******This Standard Supersedes BECo 2.10-2.1, COM/Elec NEFA******

DISTRIBUTION DUCTBANK CONSTRUCTION AND MATERIALS

Table of Contents

1.0 Scope

The purpose of this standard is to provide ductbank construction details, installation requirements and material lists for concrete-encased and direct buried conduit systems.

2.0 General

2.1 All excavation, backfill and paving shall be done In accordance with this standard and all applicable local and state regulations. When conflicts exist between local/state regulations and this standard the more stringent requirement shall be adhered to unless otherwise directed by NSTAR.

2.2 Before placing concrete within ductbank forms and backfilling an NSTAR inspection is required to ensure compliance with all referenced specifications.

2.3 DIG Safe marking and notification regulations are to be understood and adhered to during all construction.

2.4 All NSTAR safety standards as well as all applicable OSHA and DOT worker safety requirements shall be adhered to at all in times. Refer to NSTAR Work Method Standard, "W1000, Entering and Working in Underground Locations including Subsurface Vaults" specific requirements.

3.0 Conduit & Fittings Specifications

All encased conduit shall be PVC conduit (Type EB) and fittings shall be schedule 40 unless otherwise specified by NSTAR. Direct buried conduit and fittings shall be schedule 40 minimum. Refer to NSTAR Material Standard "M1000, PVC Conduit & Fittings" for details.

4.0 Conduit Plan and Records/Data Requirements

4.1 All proposed electric utility pans shall be approved by NSTAR local engineering dept. before construction begins. New subdivision or commercial development plans to be submitted for local authority petitions (town approval) shall also be provided to NSTAR as AutoCAD data files. These shall show all proposed and existing utility plan view layers including electric, gas, water, sewer, drain, cable/data, telephone, and fire alarm.

4.2 The proposed electric utility plans shall include profile views that show relative elevation and clearances where proposed electric duct banks or lines intersect with non-electric utilities. Separation in any direction from electric to other utilities of 12" or less shall be detailed on the drawings.

4.3 GPS land based x-y-z coordinates shall be in NAD83 state plane feet format, with a minimum one foot accuracy. These plans shall show the road layout, curb lines, property lines (parcel boundaries), utility easements and utilities. Center coordinate positions shall be provided for all new manholes/pull boxes, equipment pads, and riser poles. Conduit location coordinates shall be provided at every 50 ft on straight sections or curves with less than 5 degree radii, and at every 20 ft for curves/sweeps over 5 degrees. GPS data for new conduit and infrastructure shall have accuracy of 6 inches or better.

4.4 Contractor shall provide NSTAR Survey and Records department (or local engineering) with as-built new facility location data in electronic file format within 20 business days of completing the project (CD or EFT). All files shall be labeled with the project title, town, NSTAR work order number and date of completion.

5.0 Application

5.1 Typically all primary and secondary distribution duct banks shall be unreinforced concrete encased using Type EB conduit. Stocked fittings are generally Schedule 40 unless otherwise specified.

5.2 If the interval between concrete pours for a continuous duct bank is expected to be more than 4 hours apart, industry standard construction joints shall be formed to ensure that the continuation of the ductbank pour shall create an interlocking joint between different pours. Refer to Figure “E” for detail.

5.3 The concrete specified for ductbanks shall be an approved 2500 psi pea stone mix using Type 2 Portland cement.

5.4 Reinforced distribution ductbanks maybe required per NSTAR for locations where ductbanks cross over other utilities and/or a future excavation could expose NSTAR ductbank without support. Reinforced ductbanks may also be required when installation is in soils that do not meet NSTAR specified backfill. For reinforced concrete ductbank standards refer to NSTAR Construction Standard, “C1101, Distribution Duct bank Construction, and (Steel Reinforced Concrete)”.

5.5 Exceptions to concrete encased ductbanks, i.e. direct buried conduit, may be allowed by NSTAR for secondary conduits installed off roadways and areas not subject to vehicle loads such as greenbelts and yards. Also when approved by NSTAR, single or double primary conduit runs in URD residential subdivisions may be direct buried as long as minimum schedule 40 conduit is used and local regulations allow it.

6.0 Excavation, Backfill and Street Restoration

6.1 Excavation

The roadway surface shall be cut in reasonably straight and parallel lines using a jackhammer, saw or other accepted method to insure the least amount of damage to the roadway surface.

Sheeting and bracing shall be required for excavations in excess of 5 feet deep in accordance with the latest OSHA Standards.

6.2 Backfill Material

A. Backfill material shall conform to "MHD M1.03.1 Process Gravel for Subbase". Backfill shall be mechanically compacted in eight inch (8") loose layers to 95% of the maximum density per ASTM D1557 unless otherwise approved by NSTAR.
B. Excavated material that has been evaluated as unsuitable for backfill shall be removed from the site and disposed of properly.
C. If directed by NSTAR only "Type IE", (Controlled Density Fill ,"CDF", or excavatable flowable fill), shall be used as backfill in certain instances, such as filling hard to reach areas where maneuvering compaction equipment would be difficult or when directed by the governing municipality.
D. Note, NSTAR approved red caution tape, marked "CAUTION ELECTRIC LINES BURIED BELOW", shall be installed 6-9 inches below surface grade, centered above the buried line or ductbank.
E. Backfilling shall not commence less than two hours after the duct bank concrete has been placed.

6.3 Street Restoration

All street paving of open excavations shall be restored using temporary or Interim pavement with two – 1-1/2 inch lifts of compacted hot mix asphalt binder (unless otherwise noted by NSTAR). Cold patch repairs when approved by NSTAR shall be cold patch NSTAR Cat ID 1628. Permanent street paving shall be by the governing municipality.

7.0 Installation

7.1 Duct Bank Forms – In general duct banks shall be constructed using forms for the sidewalls. Where suitable stable soil conditions exist the trench walls may be used to form the sidewalls. Duct bank standards shall be maintained.
7.2 Common Trench – Other utilities sharing a common trench with NSTAR ductbank shall not be enveloped within the same concrete formed encasement, but shall be separate from our encasement and a minimum clearance of 12 inches away.
7.3 Cutting Duct – Use a fine tooth wood saw to cut conduit. All ruff or abrasive edges shall be sanded smooth.
7.4 Duct Plugs – NSTAR approved duct plugs shall be installed in all open conduit. The plugs shall be installed during construction when a conduit installation is

partially complete to manhole or equipment as well as at all terminations in manholes.

7.5 Joining Duct – All conduit ends shall be cleaned by wiping off all dust, dirt and moisture from the surfaces to be cemented and brushed gently with a fine abrasive paper or cloth. Apply the approved PVC solvent cement with a non-synthetic bristle brush evenly coating the full length PVC socket of the fitting. Refer to manufacturers' instructions for additional detail.

7.6 Depth of Cover – The minimum depth of cover over a single conduit or multiple duct bank shall be 36 inches unless otherwise directed by NSTAR. In limited situations NSTAR may allow shallow depth ductbank installations less than 36 inches. Prior approval from NSTAR is required for shallow depth construction as well as the requirement to use ¼ inch thick steel plates above and adjacent to the side wall of the ductbank.

7.7 Clearance– The minimum clearance between an NSTAR conduit or ductbank and any other subsurface structure or utility (EXCEPT Steam Lines) shall be 12 inches unless otherwise approved by NSTAR. Steam lines shall maintain a 10 ft. minimum from NSTAR ductbank or lines.

7.8 Conduit Spacers – Conduit Spacers shall be of the approved type per NSTAR Material Standard, "M1000, PVC Conduit and Fittings". Spacers shall be installed at typically 5 ft. spacing (7 ft. maximum) along the ductbank. Refer to Figure "B" for conduit construction plastic spacers details.

7.9 Conduit Sweeps and Bends – Conduit heat bending is not allowed. All sweeps and bends shall be constructed using pre-fabricated approved fittings. Refer to "Table 3 – Conduit Sweeps and Angle Fittings".

7.10 Mandrel – Upon completion of the duct bank installation or direct buried ducts, a standard flexible mandrel, (not less than 12 inches long with a diameter not less than ½ inch less than the inside diameter of the duct) shall be pulled through each duct to loosen particles of earth, sand and other foreign material left in the line. A brush with stiff bristles shall then be pulled through each duct to remove the loosened particles. The diameter of the brush shall be the same as, or slightly larger than the diameter of the duct.

7.11 Building Wall Construction – When conduit or ductbank enters a structure and differential settlement is expected, construction details shall be per Figure "C".

7.12 Riser Construction – When conduit transitions from underground to above ground a galvanized steel conduit with a 36 inch radius sweep shall be used. For typical riser construction details refer to Figure "D".

7.13 All conduit shall have "mule tape" or equal, i.e. pulling tape made of woven polyester with a strength of 2500 lbs. installed within.

7.14 Transposition of Ducts – When ducts leaving one manhole/pad/equipment foundation require altering the duct bank cross section along the run, the revised configuration (and corresponding duct numbering) shall be as shown on Figure "G" unless otherwise approved by NSTAR.

8.0 Breaking into existing Manholes

8.1 Manhole breaks for new ductbank penetrations shall receive prior approval from NSTAR inspector. Contractors must be pre-qualified by NSTAR to work in or break into live manholes. Sidewall breaks are generally not allowed unless prior approval from NSTAR inspector.

8.2 All newly formed bell mouths shall be installed per Figure "F".

9.0 Compatible Unit Format for Conduit & Fittings

The Compatible Unit format for Conduit & Fittings, which are considered Non-electric Facilities, is described below:

9.1 Conduit, Banks and Riser CU Formats -unit lengths are noted in CU title:

NC (Application/Material) (Size) - (Quantity {row x height})

(Application/Material) -

D – Direct Buried (schedule 40 PVC)
E – Concrete Encased PVC (Type EB with spacers needed)
RP – Riser PVC (pipe and sweep- schedule. 40)
RS – Riser steel (pipe and sweep – galv. steel)
S – Steel Conduit
FLEX – flexible PVC, schedule 40

(Size) – Conduit inside diameter (inches)

(Quantity) – Cross section, rows x height (greater than one only, if one leave blank)

Examples: NCE4-3x3: 3x3 duct bank, 4", PVC type EB
NCRS4: 4", galvanized steel, riser pipe and sweep
NCD2: single 2" schedule 40 PVC duct, direct buried

9.2 Conduit Fitting CU Formats:

NF (Material) (Size) - (Type) – {detail below}

(Material) – P – PVC schedule 40 or DB/EB, **S** – Steel, **I** - Iron

(Size) – Conduit inside diameter in inches

(Type) - SW – Sweeps & angle fittings in degrees
(Angle)-(Radius) - For 36 in. radius bends leave blank, show all others.
R - Reducers **(A side – B side)** – in inches
CAP - Riser Caps, **PLUG** – Duct Plugs, **CPL** – Straight Couplings
RADP - Riser Adapter, **FA** – Fairleader, **BEL40** – Endbell – Sch 40,
BELEB - Endbell – EB, **SLIP** – Slip Coupling, **SPLIT** – Split Repair
PS - PVC to Steel Coupling, **GNDBUSH** – Grounding Bushing,
GNDUCONN – pipe ground connector

Examples: NFP4-SW90-24: 4", PVC, 90 degree angle sweep with 24 in radius
NFP5-SW22: 5" PVC duct, 22.5 degree sweep, 36 in radius
NFP6-CAP: 6" PVC riser cap (for spare)
NFP5-CPL: 5" PVC straight coupling
NFS4-GNDBUSH: 4" Grounding Bushing:

9.3 Conduit Accessory CU Formats:

NA (Material) - (Size option if any**)**

Material – CM - PVC cement, **MT** - marker tape, **FL**- fish line, **DX** - duxseal, **DF** - duct foam, **CP** - cold patch, **FA** – fairleader

10.0 Ductbank Compatible Units

10.1 Ductbanks shall be designed using Compatible Units (CUs). The table below references the CUs for the most commonly used ductbanks for distribution construction. Refer to NSTAR Material Standard, "M1000, PVC Conduit & Fittings" for additional information.
10.2 Refer to Figure "E" for typical ductbank construction details.
10.3 Figures 1 thru 21 noted below refer to standard cross sections on pages 19-24.

DUCTBANK COMPATIBLE UNIT REFERENCE TABLE

Note: Each single duct bank CU includes 20 ft of trenching, needed lengths of conduit, spacers, concrete, backfill & resurfacing.

FIG	4" Ducts	5" Ducts	6" Ducts
1	NCE4-2x1	NCE5-2x1	NCE6-2x1
2	NCE4-3x1	NCE5-3x1	NCE6-3x1
4	NCE4-2x2	NCE5-2x2	NCE6-2x2
5	NCE4-3x2	NCE5-3x2	NCE6-3x2
8	NCE4-4x2	NCE5-4x2	NCE6-4x2
9	NCE4-3x3	NCE5-3x3	NCE6-4x2
13	NCE4-4x3	NCE5-4x3	NCE6-4x3
21	NCE4-4x4	NCE5-4x4	NCE6-4x4

11.0 Bill of Materials and Compatible Units – Conduit, Fittings & Accessories – Tables 1- 6

Table 1 - PVC & Steel Conduit Only (not banks)

Material	Size (ID)	Wall Thickness (Type/ Sch)	Unit Length (Ft)	Catalog ID	Compatible Unit
PVC – rigid	2	40	10	1197	NCD2
"	3	40	10	1198	NCD3
"	4	40	10	1195	NCD4
"	4	EB	20	1362	NCE4
"	5	40	10	1196	NCD5
"	5	EB	20	1363	NCE5
"	6	40	10	15174	NCD6
"	6	EB	20	16047	NCE6
PVC – flexible	1-1/2	40 flex	1	15968	NCFLEX1.5
"	2	40 flex	1	9480	NCFLEX2
"	2-1/2	40 flex	1	15969	NCFLEX2.5
"	3	40 flex	1	9481	NCFLEX3
"	4	40 flex	1	9482	NCFLEX4
Steel, Galv	2	40	10	9474	NCS2
"	3	40	10	1246	NCS3
Steel, Galv	4	40	10	1248	NCS4
"	5	40	10	1249	NCS5
"	6	40	10	15177	NCS6

Table 2 – Straight Couplings, Split Duct and Reducers (PVC to PVC Only)

Material	Type	Size(s)	Application	Catalog ID	Compatible Unit
PVC	Straight Coupling	2	Joining	1208	NFP2-CPL
"	"	3	Joining	1209	NFP3-CPL
"	"	4	Joining	1210	NFP4-CPL
"	"	5	Joining	16375	NFP5-CPL
"	"	6	Joining	16355	NFP6-CPL
PVC	Split Duct	2	Repair	16873	NFP2-SPLIT
"	"	3	Repair	16874	NFP3-SPLIT
"	"	4	Repair	16875	NFP4-SPLIT
"	"	5	Repair	16876	NFP5-SPLIT
"	"	6	Repair	16831	NFP6-SPLIT

PVC	Reducer	3 to 2-1/2	change dia.	13661	NFPR3-2.5
"	"	3 to2	change dia	13639	NFPR-3-2
"	"	4 to 3	change dia.	16043	NFPR-4-3
"	"	5 to 4	change dia.	16044	NFPR-5-4
"	"	6 to 5	change dia.	16045	NFPR-6-5

Table 3 – Conduit Sweeps and Angle Fittings

Material	Angle (deg)	Size (ID)	Radius	Catalog ID	Compatible Unit
PVC	5	4	N/A	1357	NFP4-SW5
"	"	5	N/A	1358	NFP5-SW5
"	"	6	N/A	16354	NFP6-SW5
"	22.5	3	13	15319	NFP3-SW22-13
"	"	4	36	1168	NFP4-SW22
"	"	5	36	1169	NFP5-SW22
"	"	6	48	16359	NFP6-SW22-48
PVC	45	3	13	15320	NFP3-SW45-13
"	"	4	36	1166	NFP4-SW45
"	"	5	36	1170	NFP5-SW45
"	"	6	48	16358	NFP6-SW45-48
"	90	2	18	1158	NFP2-SW90-18
"	"	3	24	1159	NFP3-SW90-24
"	"	4	36	1167	NFP4-SW90
"	"	4	24	16374	NFP4-SW90-24
"	"	4	16	7746	NFP4-SW90-16
PVC	90	4	48	16385	NFP4-SW90-48
"	"	5	36	1171	NFP5-SW90
"	"	5	60	16361	NFP5-SW90-60
"	"	6	36	16363	NFP6-SW90
"	"	6	60	16364	NFP6-SW90-60
Galv. Steel	90	2	30	16854	NFS2-SW90-30
"	"	3	30	1173	NFS3-SW90-30
"	"	4	36	9898	NFS4-SW90
"	"	5	36	9899	NFS5-SW90
"	"	6	36	15176	NFS6-SW90

Table 4 – Underground Conduit Plugs and End Bells

Material	Description	Size (ID)	Ends	Catalog ID	Compatible Unit
PVC/rubber	Duct Plug	2	n/a	1634	NFP2-PLUG
"	"	3	n/a	1635	NFP3-PLUG
PVC/rubber	Duct Plug	4	n/a	1636	NFP4-PLUG
"	"	5	n/a	1637	NFP5-PLUG
"	"	6	n/a	16869	NFP6-PLUG
PVC	Sched 40 End Bell	2		9423	NFP2-BEL40
"	"	3		9424	NFP3-BEL40
"	"	4		9425	NFP4-BEL40
"	"	5		16428	NFP5-BEL40
"	"	6		16367	NFP6-BEL40
PVC	Type EB End Bell	2		16365	NFP2-BELEB
"	"	3		16366	NFP3-BELEB
"	"	4		1156	NFP4-BELEB
"	"	5		1157	NFP5-BELEB
"	"	6		16429	NFP6-BELEB

Table 5 – Pole Riser Sections including Fittings (Steel to PVC, Steel to Steel)

Material	Description	Size (ID)	Ends	Catalog ID	Compatible Unit
PVC	External Cap	2		16918	NFP2-CAP
"	"	3		16917	NFP3-CAP
"	"	4		9460	NFP4-CAP
"	"	5		16393	NFP5-CAP
"	"	6		16394	NFP6-CAP
Galv. Steel	Riser Pipe Section (steel sweep, 10 ft Rigid steel conduit, iron slip coupling & PVC-steel coupling)	2	sweep RS cond slip cplg thrd cplg	16854 9474 16351 9513	NCRS2
"	"	3	sweep RS cond slip cplg thrd cplg	1173 1246 1343 9514	NCRS3
"	"	4	sweep RS cond slip cplg thrd cplg	9898 1248 1345 1099	NCRS4

Galv. Steel	Riser Pipe Section (steel sweep, 10 ft Rigid steel conduit, iron slip coupling & PVC-steel coupling)	5	Sweep RS cond slip cplg thrd cplg	9899 1249 1346 1100	NCRS5
"	"	6	sweep RS cond slip cplg thrd cplg	15176 15177 n/a 16368	NCRS6
Steel	Grounding Bushing	2	threads	15971	NFS2-GNDBUSH
"	"	3	"	1190	NFS3-GNDBUSH
"	"	4	"	1188	NFS4-GNDBUSH
"	"	5	"	1189	NFS5-GNDBUSH
"	"	6	"	16934	NFS6-GNDBUSH
Copper	Pipe Ground Conn.	2"	U bolt	9011	NFS2-GNDUCONN
"	Pipe Ground Conn.	4"	"	15363	NFS4-GNDUCONN
"	Pipe Ground Conn.	5"	"	15363	NFS5-GNDUCONN

Table 6 – Conduit Installation Accessories

Material	Description	Size	Catalog ID	Compatible Unit
PVC Cement	All season, quick setting cement	Quart	1213	NA-CM
Marker Tape	Caution Tape to install over buried electric lines	1000 ft roll	9913	NA-MT
Fish Line	Pull line, 2500lb strength	3000 ft	16860	NA-FL
Duct Foam	Expands and seals around cables at duct mouths	13 oz can	1380	NA-DF
Dux Seal	Plug compound, nonhardening	Large, 5lb	1239	NA-DX5
"	"	Small, 1lb	9469	NA-DX1
Cold patch	Temporary Pavement	60 lb	1628	NA-CP
Fairleader	For Duct Mouths	3-5	1371	NA-FA

12.0 Typical Construction Plans - Figures A thru F

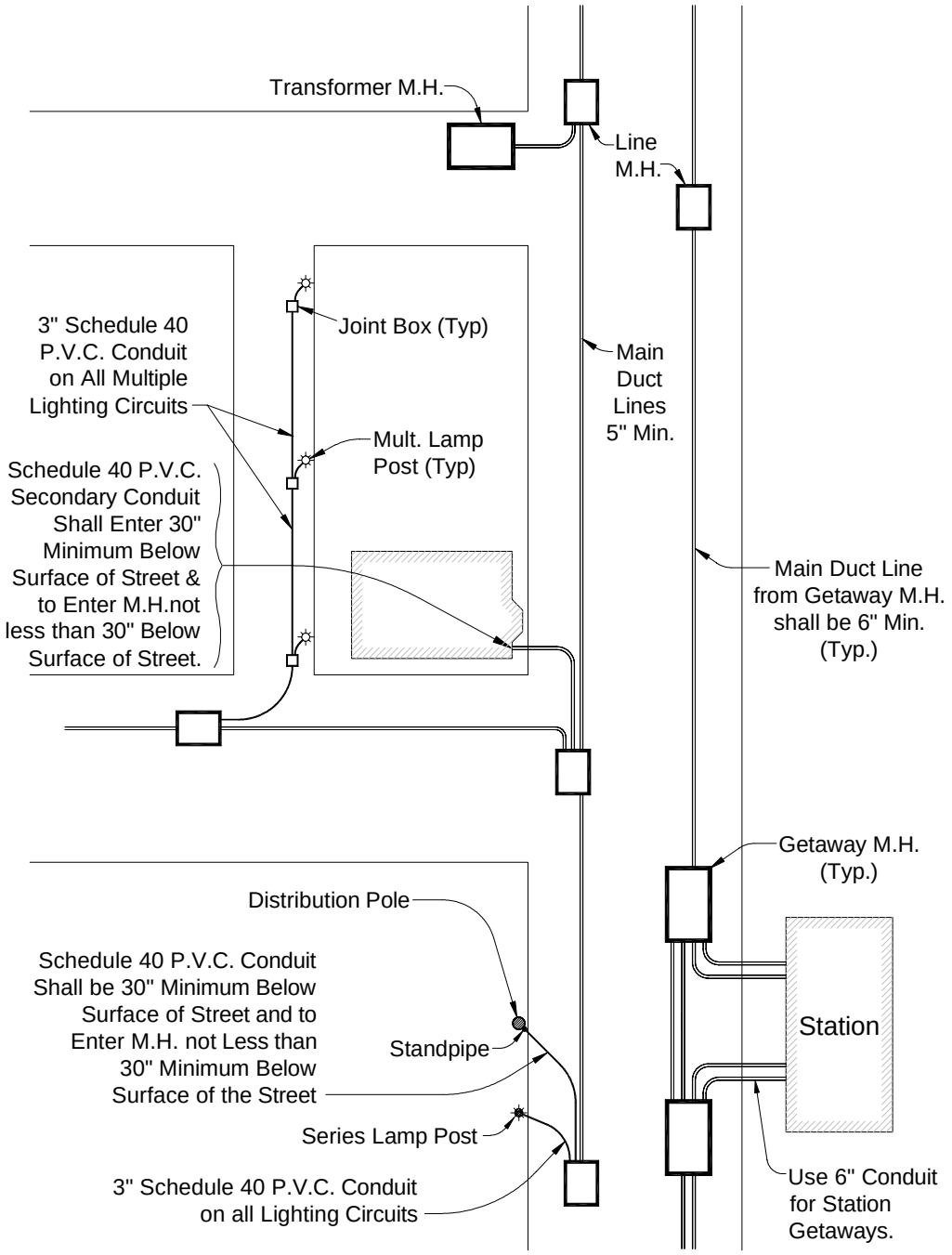
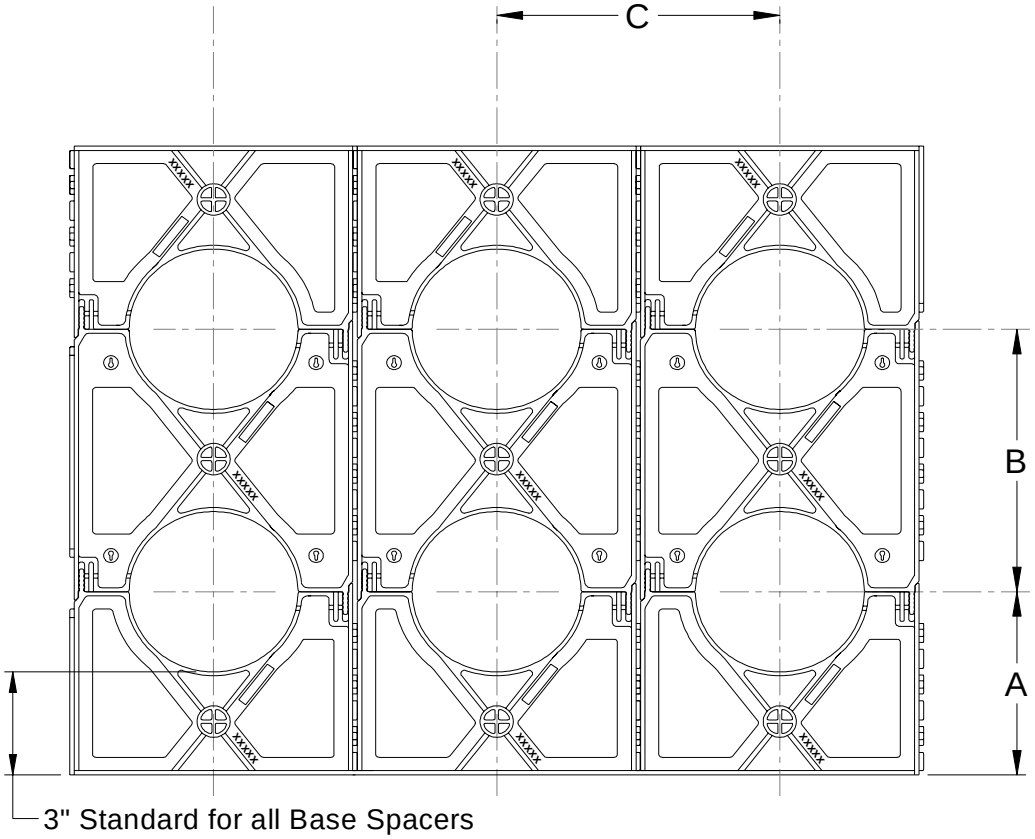
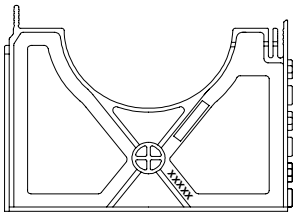
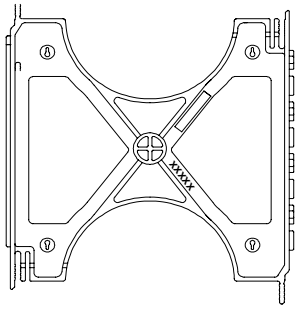


FIGURE A - PLAN VIEW
TYPICAL DISTRIBUTION CONDUIT CONSTRUCTION DETAILS





BASE SPACERS

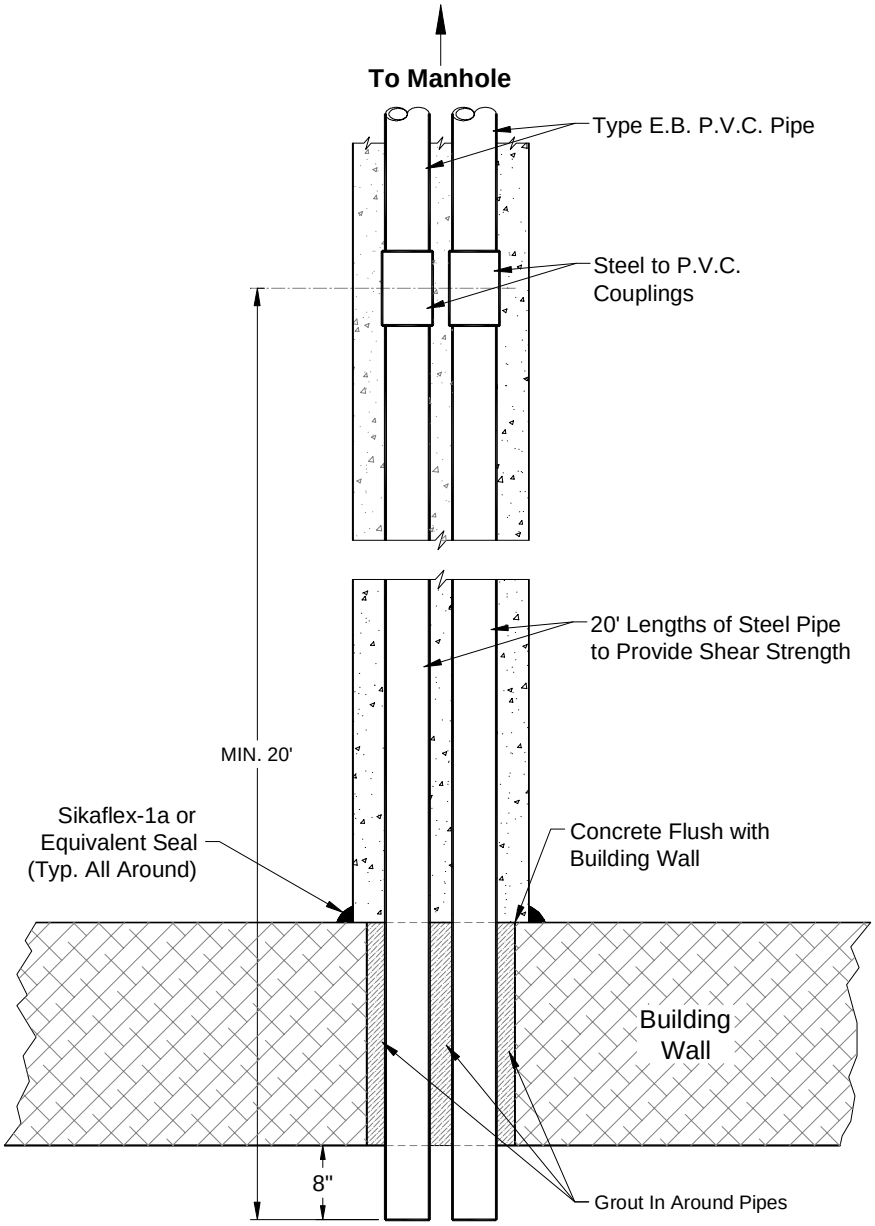


INTERMEDIATE SPACERS

Size	Spacing	A	B	C	Base Spacer; Cat. ID	Intermediate Spacer; Cat. ID
4"	1 1/2"	5.310	6.010	6.250	9462	9464
5"	1 1/2"	5.840	7.070	7.310	9465	9463
6"	1 1/2"	6.380	8.140	8.380	16378	16379

Note: Conduit spacers shall be installed every 5 ft. (7 feet maximum).

FIGURE B
CONDUIT CONSTRUCTION PLASTIC SPACER
(TYPICAL)



Note:

Building wall construction to be used wherever settlement of building or conduit is anticipated.

FIGURE C – PLAN VIEW
BUILDING WALL CONSTRUCTION

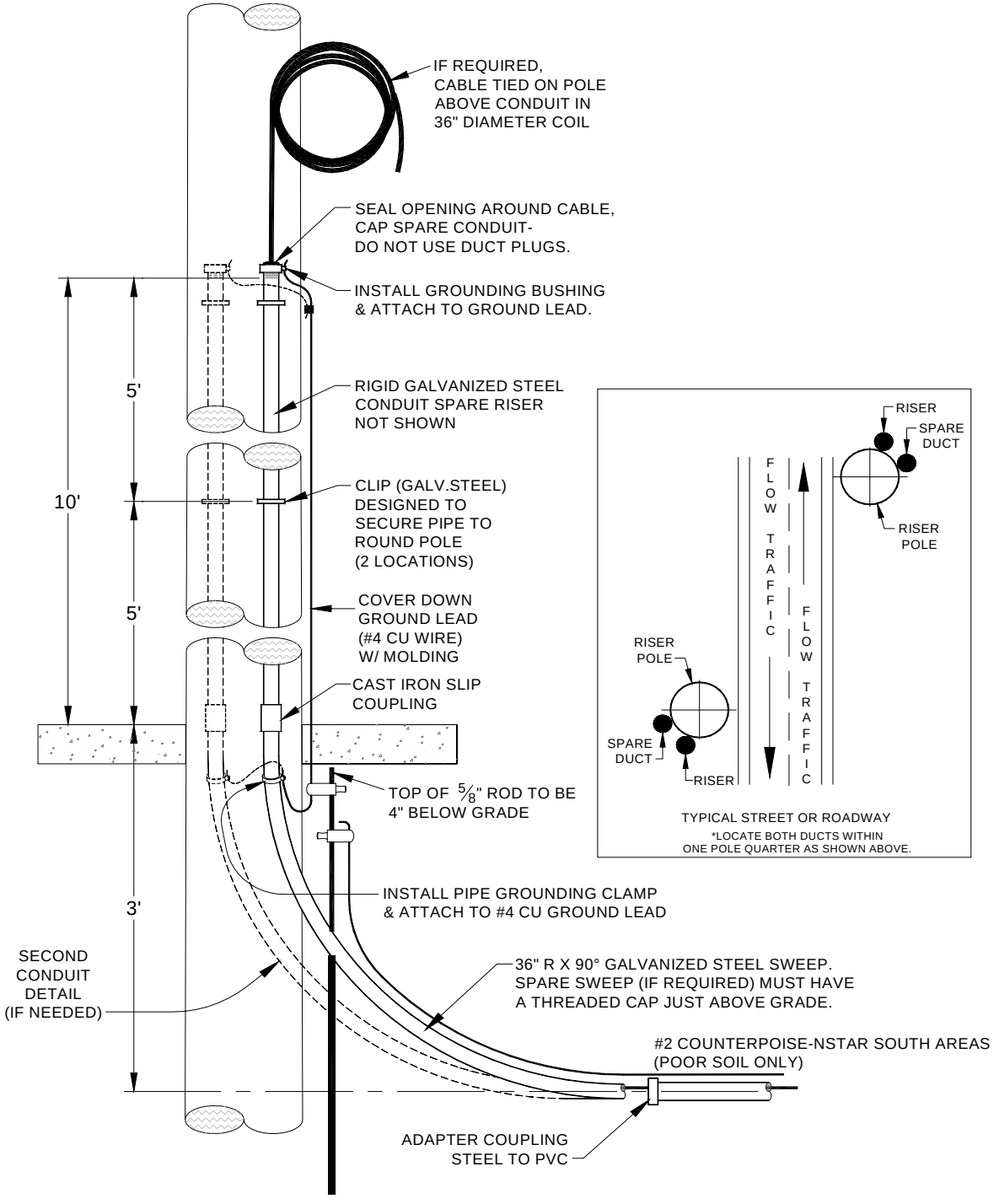
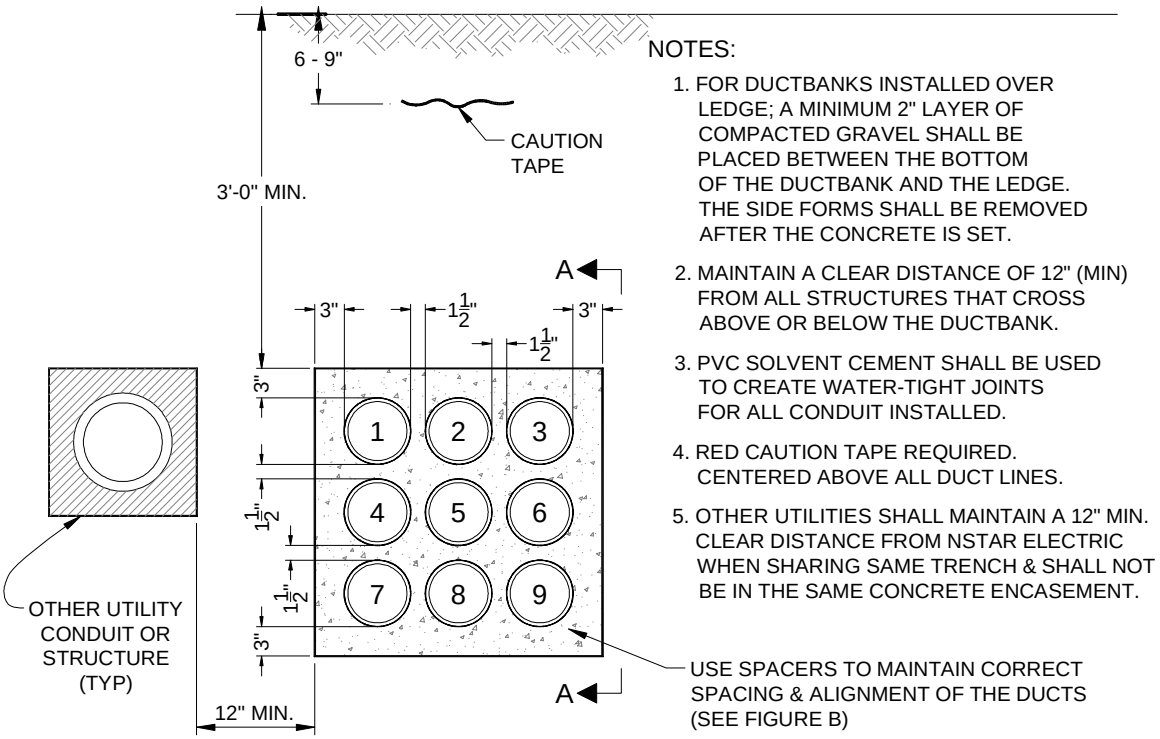


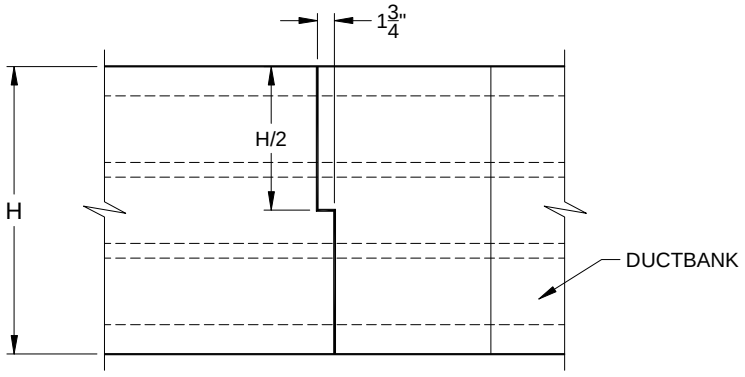
FIGURE D – PROFILE
TYPICAL RISER CONSTRUCTION DETAIL



NOTES:

1. FOR DUCTBANKS INSTALLED OVER LEDGE; A MINIMUM 2" LAYER OF COMPACTED GRAVEL SHALL BE PLACED BETWEEN THE BOTTOM OF THE DUCTBANK AND THE LEDGE. THE SIDE FORMS SHALL BE REMOVED AFTER THE CONCRETE IS SET.
2. MAINTAIN A CLEAR DISTANCE OF 12" (MIN) FROM ALL STRUCTURES THAT CROSS ABOVE OR BELOW THE DUCTBANK.
3. PVC SOLVENT CEMENT SHALL BE USED TO CREATE WATER-TIGHT JOINTS FOR ALL CONDUIT INSTALLED.
4. RED CAUTION TAPE REQUIRED. CENTERED ABOVE ALL DUCT LINES.
5. OTHER UTILITIES SHALL MAINTAIN A 12" MIN. CLEAR DISTANCE FROM NSTAR ELECTRIC WHEN SHARING SAME TRENCH & SHALL NOT BE IN THE SAME CONCRETE ENCASEMENT.

PROFILE



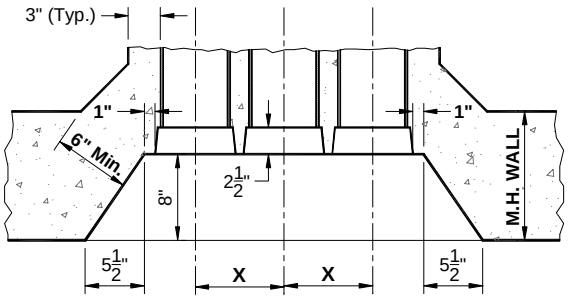
H = HEIGHT OF DUCTBANK

SECTION A-A

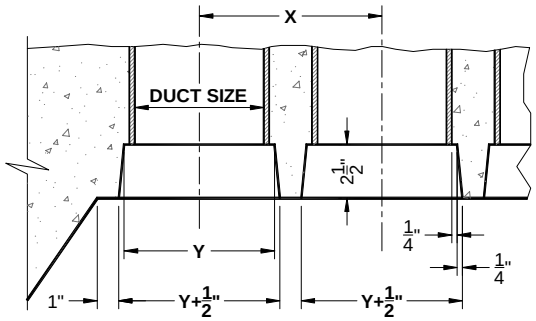
CONCRETE SPECIFICATION:

CONCRETE SHALL BE NORMAL WEIGHT WITH PEASTONE MIX,
2500 PSI @ 28 DAY COMPRESSIVE STRENGTH.
UNLESS OTHERWISE SPECIFIED, CONSTRUCTION SHALL CONFORM
TO ACI-318 (LATEST EDITION) WHERE REINFORCEMENT IS SPECIFIED.

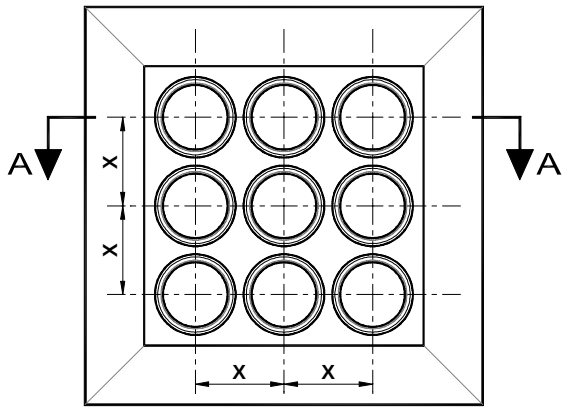
FIGURE E – PROFILE & SECTION VIEWS
STANDARD UNREINFORCED CONCRETE DUCTBANK CONSTRUCTION DETAILS



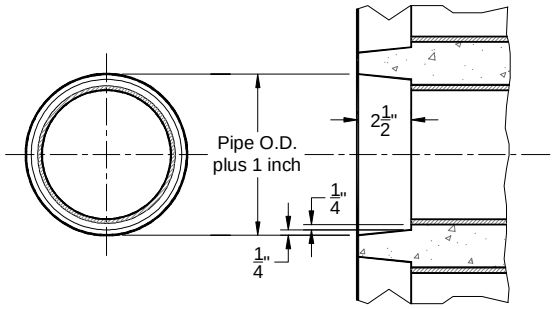
SECTION "A-A"



DETAIL OF DUCT MOUTH



DUCT FACE



DUCT MOUTH FOR SERVICE PIPES, ETC.

Duct Size	X	Y
4"	6 ½"	5"
5"	7 ½"	6"
6"	8 ½"	7"

Notes:

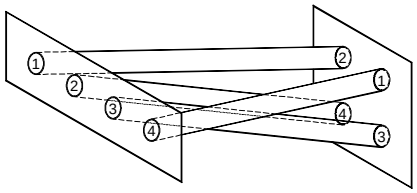
1. Ducts shall be 5" size unless otherwise specified.
2. Ducts shall be terminated with a matching schedule PVC end bell, which shall then be sealed around with mortar mix.

FIGURE F
MANHOLE BELLMOUTH CONSTRUCTION

This Standard Specifies the Typical Arrangement of Transposed Duct Numbering as the Configuration changes from Horizontal to Vertical or vice versa.

Connect Left to Right as Follows:

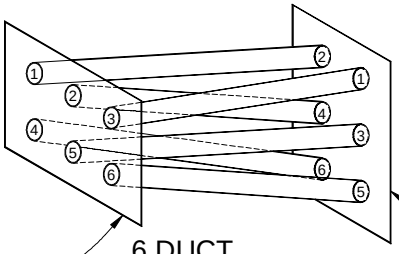
1 to 2
2 to 4
3 to 3
4 to 1



4 DUCT

Connect Left to Right as Follows:

1 to 2
2 to 4
3 to 1
4 to 6
5 to 3
6 to 5



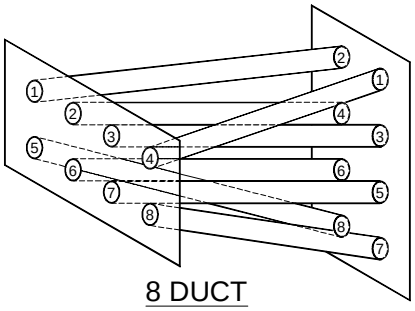
Configuration Entering or Approaching Manhole/Pad/ Equipment Fdn. (Typ)

Configuration Leaving Manhole/Pad/ Equipment Fdn. (Typ)

6 DUCT

Connect Left to Right as Follows:

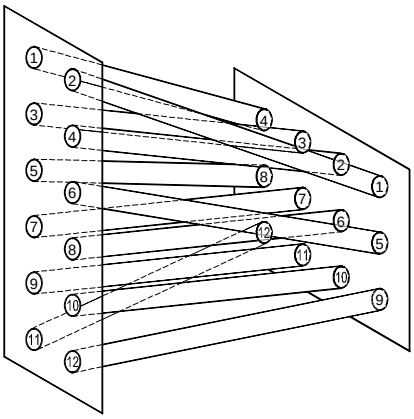
1 to 2
2 to 4
3 to 3
4 to 1
5 to 8
6 to 6
7 to 5
8 to 7



8 DUCT

Connect Left to Right as Follows:

1 to 4
2 to 1
3 to 3
4 to 2
5 to 8
6 to 5
7 to 7
8 to 6
9 to 11
10 to 10
11 to 12
12 to 9



12 DUCT

Notes:

1. The open duct ends, as viewed from the center of the Manhole/Pad/Equipment Foundation, shall be numbered as shown on Figures No. 1 - 23.
2. If other duct transpositions are required prior approval from NSTAR is required.

FIGURE G
TRANSPOSITION OF DUCTS – (WHEN NECESSARY)

13.0 Duct Bank Cross Sections – Figures 1 thru 23
Standard and Nonstandard (Alternate) Designs shown to support old construction.

DUCT BANK LAYOUT FOR 4", 5", & 6" CONDUIT
(NON-REINFORCED CONCRETE)

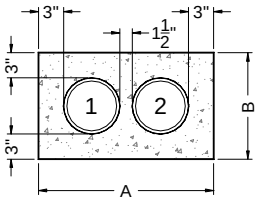


FIG. 1 2-DUCTS

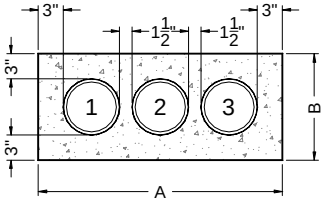


FIG. 2 3-DUCTS

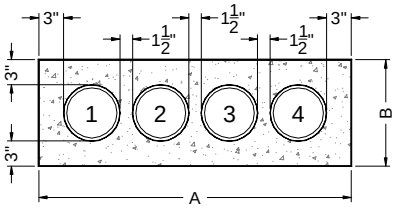


FIG. 3 4-DUCTS (Alternate)

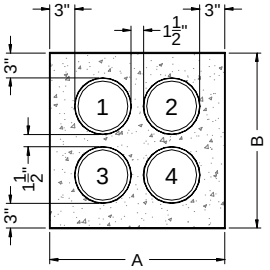


FIG. 4 4-DUCTS

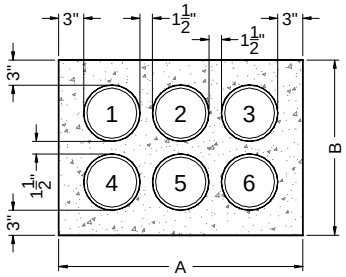


FIG. 5 6-DUCTS

Numbers in Duct Indicate Numbering System when Viewed from the Open End of a Ductbank.

DIMENSIONS						
FIG	4" Ducts		5" Ducts		6" Ducts	
	A Inches	B Inches	A Inches	B Inches	A Inches	B Inches
1	16 ½"	10 ½"	18 ½"	11 ½"	21"	12 ½"
2	22 ½"	10 ½"	25 ½"	11 ½"	29"	12 ½"
3	28 ½"	10 ½"	32 ½"	11 ½"	37"	12 ½"
4	16 ½"	16 ½"	18 ½"	18 ½"	21"	21"
5	22 ½"	16 ½"	25 ½"	18 ½"	29"	21"

NOTE: See pages 25 for duct bank weights and concrete quantities.

DUCT BANK LAYOUT FOR 4", 5", & 6" CONDUIT
(NON-REINFORCED CONCRETE)

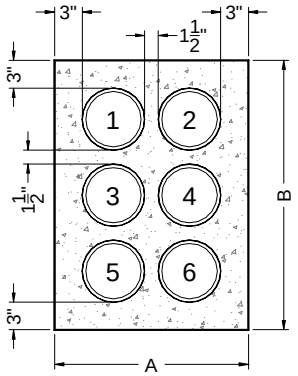


FIG. 6 6-DUCTS (Alternate)

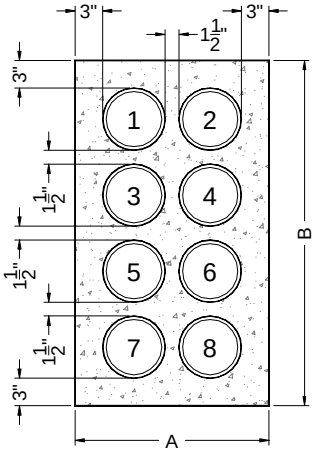


FIG. 7 8-DUCTS (Alternate)

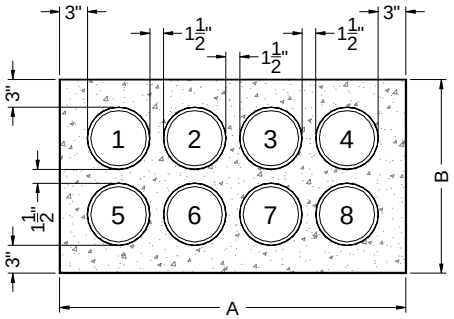


FIG. 8 8-DUCTS

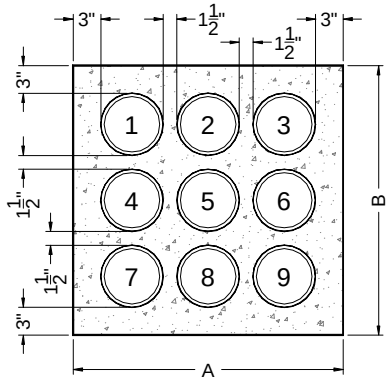


FIG. 9 9-DUCTS

Numbers in Duct Indicate Numbering System when Viewed from the Open End of a Ductbank.

DIMENSIONS						
FIG	4" Ducts		5" Ducts		6" Ducts	
	A Inches	B Inches	A Inches	B Inches	A Inches	B Inches
6	16 ½"	22 ½"	18 ½"	25 ½"	21"	29"
7	16 ½"	28 ½"	18 ½"	32 ½"	21"	37"
8	28 ½"	16 ½"	32 ½"	18 ½"	37"	21"
9	22 ½"	22 ½"	25 ½"	25 ½"	29"	29"

NOTE: See pages 25 for duct bank weights and concrete quantities.

DUCT BANK LAYOUT FOR 4", 5", & 6" CONDUIT
(NON-REINFORCED CONCRETE)

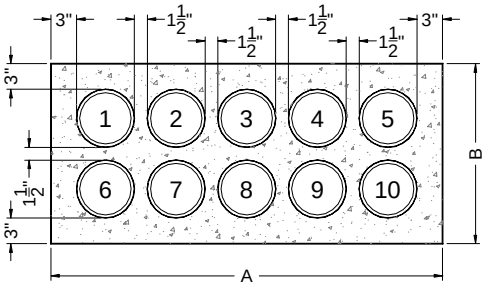


FIG. 10 10-DUCTS

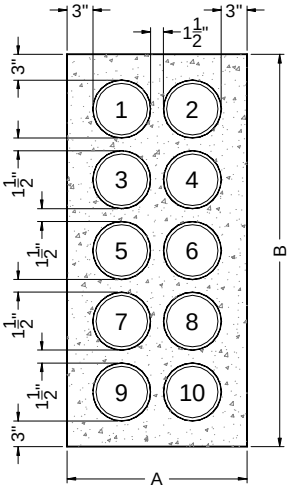


FIG. 11 10-DUCTS (Alternate)

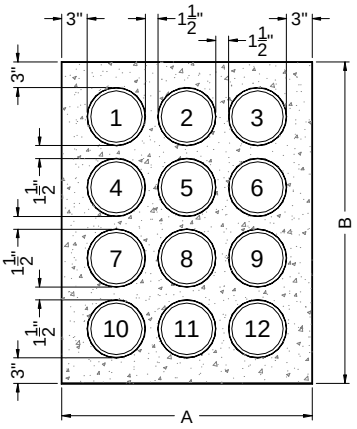


FIG. 12 12-DUCTS (Alternate)

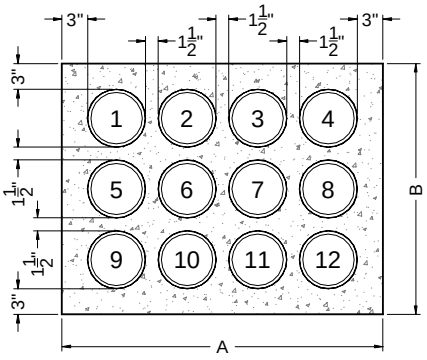


FIG. 13 12-DUCTS

Numbers in Duct Indicate Numbering System when Viewed from the Open End of a Ductbank.

FIG	DIMENSIONS					
	4" Ducts		5" Ducts		6" Ducts	
	A Inches	B Inches	A Inches	B Inches	A Inches	B Inches
10	34 ½"	16 ½"	39 ½"	18 ½"	45"	21"
11	16 ½"	34 ½"	18 ½"	39 ½"	21"	45"
12	22 ½"	26 ½"	25 ½"	32 ½"	29"	37"
13	28 ½"	22 ½"	32 ½"	25 ½"	37"	29"

NOTE: See pages 25 for duct bank weights and concrete quantities.

DUCT BANK LAYOUT FOR 4", 5", & 6" CONDUIT
(NON-REINFORCED CONCRETE)

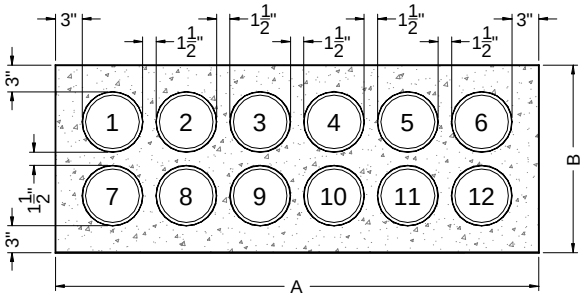


FIG. 14 12-DUCTS

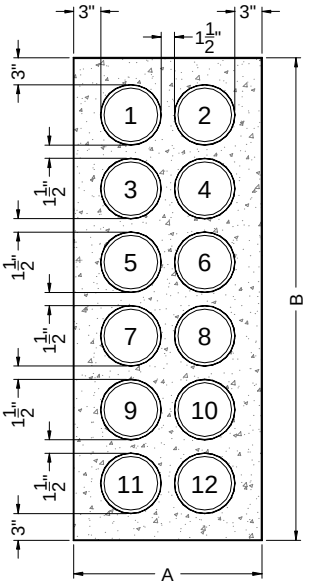


FIG. 15 12-DUCTS (Alternate)

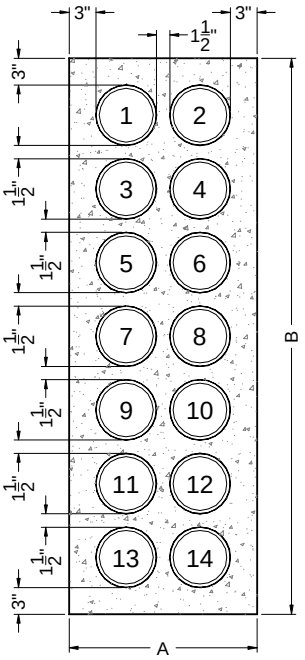


FIG. 16 14-DUCTS (Alternate)

Numbers in Duct Indicate Numbering System when Viewed from the Open End of a Ductbank.

FIG	DIMENSIONS					
	4" Ducts		5" Ducts		6" Ducts	
	A Inches	B Inches	A Inches	B Inches	A Inches	B Inches
14	40 ½"	16 ½"	46 ½"	18 ½"	53 ½"	21"
15	16 ½"	40 ½"	18 ½"	46 ½"	21"	53 ½"
16	16 ½"	46 ½"	18 ½"	53 ½"	21"	61"

NOTE: See pages 25 for duct bank weights and concrete quantities.

DUCT BANK LAYOUT FOR 4", 5", & 6" CONDUIT
(NON-REINFORCED CONCRETE)

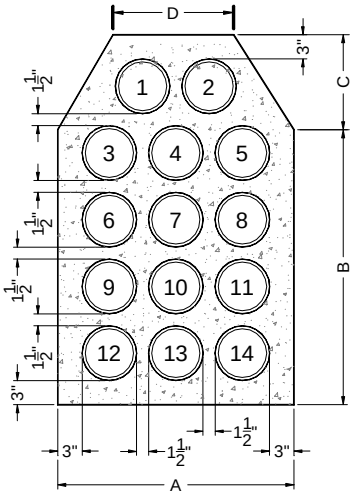


FIG. 17 14-DUCTS (Alternate)

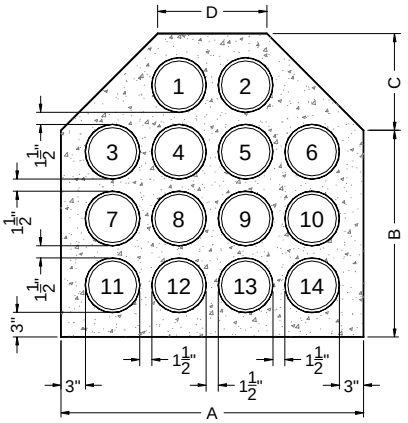


FIG. 18 14-DUCTS

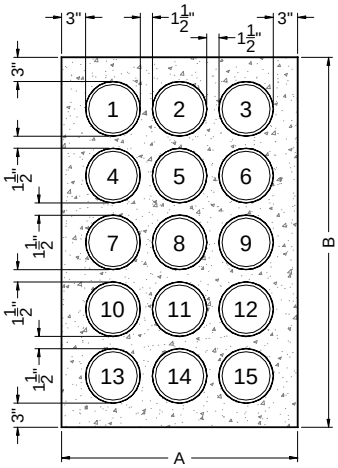


FIG. 19 15-DUCTS (Alternate)

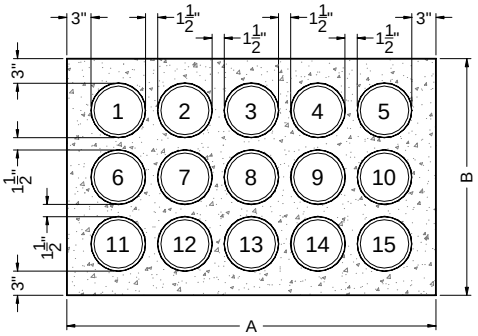


FIG. 20 15-DUCTS

Numbers in Duct Indicate Numbering System when Viewed from the Open End of a Ductbank.

FIG	DIMENSIONS											
	4" Ducts				5" Ducts				6" Ducts			
	A Inches	B Inches	C Inches	D Inches	A Inches	B Inches	C Inches	D Inches	A Inches	B Inches	C Inches	D Inches
17	22 ½"	25 ½"	9"	12"	25 ½"	29 ½"	10"	14"	29"	33 ½"	11"	16"
18	28 ½"	19 ½"	9"	10"	32 ½"	22 ½"	10"	12"	37"	25 ½"	11"	14"
19	22 ½"	34 ½"	N/A	N/A	25 ½"	39 ½"	N/A	N/A	29"	45"	N/A	N/A
20	34 ½"	22 ½"	N/A	N/A	39 ½"	25 ½"	N/A	N/A	45"	29"	N/A	N/A

NOTE: See pages 25 for duct bank weights and concrete quantities.

DUCT BANK LAYOUT FOR 4", 5", & 6" CONDUIT
(NON-REINFORCED CONCRETE)

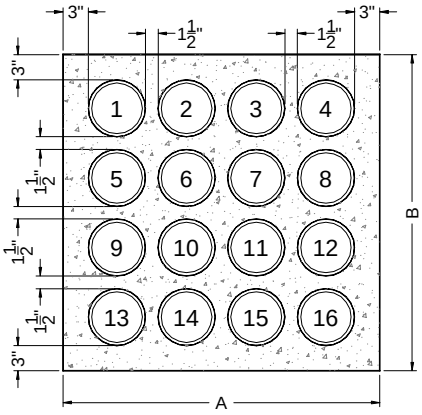


FIG. 21 16-DUCTS

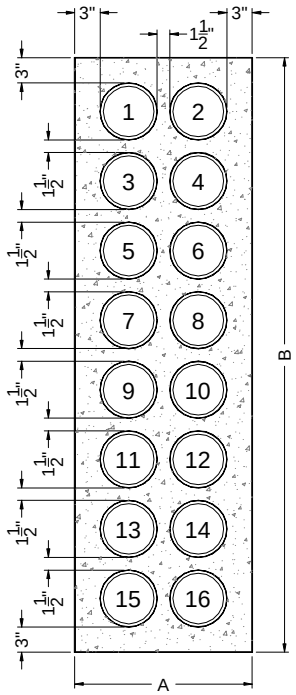


FIG. 22 16-DUCTS (Alternate)

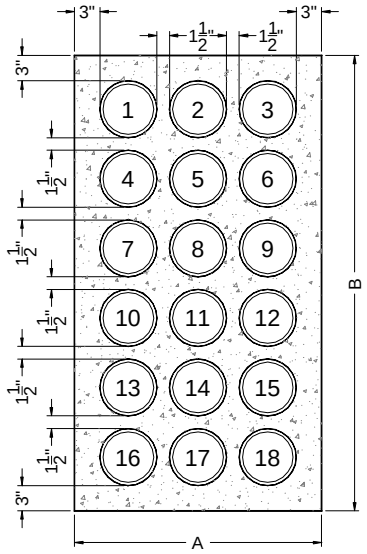


FIG. 23 18-DUCTS

Numbers in Duct Indicate Numbering System when Viewed from the Open End of a Ductbank.

FIG	DIMENSIONS											
	4" Ducts				5" Ducts				6" Ducts			
	A Inches	B Inches	C Inches	D Inches	A Inches	B Inches	C Inches	D Inches	A Inches	B Inches	C Inches	D Inches
21	28 ½"	28 ½"	N/A	N/A	32 ½"	32 ½"	N/A	N/A	37"	37"	N/A	N/A
22	16 ½"	52 ½"	N/A	N/A	18 ½"	60 ½"	N/A	N/A	21"	69"	N/A	N/A
23	22 ½"	40 ½"	N/A	N/A	25 ½"	46 ½"	N/A	N/A	29"	53 ½"	N/A	N/A

NOTE: See pages 25 for duct bank weights and concrete quantities.

14.0 Conduit Bank Concrete Requirements and Weights per linear foot.

CONDUIT CONSTRUCTION
DUCT SIZES, WEIGHTS & CONCRETE QUANTITIES

No. of Ducts	4 Inch Dia.		5 Inch Dia.		6 Inch Dia.	
	Unreinforced Concrete PVC Duct & Cable		Unreinforced Concrete PVC Duct & Cable		Unreinforced Concrete PVC Duct & Cable	
	lbs/lin. ft.	cu.yds/lin. ft	lbs/lin. ft.	cu.yds/lin. ft	lbs/line. ft. ft.	cu.yds/lin. ft.
2	180	0.0363	200	200	228	0.05
3	245	0.0483	274	274	312	0.067
4(2wx2D)	285	0.0536	316	316	373	0.078
4 (4W)	315	0.0606	347	347	394	0.083
6	385	0.0709	432	432	508	0.1037
8	490	0.0882	548	548	641	0.129
9	530	0.0931	590	590	687	0.1367
10	600	0.106	663	663	774	0.154
12 (4Wx3D)	675	0.116	748	748	867	0.17
12 (6Wx2D)	700	0.123	778	778	918	0.183
14	810	0.141	858	858	984	0.191
15	815	0.138	904	904	1048	0.203
16 (4Wx4D)	840	0.141	948	948	1095	0.211
16 (2Wx8D)	865	0.155	961	961	1186	0.231
18 (3Wx6D)	946	0.161	1063	1063	1261	0.24

15.0 Reference Standards

13.1 W1000, "Entering and Working in Underground Locations including Subsurface Vaults"
13.2 C1101, "Distribution Duct bank Construction, and (Steel Reinforced Concrete)"

16.0 Signature Approval

Approved by: Amin Jessa
Director, Distribution Engineering