

**Transmission & Distribution
Material & Installation Specification**

Single Phase Overhead Transformer

I. Scope and classification

Scope: This document is to govern the product and installation of Single Phase transformers commonly used by the City of Columbus, Division of Power.

Classification: The contractor shall supply single phase transformers, of various ratings and connections. The City of Columbus distribution system consists of 3-wire 7200-Volt delta, 3-wire 14.4/8.32-kV ungrounded wye, and 4-wire 14.4/8.32-kv grounded wye. The single phase transformers specified herein shall be for connection to one or more of these systems. Connection options are noted in TDMIS-800. The awarded supplier(s) shall be required to submit preliminary drawings for approval prior to the manufacturer of the transformers. The supplier is also to perform contamination testing prior to delivery. Final drawings, operating manuals and certified test results shall be provided. Transformers are to be shipped complete with oil.

Bidders are to submit no-Load (core) and load (winding) loss wattage at 25%, 50%, 75% and 100% load as an Attachment to their online bid that will be used for the bid evaluation. Core and winding loss will be part of the evaluation.

Transformers manufactured under this specification shall meet the efficiency requirements as directed by the Department of Energy (DOE) per its Energy Conservation Program: Energy Conservation Standards for Distribution Transformers, Final Rule. – 10 CFR Part 431.196(b) (2013).

II. Applicable publications and standards

All items characteristic, definitions, and terminology, except as specifically covered in this specification, shall be in accordance with the latest revisions of the following ANSI, IEEE, Department of Energy and NEMA standards, including US Department of Energy National Efficiency Standard 78 FR 2335.

III. Requirements

GENERAL REQUIREMENTS

- A. Term: This document is to govern the product and installation of single phase transformers commonly used by the City of Columbus, Division of Power.
- B. Quantity: The quantities are specified for each item on the bid document.
- C. Quality standards: Transformers are to be new and unused. All insulating components, oil, paper, and wire enamel, shall be made of thermally upgraded materials, which are all compatible at today's industry standard 65 degrees Celsius temperature rise.
- D. Automatic pressure relief valve: Shall be provided per IEEE C57.12.20, Section 7.2.5.1 with the following clarification.
 - Indicator shall include an orange or red indicator that becomes visible only after the valve has vented.
 - Cap and pull ring shall cover the valve that separates from the assembly during venting, revealing the orange or red indicator and hanging down from the valve via a chain or strap.
 - Sealant: Valve threads shall be sealed with a liquid pipe thread compound such as Rectorseal, liquid Teflon, or similar, not Teflon tape.
- E. All supplied equipment is to be complete with oil (NON-PCB), and all accessories, mounting hardware, lifting provisions, suitable and ready for their intended use upon delivery.
- F. The primary voltage ratings of the transformers specified herein are designated as per IEEE standard C57.12.00.
- G. The exterior of each transformer must be permanently marked with a "NON-PCB" decal.
- H. The awarded supplier shall be required to submit preliminary drawings in one Adobe Acrobat PDF file for approval prior to the manufacturer of the transformers. The drawings will promptly be reviewed by the city and returned approved or with corrections as required.

CITY OF COLUMBUS DEPT. OF PUBLIC UTILITIES – DIVISION OF POWER SINGLE PHASE OVERHEAD TRANSFORMER		
DRAWN BY: AEC	DATE: 01/01/2018	TDMIS-804
APPROVED: <i>[Signature]</i>		
	SHEET 1 of 8	

- I. Final drawings, operating manuals, maintenance manuals, and certified test results shall be provided at time of delivery.
- J. The City of Columbus distribution system consists of 3-wire 7200-Volt delta, 3-wire 14.4/8.32-kV ungrounded wye, and 4-wire 14.4/8.32-kv grounded wye.

CONTRACTOR REQUIREMENTS

- A. Approval drawings for transformers: All documentation shall be in English and use customary inch-pound units. The successful bidder shall submit in a single Adobe Acrobat PDF file the following:
 - An outline drawing showing the principle view and dimensions and including a descriptive table of the accessories.
 - A nameplate drawing including wiring diagram.
 - No-load (core) loss, load (winding) loss at 25%, 50%, 75% and 100% rated current, and delivery days after order.
 - Instructional materials demonstrating the proper installation, operation, and maintenance of the equipment.
 - Certified test data for each transformer type bid and for every category listed in IEEE C57.12.00 Section 8.7. Format test data using numbering system shown in IEEE C57.12.00 Section 8.7.
- B. The contractor shall test each transformer and provide factory certified test results to prove its compliance with the guaranteed losses as stated within the bid. The certified test results shall be provided at time of delivery and shall include:
 - No-load (core) Loss
 - Load (winding) loss at 25%, 50%, 75% and 100% rated current

PRODUCT REQUIREMENTS

Additional requirements specific to this type:

- A. These transformers shall be 125 KV BIL for primary windings. All transformers shall be rated 30 KV BIL for secondary windings. The KVA ratings are to be 65 degrees Celsius rating.
- B. Taps: The transformers shall be equipped with four no-load adjustable primary taps for de-energized operation. The taps shall be all four 2-1/2% below rated voltage.

- C. Primary bushings: The primary bushings shall be made of porcelain, and shall be cover mounted and conveniently replaceable. There shall be two primary bushings for delta and ungrounded wye connections. There shall be one primary bushing and one neutral bushing for multigrounded wye connections.
- D. Secondary bushings: The secondary bushings shall be individually sidewall mounted and conveniently replaceable. Tanks shall have two (2) ground connectors, all grounding provisions shall be treated with an oxide-inhibiting compound.
- E. Color: The color of the transformers and bushings shall be Light Gray Number 70, Munsell Notation 5BG7.0/0.4. When measured with a magnetic thickness gauge, the paint thickness shall be the following:
 - Cover 8 mils thick, minimum
 - Tank 3 mils thick, minimum
- F. The tanks shall be completed with an anodized stainless steel etched or engraved nameplate per IEEE standard C57.12.00, nameplate A with stainless steel fasteners. Include on nameplate the statement "CONTAINS LESS THAN 1PPM PCB AT TIME OF MANUFACTURE."

IV. Method of measurement

Shall be per each completed and operational single phase transformer including transformer, accessories, grounding lugs and tank bosses for #2 copper ground loop, (Circle Ground) and secondary X2 bushing, bushing inserts, arresters, labor material, delivery and placement and attachment to / on pole, equipment, tools supervision and miscellaneous hardware required for a complete and operational module.

The associated apparatus and hardware shall include, but not limited by items described in TDMIS-800, 801, 802, and 804. Primary and secondary connections shall be included.

V. Basis of payment

Items	Unit	Description
TDMIS-804	Each	___ KVA, single phase transformer

CITY OF COLUMBUS DEPT. OF PUBLIC UTILITIES – DIVISION OF POWER SINGLE PHASE OVERHEAD TRANSFORMER		
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	SHEET 2 of 8	

THE ONLY MATERIAL INCLUDED IN THIS MODULE IS A TRANSFORMER RISER ASSEMBLY WHICH CONSISTS OF BOTH THE PRIMARY CONDUCTOR AND SECONDARY CONDUCTOR PLUS ASSOCIATED HARDWARE.

IT IS USED FOR ESTIMATING PURPOSE ONLY, NOT FOR THE REPORTING OF MATERIAL.

ITEM LIST				SECONDARY WIRE SCHEDULE			
ITEM #	DESCRIPTION	DOP PART #	QTY.	DOP WIRE SIZE	DOP PART NUMBER	NEC AMPACITY (XHHW-2 90° WET)	AMPACITY * 120%
①	TAPE, ELECTRICAL INSULATING, HIGH VOLTAGE	21086	3	2 AWG CU	20096	130	156
②	STAPLE, 3/8"X1 1/2" LENGTH	20343	6	2/0 AWG CU	19952	195	234
③	CLAMP, HOT LINE, SMALL	20218	2	4/0 AWG CU	19959	260	312
④	CONDUCTOR, #6 CU, BARE, SOFT DRAWN	20082	14	250 MCM CU	19962	290	348
⑤	CONNECTOR	SEE SCH.	11	350 MCM CU	19966	350	420
⑥	CONDUCTOR, SECONDARY (SIZE AS REQUIRED)	SEE SCH.	20'	400 MCM CU	19969	430	516
⑦	PAD, SCOTCH, LARGE (SEALING PADS) 4 1/2"X6 1/2"	21072	3				

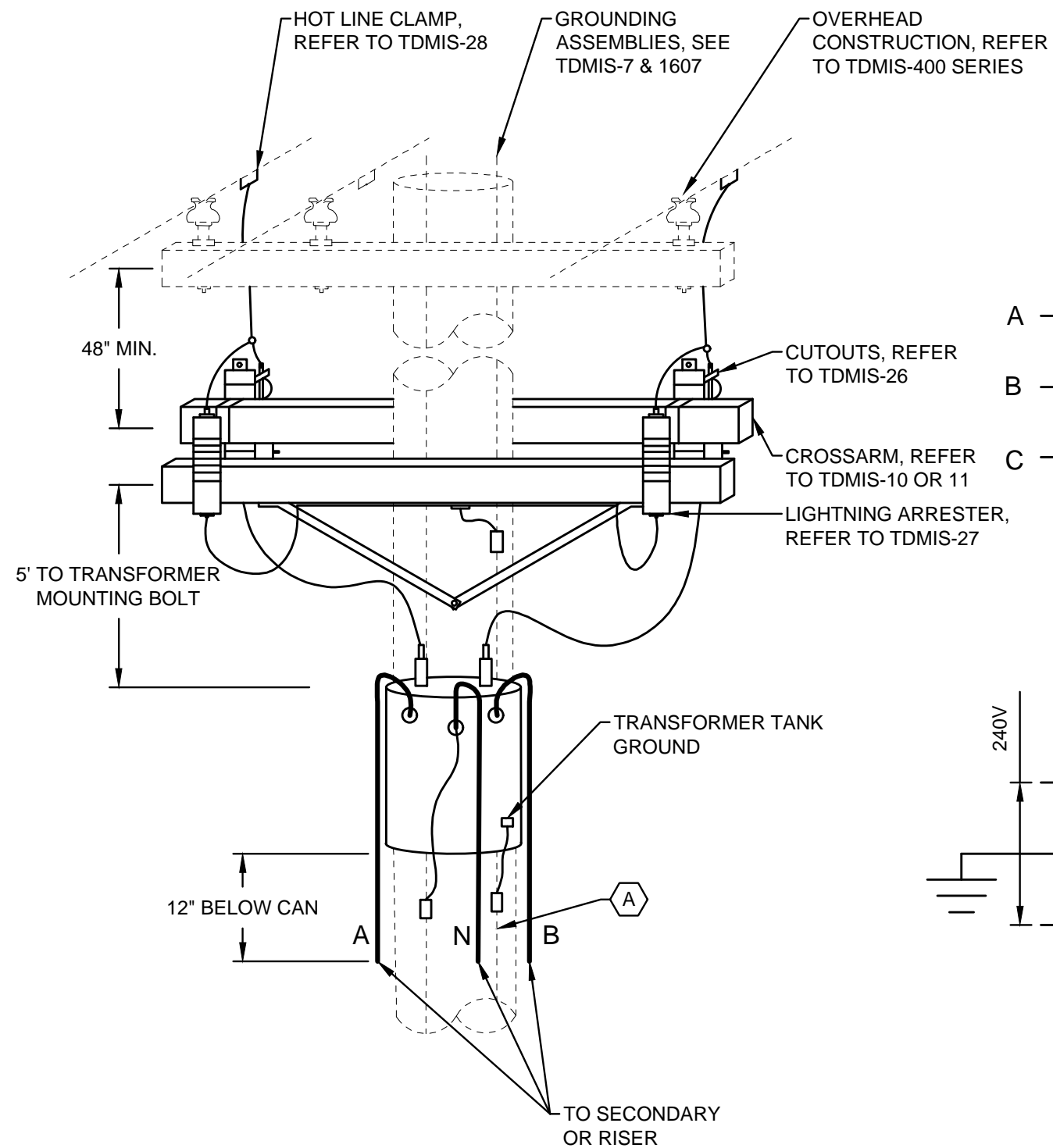
SECONDARY WIRE SIZING							
OH TRANSFORMER KVA		1 120/240 V		3 277/480V		1 480V	
SINGLE PHASE	THREE PHASE	AMPS	WIRE SIZE	AMPS	WIRE SIZE	AMPS	WIRE SIZE
5	15	42	2 AWG CU	18	2 AWG CU	10	2 AWG CU
15	45	125	2 AWG CU	54	2 AWG CU	31	2 AWG CU
25	75	208	2/0 AWG CU	90	2 AWG CU	52	2 AWG CU
37.5	112.5	313	4/0 AWG CU	135	2 AWG CU	78	2 AWG CU
50	150	417	350 MCM CU	181	2/0 AWG CU	104	2 AWG CU
75	225	625	500 MCM CU	271	4/0 AWG CU	156	2 AWG CU
100	300	833	2X350 MCM CU	361	350 MCM CU	208	2/0 AWG CU
167	500	1389	3X500 MCM CU	602	2X250 MCM CU	347	250 MCM CU

CONDUCTOR SCHEDULE	
APPLICATION	DOP PART NUMBER
#14 THRU #1	42373
1/0 THRU 4/0	42374
336 MCM THRU 556 MCM	42375

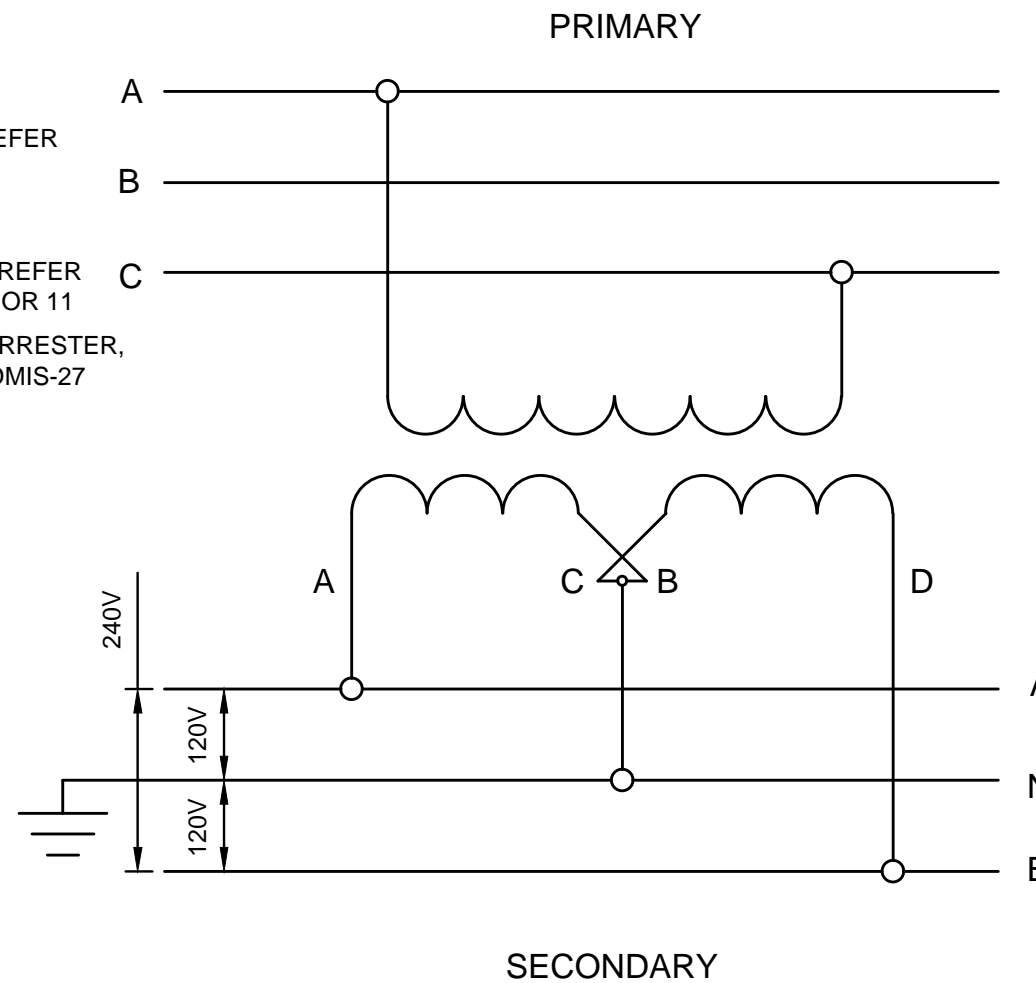
CITY OF COLUMBUS, OHIO DEPT. OF PUBLIC UTILITIES - DIVISION OF POWER	
SINGLE PHASE OVERHEAD TRANSFORMER TRANSFORMER RISER PART NUMBERS MTIRA	
DRAWN BY: AEC	DATE: 01/01/2018
APPROVED: <i>[Signature]</i>	TDMIS-804
SCALE: NONE	

CODED NOTES:

(A) FOR PRIMARY GROUNDED WYE SYSTEM, CIRCLE GROUND SHALL BE USED. REFER TO TDMIS-1213.



**DETAIL 1
OVERHEAD CONFIGURATION**

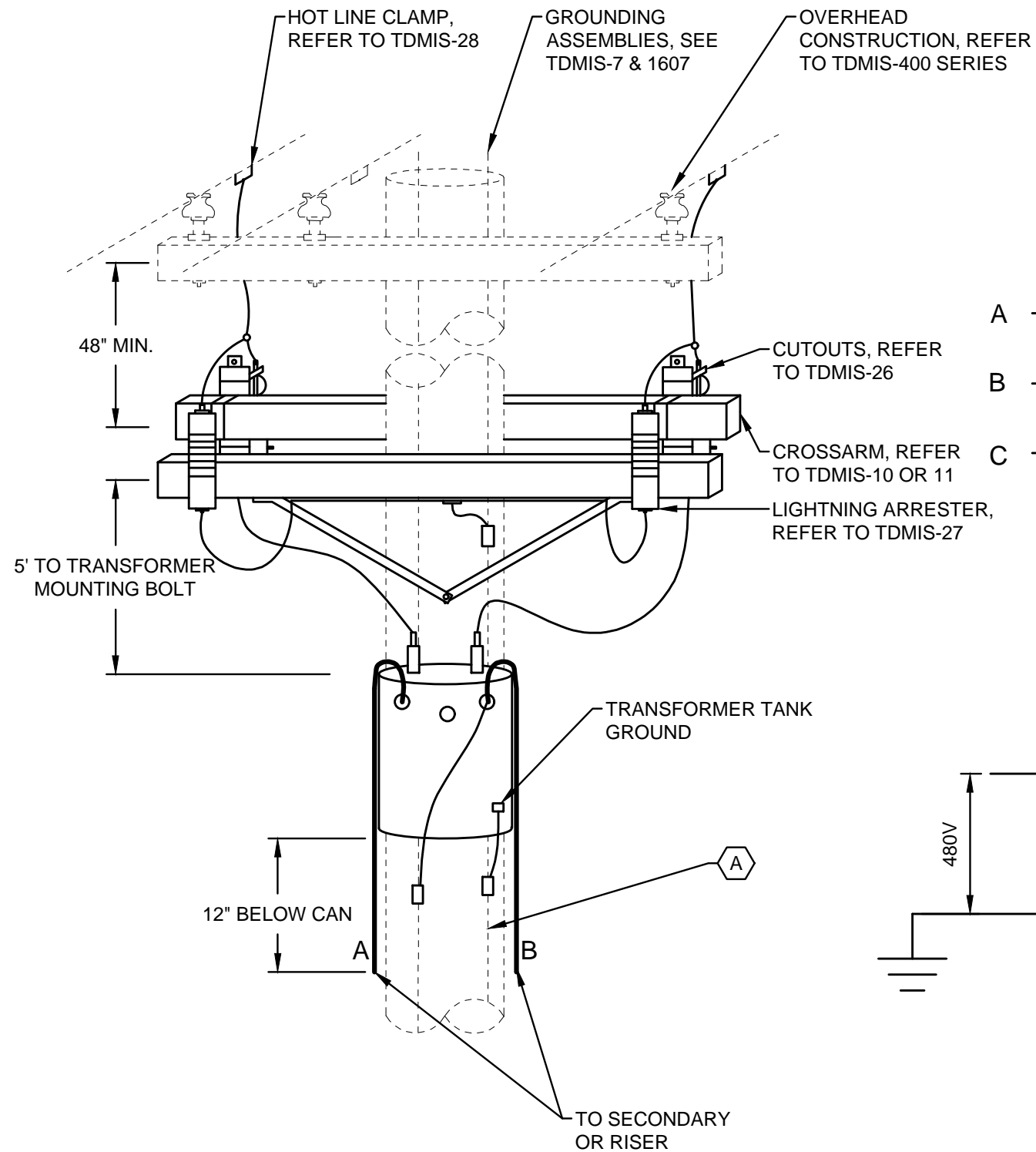


**DETAIL 2
CONNECTION**

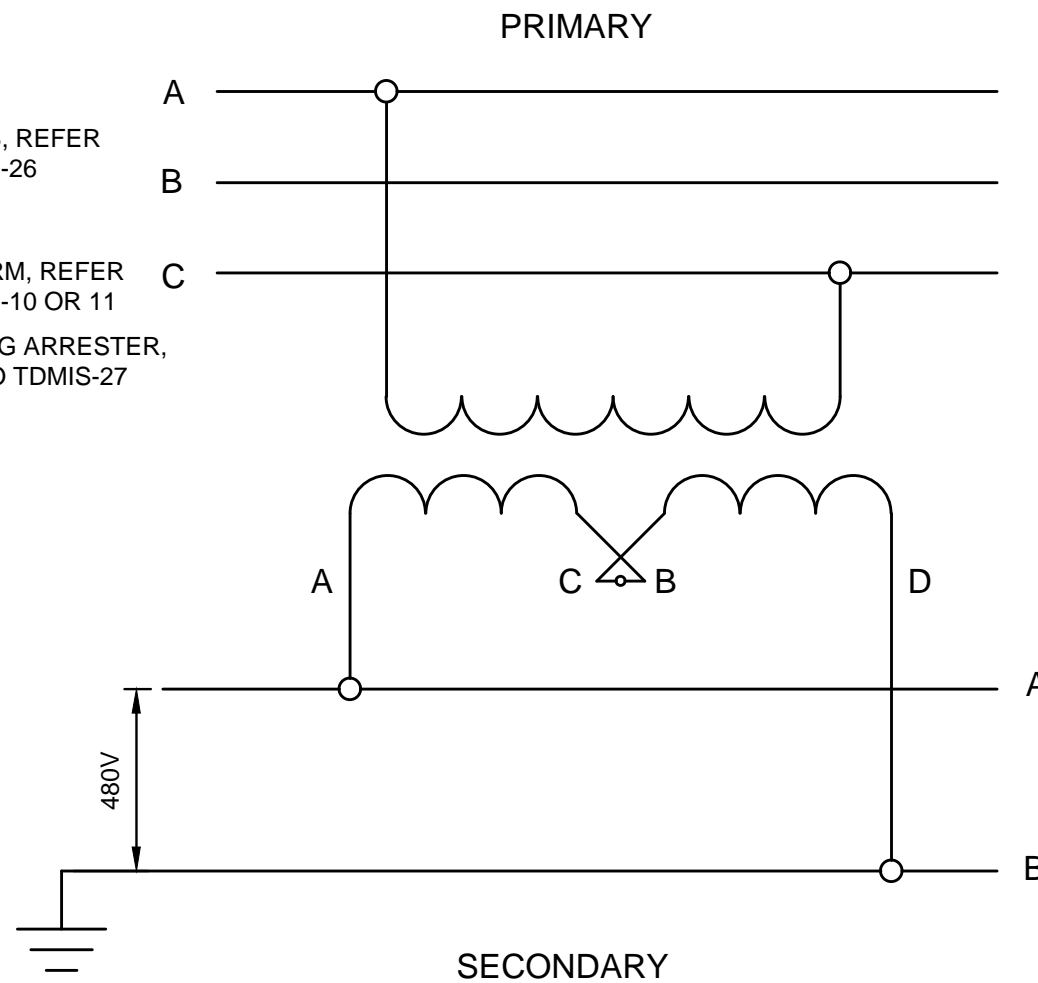
CITY OF COLUMBUS, OHIO DEPT. OF PUBLIC UTILITIES - DIVISION OF POWER		TDMIS-804
SINGLE PHASE OVERHEAD TRANSFORMER 120/240 VOLT - SINGLE PHASE THREE WIRE		
DRAWN BY: AEC	DATE: 01/01/2018	
APPROVED: <i>[Signature]</i>		
SCALE: NTS	SHEET: 4 OF 8	

CODED NOTES:

(A) FOR PRIMARY GROUNDED WYE SYSTEM, CIRCLE GROUND SHALL BE USED. REFER TO TDMIS-1213.



**DETAIL 1
OVERHEAD CONFIGURATION**

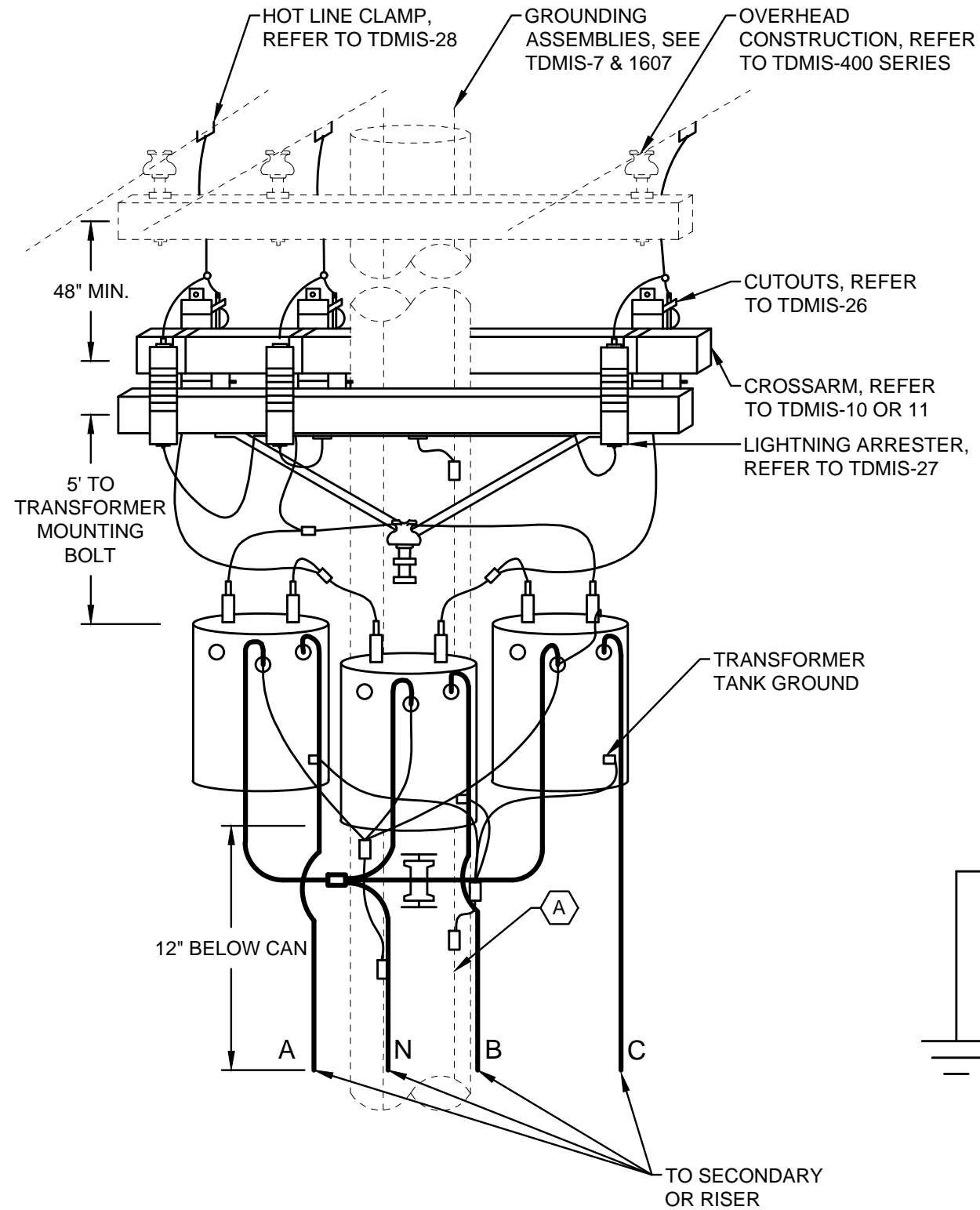


**DETAIL 2
CONNECTION**

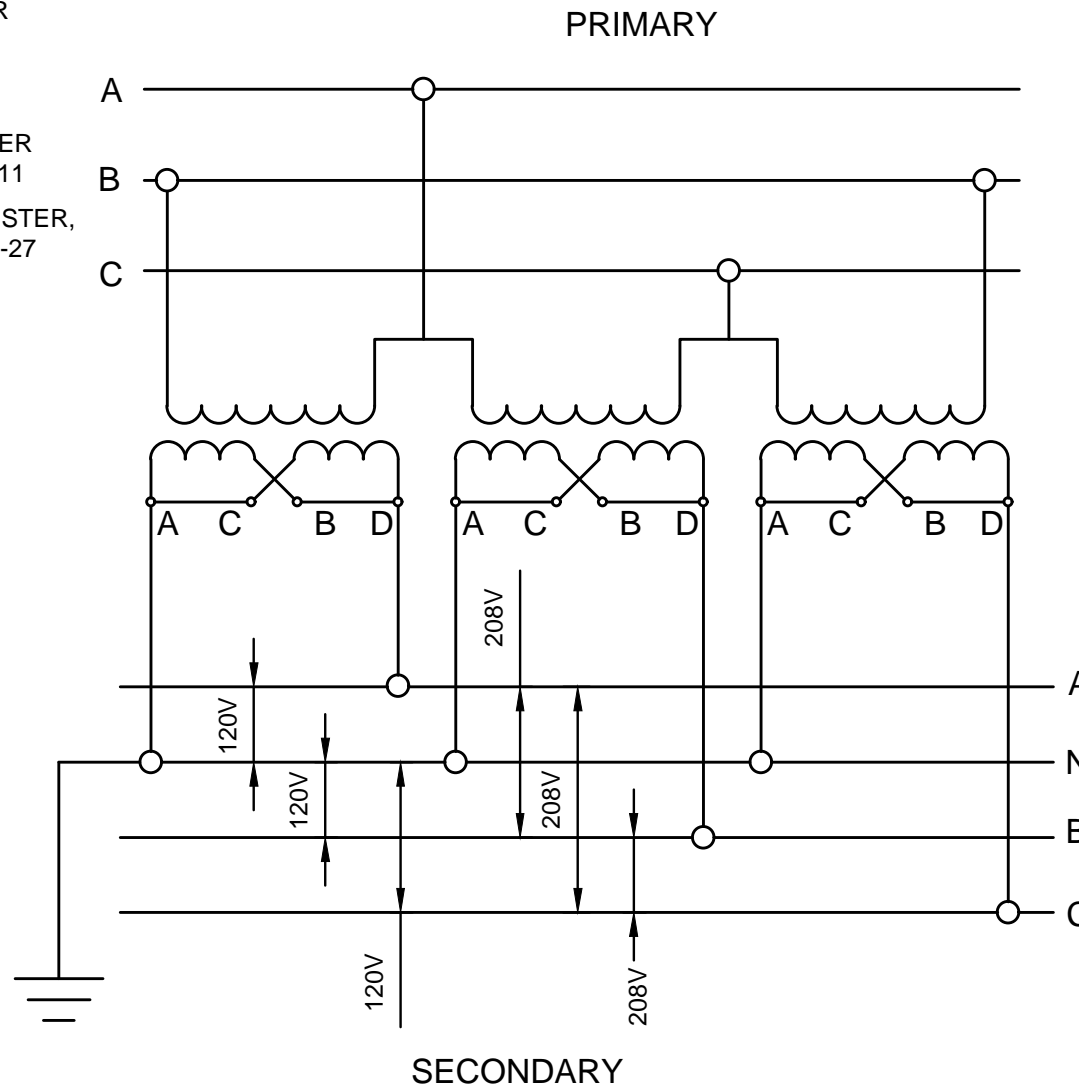
CITY OF COLUMBUS, OHIO DEPT. OF PUBLIC UTILITIES - DIVISION OF POWER		
SINGLE PHASE OVERHEAD TRANSFORMER 480 VOLT - SINGLE PHASE		
DRAWN BY: AEC	DATE: 01/01/2018	TDMIS-804
APPROVED: <i>[Signature]</i>		
SCALE: NTS	SHEET: 5 OF 8	

CODED NOTES:

(A) FOR PRIMARY GROUNDED WYE SYSTEM, CIRCLE GROUND SHALL BE USED. REFER TO TDMIS-1213.



**DETAIL 1
OVERHEAD CONFIGURATION**

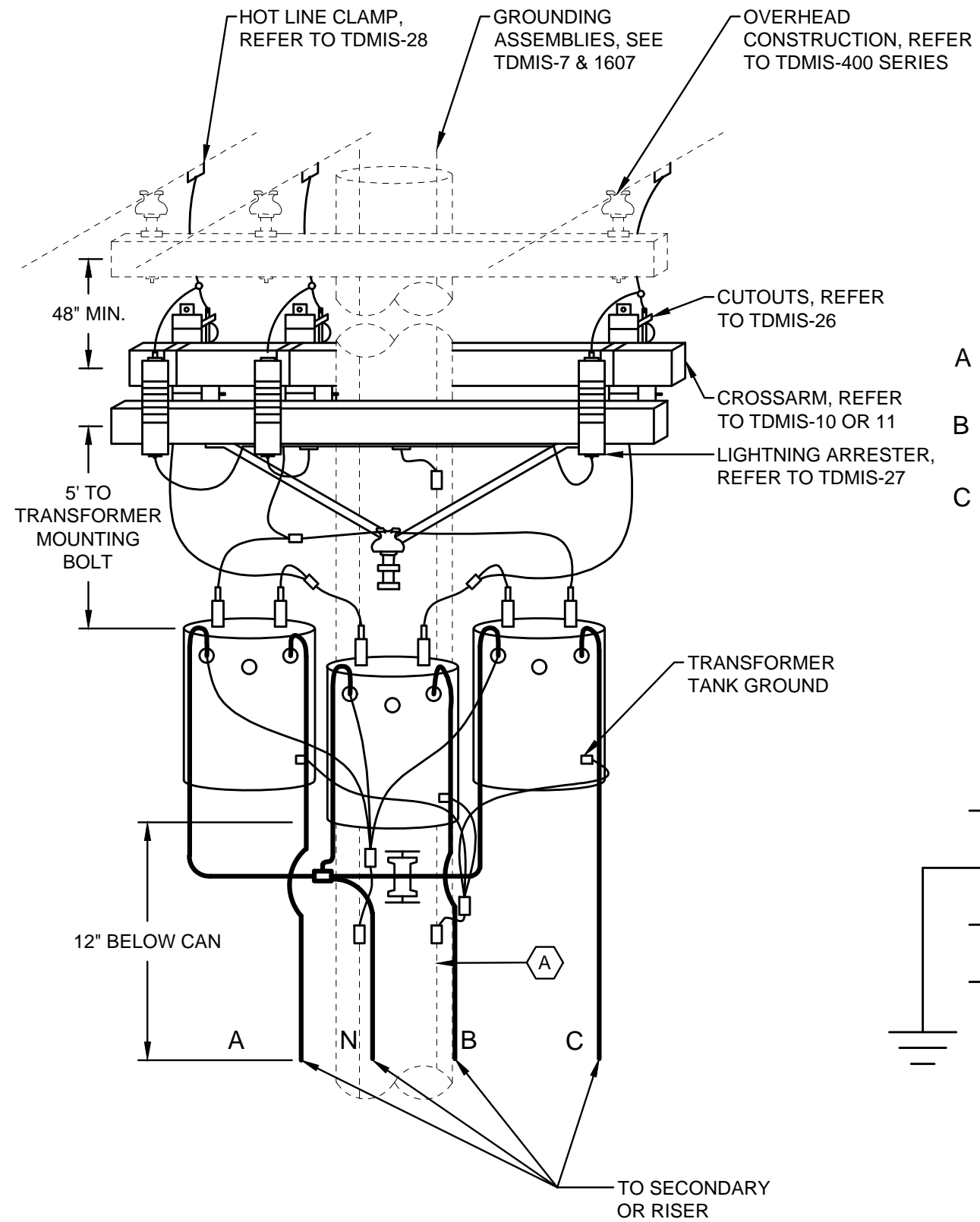


**DETAIL 2
CONNECTION**

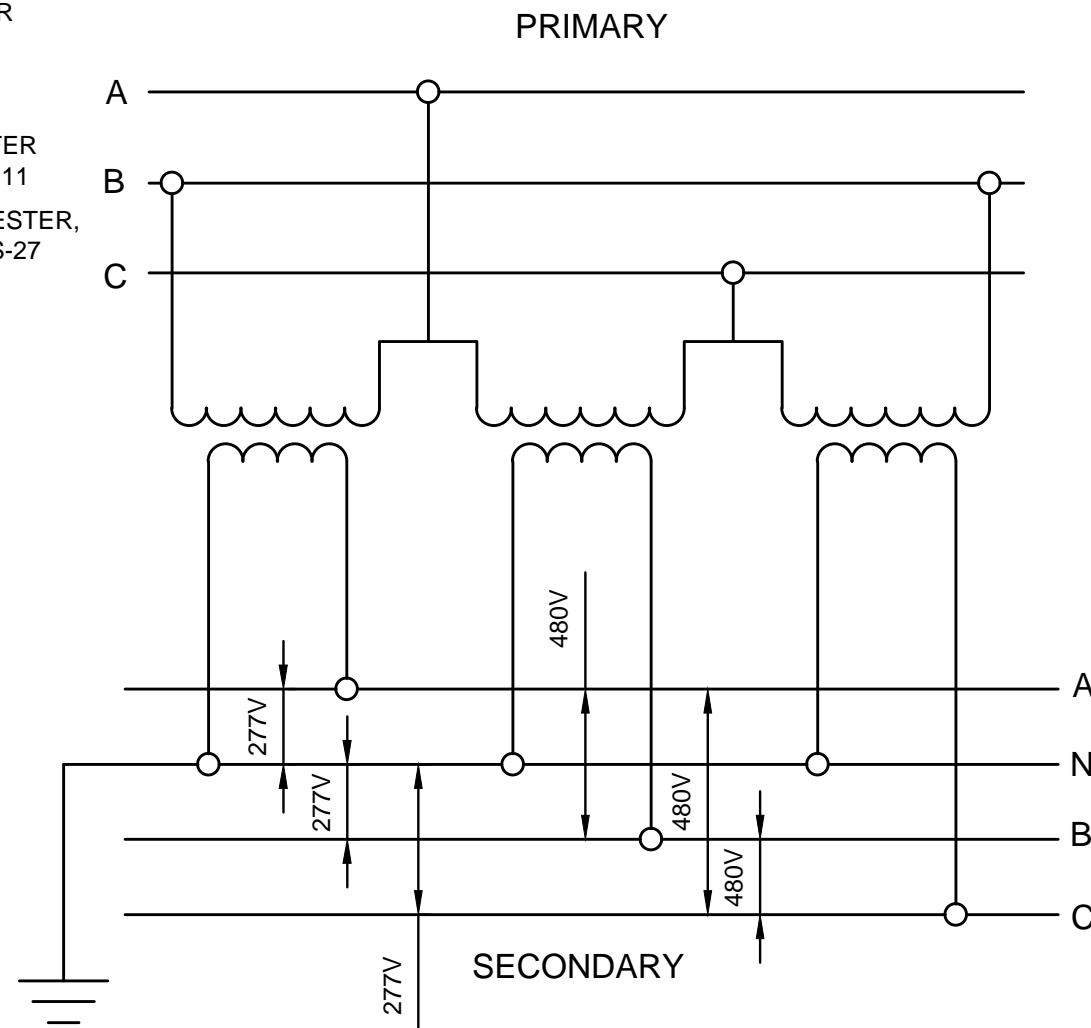
CITY OF COLUMBUS, OHIO DEPT. OF PUBLIC UTILITIES - DIVISION OF POWER		TDMIS-804
SINGLE PHASE OVERHEAD TRANSFORMER 120/208 VOLT - THREE PHASE FOUR WIRE		
DRAWN BY: AEC	DATE: 01/01/2018	
APPROVED: <i>[Signature]</i>		
SCALE: NTS	SHEET: 6 OF 8	

CODED NOTES:

(A) FOR PRIMARY GROUNDED WYE SYSTEM, CIRCLE GROUND SHALL BE USED. REFER TO TDMIS-1213.



**DETAIL 1
OVERHEAD CONFIGURATION**

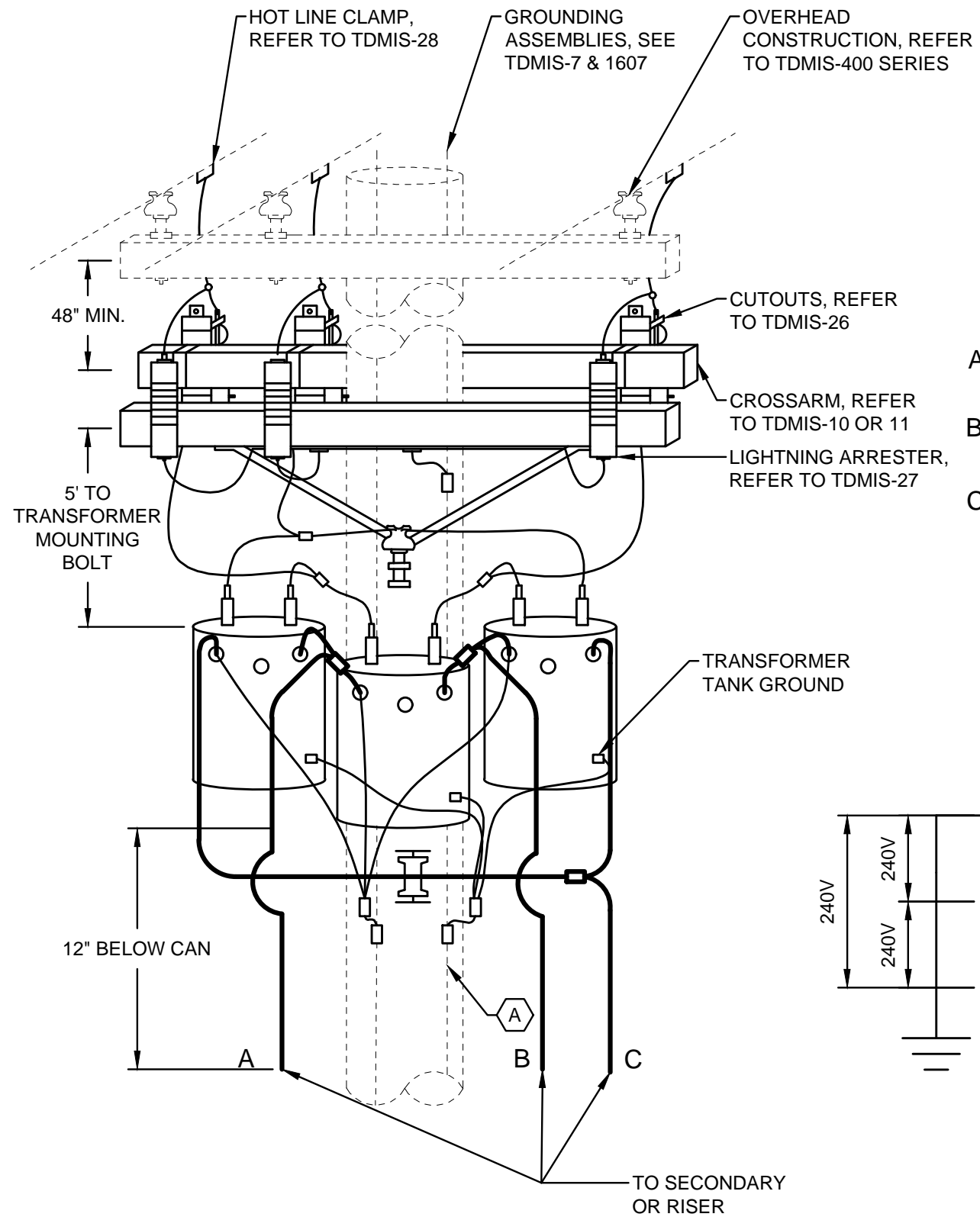


**DETAIL 2
CONNECTION**

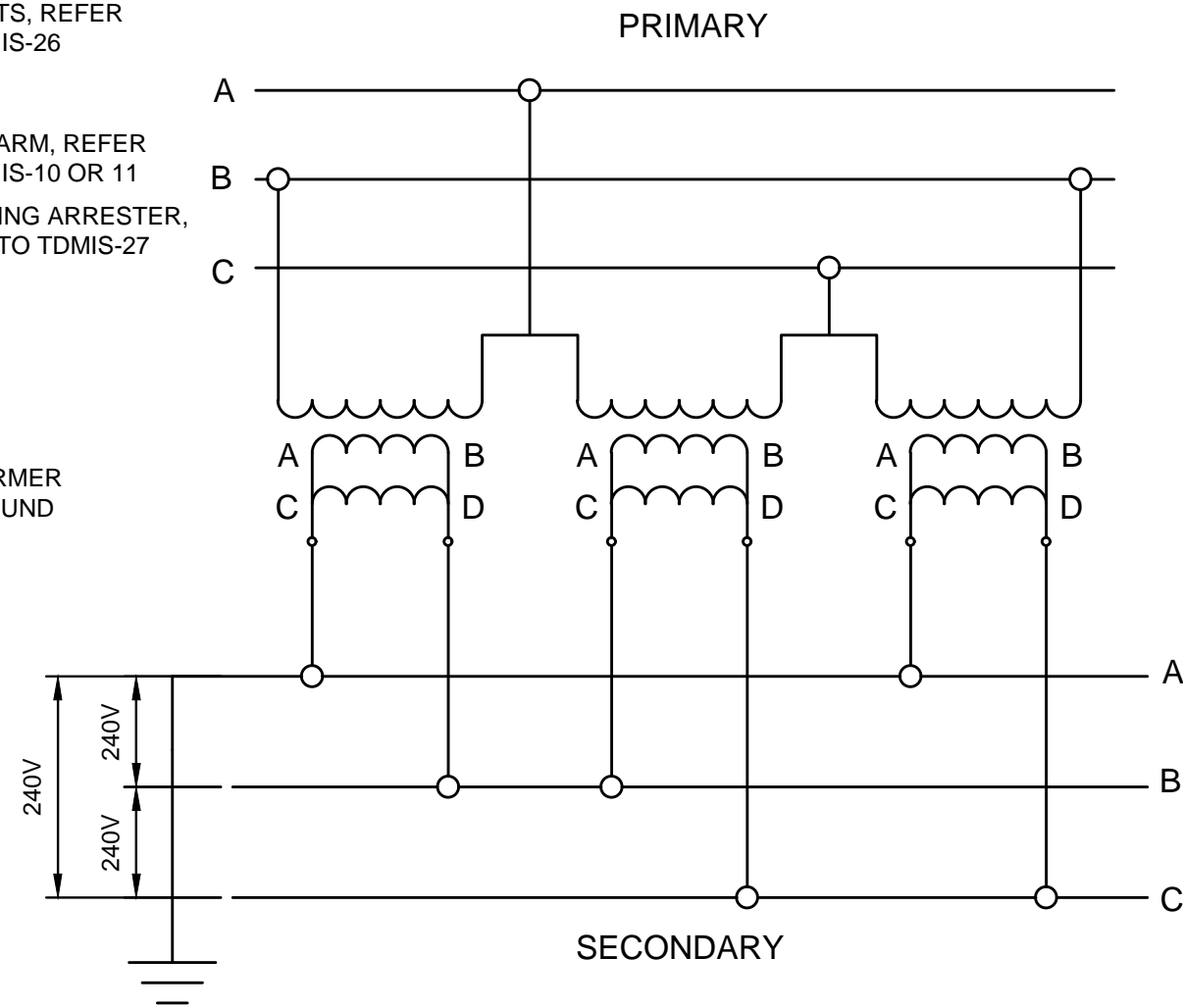
CITY OF COLUMBUS, OHIO DEPT. OF PUBLIC UTILITIES - DIVISION OF POWER		TDMIS-804
SINGLE PHASE OVERHEAD TRANSFORMER 277/480 VOLT - THREE PHASE FOUR WIRE		
DRAWN BY: AEC	DATE: 01/01/2018	
APPROVED: <i>[Signature]</i>		
SCALE: NTS	SHEET: 7 OF 8	

CODED NOTES:

(A) FOR PRIMARY GROUNDED WYE SYSTEM, CIRCLE GROUND SHALL BE USED. REFER TO TDMIS-1213.



**DETAIL 1
OVERHEAD CONFIGURATION**



**DETAIL 2
CONNECTION**

CITY OF COLUMBUS, OHIO DEPT. OF PUBLIC UTILITIES - DIVISION OF POWER		TDMIS-804
SINGLE PHASE OVERHEAD TRANSFORMER 240 VOLT - THREE PHASE THREE WIRE		
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APPROVED: <i>[Signature]</i>		
SCALE: NTS	SHEET: 8 OF 8	