Purchase Specification
For

Medium Voltage
Cable Bus and Cable Tray

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1.0 Introduction

This purchase specification and all documents referenced herein contain the detailed requirements for the required cable bus, and cable tray systems to be utilized at the Naval Surface Warfare Center, Carderock Division, Ship Service Engineering Station (NSWCCD-SSES), Philadelphia Naval Base, Philadelphia, PA. These cableways shall be used in performing testing of an Integrated Power System.

2.0 Scope

2.1 Equipment and Services to be Provided by the Supplier:

The cable bus and cable tray shall be suitable for industrial installation and shall be constructed in accordance with the best commercial practices. It shall be the Supplier's responsibility to furnish material that is suitable and complete in details for the services intended. The cable bus and cable tray shall be designed, constructed and tested in accordance with the latest applicable industry standards including but not limited to those referenced in Section 3.0 of this specification. The Supplier shall be responsible for delivery of all cable bus and cable tray to NSWCCD-SSES in Philadelphia, PA. The cable buses required to be supplied are itemized in section 4.1.2. The cable bus manufacturer is required to supply all parts necessary to install the identified cable buses with the exception of cable lugs and support steel. The cable bus manufacturer must provide a complete parts list of the materials provided for each cable bus run identified in Section 4.1.2. The cable tray materials required to be supplied are itemized in Section 4.2.2

2.2 Equipment and Services to be Provided by the Government:

The Government shall install the cable bus and cable tray and shall be responsible for cable bus supports, cable tray supports and other support structures as well as installation of the cable bus and cable trays specified.

3.0 Applicable Documents

1. NFPA 70, National Electric Code, 2002
2. NEMA VE-1, Metal Cable Tray Systems
3. NEMA VE-2, Metal Cable Tray Installation Guidelines
4. ANSI/IEEE C37.23, Guide for Metal Enclosed Bus and Calculating Losses in Isolated Phase Bus
5. UL 1072, Safety Standard for Medium Voltage Power Cables

6. IEEE 48, Standard Test Procedures and Requirements for Alternating Current Terminations 2.5KV Through 765KV
7. ICEA S-93-639 / NEMA WC74, Shielded Power Cable Rated 5 – 46KV
8. ICEA S-97-682, Utility Shielded Power Cable Rated 5 – 46KV
9. IEEE 383, Standard for Type Test of Class 1E Electric Field Splices and Connections for Nuclear Generating Stations (Vertical Tray Cable Flame Retardant Test)
10. AEIC CS6, Ethylene Propylene Insulated Shielded Power Cables Rated 5 through 69KV.

4.0 Technical Requirements

4.1 Cable Bus

4.1.1 Cable Bus General Requirements:

4.1.1A. Installation Location:	1. The cable bus shall be suitable for indoor installation in an ambient temperature from 50°F - 104°F. 2. A cable bus circuit listing is shown in Section 4.1.2 and cable bus arrangements are shown on figures 1A, 1B, 2A, 2B, 3A, 3B, 4A, 4B, 5A, 5B, 6A, 6B, 7A, 7B, 8A, 8B, 9A, 9B, 10A, 10B, 11A, 11B, 12A, 12B, 13A, 13B, 14A, 14B, 14C, 14D, 14E, 14F, 14G, 14H, 15A, 15B, 15C, 15D, 15E, 15F, 15G, 15H (attached). Note that the 4th column of section 4.1.2 (Cable Bus Figures & Cable Bus Enclosure Length) refers to specific figures that are applicable to each subsection. 3. The cable bus shall be able to be secured to site provided steel structure using cable bus clamp/ guide hardware provided.
4.1.1.B. Enclosure Construction:	1. The cable bus shall be made of non-magnetic heavy gauge, corrosion resistant aluminum alloy. 2. The cable bus shall be provided in 12 foot lengths unless shorter lengths are required based on site arrangement details. 3. The cable bus top and bottom covers shall be slotted for ventilation and be corrugated to provide mechanical strength. The bottom cover shall be factory welded and the top cover shall be bolted or screwed into the cable bus enclosure. The covers shall preclude personnel contact with the cable system. 4. The cable bus shall be self cooled. 5. The cable bus shall utilize high pressure bolted splice joints for maximum structural capability and minimum

	electrical resistance (50 micro ohms) across joint. 6. The conductor support blocks shall provide cable support at least every 36" in the horizontal direction and every 18" in the vertical direction and shall provide at least one cable diameter separation of the cables at their points of support. 7. The cable bus shall be designed to eliminate any sharp edges or projections that may injure personnel or damage cable. 8. The bus enclosure fittings shall provide a minimum bend radius for the cable of 24". Note that larger 36" bend radius fittings are shown in the arrangement sketches for most vertical inside bends to allow for cable rollers that will be utilized outside the inner cable bus edge during cable pulling. Cable bus fitting types provided must allow cable pulling using similar roller techniques that are utilized with cable tray. 9. The cable bus enclosure shall not require more than 12" vertical clearance above it to pull and install cables. 10. The cable bus shall not vertically deflect more than .125 inches for a straight 12' run supported at its ends with all of its cables, support blocks, covers, etc. installed. 11. The cable bus shall be able to withstand a 200LB concentrated load at mid-span in addition to the full load cable rating without permanent deformation of its side rails. 12. An aluminum seal plate shall be provided that can be bolted to the bottom of equipment openings and will provide a mechanism for attaching the cable bus to the bottom of the equipment and allow cable entry into the equipment. Seal blocks shall not be utilized at this location. The exact size of each seal plate will be provided to successful bidder during the drawing review process prior to obtaining a Release for Manufacture. Note: Seal plates will not be utilized where cables free air into equipment or where connection boxes are specified. 13. Where cable buses enter switchgear (SG-*) as indicated in the Cable Bus Runs found in Section 4.1.2, the last support block shall be 18 to 24 inches from the end of the cable bus enclosure so as to allow the cables to begin transposing for termination below the switchgear enclosure.

4.1.1.C. Electrical Properties:	1. The 60 cycle cable buses shall have a minimum short circuit rating of 40 kA RMS symmetrical with a minimum asymmetrical short circuit rating of 69,200A RMS. The test duration shall be .167 seconds. 2. The DC cable buses shall have a minimum short circuit rating of 100,000A RMS symmetrical. The test duration shall be .167 seconds. 3. The conductors shall be phased to maintain low impedance and provide impedance balance between paralleled conductors. An impedance analysis of each cable bus run shall be provided as required by Section 5.1 and must document impedance balance between conductors and projected voltage drop. Impedance characteristics of Resistance (ohms/ft), Inductance (H/ft) and Capacitance (F/ft) shall be provided for each type of cable bus run. 4. The conductors shall not require transposing within a cable bus run to meet impedance requirements. 5. Conductor temperature rise calculations shall be provided to show that cables installed in a 40C environment will not exceed 90C conductor temperature for the various configurations requested. 6. Current carrying conductors shall be one of the following as directed in the details section of this specification: a. 15 kV Cable: The 15 kV class cable shall be Okonite 115-23-2131 (for 500 MCM),115-23-2127 (for 350 MCM) or equivalent and shall meet the minimum key requirements as specified below. The cable shall conform to the requirements of NEMA-WC-74 and UL 1072, except as modified below. The cable shall have the following ratings, construction and parameters. 1. The cable shall be rated 15 kV, 133% insulation level. 2. The conductor shall be class B (or finer) stranded copper conforming to ASTM B8 or equivalent. 3. The conductor size shall be in accordance with Section 4.1.2. The conductor shall be provided with a clean stripping extruded (preferred) or tape strand shield. 4. The cable minimum bend radius shall not exceed 19". 5. The insulation shall be EPR rated at 105 degrees Centigrade operating temperature and shall conform to

NEMA-WC-74 in thickness.

6. An extruded insulation shield shall be applied (a non extruded insulation shield will be considered if the manufacturers standard).
7. A metallic shield of the manufacturers standard method is to be applied (copper tape preferred) over the insulation shield.
8. A jacket of hypalon (CSPE) shall be provided
9. Binders, fillers and other components to facilitate the manufacturing process or performance may be applied; however, any such materials shall be non-wicking and shall not support combustion.
10. Cable components shall be free stripping and otherwise facilitate termination.
11. Extruded materials shall be thermosetting.
12. PVC and asbestos materials are not permitted.
13. The completed cable shall pass the IEEE-383 or equivalent flame test.
14. The outer jacket shall be marked to show as a minimum, the manufacturers name, year of manufacture, conductor size, voltage rating and sequential footage. This information shall be repeated at 24 inch intervals.

b. 5 kV Cable:

The 5 kV class cable shall be Okonite 114-23-2743 or equivalent and shall meet the minimum key requirements as specified below.

The cable shall conform to the requirements of NEMA-WC-74 and UL 1072, except as modified below. The cable shall have the following ratings, construction and parameters.

1. The cable shall be rated 5 kV, 133% insulation level.
2. The conductor shall be class B (or finer) stranded copper conforming to ASTM B8 or equivalent.
3. The conductor shall be 500kcmil or as shown on the purchasers procurement document.
4. The cable minimum bend radius shall not exceed 16".
5. The conductor shall be provided with a clean stripping extruded (preferred) or tape strand shield.
6. The insulation shall be EPR rated at 105 degree Centigrade operating temperature and shall conform to NEMA-WC-74 in thickness.
7. An extruded insulation shield shall be applied (a non

extruded insulation shield will be considered if the manufacturers standard).

8. A metallic shield of the manufacturers standard method is to be applied (copper tape preferred) over the insulation shield.
9. A jacket of hypalon (CSPE) shall be provided.
10. Binders, fillers and other components to facilitate the manufacturing process or performance may be applied; however, any such materials shall be non-wicking and shall not support combustion.
11. Cable components shall be free stripping and otherwise facilitate termination.
12. Extruded materials shall be thermosetting.
13. PVC and asbestos materials are not permitted.
14. The completed cable shall pass the IEEE-383 or equivalent flame test.
15. The outer jacket shall be marked to show as a minimum, the manufacturers name, year of manufacture, conductor size, voltage rating and sequential footage. This information shall be repeated at 24 inch intervals.

c. The following information shall be provided with the quotation:

1. A complete description of the cable construction including OD and weight
2. A list and explanation of any deviation from the requirements herein
3. A statement of conformance to the flame test listed above or an acceptable equivalent test
4. Installation, storage and handling instructions
5. Minimum bend radius
6. Maximum pulling tension for pulling by conductor and by basket grip
7. Acceptable pulling lubricants
8. Recommendations for field testing after installation
9. Conductor resistance, capacitance, and inductance

All cable bus runs shall be provided with Raychem single conductor heat shrinkable termination kits (type HVT-G or MHHT-G) or equivalent for indoor use as identified in Section 4.1.2. Note: MHHT kits are equivalent to Raychem HVT-Z termination kits. The part number distinguishes this termination kit from the standard kit to indicate certification to US Navy Test Requirements.

	7. The grounding conductor shall be soft annealed tinned class B stranded 500MCM cable that is provided with fittings to allow bonding to the outside of the cable bus enclosure. The bonding shall be done at not greater than ten feet so as to provide the required mechanical support of the cable. The grounding conductor shall pass into the applicable equipment enclosure in proximity to the phase conductors and shall not be enclosed by steel unless the phase conductors are also enclosed within the same steel opening.
4.1.1.D. Nameplate:	1. Each cable bus circuit shall have a nameplate securely affixed to the enclosure exterior with screws or rivets. The nameplate shall include manufacturer name & date, order number, and electrical ratings (max voltage, rated continuous current, Basic Impulse Level, Frequency, rated short circuit current, temperature rise of conductor & enclosure)

4.1.2 Cable Bus Detail Requirements:

Cable Bus Run	Cable Details, Total Cable Length Including +10%, Cable Bus Rating (Total Cable length includes all phases and parallel runs of cable)	Termination Type	Cable Bus Figures & Cable Bus Enclosure Length	Cable Bus Enclosure (Max Outside Flange Dimensions)
4.1.2.1 SG-1 to SG-2	(12) Okonite Okoguard- Okolon 115-23-2131 (or equivalent) EPR 15KV 133% insulation 500MCM single conductor cables, (4) per phase, 2587 feet of cable (2000A, 13.8KV, 3 PH, 60HZ Cable Bus	Raychem MHHT-15K3-G (or equivalent)	1A, 1B 180 feet	8.25"H X 28"W

4.1.2.2 SG-1 to SG-3	(12) Okonite Okoguard- Okolon 115-23-2131 (or equivalent) EPR 15KV 133% insulation 500MCM single conductor cables, (4) per phase, 765 feet of cable (2000A, 13.8KV, 3PH, 60HZ Cable Bus)	Raychem MHHT-15K3-G (or equivalent)	2A, 2B 42 feet	8.25"H X 28"W
4.1.2.3 SG-2 to SG-4	(12) Okonite Okoguard- Okolon 115-23-2131 (or equivalent) EPR 15KV 133% insulation 500MCM single conductor cables, (4) per phase, 2165 feet of cable (2000A, 13.8KV, 3PH, 60HZ Cable Bus)	Raychem MHHT-15K3-G (or equivalent)	3A, 3B 148 feet	8.25"H X 28"W
4.1.2.4 SG-3 to SG-4	(12) Okonite Okoguard- Okolon 115-23-2131 (or equivalent) EPR 15KV 133% insulation 500MCM single conductor cables (4) per phase, 1900 feet of cable (2000A, 13.8KV, 3PH, 60HZ Cable Bus)	Raychem MHHT-15K3-G (or equivalent)	4A, 4B 128 feet	8.25"H X 28"W
4.1.2.5 SG-3 to LCXFMR21	(3) Okonite Okoguard- Okolon 115-23-2127 (or equivalent) EPR 15KV 133% insulation 350MCM single conductor cables, (1) per phase, 422 feet of	Raychem MHHT-15K2-G (or equivalent)	5A, 5B 114 feet	6.25"H X 18"W

	cable (500A, 13.8KV, 3PH, 60HZ Cable Bus)			
4.1.2.6 SG-3 to LCXFMR31	(3) Okonite Okoguard- Okolon 115-23-2127 (or equivalent) EPR 15KV 133% insulation 350MCM single conductor cables, (1) per phase, 512 feet of cable (500A, 13.8KV, 3PH, 60HZ Cable Bus)	Raychem MHHT-15K2-G (or equivalent)	6A, 6B 141 feet	6.25"H X 18"W
4.1.2.7 SG-4 to LCXFMR22	(3) Okonite Okoguard- Okolon 115-23-2127 (or equivalent) EPR 15KV 133% insulation 350MCM single conductor cables, (1) per phase, 207 feet of cable (500A, 13.8KV, 3PH, 60HZ Cable Bus)	Raychem MHHT-15K2-G (or equivalent)	7A, 7B 47 feet	6.25"H X 18"W
4.1.2.8 SG-4 to LCXFMR32	(3) Okonite Okoguard- Okolon 115-23-2127 (or equivalent) EPR 15KV 133% insulation 350MCM single conductor cables, (1) per phase, 198 feet of cable (500A, 13.8KV, 3PH, 60HZ Cable Bus)	Raychem MHHT-15K2-G (or equivalent)	8A, 8B 45 feet	6.25"H X 18"W

4.1.2.9 **SG-1 to ATG1**	(3) Okonite Okoguard- Okolon 115-23-2127 (or equivalent) EPR 15KV 133% insulation 350MCM single conductor cables, (1) per phase, 287 feet of cable (500A, 13.8KV, 3PH, 60HZ Cable Bus Note: Cable Bus can be derated to 395A due to conduit entry.)	Raychem MHHT-15K2-G (or equivalent)	9A, 9B 72 feet	6.25"H X 18"W
4.1.2.10 **SG-3 to ATG2**	(3) Okonite Okoguard- Okolon 115-23-2127 (or equivalent) EPR 15KV 133% insulation 350MCM single conductor cables, (1) per phase, 307 feet of cable (500A, 13.8KV, 3PH, 60HZ Cable Bus Note: Cable Bus can be derated to 395A due to conduit entry.)	Raychem MHHT-15K2-G (or equivalent)	10A, 10B 76 feet	6.25"H X 18"W
4.1.2.11 **SG4 to MTG2**	(12) Okonite Okoguard- Okolon 115-23-2131 (or equivalent) EPR 15KV 133% insulation 500MCM single conductor cables, (4) per phase, 805 feet of cable (2000A, 13.8KV, 3PH, 60HZ Cable Bus)	Raychem MHHT-15K3-G (or equivalent)	11A, 11B 50 feet	8.25"H X 28"W

4.1.2.12 SG3 to MXFMR2B	(6) Okonite Okoguard- Okolon 115-23-2131 (or equivalent) EPR 15KV 133% insulation 500MCM single conductor cables, (4) per phase, 1492 feet of cable (1000A, 13.8KV, 3PH, 60HZ Cable Bus)	Raychem MHHT-15K3-G (or equivalent)	12A, 12B 210 feet	8.25"H X 18"W
4.1.2.13 SG4 to MXFMR2A	(6) Okonite Okoguard- Okolon 115-23-2131 (or equivalent) EPR 15KV 133% insulation 500MCM single conductor cables, (4) per phase, 884 feet of cable (1000A, 13.8KV, 3PH, 60HZ Cable Bus)	Raychem MHHT-15K3-G (or equivalent)	13A, 13B 118 feet	8.25"H X 18"W

4.1.2.14 MR2AIB to PMMD2	(12) Okonite Okoguard- Okolon 114-23-2743 (or equivalent) EPR 5KV 133% insulation 500MCM single conductor cables per cable bus, (6) positive & (6) negative cables per cable bus, 4 cable buses total, (1-3) 1043 ft cable (4-6) 964 ft cable (7-9) 950 ft cable (10-12)964 ft cable (3000A, 2.0KVDC per Cable Bus). Each 12 conductor cable bus shall be configured for (3) 4 conductor DC circuits arranged in an optimal arrangement.	Raychem HVT-82-G (or equivalent)	14A, 14B, 14C, 14D, 14E, 14F, 14G, 14H (1-3) 51ft (4-6) 45 ft (7-9) 45 ft (10-12) 46 ft	8.25"H X 28"W (4 enclosures are utilized for 4 cable buses)

4.1.2.15 MR2BIB to PMMD2	(12) Okonite Okoguard- Okolon 114-23-2743 (or equivalent) EPR 5KV 133% insulation 500MCM single conductor cables per cable bus, (6) positive & (6) negative cables per cable bus, 4 cable buses total, (1-3) 1029 ft cable (4-6) 845 ft cable (7-9) 1030 ft cable (10-12) 937 ft cable (3000A, 2.0KVDC per Cable Bus). Each 12 conductor cable bus shall be configured for (3) 4 conductor DC circuits arranged in an optimal arrangement.	Raychem HVT-82-G (or equivalent)	15A, 15B, 15C, 15D, 15E, 15F, 15G, 15H (1-3) 50 ft (4-6) 36 ft (7-9) 50 ft (10-12) 43 ft	8.25"H X 28"W (4 enclosures are utilized for 4 cable buses)

4.2 Cable Tray

4.2.1 Cable Tray General Requirements

4.2.1A. Installation Location:	1. The cable tray shall be suitable for indoor or outdoor installation in an ambient temperature from 0°F - 104°F. 2. The cable tray shall be able to be secured to site provided steel structure using cable tray clamp/ guide hardware provided assuming tray installation in accordance with NEMA VE2 with supports on 10' centers.
4.2.1.B. Enclosure Construction:	1. The cable tray shall be made of non-magnetic heavy gauge, corrosion resistant aluminum alloy meeting NEMA 20C loading and deflection requirements. 2. The cable tray shall be able to withstand a 200LB concentrated load at mid-span in addition to the full load cable rating without permanent deformation. 3. The cable tray shall be UL classified and labeled. 4. The cable tray shall be provided in 20 foot lengths.

	5. The cable tray shall have a 5 inch working depth and 6 inch deep rails or 6 inch working depth and 7 inch deep rails as specified in Section 4.2.2. 6. The cable tray shall utilize high pressure bolted splice joints for maximum structural capability and minimum electrical resistance (330 micro ohms) across joint. 7. Splice plate construction shall be such that a splice may be located anywhere within the support span without diminishing the load carrying capability of the cable tray. 8. Splice plates shall be provided with straight sections and fittings. 9. Splice plate bolting hardware shall be included with the splice plates. 10. The cable tray shall be designed to eliminate any sharp edges or projections that may injure personnel or damage cable.

4.2.2 Cable Tray Detail Requirements:

Item	QTY	Description	Material	Specification	Remarks
4.2.2.1	6	Ladder cable tray, straight section. 20'L, 36"W, 7"D, 9" rung spacing	Aluminum	Commercial NEMA 20C	NEMA Standard VE1
4.2.2.2	1	Ladder cable tray, 90° inside vertical bend, 36"W, 7"D, 9" rung spacing. 36" bend radius	Aluminum	Commercial NEMA 20C	NEMA Standard VE1
4.2.2.3	1	Ladder cable tray, 90° outside vertical bend, 36"W, 7"D, 9" rung spacing. 36" bend radius	Aluminum	Commercial NEMA 20C	NEMA Standard VE1

4.3 Testing

4.3.1. Cable Bus Tests:	1. The manufacturer shall supply test data documenting the short circuit rating of the cable buses provided exceeds the required rating as specified in Section 4.1.1.C.1 & 4.1.1.C.2. If similar cable bus configurations were not previously tested using the same cable bus materials, new tests will be required to be conducted to show compliance. 2. The manufacturer shall supply test data showing the maximum temperature of the cable will not exceed 90C in a 40C ambient with the cable shields grounded at both ends (conservative). The manufacturer can utilize data from similar designs to satisfy this requirement. 3. The manufacturer shall supply test data showing the manufactured cables had the following factory tests performed in accordance with industry standards: a. Insulation Resistance Test b. DC Conductor Resistance Test c. AC Hi-Pot Test d. Corona Test 4. The test data shall be provided in the Technical Manual (Section 5.2).
4.3.2. Cable Tray Tests:	1. The manufacturer shall provide a test report showing that NEMA 20C cable loading criteria (100lbs/ foot with a 20 foot span) has been met and that the tray can also withstand an additional 200lb concentrated load at midspan without permanent deformation. (Section 4.2.1.B.1 & 4.2.1.B.2) 2. The test report shall be provided in the Technical Manual (Section 5.2).

5.0 Technical Data

5.1 Drawings

Final Outline and Detail Drawings are required for each cable bus run. These drawings shall include a parts list, nameplate data, cable phasing configuration with calculated circuit impedance, inside & outside enclosure dimensions, and support requirements for each cable bus run.
Assembly and Outline Drawings and technical data (including UL certification of cable bus side rail when utilized as a grounding conductor) for the cable bus materials specified. For the tray type supplied, all other accessory catalog data shall also be provided for future parts ordering.

The drawings shall be included in the Technical Manual (5.2). The Government will also approve the Suppliers Drawings to provide a Release for Manufacture for the cable bus system.

5.2 Technical Manuals

Three sets of Technical Manuals shall be forwarded not later than the delivery date of the equipment. Technical Manuals shall consist of various technical data including: Installation instructions, Testing (4.3), Drawings (5.1), Special Tools / Equipment (5.3), Recommended Maintenance (5.4), and any other technical information required to install, operate, or maintain the cable bus and cable tray.

5.3 Special Tools / Equipment

A list of special tools / equipment required to install the cable bus and cable tray shall be provided for Release to Manufacture and shall also be included in the Technical Manual (5.2).

5.4 Recommended Maintenance

Recommendations shall be provided on the recommended cable insulation and Hi-Pot testing to be performed prior to energizing the cable bus and if any other future testing or maintenance of the cable bus system is recommended. This information shall consider the cable manufacturer's recommendations. This information shall be provided in the Technical Manual (5.2) not later than the delivery date of the equipment.

6.0 Release For Manufacture

The Supplier shall submit the following to the Government, for approval, prior to obtaining a Release for Manufacture:

1. Outline & Detail Drawings (5.1) for each cable bus run. These drawings shall include a parts list, nameplate, cable phasing configuration with calculated circuit impedance (Inductive and Capacitive reactance, inside & outside enclosure dimensions, and support requirements for each cable bus run.
2. Assembly & Outline Drawings and technical data (5.1) (including UL certification of cable bus side rail when utilized as a grounding conductor) for the cable bus materials specified. For the tray type supplied, all other accessory catalog data shall also be provided for future parts ordering.
3. List of Special Tools / Equipment (5.3) required for cable bus enclosure assembly & cable installation in the cable bus.
4. Cable bus installation instructions (5.2).

7.0 Inspection and Testing

Testing of the equipment shall be performed by the Supplier as specified in Section 4.3. The Government reserves the right to witness Supplier testing and to perform equipment inspections where such inspections are deemed necessary to assure supplies and services conform to the prescribed requirements. A Test Report, containing as a minimum, the data specified in Section 4.3 must be provided no later than the delivery date of the equipment and shall be included in the Technical Manual.

8.0 Shipping

8.1 Packaging

Equipment shall be packed for shipping in a manner which will ensure acceptance and safe delivery at destination. Supplier is responsible for damage during shipment.

8.2 Marking

Each package shall be marked with the Contract Number, Contract Item Number and Purchase Specification Number TS050-18.

8.3 Delivery

All equipment and technical data specified in this document shall be delivered to NSWCCD-SSES in accordance with the following schedule:

Item 0001: Cable Bus Release for Manufacture Data

Within 4 weeks after contract award.
Note: NSWC shall be given 2 weeks to review and provide Drawing Approval

Item 0002: Cable Bus System

Within 12 weeks after contract award or within 6 weeks after Drawing Approval, whichever is later.

Item 0003: Cable Bus Technical Manual

Within 12 weeks after contract award.

Item 0004: Cable Tray System

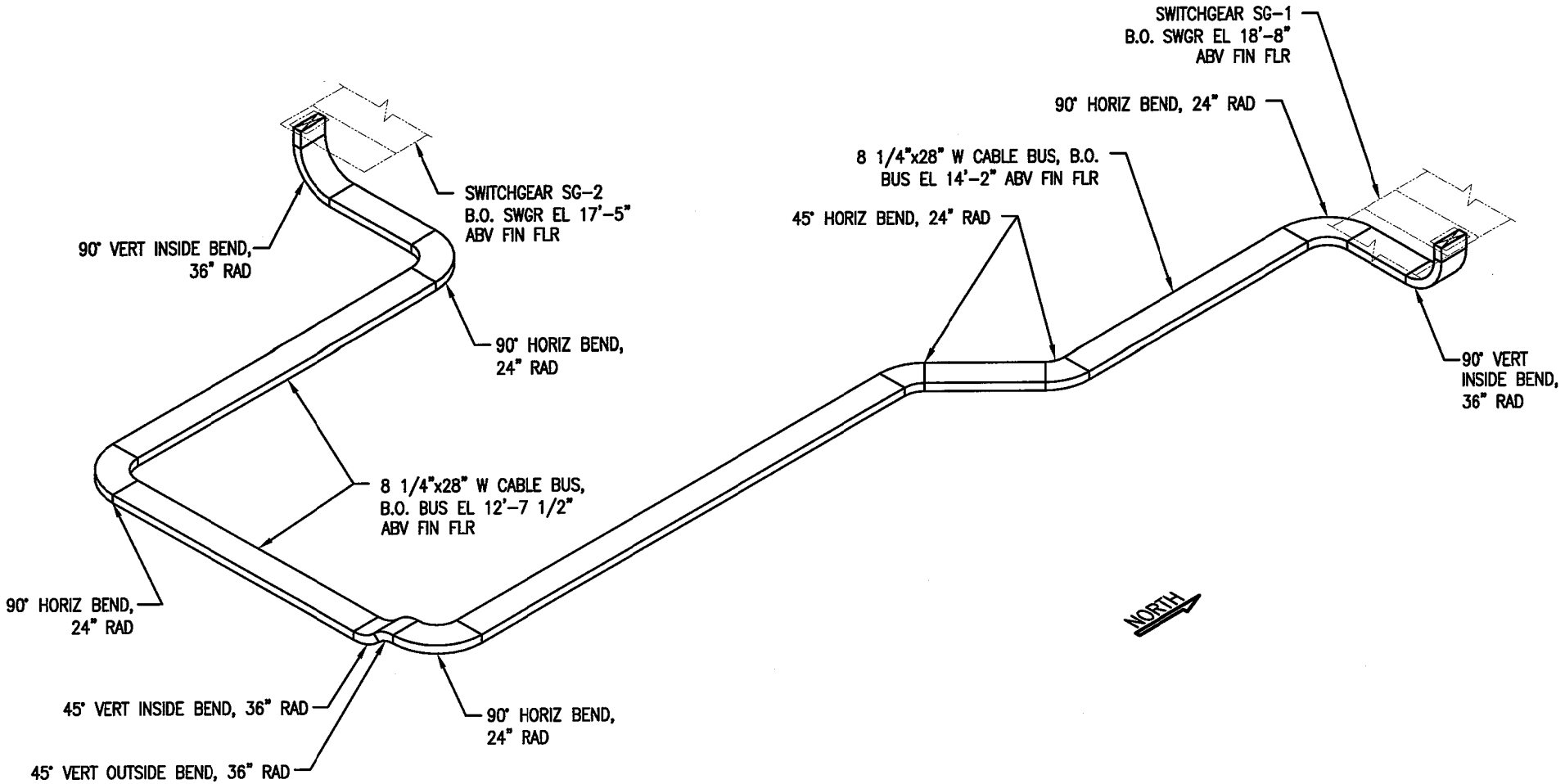
Within 10 weeks after contract award.

Items 0005: Cable Tray Technical Manual

Within 10 weeks after contract award.

All deliverables shall be forwarded to the address given below:

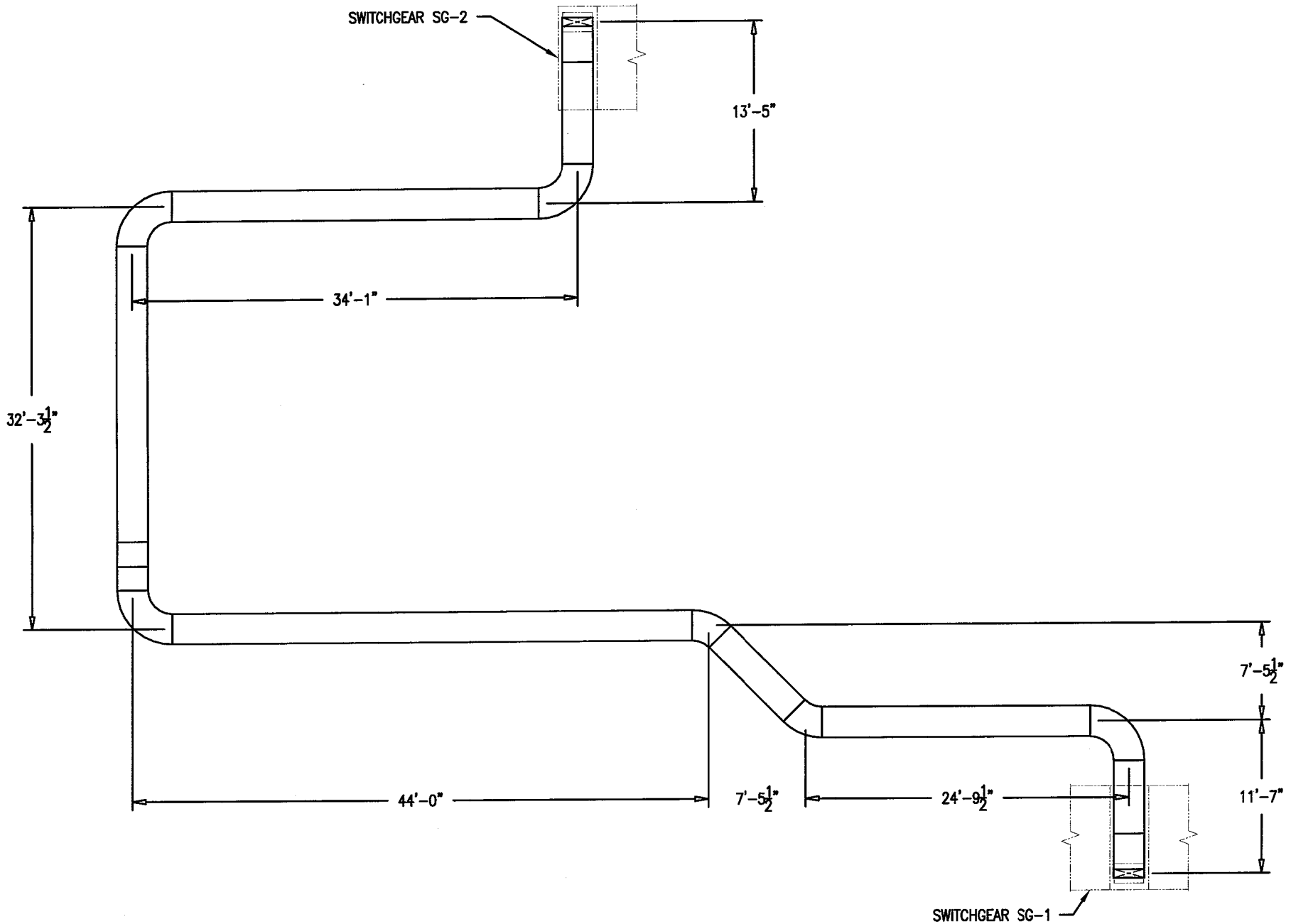
Commander
Naval Surface Warfare Center Carderock Division
Naval Business Center, Bldg 542
Philadelphia, PA 19112-5083
Attn: Mr. Ed Harvey, Code 934



ISOMETRIC VIEW

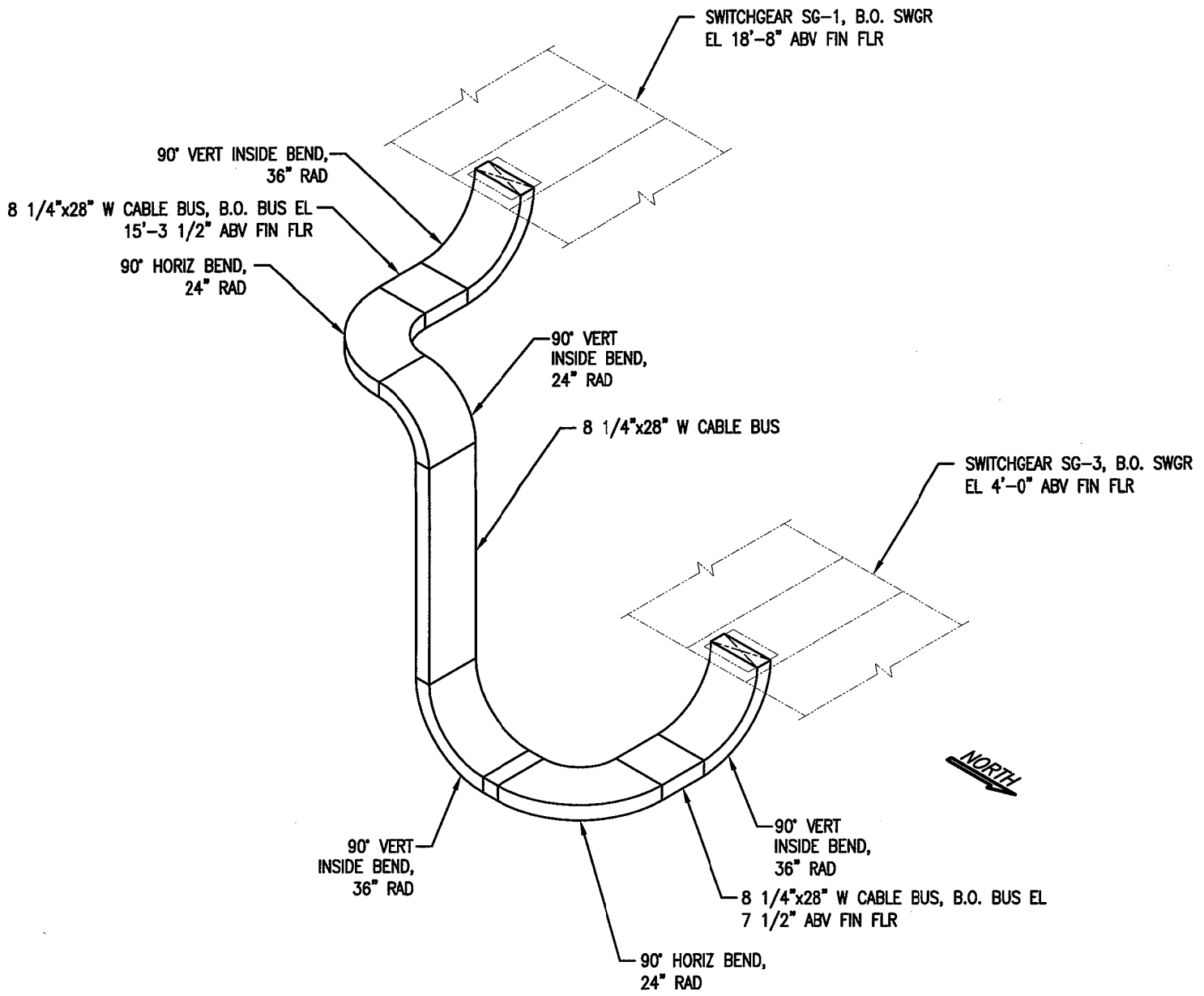
SWGR SG-1 TO SWGR SG-2
CABLE BUS RUN
SCALE: NONE

FIGURE 1A



PLAN VIEW
SWGR SG-1 TO SWGR SG-2
CABLE BUS RUN
SCALE: 1"=10'-0"

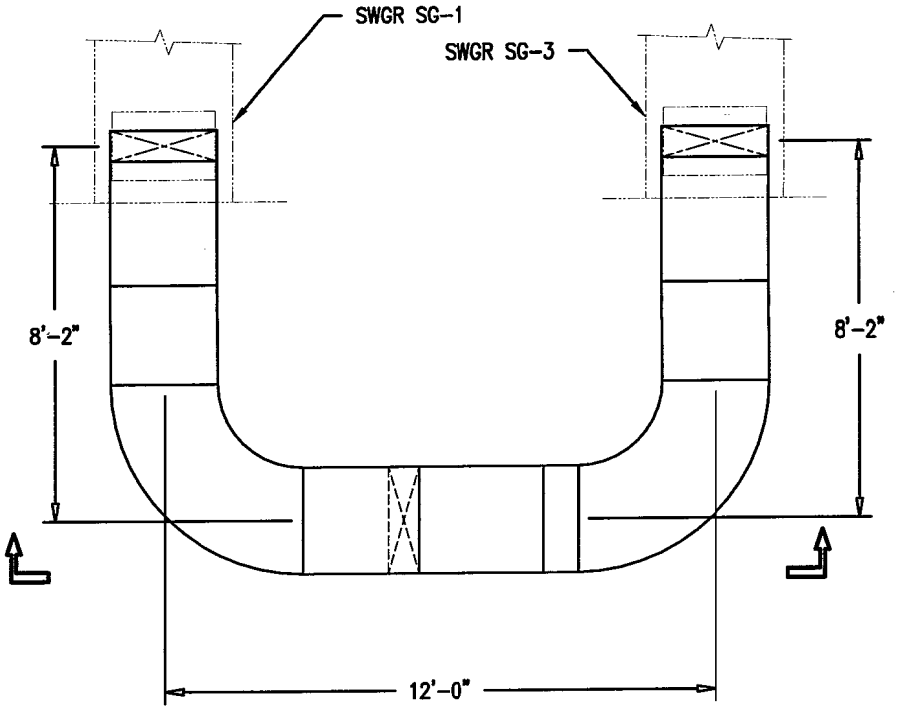
FIGURE 1B



ISOMETRIC VIEW

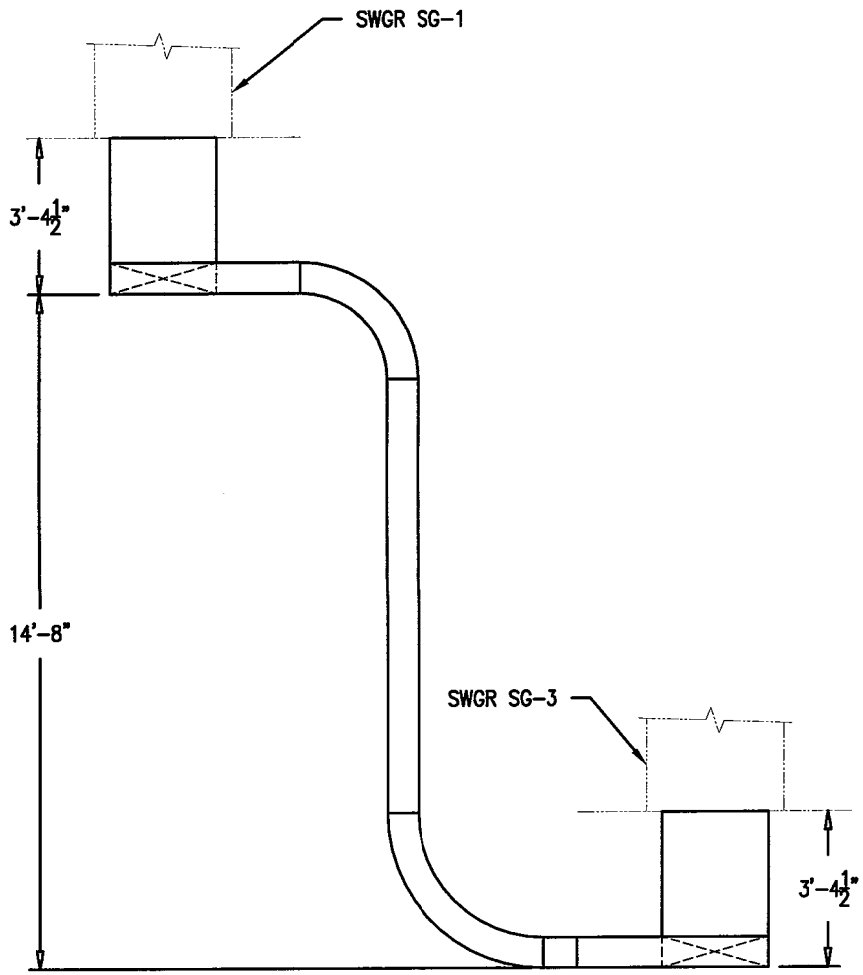
SWGR SG-1 TO SWGR SG-3
CABLE BUS RUN
SCALE: NONE

FIGURE 2A



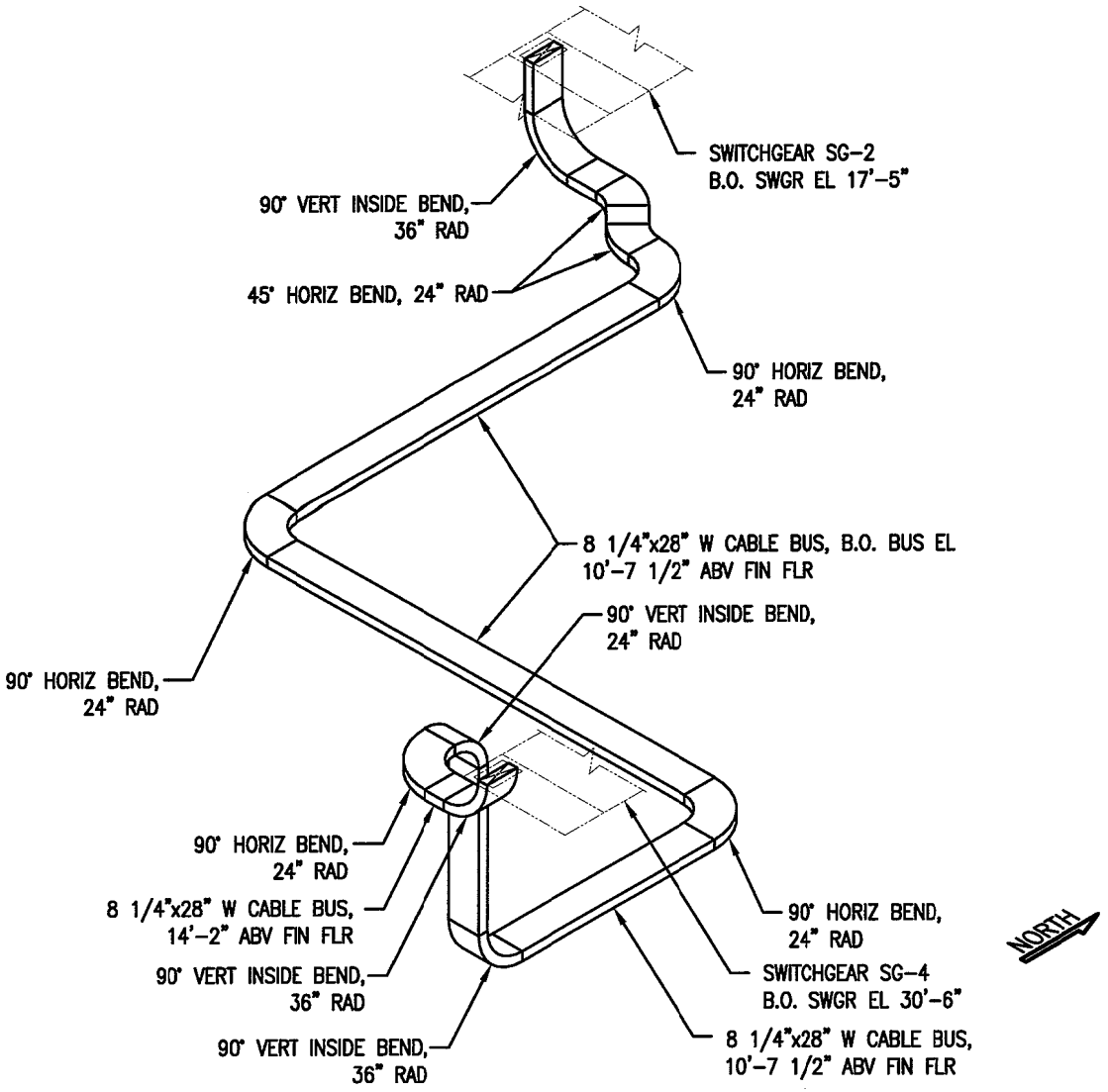
PLAN VIEW
SWGR SG-1 TO SWGR SG-3
CABLE BUS RUN
SCALE: 1/4"=1'-0"

NORTH



ELEVATION VIEW
SWGR SG-1 TO SWGR SG-3
LOOKING WEST
SCALE: 1/4"=1'-0"

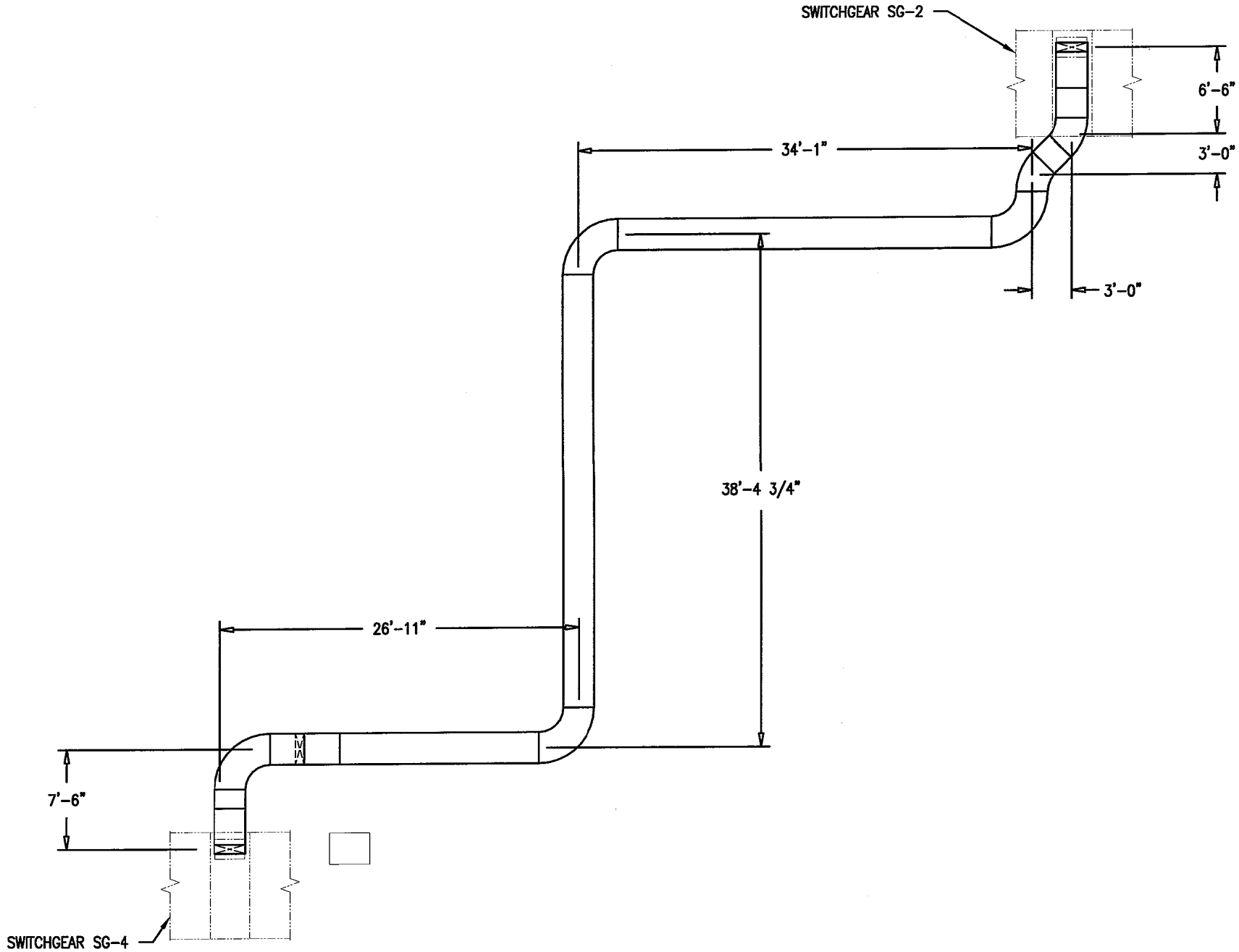
FIGURE 2B



ISOMETRIC VIEW

SWGR SG-2 TO SWGR SG-4
CABLE BUS RUN
SCALE: NONE

FIGURE 3A

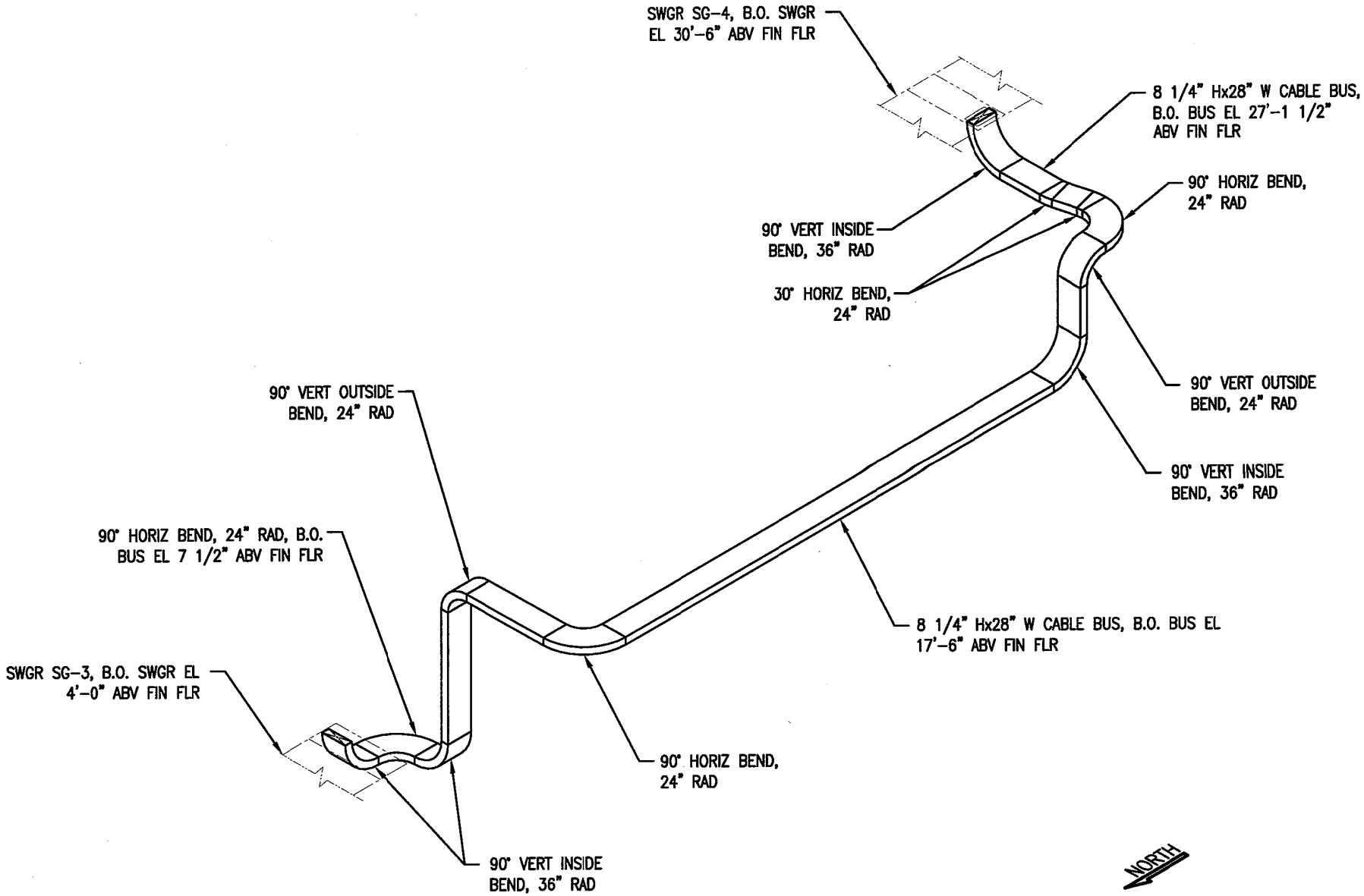


PLAN VIEW

SWGR SG-2 TO SWGR SG-4
CABLE BUS RUN
SCALE: 1"=10'-0"

NORTH

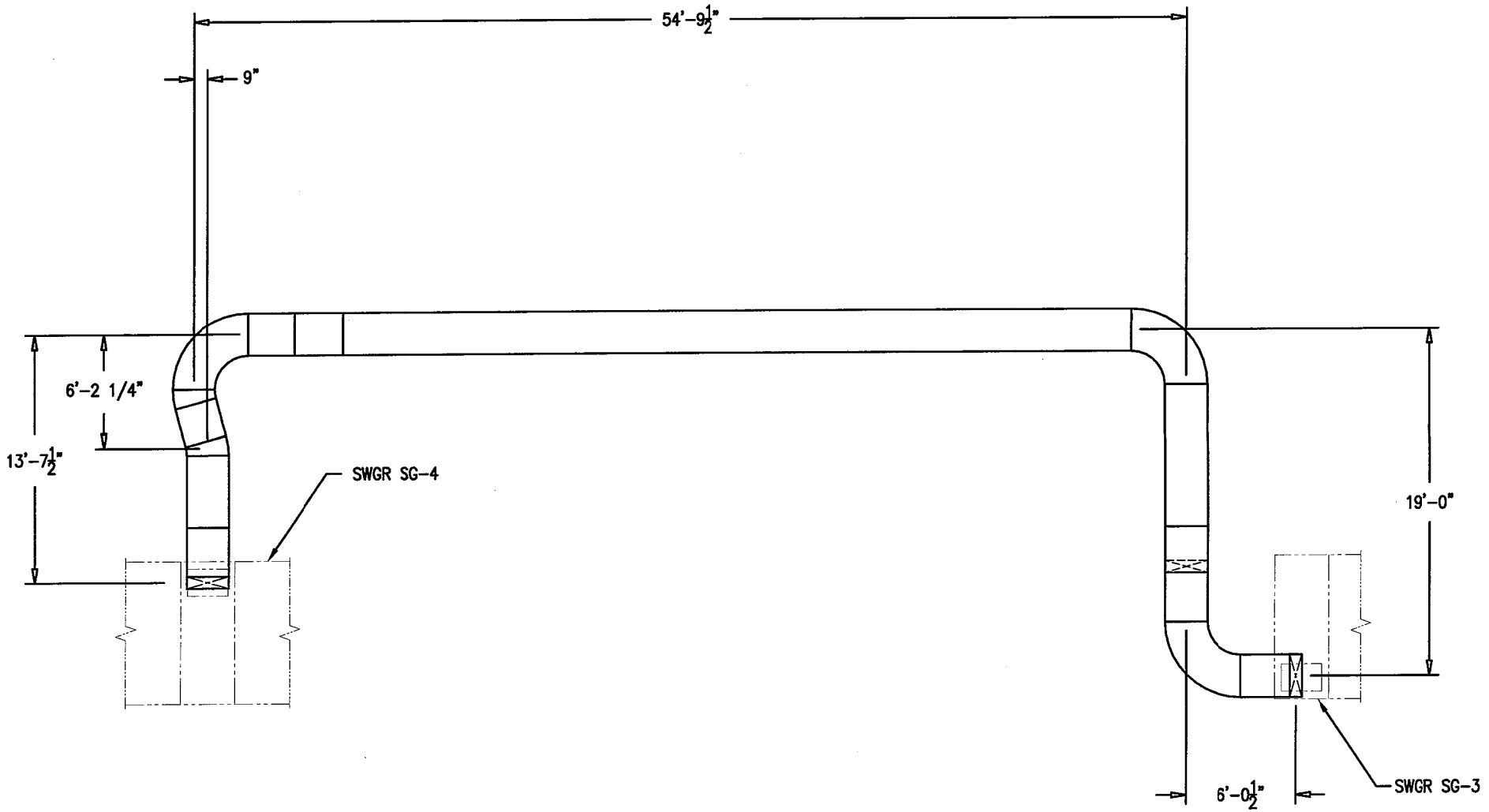
FIGURE 3B



ISOMETRIC VIEW

SWGR SG-3 TO SWGR SG-4
CABLE BUS RUN
SCALE: NONE

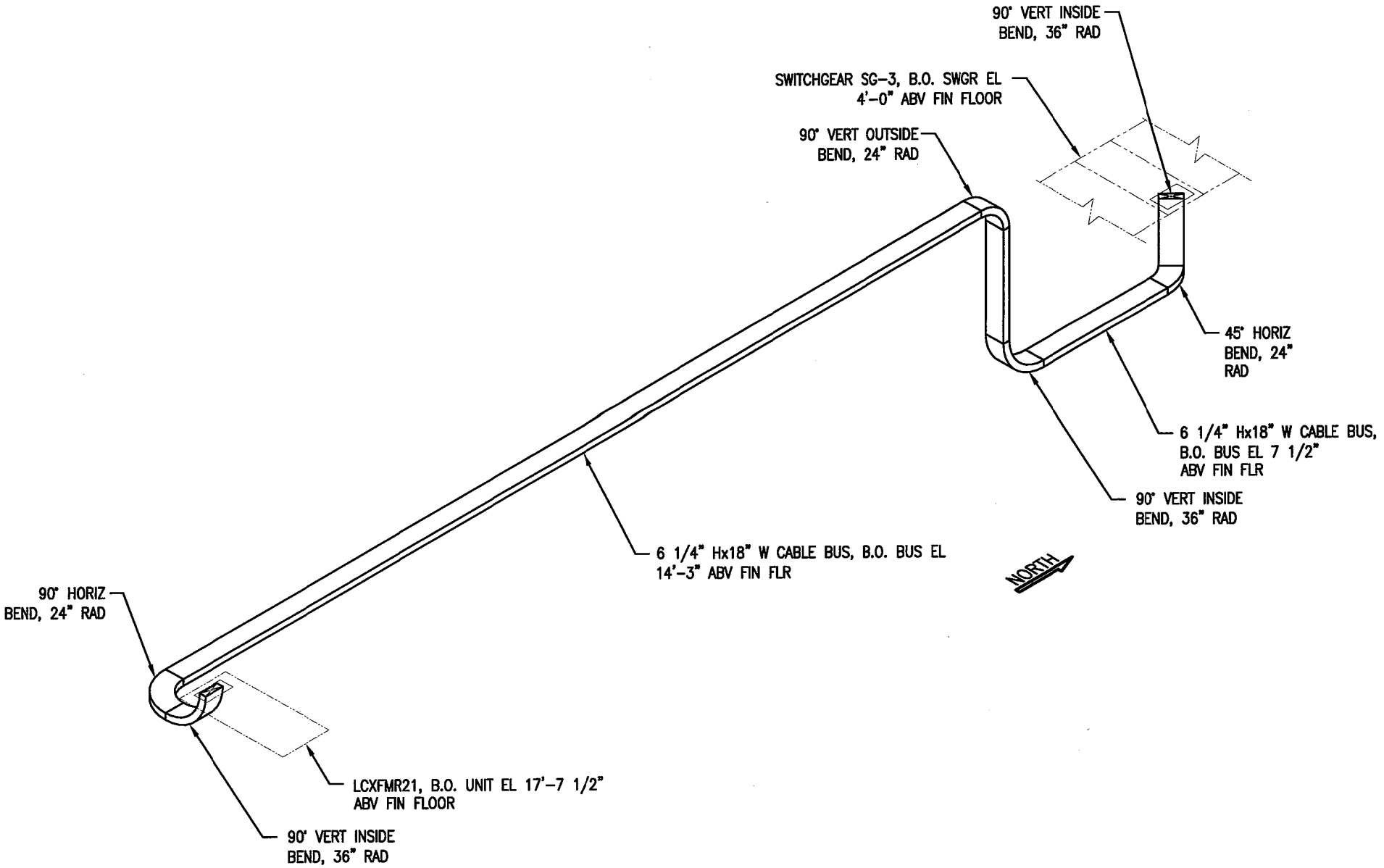
FIGURE 4A



PLAN VIEW
SWGR SG-3 TO SWGR SG-4
CABLE BUS RUN
SCALE: 1/8"=1'-0"

NORTH

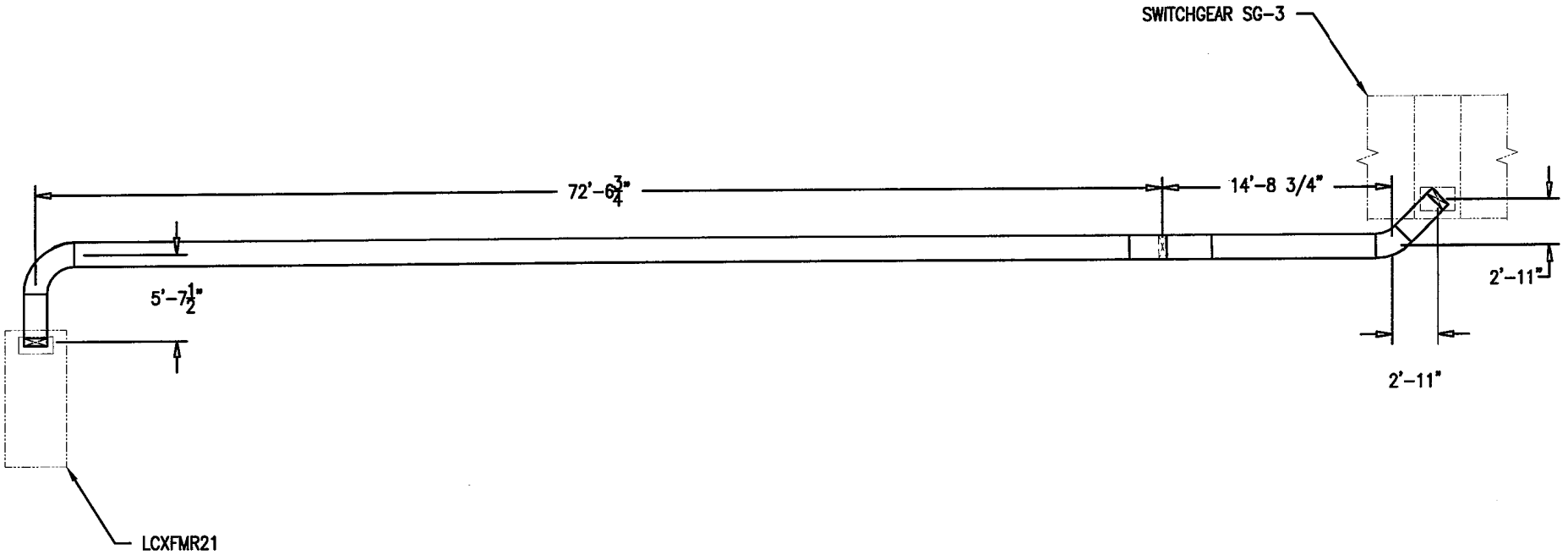
FIGURE 4B



ISOMETRIC VIEW

SWGR SG-3 TO LCXFMR21
CABLE BUS RUN
SCALE: NONE

FIGURE 5A

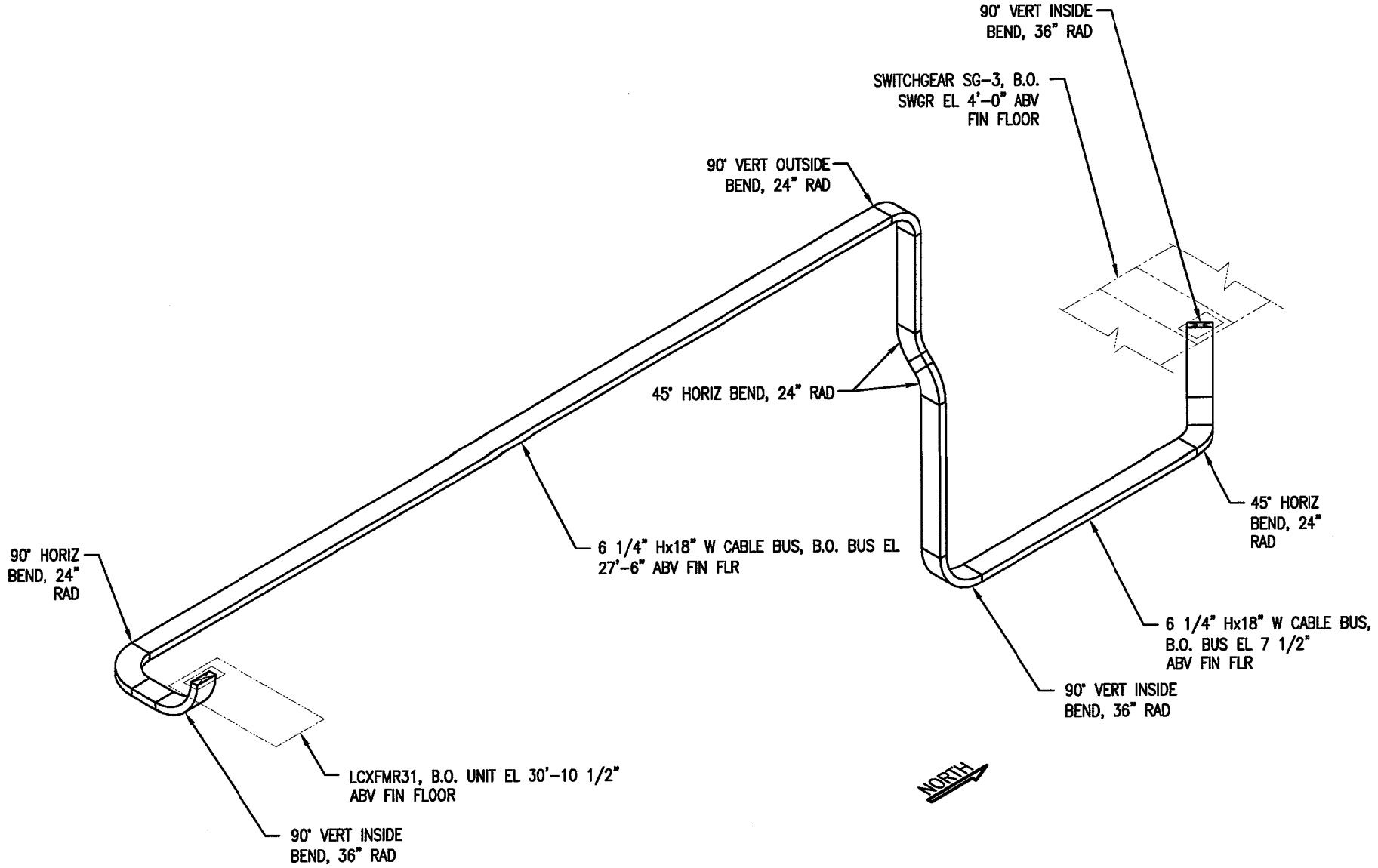


PLAN VIEW

SWGR SG-3 TO LCXFMR21
CABLE BUS RUN
SCALE: 1"=10'-0"

NORTH

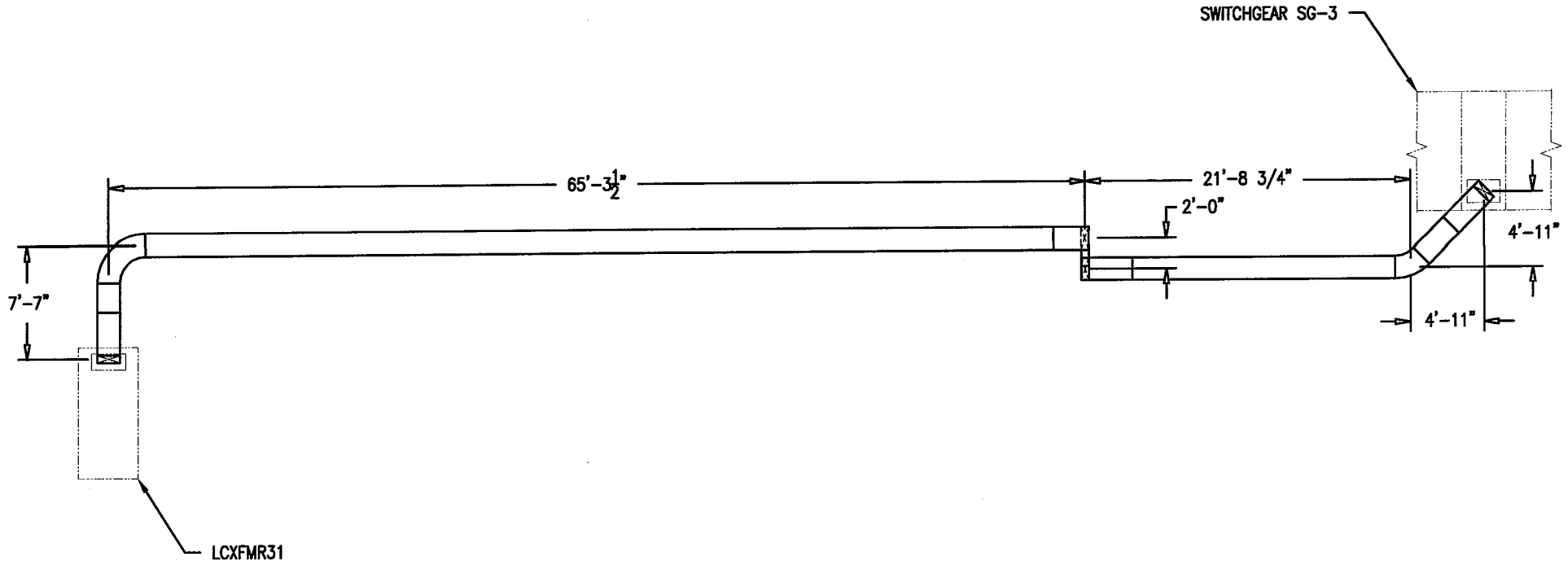
FIGURE 5B



ISOMETRIC VIEW

SWGR SG-3 TO LCXFMR31
CABLE BUS RUN
SCALE: NONE

FIGURE 6A



PLAN VIEW

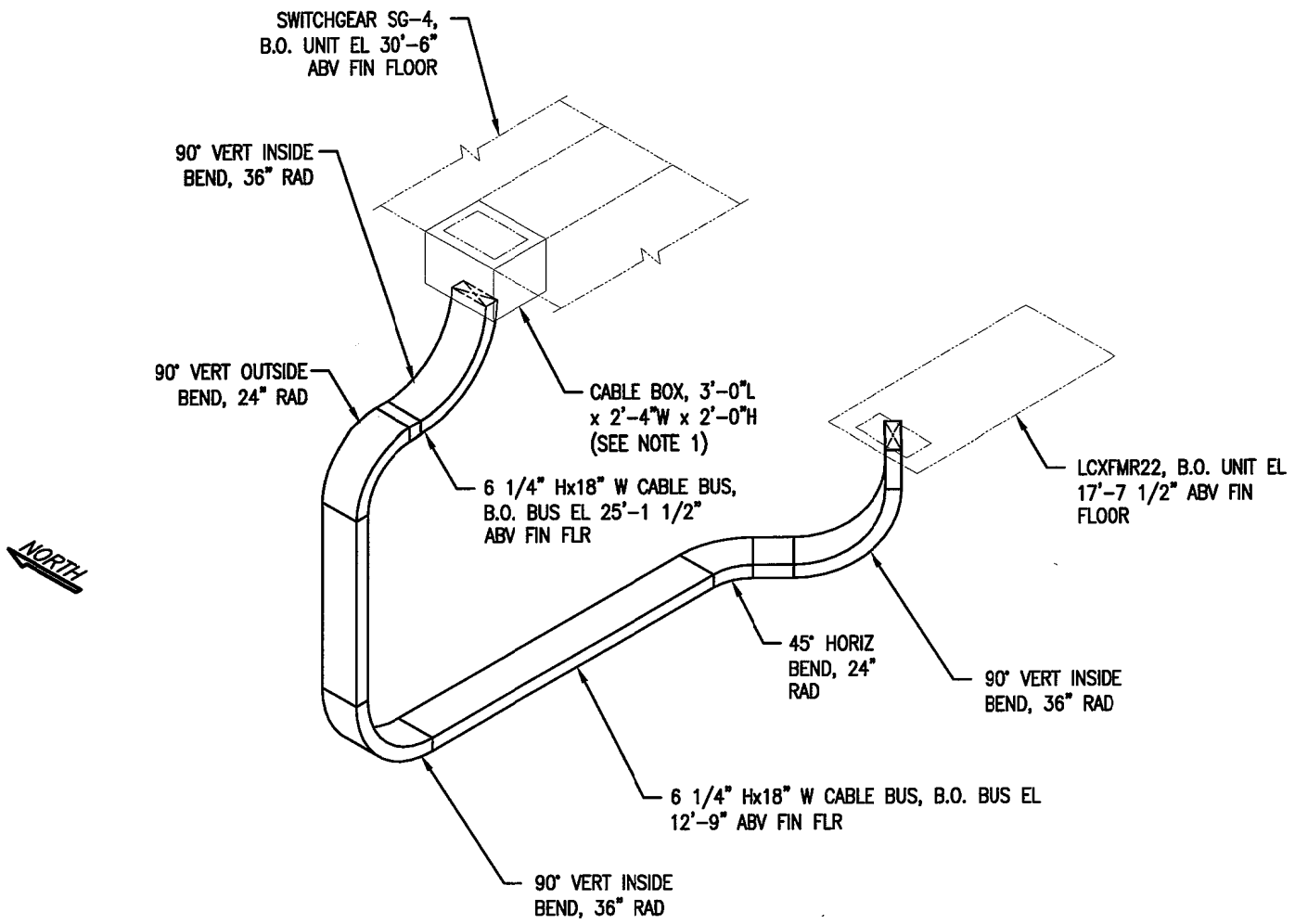
SWGR SG-3 TO LCXFMR31
CABLE BUS RUN
SCALE: 1"=10'-0"

NORTH

FIGURE 6B

NOTES

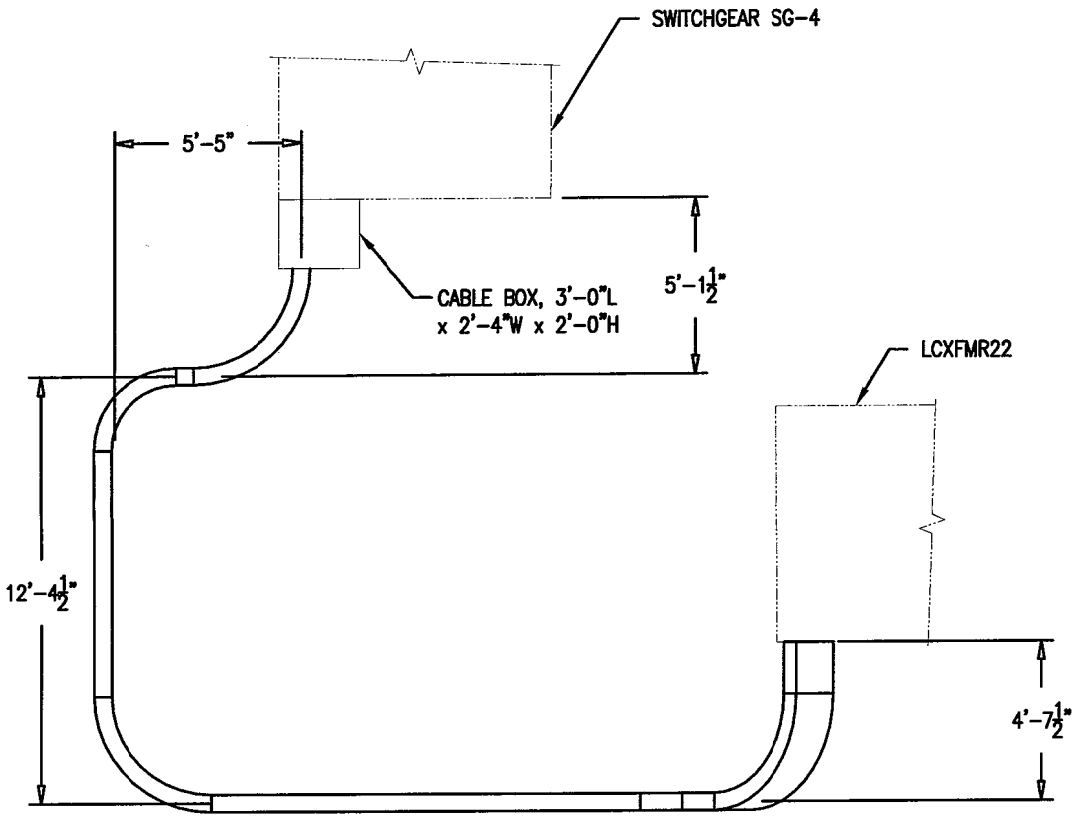
1. 3'-0" LONG x 2'-0" HIGH CABLE BOX COVERS SHALL BE REMOVABLE. THE SAME CABLE BOX IS UTILIZED FOR CONNECTION OF LCXFMR32 AND LCXFMR22 CABLE BUSES TO SG-4.



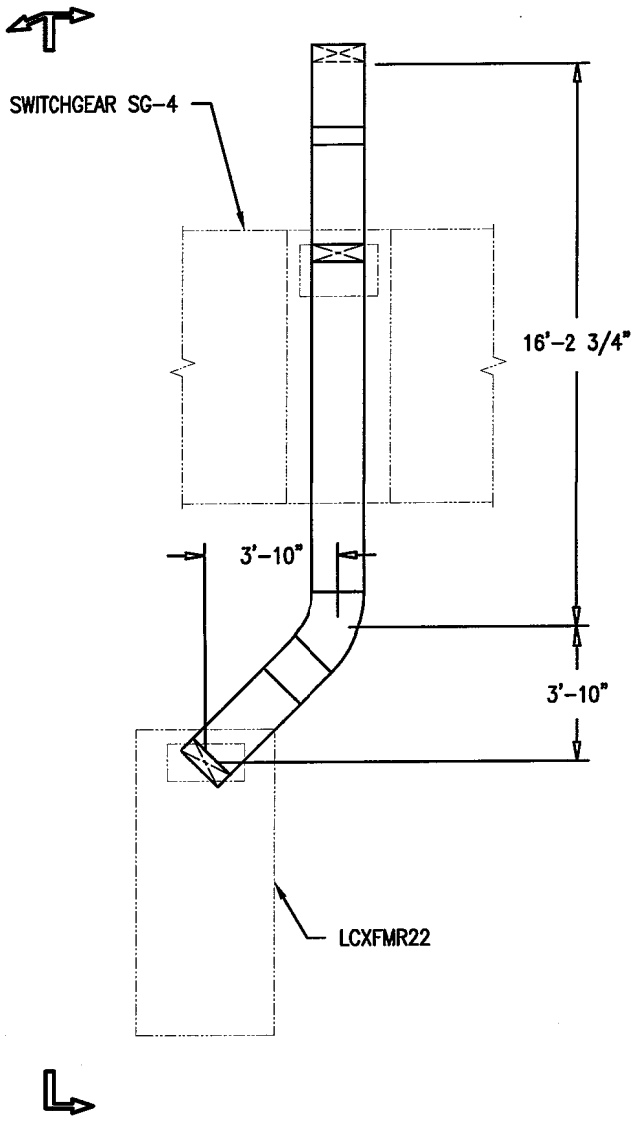
ISOMETRIC VIEW

SWGR SG-4 TO LCXFMR22
CABLE BUS RUN
SCALE: NONE

FIGURE 7A



ELEVATION VIEW
SWGR SG-4 TO LCXFMR22
LOOKING NORTH
SCALE: 3/16"=1'-0"

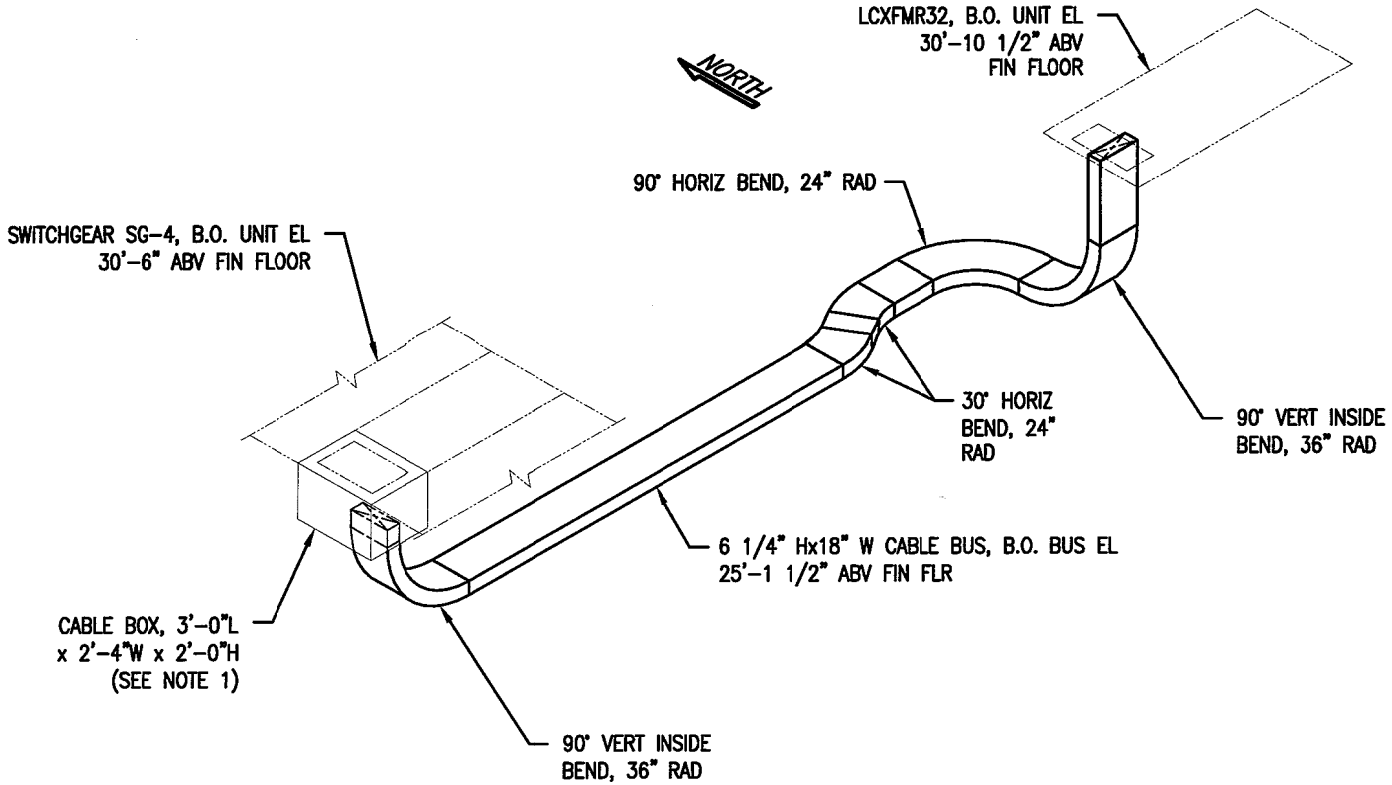


PLAN VIEW NORTH
SWGR SG-4 TO LCXFMR22
CABLE BUS RUN
SCALE: 3/16"=1'-0"

FIGURE 7B

NOTES

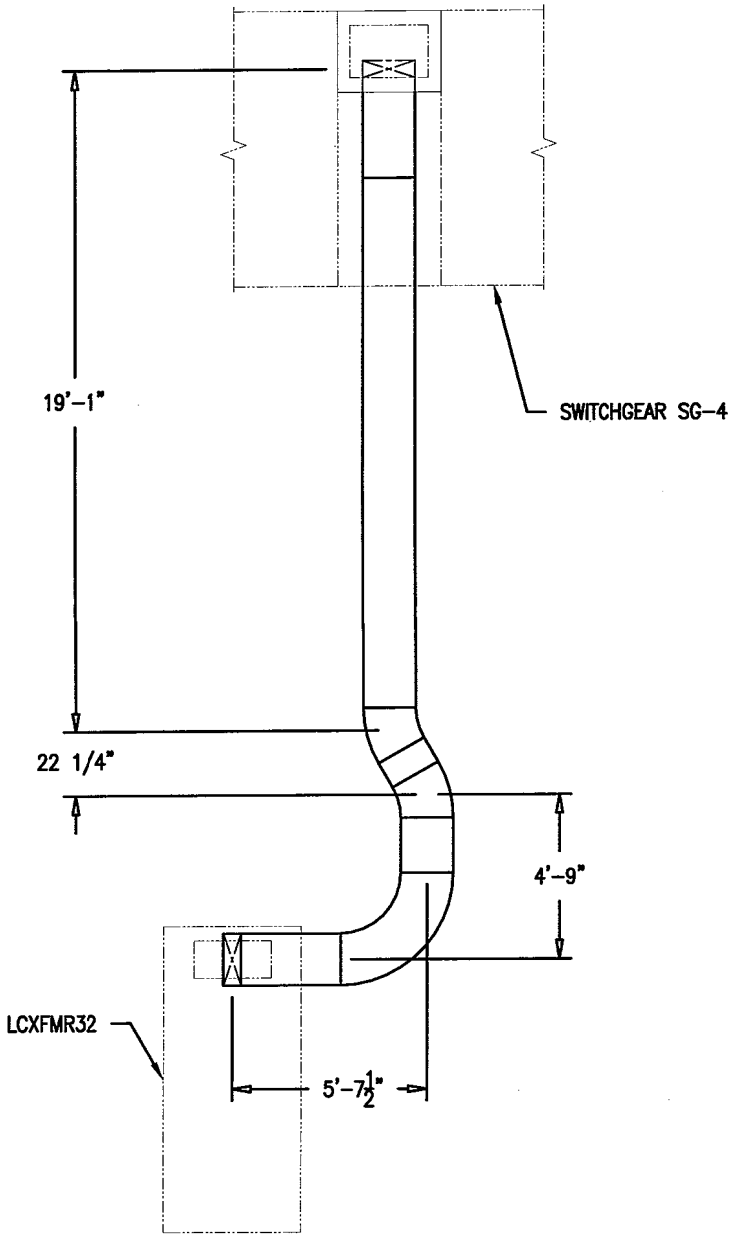
1. 3'–0" LONG x 2'–0" HIGH CABLE BOX COVERS SHALL BE REMOVABLE. THE SAME CABLE BOX IS UTILIZED FOR CONNECTION OF LCXFMR32 AND LCXFMR22 CABLE BUSES TO SG–4.



ISOMETRIC VIEW

SWGR SG–4 TO LCXFMR32
CABLE BUS RUN
SCALE: NONE

FIGURE 8A



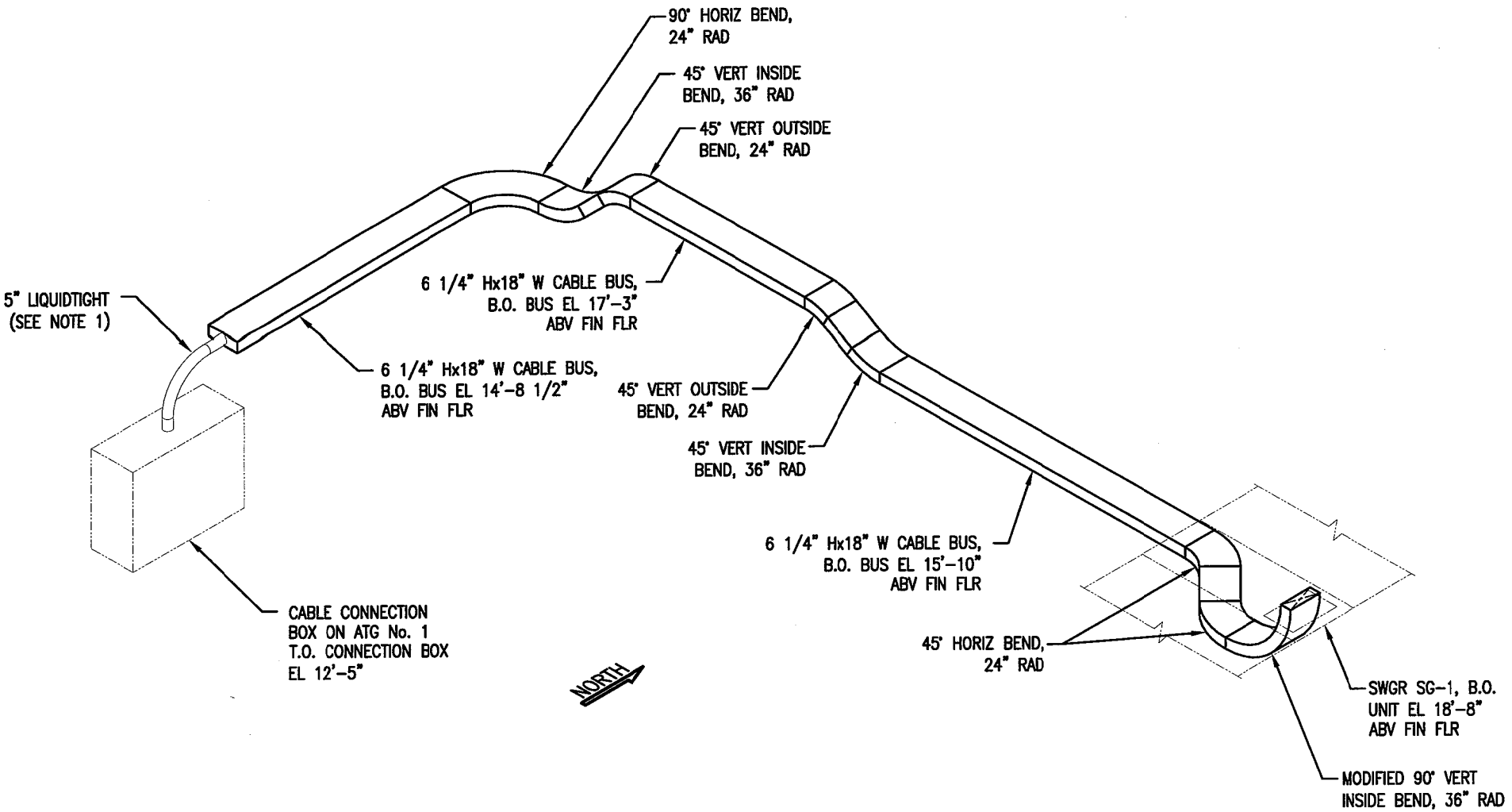
PLAN VIEW NORTH

SWGR SG-4 TO LCXFMR32
CABLE BUS RUN
SCALE: 3/16"=1'-0"

FIGURE 8B

NOTES

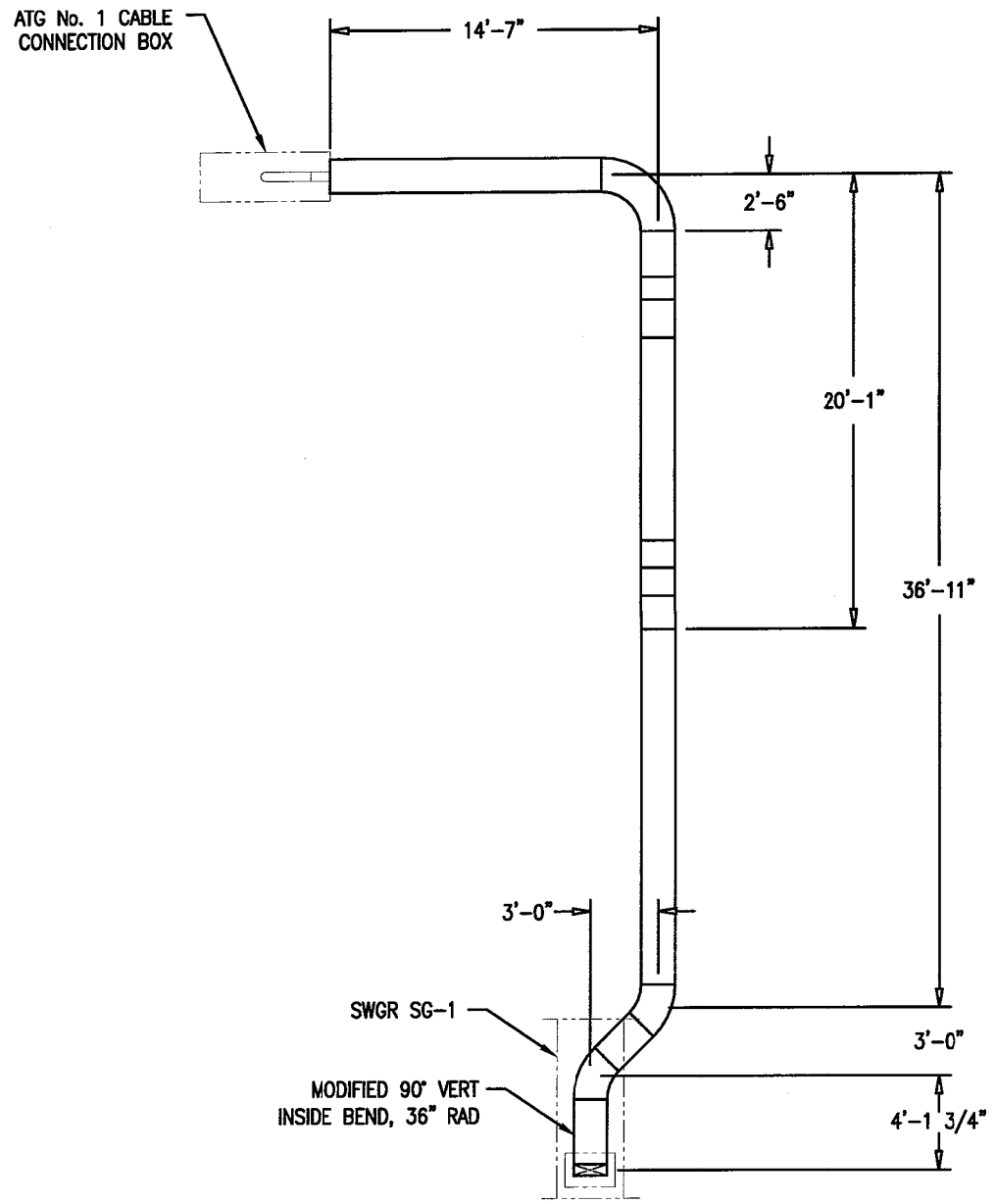
1. CABLES (INCLUDING GROUND CONDUCTOR) EXIT CABLE BUS END PLATE AND ENTER 5" DIAMETER LIQUIDTIGHT FLEXIBLE METALLIC CONDUIT TO ENTER ATG No. 1 CONNECTION BOX WHICH IS GOVERNMENT PROVIDED. LIQUIDTIGHT SHALL BE PROVIDED WITH CONNECTION FITTINGS.



ISOMETRIC VIEW

SWGR SG-1 TO ATG No. 1
CABLE BUS RUN
SCALE: NONE

FIGURE 9A



PLAN VIEW

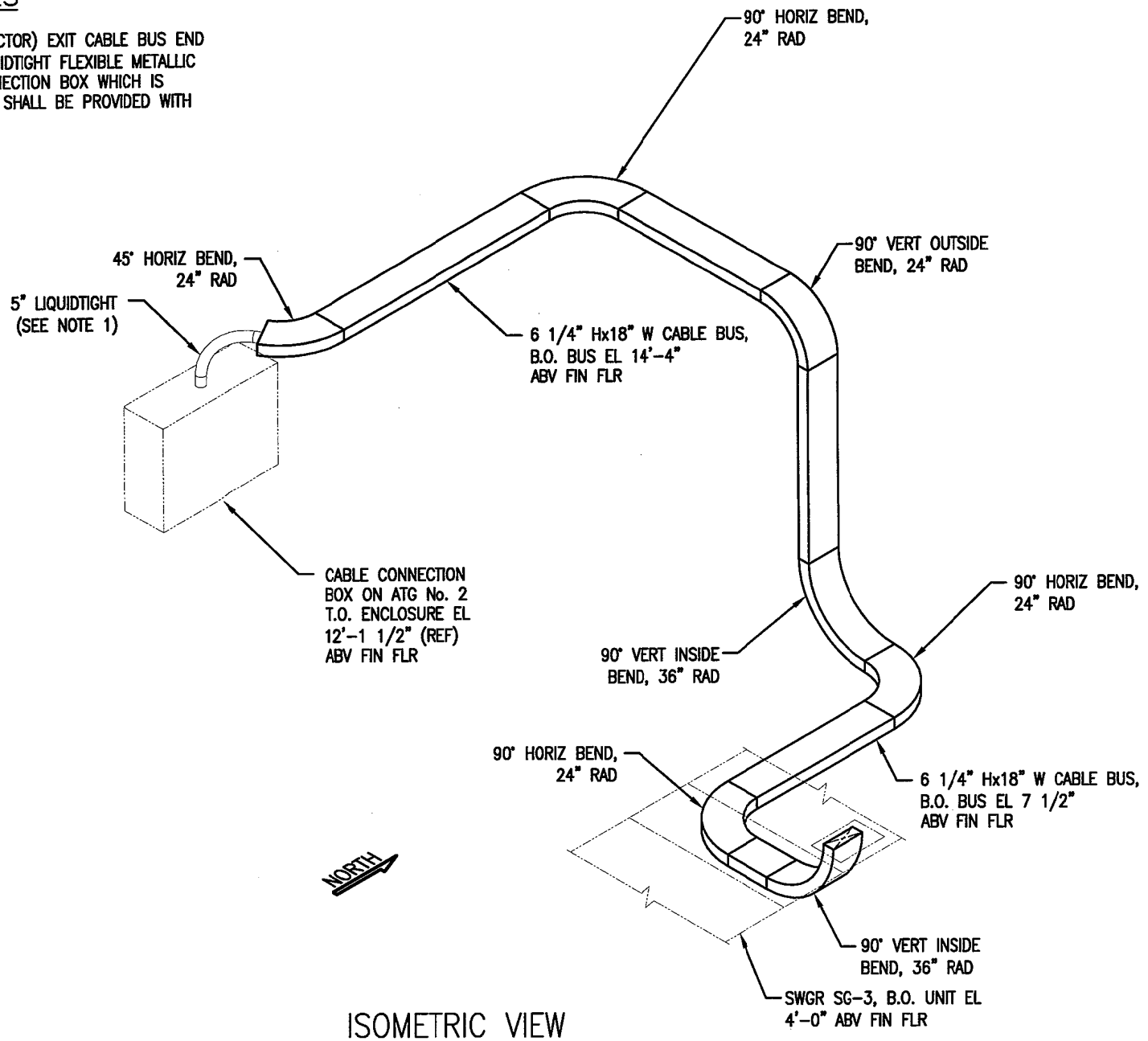
SWGR SG-1 TO ATG No. 1
CABLE BUS RUN
SCALE: 1/8"=1'-0"

NORTH

FIGURE 9B

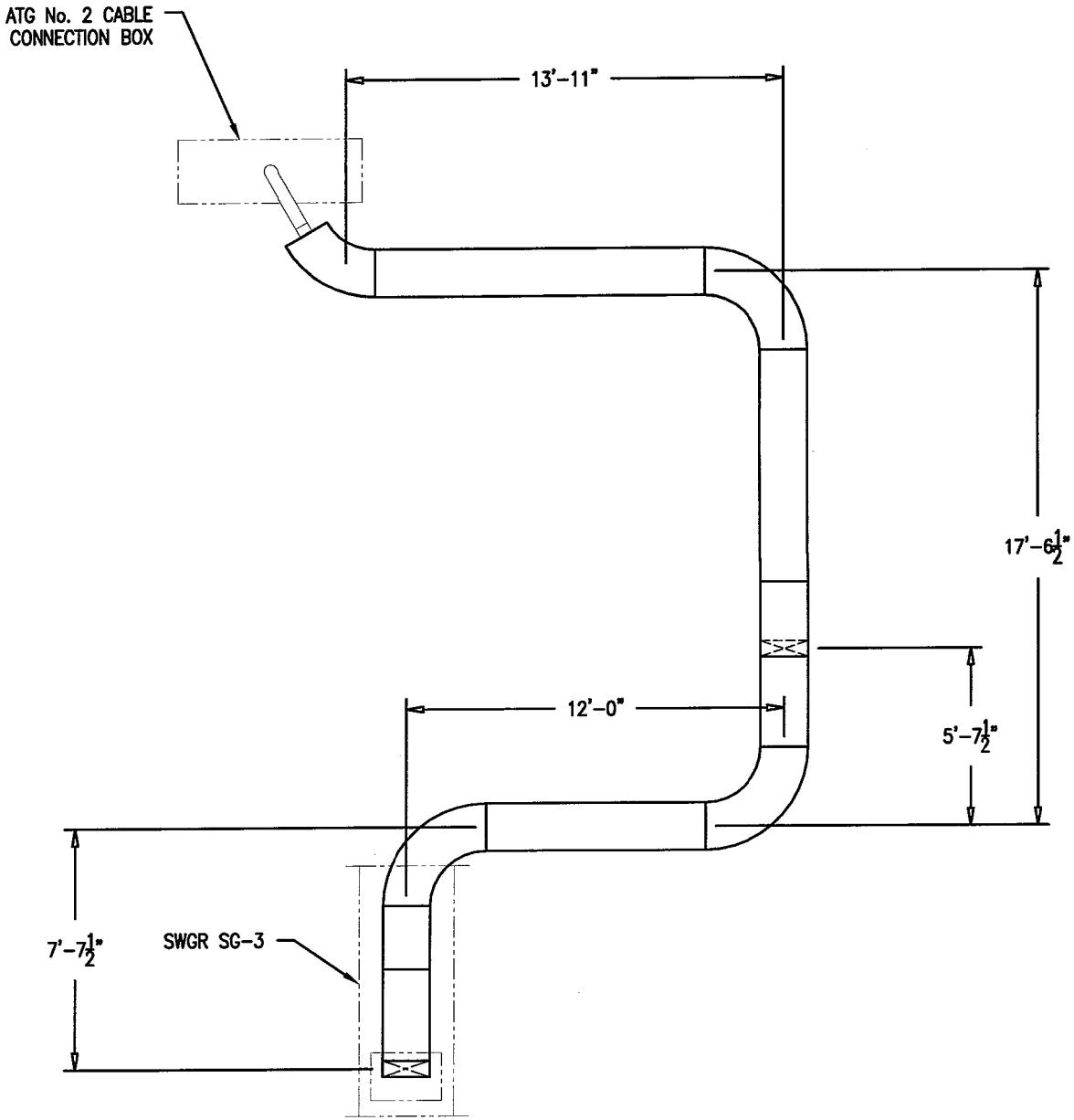
NOTES

1. CABLES (INCLUDING GROUND CONDUCTOR) EXIT CABLE BUS END PLATE AND ENTER 5" DIAMETER LIQUIDTIGHT FLEXIBLE METALLIC CONDUIT TO ENTER ATG No. 2 CONNECTION BOX WHICH IS GOVERNMENT PROVIDED. LIQUIDTIGHT SHALL BE PROVIDED WITH CONNECTION FITTINGS.



ISOMETRIC VIEW
SWGR SG-3 TO ATG No. 2
CABLE BUS RUN
SCALE: NONE

FIGURE 10A

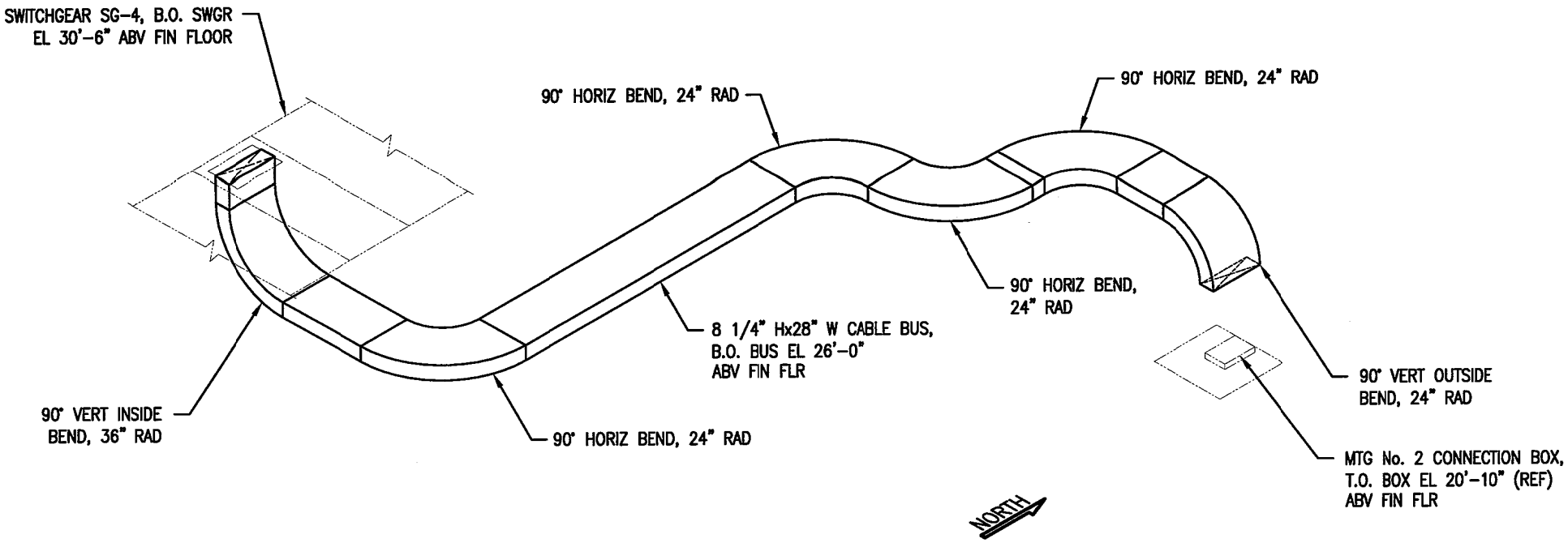


PLAN VIEW

SWGR SG-3 TO ATG No. 2
CABLE BUS RUN
SCALE: 3/16"=1'-0"

NORTH

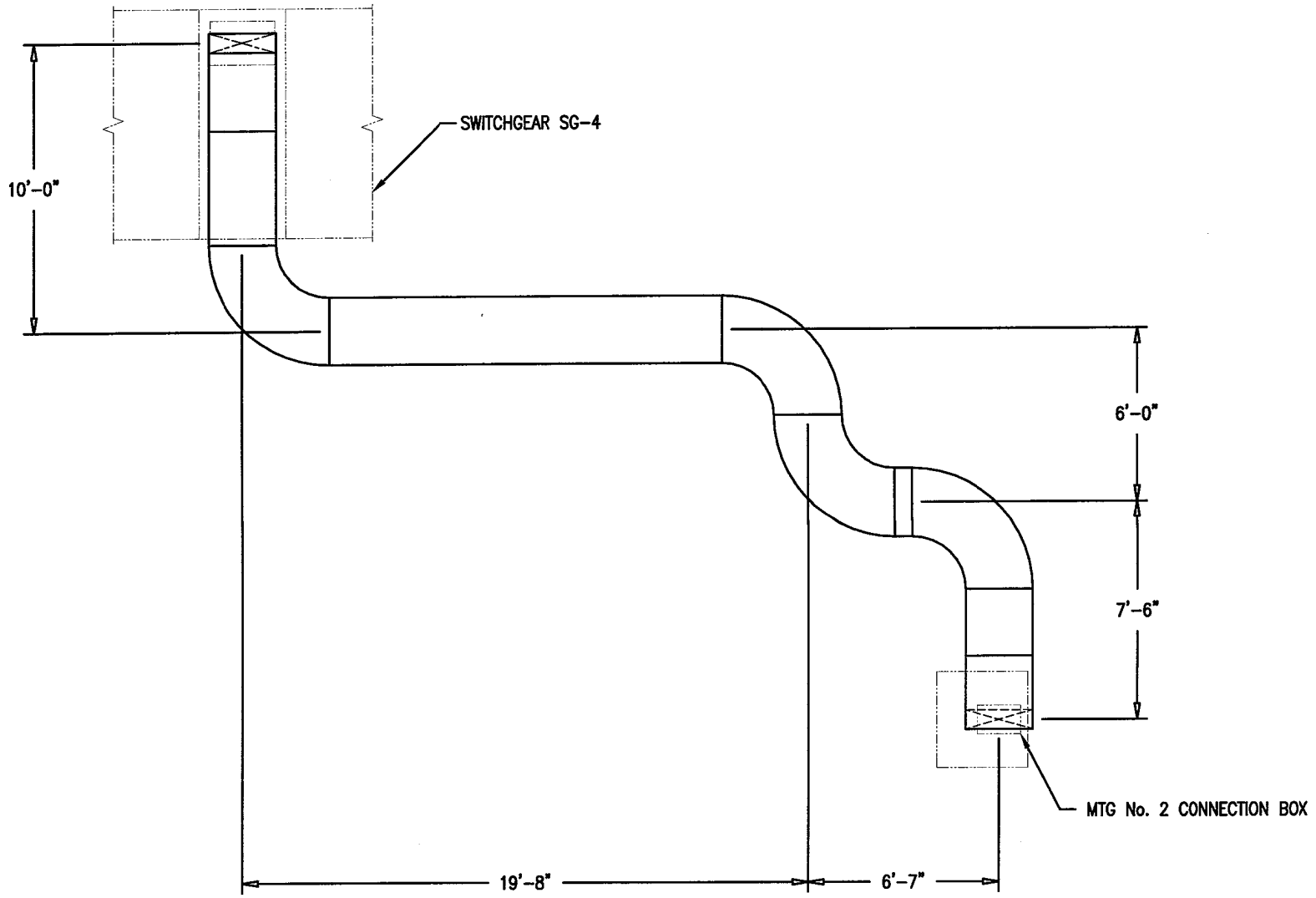
FIGURE 10B



ISOMETRIC VIEW

SWGR SG-4 TO MTG No. 2
CABLE BUS RUN
SCALE: NONE

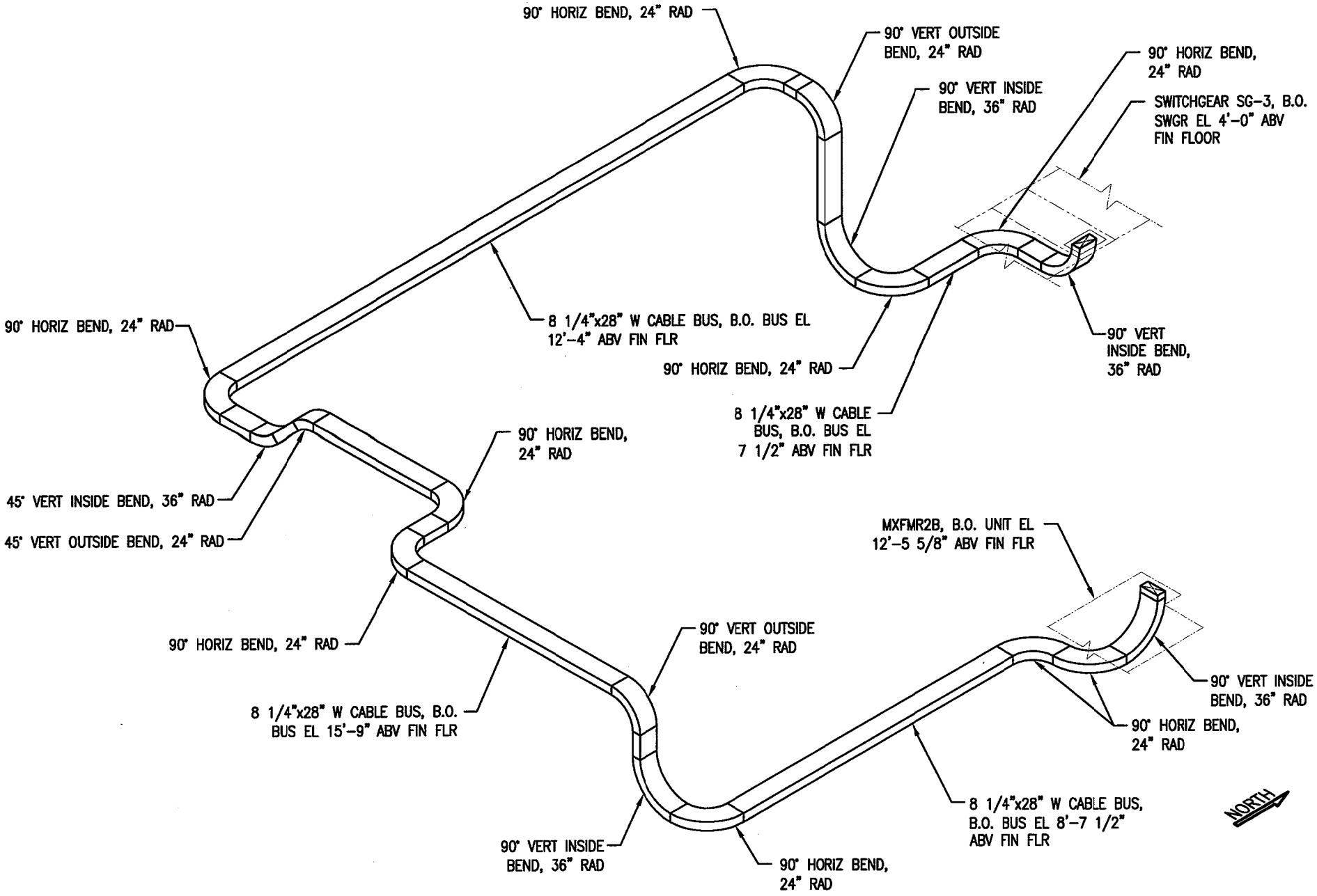
FIGURE 11A



PLAN VIEW NORTH

SWGR SG-4 TO MTG No. 2
CABLE BUS RUN
SCALE: 3/16"=1'-0"

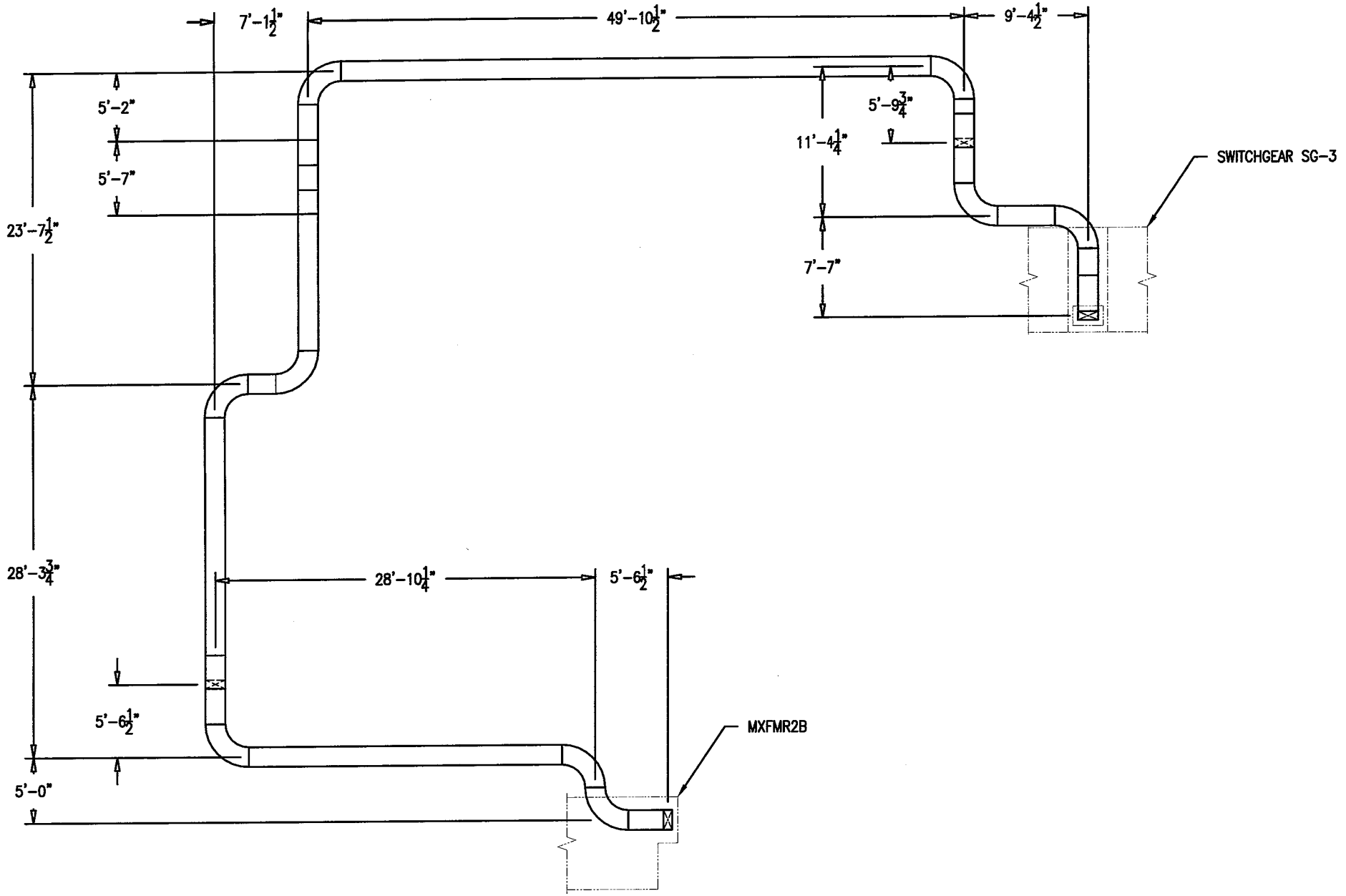
FIGURE 11B



ISOMETRIC VIEW

SWGR SG-3 TO MXFMR2B
CABLE BUS RUN
SCALE: NONE

FIGURE 12A

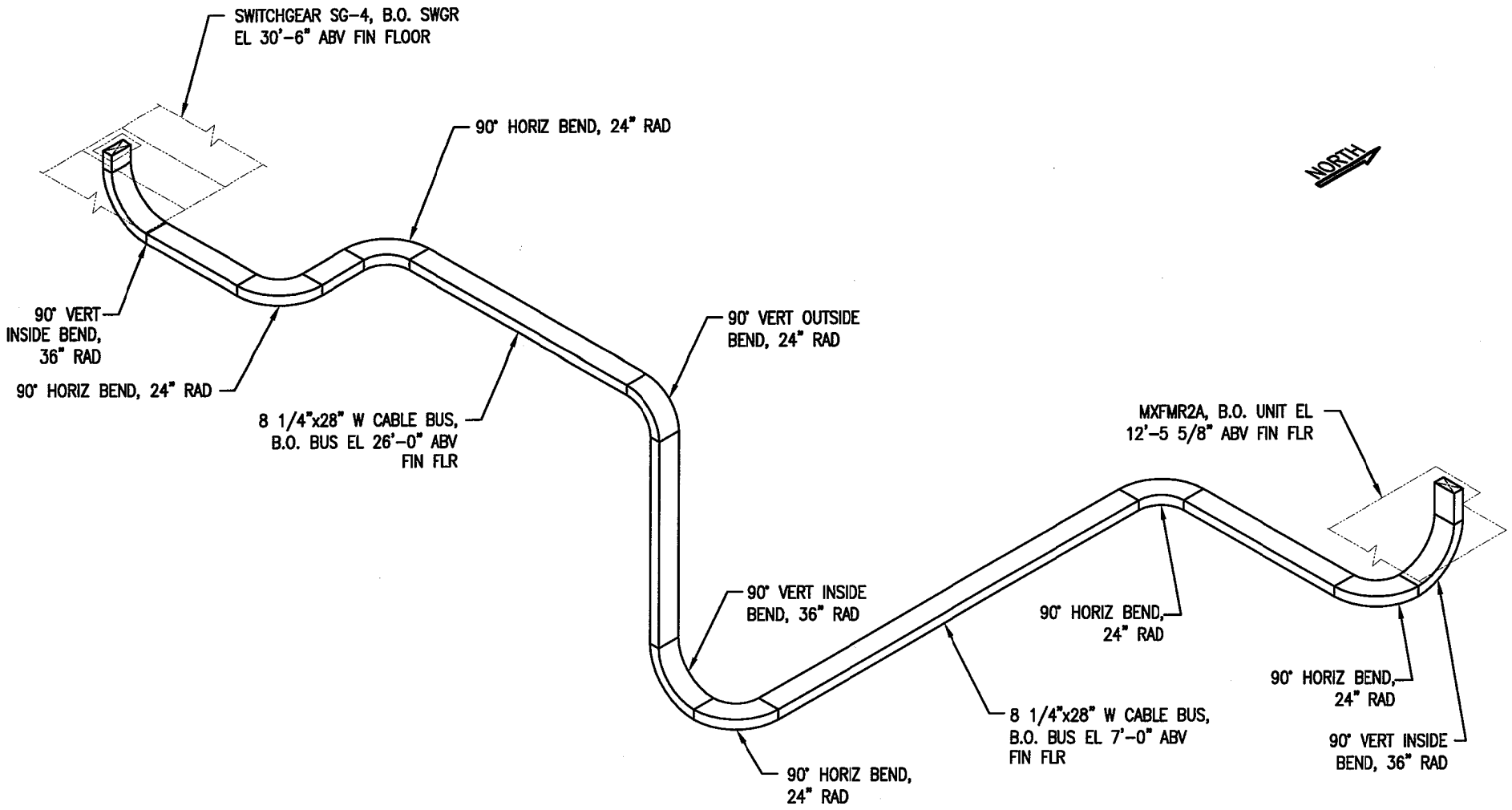


PLAN VIEW

SWGR SG-3 TO MXFMR2B
CABLE BUS RUN
SCALE: 1"=10'-0"

NORTH

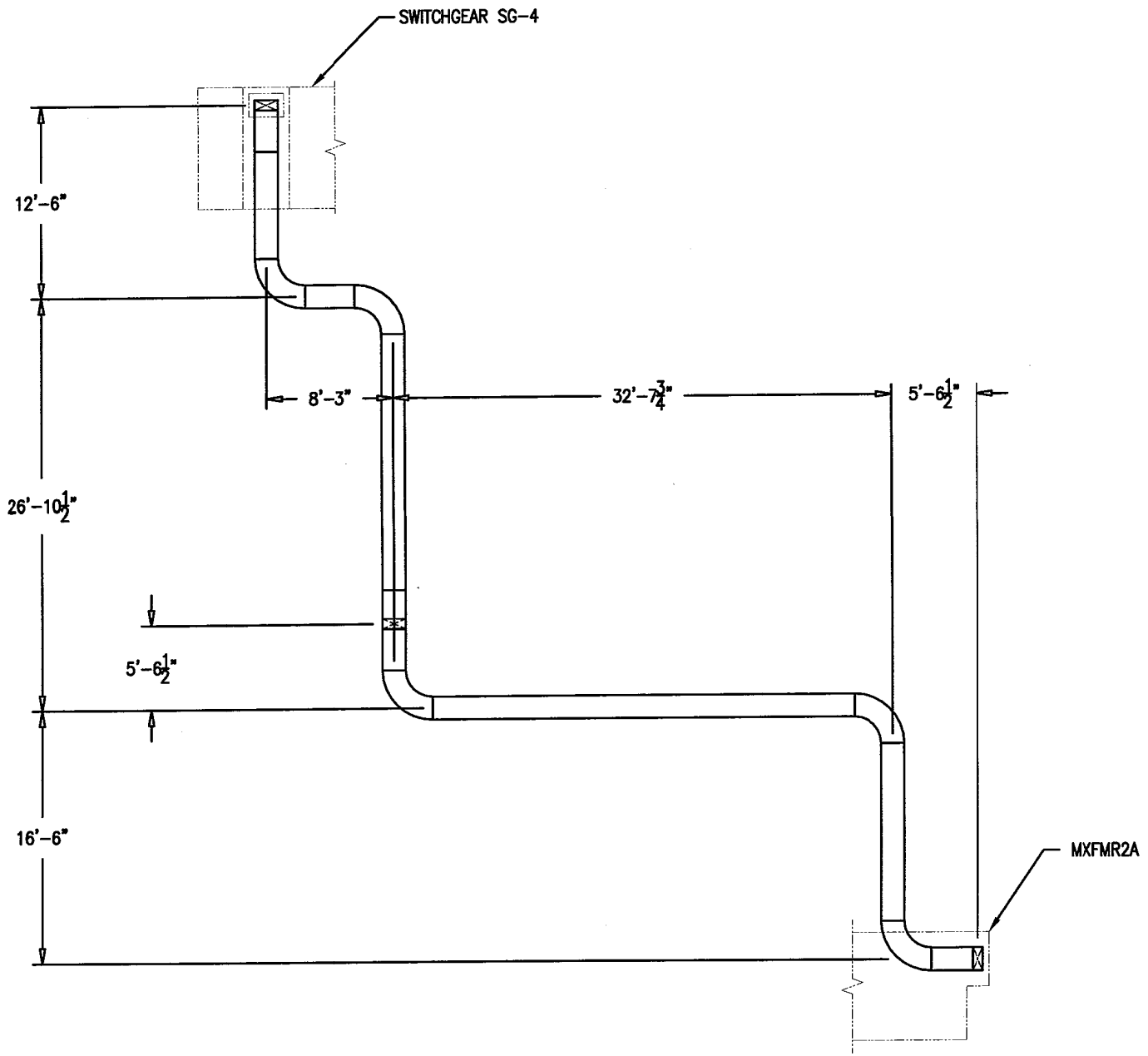
FIGURE 12B



ISOMETRIC VIEW

SWGR SG-4 TO MXFMR2A
CABLE BUS RUN
SCALE: NONE

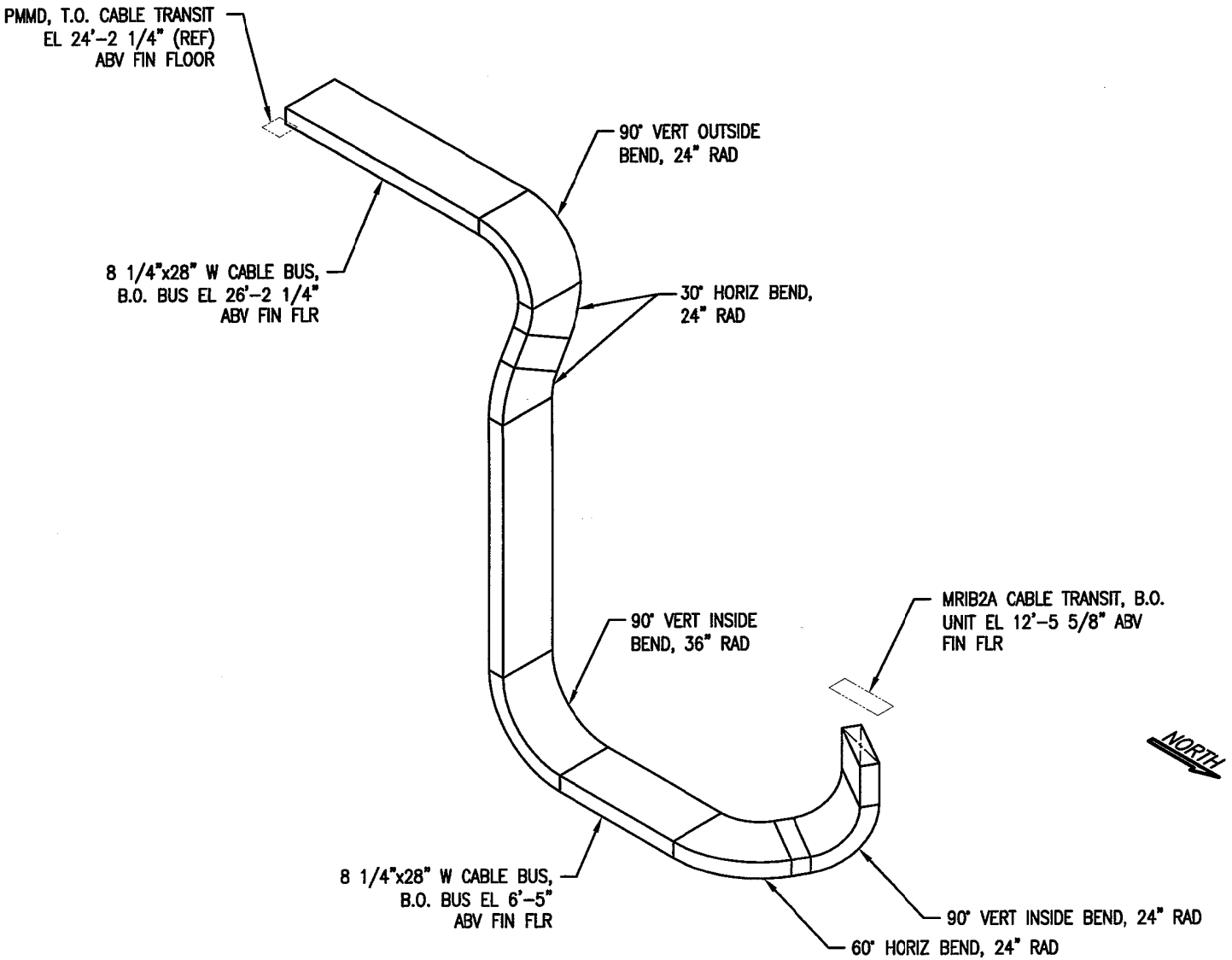
FIGURE 13A



PLAN VIEW NORTH

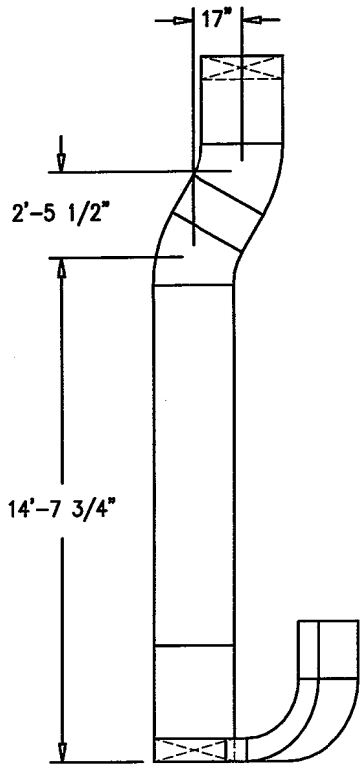
SWGR SG-4 TO MXFMR2A
CABLE BUS RUN
SCALE: 1"=10'-0"

FIGURE 13B

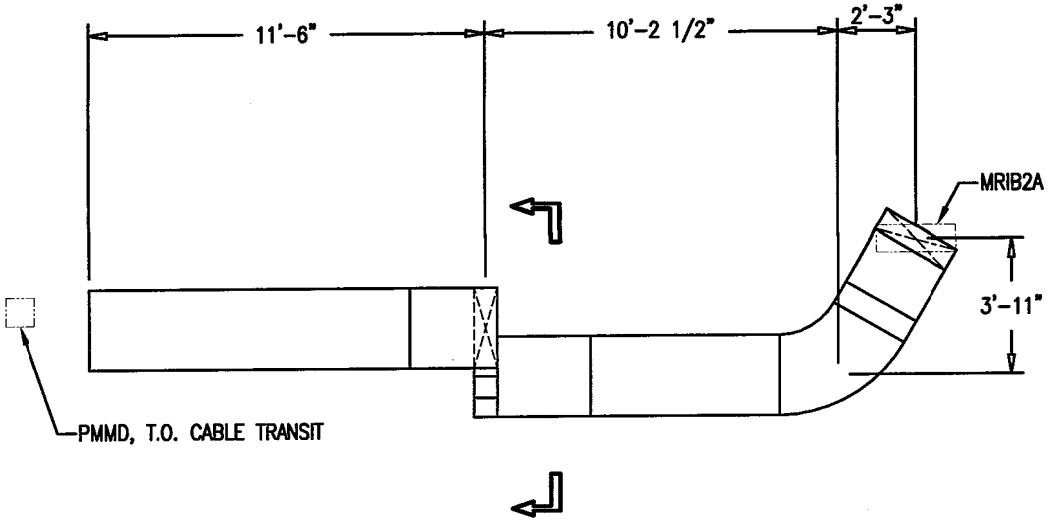


ISOMETRIC VIEW
MRIB-2A 1-3 TO PMMD
CABLE BUS RUN
SCALE: NONE

FIGURE 14A



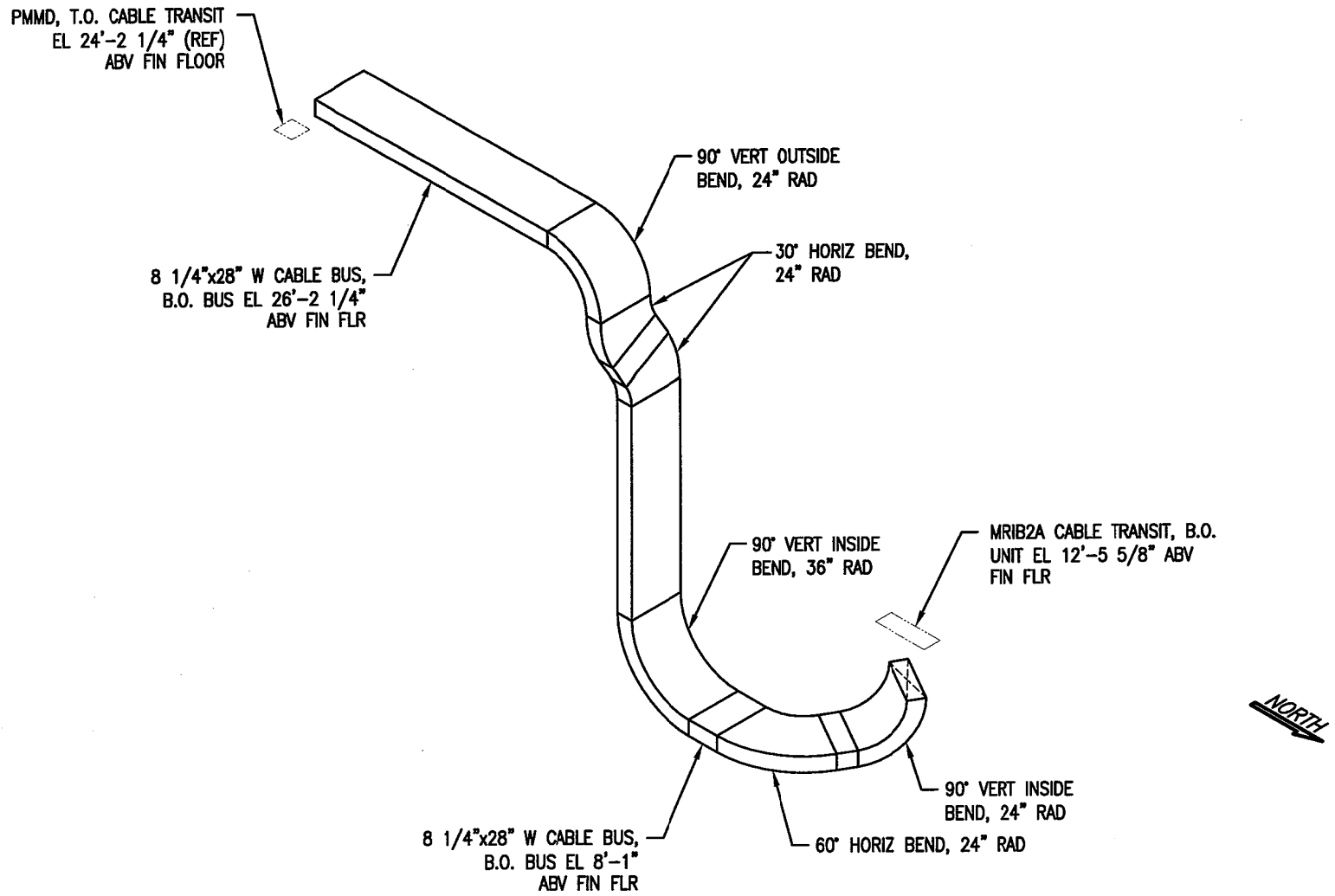
SECTION VIEW
MRIB-2A 1-3 TO PMMD
LOOKING SOUTH
SCALE: 3/16"=1'-0"



PLAN VIEW
MRIB-2A 1-3 TO PMMD
CABLE BUS RUN
SCALE: 3/16"=1'-0"

NORTH

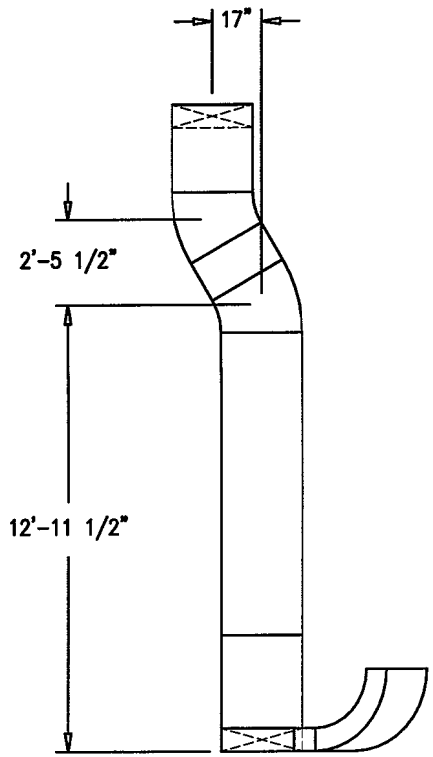
FIGURE 14B



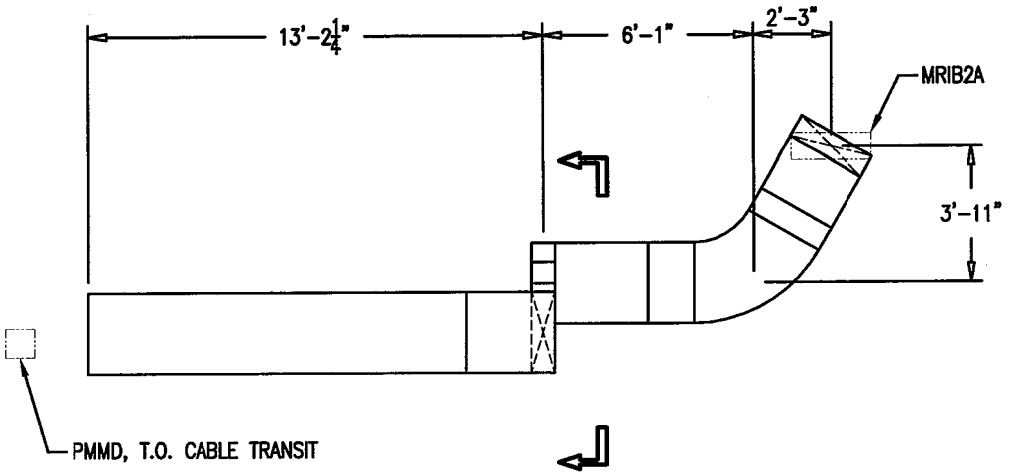
ISOMETRIC VIEW

MRIB-2A 4-6 TO PMMD
CABLE BUS RUN
SCALE: NONE

FIGURE 14C



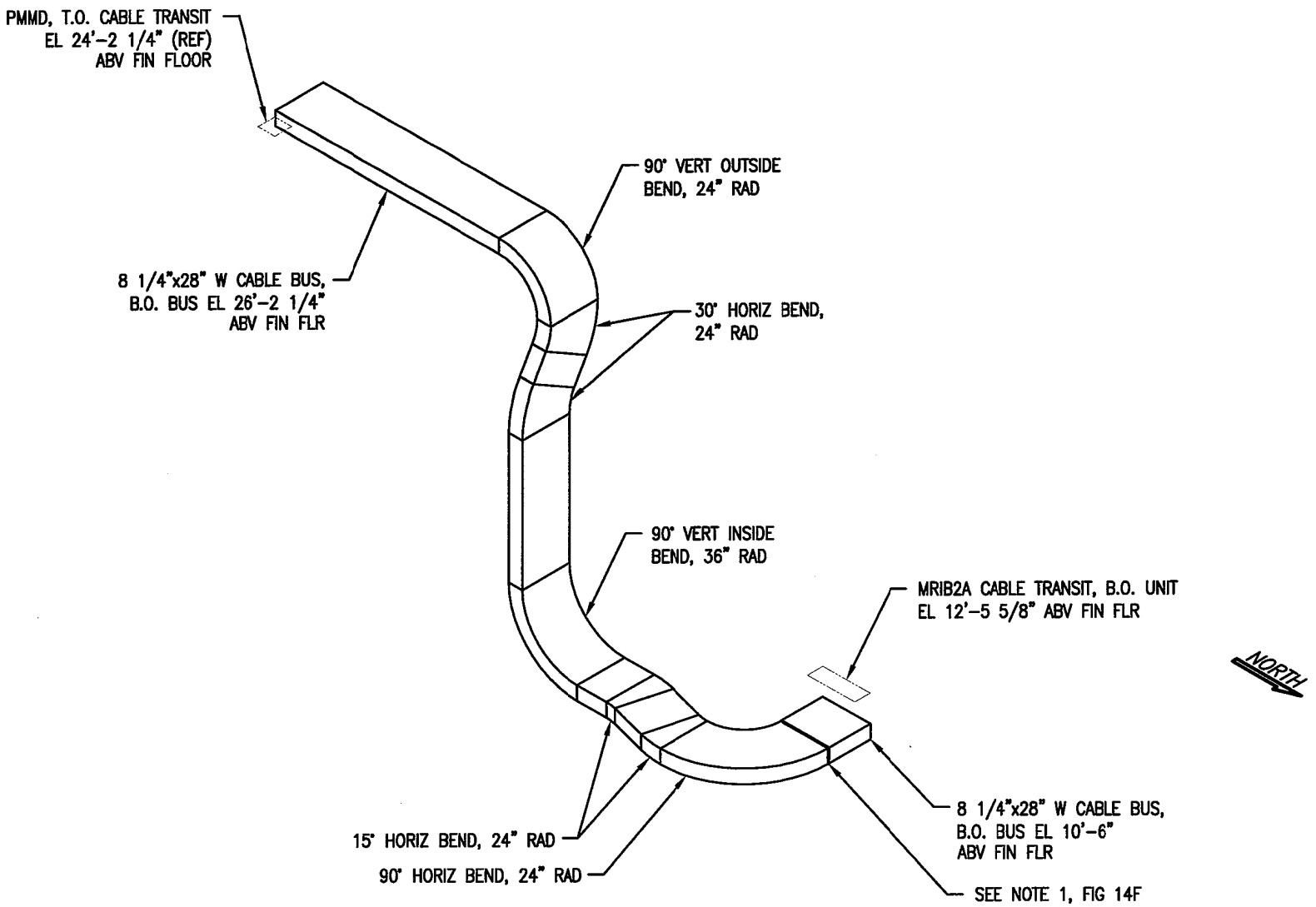
SECTION VIEW
MRIB-2A 4-6 TO PMMD
LOOKING SOUTH
SCALE: 3/16"=1'-0"



PLAN VIEW
MRIB-2A 4-6 TO PMMD
CABLE BUS RUN
SCALE: 3/16"=1'-0"

NORTH

FIGURE 14D

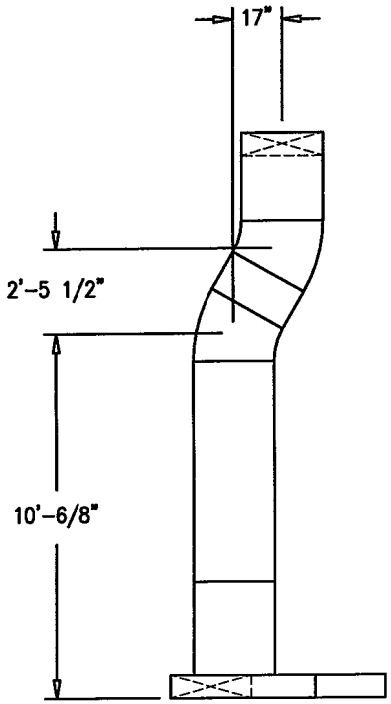


ISOMETRIC VIEW
MRIB-2A 7-9 TO PMMD
CABLE BUS RUN
SCALE: NONE

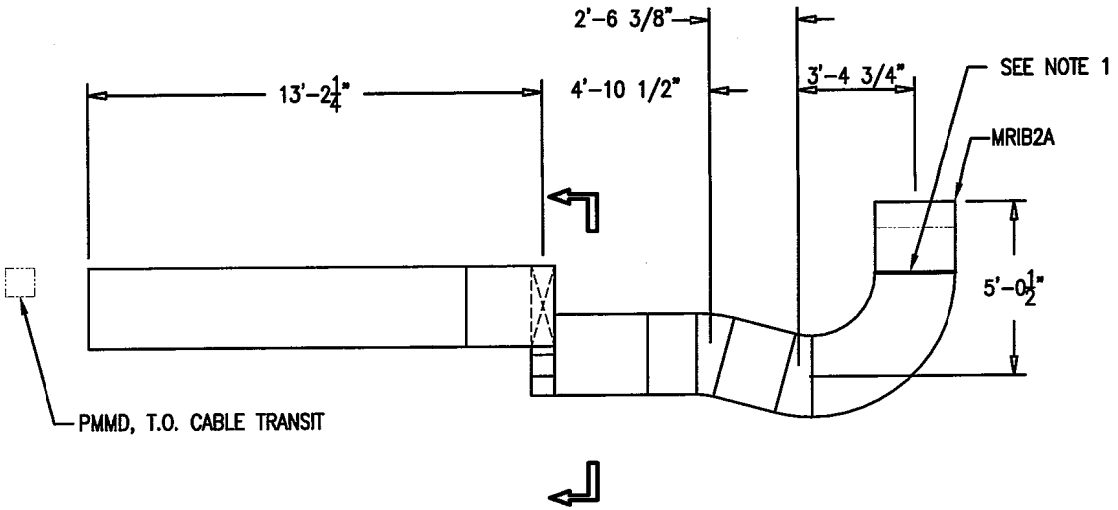
FIGURE 14E

NOTES

1. LAST CABLE BLOCK SUPPORT 18" FROM CABLE TRANSIT.

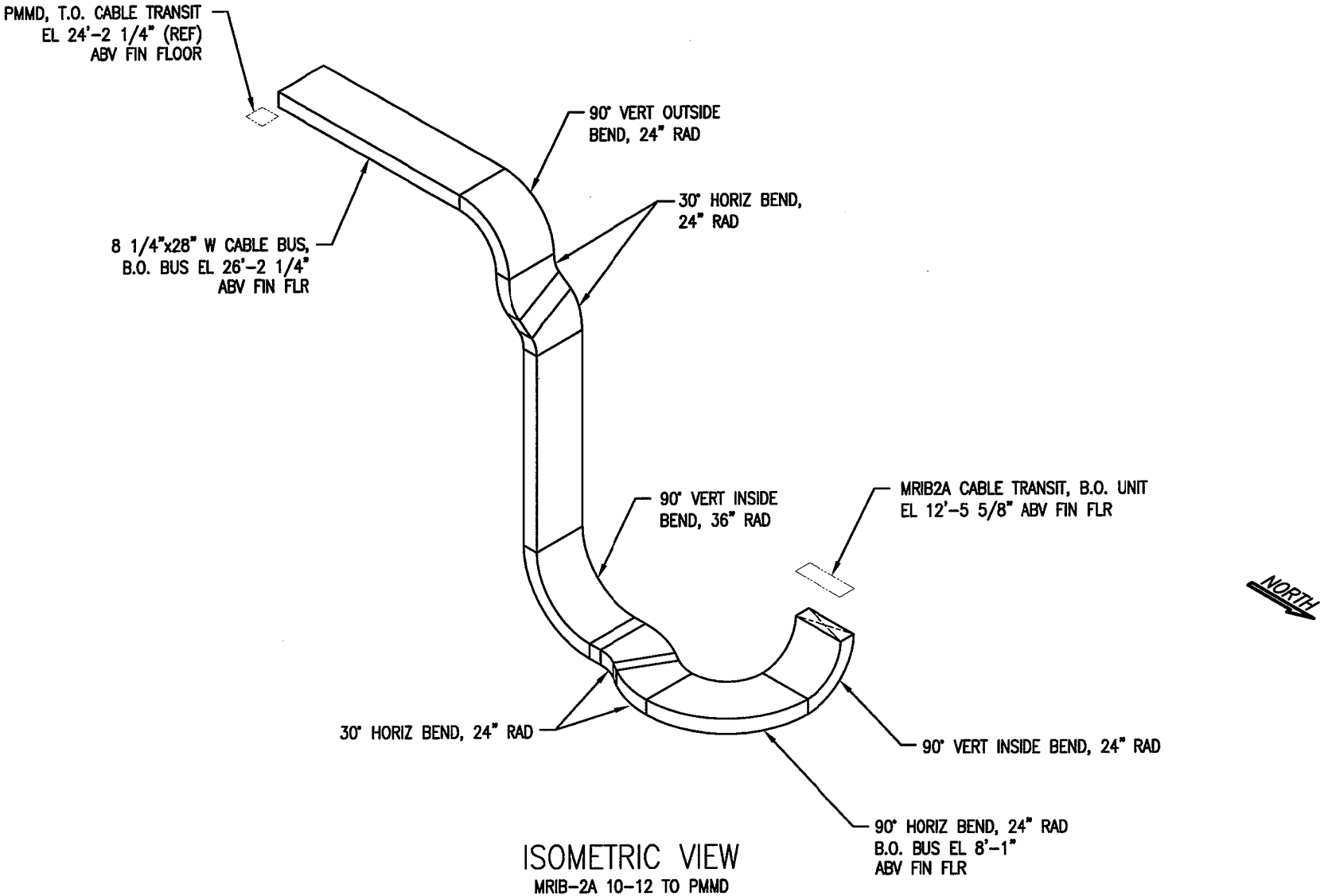


SECTION VIEW
MRIB-2A 7-9 TO PMMD
LOOKING SOUTH
SCALE: 3/16"=1'-0"



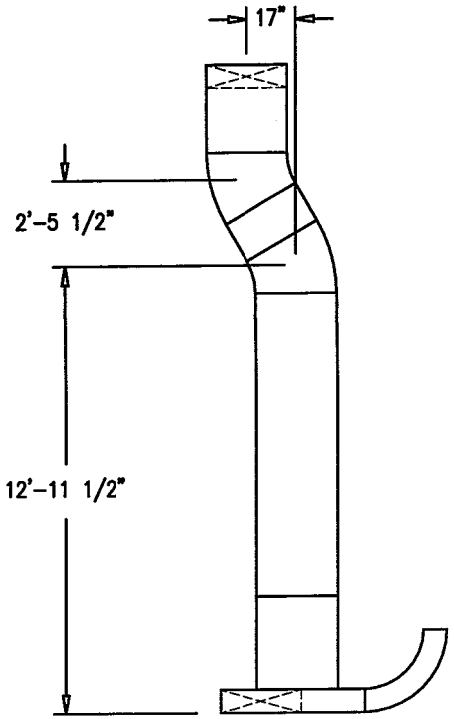
PLAN VIEW NORTH
MRIB-2A 7-9 TO PMMD
CABLE BUS RUN
SCALE: 3/16"=1'-0"

FIGURE 14F

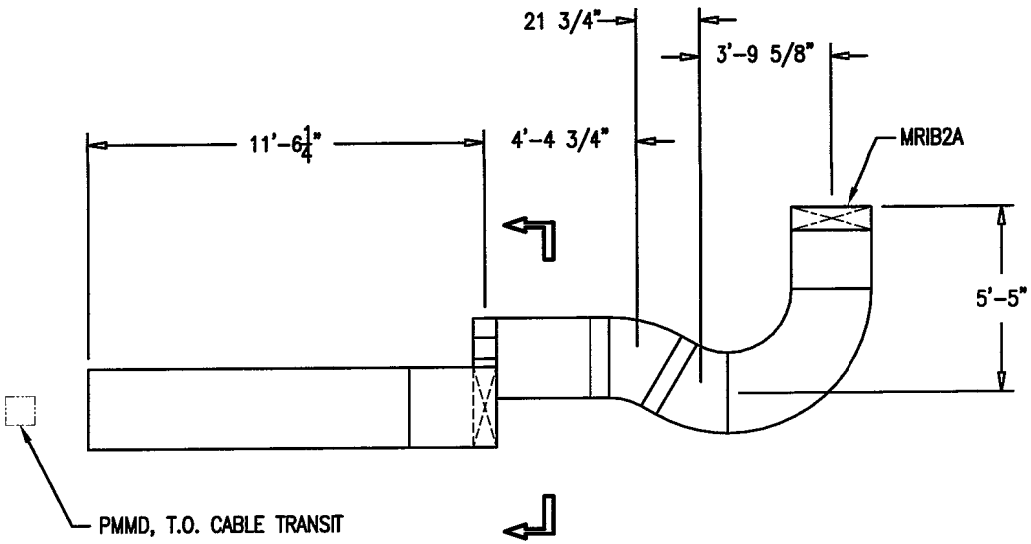


ISOMETRIC VIEW
MRIB-2A 10-12 TO PMMD
CABLE BUS RUN
SCALE: NONE

FIGURE 14G

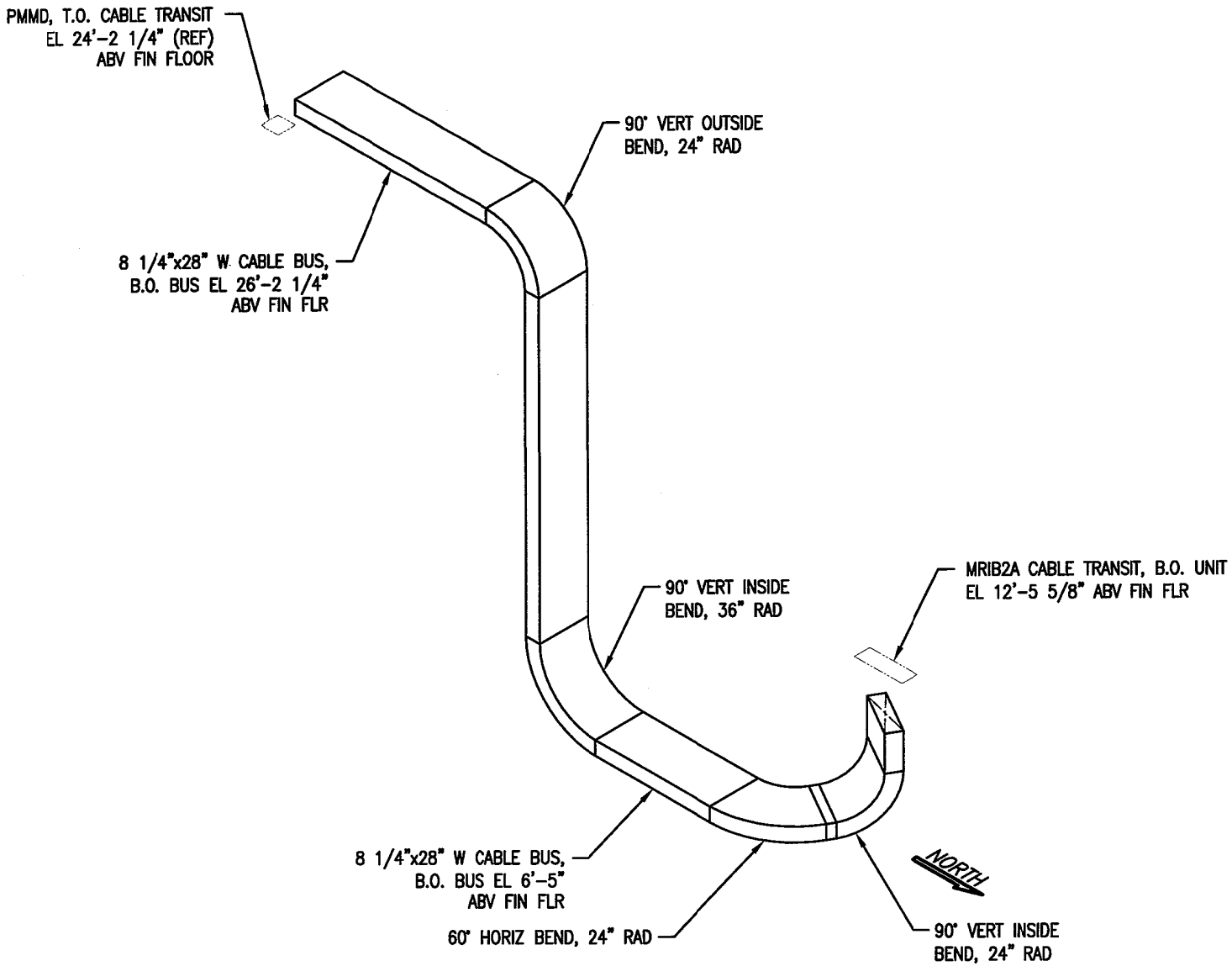


SECTION VIEW
MRIB-2A 10-12 TO PMMD
LOOKING SOUTH
SCALE: 3/16"=1'-0"



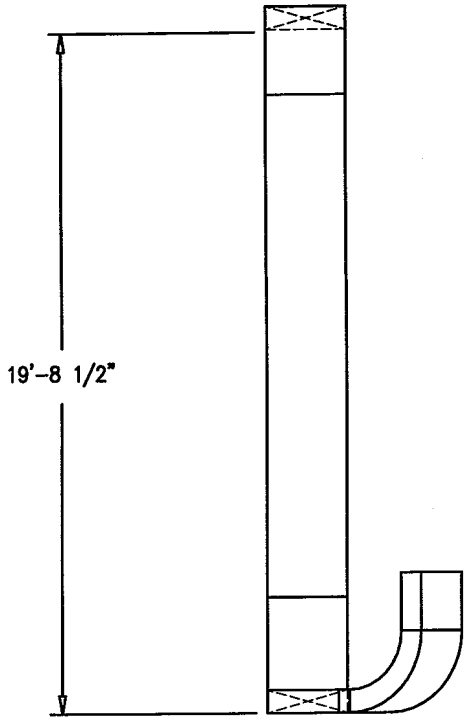
PLAN VIEW NORTH
MRIB-2A 10-12 TO PMMD
CABLE BUS RUN
SCALE: 3/16"=1'-0"

FIGURE 14H

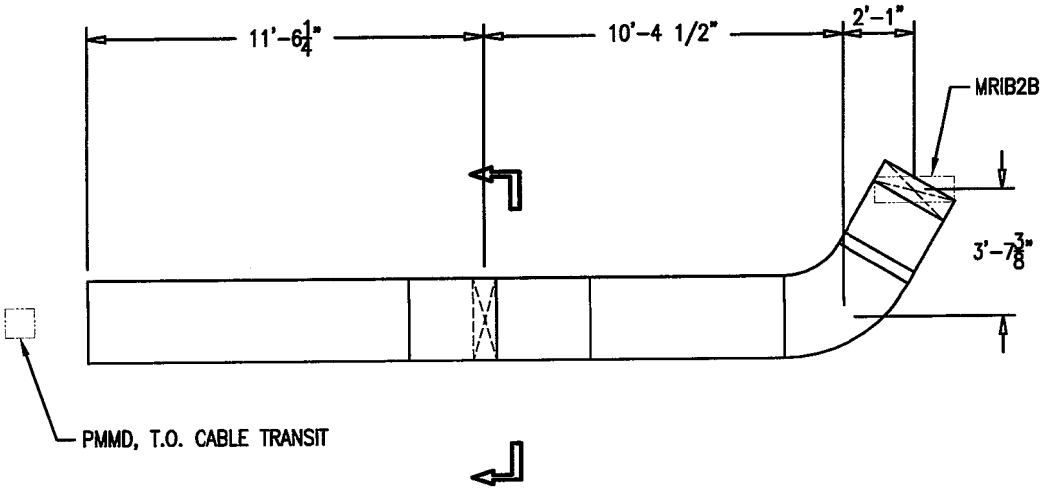


ISOMETRIC VIEW
MRIB-2B 1-3 TO PMMD
CABLE BUS RUN
SCALE: NONE

FIGURE 15A



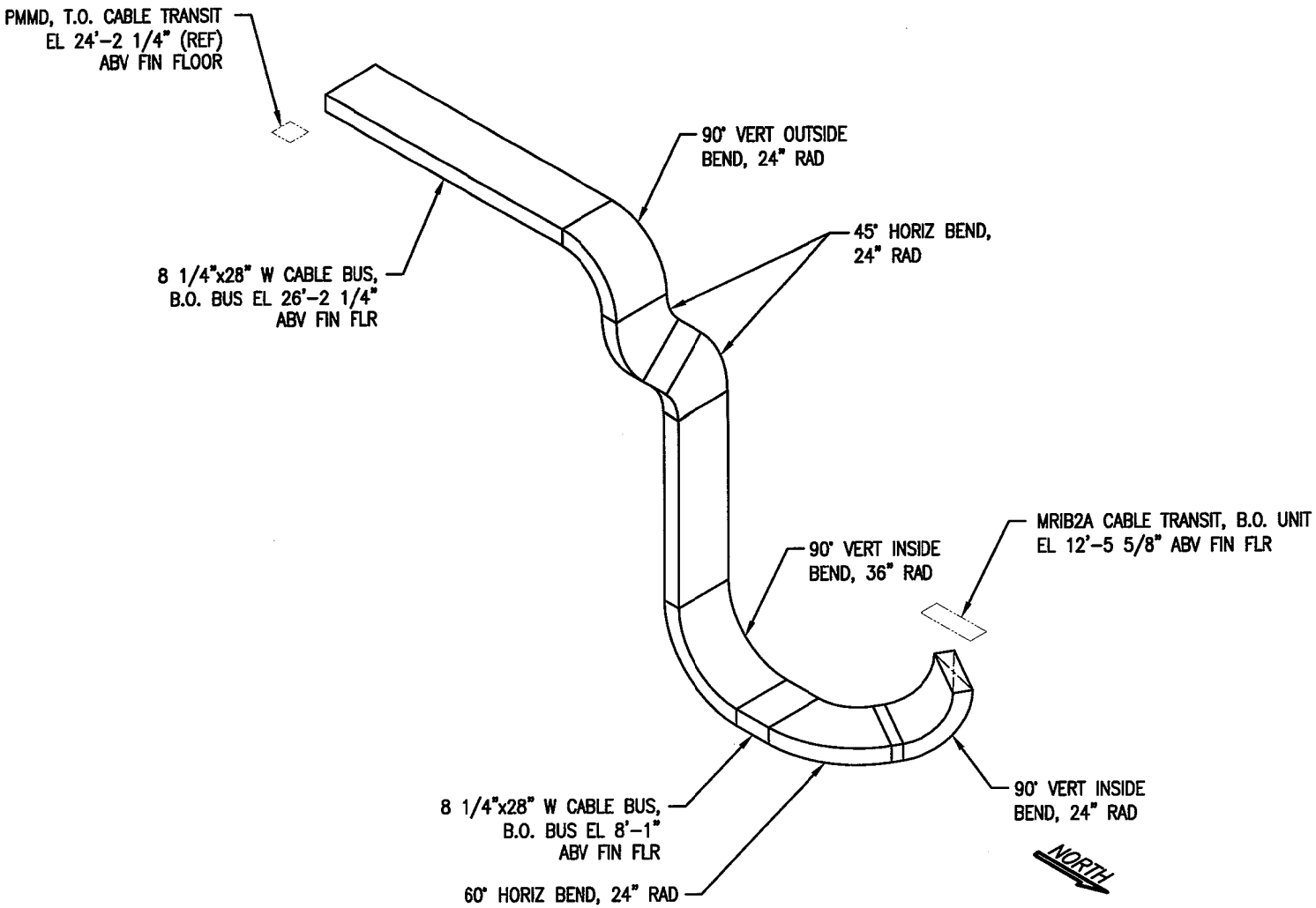
SECTION VIEW
MRIB-2B 1-3 TO PMMD
LOOKING SOUTH
SCALE: 3/16"=1'-0"



PLAN VIEW
MRIB-2B 1-3 TO PMMD
CABLE BUS RUN
SCALE: 3/16"=1'-0"

NORTH

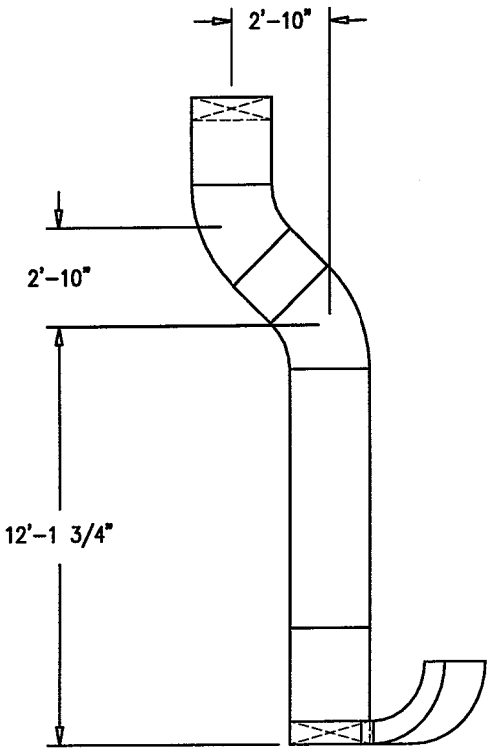
FIGURE 15B



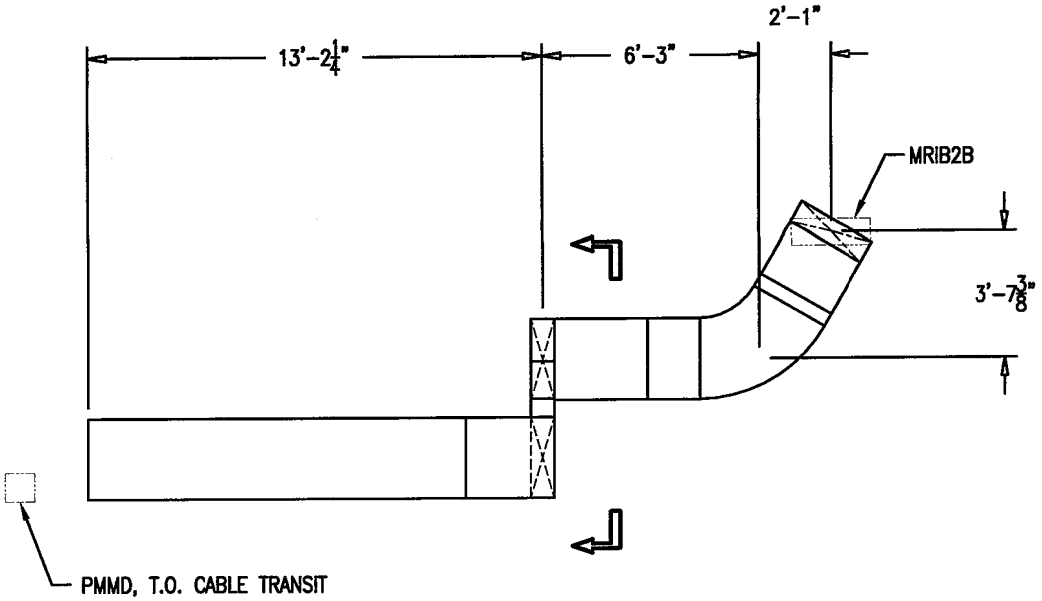
ISOMETRIC VIEW

MRIB-2B 4-6 TO PMMD
CABLE BUS RUN
SCALE: NONE

FIGURE 15C



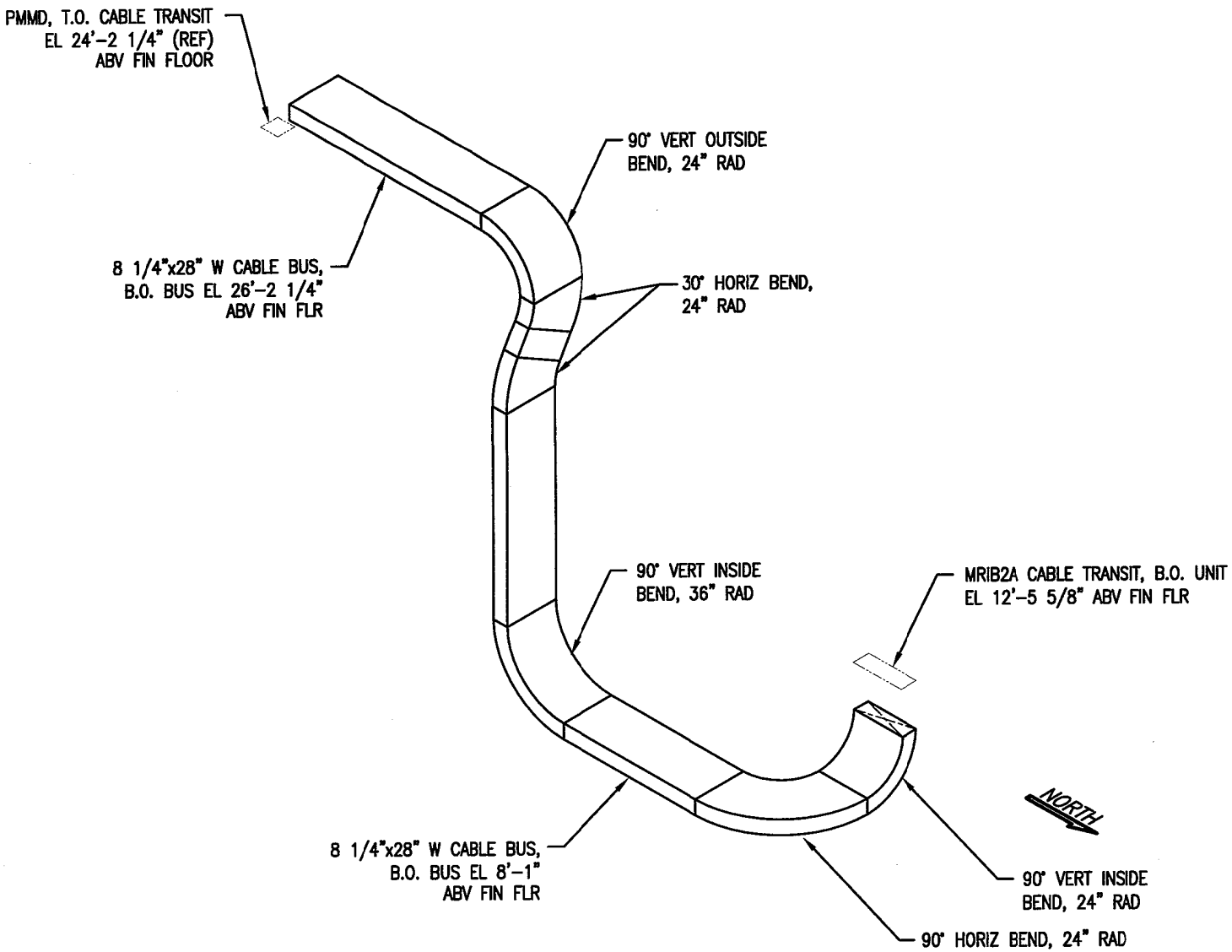
SECTION VIEW
MRIB-2B 4-6 TO PMMD
LOOKING SOUTH
SCALE: 3/16"=1'-0"



PLAN VIEW
MRIB-2B 4-6 TO PMMD
CABLE BUS RUN
SCALE: 3/16"=1'-0"

NORTH

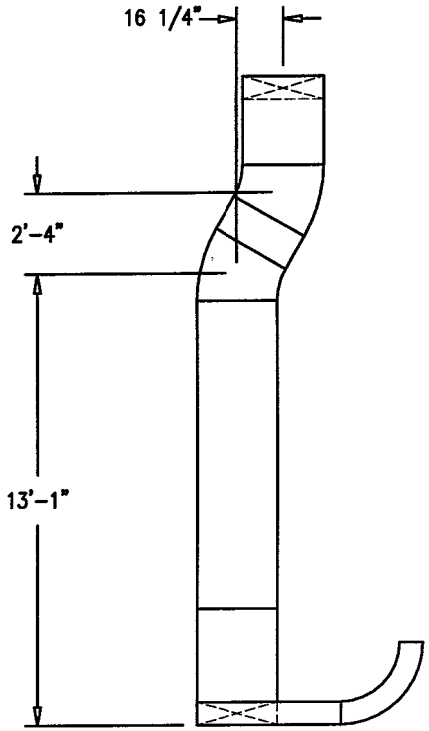
FIGURE 15D



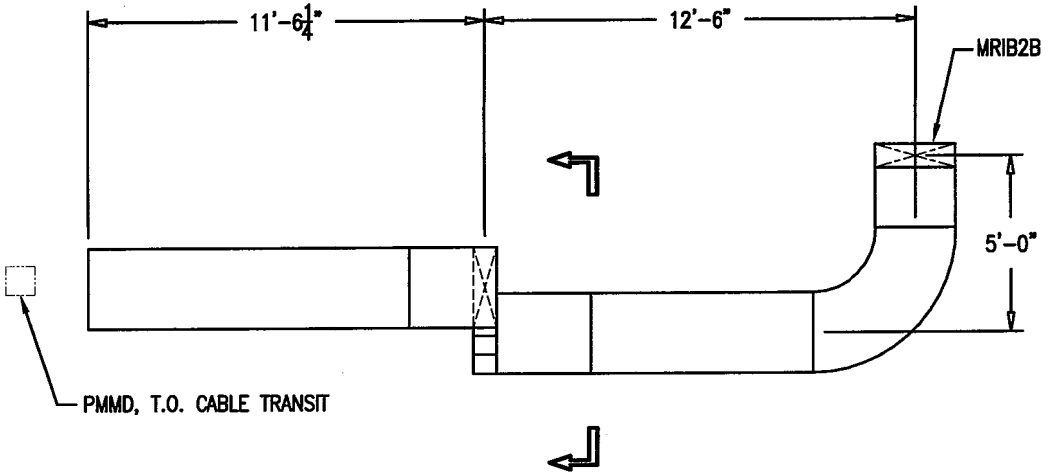
ISOMETRIC VIEW

MRIB-2B 7-9 TO PMMD
CABLE BUS RUN
SCALE: NONE

FIGURE 15E



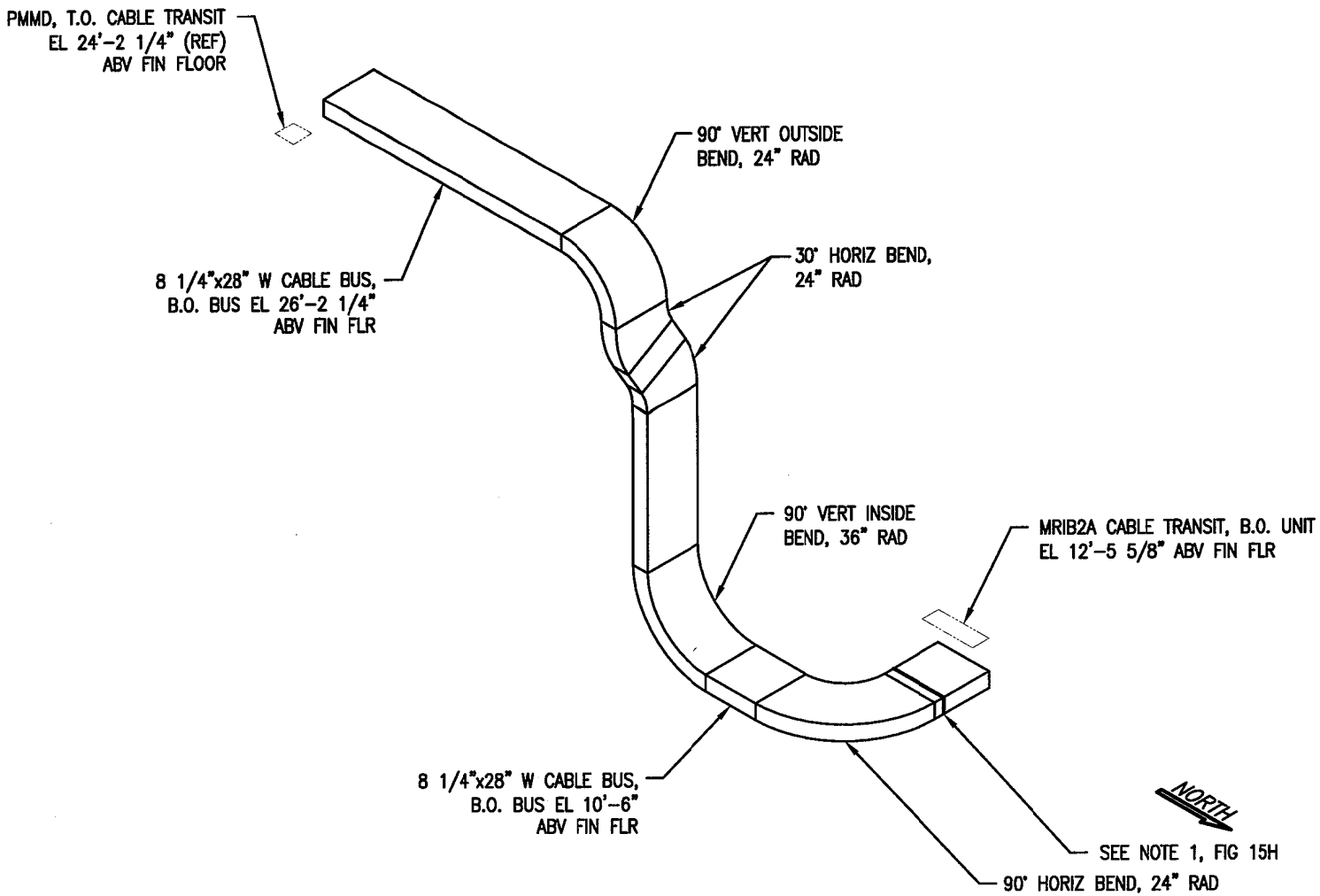
SECTION VIEW
MRIB-2B 7-9 TO PMMD
LOOKING SOUTH
SCALE: 3/16"=1'-0"



PLAN VIEW
MRIB-2B 7-9 TO PMMD
CABLE BUS RUN
SCALE: 3/16"=1'-0"

NORTH

FIGURE 15F



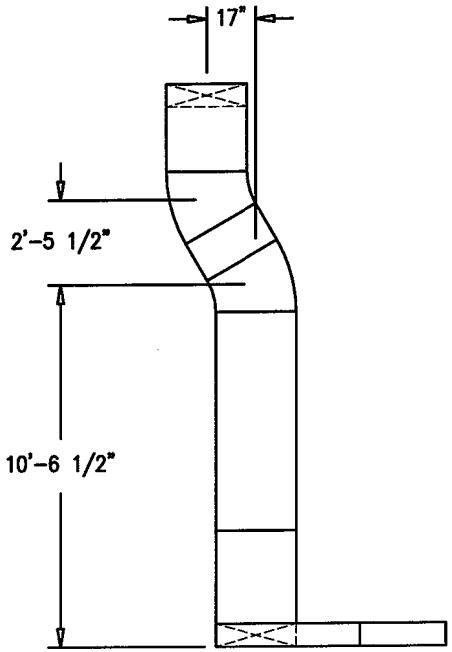
ISOMETRIC VIEW

MRIB-2B 10-12 TO PMMD
CABLE BUS RUN
SCALE: NONE

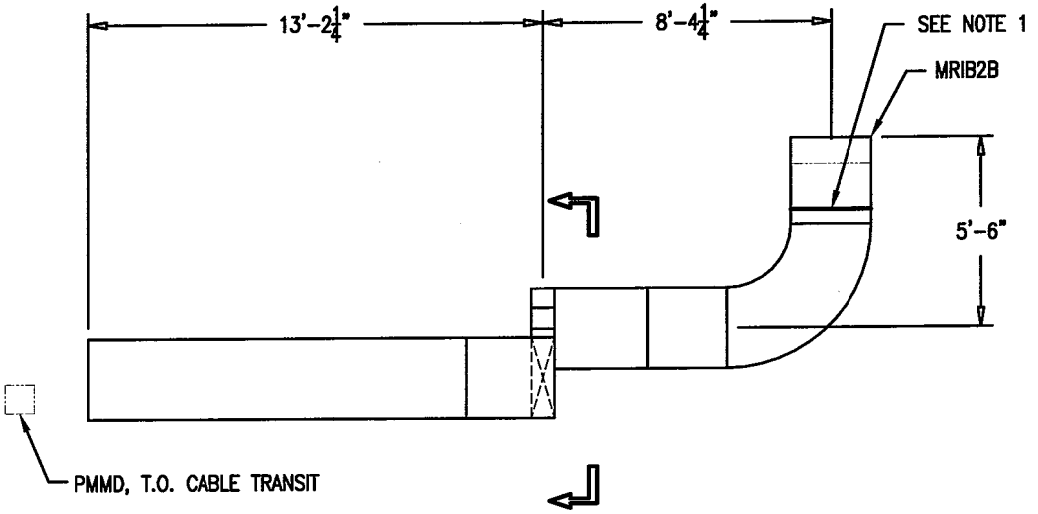
FIGURE 15G

NOTES

1. LAST CABLE BLOCK SUPPORT 18" FROM CABLE TRANSIT.



SECTION VIEW
MRIB-2B 10-12 TO PMMD
LOOKING SOUTH
SCALE: 3/16"=1'-0"



PLAN VIEW NORTH
MRIB-2B 10-12 TO PMMD
CABLE BUS RUN
SCALE: 3/16"=1'-0"

FIGURE 15H