

1.0 GENERAL

1.1 SCOPE OF WORK

1. This section specifies the supply and installation of corrugated metal culverts complete with flare ends.

1.2 RELATED WORK SPECIFIED IN OTHER SECTIONS

- | | | |
|----|----------------------|---------------------|
| 1. | Aggregate Materials | Section 31 05 16 |
| 2. | Subgrade Preparation | Section 31 23 13-00 |

1.3 SAMPLES

1. At least two (2) weeks prior to commencing work, inform Consultant of proposed source of pipe zone materials and provide a sieve analysis of the source material.

1.4 MATERIAL CERTIFICATION

1. At least two (2) weeks prior to commencing work, submit manufacturer's test data and certification that pipe materials meet requirements of this section.

1.5 SCHEDULING OF WORK

1. Schedule work to minimize interruptions to existing services.
2. Maintain existing storm water flow during construction if required.

2.0 PRODUCTS

2.1 CORRUGATED METAL PIPE AND FLARE ENDS

1. The culverts shall be galvanized corrugated metal pipe with 2.0m wall thickness (68 mm x 13 mm corrugations) of the diameters indicated complete with stock flare ends.

2.2 PIPE ZONE MATERIAL

1. Refer to Section 31 05 17 – Aggregate Materials, Designation 2. Class 25.

3.0 EXECUTION

3.1 PREPARATION

1. Clean pipes, flare ends and fittings of debris and water before installation. Carefully inspect materials for defects before installing. Remove defective materials from site.

3.2 TRENCHING AND BACKFILLING

1. Do trenching and backfill work in accordance with Section 31 23 38 – Trench Excavation and Backfill.
2. Do not allow contents of any ditch to flow into trench.
3. Trench line and depth require approval prior to placing bedding material and pipe.

3.3 BEDDING

1. Place bedding on 300 mm compacted subgrade to 98% of Standard Proctor Density.
2. Place bedding all around pipe, top, bottom and sides of pipe to a minimum depth of 200 mm compacted to 98% of Standard Proctor Density.
3. Provide 1.0m length clay plug at inlet and outlet.

3.4 INSTALLATION

1. Lay and join pipe in accordance with manufacturer's recommendations.
2. Handle pipe by approved methods. Do not use chains or cables passed through rigid pipe bore so that weight of pipe bears upon pipe ends.
3. Lay pipes on prepared bed, true to line and grade with pipe inverts smooth and free of sags or high points. Ensure barrel of each pipe is in contact with shaped bed throughout its full length.
4. Commence laying at outlet and proceed in upstream direction with socket ends of pipe facing upgrade.
5. Do not exceed maximum joint deflection recommended by pipe manufacturer.
6. Do not allow water to flow through pipes during construction except as may be permitted by the Consultant.
7. Whenever work is suspended, install removable watertight bulkhead at open end of last pipe laid to prevent entry of foreign materials.
8. Position and join pipes by methods approved by the Consultant. Do not use excavating equipment to force pipe sections together.
9. Pipe Jointing:
 1. Install gaskets as recommended by manufacturer.
 2. Support pipes with hand slings or crane as required to minimize lateral pressure on gasket and maintain concentricity until gasket is properly positioned.
 3. Align pipes carefully before joining.
 4. Maintain pipe joints free from mud, silt, gravel and other foreign material.
 5. Avoid displacing gasket or contaminating with dirt or other foreign material. Remove disturbed or dirty gaskets; clean, lubricate and replace before joining is attempted.
 6. Complete each joint before laying next length of pipe.
 7. Minimize joint deflection after joint has been made to avoid joint damage.
 8. Apply sufficient pressure in making joints to ensure that joint is complete as outlined in manufacturer's recommendations.
10. When any stoppage of work occurs, block pipes as directed by Consultant, to prevent "creep" during down time.
11. Plug lifting holes with Consultant approved prefabricated plugs, set in non-shrink grout.
12. Do not cut pieces of pipe use full pieces only.
13. Order flare ends in both bell and spigot ends and install as per the manufacturer's recommendations.

3.6 FIELD TESTING

1. Repair or replace pipe, pipe joint or bedding found defective.
2. When directed by the Consultant, draw tapered wooden plug with diameter of 50 mm less than nominal pipe diameter through culvert to ensure that pipe is free of obstruction.
3. Remove foreign material from culverts and related appurtenances by flushing with water.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 American National Standards Institute (ANSI)/National Electrical Manufacturers (NEMA)
 - .1 ANSI/NEMA C29.17-2002, Composite-Line Post Type Insulators.
 - .2 ANSI/NEMA C29.18-2003, Composite-Distribution Line Post Type Insulators.
 - .3 ANSI/NEMA C29.3-1986(R2002), Wet-Processed Porcelain Insulators-(Spool Type).
 - .4 ANSI/NEMA C29.4-1989(R2002), Wet-Processed Porcelain Insulators (Strain Type).
 - .5 ANSI/NEMA C29.5-1984(R2002), Wet-Process Porcelain Insulators (Low- and Medium-Voltage Pin Type).
- .2 Canadian Electrical Association Purchasing Specification (CEA)
 - .1 CEA LWIWG-02-96, Line Post Composite Insulator for Overhead Distribution Lines.
- .3 Canadian Standards Association (CSA International)
 - .1 CAN/CSA-G12-92(R2007), Zinc-Coated Steel Wire Strand.
 - .2 CAN/CSA-C83-96(R2005), Communication and Power Line Hardware.
 - .3 CAN/CSA-O80 Series-08, Wood Preservation.
 - .4 CAN/CSA-O15-05, Wood Utility Poles and Reinforcing Stubs.
 - .5 CSA O116-1969(R2008), Power and Communication Sawn Wood Crossarms.
- .4 Electrical and Electronic Manufacturers' Association of Canada (EEMAC)
 - .1 EEMAC 1B-1, 1957, Standard for Wet Process Porcelain Insulators (Strain Type).
 - .2 EEMAC 2B-1, 1957, Standard for Wet Process Porcelain Insulators (Spool Type).
- .5 Local Utility Standards

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop drawings:
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Alberta, Canada indicating:

- .1 Materials.
- .2 Method of anchorage.
- .3 Number of anchors.
- .4 Supports.
- .5 Reinforcement.
- .6 Assembly details.
- .7 Accessories.

1.3 QUALITY ASSURANCE

- .1 Quality assurance submittals: submit following in accordance with Section 01 45 00 - Quality Control.
 - .1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .2 Manufacturer's Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence, cleaning procedures.
- .2 Health and Safety Requirements: worker protection:
 - .1 Workers must wear gloves, respirators, dust masks, long sleeved clothing, eye protection, protective clothing when applying preservative materials.
 - .2 Workers must not eat, drink or smoke while applying preservative material.
 - .3 Clean up spills of preservative materials immediately with absorbent material and safely discard to sanitary landfill.
 - .4 Workers must wear personal protective wear: hardhat and safety shoes.
- .3 Perform work to comply with applicable Provincial/Territorial regulations.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements:
 - .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

Part 2 Products

2.1 MATERIALS

- .1 Wood preservation: to CAN/CSA O80 Series.
- .2 Power line hardware: to CAN/CSA-C83.
- .3 Wood utility poles: to CAN/CSA-O15, preservative treated.
- .4 Reinforcing stubs: to CAN/CSA-O15, wood species.

2.2 CROSSARMS

- .1 Wood crossarms: to CSA O116, pressure or vacuum treated with preservative:

2.3 INSULATORS

- .1 Primary insulators:
 - .1 Pin type: to ANSI/NEMA C29.5 for low and medium voltages.
- .2 Secondary insulators:
 - .1 Spool type: to EEMAC2B-1, ANSI/NEMA C29.3 mounted on secondary racks, for secondary runs.
- .3 Guy strain insulators:
 - .1 Strain type: to EEMAC1B-1, ANSI/NEMA C29.
- .4 Post type insulators: to ANSI/NEMA C29.17, ANSI/NEMA C29.18, CEA LWIWG-02.
- .5 Suspension/dead end insulators.

2.4 GUYS AND ANCHORS

- .1 Guy wire: to CAN/CSA-G12, 9 mm nominal diameter, stranded, galvanized steel for dead ends and guys.
- .2 Guy clamps: three-bolt heavy duty or preform grip type.
- .3 Eye bolt: 19 mm thimble, length to suit, four hole guy straps and 16 mm machine bolt with square washer to attach guy wire to pole.
- .4 Anchor rod: 19 mm diameter x 2.7 m long, galvanized steel with thimble eye.
- .5 Anchor: manufacturer's standard, approved by Departmental Representative
 - .1 Heavy duty expanding type, four way.
 - .2 Power installed screw anchor (PISA), double helix.
 - .3 Log anchor in earth or swamp.
 - .4 Rock anchor.
- .6 Guy guard: half-round, galvanized steel 2.7 m long.
- .7 Guy guard: plastic, colored yellow, 2.7 m long.

2.5 GROUND RODS, GROUND CONDUCTORS AND GRADIENT MAT

- .1 In accordance with Section 26 05 27 - Grounding - Primary.

2.6 EQUIPMENT IDENTIFICATION

- .1 Rustproof number nails with 50 mm high designated number.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Install electrical pole lines and hardware in accordance with manufacturer's written recommendations and specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 PREPARATION OF POLES

- .1 Where poles require shortening, cut piece from top only.
- .2 Roof top of poles with two cuts forming planes at 45 degrees to meet in horizontal ridge.
- .3 Treat roof top, gains, bored holes with preservative before assembly.
- .4 Cut parallel plane crossarm gains in face of pole for single and double arming, spacing as indicated.
- .5 Bore hole in center of each gain for crossarm bolt.
- .6 Drill crossarms for pins, through bolts, double arm bolts and brace bolts.
 - .1 Pre-drill treated crossarms to standard spacing.
- .7 Fasten insulator pins to crossarms with galvanized steel nails.
- .8 Install crossarms and braces.
- .9 Attach stand-off insulators and eye-bolts.

3.3 INSTALLATION

- .1 Locate and dig pole holes.
 - .1 Make holes large enough to allow space for tamping backfill.
- .2 Set poles.
- .3 Align poles with crossarms at right angles to pole line on straight runs.
- .4 At change in direction of line, set crossarms to bisect angle formed by change.
- .5 Set poles to maintain even grade.
 - .1 Allow for contour of terrain and do not exceed grading of 1.5 m per pole.
- .6 Replace backfill in 150 mm layers.
 - .1 Tamp each layer, and apply final layer to drain water away from pole.
- .7 Locate and install guy wires and anchors at dead-ends, at non-tangent poles, corner poles, and start of branch feeders.
- .8 Insert anchor at least 1.8 m into ground. Backfill and tamp in 150 mm layers.

- .9 Install insulators.
- .10 Locate and construct transformer platform between 2 poles.
- .11 Install number nails on each pole.
- .12 Identify primary circuit on pole showing phasing of each conductor, every 1000 m and including origin of primary pole.

3.4 FIELD QUALITY CONTROL

- .1 Perform tests and field inspection for pole lines and hardware prior to energization.
- .2 Use qualified tradespersons for installation, termination and testing of high voltage power lines and hardware.
- .3 Submit test result and inspection certificate for review.

3.5 CLEANING

- .1 Clean in accordance with Section 01 74 11 – Cleaning.
 - .1 Remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CAN/CSA A23.1-04/A23.2-04, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 QUALITY ASSURANCE

- .1 Quality assurance submittals: submit following in accordance with Section 01 45 00 - Quality Control.
- .2 Regulatory Requirements: Perform Work to comply with applicable Provincial/Territorial regulations.
 - .1 Co-ordinate and meet requirements of power supply authority.
 - .1 Ensure availability of power when required.
- .3 Certificates: submit certificates signed by manufacturer certifying materials comply with specified performance characteristics and physical properties.
- .4 Manufacturer's Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence, cleaning procedures.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements:
 - .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

Part 2 Products

2.1 MATERIALS

- .1 Underground ducts: rigid type DB2, size as indicated.

- .2 Rigid steel galvanized conduit and fittings: size as indicated.
- .3 Conductors: copper, type RWU-90, size and number of conductors as indicated.
- .4 Meter socket: weatherproof, and approval of supply authority.
- .5 Concrete: to CAN/CSA A23.1/A23.2.
- .6 Backfill: clean and free of debris.
- .7 Pulling Iron:
 - .1 22 mm diameter hot dipped galvanized steel bar with exposed triangular shaped opening.

Part 3 Execution

3.1 APPLICATION

- .1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 INSTALLATION

- .1 Allow adequate conductor length for connection to supply by power supply authority.
- .2 Install meter socket and conduit.
- .3 Allow adequate conductor length for connection to service equipment.
- .4 Make grounding connections in accordance with Section 26 05 28 - Grounding - Secondary.
- .5 Install concrete encased ducts for electrical systems as indicated and in accordance with CAN/CSA A23.1.
- .6 Install pulling irons as required.
- .7 Seal ducts and conduits at building entrance location after installation of cable.

3.3 FIELD QUALITY CONTROL

- .1 Site Tests:
 - .1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.
 - .2 Perform additional tests if required by authority having jurisdiction.
- .2 Submit written test results to Departmental Representative for review.

3.4 CLEANING

- .1 Clean in accordance with Section 01 74 11 - Cleaning.
- .1 Remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM A82/A82M-05a, Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
 - .2 ASTM A185/A185M-05a, Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.
 - .3 ASTM C139-05, Standard Specification for Concrete Masonry Units for Construction of Catch Basins and Manholes.
 - .4 ASTM C 478/C478M-06, Standard Specification for Precast Reinforced Concrete Manhole Sections.
 - .5 ASTM D1056-00, Standard Specification for Flexible Cellular Materials - Sponge or Expanded Rubber.
- .2 Canadian Standards Association (CSA International)
 - .1 CAN/CSA-A3000-03(R2005), Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).
 - .1 CSA-A3001-03, Cementitious Materials for Use in Concrete.
 - .2 CSA A23.1/A23.2-04, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
 - .3 CAN/CSA-G30.18-M92(R2002), Billet-Steel Bars for Concrete Reinforcement.
- .3 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
 - .1 Submit shop drawings for precast manholes.
- .4 Quality assurance submittals: submit following in accordance with Section 01 45 00 - Quality Control.SPEC NOTE: Specify which test reports are required and identify material to which they are to apply.
 - .1 Test reports: submit certified test reports for specified materials from approved independent testing laboratories, indicating compliance with specifications for specified performance characteristics and physical properties.

- .2 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .5 Manufacturer's Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence, cleaning procedures.

1.3 QUALITY ASSURANCE

- .1 Pre-Installation Meetings: convene pre-installation meeting one week prior to beginning on-site installation, with contractor's representative and Departmental Representative in accordance with Section 01 32 16.07 - Construction Progress Schedule – Bar (Gantt) Chart to:
 - .1 Verify project requirements.
 - .2 Review installation and substrate conditions.
 - .3 Co-ordination with other building subtrades.
 - .4 Review manufacturer's installation instructions and warranty requirements.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements. Deliver, store and handle materials in accordance with manufacturer's written instructions.

Part 2 Products

2.1 PVC DUCTS

- .1 PVC ducts, type EB1, encased in reinforced concrete.

2.2 PVC DUCT FITTINGS

- .1 Rigid PVC opaque solvent welded type couplings, bell end fittings, plugs, caps, adaptors as required to make complete installation.
- .2 Expansion joints.
- .3 Rigid PVC 5 degree angle couplings.

2.3 DRAINAGE

- .1 Floor drain fittings: consisting of floor drain, back water valve, trap and pipe connection to drainage system.
- .2 Storm sewer connection: cast iron service saddle consisting of oil resistant gasket, stainless steel clamp and oil resistant O ring.
- .3 Sump pit: 300 x 300 x 125 mm.

2.4 GROUNDING

- .1 Ground rods: in accordance with Section 26 05 27 - Grounding - Primary for cable rack grounding.

2.5 CABLE PULLING EQUIPMENT

- .1 Pulling iron: galvanized steel rods, size and shape as indicated.
- .2 Pull rope: 6 mm stranded polypropylene, tensile strength 5 kN, continuous throughout each duct run with 3 m spare rope at each end.

2.6 MARKERS

- .1 Concrete type cable markers: 600 x 600 x 100 mm, with words: "Cable", "Joint", "Conduit" impressed in top surface, with arrows to indicate change in direction of duct runs.
- .2 Cedar post type markers: 89 x 89 mm square, 1.5 m long, pressure treated with clear or copper naphthenate or 5% pentachlorophenol solution, water repellent preservative, with nameplate fastened near post top, on side facing duct.
 - .1 Nameplate: aluminum anodized 89 x 125 mm, 1.5 mm thick mounted on cedar post with mylar label 0.125 mm thick with words "Cable", "Joint", "Conduit" with arrows to indicate change in direction.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 INSTALLATION GENERAL

- .1 Install underground duct banks including formwork.
- .2 Build duct bank on undisturbed soil or on well compacted granular fill not less than 150 mm thick, compacted to 95% of maximum proctor dry density. Open trench completely between manholes before ducts are laid and ensure that no obstructions will necessitate change in grade of ducts.
- .3 Prior to laying ducts, construct "mud slab" not less than 75 mm thick.
- .4 Install ducts at elevations and with slope as indicated and minimum slope of 1 to 400.
- .5 Install base spacers at maximum intervals of 1.5 m levelled to grades indicated for bottom layer of ducts.

- .6 Lay PVC ducts with configuration and reinforcing as indicated with [preformed interlocking, rigid plastic intermediate spacers to maintain spacing between ducts at not less than 40 mm horizontally and vertically.
 - .1 Stagger joints in adjacent layers at least 150 mm and make joints watertight.
 - .2 Encase duct bank with 75 mm thick concrete cover.
 - .3 Use galvanized steel conduit for sections extending above finished grade level.
- .7 Make transpositions, offsets and changes in direction using 5 degree bend sections, do not exceed a total of 20 degree with duct offset.
- .8 Use conduit to duct adapters when connecting to conduits.
- .9 Terminate duct runs with duct coupling set flush with end of concrete envelope when dead ending duct bank for future extension.
- .10 Cut, ream and taper end of ducts in field in accordance with manufacturer's recommendations, so that duct ends are fully equal to factory-made ends.
- .11 Allow concrete to attain 50% of its specified strength before backfilling.
- .12 Use anchors, ties and trench jacks as required to secure ducts and prevent moving during placing of concrete. Tie ducts to spacers with twine or other non-metallic material.
 - .1 Remove weights or wood braces before concrete has set and fill voids.
- .13 Clean ducts before laying:
 - .1 Cap ends of ducts during construction and after installation to prevent entrance of foreign materials.
- .14 Duct cleaning:
 - .1 Pull 300 mm long x diameter 6 mm less than internal diameter of duct steel mandrel through each duct, immediately after placing of concrete.
 - .2 Then pull stiff bristle brush through duct; avoid disturbing or damaging ducts where concrete has not set completely.
 - .3 Pull stiff bristle brush through each duct immediately before pulling-in cables.
- .15 Install pull rope continuous throughout each duct run with 3 m spare rope at each end.

3.3 MARKERS

- .1 Mark location of duct runs under hard surfaced areas not terminating in manhole with railway spike driven flush in edge of pavement, directly over run.
 - .1 Place concrete duct marker at ends of such duct runs.
 - .2 Construct markers and install flush with grade.
- .2 Mark ducts every 150 m along straight runs and changes in direction.
- .3 Where markers are removed to permit installation of additional duct, reinstall existing markers.
- .4 Lay concrete markers flat and centered over duct with top 25 mm above earth surface.

- .5 Provide drawings showing locations of markers.

3.4 FIELD QUALITY CONTROL

- .1 Site Tests/Inspections:
 - .1 Inspection of duct will be carried out by Departmental Representative prior to placing.
 - .2 Placement of concrete and duct cleanout to be done when Departmental Representative present.

3.5 CLEANING

- .1 Proceed in accordance with Section 01 74 11 - Cleaning.
- .2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

