CITY OF DETROIT

SPECIAL PROVISIONS
FOR
ELECTRICAL WORK

a. Description:

The following specifications shall constitute the specifications for electrical construction and/or relocation of lighting facilities with Public Lighting Department Standards of Construction in the City of Detroit.

General:

The following abbreviations will apply to these specifications and to the plans:

	SPECS	PLANS
Institute of Transportation Engineers	I.T.E.	I.T.E.
National Electric Manufacturers Assoc.	N.E.M.A.	N.E.M.A.
Public Lighting Department	P.L.D.	P.L.D.
Detroit Edison Company	D.E. CO.	E.
Michigan Consolidated Gas Company	M.C.G.	G.
Detroit Metro Water Dept.	D.W.S.	W.
Ameritech	T.	T.
American Society for Testing and Materials	A.S.T.M.	A.S.T.M.
American National Standards Institute	A.N.S.I.	A.N.S.I.
Institute of Electrical and Electronic Engineers	I.E.E.E.	I.E.E.E.
Illuminating Engineering Society	I.E.S.	I.E.S.
Industrial Fasteners Institute	I.F.I.	I.F.I.
International Municipal Signal Association	I.M.S.A.	I.M.S.A.

The Contractor shall be held to have inspected all streets and alleys where work is to be done before submitting his proposal. He shall be held to have inspected all conditions which may affect his work, including traffic, and no extras will be allowed for such conditions or for interference with his work by other Contractors or Utilities.

The Contractor shall furnish and maintain the lighting in areas specified for the maintenance of traffic.

All work on any P.L.D. facility is subject to P.L.D. inspection.

The Contractor shall notify the Public Lighting Department System Operator (224-0500) 48 hours prior to performing any type of work on Public Lighting Department overhead or underground secondary, street lighting, or primary circuits.

No transformer shall be energized or de-energized without prior approval of the "Public Lighting Department System Operator."

The Contractor shall make arrangements as described above to work on street lighting circuits. Work on street light circuits shall be complete and ready for operation prior to 4 P.M. each day.

Construction must be performed by qualified and experienced personnel. All work must meet standards and practices of the P.L.D., the National Electrical Code, and the Electric Code of the City of Detroit, the National Electrical Safety Code and the Michigan Public Service Commission.

The Contractor shall secure all necessary permits covering his operations, including permits from the Public Authorities having jurisdiction over the streets or other Public Properties in which the work is located and the improvements therein. The bidder shall ascertain the amount of any charges required by such authorities and shall include the cost thereof in his bid price.

The Contractor shall ascertain the requirements of said authorities and shall include in his bid price all costs of restoring existing improvements, including sidewalks, pavements and landscaping to the satisfaction of the authority having jurisdiction in each case.

The Contractor shall assume all risks and responsibility because of existing soil conditions and shall complete the work in whatever material and under whatever ground conditions he may encounter or create, without additional cost to the Owner.

All material and equipment furnished by the Contractor must be new, unless specified otherwise, and must comply with the specifications for that material and equipment. The Owner shall have the right to reject any equipment which does not meet with specifications.

Manufacturer's test certificates in accordance with the specifications will be required for all wire and cable. These certificates shall be submitted to the City of Detroit, Public Lighting Department immediately upon receipt by the Contractor. No Contractor shall install any wire or cable before it has been approved by the City of Detroit, Traffic Engineering Division.

Contractors should include on their material order, especially on wire and cable, the statement that "Material must be in strict accord with the Specifications".

The Contractor shall not install any salvaged material or equipment unless it has been inspected and approved for reuse by the Owner.

Where the contract calls for the reuse of existing material and equipment, the Contractor shall reuse only the best of the existing material and equipment. The P.L.D. shall have the right to furnish the Contractor a new part for any that is found defective prior to dismantling. Any part or parts damaged subsequent to starting the removal are a liability of the Contractor.

Within five days after completion of each section of the underground conduit or cable work or the overhead line work, the Contractor shall furnish to the "Owner" an exact record of all underground or overhead work installed. This shall include length of duct lines; location of handholes and manholes; and location and size of poles. All removed street lighting, traffic signal, communication and all P.L.D.

material shall be salvaged and delivered in usable condition to the City of Detroit, Public Lighting Department.

The locations of existing underground obstructions or facilities of other utilities are not necessarily indicated on the plans. Where facilities of other utilities are shown their locations are only approximate

and their exact location is not guaranteed for correctness. The Contractor must exercise caution in avoiding damage to other utilities and must notify the other utilities that he is in fact proposing to break pavement or excavate so that they may provide him with the very latest information or drawings of their existing facilities.

The Contractor shall be responsible for maintenance, vandalism and accident damage to the lighting, traffic signal, conduit, wood pole, overhead wires, cable, etc. and all other material installed, or to be installed, related to, or necessary for the electrical installation of the project until the installation is complete, tested and accepted by City of Detroit, Traffic Engineering Division.

Materials furnished by the P.L.D. to the Contractor shall be picked up by the Contractor at such warehouse as designated by the P.L.D.

During installation of cable and conduit and all related work, the Contractor shall at all times maintain traffic in the manner and requirements of the City of Detroit, Traffic Engineering Division. The City of Detroit, Traffic Engineering Division may impose restrictions regarding particular times of certain days of the week wherein the Contractor cannot perform his work and may in fact be required to clear the area of work obstacles or construction equipment. The Contractor shall take note of this and there will be no extra payment to perform the work with possible restrictions imposed. There will be no extra payment if the Contractor chooses to do his work out side of normally designated work hours.

b. Materials:

1. Conduit:

   Conduits, fittings and bends shall be plastic (acronitrile butadiene or polyvinylchloride) in accordance with N.E.M.A. Standards Publication TC6-1974, "Plastic Utilities Duct for Underground Installation", Type EB for concrete encased installation or Type DB for non-encased direct burial.

   The galvanized pipe conduit for direct burial, or jacking and boring riser or cable raceway shall meet the requirements of the Federal Specification WW-C 581d and must be so identified.

   If required on the plans, direct buried or Schedule 80 polyvinylchloride conduit shall meet the dimensional and compounding requirements of NEMA TC-2, latest revision.

   Concrete for encased conduit shall be as specified under Concrete.

2. Manholes and Handholes:

   Concrete shall be as specified under Concrete (Section C.).

Brick for P.L.D. manholes and handholes shall be the same as required for City of Detroit Drainage Structures.

All brick for manhole or handhole shall be of nominal size.

Steel rails for roofs of manholes or handholes shall be 60 lbs. per yard or heavier. The rails may be scrap railroad rail. Alternates may be as shown on the detail sheets.

Cable racks and hooks shall be as shown on the detail drawings.

Precast concrete handholes shall be of the design and dimensions as shown on the plans. Design for all precast manholes and handholes must be submitted to and approved by the PLD prior to installation. The handholes shall be manufactured of vibrated concrete reinforced with an all welded cage containing 0.35 percent longitudinal steel, unless otherwise shown on the plans. The concrete shall have a minimum compressive strength of 3500 psi.

Manhole Covers - Manhole covers shall be as specified on the plans.

Handhole Covers - Handhole covers shall be as specified on the plans.

Manhole and handhole frames and covers shall conform to the requirements of the P.L.D. The patterns for frames and covers will be loaned to the Contractor at no cost but he shall be liable for any damage incurred. The use of the patterns cannot interfere with the P.L.D. needs.

Cable pulling irons shall be as shown on detail drawings.

Manhole and handhole frames and covers and sewer grates and rings shall conform with the current specifications for Gray Iron Castings, A.S.T.M. Designation: A-48 and shall be finished in accordance with and otherwise meet the P.L.D. Standard Specifications and Details. They shall be made from the P.L.D. patterns, or equal, as numbered on the drawings. If Contractor uses P.L.D. - owned patterns, such usage must not interfere with time of use by P.L.D. Contractor will be responsible for all damage to P.L.D. Patterns.

3. Concrete:

Concrete for manholes and handholes shall be grade 35S and concrete for foundations and encased conduit shall be grade 30M as specified in Division 7 of the Michigan Department of Transportation (2003) Standard Specifications. The coarse aggregate used for concrete to encase conduits shall be 17A.

A. Concrete shall be placed in the forms in a layer of such thickness that when compacted and finished, the pad will be of the thickness shown on the drawings. The pad shall be continuous between expansion joints. After the concrete has been placed between side

forms, a strike-off guided by the side forms shall be used to bring the surface to the proper section to be compacted.

B. Concrete, during and immediately after depositing, shall be compacted by means of rods, forks and other suitable tools. The concrete shall be worked thoroughly around enforcements, around embedded fixtures and into corners. Every precaution shall be taken to produce a dense water-proof concrete free of voids and honeycombs.

C. Temporary enclosures and other protection for concrete shall remain intact for less than twenty-four hours (24 hours after the heating source is removed).

D. Salt, or other chemicals for the prevention of freezing, shall not be used.

4. Granular Materials:

Granular materials for use as fill, backfill, sub-base, and filter aggregates shall be as indicated on the plans.

5. General Overhead Line Section:

A. Description:

This work shall consist of furnishing, installing, removing and relocating wood poles, Overhead Street lighting units, overhead lines, cable poles, transformers, and overhead line material. Included is all related work, materials and equipment required to provide a complete and operating job, as specified herein and as shown on the plans.

B. Materials:

Wood Poles

(a) All poles furnished shall be Western Red Cedar or Southern Yellow Pine and shall conform in all respects to the latest revision of the A.N.S.I. Specification 05.1 and P.L.D. Specifications for Wood Poles.

(b) All poles shall be incised over an area starting from a minimum of two feet below the ground line and extending to a minimum of one foot above the ground line. All poles shall be machine shaved full length above the incised area.

(c) All poles shall be full-length treated in accordance with the American Wood-Preservers Association Standard for the Preservative Treatment Wood Poles.

(d) Preservative

The preservative used shall be Pentachlorophenol-petroleum solution.

Pentachlorophenol-petroleum solution shall conform to the A.W.P.A. Standards P8-64 and P9-65. The solution shall contain not less than five percent (5%) of pentachlorophenol by weight.

(e) Alternate Wood Species, treatment and physical manufacturing details are subject to approval by the Public Lighting Department before use or purchase by Contractor.

C. Crossarms:

All crossarms furnished shall be made of Douglas Fir and in accordance with the latest revision of Edison Electric Institute Specification TD90-1960 and the following options specified therein:

(a) Dense or close grain grades or a mixture of the two (2) is satisfactory.

(b) Dimensions, drilling and allowable tolerance shall be in accordance with Public Lighting Department Drawing No.42-0422.

(c) All crossarms shall be incised on all four (4) faces to a depth of 3/16-inch.

(d) Preservative Treatment

The preservative shall be pentachlorophenol-petroleum solution in accordance with the American Wood-Preservers Association Standards P9-64 and P9-65. The solution shall contain not less than five percent (5%) of pentachlorophenol by weight.

The treatment shall be an empty-cell pressure process with 6 pounds per cubic foot retention of pentachlorophenol in accordance with the A.W.P.A. Standard C-26 with the minimum penetration of the preservative longitudinal from ends and holes of not less than 2-1/2 inches.

(e) Cleanliness

In order that crossarms shall be clean for handling upon receipt at destination, there will be no free oil, sludge, or sediment apparent on any face upon completion of the preservative treatment or upon receipt by the user.

(f) Alternate Wood Species, treatment and physical manufacturing details are subject to approval by the Public Lighting Department before purchase and/or use by Contractor.

(g) Contact P.L.D. before purchasing crossarms. Crossarms with holes sized for metal pins may be required.

D. Steel Insulator Pins:

Steel insulator pins for use on wood crossarms shall be hot dip galvanized.

Pins shall have a 5-inch shaft height, 5/8-inch shaft diameter, 6-1/2-inch shank length, 1-inch diameter lead thread, 3-1/4-inch thread length, 2-inch diameter base with one 2-inch round washer, 1-split lockwasher, and 1-square nut from Cooper Power Systems Catalog #DP-2S51 or approved equal.

E. Miscellaneous Hardware:

Miscellaneous pole line hardware shall be hot-dip galvanized and shall be standard products of such manufacturers as Kearney, Line Material, Oliver or approved equal.

F. Guys and Guy Anchors:

Guy wire shall be 7 strand, size as shown on the plans.

1/4-inch guy wire shall be Sieman-Martin Grade.
3/8-inch guy wire shall be Extra High-Strength Grade.
Guy anchors shall be heavy duty, eight blade, and expansion type.
Guy anchor rods shall be galvanized, 3/4-inch x 8 feet, thimble eye type.
All anchor guys shall be provided with metal or plastic guards.

G. Potheads:

Potheads shall be as shown on detail drawings.

H. Wire:

All wire and cable shall be as shown on the drawings.

I. Overhead Wire:

#8 duplex (#8 twin) wire shall be in accordance with the latest revision of the Public Lighting Department Specification #23:0113 for "Wire - Copper, Two - Conductor Parallel".

(a) Triplex Aerial Cable, 600 Volt Rated, #6 AWG:

Triplex aerial cable shall consist of two insulated copper conductors wound spirally around a supporting neutral conductor, right hand lay, 36 inches $\pm$2 inches length of lay.

The insulated conductors shall be #6 AWG, 7-strand uncoated soft-drawn or annealed copper in accordance with ASTM B-8. The neutral shall be bare, and shall consist of a single strand of copper-clad steel wire and two strands of hard-drawn copper wire, right hand lay, maximum overall resistance of 0.415 ohms per 1000 feet at 60 degrees F. The tensile breaking strength of the neutral shall be 2300 lbs., minimum.

Insulation shall be black cross-linked polyethylene, 0.060 inches thick, in accordance with the latest revision of Interim Standards #2, I.C.E.A. Pub. S-66-524.

One insulated conductor shall be identified throughout by a permanent stripe or rib.

Certified test reports are required in accordance with the above standard, including insulation thickness, insulation physical and aging tests, all insulation electrical tests, water absorption test, heat distortion test, and resistance of each conductor on all reels.

(b) Triplex Aerial Cable, 600 Volt Rated, #2 AWG:

Triplex aerial cable shall consist of a copper messenger and two separately insulated copper conductors wound spirally around the messenger. The two insulated conductors shall be entirely supported by the messenger.

The insulated conductors shall be #2, 7-strand uncoated soft-drawn or annealed copper in accordance with latest revision of ASTM B-8. The messenger shall be used as a bare, grounded circuit neutral conductor, and shall be #2 AWG, 7-strand, uncoated, of hard drawn copper wire, right hand lay.

The insulated conductors shall be spiraled around the neutral conductor (messenger) for mechanical support. The direction of lay of the insulated conductors shall be right hand, the same direction as the neutral conductor strands, and the length of the lay shall be 36 to 42 inches.

Insulation on the two power conductors shall be abrasion resistant, black cross-linked polyethylene, suitable for outdoor use at 90 degree C conductor temperatures. The insulation on each of the power conductors shall be 0.045 inches thick, with a minimum thickness at any point not less than 90% of the nominal thickness. The electrical and physical properties of the insulation shall conform to the latest revision of I.C.E.A. Pub. No.S-66-524.

One of the two insulated conductors shall be identified throughout its length by a permanent stripe, rib or equivalent of which does not reduce the insulation.

Certified test reports, in accordance with the latest revision of ICEA publication No.S-66-524, shall be furnished by the manufacturers. These test reports shall include:

(1) The results of insulation physical and aging tests, all insulation electrical tests, the accelerated water absorption test, and heat distortion test.

(2) The resistance per 1000 ft of each of the three conductors on all reels and the tensile strength of the hard drawn copper messenger.

J. Line Wire:

All overhead wire shall be in accordance with P.L.D. #23-0115 Revision R and either of the following Specifications: ANSI No. C8.34-1954 (R-1962) - Weather-Resistant Wire, Neoprene Type, or ANSI/ICEA No. S-70-547-1984-Weather-Resistant Polyolefin covered wire and cable.

Conductors and hardness shall be as follows:

#6	Solid	Hard-drawn
#2	Solid	Hard-drawn
#2/0	Stranded	Hard-drawn
#4/0	Stranded	Medium Hard-drawn

The coverings shall adhere to the conductor, but shall not be bonded to it; shall strip clean, but shall not be free-sliding.

Certified copies of test reports for all tests stipulated in the above specifications are required.

K. Tie Wire:

All tie wire shall be solid, soft-drawn, neoprene-covered and in accordance with the above ANSI Specification C 8.34-1954.

L. Ground Wire and Ground Rods:

Ground wire shall be No. 2 AWG copper, 7 strand, soft-drawn, for all applications except traffic signals, unless otherwise noted in the drawing.

Ground rods shall be 5/8-inch x 8 feet copper clad steel, for all applications, except traffic signals, unless otherwise noted in the drawings.

Traffic signal foundations shall be grounded such that resistance to ground is 10.0 ohms or less. Contact P.L.D. for further information.

All handholes and manholes shall have a 5/8-inch x 8 feet copper clad steel ground rod protruding approximately 4 to 5 inches near the perimeter of the hole, not in the center.

M. Insulators:

Insulators for series street lighting circuits shall be medium blue, pin type, plain glaze (not radio - free type), class 55-2, in accordance with A.N.S.I. Standard C 29-5-1969 (R 1974) for "Wet Process Porcelain Insulator (Low and Medium Voltage Pin Type)".

Insulators for 2.4 KV to 7.2 KV distribution circuits shall be white, pin type, plain glaze (not radio free type) and shall conform to the requirements for a Class 55-4 insulator of the standard for Wet-Process Porcelain Insulators (Low and Medium Voltage Pin Type ANSI-C29.5-1969(R1974).

Primary dead end/suspension insulators for street lighting and distribution circuits shall conform to the requirements for ANSI C29.2 Class 52-2 and 52-4 insulators with unibody weathershed construction molded on fiberglass rod. Insulators shall be rated at 15,000 lbs. ultimate with hot dip galvanized ductile iron end fittings.

Spool type insulators shall be white, Class 53-1, or 53-2 in accordance with the latest revision of A.N.S.I. Standard C29.3-1961 (R1974) for "Wet Process Porcelain Insulators (Spool Type)".

Strain insulators shall be white, Class 54-3/Class 54-2, in accordance with the latest revision of A.N.S.I. Standard C29.4-1961 (R1974) for "Wet Process Porcelain Insulators (Strain Type)".

N. Distribution Transformers:

Distribution transformers shall be in accordance with the latest revision of Public Lighting Department Specification #20:0231. Transformers shall be furnished in the sizes and voltage ratings specified in the plans and shall be outdoor, pole type, oil immersed self-cooled.

Transformer primary windings shall be equipped with taps as follows:

Primary Voltage Rating	Taps
4800 V.	(2)-2-1/2% above & below normal
7200 V.	(2)-2-1/2% above & below normal
2400 X 4800 V.	1-5% & 2-2-1/2% above & below normal In the 2400V winding and (2) -2-1/2% taps above & below normal in the 4800V winding

There shall be installed, in a permanent manner, a brass identification disk supplied by the Public Lighting Department. The Contractor shall provide the Public Lighting

Department, Stores Division, with the manufacturers name, transformer size, primary and secondary voltages, and serial number when requesting the identification disks.

O. Lightning arrester:

Lightning arrester for the series street lighting circuits shall be outdoor, valve type lightning arrester with top series gap, rated at 3,000 volts for use on 7,500 volt ungrounded secondary of a series street lighting current regulator. These arresters shall include an accessible top series gap and a solderless type ground terminal to accommodate #2 to #4 solid wire housed in the best grade of wet processed porcelain. Also, a bracket is to be included for crossarm mounting. All ferrous parts shall be hot-dipped galvanized, in accordance with the Specifications for Zinc Coating (Hot-Dip) on Iron and Steel Hardware A.S.T.M. A-153.

The Contractor shall furnish the Engineer certification of compliance with the following requirements when tested in accordance with the Standard for Lightning Arresters for Alternating-Current Power Circuits ANSI-C62.1-1962.

The critical sparkover shall not exceed 39 KV on impulse breakdown and the 60 cycle breakdown shall not exceed 26 KV. It shall be able to withstand a lightning surge of 100,000 amperes and short circuit current of 20,000 amperes.

P. Lightning Arresters For Distribution Circuits:

The lightning arresters for 2.4 KV, 4.8 KV and 7.2 KV distribution circuits shall be of 3 KV, 6 KV or 9 KV respectively and shall be valve type, distribution class, for crossarm mounting totally porcelain enclosed and for direct connection to the line. They shall have the line connection suitably enclosed.

The Contractor shall furnish the Engineer certification of compliance when tested in accordance with Lightning Arresters for Alternating-Current Power Circuits ANSI-C62.11-1987.

Lightning arresters for multiple street lighting circuits shall be outdoor type secondary arresters, 2 pole, rated 650 volts maximum.

Q. Distribution Circuit Cutouts and Disconnects:

On distribution circuits thru 4,800 volts cutouts shall be outdoor type, porcelain, enclosed, 5.2 KV rated, extra heavy duty, rated 200 amperes continuous. Interrupting capacity shall be 15,000 amperes asymmetrical at rated voltage. If specified in the plans, a solid blade door shall be furnished, rated at 400 amperes continuous.

On 7200 volt distribution circuits, cutouts shall be outdoor type, porcelain, enclosed, 7.8 KV rated, extra heavy duty, rated 100 amperes continuous. Maximum interrupting capacity shall be one shot, 12,000 amperes asymmetrical at rated voltage. If specified in the plans, a solid blade door shall be furnished, rated 200 amperes continuous.

Cutouts shall conform with SPECIFICATIONS FOR DISTRIBUTION ENCLOSED, OPEN AND OPEN-LINK CUTOUTS, ANSI C37.42, latest revision.

Dead blade disconnects shall be outdoor, 7.8 KV rated, 400 ampere continuous rating, with a momentary rating of 20,000 amperes.

Cutouts and dead blade disconnects shall be furnished with swivel type crossarm hangers, adjustable for 3-1/4 inches x 4-1/4 inches and 3-3/4-inch x 4-3/4-inch crossarm sections. All hardware shall be hot-dip galvanized in accordance with ASTM Specification A-153.

c. Construction Methods:

1. Cable Section:

Cable shall be pulled into ducts using the proper cable grip for the purpose. The cable shall be handled so that it is not subject to excessive strain or is not kinked when pulled thru the conduit. Damaged or kinked cable shall not be used. Where more than one cable is to be installed in the same duct, cables shall be pulled thru simultaneously.

Splices in ducts will not be permitted.

When cable is installed but not immediately spliced, all cable ends shall be thoroughly sealed and racked out of the way of possible damage.

The ends of the cables which are to be abandoned and left in place shall be sealed with a water tight cap.

Cables shall be neatly racked on cable racks in all manholes after being formed to their final position. Cables shall be racked slightly higher than the duct entrances so that they will not rest on the edges of the duct. Each new cable shall be tagged, and any existing cable which has its circuit number changed shall be retagged, in all manholes and in all handholes in which it is exposed.

The sheaths of all lead sheathed cables shall be bonded to one another in each manhole and handhole with flexible copper braid approximately equal to #9 AWG.

All new cable installed between lighting standards shall be a continuous pull. Splices between standards will not be permitted.

The use of wire nuts in splices and taps will not be permitted.

2. Steel Standards:

The pole shall be oriented on the foundation so that the handhole is on the side of the pole opposite oncoming traffic.

The upper third of the shaft shall be given one field coat of weather-resistant enamel, color as specified.

3. Conduit:

Conduit runs shall be built in as straight a line as possible. When conduit sweeps are necessary, only one sweep, in one direction will be permitted between manholes or between manhole and cable pole. The radius of the sweep shall not be less then 24 feet.

Factory conduit bends shall only be used when entering foundations or at the base of cable poles.

All excavation for a main conduit run shall be to a depth to leave at least 36 inches from the top of the conduit encasement or top of direct buried rigid conduit to top of finished grade. For lateral conduit runs, the corresponding dimensions shall be 30 inches. Typical depth and widths of excavations will be shown on the plans. The trench shall be graded to handhole and manhole location, so that the finished conduit runs will have no low spots where water might accumulate but will drain into a handhole or manhole.

The contractor shall sheet and brace the trenches as required, and shall adequately support all pipes or other structures exposed in the trenches. The support shall be incidental to the conduit construction and will not be paid for as separate items.

Conduit runs shall be encased in concrete or direct burial as specified. Adjacent conduits shall be spaced a minimum of 1-inch from each other and the concrete on the top, bottom, and side of the conduit encasement. Where steel reinforcement is required the reinforcing bars shall be separated from the conduits by 2 inches of concrete, and there shall be a minimum of 3 inches of concrete from the reinforcing bars to the outside of the encasement. Conduit joints shall be staggered vertically. Separators, spacers, blocks, or supports to be left in the finished concrete structure shall be composed of concrete or plastic.

Spacers shall be not more than every 7 feet when 20 foot lengths of conduit are installed and not more than every 5 feet when 10 foot lengths of conduit are installed.

The concrete mix, used to encase the conduit, shall be designed with enough workability (slump greater than 8 inches) to ensure encasement underneath the conduit. The bottom of the trench shelf shall be lined with a polyethylene sheet to ensure integrity of the concrete.

Concrete, during and immediately after depositing, shall be consolidated by means of mechanical vibrators. The concrete shall be worked thoroughly around enforcements, embedded fixtures, and into corners. Every precaution shall be taken to provide a dense, waterproof encasement, free of voids and honeycomb. The conduit bank shall be prevented from floating up when the concrete is poured, by anchoring to stakes at intervals not to exceed 10 feet in firm soil and not to exceed 5 feet in loose soil.

A bank of encased conduits may be constructed in either of two ways as described herein.

a. Tier-By-Tier Method. A foundation of concrete at least 3 inches thick is first placed on the bottom of the trench after it has been graded. When steel reinforcement is required the thickness of the concrete shall be at least 5 inches with the reinforcing bars in place. On this concrete base the bottom tier of conduits are laid, separated from each other by suitable spacers. The space between conduits of this first tier shall then be filled with concrete and the conduits covered to the height of the next succeeding conduit tier. Succeeding tiers shall be constructed in a similar manner. Work shall proceed as continuous operation with no interruptions in excess of 45 minutes between the placing of successive layers of concrete.

b. Built-Up or Monolithic Method. Masonry supports at intervals of 3 to 5 feet, or a foundation of concrete at least 3 inches thick, shall be first placed in the bottom of the trench after it has been graded. Where steel reinforcement is required, the thickness of the concrete foundations shall be at least 5 inches with reinforcing bars in place. All conduits shall then be placed, using plastic or concrete separators, to erect a rigid, self-supporting structure of conduits in position before the concrete to completely fill the spaces between the conduits without damaging or displacing the conduits.

No conduit shall be encased until it has been inspected and approved by the City of Detroit, Public Lighting Department.

Typical sections and various typical arrangements of conduit will be shown on the plans.

Backfill for trenches shall be as indicated on the plans.

After the conduit runs are built, the Contractor shall pull a mandrel 12 inches long (shorter in conduit runs with bends) and 1/2-inch smaller in diameter than the conduit and a suitable swab or cleaning device designated to clear the conduit of debris. The Contractor shall notify the inspector prior to performing this phase of the work so that he may be present during this work. The contractor shall certify that this work has been done before payment will be made.

A coupling shall be placed on the ends of all conduits terminations and plugged with a suitable removable plug.

Backfill for trenches outside the roadbed may be the material excavated therefrom unless it is unsuitable for backfill material. Backfill for trenches within the limits of the roadbed shall be a Grade A fill material.

Where iron pipe conduit is installed, plastic conduit shall be installed within the iron pipe. Cable then shall be installed in the plastic conduit. Cable shall never be installed in iron pipe without the plastic conduit installed within.

Within five days after completion of the conduit work or of any portion where a working cable is installed, the Contractor shall furnish to City of Detroit, Public Lighting Department., a record of the length of the duct lines as constructed, clearly showing any departures from the original plans. The lengths shall be measured from the inside walls of manholes and the center of post foundations, cable poles, and handholes. Final payment shall be withheld until work is completed.

No concrete encasement shall be in contact with any obstruction. A vertical clearance of 9 inches shall be provided, except that conduits parallel to water and gas mains shall be separated by not less than 12 inches.

City of Detroit, Public Lighting Department shall be notified 48 hours prior to the pouring of any concrete encasement.

Conduit grades shall be staked at 8 foot intervals or less. Excavation below the bottom line of the trench shall be filled with Grade A backfill, well compacted. Grade shall have a fall to the lowest manhole or handhole, or from the middle of the run toward both holes, of not less than 4 inches per 100 feet.

All surfaces which have been dug up or disturbed for any reason by the Contractor shall be restored in kind to its original condition including but not limited to top soil and grass, sidewalk ramp, curb and gutter, and roadway bed including sub base and pavement materials.

4. Foundations:

No construction rubble, broken sidewalk or other foreign material will be permitted in place of concrete. Cracked or otherwise defective foundations will not be accepted.

Standards shall not be installed on foundations until the concrete has cured for a minimum of seven days.

Foundations shall at all times be properly protected and guarded to prevent injury to persons until the standards are installed.

No foundation shall be poured until the curb is in place. Foundations shall be located as shown on the plans unless otherwise authorized by the Engineer.

Ground rods and ground wires shall be installed as shown on the detail drawings. The ground wire shall be embedded in the foundation and shall be connected to the ground rod with a copper clad steel solderless type clamp. The connection must be electrically solid and mechanically secure.

The lower portion of the foundation shall be poured without forms unless the soil is subject to cave-in and the use of forms is authorized by the Engineer. Forms shall be used to shape the upper part of the foundation, as shown on the plans. The top surface of the foundation shall be horizontal and at the elevation shown on the plans or established by the Engineer.

Concrete shall fill the entire hole excavated for the foundation. Forms shall not be used, except to form the foundation top, without the prior approval of the Project Engineer.

Foundations shall be installed in undisturbed earth. Foundation excavation shall be augured or hand dug only.

Foundation bolts shall be wired in place near the bottom of the excavation in order to prevent movement of the bolts during the pour.

Conduit bends shall be wired in place to the anchor bolts in order to prevent movement of conduit bends during the pour.

Openings of conduit bends shall be sealed prior to pour in order to prevent entry of concrete into conduit.

Anchor bolt projections above grade shall be coated with oil prior to pouring to prevent concrete from adhering to anchor bolts.

Conduit shall extend vertically outside foundation envelope a minimum of 4 inches. A coupling and a straight extension may be used in order to obtain the necessary vertical projection.

The entire foundation, exclusive of the cap, shall be placed with a single pour of concrete.

5. Manholes and Handholes:

Precast or cast-in-place handholes shall be installed or constructed as shown on the plans.

Manholes shall be constructed as shown on the plans.

Unused conduit entrances and conduit openings to be extended by others shall be blanked off, to prevent entrance of earth, with suitable removable plugs of plastic or other material as approved by the Engineer.

Bell ends are required on all conduits entering manholes and handholes.

When a new manhole is built into an existing conduit run, the concrete encasement shall be carefully chipped away and the conduits removed between the inside walls of the new manhole. All existing cables thus exposed shall have additional lengths spliced into them so that they may be properly racked on the walls of the manhole.

Where holes are built in the future roadways, top of manhole frames shall be set for future roadway grade. Where manhole frames built to future roadway grades may interfere with existing roadways, the frames should be set to allow for future adjustments.

Sewer drains shall have a drainage grade of not less than 6 inches per 100 feet. Bell and spigots shall be tight fit, cemented. Saddles shall be installed where required. In some cases, the City Sewer Division will make the main sewer tap and the cost for this work shall be incidental and will not be paid for separately. Open joint sewers for manhole drains will not be permitted.

Backfilling shall conform to the requirements as herein before mentioned.

Upon completion of all manhole, handhole, conduit and sewer drains, the holes shall be free of all rubbish, construction debris and water. All sewer drains shall be free-running and the traps clean.

Adjusting manhole and handhole shall apply where the elevation of the cover is not changed more than 6 inches and no other alterations are necessary. Existing covers shall be adjusted to the proper elevation by removing or chipping enough adjacent pavement, curb, or curb and gutter to remove the frame or castings, and raising or lowering them to the required elevation by supporting them on a concrete roof slab, masonry or steel reinforced rod, so constructed as to hold them firmly in place. The adjacent pavement, curb, or curb and gutter shall be replaced to the original elevation condition and kind of construction.

Reconstructing Manhole and Handhole shall apply where elevation of the cover is changed more than 6 inches and not other alterations are necessary. The scope of work for reconstructing the manhole or handhole otherwise shall be the same as for adjusting the manhole or handhole.

Abandoning manholes and handholes shall be broken down to 24 inches below the required grade of the bottom of the concrete slab and backfilled with granular material. When so noted on the plans the existing conduit shall be spliced through and encased with concrete. The spliced conduit shall be clear of all obstruction.

Removing manholes and handholes shall have the frame and cover removed and the structure shall be broken down below grade as required. The handhole or manhole shall be required to be removed only where a new handhole or manhole is to be built in the same location. Therefore the wall structure of the existing hole to be removed shall be broken down as required to accommodate the new manhole or handhole in the same location.

6. Cable Tags for Installation in Manholes and Handholes:

Material

Tags are to consist of UV inhibited polypropylene, with .040 inch thick black polypropylene character embedded in a colored polypropylene substrate. Material to be non-conductive, non-corrosive, abrasion resistant, chemically inert, and tolerate a temperature range of -50 to +300 degrees F.

Size and Color

Legend to consist of 1-inch high block style letters, except tags with special legends as given below. Text to be black on yellow substrate except for the following characters, which are to consist of black characters on orange substrate:

2.4 KV 4.8 KV 7.2 KV 13.2 KV

In addition, the 24 KV tag is to consist of black characters on a red substrate.

Mounting

Characters comprising tag shall be mounted in a polyethylene holder which shall be fastened to the cable with nylon tie straps.

Legends

Contact P.L.D. Engineering Division for cable and circuit designations.

Method of Construction

Each tag is to be mounted with two nylon tie straps. Tags are to be installed near the duct pocket, and, when conditions allow, in a location on the cable where they may be read without having to enter manholes and handholes.

7. Cable Tags for Use in Lighting Load Centers and Controllers:

Material

Individual tags are to be made of polypropylene, with raised high relief letters. Material to be non-corrosive, non-conductive, weatherproof, stabilized for ultraviolet, resistant to salt water, organic solvents, mild acid or alkalai solutions, and high humidity.

Size and Color

Legend to consist of 3/8-inch high block style black letters on a yellow background.

Mounting

Characters comprising tag shall be mounted in a polyethylene holder which is fastened to the cable with nylon tie straps.

8. General Overhead Line:

The Contractor shall relocate all Public Lighting Department and foreign contacts required for right-of-way preparation unless it is noted on the drawings that the owning utility has been requested to relocate its facilities.

All thru splices in line wire shall be made with automatic line splices. The number of such splices shall be kept to a minimum but in no case shall exceed one splice in three consecutive spans of wire.

All wire which is trained under crossarms or vertically on the pole shall be covered with wood or plastic molding.

#6 line wire shall be dead-ended on double pins and double arms. Line wire larger than #6 shall be dead-ended as shown on the plans.

Two street lighting strain insulators or "breakers" shall be used to separate the line conductors on 3-way and 4-way overhead series circuit connections.

Three "breakers" shall be used to separate the conductors of two different series circuits which are dead-ended "back-to-back" at the same crossarms.

A single "breaker" shall be used in the line conductor when installing series ballast.

When installing a series ballast in a two-wire series circuit lead, the ballast shall be connected into that wire of the pair which is physically closest to the luminaire which the ballast will serve. Single wire runs of different series street lighting circuits shall not occupy adjacent pin positions on the same side of the pole.

#6 tie wire shall be used with all line wire #2 and larger. #8 tie wire shall be used with #6 line wire. #12 tie wire shall be used with #8 duplex.

No splice shall be made in a #8 duplex run between ballast and luminaire unless the length of wire required from ballast to luminaire exceeds 500 feet.

9. Wood Poles:

Wood poles shall be set to depths, according to length of pole, as shown on the detail drawings. Poles shall be made self-supporting or shall be guyed where so noted on the plans. All poles which are set for the installation of lighting units shall be made self- supporting in crushed stone or concrete (If specified) as shown on the detail drawings.

Wood poles which are to be removed shall be completely removed. Cutting off at or below grade will not be permitted. Holes shall be backfilled and the surface repaired in kind. No broken concrete or other rubble shall be used as backfill material.

Wood poles which are set for the installation of lighting units shall be set with the face of the pole 2 feet back of the curb unless otherwise noted on the plans.

10. Traffic Signals:

No traffic signal installation shall be placed in service without the prior approval of the Engineer.

The representative of the manufacturer of the controller and cabinet shall be responsible for programming the controller, wiring of the cabinet, and installation of the transformer. The traffic signal permits shall be provided by the City of Detroit, Traffic Engineering Division.

All traffic signal cable shall be installed as shown on the plans. Cables shall be installed in one length without joints from the controllers to each traffic signal, except when indicated otherwise on the plans. Cables shall be trained near the top of the wall of manholes and handholes and bends shall not be so small as to cause damage to cable. Cables shall be bundled together under 1-1/2-inch wide lead straps which shall be secured to the wall with galvanized anchors. A maximum spacing of 2 feet-0 inches shall be maintained between supports.

The Contractor shall make all cable connections at each signal head and at the controller. Controller timing shall be done by the contractor, in the field, and after all above cable connections have been completed.

The traffic signal cable shall be brought into the traffic signal head and shall extend for a minimum of 48 inches into the controller cabinet. All traffic signal cables shall be securely strapped inside the controller cabinet. Each cable in the traffic signal controller shall be tagged or stamped with the number of the traffic signal to which it is connected. Overhead signals are to be prewired with standard wire prior to mounting.

Each signal cable shall be tagged, with the number of the signal head to which it is connected inside the controller cabinet and in each handhole and manhole.

All cables, including interconnect and secondary service cables, shall be tested for continuity and resistance to ground before final connections are made. The complete final installation shall be

tested in operation by the Contractor prior to placing in service. Tests shall include verification of proper operation and sequencing of each signal indication and measurement of secondary voltage under load. The tabulated results of these tests shall be furnished to the Project Engineer before the installation is placed in service.

To minimize the entrance of gases from the conduit system into the controller cabinet, all duct openings into the controller foundation shall be plugged with duct-seal, or the equivalent, after all cables have been pulled in and connected.

All cables shall be pulled into the controller cabinet with sheaths intact. Cables shall be trained across the bottom of the cabinet and at least 3 inches up the cabinet wall before the sheath is stripped.

Cable entrance bushings shall be installed in all wire entrance holes in standards and mast arms.

Overhead traffic signal cable splices shall be made with crimp-type connectors; each individual crimp connection shall be wrapped with three (3) layers of PVC (electrical) tape. The crimp connections shall be staggered and the entire group shall be wrapped with three (3) layers of PVC (electrical) tape. Proper crimping tools shall be employed.

Underground traffic signal cable splices shall be made with crimp-type connectors; each individual crimp connection shall be wrapped with three (3) layers of tape and the splices enclosed in a heat-shrink case per manufacturer's specifications. The crimp connections shall be staggered within the encasement. Proper crimping tools shall be employed.

Salvaged signal suspension fittings (mast arm end fittings, span wire clamps, wire entrance fittings, clevises) shall not be reused without prior approval of the Project Engineer.

All mast arm and span wire mounted signal heads shall be furnished with safety chains as shown on the plans.

Signals which cannot be placed in service on the day of installation shall be hooded or covered to avoid traffic confusion.

The signal cable shall be pulled with sheath intact, into the lower frame work member of bracket arm and pedestal signal. The sheath shall not be stripped any closer than 6 inches from the point of entry into the framework.

The signal face shall be aimed as indicated on the plans. In those cases where aiming instructions are not included in the plans, such information will be furnished by the Department of Transportation prior to placing the signals in service.

The 240 volt-120 volt transformer shall be mounted inside of the controller cabinet, in the lower part of the cabinet. The transformer may be mounted either vertically or horizontally, on the cabinet wall or

bottom, as available space dictates. The transformer primary shall be connected so that the secondary voltage, under load, will fall within the range of 115 volts 120 volts. All splices and the ends of unused taps shall be insulated.

d. Method of Measurement and Basis of Payment

The completed work as described shall be paid for at the contract unit price for the following contract item (pay item):

Conduit Repr, Under Pavt, Modified and **Conduit Repr, Under Sidewalk or Dirt, Modified** will be measured as a unit. The contract unit price each shall be payment in full for locating the conduit breakdown, repairing and sleeving a new conduit section, repairing the concrete encasement, furnishing all labor, materials and equipment. Excavation, granular material backfill, disposal of waste excavated material, together with pavement, sidewalk and curb removal and replacement is also included.

Conduit, Encased,___, ___ inch, Modified size and number as shown on the plans will be measured in linear feet in place of conduit measured by the length in linear feet in place, from the inside walls of manholes and the centers of handholes, foundation and cable poles. The contract unit price per linear foot shall be payment in full for furnishing all labor, materials and equipment for excavation, installing the conduit, reinforcement where called for and encasement complete. Restoration to original condition of all surfaces, pumping and cleaning manholes and handholes, disposal of waste excavated materials, and swabbing conduits after installation shall be included in this item and will not be paid for separately.

Pay Item	Pay Unit
Conduit Repr, Under Pavt, Modified	Each
Conduit Repr, Under Sidewalk or Dirt, Modified	Each
Conduit, Encased, ___, ___ inch, Modified	Foot