bonding material is not necessary, then seal the upper edges of the flashing against the wall by caulking with a sealant that is compatible with the waterproofing material and the substrate. Construction joints which are not designed to provide for expansion and/or non-moving cracks shall first be caulked with joint filler and then filled with joint sealant. Expansion joints, horizontal and vertical, and/or moving cracks shall be treated as recommended by the waterproofing system manufacturer. Joints meeting at sidewalk level with the external

face of a building wall shall be waterproofed as indicated on Drawings EO-6188-C or EO-16563-D.

6.3.1 Joint Filler, Sealant, and Waterproofing Membrane Protection Course

The following materials shall be installed or applied as necessary to the substrate before the waterproofing work is performed to ensure the integrity of the application:

a. Joint Filler - A soft backer rod with a diameter 20% greater than the width of a non-moving crack or joint shall be inserted to a depth of about 1½" from the surface. Untarred, unoiled jute packing (EO-3017) can also be used as a joint filler.

b. Joint Sealant - The sealant used to seal all joints between surfaces being waterproofed shall be made of 2-component polyurethane and shall meet the requirements of ASTM C-920, Type M, Grade P or NS, Class 25. The joint sealant should be poured into the joint after the joint filler has been inserted.

c. Protection Course Over Membrane - A protection course of mortar mixed in the proportion of one part portland cement and two parts sand (with just enough water to obtain a thick consistency paste) shall be placed over the cured waterproofing membrane and over the compatible bonding compound which has been applied to the substrate. This mortar course shall be reinforced midway between its inner and outer surfaces by placing a layer of a galvanized welded wire mesh. The upper ends of the wire mesh shall be bonded to the vertical substrate.

The mortar shall be troweled to a smooth, hard finish and, where required, true to grade. If a drain/sump exists, the mortar surface shall be pitched towards the drain. The application of the protection course shall follow the waterproofing so closely that the latter shall not be exposed without protection for more than the specified curing time of the waterproofing material and the successful water test. Where this is not practical, protection boards (min. ¾" thick) shall be provided to protect the installed membrane. The

protection mortar shall be placed as shown on EO-6188-C or EO-16563-D.

6.3.2 Protection Course Ingredients

Use the following ingredients (each meeting its corresponding ASTM specification) to prepare the protection mortar:

a. Cement - Cement shall be Portland cement meeting requirements of ASTM C150.

b. Sand - Sand shall be clean, hard, sound, well-graded, dry, and natural sand conforming to ASTM C33.

c. Water - Water shall be clean, potable, and contain no organic matter or contamination. Extremely cold, icy, or hot water shall not be used for mixing purposes.

d. Galvanized Welded Wire Reinforcement - Galvanized Welded wire reinforcement sized 2" X 2" X W12/12 (0.39 inch nominal diameter) shall be used. It shall conform to ASTM A185.

e. Cement mortar as per EO-100167.

6.3.3 Foundation Wall Protection:

In case the building foundation wall is used as the fourth wall of the vault structure, a waterproofing shall be installed over the entire wall area inside the vault. Also, a 4” minimum, non-bearing concrete protection shall be installed over the water proofing layer. See EO-16563-D for detail.

7.0 WATER TEST

After the waterproofing system has been applied and cured, and prior to the application of the protection course mortar, the membrane shall be tested for watertight integrity by flooding it with clean water. Drains shall be sealed. At least 2" of water shall stand on the newly waterproofed surface for a minimum of 24 hours. Evidence of moisture penetration shall be rectified by the waterproofing contractor to the satisfaction of the Company contractor to the satisfaction of the Company Representative.

8.0 MEMBRANE WATERPROOFING FOR 460 VOLT NETWORK PROTECTOR COMPARTMENTS

Network protector compartments containing 460/265 volt equipment are particularly vulnerable to moisture. Waterproofing measures shall be in place prior to equipment installation. Buildings with network protector compartment space either under sidewalk, within building, or above-grade shall have the network protector compartment roof and floor areas completely waterproofed with membrane as per Drawing EO-16563-D. Walls above compartment areas shall also be membrane waterproofed for 18 inches vertically –by turning the slab waterproofing vertically- to eliminate possible moisture intrusion at slab wall interface.

9.0 QUALITY ASSURANCE

A. The waterproofing material shall comply with the purchase recommendation for the waterproofing system spec EO-100642.

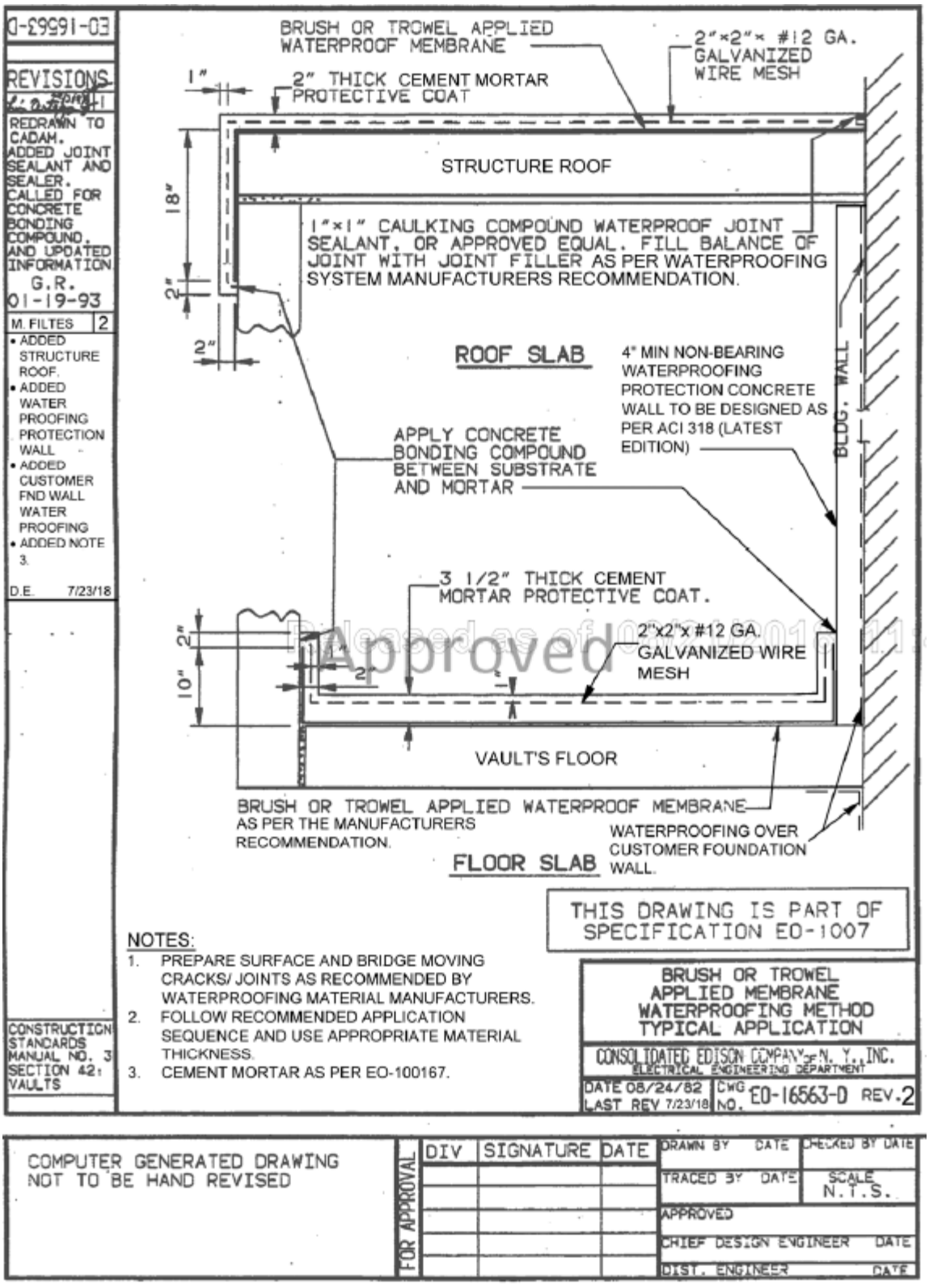
B. The waterproofing contractor must be specializing in performing the waterproofing membrane, and approved by the waterproofing membrane system manufacturer.

Mohsen Shaaker (Signature on File)
Mohsen Shaaker
Manager
Tools and Structures
Distribution Engineering

Attachment: Drawing EO-6188-C (for record only)
Drawing EO-16563-D

Maged Filtes

REVISION NO. 13:	**FILE:**
Add items 6.3.3.e, and 6.3.3 Some minor editing To be reviewed by 08/2022.	Construction Standards, Manual No. 3 Section No. 42 - Vaults


EO-16563-D
REVISIONS
REDRAWN TO CADAM. ADDED JOINT SEALANT AND SEALER. CALLED FOR CONCRETE BONDING COMPOUND, AND UPDATED INFORMATION
G.R. 01-19-93
M. FILTES 2
• ADDED STRUCTURE ROOF.
• ADDED WATER PROOFING PROTECTION WALL
• ADDED CUSTOMER FND WALL WATER PROOFING
• ADDED NOTE 3.
D.E. 7/23/18
CONSTRUCTION STANDARDS MANUAL NO. 3 SECTION 42: VAULTS
BRUSH OR TROWEL APPLIED WATERPROOF MEMBRANE
2"×2"× #12 GA. GALVANIZED WIRE MESH
1"
2" THICK CEMENT MORTAR PROTECTIVE COAT
STRUCTURE ROOF
18"
2"
1"×1" CAULKING COMPOUND WATERPROOF JOINT SEALANT, OR APPROVED EQUAL. FILL BALANCE OF JOINT WITH JOINT FILLER AS PER WATERPROOFING SYSTEM MANUFACTURERS RECOMMENDATION.
2"
ROOF SLAB
4" MIN NON-BEARING WATERPROOFING PROTECTION CONCRETE WALL TO BE DESIGNED AS PER ACI 318 (LATEST EDITION)
BLDG. WALL
APPLY CONCRETE BONDING COMPOUND BETWEEN SUBSTRATE AND MORTAR
3 1/2" THICK CEMENT MORTAR PROTECTIVE COAT.
2"
10"
2"x2"x #12 GA. GALVANIZED WIRE MESH
2"
VAULT'S FLOOR
BRUSH OR TROWEL APPLIED WATERPROOF MEMBRANE AS PER THE MANUFACTURERS RECOMMENDATION.
WATERPROOFING OVER CUSTOMER FOUNDATION WALL.
FLOOR SLAB
THIS DRAWING IS PART OF SPECIFICATION EO-1007
NOTES:
1. PREPARE SURFACE AND BRIDGE MOVING CRACKS/ JOINTS AS RECOMMENDED BY WATERPROOFING MATERIAL MANUFACTURERS.
2. FOLLOW RECOMMENDED APPLICATION SEQUENCE AND USE APPROPRIATE MATERIAL THICKNESS.
3. CEMENT MORTAR AS PER EO-100167.
BRUSH OR TROWEL APPLIED MEMBRANE WATERPROOFING METHOD TYPICAL APPLICATION
CONSOLIDATED EDISON COMPANY OF N. Y., INC.
ELECTRICAL ENGINEERING DEPARTMENT
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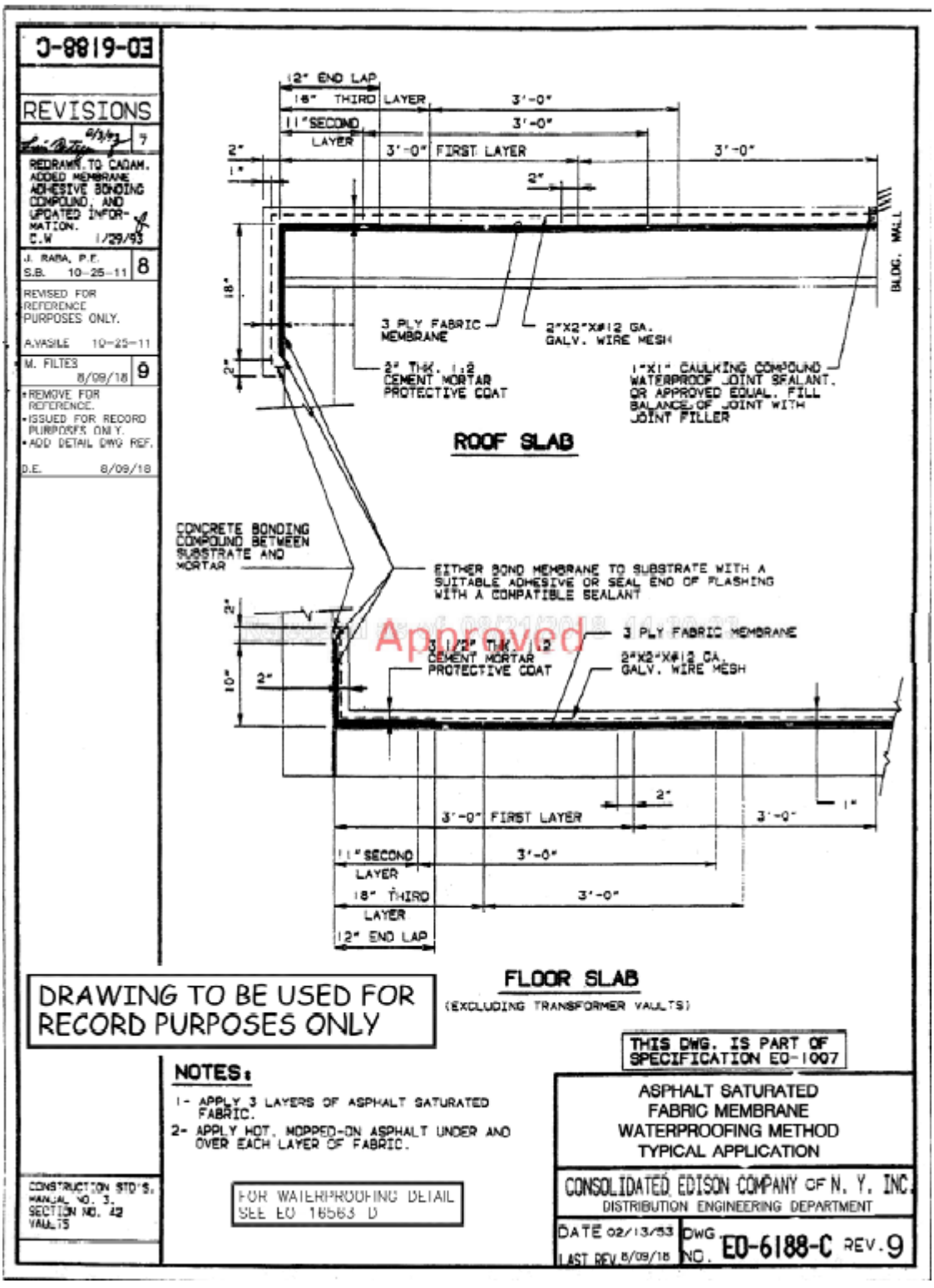
C-8819-03
REVISIONS
REDRAWN TO CADAM. ADDED MEMBRANE ADHESIVE BONDING COMPOUND, AND UPDATED INFORMATION. C.W 1/29/93
J. RABA, P.E. S.B. 10-25-11 8
REVISED FOR REFERENCE PURPOSES ONLY. A.VASILE 10-25-11
M. FILTES 8/09/18 9
•REMOVE FOR REFERENCE.
•ISSUED FOR RECORD PURPOSES ONLY.
•ADD DETAIL DWG REF.
D.E. 8/09/18
12" END LAP
18" THIRD LAYER
11" SECOND LAYER
3'-0"
3'-0" FIRST LAYER
2"
1"
18"
2"
BLDG. WALL
3 PLY FABRIC MEMBRANE
2"X2"X#12 GA. GALV. WIRE MESH
2" THK. 1:2 CEMENT MORTAR PROTECTIVE COAT
1"X1" CAULKING COMPOUND WATERPROOF JOINT SEALANT, OR APPROVED EQUAL. FILL BALANCE OF JOINT WITH JOINT FILLER
ROOF SLAB
CONCRETE BONDING COMPOUND BETWEEN SUBSTRATE AND MORTAR
EITHER BOND MEMBRANE TO SUBSTRATE WITH A SUITABLE ADHESIVE OR SEAL END OF FLASHING WITH A COMPATIBLE SEALANT
Approved
3 PLY FABRIC MEMBRANE
2"X2"X#12 GA. GALV. WIRE MESH
2" THK. 1:2 CEMENT MORTAR PROTECTIVE COAT
10"
2"
2"
1"
FLOOR SLAB
(EXCLUDING TRANSFORMER VAULTS)
DRAWING TO BE USED FOR RECORD PURPOSES ONLY
NOTES:
1- APPLY 3 LAYERS OF ASPHALT SATURATED FABRIC.
2- APPLY HOT, MOPPED-ON ASPHALT UNDER AND OVER EACH LAYER OF FABRIC.
FOR WATERPROOFING DETAIL SEE EO 16583 D
CONSTRUCTION STD'S. MANUAL NO. 3, SECTION NO. 42 VAULTS
THIS DWG. IS PART OF SPECIFICATION EO-1007
ASPHALT SATURATED FABRIC MEMBRANE WATERPROOFING METHOD TYPICAL APPLICATION
CONSOLIDATED EDISON COMPANY OF N. Y. INC.
DISTRIBUTION ENGINEERING DEPARTMENT
DATE 02/13/53 LAST REV 8/09/18
DWG. NO. EO-6188-C REV. 9