DG 254

Auxiliary Electrical Power and Lighting Engineering Design Criteria and Guidelines

Issue No. 6
October 30, 2015

Approved By:
Stanley Karoly, P.E. Chief Electrical Engineer

Issue Record

<table>
<thead>
<tr>
<th>No.</th>
<th>Date</th>
<th>Description of Change</th>
<th>Entered By</th>
<th>Formal Review</th>
<th>Intermediate Review</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>7/1/94</td>
<td>Initial Issue</td>
<td>S. Karoly</td>
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<td>8/17/94</td>
<td>Initial Issue as a draft.</td>
<td>S. Karoly</td>
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<td></td>
</tr>
<tr>
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<td>7/01/95</td>
<td>Signed Issue</td>
<td>S. Karoly</td>
<td></td>
<td></td>
</tr>
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<td>4</td>
<td>3/14/97</td>
<td>Reissued to include Station Lighting</td>
<td>S. Karoly</td>
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</tr>
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<td>5</td>
<td>12/10/12</td>
<td>Fixed transformer concrete pad to be 6&quot;, Grammatical revisions</td>
<td>T. Thottukadavil</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>6</td>
<td>10/30/15</td>
<td>Use of MC cable for tunnel lighting, LED lights in stations &amp; tunnels, battery back-up in under river tunnels, AC/DC/battery emergency lighting in Stations, External lighting of EXIT signs in stations</td>
<td>T. Thottukadavil</td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>

Division of Engineering Services
Alok Saha, P.E.,
Vice President and Deputy Chief Engineer
SECTION 1. GENERAL

1-1.0 PURPOSE.
1-2.0 SCOPE.
1-3.0 DEFINITIONS.
1-4.0 APPLICATION OF THE GUIDELINES.
1-5.0 CHANGES TO THE GUIDELINES.
1-6.0 COMPLIANCE WITH THE GUIDELINES.
1-7.0 QUALITY. (Functionality, Availability, Reliability and Maintainability)
1-8.0 ENVIRONMENTAL CONSIDERATIONS.
1-9.0 THE DESIGN PROCESS.
1-10.0 EQUIPMENT.
1-11.0 STANDARDS AND CODES.

SECTION 2. AUXILIARY ELECTRIC POWER

2-1.0 PURPOSE.
2-2.0 SCOPE.
2-3.0 ELECTRIC SERVICE
2-4.0 TEMPORARY POWER
2-5.0 GROUNDING
2-6.0 STRAY CURRENTS
2-7.0 NUMBER OF ELECTRIC SERVICES

SECTION 3 TUNNEL LIGHTING

3-1.0 PURPOSE.
3-2.0 SCOPE.
3-3.0 LIGHTING REQUIREMENTS
3-4.0 POWER SOURCES.
<table>
<thead>
<tr>
<th>Section</th>
<th>Topic</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>3-5.0</td>
<td>TEMPORARY LIGHTING</td>
<td>43</td>
</tr>
<tr>
<td>3-6.0</td>
<td>CRITERIA FOR LAMP AND FIXTURE</td>
<td>44</td>
</tr>
<tr>
<td>3-7.0</td>
<td>TUNNEL ILLUMINATION</td>
<td>46</td>
</tr>
<tr>
<td></td>
<td>Wiring</td>
<td>47</td>
</tr>
<tr>
<td>3-8.0</td>
<td>EMERGENCY EXIT LIGHTING</td>
<td>48</td>
</tr>
<tr>
<td>3-9.0</td>
<td>PORTAL LIGHTING</td>
<td>48</td>
</tr>
<tr>
<td>3-10.0</td>
<td>EMERGENCY ALARM LOCATION LIGHTING  (Blue Lights)</td>
<td>49</td>
</tr>
<tr>
<td>3-11.0</td>
<td>TUNNEL RECEPTACLES</td>
<td>49</td>
</tr>
<tr>
<td></td>
<td>SECTION 4 GENERAL LIGHTING-FACILITIES</td>
<td>51</td>
</tr>
<tr>
<td>4-1.0</td>
<td>PURPOSE</td>
<td>51</td>
</tr>
<tr>
<td>4-2.0</td>
<td>SCOPE</td>
<td>51</td>
</tr>
<tr>
<td>4-3.0</td>
<td>GENERAL</td>
<td>51</td>
</tr>
<tr>
<td>4-4.0</td>
<td>AIR COMPRESSOR ROOMS</td>
<td>53</td>
</tr>
<tr>
<td>4-5.0</td>
<td>POLICE QUARTERS</td>
<td>53</td>
</tr>
<tr>
<td>4-6.0</td>
<td>CREW FACILITIES</td>
<td>54</td>
</tr>
<tr>
<td>4-7.0</td>
<td>PUMP ROOMS</td>
<td>54</td>
</tr>
<tr>
<td>4-8.0</td>
<td>EJECTOR ROOMS</td>
<td>54</td>
</tr>
<tr>
<td>4-9.0</td>
<td>VENT PLANTS</td>
<td>54</td>
</tr>
<tr>
<td>4-10.0</td>
<td>YARDS</td>
<td>54</td>
</tr>
<tr>
<td></td>
<td>SECTION 5. STATION LIGHTING DESIGN</td>
<td>55</td>
</tr>
<tr>
<td>5-1.0</td>
<td>GENERAL DRAWING REQUIREMENTS</td>
<td>56</td>
</tr>
<tr>
<td>5-2.0</td>
<td>ELECTRIC SERVICE AND SERVICE EQUIPMENT</td>
<td>57</td>
</tr>
<tr>
<td>5-3.0</td>
<td>ELECTRICAL ONE-LINE DIAGRAM-DRAWING</td>
<td>59</td>
</tr>
<tr>
<td>5-4.0</td>
<td>ELECTRICAL DISTRIBUTION AND ELECTRICAL PANEL ROOMS</td>
<td>61</td>
</tr>
<tr>
<td>5-5.0</td>
<td>DISTRIBUTION BOARDS AND PANELBOARDS</td>
<td>62</td>
</tr>
<tr>
<td>5-6.0</td>
<td>LIGHTING FIXTURES</td>
<td>65</td>
</tr>
</tbody>
</table>
5-7.0 RACEWAYS
5-8.0 WIRING DEVICES
5-9.0 AUTOMATIC FARE COLLECTION, CONTROLS AND ADVERTISING
5-10.0 ELECTRIC HEAT TRACE AND ELECTRIC HEATERS
5-11.0 DEMOLITION

SECTION 6 INSTRUMENTATION AND CONTROL

SECTION 7 APPENDIX

7-1.0 STANDARD DRAWINGS
7-2.0 DEPARTMENT OF INFRASTRUCTURE REQUIREMENTS FOR ELECTRIC DISTRIBUTION ROOMS
7-3.0 ELECTRICAL DISTRIBUTION BULLETIN
7-4.0 STRAY CURRENTS.

EXHIBITS
SECTION 1. GENERAL

1-1.0 PURPOSE.
The purpose of the Electrical Engineering Design Guidelines, hereafter referred to as the “Guidelines”, is to establish in one document, the typical engineering data and drawings as well as the minimum requirements, to be included in the engineering design and planning of construction type projects for Auxiliary Electrical Power, Lighting and Controls.

The Guidelines consist of two complementary parts, a written descriptive type section and a drawings section, that are intended to be explanatory of one another. The “Guidelines” were developed and agreed to by a committee of representatives of the NYC Transit Safety, Operation, Maintenance and Engineering Departments.

1-2.0 SCOPE.
The Guidelines standardize electrical engineering design and data and are generally used to establish ratings for equipment and for evaluations of the parameters necessary for the specification of equipment used for power distribution, lighting and instrumentation and controls. Specifically, the Guidelines establish minimum requirements for the number of utility electric services, materials to be used, the means and method of power distribution, the lighting levels, temporary power and lighting, construction work sequences, control and other requirements for electrical maintenance, repair, upgrade, and safety in stations, tunnels, personnel/maintenance facilities, ventilation plants, subway yards and pump rooms. The drawings typically depict the utility supplied electrical services, power distribution, lighting, heating, instrumentation and controls required.

A current list of drawings is included in the appendix.

1-3.0 DEFINITIONS.
The words defined herein are intended for use only with these Guidelines. Definitions of words in a document referenced by these Guidelines shall be applicable to that document only.

AC.   Alternating current.

Approved.   Acceptable to the Authority Having Jurisdiction.

Authority Having Jurisdiction.   The division, department, office or person responsible for approving equipment, installation, or procedure.

Auxiliary Electric Power.   Electrical AC power that is separate from the DC traction power and is used for lighting, heating and the operation and control of equipment and signaling within the Transit System. Usually provided from a normal and reserve electric utility services.
**Beneficial Use.** Equipment or construction that has been tested for usage in accordance with specified requirements and is ready to perform its specified function as a system or as part of a functional system.

**Contact Rail.** A rail supported by insulators and physically parallel with and outside the running rails. It carries the nominal 600 Volt DC for subway car propulsion. (Traction)

**DC.** Direct Current, nominal 600 volts converted from AC, it is used for train propulsion in the New York City Transit system. 600 Volt DC is also used for emergency and utility lighting in station areas and other limited heating and lighting applications.

**EDR.** Electrical Distribution Room, the location where the utility company provides the normal or reserve electric services and from which area the electrical power is distributed to other locations within the system. The normal and reserve services shall always be in separate rooms and with separate access.

**Equipment.** Raceways, wire, panelboards, circuit breakers, switches, fuses, transformers, light fixtures, bulbs, relays, sensors etc. which are used for the distribution and control of electric power, heating and lighting.

**Grounding.** An intentional, low impedance electrical connection to earth to prevent the buildup of voltages that may result in undue hazards to connected equipment or to persons.

**Guidelines.** This set of documents consisting of a written section and a drawings section.

**New York City Transit System.** The rapid transit (subway and elevated line) and surface (bus transportation) facilities including all appurtenances, subway yards, bus depots, rolling stock and equipment of N.Y.C. Transit.

**Normal Service, Reserve Service.** Designations for metered and independent power sources derived from or provided by the Con Edison or the Long Island Power Authority (LI PA) utility companies. The two services are used for load sharing and for backup purposes through automatic transfer switches.

**Operation of the Railroad.** The act of transporting fare paying passengers as well as the other normal functions required for maintenance and alteration of the system.

**Permanent Power.** Power supplied by the normal and reserve services on a regular and continuous basis.

**Power Source.** Energy provided by an electric utility, generator, battery, or some other means.

**Raceway.** A channel exclusively used for holding or routing wires, or bus-bars.

**Railroad.** The rapid transit facilities of the N.Y.C. Transit, including all appurtenances, rolling stock and equipment.
Temporary Lighting. Illumination during construction energized from temporary or permanent normal and reserve services to maintain existing or specified lighting levels required to maintain operation of the railroad.

Temporary Power. Power during construction from temporary or permanent normal and reserve services, required to maintain operation of the railroad.

Temporary Service. A metered power source provided by the utility or a generator that is used for powering equipment or facilities to maintain continuous operation. It is usually required where the existing services are upgraded, relocated or modified.

Traction Power. Electrical power at a nominal 600 Volt DC used for subway car propulsion and distributed over the contact rails (third rail).

Transit System. Facilities and equipment to provide safe rail transportation for fare paying passengers, as well as equipment and facilities required for operation, maintenance, repair and overhaul.

1-4.0 APPLICATION OF THE GUIDELINES.

Applicability.

1. The Guidelines are applicable to nominal AC/DC voltages of 600 Volts or less.

2. The Guidelines are applicable for the preparation of design drawings and specifications for the construction of electrical services, power distribution, lighting and control for:

   Personnel Facilities
   Stations
   Fan Plants (See Fan Plant Guideline)
   Pump Rooms (See Pump room Guideline)
   Subway Yards, Barns and other Yard Facilities
   Tunnels

No Applicability.

These Guidelines are NOT applicable to the following:

1. Railroad signaling.
2. Communications such as telephone, train, command center, etc...
3. Traction power substations, DC power distribution.

For information on the above refer to the appropriate N.Y.C. Transit Standards and Guidelines under Standards and Codes listed elsewhere.
Immediate Application.

To avoid complications with ongoing projects immediately after the formal approval and adaptation of the new Guidelines, the following should be complied with:

1. The Guidelines shall be applicable to all new design and construction projects.
2. Applicability to partially completed design or construction projects shall be based on schedule, economic and other considerations.
3. Safety determinations may be cause for the immediate applicability of these guidelines on all projects.

1-5.0 CHANGES TO THE GUIDELINES.

Changes involving engineering computations shall be under the purview of the Electrical Division.

Future changes to the Guidelines may be necessary to comply with new codes, changes in technology, altered or new NYC Transit work practices or for other reasons.

Procedure for effecting changes/variances to the guidelines.

1. Requests for changes to the guidelines shall be submitted in writing to the chairman of the standards committee.

2. The chairman shall forward the request and a fact summary to the representatives of the departments/divisions on the committee and to others who may have a pertinent input. (Environmental, Cost Estimating, Value Engineering, etc.)

3. The department representatives will have the responsibility of dissemination of the request within their department and obtaining a department position.

4. For the record, a position paper, detailing the decision reached shall be submitted by each representative;

5. At the present, the following groups are represented on the committee

   Capital Program Management (CPM)
   Division of Car Equipment
   Division of Maintenance of Way Comprised of the following Sub-divisions -
   Electronics Maintenance
   Electrical
   Elevators and Escalators
   Engineering
   Infrastructure (DOI)
   Track
   Office of System Safety (OSS)
   Division of Service Delivery
   Division of Station Environment (DSE)
6. The submitted request for change shall be voted at the earliest meeting. Each department/division shall have one vote.

7. If no unanimous decision can be reached on the submitted request, then the request shall be elevated.

1-6.0 COMPLIANCE WITH THE GUIDELINES.

1. The written and drawings portion of the Guidelines herein are complementary and shall be complied with to the fullest extent. Where compliance with the standards is not possible because of cost factors, safety considerations, space considerations or other reasons, then deviations to the Guidelines must be agreed to by all the pertinent departments.

2. In view of the above, when deviations from the Guidelines occur in design and construction documents, then these deviations should be construed as considered and necessary variances to the Guidelines that are applicable to that one particular situation only. No claims shall be made regarding necessary deviations from the Guidelines.

3. In case of conflict between these Guidelines and other applicable legal codes or regulations then the provisions of the more restrictive of the Guidelines or legal codes shall prevail.

4. The Guidelines are not intended to prevent or discourage the use of new methods, materials or devices during design or construction. To be considered, sufficient technical data are to be submitted for approval demonstrating that the new method, material or device is equivalent to or superior to the requirements of these guidelines with respect to safety, durability, quality, maintenance, ease of installation, and economics.

5. Where the Guidelines refer to Codes or regulations or other guidelines, it is intended that the references shall be the latest issue or publication.

1-7.0 QUALITY. (Functionality, Availability, Reliability and Maintainability)

Quality may be defined as: The totality of features and characteristics of a product or service that bear on its ability to satisfy a given need.” The “need” for the NYC Transit, is the satisfaction of passengers by providing quick, safe and reliable transportation. “The totality of features” makes quality an organization wide goal and in upgrading or improving the infrastructure, engineers must consider the impact of their designs on NYC Transit departments and passengers’ needs.

Functionality

Functionality is defined as: “The ability of an equipment or system to perform the intended function(s) as defined by engineering and industry standards and user requirements, in the environment in which it is installed and to support the other
equipment or systems with which it interfaces, and to exhibit only acceptable or defined failure modes in a predictable manner such that unexpected or unintended modes of operation are not exhibited.

**Availability**

Availability is defined as: “The measure of the continuity of service from sources of energy, communication, transport etc”. It is a measure of reliability and maintainability by indicating how long a component or system is operational. Continuity of power systems, lighting communications etc. are vital in providing satisfactory service to passengers. Our goal is to maximize this attribute of quality by the following:

1. Maximizing reliability
2. Maximizing maintainability
3. Minimizing construction/rehabilitation time
4. Minimizing electric service outage due to construction upgrades
5. Minimizing NYC Transit labor such as flagging
6. Minimizing work train usage

**Reliability**

Reliability is defined as: “The probability that a component part, equipment, or system will satisfactorily perform its specified function under given conditions such as environmental conditions, limitations as to operating time and frequency and thoroughness of maintenance for a specified period of time.

To maximize the reliability of components and systems the following elements shall be adapted in designs:

1. Conservative tolerances for equipment.
2. Suitability for the intended environment.
3. Robustness of equipment.
4. Proper grounding and electrical connections.
5. Protection against stray currents.
6. Protection against corrosion and other adverse environmental circumstances.
7. Redundancy, such as multiple circuits, feeders equipment etc.
8. Low maintenance requirements.
9. Backup power sources

**Maintainability**

Maintainability is defined as: “The ability of equipment or systems to meet operational objectives with a minimum expenditure of maintenance effort under operational environmental conditions in which scheduled and unscheduled maintenance is
performed”. For good maintainability the following elements shall be adapted in designs:

1. Minimize special tools
2. Equipment shall have good accessibility
3. Preclude or minimize the need for scheduled maintenance
4. Provide fault isolation of circuits and systems.
5. Provide built in tests and test equipment for fault detection and alarms.
6. Provide built in recording instruments for record keeping and for forensic investigations.
7. Provide keying, guide pins, size and shape differentiation etc. for ease of assembly and disassembly.
8. Provide legends and markings to group equipment, to identify equipment and to identify wires circuits etc.
9. Select “off the shelf” equipment where possible to reduce lead time for component replacement.

1-8.0 ENVIRONMENTAL CONSIDERATIONS.

Asbestos, PCB and Lead Paint.

Early during the design stage, a survey should be undertaken to identify any asbestos and lead paint material that may be disturbed during construction. In addition, transformers to be replaced must be tested for PCB contamination. These materials must be abated. Provisions for the abatement must be made in accordance with the requirements of the Office of System Safety (OSS).

Water Conditions.

For equipment specifications purposes, tunnel areas are classified as wet areas.

Early during the design stage a survey should be undertaken, or the user department must be requested to provide information on water infiltration problems in rooms proposed to locate electrical equipment. The water conditions and structural deficiencies, if any, must be remedied prior to the installation of electrical equipment or the equipment must be relocated to another suitable location. Before relocating equipment, the availability of space, accessibility and economics shall be considered by the Station Clearing House, User, Maintenance and Engineering Departments.

Service or distribution equipment shall not be installed on the track level. If necessary, a new floor/room at the platform height or higher shall be provided. For specific guidelines in areas that are prone for Hurricanes and coastal flooding, see DG 312.

Space Considerations.

Available space in tunnels and subway structures is limited and all efforts should be made to minimize equipment sizes.
When specifying equipment, careful planning must be given to the delivery of the equipment to its intended location. Stairwell and other delivery route clearances must be investigated, work train requirements should be minimized and ease of future maintenance/equipment removal must be assured.

When locating equipment, careful consideration must be given to clearances for train movements as well as for the safety requirements for maintenance personnel.

**Corrosion.**

In general, three causes of corrosion should be considered before specifying equipment and materials. It should be noted that corrosion cannot be eliminated, only minimized.

**Oxygen concentration cell corrosion**

This type of corrosion occurs in crevices and deep recesses where water may collect and where the diffusion of oxygen is hindered. These low oxygen areas are anodic and corrosion may occur at the waterlines where there will be differences in oxygen concentrations.

Mitigation in general will involve sloping for shedding water and/or the application of protective coatings such as paint.

**Dissimilar metals**

Galvanic corrosion occurs when two dissimilar metals are in direct contact and in the presence of an electrolyte such as water.

To reduce corrosion, avoid dissimilar metals or select metals with the least difference in electro-negativity.

**Stray current corrosion**

Refer to DG 255 for Stray current Guidelines

1-9.0 THE DESIGN PROCESS.

The design process involves the planning of the upgrade and replacement of electrical systems and equipment in accordance with accepted regulations and codes and with minimal interruption to the operation of the Railroad. It cannot be emphasized too strongly that the intent is to have full operation of the railroad during the interval of construction. This may require the code compliant installation of power, equipment and lighting systems, on a temporary basis. The designers should keep the requirement for full operation foremost in their planning.

It is assumed that the scope preparation has been completed and that the designer’s responsibility begins at this point. In general the design process should involve the following:
Personnel Assignment.

It is preferable to assign the same portion of the project to two designers for the following reasons:

1. Someone familiar with design will be available more often.
2. One designer will check the work of the other automatically.
3. The designers will consult and motivate each other.
4. Field surveys are performed easier and more information is collected.

Scheduling.

A determination should be made which work items require long times to plan. This work should be started as soon as possible. In particular, the following should be pursued:

1. Electric service requests to Con Ed or other agencies whose approval has to be obtained. (Prior to equipment selection and room layout)
2. Field surveys for the following that require the cooperation of other departments. Field reports must be prepared and kept on file.
   A. To determine the existing electrical loads. This should be a joint effort with the user and maintenance departments. The maintenance department will identify the existing loads.
   B. To determine the location of rooms to house temporary or permanent electrical equipment. A joint field survey with the Station Clearing House/Department and the maintenance department will be required. In view of the station program, the final decision for the room location will be made by the Station Clearing House/Department.
   C. Field surveys for existing conditions, for measurements and to investigate where to run conduits. For conduit runs in station areas, the Station Clearing House/Department must be consulted.

Sequence of Work.

A properly planned design shall include a sequence of work during the construction stage for the dual purpose of providing for an efficient installation of equipment and a minimum interruption to the operation of the Railroad. In particular, the following should be considered:

1. The existing location and physical conditions of the equipment rooms that may affect the delivery or installation of equipment.
2. In sequencing the work, the locations of track switches and signal interlocks and the availability of General Orders, Flagging and work trains shall be evaluated.
3. Sectioning the work for the construction stage to limit the work to one section at a time. The sections shall be determined by agreement between the designer, the Construction Manager and the user and the maintenance departments.

4. The installation and energization of temporary services.

5. The installation and energization of temporary equipment.

**Design File.**

A design file must be established early. It shall be used to file the following;

1. Scope of Work.
2. Environmental considerations.
3. Utility correspondence, service layouts etc.
4. Agreements between departments.
5. Field survey reports.
7. One line and process diagrams.
8. Manufacturers catalog cuts for the specified equipment.
9. Manufacturer’s correspondence, diagrams, computations etc.
10. Data from the design follow-up.

**Intent of Engineering Computations.**

Engineering computations should be performed with the following intent:

1. To provide a clear trail of documentation indicating the conformity of the design with the established relevant codes and criteria.

2. To provide Design Input for Contract Documents in a systematic manner consistent with Codes, acceptable engineering practices, NYC Transit Guidelines and Procedures and the function for which the facility is being designed.

3. To insure that the design approach is consistent with the field conditions at the time of the field surveys and the project can be constructed in a safe, economical and timely manner.

4. To provide a complete, permanent record of the assumptions, functional requirements and technical methodology used in arriving at the design solution for a project.

5. To provide alternative designs based on economic considerations.

6. To provide reference material for training, troubleshooting and design changes.
Engineering Computations.

Computations for, but not limited to the following shall be performed, checked and kept on file in the design file. Include assumptions, alternatives, field measurements etc...

For other requirements and typical calculations, see appendix.

1. Utility operating and short circuit impedance and available short circuit current in the property line box.

2. The distribution system impedance and the available short circuit current at switching equipment. The computations by the ohmic method shall be used.

3. Load calculations. See also the section; Electric Services.

4. Voltage drops between the main disconnect and loads. The purpose of the voltage drop calculations is to ensure that equipment operates within rated voltage and that copper requirements are minimized. The computations shall consider the resistance and inductance of the feeders, the transformers and the power factor of the load. In general the total voltage drops shall be limited to a maximum of 5%, preferably less, as follows:
   A. 2% between the utility metering and panel boards.
   B. 3% between panel board and load.

5. In many cases, the panelboards may be located very close to the main disconnect and it may not be possible to provide a voltage drop of 2% to the panelboard from the main disconnect. In these cases the overall voltage drop should be limited to 5% and computations should be performed to minimize copper requirements. It should be noted that minimizing copper should always be subordinate to voltage drop and NEC requirements. All lighting panelboards shall have a main circuit breaker.

6. Conduit fills.

7. Transformer sizing and overcurrent protection.

8. Motor starting and overcurrent protection.

9. Cable and conduit sizing and overcurrent protection.


11. Fuse and circuit breaker coordination and trip settings.

12. Cable pulling limits and cable pull box locations.

13. Pull box and splice box sizing.

14. Foot candle levels.

15. Heat trace or snow melting cable loading.

16. Cost benefit or economic analysis for different options including consolidation of multiple electric services.
The computed values shall be used as a guide for the ratings determination of equipment. If the computations indicate that the equipment rating is borderline, then strong consideration should be given to the specification of equipment with a higher rating.

**Future Expansion.**

The design drawings and specifications should provide about a 30% spare capacity in panel and distribution boards. Feeders shall be fully sized for the rated capacity of the main circuit breaker frame.

Electric services should also have a spare capacity. See Electric Services.

**Drawings.**

In general the design drawings should depict the following;

1. One line and/or process diagrams.
2. Plans showing feeder runs.
3. Panelboard schedules and circuit breaker settings.
5. Equipment elevations/plans and equipment clearances (NEC) as required.
7. Any and all notes necessary for the interpretation of the drawings. In preparing the drawings, particular efforts should be made to ensure the proper interpretation of the drawings by the following non-engineering groups.
   A. NYC Transit Capital Cost Estimating
   B. NYC Transit User Department
   C. NYC Transit Maintenance Department
   D. The Contractor/Installer

**Design Follow-up.**

In the planning of electrical and lighting systems, standard computations provide an accepted guide for the specification and installation of equipment. However, this guide should be verified by post-construction field inspections and inquiries so that insight may be gained for future planning and improvements. The post-construction investigation should cover the following:

1. Light level readings.
2. Seasonal voltage and current recording.
3. Inputs from user/operating personnel.
4. Inputs from maintenance personnel.
The investigation results should be compared with the assumptions and data used for the preparations for the design documents. The design follow-up data should be kept in the design file, discussed and distributed to user and maintenance personnel as well as to other design teams.

1-10.0 EQUIPMENT.

In general, the selection of equipment shall be based on a range that includes tolerances of the required rating rather than on an exact calculated value. The criteria, where presented here, is typical. For accuracy, the equipment manufacturer must be consulted.

Equipment and material selected for use shall be chosen for safety, reliability, durability, efficiency, ease of installation, economics and low maintenance requirements. In addition they shall confirm to the latest applicable standards of recognized associations and governmental standards and regulations.

Overcurrent Protective Devices.

Overcurrent protective devices, fuses and circuit breakers are to be used to secure protection against overcurrent and short circuits. For a safe and reliable distribution system, the following three basic criteria shall be met:

1. The overcurrent devices shall have proper interrupting ratings. (NEC 110-9)
2. The electrical equipment shall be properly protected. (NEC 110-10)
3. The Overcurrent devices shall have proper selective coordination. (NEC 240-12)

In general, a short circuit study will have to be done to specify the appropriate overcurrent protective devices.

Fuses.

Fuses are to be used for overload and overcurrent protection applications usually in conjunction with switches.

1. Fuses with voltage, and interrupting ratings equal to as a minimum or greater than the circuit rating shall be specified and installed.
2. Electric service feeders with more than two conductors per phase shall be specified with current limiting lugs on both ends of the conductors.
3. Electric services rated more than 600 amperes, shall be specified with Class L fuses.
4. For services and equipment rated at 600 amperes or less Class J or Class R fuses shall be specified.

5. Fuse and circuit breaker combinations shall not be used for current limiting applications unless so rated by the circuit breaker manufacturer.

6. AC voltage fuses shall not be used for 600 volt DC applications.

**AC Circuit Breakers.**

Circuit breakers are to be used for circuit switching as well as for circuit and equipment overload and overcurrent protection applications.

1. Industrial quality circuit breakers with voltage, current and interrupting ratings equal to or greater than the power utilization requirements shall be specified and installed in accordance with latest issue of the NEC.

2. The circuit breakers may be one, two or three pole, molded case Bolt-on or, air circuit breakers, as required.

3. Motors, transformers and heat trace equipment have inrush current characteristics that should be considered during the circuit breaker selection process.

4. Solid state circuit breakers may be calibrated in RMS values or PEAK values.

5. Circuit breakers may be used instead of switches if the circuit breakers are specified without the inverse time and instantaneous trip characteristic.

6. Circuit breakers must be coordinated with the downstream circuit breakers, by utilizing the manufacturer's coordination curves.

7. For overcurrent protection of motors, obtain the motor starting curves from the motor manufacturer.

8. When specifying circuit breakers for air cooled, totally enclosed, low temperature rise transformers, it must be noted that, the manufacturers usually supply a transformer twice the size of the specified unit and de rate it. This raises the inrush current to twice the expected value of the smaller rated transformer. Inrush currents approximately 15-20 times the transformer full load current (of the larger transformer) for about 15 cycles, or 1/4 seconds may be generated.

9. Consideration must be given to the fact that when a heat trace cable is energized in the cold state, inrush currents could trip the branch circuit breaker. The cable manufacturer should be consulted for information regarding inrush currents.
DC Circuit Breakers.
For switching nominal 600 Volt DC circuits, circuit breakers may be specified provided they comply with the following requirements.

1. The circuit breakers shall be 4 poles, each rated for 250 volts DC.
2. The four poles shall be connected in series.
3. Interrupting capacity shall be 40,000 Amperes minimum.

Ground Fault Circuit Breakers
Ground fault circuit breakers are used to open circuits that have developed a predetermined current leak to ground. They are used for person protection up to about 5 mille-amp leakage, and equipment protection above 30 mille-amps. They shall be specified for the following conditions.

1. Wet locations with the exception of tunnels.
2. Areas defined by the NEC.
3. Work areas such as subway yard buildings where stray currents can cause dangerous conditions.
4. Tunnel receptacles.
5. Heat trace panel
6. Booth status indicator

Clearances.
Clearances shall be provided around electrical equipment for reasons of personnel safety and for safe access for equipment maintenance.

1. The clearances about electric equipment shall satisfy Section 110-16 through 34 of the National Electrical Code.
2. Clearances in front of equipment shall permit door openings of 90 degrees minimum.
3. Clearances in tunnels or along tracks for equipment shall satisfy NYC Transit Clearance Diagrams for Equipment Installation.
4. Personnel safety clearances and signage required shall be guided by the Office of System Safety requirements.
5. On station platforms, a five foot clearance (or as required by the Office of System Safety) to the edge of the platform shall be provided.

Conduit and Troughs.
Electrical conduit or trough shall be provided as a wiring raceway for the following reasons:

1. Mechanical protection of wiring
2. Containment of short circuits
3. Return path for fault currents (Rigid steel galvanized conduit only)
Material and Size.
1. Hot dip galvanized rigid steel conduit, minimum size 3/4” shall be used when exposed and 1” concealed.
2. In tunnels and wet areas, rigid conduit shall be provided with a polyurethane coating on the inside and outside, except the threads.
3. For tunnel use and in concrete, the minimum conduit size shall be 1”.
4. For inventory control purposes, rigid steel conduit sizes to be specified shall be restricted to: 3/4”, 1”, 1-1/2”, 2”, 2-1/2”, 3” and 4”

Exceptions:
1. Concrete encased fiberglass ducts may be used for electric services and feeders. Provide a ground wire.
2. For rotating machinery or movable or vibrating equipment flexible conduits shall be used in accordance with the latest issue of the NEC.
3. For temporary wiring, EMT may be used. Provide a ground wire.
4. For non-industrial office areas, armored (BX) cable may be used for branch circuits.

Troughs shall be NEMA 12, hot dip galvanized after fabrication.

Wire Fill.
For tunnels, the cross sectional area of wire fill in conduits shall be limited to 25% of the cross sectional area of the conduit.

For other, non-tunnel applications, the wire cross sectional area shall be limited to 40% and satisfy the latest issue of the NEC.

For troughs, wire fill shall satisfy the latest issue of the NEC. Provide a ground wire.

Enclosures.
Enclosures are used to house electrical apparatus including wires and splices, for protection against the environment, mechanical damage, containment of short-circuits, to permit safe circuit switching and to localize or group equipment control.

In general enclosure material shall be as follows:
1. For outdoor use, stainless steel, NEMA 3R rated.
2. For tunnels, enclosures shall be cast iron or stainless steel.
3. For station areas, enclosures 8 inch x 8 inch and smaller shall be cast iron. Larger enclosures shall be steel.
4. In public access areas, such as stations, enclosures 8 inch by 8 inch and smaller shall be cast iron. Larger enclosures shall be stainless steel. All work in public areas shall require the approval of Station Clearinghouse.
5. For EDR, the enclosures 8 inch x 8 inch and smaller shall be cast iron. Larger enclosures shall be steel.
6. For Vent Plants and Pump rooms, refer to the pertinent guidelines.

Specific requirements for enclosures are

1. Steel enclosures shall be corrosion protected both internally and externally by galvanizing and painting. Enclosure covers shall be similarly protected.
2. In general, the equipment enclosures shall have a 1/8 inch neoprene gasket that is continuous between the enclosure and the cover,
3. The steel enclosures shall be 10 gauge with welded seams, NEMA 12 rated.
4. For outdoor use, the enclosures shall be stainless steel, NEMA 3R.
5. For certain applications and with the concurrence of the user department, low smoke toxicity fiberglass enclosures may be used subject to approval by system safety.
6. Enclosures shall not have knockouts, or openings for more than the actual conduits that enter them.
7. In EDR rooms conduits shall have threaded watertight hubs to terminate conduits. Secure inside the enclosure with insulated ground bushing with ground lug.
8. Cast iron boxes shall come with hubs as an integral part of the box. The hubs shall engage five full threads of the conduit.
9. In hazardous areas such as battery rooms, paint storage or fuel dispensing areas, the enclosure has to satisfy NEC Article 500 for hazardous areas.

**Pull Boxes.**

Pull boxes are used to permit pulling of cables in conduit runs where calculations show that the conduit length exceeds the safe cable pulling length.

1. They shall satisfy the provisions for enclosures as required.
2. Where there are more than two 90° bends in a conduit run, pull boxes shall be installed.
3. In general, pull box sizes shall be in accordance with the latest issue of the NEC.
4. For tunnel or station area use, pull boxes shall be cast iron or stainless steel.
5. Pull box locations, based on cable pulling computations, shall be specified in the drawings.
Splice boxes.
Splice boxes shall be used to protect wiring splices. They shall satisfy the provisions for enclosures as required.

1. In general, splice box sizes as a minimum shall be in accordance with NEC.
2. Splice boxes shall have sufficient dimensions to permit splicing all wires passing through the box.
3. For tunnel or station area use, splice boxes shall be cast iron or stainless steel.

Switches.
Switches are to be used for circuit switching at rated load. With fuses incorporated, they shall be used for circuit and equipment overload and overcurrent protection.

1. Motorized switches shall not be specified.
2. Switches shall have quick make quick break mechanisms.
3. In general, switches shall be fused but for tumbler switch and motor isolation applications in accordance with the latest issue of the NEC, or for other isolating requirements, unfused switches shall be specified.
4. Switches shall be heavy duty, industrial quality, fused or unfused as required.
5. In general, the neutrals shall be terminated in a solid copper neutral assembly, insulated from ground.
6. Switches used to interrupt motor circuits shall be rated in horsepower and must be capable of interrupting at their rated voltage the maximum operating overload current of a motor of the same horsepower as the switch rating. The maximum operating overload current is taken as 6 times the rated full load motor current.
7. Switches shall be enclosed, externally operated. The enclosures shall satisfy the enclosure requirements listed elsewhere.
8. Switches shall be capable of locking in the on or off position.

Service Entrance Switches.
The service entrance switches or main disconnects shall be fused, manually operated bolted pressure switches. A blown fuse indicator shall be provided.

Automatic Transfer Switches.
Automatic transfer switches are used to select and connect one out of two power sources to a load in such a manner that the selection and connection
take place rapidly and without human intervention whenever one of the two power sources fails.

In general, automatic transfer switches shall be used to automatically switch between power sources such as normal and reserve services, generators or 600 Volt DC sources (rated for 750 volts DC).

The transfer switches shall be solenoid operated and mechanically held. The transfer switch mechanism shall also be capable of manual operation.

Switching criteria shall be field programmable.

The transfer switches shall be open transition, with switched neutrals.

**Contactors.**

Contactors are remote controlled switches utilized for connecting circuits in a panel, for motor control, or for other remote control applications.

In general, the contactor shall use solenoid and electrically held.

The control circuit shall be so arranged that in case of power or equipment failure, the contactor will open or close in a “fail safe” manner. Fail safe manner shall be construed to mean that the controlled circuit will assume the state that will benefit the passengers. For example, remote controlled lights will be energized.

**Transformers.**

Transformers shall be used for voltage level shifting, for instrumentation and for electrical isolation purposes. The voltage level shifting is typically applied to match the existing equipment power characteristics to the power source. Reducing power losses by distributing power at a higher voltage level is another application.

Careful consideration must be given for sizing transformers for fire pumps. Fire protection codes require that the circuit should be rated for the locked rotor current of the pump motor.

Typical uses for transformers may be:

1. Stepping down the Con Edison service voltages from 277/480 volts to 120/208 volts.
2. Stepping up the Con Edison 208 voltage to 480 volts for tunnel lighting.
3. Stepping up the Con Edison 208 voltage to 600 volts to power existing 600 volt equipment.
4. Reducing stray current problems in subway yards by isolating the Con Edison electric service neutral through isolation transformers.
5. Voltage and current conditioning for instrumentation.
Typical specifications for transformers shall include the following:

1. Transformers shall be air cooled, totally enclosed, non-ventilated.
2. Windings shall be copper.
3. Transformers shall be pedestal mounted (min 6”).
4. 3 phase transformers shall be delta connected on the primary side and wye connected on the secondary side.
5. The enclosure and wye neutral point on secondary of a three phase transformer shall be grounded.
6. Overcurrent protection and disconnect means on the primary and secondary sides.

**600 Volt Transformers.**

1. The 600 Volt replacement transformers shall be sized electrically equivalent to the transformer that is being replaced.
2. The transformers shall be single phase.
3. The transformer primary shall be rated at 208 volts and the secondary shall be rated at 600 Volts.
4. Both primary and secondary overcurrent protection shall be specified as per the latest issue of the NEC.
5. The enclosure and one leg of the secondary of a 600 Volt transformer shall be grounded.

**Isolation Transformers**

Isolation transformers shall be specifically built for isolation purposes with electrostatic shields. Applications are in barns where the barn electrical distribution system has to be isolated from the utility electric service for stray current mitigation purposes.

Another application for isolation transformers is the establishment of an isolated ground for control or computer power supplies.

Depending on the application, the isolation transformers characteristics shall conform to transformer requirements

**Instrumentation Transformers.**

Instrumentation transformers; potential and current transformers, transform line currents and voltages suitable for standard instrumentation. In addition, they provide isolation from the line voltages.

Location of the instrument transformers in monitored circuits shall be evaluated and specified for maximum information and usefulness to operating personnel.
Conductors.
Insulated copper wire shall be used for hard wired control and for distributing electrical power from the Con Ed service equipment to the electrical equipment utilizing the power.

1. Bus duct shall not be used
2. Wires shall be stranded, copper.
3. Wires shall comply with the short-circuit, overload and physical protection requirements of the latest issue of the NEC.

To reduce inventory requirements, the only the following wire sizes (AWG) shall be specified:

1. For control wiring: #18, #16, #14, #12, #10
2. For power wiring: #12, #10, #8, #6, #2, #2/0, #250 kcmil, #350 kcmil and #500 kcmil.

Wire shall conform to the NYC Transit Wire and Cable Spec. and typically shall be as follows:

1. Type THHN-THWN-600 volt insulation for AC voltage up to 600 volts. (TU Spec)
2. Rubber insulated, Neoprene jacketed, 1000 volt insulation for 600 volt AC or DC circuits. (TR Spec)
3. Type SE for service wire. Other types of insulation may also be used, depending on the application and compliance with NYC wire and cable standards.
4. Type XHHW-2 wires shall be used for wiring in areas that are prone to damages from flooding. See DG312 for details.
5. 600 Volt DC wires shall be run in separate raceway from AC wires.
6. Wire bending radius in panels, junction boxes and motor controllers shall not be less than 5 times the cable diameter.

Connections and Splices.
Connections and splices (joints) are used to provide electrical continuity in wiring. In general only pressure type connectors shall be used.

Typical connection uses are:
1. From bus to bus.
2. From bus to wire.
3. From wire to wire.
Typical connectors of the pressure type used.

1. Wire nuts. Up to wire gage #10
2. Lug connectors.
3. Split bolt connectors.
4. Cast copper connectors
5. Crimp or compression type connectors
6. Welded connections
7. Terminal or power distribution blocks

All joints and wires shall be suitably prepared and cleaned.

Joints shall be suitably torqued so that the conductivity of the joint is at least equal to the conductivity of a corresponding length of connected bus or wire.

In general, bus connections shall not be insulated.

All joints in manholes shall be waterproof joints.

Splices to utility cables in manholes and property line boxes shall be in accordance with the utility’s requirements.

Joints in general, shall be insulated as follows:

1. Contouring plastic and electrical grade plastic tape, applied in overlapping layers.
2. Insulating covers by the same manufacturer as the joint manufacturer.
4. Joint manufacturer recommended insulation.

Panelboards.

Panelboards are assemblies of circuit breakers or switches in one enclosure. They provide a common control point and a convenient grouping of overcurrent devices.

Panelboards shall have the following characteristics:

1. Panelboard installations shall satisfy NEC requirements. Particular attention should be directed at satisfying mounting heights, wiring spaces, minimum bending criteria and entering conductor deflections.
2. The panelboard enclosures shall satisfy the requirements for enclosures listed elsewhere.(Standard drawing E-2060)
3. They shall be only front accessible.
4. Buses shall be rated at 1000 Amps per square inch.
5. Circuit breakers shall be the bolt on type.
6. All lighting panelboards shall have a main circuit breaker.
7. Panelboards fed from outside the room in which they are located shall have a main circuit breaker.

8. Panelboards shall have a maximum of 42 overcurrent devices. A three pole breaker shall count as three devices.

9. Conduits in panelboards shall be grounded as indicated in the standard drawing (E-2020).

10. Panelboards installed in Rapid Transit areas shall have insulated neutral and ground buses.

Installation of Equipment.

As a minimum guideline, all equipment shall be installed as recommended by the manufacturer.

Sufficient access for maintenance purposes shall be provided.

In general, electrical equipment shall be mounted away from walls and ceilings on hot dipped galvanized Kindorf channel. A minimum clearance of 3/4 inch shall be maintained.

Equipment may also be supported on a suitable galvanized steel frame.

In general, normal and reserve feeders shall be run separately on opposite sides of a tunnel or in station areas, on opposite sides of a platform.

Conduits.

Rigid Steel

Conduits shall be supported at definite points. The supports shall not be more than:

- 7-1/2 feet on concrete or masonry
- 5 feet on steel structure
- 3 feet over track ways

In general, conduit shall not be supported by equipment. A minimum of one support, independent of the equipment shall be provided for the conduit.

Conduit entry into enclosures shall be perpendicular to the side of the enclosure.

Multiple runs of conduit shall be racked together in a true parallel run. All cable lengths shall be equal.

In general, conduit shall be provided with offsets and saddles so they can be mounted, to effect proper entry into equipment and to avoid obstacles.
For wire pulling purposes each offset shall be counted as one 90 degree bend and each saddle shall be counted as two 90 degree bends.

To change direction, conduits may be bent in the field as required. The inside bending radius of the bend shall not be less than six times the nominal size of the conduit.

Provide sleeves for conduit penetrations through walls and floors. The space between the sleeve and conduit is to be sufficient for conduit penetrations to be fireproofed to the same rating as the enclosures.

**Flexible Conduit**

Flexible conduit shall be supported every 4 1/2 feet maximum.

The minimum inside bending radius for flexible conduit shall be five times the nominal diameter of the conduit.

**Trough**

As a minimum, troughs shall be supported as per the manufacturer’s recommendations.

Troughs shall not be supported by or from other equipment.

**Transformers.**

Transformers shall be mounted on a 6 inch concrete pad.

Transformers larger than 15 KVA shall be provided with vibration mounts.

Transformers shall be located near ventilation openings.

Electrical equipment shall not be mounted above transformers.

**1-11.0 STANDARDS AND CODES.**

In addition to the Guidelines, design and construction within the Transit System shall be in accordance with, but not necessarily limited to the latest applicable version of the codes and standards listed below.

American Disabilities Act (ADA)
American Public Transit Association (APTA)
American National Standards Institute (ANSI)
American Society of Testing Materials (ASTM)
Con Edison Requirements for Electric Service Installations
Illumination Engineering Society (IES)
| Auxiliary Electrical Power, Lighting and Controls  
<table>
<thead>
<tr>
<th>Engineering Design Criteria and Guidelines</th>
</tr>
</thead>
<tbody>
<tr>
<td>National Electrical Code (NEC)</td>
</tr>
<tr>
<td>National Electrical Manufacturers Association (NEMA)</td>
</tr>
<tr>
<td>National Fire Protection Association</td>
</tr>
<tr>
<td>NY City Electrical Code</td>
</tr>
<tr>
<td>NYC Transit Bus Depot Planning and Design Guidelines</td>
</tr>
<tr>
<td>NYC Transit Clearance Diagrams for Equipment Installation</td>
</tr>
<tr>
<td>NYC Transit Communications Design Guidelines</td>
</tr>
<tr>
<td>NYC Transit Corrosion Control Guide</td>
</tr>
<tr>
<td>NYC Transit DC Connections Design Criteria and Guidelines</td>
</tr>
<tr>
<td>NYC Transit Station Planning and Design Guidelines</td>
</tr>
<tr>
<td>NYC Transit Ejector Plant Guidelines</td>
</tr>
<tr>
<td>NYC Transit Electrical Engineering Design Process Guidelines</td>
</tr>
<tr>
<td>NYC Transit Fan Plant Standards</td>
</tr>
<tr>
<td>NYC Transit Power Substations Design Criteria and Guidelines</td>
</tr>
<tr>
<td>NYC Transit Pump Room Standards</td>
</tr>
<tr>
<td>NYC Transit Project Management Procedures</td>
</tr>
<tr>
<td>NYC Transit Quality Control Plan</td>
</tr>
<tr>
<td>NYC Transit Supervisory Control and Data Acquisition (SCADA) System Design Criteria and guidelines</td>
</tr>
<tr>
<td>NYC-Transit Shops and Yards Planning and Design Guidelines</td>
</tr>
<tr>
<td>NYC Transit Stray Current Control Guidelines</td>
</tr>
<tr>
<td>NYC Transit Wire and Cable Specifications</td>
</tr>
<tr>
<td>NY State Uniform Fire Prevention and Building Code</td>
</tr>
<tr>
<td>OSHA Occupational Safety and Hazard Act</td>
</tr>
<tr>
<td>UL Underwriters Laboratories</td>
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<tr>
<td>ETL Testing laboratories</td>
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<td>NIOSH National Institute for occupational safety and health</td>
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Section 2. Auxiliary Electric Power

2-1.0 PURPOSE.

The purpose of the Guidelines for Auxiliary Electric Power is to establish the minimum requirements for the design and planning of the construction of the temporary and permanent electric power sources and power distribution systems that are required for the operation of the Railroad.

2-2.0 SCOPE.

This section of the Guidelines establishes the minimum requirements for the Auxiliary Electric Power to be provided for:

1. Lighting and Heating
2. Ventilation
3. Escalators and Elevators
4. Pumps and Ejectors
5. Signals and Communications
6. Miscellaneous Electric Equipment
7. Automatic Fare Control
8. Token Booth Operations

Auxiliary Electric Power ( Alternating Current) is separately provided and distinct from Traction Power (600 V DC Current) for reasons of safety, reliability and the availability of AC equipment. Traction Power shutdown will not affect station lighting, each station can have two separate power sources from the reliable utility grid and a much larger selection of equipment is available for AC power than DC power. However, 600 Volt DC Traction Power from the contact rail is also used for some existing tunnel lighting, heating and for emergency/maintenance lighting in station, ventilation plant, and maintenance areas.

Auxiliary Electric Power shall be obtained from Con Edison or Long Island Lighting Company services at a frequency of 60 Hertz and at various three phase voltages.

For additional details for separate areas, refer to:

1. DG-302 Subway Emergency Ventilation Facilities Design Guidelines
2. DG-303 Pump room Design Guidelines
3. DG-310 Rail Car Maintenance Shops and Car Washer Design Guidelines
4. DG-401 Unified Buses Planning & Design Guidelines
2-3.0 ELECTRIC SERVICE

Consolidation of Multiple Services or Power Sources

Consideration should be given to consolidate multiple services at one location. Consolidation of the existing services with new services shall be evaluated with respect to economy, reliability, usability, serviceability and space availability.

Under no condition should Normal and Reserve services be combined. Affected departments such as Signals should be notified of the impending service consolidation.

Load Calculations

Load calculations are important and necessary for establishing the size of electric service equipment and for requesting new or reinforced electric services from the utility company. The following is a guide in computing load magnitudes.

Signal Loads

Use 80% of the rating of the overcurrent protective device and investigate if there are any planned load increases in the near future.

New or Additional Loads

Obtain manufacturer’s data on the new equipment and calculate loads based on expected usage of the equipment.

Spare Capacity

The spare capacity for an electric service shall be 50% of the actual loads. Ventilation and pumping equipment loads (large fans and pumps) shall not be included in the calculation for spare capacity. Empty space, such as a station upper mezzanine, shall be evaluated for potential use and included in the spare capacity. The load evaluation for empty space, depending on intended usage, shall include office lighting, electric heating and air conditioning and future concession load. On a square foot basis, this load may be 20 - 40 watts.

Existing Service

Load calculations of an existing service should be performed with caution as not all equipment is energized at the same time. The following may be used in computing the load:

- Perform a load survey
- Request peak demand records from the utility company and calculate the peak amperes.
600 Volt Loads
In general, 600 volt loads are energized from a transformer. As estimation of these loads is difficult, the KVA rating of the existing transformer should be taken as the load magnitude.
Each existing 600 Volt circuit, whether energized or not, shall be provided with its own fused disconnect in a new panel. The existing circuit labeling shall be preserved and reapplied to the new disconnect. Circuits to be discontinued such as 600 Volt tunnel lighting shall not have any new circuiting provided for.

Electric Utility Service Requests
There are two types of electric service utility requests;
    Reinforcement of an existing service
    Request for a new service
    (Request for a new Concession service should be done separately)
All requests to the utility shall follow the “Procedure for Processing of Con Edison Electric Service Requests through the Division of Electrical Systems Power Operations Department”.
All new service requests from the utility and all new installations shall be for 3 phase, 4 wire, 60 Hertz. The intent is to phase out 25 Hertz equipment and services.
Depending on the load requirements and Con Edison electric service availability, 3 phase, 4 wire 60 Hertz at 120/208 Volts, 277/480 Volts, 2400/4160 Volts or higher voltages may be requested.
Early in the design process, a load estimate shall be prepared to notify the utility company of any planned changes to loads on the existing utility meter or to request a new service. The load estimate shall be the actual connected loads plus an estimate of future load requirements and shall be calculated as follows:

Reinforcement of an Existing Service
To calculate the load estimate, evaluate the following that is applicable:
    New or additional loads
    Existing services to be incorporated into the new service
    Spare capacity
    600 Volt loads

New Service
To calculate the load estimate, evaluate the following that is applicable:
    Signal loads
    New Loads
    Existing services to be incorporated into the new service
    Spare capacity
    600 Volt loads
Sizing Electric Service Equipment

Electric service capacities shall range from 200 amperes to 400-800, 1000-2000 and to 2000-4000 amperes.

Up to 200 amperes, utility metering is direct. Above 200 amperes, current transformer type metering is required by Con Edison.

Electric service equipment shall be sized by totaling the following:
- Signal loads
- New loads
- Existing loads
- Spare capacity
- Existing services to be incorporated into the new service

Demand factors if used, shall be evaluated carefully. For example, air conditioning loads and heating loads will not be on at the same time and only one, the larger load, should be included in the load calculations.

Electric Service Equipment

Electric service equipment starting at utility connection consists of the following:
- Property line box or service end box
- Copper Detail
- Feeders to current transformer (CT) pull-box
- CT cabinet
- Service disconnect(s)
- Utility meter and wiring

The utility company specifications must be followed for the following:
- Property line box or service end box
- Copper Detail
- CT cabinet
- Utility meter and wiring

With the exception of the final connections between the utility and NYC Transit cables, installation of the service equipment is the responsibility of NYC Transit.

The utility company or applicable codes have equipment restrictions as follows:
1. Service equipment with rating in excess of 1000 KVA shall be submitted to the utility company for approval. (NYC Electrical Code)
2. The number of cables per phase terminating in a CT cabinet is limited in accordance with the rating of the CT cabinet.
3. For multiple service disconnects, the sum of the fuse values shall be limited to the rating of the utility current transformer (cabinet).
4. The utility meter shall not be more than 25 feet from the CT cabinet.
There may be other code or utility restrictions, not listed here, that should be followed.

Metering shall be provided on the load side circuit of the main disconnect as follows:

   - Meter shall be the digital type.
   - Meter shall permit simultaneous reading of all three phases of the following parameters on an LCD type screen:
     - Voltages
     - Currents
     - KVA
     - Watts and KWH
     - VAR

The meter shall have a recording capability for the above parameters and it shall have a feature to download the recordings to a PC.

Electric Distribution Rooms

An electric distribution room (EDR) is the location where the electric service and some of the distribution equipment is installed. In general, electric service rooms shall have the following characteristics:

   - Each electric service shall be installed in its own dedicated (separate) electric distribution room.
   - Equipment layout shall be in accordance with applicable codes, Standard Drawing No. E-2025, Arrangement Plans for Normal and Reserve EDRs and with infrastructure requirements, listed in the Appendix.

Electric Service Installation

Electric service installations should be planned carefully to maintain continuous operation of the railroad. In general, this means that the number of existing power sources must be maintained continuously. If an electric service is to be rehabilitated and the work affects the power supply then temporary power sources must be installed for the duration of construction.

The planning shall involve staging the load transfers on a load by load basis and show the installation of the required switches, overcurrent protection devices, wiring etc. on a stage by stage basis as shown on the standard drawings.

Based on the existing conditions and the work required, the following are the different but not exclusive situations for which electric service installations may require staging plans:
Staging Plan for a Station With:

(1) **Two Existing - Operational AC Services and Requires Two New EDRs**

a) Build both new EDRs and install the new services and equipment as shown on the standard drawings. Then transfer all existing station and tunnel loads to the new services.

b) Install the new DC service.

(2) **Two Existing - Operational AC Services and requires one New EDR (the existing 25HZ EDR will be reconstructed)**

a) Build the new EDR and install the new service.

b) Transfer the 25HZ station and tunnel load to the new service and tie in the existing 60HZ - if required - by installing any interface equipment.

c) Remove the existing 25HZ equipment, reconstruct the room and install the new second service.

d) If the existing 60HZ EDR will be reconstructed rather than the 25HZ, the contractor will install temporary equipment as shown on the temporary power drawings and temp out the existing 60HZ and tie in the new service - if required.

e) Reconstruct the existing 60HZ EDR, using care not to interrupt the service, construct a new point of entry for the new service and install the new equipment.

f) Tie the two new services together to feed all loads.

g) Install the new DC service.

(3) **Two Existing - Operational AC Services, Using Existing EDRs**

a) Install temporary equipment as shown on temporary power drawing and then temp out the existing reserve service.

b) Remove existing equipment and install new.

c) If there are existing spare ducts, the same point of entry can be used for the new service. If the service entry cables have to be replaced and the work cannot be coordinated and performed in a two hour interval a new point of entry will required.

d) The new service is installed and tied in with the existing one, disconnecting the temporary.

e) Using the same temporary equipment and temporary EDR with the required modifications repeat steps b to d for the existing normal service.

f) Tie both new services together.

g) Install the new DC service.
(4) One Existing Operational AC Service and Requires Two New EDRs

a) Build both new EDRs and install both services and equipment as shown on standard drawings. No work will be allowed in the existing EDR, other than connecting the AFC panel until the new services are complete. The existing EDR will be under DOI jurisdiction during this period. No temporary service and equipment are necessary if both EDRs and services are constructed concurrently.

d) When both new EDRs are ready with the equipment as shown on the permanent drawings, the contractor then transfers all the station and tunnel loads to the two new services.

c) A new 600VDC service will be provided.

(5) One Existing Operational AC Service and Requires One New EDR

a) Build the new EDR and install one of the two new services, as the first work to be done. No work will be allowed in the existing EDR until the new service is complete - excepted connecting the AFC panel. During this period the existing EDR will remain under DOI jurisdiction.

b) Install the temporary equipment as shown in the temporary service arrangement drawings and temp out the existing 60HZ service. The station now will have two 60HZ services.

c) The existing 11KV, 25HZ EDR will be decommissioned and used as the second EDR; this second service can be installed concurrently with the first one, therefore no temporary equipment and service are required.

d) When both rooms are complete with the equipment as shown in the permanent power drawings all station and tunnel loads will be transferred to the new services.

e) A new 600VDC service will be provided.

600 Volt loads

The number of existing power sources at a location energizing 600 Volt loads shall be maintained during construction.

The contact rail shall not be used as an acceptable power source on a continuous basis.

The planning of the installation of power sources and load transfers between power sources for 600 Volt circuits shall be guided by the planning required for the installation of electric services above.
In transferring loads and services, the construction work must be planned in stages to maintain continuous operation to the extent that necessary outages are minimized. This will require the planning of the installation of wiring, switches, panels etc. before transferring existing loads so that only cable connections will be required during the actual power transfer.

2-4.0 TEMPORARY POWER

Temporary power is used to satisfy legal code and NYC Transit requirements for two independent sources of power when an existing power source or an existing circuit has to be de-energized during construction.

Temporary power may be supplied by the following:

- A new temporary utility service
- An engine driven generator
- A tap from another independent service
- Batteries

Temporary power has to be installed before starting any other construction work.

Temporary power in public areas.

Temporary power may be installed in platform, mezzanine or other public areas with the following requirements:

1. Equipment shall not be mounted on walls but shall be supported from a steel framework secured to the floor and ceiling.
2. The equipment shall be enclosed in a temporary fireproof painted enclosure. The enclosure shall satisfy the requirements for temporary enclosures set forth by the Office of System Safety.
3. The electrical work shall meet temporary wiring requirements set forth in the NEC and NYC Electrical codes.
4. The wiring inside the enclosure does not have to be in conduit.
5. Outside the enclosure wiring shall be in EMT conduit.
6. Equipment may be NEMA 1 classification.
7. Transformers may be air cooled 180 degree rise.

Temporary power in rooms

For the installation of temporary power in rooms secured from the public, the following shall be used as a guideline:

The electrical work shall comply temporary wiring requirements set forth in the NEC and NYC Electrical codes.
The wiring inside the room does not have to be in conduit.
Outside the room, wiring shall be in EMT conduit.
Equipment may be NEMA 1 classification.
Transformers may be air cooled 180 degree rise.

2-5.0 GROUNDING
In general, NYC Transit follows several grounding methods. This is due to the presence of stray currents generated by the 600 Volt DC traction system.

For grounding, the following guidelines shall be followed:

**Rigid Conduit**
Though the conduit is allowed as a path for grounding, the integrity of the conduit can be compromised. In general, a dedicated ground wire shall be provided in all conduit as the return path for fault currents.

**Thin wall Conduit**
A ground wire shall be used in thin wall conduit.

**Fiberglass Conduit**
A ground wire shall be used in fiberglass conduit.

**Rapid Transit System**
In general, any facility physically associated with Rapid Transit shall have equipment grounding only. These facilities are;
- Stations
- Fan Plants
- Pump Rooms
- Air Compressor Rooms
- Crew Quarters
- Escalators and Elevators

In the four wire electrical distribution system derived from the utility, the neutral is NOT connected to structural steel or to any ground system.

An isolated bus shall be installed in service and distribution equipment to receive the circuit neutrals.

THE NEUTRAL IS LEFT TO FLOAT.
EDRs
All equipment enclosures in an EDR shall be connected to structural steel through a copper cable installed in a conduit going around the EDR. For more detail, see Standard Drawing E-2020.

Barns in Subway Yards
Barns are buildings in subway yards used for subway car maintenance or rehabilitation. These buildings have tracks running through them so that cars can be moved in and out of the building. Because the tracks are part of the 600 Volt traction system, they have a different potential than the building structure. Since the building structure is nominally at the same potential as the utility neutral, currents will flow between the tracks and a grounded tool when the tool touches a car that is on the tracks. As the traction system is a very low impedance system, heavy welding currents can flow.

To permit car maintenance, one solution is to electrically connect the building structure to the tracks in the building. This will require an isolation transformer derived power source to the building and electrical isolation of the building tracks from the rest of yard tracks.

For detail, refer to the Stray Current Standards in the Appendix.

Transformers
Transformers shall be solidly grounded to structural steel as follows:

1. The enclosure and wye neutral point on secondary of a three phase transformer shall be grounded.
2. The enclosure and wye neutral point on secondary of a single phase transformer shall be grounded.
3. The enclosure and one leg of the secondary of a 600 Volt transformer shall be grounded.

Other Facilities
Buildings not associated with the Rapid Transit System such as storage buildings, office buildings etc. shall be provided with a grounded neutral service as per NEC and NYCT Electrical code requirements.

2-6.0 STRAY CURRENTS
Stray currents are currents from the traction system, seeking low impedance return paths to the substations. See DG 255 for details.
2-7.0 NUMBER OF ELECTRIC SERVICES

Independent power sources or electric services, a normal and a reserve electric service shall be installed as indicated for the following:

**Stations**

Stations shall be provided with two services, a normal and a reserve service.

If there are facilities such as air compressor rooms, or pump rooms associated with the station then the installation of additional services shall be investigated with respect to available space, economy and ease of maintenance. Provide Generator connection box for DBN and DBR whenever new station services are installed or if DBN and DBR are being replaced as per Electrical Standard drawing E-2058.

Loads on a station shall not be fed from services at another station.

**Air Compressor Rooms**

Air compressor rooms shall have two power sources with automatic switchover in case of loss of one of the power sources.

All distribution and switching equipment shall be located in the control room.

**Pump Rooms**

Pump rooms shall have two power sources with automatic switchover in case of loss of one of the power sources. In addition, pump rooms shall be provided with a remote receptacle or Generator connection box to provide emergency power to the pump room in case both power sources are de-energized.

All distribution and switching equipment shall be located in the pump room.

Under river pump rooms shall have the two power sources from opposite sides of the river.

For more details, consult DG-303 Pump room Design Guidelines.

**Vent Plants**

Vent plants rooms shall have one power source.

For more details, consult DG-302 Subway Emergency Ventilation Facilities Design Guidelines.

For more detail consult the NYC Fan Plant Standards.
**Facilities**

Facilities such as crew quarters, Transit Police, signal towers, communications rooms etc. shall have two independent power sources, normal and reserve.

See DG 310 for Rail car Maintenance shops and car washers

**Yards**

Yard buildings collectively are large power users that require multiple, full size services. Due to the relatively large distances between buildings as well as the large power required, distribution systems may be at voltage levels higher than 600 volts. The number of services should be decided on a site by site basis with input from the user and maintenance departments.

Signal towers and facilities involved with Railroad operation shall have two independent services.

Barns and other maintenance buildings shall have diesel generator for all critical equipment.

Critical equipment such as boilers, pumps etc., shall have a connection point for diesel generators to be used in case of power failure. These connection points, their location and their rating, shall be determined in consultations with the user and maintenance departments.
SECTION 3 TUNNEL LIGHTING

3-1.0 PURPOSE.

The purpose of the Guidelines for tunnel lighting is to establish minimum requirements to be included in the design and planning of construction and maintenance of lighting, receptacles and controls that are required for the underground operation of the Railroad.

3-2.0 SCOPE.

The scope for tunnel lighting in the NYC Transit System encompasses requirements for power sources, lamps and luminaries, permanent and temporary lighting, tunnel receptacles and for equipment and installation for the following areas.

1. Tunnel/track and “void area” illumination.
2. Identification of emergency exit locations.
3. Illumination of emergency exits.
4. Identification of emergency alarm/communication locations.
5. Portal illumination.
6. Lighting of track switch points

3-3.0 LIGHTING REQUIREMENTS

Codes.

Lighting shall be based on the following codes:

- Portals: APTA 2-5.2.4, 1981 Design Guidelines for Design of Rapid Transit Facilities

Lighting Levels.

The minimum maintained lighting levels shall be as follows:

- Tunnels: A minimum maintained level of 0.25 Foot-Candles.
- Emergency Exits: A minimum maintained level of 1.00 Foot-Candles.
- Portals: A minimum maintained level of 10.00 Foot-Candles.
Power Source and Lighting Swing-Over

1. Prior to starting electrical or tunnel lighting construction work, notification of the work must be given to the affected NYC Transit Departments through the issuance of an approved Electrical Distribution Bulletin.

2. During the design phase, an evaluation shall be made on the effect of power source and lighting swing over during the installation of new equipment or during demolition or other work that may affect the tunnel lighting system.

3. Installation of new tunnel lighting must be planned so that swing over from existing to new equipment is minimized. If necessary, drawings shall be prepared to show the sequence of work.

3-4.0 POWER SOURCES.

Two independent sources of power must be provided for and available for tunnel lighting at all times.

Permanent Power

With the exception of portal lighting circuits, lighting circuits must be connected to a dedicated transfer switch that in case of power failure, will automatically switch the tunnel lighting circuits between the normal and reserve services. The dedicated automatic transfer switch shall be located in the Normal EDR.

Two separate transformers, one located in the Normal and one located in the Reserve EDR must be used if voltage level shifts such as 208 volts to 277/480 volts are required.

Power availability to the lighting circuits must be monitored. For details see Instrumentation and Controls Guideline DG 263.

Temporary power

If construction work affects the existing service(s) or distribution system(s) to the extent that power outages are required, then an independent power source(s) must be provided to maintain power to the existing lighting system.

If temporary power sources are required, they shall be installed prior to the beginning of any work on existing lighting circuits and equipment and they will be removed after completion of all work.

3-5.0 TEMPORARY LIGHTING.

An operating Railroad requires that lighting for tunnels, emergency exits and other underground areas shall be provided. During construction where the existing lighting system is to be upgraded or where the existing lighting system is affected, temporary lighting shall be installed and maintained during the construction period.
The temporary lighting may be provided by the existing lighting system or by a new temporary lighting system.

The temporary lighting system shall be energized from two independent power sources with automatic switching between the power sources in case of power failure.

The contact rail shall not be used as a power source for the temporary lighting.

The level of maintained illumination shall be equal to the original illumination levels.

After the completion of all work, the temporary lighting system shall be removed.

3-6.0 CRITERIA FOR LAMP AND FIXTURE

Codes.

Lighting shall be based on the following codes:

- **Tunnels**: NFPA 130, Standard for Fixed Guideway Transit Systems.
- **Portals**: APTA 2-5.2.4, 1981 Design Guidelines for Design of Rapid Transit Facilities

Lighting Levels.

The minimum maintained lighting levels shall be as follows:

- **Tunnels**: A minimum maintained level of 0.25 Foot-Candles.
- **Void Areas**: A minimum maintained level of 0.25 Foot-Candles.
- **Emergency Exits**: A minimum maintained level of 1.00 Foot-Candles.
- **Portals**: A minimum maintained level of 10.00 Foot-Candles.

Environmental-Operational Requirements

The tunnel lights shall operate under the following conditions.

- **Temperature**: Able to start at 0.0°F Fahrenheit.
- **Vibration**: Able to endure vibration levels of 0.01 in/sec.
- **Humidity**: Able to function at 100% Relative Humidity.
Considerations.
The tunnel lighting lamp, fixture and ballast assembly shall be designed to achieve the lowest life cycle cost and be consistent with the following:

1. Lighting must not interfere with, change the appearance of, or obstruct the train operator’s line of sight of signal aspects or other fixed signals (signs).

2. Lighting fixtures and appurtenances shall not block or hinder personnel clearances, impede personnel clearing for a passing train, or present a safety hazard.

3. Lighting fixtures and appurtenances shall not intrude into the equipment clearance envelope.

4. The location of the light fixtures shall not impair the train operator’s visibility.

5. Glare produced by lighting shall be acceptable to train operators and maintenance personnel.

6. Fixtures shall be shielded in the direction of normal traffic.

7. Fixtures shall be shielded to accommodate reverse trafficking when this is standard operating practice under normal operating conditions.

8. Lighting produced shall not compete with signal aspects or safety vest color used by NYC Transit personnel.

9. Type of lamp used shall be capable of replacement with no additional equipment other than a Re-lamp Stick and not require the use of ladders.

10. All appurtenances required for lamp operation shall be housed within a non-corrosive enclosure and be easily removable (i.e. hinge type cover).

11. Lamp socket shall be secured within a non-metallic noncorrosive enclosure with lamp socket open on bottom.

12. Lamp socket shall be capable of being locked within its holding enclosure so as to prevent socket turning during re-lamping.

13. Battery packs shall not be utilized for any tunnel lighting except in areas where the battery packs were recommended by hazard assessment, specifically all under river tunnels. All fixtures with battery back-up shall be installed on a Universal mounting bracket that can easily be removed for replacement with a new/rebuilt unit.

14. Blue lights shall be provided at all emergency alarm locations, on both sides of all the tracks.
15. Tunnel lighting lamp and/or fixture maintenance shall not require the use of special vehicles.

16. Type of lamp used for tunnel lighting shall be proven through industrial use.

17. Type of lamp used for tunnel lighting shall not cause "electromagnetic" interference with signal operation, use of portable radios or other electronics.

18. The height of the splice boxes/fixtures etc. shall not exceed 13 feet.

3-7.0 TUNNEL ILLUMINATION.

Tunnel illumination encompasses lighting for underground track areas between stations including void areas.

Installation

1. Tunnel lighting fixtures shall comply with section 3-2, Criteria for Lamp and Fixture. At the present time, bare bulb, 277 Volt, 20 Watt compact fluorescent lamps are being used to be phased out with an LED lamp under study. Lamps such as LED yielding a lesser life cycle cost may be used subject to acceptance by the stakeholders.

2. All wiring for lights as well as receptacles shall be done using MC Cable starting from the load side of the panelboards. Stainless steel boxes shall be used for splices. The complete installation shall meet the requirements of UL 2196. All MC Cable connectors shall be water tight.

3. Tunnel lights shall be installed on columns and walls on 40 feet centers on each tunnel wall and staggered 20 feet on opposite walls. For tracks that have traffic in both directions under normal operating conditions, install double shielded fixtures on 30 foot centers on each tunnel wall and staggered on 15 foot centers on opposite wall.

4. Double shielded fixtures shall be used for the following:
   - All instances of reverse signaling
   - Under river tubes
   - Emergency exit locations
   - Portals
   - M (middle) track
   - Track switch areas

5. Wherever there are no walls or columns between tracks, the fixture and conduit shall be mounted on the outer wall of each track.

6. Fixtures shall be mounted so that they are in a straight line.

7. Mounting height shall be 9'-6" from the base of rail to the bottom of the bulb. In case of interferences, the fixtures shall be relocated.
8. Light fixtures shall be mounted on the tunnel column face line. If necessary, galvanized or stainless steel standoffs shall be utilized for mounting the fixture on the column line.

9. Fixtures/bulbs shall not be mounted in a zone between 6’-0” and 9’-6” above the base of rail.

10. All tunnel lighting fixtures cannot be closer than 10 feet in front of or 5 feet behind a signal light. Where the signal lights face in both directions, maintain 10 feet spacing on both sides.

11. The first tunnel light fixture shall be 20 feet from the end of the station platform.

12. Tunnel lights shall be fed from a two conduit system (one conduit on each wall) from the north and south stations at opposite ends of the tunnel.

13. Express tracks in the station area shall have switched tunnel lighting. A safety switch for each wall shall be installed 4’-0” above the base of rail, opposite the EDR.

14. Each tunnel light shall be fed from a junction box. The junction box sizing shall be guided by Article 370 of the NEC and provisions shall be made for wire slack consisting of a loop of all the wires passing through the junction box. In addition, enough volume shall be provided for splicing all the wires passing through the junction box.

15. All junction and pull boxes in tunnels shall be stainless steel.

16. Wire pulls shall be limited to 500 feet. All wires at that point shall be spliced.

**Wiring**

1. The tunnel lighting fixtures shall be wired in groups of three phase (A,B,C,A.....) for three circuits or in groups of six (A1,B1,C1, A2,B2,C2, A1.....) for six circuits and so arranged that the loss of any one phase will result in every third fixture to be dark. All circuits are to be extended to the fixture junction box.

2. Each group of three phase circuits shall be provided with a separate neutral. Breakers shall be provided with a handle tie to meet the requirements of the NEC.

3. Conduit wire fill for tunnel lighting and/or tunnel receptacles shall not exceed 25 %.

4. Wires shall be color coded. Wires, conduits, boxes and enclosures shall be identified and tagged.

5. The voltage drop between the service disconnect and the last fixture shall be limited to a maximum of 5%. The transformer impedances shall be included in the calculations.

6. Separate MC Cable shall be used for lighting and receptacle.
Track Switch Point Area Lighting

Switched lighting shall be provided for track switch areas.

The lighting fixtures shall be double shielded tunnel lighting fixtures.

For installation details see standard drawings.

3-8.0 EMERGENCY EXIT LIGHTING.

Emergency exit lighting is illumination for emergency exits that are used for passenger evacuation from tunnels.

1. The minimum lighting level in emergency exits shall be 1 Foot-Candle (FC).

2. Four double shielded tunnel lighting fixtures shall identify emergency exit locations. The fixtures shall be located over the exit doorway. Two of the lights shall be fed from tunnel lighting circuits on one side of the tunnel and the other two lights shall be fed from tunnel lighting circuits on the other side of the tunnel.

3. The emergency exit lighting shall be fed from the three phase tunnel lighting circuits. Distribute the fixtures equally on the three phases. Utilize circuits from both sides of the tunnel. Stagger fixtures so that outage of circuits on one side of the tunnel will cause darkening of every other fixture in the emergency exit.

3-9.0 PORTAL LIGHTING.

Portal lighting provides a transition between daylight and tunnel lighting in portal areas.

1. The lighting level in portals shall be 10 FC for a distance 300 feet inside the tunnel. Where the portal is less than 300 feet from a station, portal lighting shall be extended to the station.

2. Groups of four close mounted, double shielded tunnel lights on 10 foot centers shall be used for portal lighting. Mounting height shall be 6'-8" above base of rail on the low bench side and 9'-6" above the base of rail at other locations.

3. The portal lighting fixtures shall be turned on during daylight hours by means of a photocell controlled contactor. The contactor shall be located in its own enclosure in the EDR room. Locate the photocell by the stairway entrance to the station if feasible.
4. The photocell and contactor shall provide a fail safe operation of the portal lights. The contactor shall close in case of malfunction of the photocell.

5. A dedicated conduit and circuit breaker panel shall be used to feed the portal lights. The circuit breaker panel shall be located in the EDR room if feasible.

3-10.0 EMERGENCY ALARM LOCATION LIGHTING. (Blue Lights)

Blue lights shall be used to identify the physical location of emergency telephones, fire extinguishers and alarms in the tunnels.

1. The blue lights shall be unique with the color rendition as specified

2. A blue light shall be located within five (5) feet of an emergency alarm in the tunnels.

3. In addition to, and in line with the blue light at the emergency alarm, each side of each track shall have a blue light mounted at a height of 11 feet-6 inches on the high bench side and 8 feet on the low bench side, measured from the base of rail to the bottom of the fixture. For middle tracks without a high bench, the blue lights shall be mounted 8’ above the base of rail.

4. At least one blue light shall be visible from an observation point in the middle of the track and midway to the next emergency alarm location, approximately 300 feet. If the blue lights are obstructed by knee-braces or other elements, the lights shall be lowered or relocated to provide visibility.

5. The blue lights shall not interfere with the visibility nor interfere with the color rendition of the signal lights. The blue lights interfering with the signal lights shall be relocated. RTO shall make the final decision whether interference exists.

6. The blue lights shall be fed from the tunnel lighting circuits.

7. A steel ladder shall be provided for each blue light mounted more than 5 feet above the bench walk.

3-11.0 TUNNEL RECEPTACLES.

Receptacles shall be installed in the tunnels to be used for temporary applications such as hand tools and work area lighting.

1. The tunnel receptacles shall be installed on 100 foot centers to be used with the standard 50 foot extension cords in use.
2. For 1, 2 and 3 track tunnels, the receptacles shall be installed along one inside wall. For 4 track tunnels, the receptacles shall be installed along the two inside walls. Receptacles shall be mounted on both sides of the center walls where the center walls are solid and without a passageway.

3. Receptacle feeders shall be run from the stations using independent MC Cable and boxes.

4. Voltage drop to the last receptacle shall be limited to 5% with an assumed 16 ampere, 90% PF load. To reduce the feeder size for long runs, the receptacles may be fed from two stations by running 1/2 the tunnel length from each station. See standard drawing for typical feeder arrangements for multiple tracks.

5. Two receptacles with 20 Amp circuit breakers for switching and protection shall be specified at each location. The receptacles shall be wired to separate phase legs from the feeder.
Section 4 GENERAL LIGHTING-FACILITIES

4-1.0 PURPOSE
The purpose of these Guidelines is to specify lighting requirements for the performance of tasks normally associated with NYC Transit facilities.

4-2.0 SCOPE
These Guidelines shall be applicable for providing illumination for the following:

- Air Compressor Rooms
- Crew Facilities
- Pump Rooms
- Ejector Rooms
- Police Quarters
- Ventilation Shafts
- Subway Yard

4-3.0 GENERAL
The following shall be used as a guide:

Lighting Levels

<table>
<thead>
<tr>
<th>AREAS</th>
<th>FOOT CANDLES-AVERAGE MAINTAINED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air Compressor Rooms</td>
<td>30</td>
</tr>
<tr>
<td>Ejector Rooms</td>
<td>25</td>
</tr>
<tr>
<td>Emergency/Maintenance</td>
<td>15</td>
</tr>
<tr>
<td>Crew Facilities/Police Quarters</td>
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</tr>
<tr>
<td>Locker Rooms</td>
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<tr>
<td>Offices</td>
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<tr>
<td>Showers</td>
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<tr>
<td>Storage</td>
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<td>Washrooms/Toilets</td>
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<td>Communications/monitoring</td>
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<tr>
<td>Training &amp; Conference</td>
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<tr>
<td>Cells</td>
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### AREAS

<table>
<thead>
<tr>
<th>Areas</th>
<th>Foot Candels-Average Maintained</th>
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<tbody>
<tr>
<td>Pump Rooms</td>
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<td>Control Area</td>
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<tr>
<td>Sumps</td>
<td>25</td>
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<tr>
<td>Pipe Chambers</td>
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</tr>
<tr>
<td>Ventilation Shafts</td>
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</tr>
<tr>
<td>Control Area</td>
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<td>Plenum</td>
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<td>Fan Area</td>
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<td>General Area</td>
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</tr>
<tr>
<td>Switch point</td>
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</tr>
</tbody>
</table>

**Fixtures**

1. The lighting fixtures shall be LED, or fluorescent, as required. Final decision shall be based on life cycle cost analysis by the designer.
2. Fixture types shall be vandal proof, surface or pendant mount suitable for wet locations, suitable for hung ceilings etc. as required.
3. Fixtures shall be supported from the ceiling or from steel “channel” type raceways.

**Wiring**

1. Raceways shall be galvanized rigid steel, or galvanized steel “channel” as indicated.
2. When more than one fixture is used in an area, multiple circuits shall be specified.
3. The lighting shall be switched from an entrance location.
4. For two entrance rooms three-way switching shall be specified.
5. In suspended ceilings, raceways shall be supported from the ceiling. Support from the grid, black iron, pencil rods shall not be acceptable.
6. Where fire rating is required appropriate listed wiring shall be used.

**Emergency/Maintenance Lighting**

Unless otherwise indicated, a 600V DC, lighting system with 4 hour battery back-up shall be specified for the following:

1. Electrical distribution rooms
2. Air compressor rooms
3. Crew facilities
4. Pump rooms
5. Ventilation shafts
6. Other locations as required by the user and maintenance
7. Lighting levels shall be as indicated in Section 4-3 General
8. The 600V DC maintenance lighting system shall consist of LED fixtures.
9. The fixtures shall be energized from the 600V DC contact rail through a fused disconnect and a normally closed single pole, double throw contactor. A relay shall monitor the availability of the AC power source for lighting purposes. Failure of any of the phases of the AC power source shall automatically de-energize the contactor and connect the 600V fixtures to the contact rail.
10. For more than two circuits a panelboard with AC/DC circuit breakers shall be specified.
11. The lighting system shall also have manual override for turning on the 600V DC lights.

4-4.0 AIR COMPRESSOR ROOMS
1. Lighting levels shall be as indicated in Section 4-3 General
2. Air compressor rooms and associated control rooms shall be equipped with LED or fluorescent lighting based on lowest life cycle cost.
3. The lighting may be pendant or surface mounted as required. A steel “channel” type raceway may be used for the wiring and fixture support.

4-5.0 POLICE QUARTERS

Lighting for police quarters shall be as follows:
1. Lighting levels shall be as indicated in Section 4-3 General.
2. LED/Fluorescent type fixtures suitable for the area of use shall be specified.
3. Fixtures in cells shall be surface mount, vandal resistant. There shall be no switches and no receptacles in the cells.
4. For emergency lighting, including exit lights, battery type emergency fixtures shall be specified.
5. Dimmers shall be provided in the conference and training areas.
6. Lighting shall be provided at the front entrance for identification purposes.
4-6.0 CREW FACILITIES

Crew facilities are used by transit personnel for various functions such as office, lunch room, work, wash up, storage and communications/monitoring. The following lighting shall be provided.

1. Lighting levels shall be as indicated in Section 4-3 General.
2. Crew facilities shall be provided with LED or fluorescent lighting.
3. 600 VDC lighting shall be provided with 4 hour battery back-up.
4. Exit lights shall have battery backup.

4-7.0 PUMP ROOMS

Pump rooms consist of a sump and a control area with the sump usually below the control area. Lighting shall be as follows;

**Control Area**
1. Lighting levels shall be as indicated in Section 4-3 General.
2. Lighting in control area shall be LED/fluorescent, suitable for wet areas.
3. 600V DC lighting shall be provided with 4 hour battery back-up.

**Sump Area**
1. Lighting levels shall be as indicated in Section 4-3 General.
2. Lighting fixtures shall be suitable for “tank type” installations.
3. There shall be one fixture near the ladder. No 600 V DC lighting will be provided in the sump area.

4-8.0 EJECTOR ROOMS

1. Lighting levels shall be as indicated in Section 4-3 General.
2. LED or Fluorescent lighting fixtures suitable shall be specified.
3. Exit lights shall have battery backup.

4-9.0 VENT PLANTS

Lighting levels shall be as indicated in Section 4-3 General.

LED or Fluorescent fixtures shall be specified for the control areas.

4-10.0 YARDS

1. Lighting levels in yards shall be as indicated in Section 4-3 General.
2. Consideration is to be given to the effect of lighting on neighboring private properties.
3. Lighting designs will have to be undertaken on a case by case basis with concurrence from CPM, Infrastructure, Property Protection and Office of System Safety. Final decision shall be based on life cycle cost.
## SECTION 5. STATION LIGHTING DESIGN

<table>
<thead>
<tr>
<th>EXHIBIT</th>
<th>DESCRIPTION</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>SYMBOL LIST</td>
<td>A-1</td>
</tr>
<tr>
<td>B</td>
<td>PANEL SCHEDULE</td>
<td>B-1</td>
</tr>
<tr>
<td>C</td>
<td>LIGHTING DESIGN MANUAL</td>
<td>C-1 TO C-24</td>
</tr>
<tr>
<td>D</td>
<td>AD.CLOCKS AND AD. PANELS</td>
<td>D-1 TO D-6</td>
</tr>
<tr>
<td>E</td>
<td>CONDUIT INSTALLATION</td>
<td>E-1 TO E-14</td>
</tr>
<tr>
<td>F</td>
<td>AUTOMATIC FARE COLLECTION</td>
<td>F-1 TO F-18</td>
</tr>
<tr>
<td>G</td>
<td>ELECT. CONTROL FOR HVAC EQUIP.</td>
<td>G-1</td>
</tr>
<tr>
<td>H</td>
<td>HEATING DESIGN GUIDELINE</td>
<td>H-1</td>
</tr>
<tr>
<td>J</td>
<td>TUNNEL LIGHTING EQUIPMENT</td>
<td>J-1 TO J-2</td>
</tr>
<tr>
<td>K</td>
<td>CONDUIT, CABLE AND TROUGH SIZE</td>
<td>K-1</td>
</tr>
<tr>
<td>L</td>
<td>WIRING DIAGRAM FOR FAN CONTROL</td>
<td>L-1 TO L-2</td>
</tr>
<tr>
<td>M</td>
<td>CON EDISON SERVICE REQUEST</td>
<td>M-1 TO M-8</td>
</tr>
<tr>
<td>N</td>
<td>ABBREVIATION</td>
<td>N-1</td>
</tr>
<tr>
<td>P</td>
<td>PERSONNEL CLEARANCE AND DIAGRAMS</td>
<td>P-1 TO P-15</td>
</tr>
<tr>
<td>Q</td>
<td>RECEPTACLE REQUIREMENT</td>
<td>Q-1</td>
</tr>
<tr>
<td>R</td>
<td>LIGHTING SWITCH REQUIREMENT</td>
<td>R-1</td>
</tr>
</tbody>
</table>
5-1.0 GENERAL DRAWING REQUIREMENTS

A) Provide key plan, scale and north arrow on all applicable drawings. Part plan drawings shall be provided with reference column numbers and key plan. All stairs shall be indicated with arrow with up and down as applicable. All rooms shall be identified with purpose and room number and agree with architectural drawings. All drawings shall be legible when reduced to half size. All applicable drawings shall have 1/8”=1'-0" scale. All rooms that require enlargement shall have 1/4”=1'-0’ scale except EDR shall have 1/2”=1'-0” scale.

B) Use the TA standard:
1. Symbol list. See attached EXHIBIT-A.
2. Conduit sizes. See attached EXHIBIT-K.
3. Cable sizes. See attached EXHIBIT-K.
4. Line weight for differentiating existing electrical work to be removed, new electrical work, existing electrical equipment to be relocated and rewired.
5. Line symbols for exposed conduit on wall, exposed conduit on ceiling, concealed in floor, etc.

C) Provide general notes into following groups for quick and easy understanding of electrical work indicated in their respective drawing or first drawing in their respective headings.
1. Conduits and Conduit installation.
2. Cables and Cable installation.
3. DC lighting.
4. AC lighting.
5. Transformers.
6. Distribution panels and panelboards.
7. Existing electric work to be removed and/or relocated.
8. Temporary electrical power.

D) Specific notes shall be indicated on applicable drawings.

E) The following are the headings and order of drawings. Each heading may have more than one drawing and accordingly drawing numbers are adjusted.
1. Symbol List, Abbreviation and General notes
2. One-Line Diagram (Existing)
3. One-Line Diagram (New)
4. Demolition Plan
5. EDR and EPR Room Layouts
6. Feeder Plan
7. Lighting Plans - Platform and Rooms
8. Lighting Plans - Mezzanine and Rooms
9. Power Plan - Platform and Mezzanine (Ventilation and AC)
10. Automatic Fare Collection Conduit Layout
11. Electromagnetic Lock System Schematic
12. Electromagnetic Lock Details
13. Electromagnetic Lock Conduit Layout
14. Panelboard Schedules
15. DC Emergency Lighting Schematic
16. Heat Trace Control Schematic
17. Panelboard Box Details
18. Fixture Mounting Details
19. Method of Installing Fuse Box and Rail Connectors
20. Fuse box, 60A for 3rd Rail
21. Typical Grounding Methods for Electrical Equipment

5-2.0 ELECTRIC SERVICE AND SERVICE EQUIPMENT

A) Upgrade existing normal and reserve electrical services to next rated service group over the actual load requirement plus 50% for future load expansion. Rated service groups are 400A, 800A, 1200A, 2000A, 4000A, etc. Each station shall be provided with two (normal and reserve) electric services. If the station has other service(s) the consideration should be given to consolidate the multiple service(s) into the station normal and reserve services. Consolidation of the existing services with the normal and reserve services shall be evaluated with respect to economy, reliability, usability, serviceability and space availability.

B) Normal and reserve electrical services shall be supplied from separate Con Edison manholes.

C) Provide normal and reserve electric services in separate electrical distribution rooms sized to comply with latest NYC Transit standards. The service and distribution equipment shall not be installed on the track level. If necessary a new floor of the platform height shall be provided. See DG 312 for flood resiliency design guidelines.

D) Prepare site plans showing manhole or property line box, service end box, service switch in EDRs, point of entry and itemized electric load request letter along with One-Line diagram and submit to Con Edison for new electric services. Location of the service end box in ventilation grating is unacceptable unless there is insufficient height in street above the station to construct a manhole. Provide 25% spare ducts/conduit(s) from the property line manhole or box to service end box located in electrical distribution room for future use. Waterproof ferrules shall be used for conduit. Wires shall be sealed at both ends against water intrusion using approved fittings.
E) Provide copies of electric service request letter written to Con Edison for upgrading electric service and Con Edison reply with service layouts showing resistance and reactance values at point of entrance of electric service. See attached EXHIBIT-M.

F) The design characteristic of normal and reserve electrical distribution systems shall be fully rated and selectively coordinated. The overcurrent protective device closest to the fault opens the circuit, while the upstream overcurrent protective device remains closed. This limits unnecessary interruption of service to unaffected portions of the system. A system coordination study must be performed to assure selectivity and submitted with substantial completion of contract drawings.

G) Consolidate the existing and proposed electrical panels into a unified system which is to provide for future expansion, incorporating the latest TA design standards and guidelines.

H) Provide separate fused service disconnect switch instead of a main circuit breaker in the distribution board. A combined current transformer cabinet and service disconnect may be installed if space is not available. However, the service end box must be installed separately and have no electrical equipment below it.

I) Provide an automatic transfer switch (ATS) for uninterruptible AC power supply. The normal and reserve electric services will be connected to normal and reserve terminals of the ATS. Load terminals of the ATS are connected to normal reserve distribution board (DBNR).

J) Automatic transfer switch for station load shall never be installed in the same enclosure of the normal service equipment (BPSN and/or DBN).

K) The current transformer cabinet, Con Edison meter and service disconnect must always be located in electrical distribution room. The service disconnect shall be located as close to the service entrance as possible subject to approval from Con Edison.

L) Provide copper details in the service end box for present and future concessions. Concession meters to be grouped inside EDR and properly identified. Combination of meter banks and main circuit breakers to be used.
M) Provide voltage drop calculations for all feeders where over sizing of feeder is required to compensate for voltage drop. The voltage drop shall be limited to a maximum of 5% preferably less, as follows:

1. 2% between the service switch and panelboards.
2. 3% between the panelboard and the load.
3. When the service switch and panelboards are located very close, overall voltage drop of 5% shall be computed.

N) All wiring for normal and reserve services shall be separated, thus ensuring that any fault on the normal or reserve wiring circuits will not affect the performance of the other wiring or equipment.

O) Signal circuit breaker shall be Westinghouse, “K” frame, “C” type, KDC series equipped with seltronic trip units independently adjustable short time pickup and delay with interchangeable rating plugs for signal loads. Interrupting rating shall be 200,000 Amps. as per Signal Department guidelines. The circuit breakers shall be installed in NEMA 12 enclosures and capable of being locked in both the on and off positions.

P) Provide signal compressor fused disconnect switches for signal compressor load as per signal department guidelines.

Q) Signal circuit breakers and signal compressor fuse disconnect switches shall be connected to line side of service switches and mounted separately from all distribution equipment enclosures.

R) At isolation of circuits, star point of secondary of the transformer shall be grounded. Electric company neutral must not be grounded on right-of-way property.

5-3.0 ELECTRICAL ONE-LINE DIAGRAM-DRAWING

A) Provide one-line diagram for normal and reserve electric services and distribution systems on one drawing for each station. Provide Con Edison meter number for existing service.

B) Normal and reserve services shall be shown on left and right side of drawing respectively.

C) Use TA standard abbreviations and symbols for all electrical equipment, as per EXHIBIT-N, and indicate on first line with bold large letters. No two electrical equipment shall have same identification, even with same size and electrical parameters of equipment.
D) Indicate ampere, voltage, pole, phase, wire, HZ, KVA or VA, IAC and other applicable electrical parameters on second line for all electrical equipment as referred to on the one-line diagram.

E) Indicate number and size of cables, conduits, trough between all electrical equipment as close as possible to the origination of the feeder. It shall be shown with loop around feeder line. Arrows shall not be used to indicate conduit and cables sizes.

F) Wiring shall be capable of carrying the equipment rating current.

G) All electrical equipment must be shown with applicable enclosure and electrical connection must be shown with dot in enclosure equipment. All rooms and equipment shown on the one-line diagram must be indicated on feeder plan drawing(s).

H) Show all pertinent panels, new or existing, as well as their source of power including cables and conduit sizes.

I) Automatic Transfer Switch terminals shall be indicated with normal, reserve and load.

J) Circuit Breakers shall be indicated with frame size, ampere trip rating and pole numbers as applicable. When less than three poles are used, show the applicable phases (A, B, or C) for connection.

K) Disconnect switch shall be indicated with switch size, fuse size, and pole numbers as applicable.

L) Show all feeder runs on the one-line diagram. Branch circuits shall not be shown on the one-line diagram. DBN, DBR and DBNR shall not be used for feeding EDR lighting, exhaust fans or receptacles.

M) All electrical equipment shall be completely identified in the following order of preference:

1. Next to the equipment with no arrows.
2. With arrow, as short as possible, when there is no space on drawing for identification.
3. Tables for equipment identification, conduits and cables sizes, etc., must be shown on the same one-line diagram drawing. Tables shown on other than the one line diagram drawing will not be accepted.
N) Conduit and cables of the same size and type originating from the same distribution board shall be identified at one location only and extend a separate loop around each feeder line.

O) All feeder run lines shall:

1. Be equally spaced.
2. Have no or minimal crossings.
3. Straight with no or minimum bend.

P) The distances shall not be shown on the one-line diagram.

Q) All cables and conduits shall be identified in the following manner:

1. 4#2/0 in 2"c or
2. 4-500 Kcmil in 4"c or
3. 2 sets of 4-500 Kcmil in 2-4"c

R) The UL listed interrupting rating-RMS Symmetrical amperes of the circuit breakers installed in distribution boards (DBN, DBR, DBNR and DB) and panelboards must be indicated by notes on the one-line diagram and panelboard schedules, respectively.

S) All circuit breakers in distribution boards shall have circuit numbers.

T) All electrical equipment shown on the one-line diagram is located in their respective rooms except the track fuse box(es). All equipment shall be grouped to show the room to which it belongs. The equipment shall be surrounded by dotted lines to indicate within the room. All rooms shall be identified with location such as platform, mezzanine, N/E, S/E, N/B, S/B, communication room, ejector room, etc.

5-4.0 ELECTRICAL DISTRIBUTION AND ELECTRICAL PANEL ROOMS

A) Provide plan view and elevation of normal and reserve electrical distribution and electrical panel rooms, showing all electrical equipment including framed one-line diagram, spare fuse cabinet and rubber mats, etc. All equipment identification shall be written inside the equipment symbol. Clearance dimensions between electrical equipment shall comply with TA guidelines for electrical distribution rooms.

B) All electrical equipment shown on one line diagram shall be arranged (electrical distribution and/or electrical panel room) in such a way that they will agree with the flow of current in the system. The criss-crossing of the conduits and cables shall be minimum and as short as possible. The arrangement of equipment shall be most efficient and economical.
C) All electrical equipment such as transformers, disconnect switches, lighting panels, etc. shall be located inside electrical distribution and electrical panel rooms. Existing electrical equipment shall be removed, relocated and rewired as required.

D) Normal and Reserve EDRs shall be monitored as defined in DG 263

E) Provide one electrical panel room (EPR) in the vicinity of each control area. EPR shall be located on the same floor as control area and within 75 feet from the token booth.

F) Provide an engraved laminated thermo-setting plastic nameplate to all electrical equipment located in electrical distribution rooms and electrical panel rooms. The nameplate shall be black, engraved through to the white core with 0.25 inch high letters. Refer to section 16B. In addition arc flash labels shall also be provided as required and as indicated on standard drawing E-2052.

G) All switches and circuit breakers must be installed so that the operating handle, when in its highest position, will not be more than 78 inches above the finished floor. Where equipment is elevated due to flooding concerns, appropriate platform shall be provided for maintenance.

5-5.0 DISTRIBUTION BOARDS AND PANELBOARDS

A) Provide normal and reserve distribution boards (DBN and DBR) with 30% spare circuit breakers for future expansion. These boards shall be fully silver plated copper bussed to the frame size of the service switch. Provide DBN and DBR with standard number circuits (24, 30, 36, or 42) as required.

B) Provide branch circuit breakers in “DBN” and “DBR” to feed the following applicable loads:

1. a) Station lighting panelboards (LPNN, LPRN, LPNS, LPRS, LPNI, LPRI).
   b) DBNR (station loads ATS).
   c) Tunnel lighting transformer (tunnel lighting TATS).
   d) Vent Fans (vent fans ATSF).
   e) Elevators (elevators ATSE).
   f) Signals (Signal Room ATSS).
   g) Compressors (Compressors load ATSC).
   h) Pump room (pump room ATSP).
   i) Phase monitor.
   j) Spare circuit breakers.
   k) Generator connection box
2. Automatic Transfer Switches for above item nos. b) and c) are located in the Reserve Electrical Distribution Room and the Normal Electrical Distribution Room, respectively. Automatic Transfer Switches for above item nos. d) through h) are located with their respective loads.

3. Normal terminal on automatic transfer switches for item nos. b) through e) are connected to the normal electric service and reserve terminal on automatic transfer switches for item nos. f) through h) are connected to the reserve electric service.

C) Provide a normal/reserve distribution board (DBNR) with 30% spare circuit breakers for future expansion. This board shall be fully silver plated copper bussed to the frame size of the circuit breaker feeding the ATS serving DBNR. Provide the distribution board with standard number of circuits (18, 24, 30, 36, etc.) as required.

D) Provide branch circuit breakers in DBNR to feed the following applicable loads.

1. Tunnel receptacle panel (TRP).
2. Distribution Board (DB).
3. Communication Panel (CP).
4. Lighting and receptacles for all station auxiliary rooms (LPM).
5. Exhaust fans in all station rooms.
6. AFC (token booth) Panel (CA).
7. Crew Quarters and offices (Lighting and receptacles).
8. Police District.
11. Lubricator Room.
12. EDR lighting/power
13. Signal power Dispatcher’s office
14. Escalator load

E) Provide Distribution Board (DB) in each panel room with 30% spare circuit breakers to feed the following applicable loads (DB shall be complete with standard number of circuits):

1. AFC (token booth) panel (CA).
3. Utility panel for vent fans and exhaust fans.
5. Lighting and receptacles for station auxiliary rooms.
6. Police District.
7. Spare Circuit Breakers

F) Show complete schedule for lighting panel boards with load in VA, KW or HP, as applicable. The load description column must be filled in with accurate information about the location of the load it serves. The load description column filled in with “platform lighting”, “control area” or “room heater” is not acceptable. It must be very specific such as platform lighting N/E, control area C-245 or communication room heater, etc. See attached EXHIBIT-B.

G) All lighting panelboards shall not have more than 42-1P circuits. Spare circuit breakers shall be arranged to accommodate future installation of three pole circuit breakers. Main circuit breaker in panelboard shall be mounted vertical with handle up for on and down for off positions. The panelboard shall have spare capacity of approximately 25% with a minimum of spare single pole circuit breakers as follow:

1. 12 circuit panel-4.
2. 18 circuit panel-6.
3. 24 circuit panel-8.
4. 30 circuit panel-8.
5. 36 circuit panel-8.
6. 42 circuit panel-10.

H) Provide separate normal and reserve lighting panels for each platform and locate these panels in electrical distribution room or electrical panel room as applicable. These panels shall be designated as LPNN, LPRN on northbound; and LPNS, LPRS on southbound and LPNI, LPRI on island platforms.

I) Provide 3 PH, 4W communication panel with GFI branch circuit breakers in communication room. Size to be based on the connected load and spare.

J) All distribution boards and panelboards, not in the same room with upstream protective device, shall have main circuit breaker.

K) All spare circuit breakers in DBN, DBR and DBNR shall have minimum 90 Ampere or higher trip rating depending upon the size of electrical services.

L) All circuit breakers shall be bolt on bus connection type in distribution board and panelboard.

M) All distribution boards and panelboards shall be of the same manufacture for the station where possible.
N) The U.L. listed interrupting rating-RMS symmetrical amperes of the circuit breakers installed in panel board must be indicated in panelboard schedule.

5-6.0 LIGHTING FIXTURES

A) Station lighting fixtures shall be installed in passenger accessible areas such as platform, mezzanine, control area, passageways, stairways, public toilet room and switched from the lighting panel. Provide industrial lighting fixtures in all rooms, transit employee areas and non-public transit areas. Passenger safety and ease of maintenance should be given prime consideration for lighting design.

B) Station lighting system shall be most efficient, cost effective and comply with the foot candle levels as specified in this lighting guideline Exhibit C.3. Designer shall investigate the lighting solutions with the lowest life cycle cost. LED/Fluorescent or any other type shall be considered subject to acceptance by all stakeholders. Analysis shall be based on a life cycle cost of 25 years. Maintainability shall be given due consideration. A list of spare parts shall be obtained from the proposed manufacturer along with the projected cost and lead time.

C) During Preliminary design Phase, the lighting designer to present three lighting schemes for Architect and Engineers review and selection.

D) Provide lighting calculations and submit computer generated analysis with photometric data showing foot candle level for each control area, mezzanine and each platform to meet required lighting level as specified in this guidelines as shown in Appendix C.

E) Provide two sources of temporary AC power (normal and reserve) for lighting and one source for DC emergency lighting with 4 hour battery back-up with illumination level as specified in this guidelines on platforms, control areas, mezzanines, exits, stairs, and corridors at all times during the construction period.

F) Use NYC Transit standard unified lighting system comprising of normal AC lighting, reserve AC lighting and emergency DC lighting with 4 hour battery back-up.

G) All lighting fixtures shall be identified in all areas whether they are surface, pendant, or recess mounted. Also indicate whether direct or indirect/direct or wall wash and regular or vandal resistant inside fixture symbol.

H) Provide DC emergency lighting as per Transit Authority guidelines throughout the station including all rooms. DC lighting fixtures shall be switched from DC lighting panel (s) and not from local switches. DC emergency lighting shall not be provided outside the canopy of elevated and open cut station. DC lighting fixtures shall be alternately wired between two distinct circuits on platform, control areas and large mezzanines. The average distance between two DC
lighting fixtures shall be 15 feet but in no case more than 20 feet. The maximum number of DC lighting fixtures shall not exceed 25 per circuit.

I) Provide automatic changeover from normal and reserve fluorescent lighting to DC emergency lighting upon loss of AC power to any phase of any or all lighting panels. In case of a partial/full black out the emergency lights shall provide full brightness for 4 hours.

J) In lieu of illuminated exit signs, the station signage shall be lit using the emergency light fixtures that are powered by 600 V DC and 4 hour battery back-up.

K) Provide separate track fuse box for tunnel lighting and station emergency lighting.

L) Provide vandal resistant lighting fixtures in control areas, mezzanines, stairways, exits, corridors and waiting areas.

M) Provide wall wash lighting fixtures to illuminate mosaic band and tile wall, where applicable.

N) Install new platform lighting as per the latest guidelines, parallel or perpendicular to track, centered over platform.

O) Show lighting fixture mounting details for control areas and on each platform, where applicable.

P) Provide illumination levels in front of signs, art work and MCR in accordance with the TA lighting level standards. Coordinate lighting drawings with signage drawings.

Q) Install lighting fixtures in all pipe chambers and catwalk ceiling in tunnel leading to electrical distribution and auxiliary rooms.

R) Provide local switches in employee accessible rooms to control lighting fixtures. See attached EXHIBIT-R.

S) Contractor shall provide prototype installation for minimum of five (5) lighting fixtures in each control area and platform area for inspection and approval by the Architect/Engineer prior to the installation of remaining lighting fixtures.

T) Provide lighting fixtures on platforms, control areas, and mezzanines. Lighting fixtures in these areas shall be alternately wired between normal and reserve services as well as among three phases of the circuits. These lighting fixtures shall be switched from the lighting panels located in EDR or EPR.

U) Show circuiting to all lighting fixtures. All circuits other than #12 wires shall be identified. Normal and reserve circuit wiring shall be separated by barrier in trough.
V) For 120 VAC lighting circuits of a three phase, four wire system, a common neutral and a phase wire for each circuit shall be used for each group of three phase legs or part thereof. Circuit breakers for these lighting circuits shall be provided with handle ties to meet NEC requirements. Each receptacle circuit shall have a separate neutral wire independent of the lighting circuits.

W) Pole amounted luminaries shall be LED type and are to be installed at ends of stations where no canopy exists to extend to all locations along the open platforms. All pole mounted lights shall be provided with battery back-up.

X) One fail-safe electric photo cell control system shall be used to control all lights on the elevated station which are to be turned off during daylight hours. A bypass test switch is also to be installed.

Y) Provide photo electrically controlled LED booth status indicators at each street entrance stairway.

Z) Contractor shall provide two sources of AC power (normal and reserve) prior to construction start and at all times during construction but not limited to tunnel lighting, token booths, other miscellaneous loads and signal equipment disconnected during service equipment work and reconnect such equipment after work is completed. Provide all necessary transformers, generators and switch gear to maintain uninterrupted power to tunnel lighting and signal in accordance with standards and respective department bulletin.

AA) Provide tunnel lighting equipment as per applicable one-line diagram for tunnel lighting. Under no circumstances is the contractor to use 600 VDC from the track third rail for the source of tunnel light. See attached EXHIBIT-J.

BB) Provide typical mounting details with reference to the ceiling and or wall for the following items:
   1. Lighting fixtures.
   2. Lighting trough.
   3. Feed from trough to lighting system device.

CC) Reconnect and re-feed all lighting fixtures, heaters and other loads located in all rooms which are beyond the scope of the station rehabilitation limits.

DD) The mounting brackets for surface, pendant and corner lighting fixtures shall be made of extruded aluminum as per NYC Transit standard drawings.

EE) Provide LED lighting fixtures on the platform in passenger amenities such as subway map and passenger bench.

FF) Lighting circuit breaker shall have a rating or trip setting of 15 ampere at 125 volts or less. Each circuit shall be loaded to the maximum but in no case to exceed 1380 volt amperes.
5-7.0 RACEWAYS

A) Provide composite feeder plan drawing(s) showing conduit routing on platforms, mezzanines, control areas, corridors including EDRs, EPRs and auxiliary rooms. Also indicate whether exposed or concealed. See attached EXHIBIT-E.

B) Show conduit routing in EDRs, EPRs, platforms, mezzanines and control areas and also indicate whether exposed or concealed.

C) Install conduit at platform overhang, wall or platform ceiling/wall on the track side of platforms.

D) Use TA standard multi-section one piece extruded aluminum wiring trough to feed AC/DC lighting fixtures and communication speaker for wiring on platform, large control and mezzanine areas. See attached EXHIBIT-C and EXHIBIT-K.

E) Do not install conduits, troughs, junction boxes or any other electrical equipment on ceramic tile wall, art work or mosaic band unless approved by the Station Clearinghouse.

F) All conduits, feeding AC/DC lighting fixtures, booth status indicator lights and communication speakers located on stairs leading to the street from mezzanine shall be concealed by recessing into wall.

G) Utilize existing conduits that are placed within the structural concrete whenever possible.

H) Provide seal tight final short cable connection to rotating, vibrating electrical equipment such as transformer, motor, generators, etc.

I) Provide empty conduits with nylon drag lines for present and future concessions and terminate at designated locations.

J) Unless noted otherwise, all raceway shall be rigid steel, heavy wall, hot dipped, threaded galvanized type and not less than 3/4” for exposed and 1” for underground. See attached EXHIBIT-K.

K) All exposed conduits in public accessible areas shall not be bent, must use applicable conduit fittings with tamperproof stainless steel torque drive screws to change the direction. All conduits shall be installed tight to the ceiling, wall or girder surfaces.

L) The use of trough in the EDR must not compromise the redundancy, fire rating or resistance of equipment, compared to what would be achieved by using conduits.

M) The conduits for the back-lit advertising panels shall be concealed in wall or ceiling.
N) All exposed trough and conduit shall be run in a neat, inconspicuous and workmanlike manner, hidden away from public view where possible and having minimal visual impact on station architecture.

O) Lighting fixture or any other electrical item, when installed below 6'-8" which protrude more than 4” must continue to the floor or to within 8” of the floor so that may be detected by a person using a cane or a seeing eye dog.

P) The raceway for branch circuit wiring for normal AC lighting, reserve AC lighting, communications speakers and DC emergency lighting shall not be mixed and shall be provided in their own raceway.

5-8.0 Wiring Devices

A) Provide single receptacle for individual air-conditioning unit and height to be coordinated with location of unit.

B) Provide a key operated heater switch for heater in communication room.

C) Provide convenience receptacles in all rooms. See attached EXHIBIT-Q.

D) Provide a dedicated GFCI receptacle in locker room for water cooler.

E) Provide GFCI receptacles in the staff restrooms, cleaner/scrubber rooms and refuse rooms, in accordance with NYC Electrical Code and NEC.

F) Provide key-switches for electrical heaters in public toilets.

G) Provide no receptacles in public toilets and beyond the end of canopies.

H) Provide NYC Transit approved special receptacle at every 90’ intervals along platforms, mezzanines and long passageways and alternately wired between normal and reserve services. This receptacle shall be mounted 84” above finished floor or as applicable.

I) Provide minimum of two special receptacles wired from two different circuits in control area and mezzanine. No area shall be further than 45 feet from the nearest receptacle.

J) Provide power to each text telephone, where required.

K) Provide 3P-50 A breaker panel with 12 branch breakers in lubricator room where applicable.

L) Receptacle’s circuit breaker shall be rated minimum 20 ampere or as required.

M) Provide 20 A receptacle for the bird deterrent system.
5-9.0 AUTOMATIC FARE COLLECTION, CONTROLS AND ADVERTISING

A) Provide Automatic Fare Collection (AFC) drawings and indicate power wiring, conduits and panelboards to present AFC design requirements. Provide power feed from AFC panel to token booth panel. Show junction boxes and empty conduits on one line diagram to clearly identify conduits and box sizes. All AFC conduits and boxes shall be exposed in AFC work area. See attached EXHIBIT F.

B) Provide controls including thermostats and firestats as well as power wiring for all exhaust fans, pumps and all other mechanical equipment, as required. See attached EXHIBIT-G.

C) Provide power and wiring for emergency gate.

D) Provide power wiring for advertising clocks, back lit advertising panels, Urban panels at street level and MCR as required. All conduits for back lit advertising panels shall be concealed. See attached EXHIBIT-D. A dedicated circuit shall be provided to power the Urban panels as per standard drawing E-2024.

5-10.0 ELECTRIC HEAT TRACE AND ELECTRIC HEATERS

A) Provide complete heat trace system to all pipes or lines as per NYC Transit design standard drawing. Heat trace monitor panels shall be single phase 208 volts and located in EDR and EPR where applicable. Provide heat trace system to the following pipes or lines:

1. Cold water.
2. Hot water.
3. Waste lines.
4. Sprinkler lines.
5. Discharge lines.
6. Fire lines.

B) Provide electric heaters with heater switches in all rooms. See attached EXHIBIT-H.

C) All heaters shall be 208 VAC, 1 Phase, 1500 Watts, 60 Hertz Teleweld Inc. Railway Utility Division CAT. #H-1241 REV. -E with wall bracket #3368 and deflector back plate.

D) Heaters shall be provided at rate of one 1500 watt heater per 1000 cubic feet of space, with one heater minimum.
E) All room heaters shall be thermostatically controlled with line voltage 2P thermostat with no temperature indication.

F) All heaters shall be wall mounted.

G) All heaters shall be provided with local switch, next to the heater, 30A, 120-277 VAC, 2P, P&S CAT. #30AC2 except the Communication Room which will be P&S CAT. #20AC2-KL and token booth will be P&S CAT. #1228.

H) Provide Electric heating for 68° F interior design and separate 10,000 BTU/HR minimum air conditioning unit for Station Manager's Office.

I) Reconnect and re-feed all heating and other loads in all rooms which are beyond the scope of station rehabilitation limits.

J) Do not mount heaters close to automatic transfer switch.

K) Do not mount electrical equipment close to or above electrical heater.

5-11.0 DEMOLITION

A) Provide removal drawing(s) showing all heavy electrical equipment to be removed or relocated with related notes, including conduits. Number of removal drawings shall be restricted to two for simple stations to a maximum of four for complex stations.

B) Remove existing 11KV, 25 HZ system including, transformer, disconnect switches, cables, conduits and all other unused equipment from EDR. Remove 11KV feeder and cables to the nearest 11KV TA manhole. Maintain the continuity of 11KV feeders to the other stations where applicable. Special provisions shall be provided for removal of HV feeder and electrical equipment, PCB filled transformer and asbestos related work shall be developed by NYC Transit’s Environmental Engineering Office.

C) Remove all abandoned and unused electrical conduits, boxes, wires and fittings from the entire station including under the platform overhang.

D) Cement plaster over all abandoned junction boxes to match surrounding surface.

E) Remove all temporary wiring from entire station including platform overhang.

F) Provide covering and/or patching of all openings created by fixtures and equipment removal.

G) Remove existing AC/DC, fluorescent and incandescent lighting fixtures from platforms, mezzanines, control areas, stairs and exits, passageways and all auxiliary rooms.
Section 6 INSTRUMENTATION AND CONTROL

See DG 263 for Instrumentation and control guidelines.

Section 7 APPENDIX

7-1.0 STANDARD DRAWINGS

E-0000A, LIST OF DRAWINGS
E-0000B, LIST OF DRAWINGS
E-2000 GENERAL NOTES
E-2001 ELECTRICAL SYMBOLS
E-2005A TYPICAL TEMPORARY POWER FOR STATIONS ONE LINE DIAGRAM - IND
E-2005B TYPICAL TEMPORARY POWER FOR STATIONS ONE LINE DIAGRAM - IRT/BMT
E-2006, TYPICAL TEMPORARY ENCLOSURE AND DETAILS FOR STATIONS
E-2007 WORK SEQUENCE FOR EDR RECONSTRUCTION - BMT LINES
E-2008 WORK SEQUENCE FOR EDR RECONSTRUCTION - IRT LINES
E-2009 WORK SEQUENCE FOR EDR RECONSTRUCTION - IND LINES
E-2010 TYPICAL PERMANENT POWER FOR UNDERGROUND STATIONS WITH 480 VOLT TUNNEL LIGHTING
E-2011 TYPICAL PERMANENT POWER FOR ELEVATED STATIONS ONE LINE DIAGRAM
E-2012 TYPICAL PERMANENT POWER FOR STATIONS SERVICE CONNECTIONS
E-2013 TYPICAL PERMANENT POWER FOR UNDERGROUND STATIONS WITH 600 VOLT TUNNEL LIGHTING
E-2014 TYPICAL PERMANENT POWER FOR UNDERGROUND STATIONS WITH 480/600 TUNNEL LIGHTING
E-2015 TYPICAL PERMANENT POWER FROM SUBWAY YARDS FOR 480 V TUNNEL LIGHTING
E-2016 TYPICAL PERMANENT POWER FOR PORTAL AREA LIGHTING WITH 480 V TUNNEL LIGHTING
E-2017 TEMPORARY TUNNEL/STATION CIRCUIT MONITORING
E-2020 TYPICAL GROUNDING METHODS ELECTRICAL SERVICE EQUIPMENT
E-2021 TYPICAL GROUNDING DETAILS FOR YARDS
E-2025 TYPICAL EQUIPMENT ARRANGEMENT PLANS FOR 800A NORMAL AND RESERVE EDRS
E-2030 TYPICAL TUNNEL LIGHTING AND TUNNEL RECEPTACLE ARRANGEMENT I
E-2031  TYPICAL TUNNEL LIGHTING AND TUNNEL RECEPTACLE
        ARRANGEMENT II
E-2034  TYPICAL TUNNEL LIGHTING AND RECEPTACLE ARRANGEMENT AT
        TRACK CROSSOVERS
E-2035  TYPICAL EXIT LIGHTING LAYOUT AND DETAILS
E-2036  EXIT LIGHTING MOUNTING DETAILS
E-2037  TYPICAL PORTAL LIGHTING
E-2040  TUNNEL BLUE LIGHT ARRANGEMENT
E-2041  TYPICAL TUNNEL FIXTURE MOUNTING - MISCELLANEOUS DETAILS
E-2042  TYPICAL TUNNEL FIXTURE MOUNTING DETAILS - FLAT WALL
E-2045  TYPICAL TUNNEL FIXTURE MOUNTING DETAILS - CONCAVE WALL
E-2046  TYPICAL TUNNEL FIXTURE MOUNTING DETAILS - COLUMN WALL
E-2047  TYPICAL TUNNEL FIXTURE MOUNTING DETAILS - CONCRETE TUBE
E-2048  TYPICAL TUNNEL FIXTURE MOUNTING DETAILS - STEEL TUBE
E-2050  TYPICAL CABLE SIZES FOR TUNNEL LIGHTING AND RECEPTACLE
        FEEDS
E-2051  TYPICAL TUNNEL LIGHTING JUNCTION BOX, SIZES AND DETAILS
E-2052  TYPICAL DETAILS FOR EQUIPMENT IDENTIFICATION AND WIRE
        TAGS
E-2055  TUNNEL RECEPTACLE RUNS
E-2056  TUNNEL RECEPTACLE DETAILS
E-2060  PANEL BOARD ENCLOSURE 30 INCH WIDE OR LESS
E-2061  PANEL BOARD ENCLOSURE MORE THAN 30 INCH WIDE
E-2065  HEAT TRACING
E-2070  STRAY CURRENT CONTROL
E-2090  CONTACT SHOE BUG ASSEMBLY
7-2.0 DEPARTMENT OF INFRASTRUCTURE REQUIREMENTS FOR ELECTRIC DISTRIBUTION ROOMS

1. Provide two feet of free space on both sides of main distribution panels and any panels rated greater than 200 Amp capacity.

2. For panels rated 200 Amp capacity or less, provide 10 inches of free space on both sides.

3. For panels of any size mounted next to each other, provide two feet of free space between them. Provide space on the non-adjacent sides in accordance with #1 or #2 as the case may be.

4. For all panelboards, installation of entering conduit shall take place at the rear of the entering surfaces of the panelboard first, using up available space at the rear before installing conduit towards the front of the panelboard.

5. Free space on both sides of a panelboard can be reduced to six inches if three feet of ceiling height is available above the top of the panelboard, together with sufficient entrance space on the top panel surface for conduit for spare breakers.

6. Utilize a separate fused main service disconnect instead of a main breaker in the distribution board.

7. Provide dedicated space for conduit runs at the ceiling, including space for installing future additional conduit without obstructing access to existing conduit.

8. A combined CT cabinet and service disconnect may be installed. However, the service end box must be mounted separately, be equipped with copper detail, and have no electrical equipment below it. In addition, cable and conduit must exit the service end box at the highest point of the box. The box shall be sized to accommodate a drip loop in the entrance conductors.

9. Where Con Edison requires the service end box to be relocated outside of the property line, a new manhole must be constructed. Location of the service end box in ventilation gratings is unacceptable unless there is insufficient height in the street above the station to construct a manhole. Current transformer cabinet, meter, and service disconnect must always be located in the EDR. End boxes under gratings must be of corrosion resistant, water tight, heavy duty construction, with existing cables located at the high point of the boxes. Cables within the box shall be arranged with drip loops.
10. Separate transformers for 277-volt tunnel lighting and 600-volt tunnel and/or station lighting must be utilized. Do not make use of multiple taps on a transformer.

11. For all equipment other than panelboards, space requirements and installation requirements must meet National Electrical Code and New York City Electrical Code provisions as a minimum. In addition, meet or exceed manufacturer’s requirements for placement and installation.

12. A trench and drainage system should be provided at the perimeter wall of the EDRs.

13. Provision should be made for installation of concession meters and disconnects both existing and future.

14. Provision should be made for NYPA metering in equipment including future remote reading via telecommunications.

15. Transition junction boxes must be provided outside the EDRs to allow direction changes for both under platform and high wall conduit runs. Boxes must be of sufficient size to allow splicing and tagging of each conductor.

16. Panels serving 600-volt loads must be of adequate size to accommodate all present load including lighting, both tunnel and station, as well as heating loads. The intent of this requirement is to account for all 600-volt loads, both during construction, and as part of the final design. The panels must be equipped with bus bars for positive, negative and isolated ground conductor connections. The manufacturer’s rating must accommodate both 600 volt, AC and DC power sources.

17. Each station is unique as to location, size, facilities, mezzanines, mechanical equipment, communications equipment, revenue equipment, employee facilities and available space that might be utilized in the future. All existing electrical loads at a station must be compiled. An allowance for expansion of facilities must then be calculated which could include specific individual items of electrical equipment or a building-out of unused space. Based on this analysis, the capacity of the services at a station could for example, be either 400 Amp, 800 Amp, 1200 Amp or higher depending on calculations.

18. In addition, provision must be made for spare breakers to make use of the spare capacity that is brought into the station. The number of spares should represent a minimum of 25% of the total pole positions of the panelboards. If the required panelboard pole positions including spares exceed 42, then an additional panelboard must be installed. For a substantial build-out of space at a station, we will assume a new panelboard will be necessary and that the new build-out space will include a maintenance area for mounting this panelboard.
19. All above requirements are contingent on the feasibility of installation based on availability of funds. Major work such as excavation for EDR/TLR shall be identified during master plan stage including the impact the work will have on rail operations.

7.3.0 ELECTRICAL DISTRIBUTION BULLETIN

PROCEDURE FOR ELECTRICAL DISTRIBUTION BULLETINS

PURPOSE: Electrical Distribution Bulletins (EDB) notifies all concerned of a pre-approved plan whereby: electrical equipment or electrical feeders will be replaced or changed; a contractor takes over or works in an Electrical Distribution Room (EDR).

The Project Manager must initiate a bulletin seventeen (17) working days in advance of the start date.

These bulletins are not intended for work in Substations.

DISCUSSION: Electrical distribution Rooms supply power (AC or DC) for station lighting, station loads (change booths, public address, radio, ejectors, fan plants, escalators, elevators, compressors, signals, concessions, car cleaning facilities, police district offices, communications facilities, alarms, CCTV, scrubber rooms, token vending machines, station manager offices, track quarters, lubrication rooms, etc.), tunnel lighting including emergency exits, pump rooms, towers, crew quarters, etc. Personnel responding to trouble or emergency calls, caused by the disruption of power, must be aware of any changes to or work being performed on the electric power serving these facilities. Approval of the means and methods of this work must be provided for.

PROCEDURE: An Electrical Distribution Bulletin is required when:

- A Contractor works on an 11 KV feeder cable.
- A Contractor’s work requires de-energizing an 11 KV feeder cable. Note - All work on 11 KV feeders must be in accordance with applicable Power Operations Procedures.
- A Contractor takes over an EDR.
- A temporary electric service is installed.
- A feeder to an electrical panel or a larger feeder is replaced.*
- A panel is relocated.*
  Other electrical work for which operating and user departments should be notified.

* Generally not required if the Contractor has taken over the EDR under a previous EDB.
Typically, a Contractor will request of his Project Manager to be allowed to perform work on a segment of the Electrical System. The Contractor and Project Manager will plan all steps of work to be performed and discuss same and receive verbal approval of all departments involved.

The Project Manager will then draft an Electrical Distribution Bulletin for approval. The EDB will state:

- The exact nature of the work to be performed.
- What equipment will be out of service.
- What will replace the out of service equipment.
- Where will the equipment be located.
- Personnel and telephone numbers with whom special operating arrangements were previously made and whether these arrangements are temporary or permanent.
- Existing, temporary, or final wiring diagrams, as required.
- The start date and duration of the work.
- Specific arrangements for dealing with PCB transformers.
- The Operating Department support required (i.e. access and protection, hold-offs, etc.).
- Personnel and telephone numbers to be called in an emergency, (24 hours, 7 days) and the required Contractor response time.
- Operating support required.
- TA Force Account charge number.

A revised bulletin must be issued for a change in procedures or schedule from the original bulletin.

**APPROVAL:** The Project Manager will type a bulletin number on the top right hand corner of each sheet of the bulletin. It should begin with the PM office number and then a sequential number for each bulletin issued by that PM office followed by the calendar year (i.e. Bulletin #31-3-92 represents the 3rd bulletin issued by the PM 31 office in 1992).

The Project Manager will fax the EDB to all who must approve it. Approvals (or disapprovals) must be faxed back to the Project Manager within three working days.
The following must approve an EDB:

- Capital Program Management Electrical Design
- Infrastructure
- Rapid Transit Operations
- Power Operations (only if the work involves an 11 kv feeder cable).

**DISTRIBUTION:** After receiving the approvals, the Project Manager will sign the EDB and he will make a distribution, at least five working days before the start of the work, to the following departments:

- Division of Infrastructure
- Division of Electrical Systems
- Power Operations
- Communications Operations
- Signals Operations
- Capital Program Management
- Project Management
- Electrical Engineering Design
- Division of Stations
- Division of Car Equipment
- Division of Automatic Fare Collection
- Division of Revenue
- Division of Track
- Department of Transit Police
- Office of System Safety
- Division of Rapid Transit Operations
  - Subdivision - A
  - Subdivision - B
  - Command Center
  - Contractor

7-4.0 STRAY CURRENTS.

For guidelines related to Stray Currents, see DG 255.
### EXHIBIT - A

#### Auxiliary Electrical Power, Lighting and Controls Engineering Design Criteria and Guidelines

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>DESCRIPTION</th>
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<td>DG254</td>
<td>FULL BOX AS REQUIRED</td>
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<td>EXHIBIT A1</td>
<td>SPECIAL PLATE AND MEZZANINE RECEPTACLE, 30 AMPS, 120VAC 3 WIRE GROUNDING THRE LOCK, CORROSION RESISTANT, HUBBELL INC. CAT. NO. 6806H, POWER OUTLET WITH ADAPTER PLATE CAT. NO. 6808H FOR MOUNTING GROUCH TO 1 1/2 IN. BOX AND ADAPTER CAT. NO. 6809H TO CONVERT 30AMPS, 120VAC 3 WIRE LOCK TO 120VAC, STRAIGHT BLADE, MOUNTED BY ABOVE FINISHED FLOOR OR AS NOTED</td>
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<tr>
<td>DG254</td>
<td>HORIZON RECEPTACLE, 15A, 120VAC, PASS-AND-SERVE CAT. NO. 3500-HG, MOUNTED ON WALL IN TYPE BOX</td>
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<td>SINGLE RECEPTACLE, 15A, 120VAC, PASS-AND-SERVE CAT. NO. 3500-HG FOR OSVAC OR CAT. NO. 2000-HG FOR 250VAC MOUNTED ON WALL IN TYPE BOX</td>
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<td>PANELBOARD, ELECTRIC HEATER, 1000 WATTS 120VAC, SURFACE MOUNTED, TELEFRED INC. RAILWAY UTILITY DIVISION CAT. NO. 2001-HG, BALL INTEGRITY CAT. NO. 2001-HG</td>
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<tr>
<td>DG254</td>
<td>CONDUIT CONCEAL</td>
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<tr>
<td>DG254</td>
<td>CONDUIT EXPOSED</td>
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<tr>
<td>DG254</td>
<td>BRANCH CIRCUIT RUN TO PANELBOARD, HATCH LINES INDICATE NUMBER OF LINES</td>
</tr>
<tr>
<td>DG254</td>
<td>DISCONNECT SWITCH, IMPOLE AND FUSE SIZE AS INDICATED</td>
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<td>DG254</td>
<td>FIBER-ENGINEERED SIGNAL CONTROLS, MODEL no. 2223430-0120 115VAC</td>
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<td>DG254</td>
<td>LIGHTED DIRECTION INDICATORS</td>
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<td>THERMOSTAT, DPST, 220V, 220-240VAC FOR HEATER-UNIT, HARK CAT. No. 200</td>
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<td>FIRESTATION, HONEYWELL MODEL, 24-582Z SET 0-10 VAC</td>
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<tr>
<td>DG254</td>
<td>JUNCTION BOX RECESSED FOR ADVERTISING PANEL</td>
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<tr>
<td>DG254</td>
<td>JUNCTION BOX FOR ADVERTISING CLOCK</td>
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#### NYC TRANSIT STATION FLOURESCENT LIGHTING FIXTURES SHALL BE IDENTIFIED WITH APPLICABLE NUMBERS AND LETTERS LISTED BELOW AND INSERTED INSIDE THE SYMBOL

<table>
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<tr>
<th>LENGTH OF LAMP (FUSED)</th>
<th>FIXTURE MOUNTING</th>
<th>FIXTURE TYPE</th>
<th>NUMBER OF LAMPS</th>
<th>FIXTURE CONSTRUCTION</th>
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<td>PENDANT</td>
<td>DIRECT</td>
<td>3-LAMP</td>
<td>REGULAR</td>
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<td>5 FEET</td>
<td>SURFACE</td>
<td>INDIRECT/DIRECT</td>
<td>2-LAMP</td>
<td>VANDAL-RESISTANT</td>
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<tr>
<td>6 FEET</td>
<td>CORNER</td>
<td>BALLAST</td>
<td>1-LAMP</td>
<td>BOTTOMLESS WALLASH</td>
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<td></td>
<td>UNIVERSITY OF TROUGA</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

4 FLOURESCENT LIGHTING FIXTURE, SURFACE MOUNTED, DIRECT, 2 LAMP, VANDAL-RESISTANT |
6 FLOURESCENT LIGHTING FIXTURE, PENDANT MOUNTED, BALLAST, 2 LAMP |
LIGHTING

INTRODUCTION

In addition to providing a sense of security, the lighting systems in subway stations should be durable, energy efficient, and easily maintained. Lighting should respond to the given architectural conditions and be coordinated with other elements of stations.

FIXTURES

BELOW GROUND STATIONS

Luminaires shall utilize light sources that provide the lowest life cycle cost. They will be shielded to reduce glare, so that the lighted area is more apparent than the lighting source.

Light fixtures shall incorporate a standard extrusion which can be adapted to varying mounting conditions and layouts. This extrusion can house all components. The complete assembly shall be listed.

Color-improved LED lamps will be used to provide a superior quality lighting environment, rendering all lighted surfaces true to color. These lamps shall provide a 3500°K color temperature and a minimum Color Rendering Index of 70.

A point source luminaire, as described below, may also be used in below grade stations where high ceilings or other special conditions warrant the use of such a direct/indirect pendant mounted point source fixture.

Using the concept of point sources, a replica system is being developed which will provide the required illumination levels and is energy efficient as well as compatible with the architecture of the above ground stations. The new point source luminaire will be similar in profile to the Holophane Classic #02454, which is reminiscent of the original luminaire designs. The entire assembly will be subject to testing and meeting the required performance specifications of the NYCTA.

At exterior, canopied platform areas, luminaires will be pendant mounted. By providing both direct and indirect lighting components, they will illuminate the platform floor brightly and also highlight the architecture of the canopies. Luminaires shall employ the use of non-rigid, "hang straight" stems to accommodate the typically sloped canopy ceilings and to help with vandalism. Refer to Figure 12.

At the open air extensions to the platforms, a pole mounted version of the luminaire will be used to provide adequate foot-candle levels.

ABOVE GROUND STATIONS

Point source luminaires integrate well with the existing, various turn-of-the-century canopy designs.
ENTRANCES

All K1 and KA entries shall be provided with ornamental globe luminaires. Additional lighting provided by the street entrance stairway lights shall enhance the illumination at entry stair. See chapter 10 on ENTRANCES.

LAYOUTS

BELOW GROUND STATIONS

Lighting should be coordinated with ceiling and structural systems. Layouts should follow the reflected ceiling plans illustrated in Figures 13-16. Layouts for mezzanines should be similar to the platform layout, relating to the ceiling coffer, if it exists. Figures 13, 15 and 16 show lighting perpendicular to the track-way and within ceiling coffers, where a regular coffered ceiling exists.

Lighting perpendicular to platform edges facilitates maintenance by eliminating the need for a flagman. This system should not be applied in cases where ceiling conditions, variations and obstructions inhibit implementation. Lighting parallel to the trackway, as shown in Figure 14, should be used in these cases.

Where ceiling conditions permit, pendant hung direct/indirect luminaires should be used. Generally, the luminaire should not extend below the coffer and the bottom of pendant hung luminaires should align with the bottom of the ceiling coffers (refer to Figure 3). At low ceilings, luminaires should be surface mounted.

Supplemental wall wash luminaires shall be used on island platform stations to illuminate the opposite track wall when that wall has a ceramic tile finish. Refer to Figure 16.

ABOVE GROUND STATIONS

Lighting layouts for above ground station platform areas will be coordinated with ceilings, exterior canopies and structural systems. Luminaires will be spaced 8'-0" to 12'-0" on center to provide the required platform illumination. The actual spacing will depend on the specific point source luminaires used as well as the exterior platform structural bay size (typically, 25'-0"). Also, these luminaires shall be located away from the platform edge to facilitate re-lamping and maintenance. Layouts should follow the reflected ceiling plans illustrated in Figures 17-18.

Many of the head houses, mezzanines and stair enclosures at above ground stations were originally designed with unique architectural characteristics such as high, articulated ceilings, dormers and skylights. These unique spaces shall utilize point source light fixtures in station rehabilitation. Where head houses, mezzanines and covered stairs have low, flat ceilings, the designer should follow the fixture and layout guidelines for below ground stations.

All luminaire types can be installed with protective lenses; however, these lenses shall only be used where special protection is required against breakage and vandalism. For example, at low ceilings (less than 7'-6" high), luminaires with lenses should be specified. If a direct/indirect luminaire is used with a lens, then a clear lens should also be used on the top of the fixture.
ILLUMINATION LEVELS

Provide levels of illumination in all areas in accordance with the lighting level standards shown in Figure 1. The listed illumination levels are minimum standards for all stations.

<table>
<thead>
<tr>
<th>Area</th>
<th>Maintained Design Level</th>
<th>Average Foot-candles</th>
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</thead>
<tbody>
<tr>
<td>CONTROL AREA</td>
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<td></td>
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<tr>
<td>Open</td>
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<td>Closed with High Exit and/or Entrance</td>
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<td>Control Areas</td>
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<td>Remote</td>
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<td>ELEVATORS</td>
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<td>PASSENGER INFORMATION CENTERS</td>
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<td>STAIRWAYS TO SUBWAY</td>
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<td>Street</td>
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<td>First Stair Landing from Street Entry</td>
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<td>Intermediate Stair and Landings</td>
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<td>Mezzanine Level Landings</td>
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<td>Entrance from Interior Space</td>
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<td>PASSAGEWAYS OR ESCALATORS</td>
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<td>Subways or Open Cut</td>
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<tr>
<td>Subway or Open Cut</td>
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</tr>
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Fig. 1: Illumination level standards.

Notes:
1. Design Level (maintained) = 2/3 initial illuminance.
2. Illumination measured at the floor plane.
3. Max/Min ratio not to exceed 3 to 1 except for subway and elevated stair entry see note 4.
   Average/Minimum and Maximum/Average illuminance ratio shall not exceed 3/1

NYCTA DESIGN MANUAL 6/22/94 LIGHTING-16.3
4. Street landing for subway entry shall have an average of 1 FC, gradually transitioning to 10 FC average at the first landing. Max/Min ratio for the first stair from street to subway shall not exceed 8 to 1.
5. For entry to an elevated subway the average at the street level is 1 FC gradually transitioning to 10 FC at the first landing. Max/Min ratio shall not exceed 8 to 1 for the first stair.
6. Average/Minimum and Maximum/Average illuminance ratio shall not exceed 3/1 for each tread.
7. The Maximum/Minimum ratio for elevated platforms without canopy shall not exceed 5 to 1.
**Types**

Fixtures for below ground stations shall conform to the types and profiles illustrated in Figures 2-11 and to the Outline Specifications in the REFERENCE STANDARDS.

Supplemental wallwash fixtures running parallel to island platform edges and lighting track walls are illustrated in Figure 11.

Fixtures for above ground stations shall conform to the type and profile shown in Figure 12.

---

**Fig. 2:**
Type A Fixture: Direct/Indirect pendent mounted

**Fig. 3:**
Typical mounting detail for Type A Fixture

**Fig. 4:**
Optional lens detail

NYCTA DESIGN MANUAL 6/22/94
Fig. 5: Type D Fixture
Direct pendant mounted

Fig. 6: Type C Fixture
Direct pendant mounted with supplemental raceway

Fig. 7: Type D Fixture
Direct surface mounted with supplemental raceway
Fig. 8:
Type E Fixture:
Direct surface mounted

Fig. 9:
Type F Fixture:
Direct surface mounted wall wash

Fig. 10:
Type G Fixture:
Direct pendant mounted wall wash
Fig. 11: Type H Fixture: Direct pendant mounted fixture with well wash component and supplemental roadway.

Fig. 12: Type J Fixture: Direct/indirect pendant mounted; integral ballast at canopy with rising straight fitting.
LIGHTING LAYOUT PLAN A: BELOW GROUND STATIONS

Fig. 13: Reflected Ceiling Layout Plan A - Side Platform/Below Ground Stations

Fixtures arranged perpendicular to trackway

SEE FIG. 19 FOR DETAIL

SEE FIG. 20 FOR DETAIL
LIGHTING LAYOUT PLAN A1: BELOW GROUND STATIONS

Fig. 14:
Reflected Ceiling
Layout Plan A1 -
Side Platform/
Below Ground
Stations

Fixtures arranged parallel to trackway. Supplemental fixtures at control areas, stairs, escalators and elevators.

SEE FIG. 1 FOR DETAIL

SEE FIG. 13 FOR DETAIL
LIGHTING LAYOUT PLAN B: BELOW GROUND STATIONS

Fig. 15: Reflected Ceiling Layout Plan B - Island Platform/ Below Ground Stations

Fixtures arranged perpendicular to trackways.

Light Fixture

SEE Fig. 19 FOR DETAIL

NYCTA DESIGN MANUAL 6/22/94

C-10

LIGHTING-15.10
Fig. 16: Reflected Ceiling Layout Plan C - Island Platform/ Below Ground Stations

Fixtures arranged parallel to tracks. Supplemental fixtures at control areas, stairs, escalators and elevators.

LIGHTING LAYOUT PLAN C: BELOW GROUND STATIONS
LIGHTING LAYOUT PLAN D: ABOVE GROUND STATIONS

Fig. 17: Reflected Ceiling Layout Plan D- Side Platforms/ Above Ground Stations
Point Source Fixtures arranged with typical spacing as shown.

SEE FIG. 12 FOR DETAIL.
INTEGRATED SYSTEMS

WIREWAY SYSTEM

In below ground stations, a common wireway system shall be used to contain and organize the wiring requirements for the normal and emergency circuit wiring as well as miscellaneous low voltage systems. The wireway shall be extruded aluminum and shall have multiple removable covers providing easy access to individual wiring compartments. Single access covers will not be acceptable. Wireway designs shall accommodate perpendicular as well as continuous run luminaire layout designs, but shall never run against a finished wall. All other systems that cannot be routed via the common wireway system shall be organized into one of the three lettered areas indicated in Figure 19.

In above ground stations, the wireway system is typically exposed; the designer should organize the wireway so that it is integrated with the canopy structure at exterior platforms.

Fig. 19: Schematic wireway diagram concept. Lettered areas indicate wireway route zones. Pendant mounted fixtures are shown supplied by continuous wireway.
EMERGENCY LIGHTING

For below ground stations, an emergency lighting system shall be integrated into the luminaire design. The emergency power supply shall derive its source from the 600-volt DC system and built in battery and will drive the emergency lighting component. The emergency lights should be spaced no greater than 15’ O.C. and shall provide 1-footcandle minimum and as measured at the floor level of all means of egress areas throughout platforms and mezzanines. Emergency lighting should be concentrated at exit points to produce 5-footcandles. See Figures 20-23 for typical emergency lighting layouts. 600-volt DC shall be used to drive the LED lamps, during failure of Normal or Reserve service. Upon failure of AC and DC the battery packs shall continue to provide emergency lighting as per NYS building code.

At above ground stations, emergency lighting shall be incorporated into the Station lighting system as described above. Emergency lighting shall be provided at head houses, mezzanines, and exterior platforms within the extent of the canopies. Elevated platform areas with no canopy shall be provided with LED emergency lighting with battery back-up as per NYS building code.

SPECIAL CONSIDERATIONS

Every condition in the subway system has not been defined in this section. The emphasis of this guideline is to relate the lighting to the architecture. In addition, the lighting design should be organized and integrated to provide a quality environment.
Fig. 20: Emergency lighting and speaker modules spaced every 15' O.C. for fixtures placed perpendicular to trackway.

Fig. 21: Emergency lighting and speaker modules spaced every 15' O.C. for fixtures placed parallel to trackway.

- Speaker module
- Emergency light
- Emergency light w/ ballast
- Ballast
Fig. 22: Optional speaker locations when side platform is greater than 18" wide, and fixtures are placed parallel to the trackway.

Fig. 23: Central speaker locations when fixture spacing is greater than 20" wide, and fixtures are placed parallel to trackway.

- Speaker module
- Emergency light
- Emergency light w/ ballast
- Ballast
REFERENCES

ENTRANCES

REFERENCE STANDARDS

- Outline Specifications

TYPICAL DETAILS

- Light Fixture Details
  Parallel to Platform
- Light Fixture Details
  Perpendicular to Platform
- Entrance Globe/Status Light
- Bega Exterior Light Fixture

NYCTA Exterior Station/Exterior Lighting Study 12/16/92
Cosentini Lighting Design
INTERIOR LIGHT FIXTURE SPECIFICATIONS

Housing
Extruded aluminum ".125" minimum thickness. Continuous run fixtures shall utilize internal couplers and gaskets to provide hairline joints with no light leaks. Section small accommodate single or double lamp profile. Finish shall be natural anodized aluminum. Housing dimensions shall be 9-3/4" W x 4" H x length.

End Plate
End plate shall be constructed of die cast aluminum with rounded corners and shall attach to housing with no visible hardware. Finish shall match housing.

Reflector
Reflector material shall be brushed finish satin anodized aluminum with grain oriented parallel to length of lamps. Reflectors shall attach to housing with no visible hardware. Reflectors shall be removable for access to fixture and ballast wiring. Reflector shall be minimum 90% reflective.

Lamps
Lamps shall be 4 foot or 6 foot (not 8 foot) T8 slimline or LED type based on Life cycle cost analysis. Color temperature of lamps is to be 3500°K and have a tri-phosphor coating. The lamps shall be manufactured by GE, Sylvania or Phillips.

Ballast
Ballasts shall be of the high efficiency, full light output, solid state type. Single and double lamp ballasts shall be utilized as required. Ballasts shall be mounted "in-line" and shall be accessed through a removable panel. Ballasts mounting and wiring shall be of the quick disconnect type for ease of maintenance. Ballasts shall operate slimline lamps and be of the appropriate voltage for the specific project. Ballasts shall be manufactured by Universal, Triad or Advance and have a minimum starting temperature of 0°. Ballast compartment closure panel shall be frameless and fit flush with the bottom of the fixture.

Socket Assembly
Socket shall be of the heavy duty single pin compression type. Socket shall be contained within a die cast aluminum cover. Aluminum cover shall be gasketed to prevent steel dust infiltration and restrict lamp movement to prevent tampering. Cover shall be opened with 1/4 turn screw. Finish shall match housing.
<table>
<thead>
<tr>
<th><strong>Wire-way</strong> (Type C&amp;D Fixtures)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wire-way shall be constructed of extruded aluminum and shall accommodate surface mounting (type &quot;D&quot;) and pendant mounting (type &quot;C&quot;). Wire-way cover shall be aluminum and shall engage wire-way via slots or notches. Wire-way cover shall be fastened by use of captive hardware. Finish shall be natural anodized aluminum.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Pendants</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Pendants shall be 5/8&quot; O.D. steel and be factory threaded and cut to the appropriate length. Canopy shall be 5&quot; diameter and the depth shall cover the outlet box. Finish shall be baked white enamel. Pendants for continuous wire-way shall utilize a clevis hanger bracket. Pendants for luminaires mounted perpendicular to the platform edge shall accommodate two dedicated wire-way systems (i.e., normal and emergency or normal and public address). Double stems and conduits will not be acceptable. Split wiring systems shall be maintained from the distribution wire-way to the luminaires.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Surface Mounting (Type &quot;E&quot;)</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Surface mounting bracket shall be extruded aluminum and shall provide a 3/4&quot; reveal from surface to which fixture is mounted.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Optional Door Frame</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Door frame shall be constructed of extruded aluminum and shall support a clear Lexan lens. Door frame shall be gasketed and have continuous hinging. Access to lamp compartment shall be accomplished utilizing 1/4 turn tamper proof screws. Door frame shall be of the same size as the lamp utilized taking into account the socket compartment.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Emergency Unit</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Emergency unit shall accommodate 2 bi-pin U-shaped fluorescent 130 volt lamps with 600 volt ballast. Emergency unit shall always have optional door frame and shall support a wide spread clear Lexan Lens.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Manufacturer</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Fixture shall be manufactured by Linear Lighting, Neoray, McPhilben or approved equal.</td>
</tr>
</tbody>
</table>
ENTRANCE STATUS INDICATOR GLOBE

The Globe Light at subway entrances will provide a source of illumination as well as indicate whether or not the station is open. The bottom half of the globe will always be white. The top half of the globe will be either green (open) and will function much like a traffic signal. Green will indicate a full-time entrance with a manned agent booth, and red will mean no entry (exit only).

Elevation Typical Lamp

Section Typical Lamp

Detail Typical Ring
LIGHT FIXTURE DETAILS

LIGHTING PERPENDICULAR TO PLATFORM

For lighting layouts and requirements, see Design Guidelines, Chapter 15, on LIGHTING.

Plan
Bottom View

Longitudinal
Section A-A

Transverse
Sections B-B and C-C

NYCTA DESIGN MANUAL 11/15/92

TYPICAL DETAILS - RS 8.12
LIGHT FIXTURE DETAILS

LIGHTING PARALLEL TO PLATFORM

For lighting layouts and requirements, see Design Guidelines, Chapter 15, on LIGHTING.

Plan
Bottom View

Longitudinal Section A-A

Sections B-B and C-C
GUIDELINES FOR ADVERTISING CLOCKS

1. Clocks are to be installed on platforms as shown on the four attached sketches (D-1 thru D-4).

2. Clocks will be considered for mezzanines and passageways on a case by case basis at transfer stations only.

3. No clocks will be permitted in control areas.

4. All clocks are to be double-faced.

5. Minimum headroom to the bottom of clock is 7'-0". Where 7'-0" headroom does not exist, consideration will be given to wall mounted clocks.

6. Clocks shall be located as not to interfere with the following:
   a) Station architectural features including mosaic wall treatment or art work.
   b) Graphics - station name, directional and informational signs.
   c) Off-hour waiting areas.
   d) Station lighting.

7. Clocks shall be mounted at the center of the structural arch or centered on the ceiling beam.

8. Platform clocks are to be perpendicular to the platform edge.

9. MTA is to submit to the Authority drawings for approval prior to installing new clocks.

10. All existing clocks that do not conform to these guidelines are to be removed.
2-END CONTROL AREAS
ISLAND PLATFORM

200" ±

1/3 ±

1/3 ±

25" ± For stairs, ramps and escalators

Min.
- OFF-CENTER CONTROL AREA
C-E N T R A L  C O N T R O L  A R E A
FURNISHINGS, FURNITURE & EQUIPMENT

INTRODUCTION

The presences of furnishings, furniture and equipment in the public areas of stations provide many passenger amenities as well as have a marked effect on the visual environment of stations. This chapter will outline the standards for general requirements, use and placement of the specific elements described below.

FURNISHINGS

AGENT BOOTHS

Agent Booths are typically free standing and self-contained glass and stainless steel elements in the unpaid area. They primarily house NYCTA agents who provide a variety of customer services as well as furnishings and equipment necessary to those services. A detailed description of the requirements and guidelines for these booths is provided in the chapter entitled, AGENT BOOTHS.

ART

Art in the public areas of stations will be included in selected station rehabilitations. Art work is chosen by the MTA Arts for Transit Authority Committee. The design, configuration, and materials of any given design must comply with the NYCTA design and safety standards. The designer should consult with Arts for Transit and the selected artist on matters relating to lighting, installation, placement and location of the artwork. For information on the design guidelines philosophy and policy on artwork, see the chapter on ART & PRESERVATION.

ADVERTISING PANELS

Advertising panels are an important amenity in stations for both their revenue and visual interest. Two types of panels are being used in the system: paper panels and illuminated panels. They may be located both on station platform and track walls. For a detailed discussion about the requirements for their size, placement and approved locations in public areas, see the design guidelines chapter on ADVERTISING.

CLOCKS

Advertising clocks currently occur throughout the system. As the real time information program is fully implemented, the use of these clocks will be phased out of the system.

CONCESSIONS

Concessions are a vital source of revenue for the transit system. When a concession is part of station rehabilitation, it must be submitted to the MTA/NYCTA Concessions Committee for review of its proposed location. Further, any proposed concession must be designed in accordance with the guidelines outlined in the chapter on CONCESSIONS.

CONDUCTOR BOARDS

Conductor Boards are present in the public spaces and are used by NYCTA train conductors to determine exact locations for the train to stop when entering a station. As illustrated in the section on TYPICAL DETAILS, they are black and white porcelain enamel graphic signs. They must be pendant mounted from ceilings at a horizontal distance of 1'-6" from the platform edge. Where existing conditions do not permit ceiling mounting, they may be wall mounted, but must never be mounted to obstruct the existing mosaic and/or tile band on the walls of a station.
M. V. I.
MINIMUM
VISUAL IMPACT
CONDUIT INSTALLATION DESIGN GUIDELINES

- PROVIDE MAJOR EQUIPMENT IN NON-PUBLIC AREAS.

- CONCEAL CONDUIT WHERE POSSIBLE.

- RUN CONDUIT IN CONCERT WITH THE ARCHITECTURE OR STRUCTURE OF STATION

- RUN CONDUIT PARALLEL, TOGETHER AND GROUPED.

- UTILIZE CABLE TRAYS TO CONCEAL CONDUIT.

- REMOVE ABANDONED CONDUIT, BOXES AND EQUIPMENT.

- BUILD-IN CHASES AND RACEWAYS TO HIDE CONDUIT.

- DO NOT LOCATE CONDUIT, EQUIPMENT OR SUPPORT BRACKETS OVER MOSAIC TILE BANDS, STATION NAME PLAQUES, RAILINGS, SIGNAGE, OR ARTWORK.
APPLICATION OF DESIGN GUIDELINES

IN DESIGN

- SELECT LOCATIONS FOR EQUIPMENT ROOMS OUT OF PUBLIC SPACE.

- RUN CONDUIT INSIDE NON-PUBLIC AREAS.

- DESIGN EQUIPMENT ROOMS TO ACCOMMODATE FUTURE GROWTH.

- ROOMS, CABLES, AND CONDUITS THAT HAVE TO BE LOCATED IN PUBLIC SPACE SHOULD NOT BE PROMINENTLY LOCATED NOR SHOULD THEY INTERFERE WITH CIRCULATION, HEADROOM, VENTILATION, SAFETY CLEARANCES, VISUAL SECURITY, MOSAIC TILE BANDS, STATION NAME PLAQUES, OR ARTWORK.

- SPECIFY THAT UNUSED OR ABANDONED CONDUIT, CABLES AND EQUIPMENT ARE TO BE REMOVED.
IN DESIGN (Cont’d)

- PROVIDE PROPOSED CONDUIT LAYOUTS. INDICATE MINIMUM PERMITTED DIMENSIONS TO CEILING, WALLS, ARCHES, BEAMS, AND COLUMNS ETC.

- SPECIFY THE SIZES AND TYPES OF HANGERS, SUPPORTS AND CONNECTORS. DO NOT LEAVE TO THE CONTRACTOR'S DISCRETION.

- PROVIDE SMALL SQUARE, RECTANGULAR OR TRIANGULAR TROUGHS TO HOUSE CONDUITS IN STAIR SPACES WHERE THE CONDUITS CANNOT BE CONCEALED OR REMOVED.

- IN MEZZANINES, WHERE LOW CEILING HEIGHTS ARE A PARTICULAR PROBLEM; UTILIZE THE INTERSECTION OF THE CEILING AND WALL FOR A CABLE TROUGH.

- CONSIDER THE UTILIZATION OF AN ARCHITECTURAL ELEMENT, i.e., COMMON WIREWAY OR ANCILLARY SERVICE TROUGH, TO COMBINE A VARIETY OF FUNCTIONS, i.e., PUBLIC ADDRESS, LIGHTING, ELECTRICAL POWER, COMMUNICATIONS ETC.
IN CONSTRUCTION

- PROVIDE FIELD PERSONNEL WITH A COPY OF THE CONDUIT LOCATION DESIGN GUIDELINES.

- VERIFY THAT EXISTING CONDITIONS AS SHOWN ON CONTRACT DRAWINGS ARE STILL TRUE PRIOR TO ACTUAL CONSTRUCTION.

- WALK SITE WITH CONTRACTOR TO BE SURE THERE IS AN UNDERSTANDING OF HOW CONDUIT IS TO RUN.

- VERIFY THAT SHOP DRAWINGS ARE SUFFICIENTLY DETAILED TO PERMIT AN EVALUATION OF THE FINAL APPEARANCE, BEFORE ANY INSTALLATION TAKES PLACE. REVIEW OF CONDUIT LOCATION SHOULD BE SIMULTANEOUS WITH REVIEW OF BRACKETS, HANGERS AND SUPPORTS.

- VERIFY THAT SPECIFIED MATERIALS ARE BEING USED.

POST CONSTRUCTION (AFTER INSTALLATION)

- CONDUCT VISUAL INSPECTION AND COMPARE TO DESIGN AND APPROVED SHOP DRAWINGS.

- EVALUATE COMPLETED INSTALLATION.

- REMEDIATE PROBLEM AREAS.
DOUBLE LEVEL ISLAND PLATFORM

CONDUCT IN STATION AS PER DESIGN GUIDELINES
TYPICAL ISLAND PLATFORM
New York City Transit

AUTOMATED FARE COLLECTION PROGRAM OFFICE
SYSTEM DESIGN AND INSPECTION GROUP

AUTOMATED FARE COLLECTION DESIGN GUIDELINES
ABBREVIATIONS AND DEFINITIONS OF TERMS

The following terms and abbreviations are used throughout the design guidelines:

- **AFC**: Automated Fare Collection
- **AFCS**: Automated Fare Collection System
- **ADA**: Americans with Disabilities Act
- **AVM**: Automated Vending Machine
- **OCS**: Overhead Cableway System. A pair of stainless steel conduits linking the turnstile(s) and end console in a fare array. The conduits are used to supply power and communication between the end console and each successive turnstile in the fare array.

- **Fare Array**: A group of turnstiles and a single end console connected by the OCS. The minimum size fare array consists of one turnstile and one end console. The maximum size fare array consists of twelve turnstiles and one end console. A fare array can have only one end console.

- **Primary and Secondary Fare Array**: When a control area has more than one fare array, the end console which is connected to the AFC Power Panel is the primary fare array. All other fare arrays in that control area are classified as secondary fare arrays.

- **End Console**: The upright stainless steel cabinet without arms at the left most end of the fare array (viewing from the unpaid side of the fare array).

- **MCR**: Metro Card Reader, previously called Passenger Information Unit (PIU).
AUTOMATED FARE COLLECTION (AFC) SYSTEM DESIGN GUIDELINES

- Whenever an existing control area is rehabilitated or existing fare collection system is modified, all equipment required by the automated fare collection system shall be provided.

- One (1) conduit from the power panel to end console, two (2) conduits from token booth to the end console and two (2) conduits from the end console to the Metro Card Reader (MCR), previously called Passenger Information Unit (PIU), shall be provided (one for power and the other for communications). (See Figs. 5, 6 & 7).

Sizes of the various Power Conduits are:

(a) one (1) 1-1/2” from the power panel to the end console
(b) one (1) 1” from the primary array end console to the secondary array end console (if applicable)
(c) One (1) 3/4” minimum from the end console to the token booth (1” if it is branched out to another piece of AFC equipment, e.g., MCR, AVM, etc.)
(d) One (1) 3/4” minimum from the end console to the MCR.

Sizes of the various Communication Conduits are:

(a) One (1) 3/4” minimum from the end console to the token booth (1” if it is branched out to another piece of AFC equipment, e.g., MCR, AVM, etc.)
(b) one (1) 1” from the primary array end console to the secondary array end console (if applicable)
(c) one (1) 3/4” minimum from the end console to the MCR
(d) One (1) 3/4” minimum from the primary end console of the primary control area to the primary end console of all the secondary control areas within the station complex for intrastation communication run.
(e) One (1) 3/4” minimum from end console to the AVM.

- If a fully AFC equipped control area is rehabilitated, it is the responsibility of the rehabilitating contractor to relocate all conduits, copper wires, fiber-optic cables, AFC turnstiles, and all other related equipment to the new location. (Refer to the guidelines for Relocation of AFC Equipment during Rehabilitation by Outside Contractor. For details of AFC wiring, see page 6 of this guidelines).

- Conduits and junction boxes should be installed away from public view as outlined in New York City Transit Authority guidelines.
• Circuit breaker numbers 11 through 20 in the AFC power panel shall be used for AFC equipment only (see Fig. 3).

• For improved visibility in a new or reconfigured control area, either the token booth shall be located or the line of control shall be oriented so that the maximum number of turnstiles and the service/emergency gate fall within the token booth window’s 60 degree cone of vision. If there is more than one window, priority shall be given to the window located farthest from the token booth door.

• The line of control for turnstiles and service/emergency gate shall be located at a preferred distance of 15 feet from the token booth. This distance shall not exceed 20 feet.

• All turnstiles, including the agent operated turnstile, shall be capable of two-way operation and accept magnetic fare media and tokens.

• In each control area, the first turnstile located at the right end of the control line, viewing from the unpaid area, shall be agent operated. For ease of identification, it shall have approved and distinct color signage.

• For new (or when replacing existing) high exit wheels and high entrance turnstiles, approved models with automated fare collection or electro-mechanical capabilities shall be provided. This includes any conduits and connection to a power source.

• All railings along the control line shall be full height:

  (a) In **full time control areas**, all full height railings along the line of control shall have a uniform height. Where ceiling height is less than 10 feet, all openings above the railings must be closed off to within 5 inches of the ceiling.

  (b) In **part time control areas**, all railings shall be full height and their height along the line of control will vary. The top of the railings shall have a constant maximum clearance of 5 inches from the bottom of the ceiling or other objects which are suspended from the ceiling.

  (c) Along the line of control, removable overhead obstructions suspended from the ceiling above full height railings such as signs, speakers, and light fixtures, shall be relocated as required.

• All existing slam gates shall be eliminated (See requirements for emergency evacuation exiting capacity).
• In general, each control area shall have one (1) service/emergency gate with a 3 feet clear width. It should be located on the left hand side of the turnstile array adjacent to the end console, viewing from the unpaid area.

• The service/emergency gate shall be full height, agent operated, and equipped with two electromagnetic locks and a manual keyed lock (see Figs. F3 & F4).

• At control areas designated as accessible to the elderly and disabled, the service/emergency gate shall be provided with a kick plate and automated door opener, to fulfill ADA requirement, and also be equipped with a button to alert the token booth clerk. This button shall be used by persons requesting the clerk to unlock the service/emergency gate to permit exit from the paid area (see Figs. F12 & F13).

• Any secondary emergency gate which is designated for emergency exit only shall be full height and manually locked with a key. The width of the gate is determined to meet the emergency exiting capacity of the control area.

• In part time control areas, either overhead or side closing security gates shall be provided. The gates shall be full height and heavy duty.

• All turnstiles, end consoles, high exit wheels, high entrance turnstiles, service/emergency gates, security gates, and railings shall be stainless steel with designs as specified by the AFC Program Office.

• Required Number of Turnstiles for Normal Flow:

(a) The number of turnstiles required in each control area shall be determined by adding peak hour volume counts for exiting passengers and counts for all entries (paid and unpaid) during the same time period to determine the maximum total volume. Adjust the total volume by doubling the figure to account for the potential future growth and equipment failures. All design capacities for turnstiles are based on 20 minute peak volume.

(b) Modify turnstile capacity (30 passengers per minute) to compensate for contra flow as follows:

<table>
<thead>
<tr>
<th>Predominant Flow/Total Volume</th>
<th>Capacity Reduction Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>100%</td>
<td>0%</td>
</tr>
<tr>
<td>99-67%</td>
<td>20%</td>
</tr>
<tr>
<td>50-66%</td>
<td>10%</td>
</tr>
</tbody>
</table>

(c) Number of turnstiles required = Modified peak volume/Modified Capacity
At each control area, the minimum number of turnstiles shall be three (3), space permitting.

The number of turnstiles shall not be decreased by more than one (1) from the existing number at the control area.

Exit capacity for Emergency Evacuation:
Turnstiles and gates provided in each control area should be sufficient for safe evacuation of passengers during an emergency. The existing exit capacity must not be reduced. Existing exit capacity through slam gates and pass gates should be compensated by providing additional turnstiles and/or secondary emergency gates if required.
GUIDELINES FOR STATION REHABILITATION CONTRACTOR TO RUN WIRES IN AFC CONDUITS
(WHERE STATION IS ALREADY EQUIPPED WITH AFC)

### POWER

<table>
<thead>
<tr>
<th>CONDUCT RUN</th>
<th>CONDUIT SIZE</th>
<th>TOTAL WIRES</th>
<th>WIRES</th>
<th>WIRE SIZE (AWG)</th>
<th>POWER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power Panel to End Cabinet</td>
<td>1-1/2”</td>
<td>11</td>
<td>4</td>
<td>#10</td>
<td>#8</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>6</td>
<td>#12</td>
<td>#10</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>#6</td>
<td>#6</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Turnstiles</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>E.C., T.B.,</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>MCR, Green</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Ground</td>
<td></td>
</tr>
<tr>
<td>End Cabinet to Token Booth</td>
<td>1”</td>
<td>3</td>
<td>2</td>
<td>#12</td>
<td>T.B. Computer</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>#12</td>
<td>Green Ground</td>
</tr>
<tr>
<td>End Cabinet to MCR</td>
<td>3/4” (1” for in floor conduits)</td>
<td>3</td>
<td>2</td>
<td>#12</td>
<td>MCR, Green Ground</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>#12</td>
<td></td>
</tr>
<tr>
<td>E.C. (Prim) to E.C. (2ndry)</td>
<td>1”</td>
<td>11</td>
<td>4</td>
<td>#10</td>
<td>Turnstiles</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>6</td>
<td>#12</td>
<td>E.C., T.B., MCR</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>#10</td>
<td>Green Ground</td>
</tr>
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</table>

### COMMUNICATIONS

<table>
<thead>
<tr>
<th>Conduit Run</th>
<th>Size</th>
<th>Total Cables</th>
<th>Cables</th>
<th>Cable Type</th>
<th>Used For</th>
</tr>
</thead>
<tbody>
<tr>
<td>End Cabinet to Token Booth</td>
<td>1”</td>
<td>3</td>
<td>1</td>
<td>RS 422</td>
<td>Token Booth Communications</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>Twisted pair telephone (Prim. Cntrl Areas Only)</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>6 conductor #18 Plenum</td>
<td>A.O. Serv. Gate &amp; A.O. Turnstile</td>
</tr>
<tr>
<td>End Cabinet to M.C.R.</td>
<td>3/4” (1” for in floor)</td>
<td>1</td>
<td>1</td>
<td>RS 422</td>
<td>M.C.R.</td>
</tr>
<tr>
<td>E.C. (Prim.) to E.C. (2ndry)</td>
<td>1”</td>
<td>2</td>
<td>1</td>
<td>RS 422</td>
<td>Secondary E.C. A.O. Turnstile</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>6 conductor #18 Plenum</td>
<td></td>
</tr>
</tbody>
</table>

### INTRA-STATION COMMUNICATION RUN

<table>
<thead>
<tr>
<th>FIBER-OPTIC CABLE:</th>
<th>CABLE TYPE:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>6 fiber: Plenum-rated (non-PVC)</td>
</tr>
<tr>
<td></td>
<td>62.5/125 micro meters core diameter (fiber)</td>
</tr>
<tr>
<td></td>
<td>Outside cable jacket O.D.: .310 to .320 max.</td>
</tr>
<tr>
<td></td>
<td>All conductors color-coded for easy installation</td>
</tr>
<tr>
<td></td>
<td>Fan-out style cable (i.e., no fan-out kit required)</td>
</tr>
<tr>
<td></td>
<td>Connectors ST type</td>
</tr>
<tr>
<td></td>
<td>Insertion loss shall not be more than (1) db per mated pair of connectors.</td>
</tr>
<tr>
<td></td>
<td>Total loss of connectors and cable shall not exceed a maximum of (7) db total.</td>
</tr>
</tbody>
</table>

FIBER-OPTIC CABLE:

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
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</tr>
<tr>
<td>62.5/125 micro meters core diameter (fiber)</td>
</tr>
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</tr>
<tr>
<td>All conductors color-coded for easy installation</td>
</tr>
<tr>
<td>Fan-out style cable (i.e., no fan-out kit required)</td>
</tr>
<tr>
<td>Connectors ST type</td>
</tr>
<tr>
<td>Insertion loss shall not be more than (1) db per mated pair of connectors.</td>
</tr>
<tr>
<td>Total loss of connectors and cable shall not exceed a maximum of (7) db total.</td>
</tr>
</tbody>
</table>
LEGEND

- E - EXISTING P/F-WORK
- P - NEW P/F-CONDUIT
- C - NEW COMMUNICATIONS CONDUIT

LEGEND

JUNCTION BOX MOUNTED ON CEILING
JUNCTION BOX MOUNTED ON BEAM OR WALL
BOOTH HEADER
ARTICULATED ARM

NOTE:
The 1/2" conduit from the new junction boxes to the end console and the 1/2" conduit from the existing 4" junction box to the new communication junction box which are not shown on drawing are to be installed later during AFC Backfill.

N.Y.C.T.A. AUTOMATIC FARE COLLECTION PROGRAM OFFICE

SCALE: NONE
DRAWN BY: F. NOW
REVISED BY: CA

TYPICAL AFC INTERCONNECTION DIAGRAM

DATE: APPROVED BY: FIGURE 6
NOV. 18, 1991
Various rooms on the station shall be ventilated and controlled as detailed below:

<table>
<thead>
<tr>
<th>STATION ROOMS</th>
<th>MECHANICAL CRITERIA</th>
<th>ELECTRICAL CONTROL</th>
<th>MECHANICAL EXHAUST TERMINUS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Toilets (employees)</td>
<td>100 CPM/fixture* or 12 air changes whichever is less</td>
<td>Via local light switch</td>
<td>Outdoors**</td>
</tr>
<tr>
<td>Toilets on Platform</td>
<td>Same as above</td>
<td>Continuous</td>
<td>Adjacent areas</td>
</tr>
<tr>
<td>Toilets (Public) on Mezzanine</td>
<td>Same as above</td>
<td>Continuous</td>
<td>Outdoors**</td>
</tr>
<tr>
<td>Pipe Chambers</td>
<td>2 air changes</td>
<td>No separate control</td>
<td>Tied to toilet exhaust</td>
</tr>
<tr>
<td>Locker rooms</td>
<td>10 air changes</td>
<td>Via local light switch</td>
<td>Adjacent area</td>
</tr>
<tr>
<td>EDR, EPR, Signal, Communications</td>
<td>8 air changes</td>
<td>Via local timer thermostat and firestat</td>
<td>Adjacent area</td>
</tr>
<tr>
<td>Refuse Room</td>
<td>8 air changes</td>
<td>Via local timer for 15 minutes per hour and firestat</td>
<td>Adjacent area</td>
</tr>
<tr>
<td>Cleaner/Scrubber Rooms</td>
<td>8 air changes</td>
<td>Via local light switch</td>
<td>Adjacent area</td>
</tr>
<tr>
<td>Elevator Machinery Room</td>
<td>10000 BTU load Room air - 60°F min. and 100°F max.</td>
<td>Via local thermostat and firestat</td>
<td>Adjacent area</td>
</tr>
<tr>
<td>Storage Room</td>
<td>No ventilation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lubricator Room</td>
<td>8 air changes</td>
<td>Via local thermostat</td>
<td>Adjacent area</td>
</tr>
<tr>
<td>Ejector Room</td>
<td>8 air changes</td>
<td>Via local timer for 15 minutes per hour</td>
<td>Adjacent area</td>
</tr>
</tbody>
</table>

*Urinals and Water Closets only.
**Immediately below subway sidewalk vent grating.
Provide electric heating for 68°F interior design and separate 10000 BTU/HR minimum air conditioning unit for Station Manager's office.

REV: 2448/3
DATE:
HEATING DESIGN GUIDELINES

Various rooms on the station shall be electrically heated and controlled as detailed below:

<table>
<thead>
<tr>
<th>STATION ROOMS</th>
<th>HEAT REQUIRED</th>
<th>INDOOR DESIGN CRITERIA</th>
<th>OUTDOOR DESIGN CRITERIA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Toilets (employees)</td>
<td>YES</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Toilets on platform</td>
<td>YES</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Toilets (public) on Mezzanine</td>
<td>YES</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Pipe Chambers</td>
<td>NO</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Locker Room</td>
<td>YES</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>EDR, EPR, Signal &amp; Communication Rooms</td>
<td>YES</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Refuse Room</td>
<td>NO</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Cleaner/Scrubber Rooms</td>
<td>YES</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Escalator and Elevator Machinery Rooms</td>
<td>YES</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Storage Room</td>
<td>NO</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Lubricator Room</td>
<td>YES</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Station Manager</td>
<td>YES</td>
<td>68°F</td>
<td>11°F</td>
</tr>
</tbody>
</table>

- All heaters shall be 208VAC, 1 Phase, 1500 Watts, 60 Hertz Teleweld Inc. Railway Utility Division CAT. #H-1241 REV.-E with wall bracket #3368 and deflector back plate.

- Heaters shall be provided at rate of one 1500 watt heater per 1000 ft.³ of space, with one heater minimum.

- All room heaters shall be thermostatically controlled with line voltage 2P thermostat with no temperature indication.

- All heaters shall be wall mounted.

- All heaters shall be provided with local switch, 30A, 120-277VAC, 2P, P&S CAT. #30AC2 except Communication Room will be P&S CAT. #20AC2-KL and token booth will be P&S CAT. #1228.
NOTE:

1. HEAVY LINE INDICATES ELECTRICAL WORK ASSOCIATED WITH TUNNEL LIGHTING.
2. ALL THE TUNNEL LIGHTING EQUIPMENT SHALL BE INSTALLED IN RESERVE EDR, EXCEPT TUNNEL LIGHTING TRANSFORMER WHICH WILL BE INSTALLED IN NORMAL EDR.
3. TUNNEL LIGHTING PANELS, TLPN AND TLP5 SHALL FEED TUNNEL LIGHTING FIXTURES LOCATED IN NORTHBOUND AND SOUTHBOUND TUNNEL RESPECTIVELY.
EXHIBIT - K

A) **CONDUIT:**

All conducts shall be rigid steel, heavy wall, hot dipped, threaded, inside and outside galvanized type and not less than 3/4" for exposed and 1" for concealed permanent electrical work.

Standard Size:

3/4", 1", 1-1/2", 2", 3", 4"

B) **TROUGH:**

Trough shall be 0.125" thick extruded aluminum with 0.125" thick extruded individual compartment cover plate with smooth rounded corners or edges. The trough shall be installed on platforms, control areas and large mezzanines to feed AC/DC lighting fixtures and speakers.

Standard Size (Outside dimension):

- 2"x2" - 1 Compartment
- 2"x4" - 2 Compartments
- 2"x6" - 3 Compartments
- 4"x6" - 4 Compartments

C) **CABLE:**

1) All cables for 208 and 480 VAC systems shall be type THWN or THHN copper, 600 Volt NYCTA approved for wet and dry application, color coded, size and number as indicated.

Standard Size:

- #12, #10, #8, #6, #2, #2/0, 250 kcmil, 500 kcmil

2) All cables for 600V AC and DC system shall be type TR copper, 1000 Volt NYCTA approved color coded, size and number as indicated.

Standard Size:

- #12, #10, #8, #6, #1/0, 4/0

3) Wires smaller than #12 shall not be used.
EXHIBIT L
WIRING DIAGRAM FOR FAN CONTROL

1. THERMOSTAT CONTROL

2. THERMOSTAT AND FIRESTAT CONTROL

3. LIGHT SWITCH CONTROL

4. EITHER OF LIGHT SWITCH CONTROL

5. TIMER CONTROL

6. TIMER AND FIRESTAT CONTROL
## EXHIBIT-L

**WIRING DIAGRAM FOR FAN CONTROL**

### 7. DIRECT FROM CIRCUIT BREAKER (CONTINUOUS RUNNING)

<table>
<thead>
<tr>
<th>DEVICE</th>
<th>MANUFACTURER</th>
<th>DESCRIPTION</th>
<th>CATALOG NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>THERMOSTAT</td>
<td>HONEYWELL</td>
<td></td>
<td>T63C012</td>
</tr>
<tr>
<td>FIRESTAT</td>
<td>HONEYWELL</td>
<td></td>
<td>L4029E0512</td>
</tr>
<tr>
<td>MANUAL SWITCH</td>
<td>SQUARE D</td>
<td>NON-REVERSING</td>
<td>CLASS 2510</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>TYPE KW-1</td>
</tr>
<tr>
<td>LIGHT SWITCH</td>
<td>PASS &amp; SEYMOUR</td>
<td>120-277V, 30A SINGLE POLE</td>
<td>30AC1</td>
</tr>
<tr>
<td>SW-1</td>
<td></td>
<td></td>
<td>30AC2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>120-277V, 30A DOUBLE POLE</td>
<td></td>
</tr>
<tr>
<td>TIMER</td>
<td>EAGLE SIGNAL</td>
<td>120VAC ADJUSTABLE</td>
<td>DA2015A301</td>
</tr>
<tr>
<td></td>
<td>CONTROLS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DISCONNECT</td>
<td>SQUARE D</td>
<td>30 AMP</td>
<td>D2IIN</td>
</tr>
<tr>
<td>SWITCH</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**REV:**

**DATE:**
DIVISION OF ELECTRICAL SYSTEMS

Procedure for Processing of Con Edison Electric Service Requests through the Division of Electrical Systems

Power Operations Department

The Energy Management Group of the Division of Electrical Systems is the revenue paying customer to Con Edison for all Transit Authority and MABSTOA Electric and Gas Services. Con Edison will not respond to any correspondence or provide information concerning Transit Authority or MABSTOA Electric and Gas Service unless that correspondence or request for information is routed through the Division of Electrical Systems and countersigned with the approval of the Director.

The Transit Authority liaison officer to Con Edison responsible for expediting all service requests is the Division of Electrical Systems Deputy Director, Energy Management Group.

All correspondence and requests are to be routed through that office.

The present representative name and phone number is listed at the end of this EFI.

The following procedure is to be followed when requesting a new Electric Service or increasing the load of an existing service from Con Edison:

1. The initial request should include a description of the expected new loads and expected completed loads (lighting, motors, etc.) indicating KW, (do not use KVA) or HP, along with voltage, phases, number of wires and frequency. This information should be accompanied by Preliminary plans, sketches and descriptions which must show a plan of the area, dimensioned location of Electrical Distribution rooms, and desired Point of Entry for Electric Service. Dimensions must be from Street Locations (curb lines at intersections).

   The basic hourly operations of the equipment to be installed, such as fans, pumps, ejectors, heating, air conditioning units and climate changes should be included together with any other equipment operating data.

   In addition, specification should be made of the date the service layout is required and the date the electric service will be required.

   The name and telephone number of the Project Management (TA or TA consultant) should be included with all correspondence.

   The letter, plus two (2) copies and a pre-typed envelope to Con Edison shall be prepared by the originating Transit Authority Department, Engineering Division or consultant and signed by the Project Manager, Division Engineer or signed transmittal (for consultants) plus space allowing for counter-signing approval by the Director of Energy Management Group.
(2) If the preliminary plans and P.O.E. are acceptable, Con Edison will submit a service layout through the Division of Electrical Systems to the Engineering Division involved for comment. If the layout is satisfactory, Engineering Division will indicate so and return the layout to the Office of Energy Management for distribution. If the layout is not acceptable to the T.A., Con Edison is requested to submit a revised or new layout for review.

(3) If the preliminary plans and "Point of Entry" request are unacceptable to Con Edison, a revision of plans may be requested or a special field meeting may be arranged by the TA representative or Consultants to the TA.

(4) Bi-weekly meetings are held with Con Edison major service representatives and Transit Authority representatives to discuss various problems that require special attention at that time. If you wish items to be discussed, give several day advance notice to the liaison officer (Deputy Superintendent).

Special meeting to discuss one particular problem or field meetings are arranged after request is made through the Office of Energy Management by the Deputy Director, Consultant, or Con Edison.

(5) After satisfactory completion of electrical installation work, a "Certificate" letter (request to establish service) must be submitted by the Project Manager or the Division Engineer or Project Manager to Con Edison through the Electrical Department. This letter must include the applicable service layout number, Office of Energy Management date of approval, and a statement that the installation has been inspected and found satisfactory and certified safe for energizing service.

A statement indicating that NYPA rates are applicable must be included when service is eligible for NYPA rates, (On all correspondence).

(6) When the permanent service is established and is ready for operating use by the Transit Authority, notification must be made to the Division of Electrical Systems of the date of installation, the date the meter was energized, the meter number and constant and the kilowatt hour and demand readings from which the Transit Authority is to assume payment.

Upon submission of all the correspondence to the Division of Electrical Systems for approval, the original will be forwarded to Con Edison, a signed copy will be returned to the originating department for distribution and a copy will be retained by the Division of Electrical Systems.
Please note that all correspondence to Con Edison must be directed to the appropriate borough office. The latest address listings and sample letter are included with these instructions.

Liaison Representatives

Octavio Rodriguez Jr.
(212) 492-8498
Consolidated Edison Co. Of New York

Attn: Mr. (M.S.R)
Governmental Services
Commercial Services Representative
Central Government Services

Contract E-31078
Pumping Facilities Rehabilitation
Broadway - 7th Avenue Line, "A" Division
Borough of Manhattan

SERVICE REQUEST (A N Y) STREET PUMP ROOM

Gentlemen:

The installation of New Equipment in the Pump Room located at ______________ Street requires new normal and a New Reserve Electrical Service of 120/208V, 3 Phase, 4 Wire, 60 Hertz. See attached sketch for locations of points of entry.

The Normal and Reserve load will be as follows:

<table>
<thead>
<tr>
<th>ITEM</th>
<th>PHASE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. 2-10 H.P. Pumps</td>
<td>20 HP 1, 2, 3</td>
</tr>
<tr>
<td>2. Lighting</td>
<td>1 KW 1, 2, 3 &amp; N</td>
</tr>
<tr>
<td>3. Heating</td>
<td>3 KW 1, 2, 3 &amp; N</td>
</tr>
<tr>
<td>4. Receptacles</td>
<td>3 KW 1, 2, 3 &amp; N</td>
</tr>
</tbody>
</table>

The pumps will be used for seepage only and will operate when required.

Service layouts and available short circuit currents and in rush currents at this location are required by March 15, 1988. Service will be required by June 1989.

* BOROUGH ADDRESS & M.S. REP.
Contract E-31078
Pumping Facilities Rehabilitation
Broadway - 7th Avenue Line, "A" Division
Borough of Manhattan

SERVICE REQUEST (A N Y) STREET PUMP ROOM

Please provide N.Y.P.A. Power, identify and mark the phase legs and Neutral cable for each new service.

For further assistance and/or to arrange for a joint field survey, please contact Mr. _________________, P.E. at (718) 330-______________.

Very truly yours,

__________________________________________, P.E.,
Principal Engineer

APPROVED:

___________________________________________ DATE
Octavio Rodriguez Jr., Director
Office of Energy Management

Encl:

cc:
QUEENS DIVISION (718)

*Major Service Representative
J. Kennedy (M.S.R.)
118-29 Queens Blvd.
Forest Hills, N.Y. 11375

Floor
Telephone
830-8389

STATEN ISLAND DIVISION (718)

Commercial Services
60 Bay Street
Staten Island, N.Y. 10301

Floor
Telephone
3rd
390-7205
390-6371
390-6380

*Major Service Representative
H. Osborn
J. Mooney
A. Bunnicontre (M.S.R.)

Floor
Telephone
390-7203
390-6371
390-6379
390-6377

WESTCHESTER DIVISION (914)

Commercial Services
J. McGee
210 Westchester Avenue
White Plains, N.Y. 10604

Floor
Telephone
2nd
997-6010

Governmental Service Representative
210 Westchester Avenue
White Plains, N.Y. 10604

Floor
Telephone
2nd
997-6010

Governmental Service Representative
210 Westchester Avenue
White Plains, N.Y. 10604

Floor
Telephone
2nd
997-6013

*Address letter to attention of Major Service Representative
RESPONSIBLE DIVISION MANAGEMENT PERSONNEL FOR PUBLIC AUTHORITIES AND RAILROADS

MANHATTAN DIVISION (212)

*J. Della, Mgr., M.S.R.
708 First Avenue
New York, N.Y. 10017
Public Authorities and Railroads

*Major Service Representative
J. Ogilvie
708 First Avenue
New York, N.Y. 10017

BRONX DIVISION (212)

*Major Service Representative
J. Scala
960-4456
310 East Kingsbridge Road
Bronx, N.Y. 10458

BROOKLYN DIVISION (718)

*Major Services Representative
John McGregor
30 Flatbush Avenue
Brooklyn, N.Y. 11217

*Major Service Representative
J. Ogilvie
708 First Avenue
New York, N.Y. 10017

*Major Service Representative
J. Scala
960-4456
310 East Kingsbridge Road
Bronx, N.Y. 10458

*Major Services Representative
John McGregor
30 Flatbush Avenue
Brooklyn, N.Y. 11217
# ABBREVIATION

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>MTRN</td>
<td>CON EDISON METER FOR NORMAL SERVICE</td>
</tr>
<tr>
<td>MTRR</td>
<td>CON EDISON METER FOR RESERVE SERVICE</td>
</tr>
<tr>
<td>MHN</td>
<td>MANHOLE, NORMAL</td>
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<tr>
<td>MHR</td>
<td>MANHOLE, RESERVE</td>
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<tr>
<td>PLBN</td>
<td>PROPERTY LINE BOX, NORMAL</td>
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<td>PLBR</td>
<td>PROPERTY LINE BOX, RESERVE</td>
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<tr>
<td>SEBN</td>
<td>SERVICE END BOX, NORMAL</td>
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<tr>
<td>SEBR</td>
<td>SERVICE END BOX, RESERVE</td>
</tr>
<tr>
<td>CTCN</td>
<td>CURRENT TRANSFORMER CABINET, NORMAL</td>
</tr>
<tr>
<td>CTCR</td>
<td>CURRENT TRANSFORMER CABINET, RESERVE</td>
</tr>
<tr>
<td>SWBD</td>
<td>SWITCHBOARD</td>
</tr>
<tr>
<td>BPSN</td>
<td>BOLTED PRESSURE SWITCH, NORMAL</td>
</tr>
<tr>
<td>BPSR</td>
<td>BOLTED PRESSURE SWITCH, RESERVE</td>
</tr>
<tr>
<td>SSN</td>
<td>SERVICE SWITCH, NORMAL</td>
</tr>
<tr>
<td>SSR</td>
<td>SERVICE SWITCH, RESERVE</td>
</tr>
<tr>
<td>SCBN</td>
<td>SIGNAL CIRCUIT BREAKER, NORMAL</td>
</tr>
<tr>
<td>SCBR</td>
<td>SIGNAL CIRCUIT BREAKER, RESERVE</td>
</tr>
<tr>
<td>DB</td>
<td>DISTRIBUTION BOARD</td>
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<tr>
<td>DBN</td>
<td>DISTRIBUTION BOARD, NORMAL</td>
</tr>
<tr>
<td>DBR</td>
<td>DISTRIBUTION BOARD, RESERVE</td>
</tr>
<tr>
<td>DBNR</td>
<td>DISTRIBUTION BOARD, NORMAL &amp; RESERVE</td>
</tr>
<tr>
<td>ATS</td>
<td>AUTOMATIC TRANSFER SWITCH, STATION LOAD</td>
</tr>
<tr>
<td>TATS</td>
<td>AUTOMATIC TRANSFER SWITCH, TUNNEL LOAD</td>
</tr>
<tr>
<td>ATSF</td>
<td>AUTOMATIC TRANSFER SWITCH, FAN CHAMBER LOAD</td>
</tr>
<tr>
<td>ATSE</td>
<td>AUTOMATIC TRANSFER SWITCH, ELEVATOR LOAD</td>
</tr>
<tr>
<td>ATSX</td>
<td>AUTOMATIC TRANSFER SWITCH, ESCALATOR LOAD</td>
</tr>
<tr>
<td>ATSS</td>
<td>AUTOMATIC TRANSFER SWITCH, SIGNAL LOAD</td>
</tr>
<tr>
<td>ATSC</td>
<td>AUTOMATIC TRANSFER SWITCH, COMPRESSOR LOAD</td>
</tr>
<tr>
<td>TRN</td>
<td>TRANSFORMER, NORMAL</td>
</tr>
<tr>
<td>TRR</td>
<td>TRANSFORMER, RESERVE</td>
</tr>
<tr>
<td>TTRN</td>
<td>TUNNEL LIGHTING TRANSFORMER, NORMAL</td>
</tr>
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<td>TTRR</td>
<td>TUNNEL LIGHTING TRANSFORMER, RESERVE</td>
</tr>
<tr>
<td>TTRE</td>
<td>TUNNEL LIGHTING TRANSFORMER, EMERGENCY</td>
</tr>
<tr>
<td>TDB</td>
<td>DISTRIBUTION BOARD, TUNNEL</td>
</tr>
<tr>
<td>TMTS</td>
<td>MANUAL TRANSFER SWITCH, TUNNEL</td>
</tr>
<tr>
<td>TLPM</td>
<td>TUNNEL LIGHTING PANEL, N/B</td>
</tr>
<tr>
<td>TLPS</td>
<td>TUNNEL LIGHTING PANEL, S/B</td>
</tr>
<tr>
<td>TRP</td>
<td>TUNNEL RECEPTACLE PANEL</td>
</tr>
<tr>
<td>LP</td>
<td>LIGHTING PANEL</td>
</tr>
<tr>
<td>LPNN</td>
<td>LIGHTING PANEL, NORMAL, N/B</td>
</tr>
<tr>
<td>LPNS</td>
<td>LIGHTING PANEL, NORMAL, S/B</td>
</tr>
<tr>
<td>LPRN</td>
<td>LIGHTING PANEL, RESERVE, N/B</td>
</tr>
<tr>
<td>LPRS</td>
<td>LIGHTING PANEL, RESERVE, S/B</td>
</tr>
<tr>
<td>LPNI</td>
<td>LIGHTING PANEL, NORMAL, ISLAND PLATFORM</td>
</tr>
<tr>
<td>LPRI</td>
<td>LIGHTING PANEL, RESERVE, ISLAND PLATFORM</td>
</tr>
<tr>
<td>LPM</td>
<td>LIGHTING PANEL, MEZZANINE</td>
</tr>
<tr>
<td>LPNM</td>
<td>LIGHTING PANEL, NORMAL, MEZZANINE</td>
</tr>
<tr>
<td>LPRM</td>
<td>LIGHTING PANEL, RESERVE, MEZZANINE</td>
</tr>
<tr>
<td>TFB</td>
<td>TRACK FUSE BOX</td>
</tr>
</tbody>
</table>

## NOTES:

1. LETTERS N AND R SHALL BE USED AS SUFFIX WITH EQUIPMENT TO INDICATE NORMAL AND RESERVE.
2. NUMBERS (1, 2, 3 AND SO ON) SHALL BE USED FOR CLARIFICATION OF EACH EQUIPMENT.
3. LETTER 'T' SHALL BE USED AS PREFIX WITH EQUIPMENT TO INDICATE TUNNEL LIGHTING EQUIPMENT.
DESIGN GUIDELINES FOR PERSONNEL CLEARANCE

Designers are responsible for

- Adding personnel clearance to design check list(s).

- Checking personnel clearance during design. During the design phase, the designers from the involved design discipline will inspect the existing structure to determine if the new work will encroach on the personnel clearance zone. If a specific encroachment length greater than 15 feet occurs, the System Safety Department will be requested to approve posting of the area as a no personnel clearance area.

- Showing "NO PERSONNEL CLEARANCE" locations, on the drawings. The contract specifications will include provisions for installation of appropriate "NO CLEARANCE" signs, at designated locations shown on the contract drawings, prior to altering of the existing clearances.

- Checking personnel clearance during shop drawing review. The Engineering Dept. shop/working drawings approval stamp has been modified to reflect a personnel clearance check.

  Specification language requires that, when the contractor installs any temporary structure or deviates from the original contract design in location or type of equipment, a survey will be required to ensure that there is no personnel clearance encroachment. If an encroachment occurs, approval must be obtained from the designer and System Safety and "NO CLEARANCE" signs must be installed.

Structural, Equipment & Personnel Clearance Lines

The requirement for verification of personnel clearance during design and construction is in addition to the normal verification that design and construction conforms to structural and line equipment clearances.

The three different clearance lines are defined for purposes of clarification:

- **Structural Clearance Line** - No structural element (roof beams, columns, walls, duct benches) may be located within the structural clearance line. Some encroachment on the structural clearance line is permitted on interior columns at stations and crossovers.
- **Equipment Clearance Line** - No piece of equipment (signals, signal boxes, lighting fixtures, pipe, conduit etc.) may be located within the equipment clearance line. No encroachment is permitted.

- **Personnel Clearance Line** - No structural element or longitudinal line (pipe, conduit etc.) may be located within the personnel clearance line for a longitudinal distance greater than 15 feet. If it is necessary to do so, the area must be designated a no personnel clearance zone.

The designer must verify that his design elements do not encroach on the Structural or Equipment Clearance Lines and he must locate on a contract drawing, approved areas that must be designated No Personnel Clearance zones created by his design elements. Following below are clearance diagrams for the system. The latest drawings of the system in effect at the time of construction shall be used for installation.

87/206/MN:mo

2152m
### CASE I
AT SIDEWALL WITH HIGH DUCT BENCH

**NOTE A**: 6'-6" excess clearance dimension is to be measured at the top of the 6'-6" vertical clearance zone. Excess clearances are to be determined based upon applicable criteria for superelevation, center and end excesses given in the NYCTA structural design guidelines.

**LEGEND**:
- **---** LIMITING LINE OF PERSONNEL CLEARANCE AREA

---

**NEW YORK CITY TRANSIT AUTHORITY**

<table>
<thead>
<tr>
<th>PERSONNEL CLEARANCE FOR A DIVISION</th>
<th>(IRT) SUBWAY LINES</th>
</tr>
</thead>
<tbody>
<tr>
<td>DATED</td>
<td>SEPTEMBER, 1990</td>
</tr>
<tr>
<td>DIAGRAM NO.</td>
<td>PC-1</td>
</tr>
</tbody>
</table>

---

**P-3**
CASE II A
AT INTERIOR COLUMNS OR WALLS WITH NICHES, NO 3RD RAIL

NOTE "A": 6'-0" - 6'-10½" = EXCESS CLEARANCE DIMENSION IS TO BE MEASURED AT THE TOP OF THE 6'-6" VERTICAL CLEARANCE ZONE. EXCESS CLEARANCES ARE TO BE DETERMINED BASED UPON APPLICABLE CRITERIA FOR SUPERELEVATION CENTER AND END EXCESES GIVEN IN THE NYCTA STRUCTURAL DESIGN GUIDELINES.

NOTE "B": A CLEAR SPACE FOR PERSONNEL, CONSISTING OF AT LEAST ONE 2 FOOT 6 INCH WIDE SAFETY NICH OR CLEAR OPENING BETWEEN COLUMNS, MUST BE PROVIDED WITHIN A LENGTH OF ANY THREE CONSECUTIVE DAYS OR 15 FEET.

LEGEND:
--- LIMITING LINE OF PERSONNEL CLEARANCE AREA.

NEW YORK CITY TRANSIT AUTHORITY
PERSONNEL CLEARANCE FOR A DIVISION (RT) SUBWAY LINES

DATED: SEPTEMBER 1990
DIAGRAM NO. PC-IIA
CASE II B

AT INTERIOR COLUMNS OR WALLS WITH NICHES, WITH 3RD RAIL

NOTE "A": 6'-4½" + EXCESS CLEARANCE DIMENSION IS TO BE MEASURED AT THE TOP OF THE 6'-6" VERTICAL CLEARANCE ZONE. EXCESS CLEARANCES ARE TO BE DETERMINED BASED UPON APPLICABLE CRITERIA FOR SUPERELEVATION, CENTER AND END EXECESS AS GIVEN IN THE NYCTA STRUCTURAL DESIGN GUIDELINES.

NOTE "B": A CLEAR UP SPACE FOR PERSONNEL CONSISTING OF AT LEAST ONE 2 FOOT 6 INCH WIDE SAFETY NICH OR CLEAR OPENING BETWEEN COLUMNS, MUST BE PROVIDED WITHIN A LENGTH OF ANY THREE CONSECUTIVE BAYS OR 6 FEET.

LEGEND:

LIMITING LINE OF PERSONNEL CLEARANCE AREA.

NEW YORK CITY TRANSIT AUTHORITY

PERSONNEL CLEARANCE FOR A DIVISION (BRT) SUBWAY LINES

DATE: SEPTEMBER, 1990

DIAGRAM NO. PC-IIIB
CASE III A
AT WALLS WITHOUT NICHES, NO 3RD RAIL

NOTE "A" 6'-4"/4' EXCESS CLEARANCE DIMENSION IS TO BE MEASURED AT THE TOP OF THE 6'-0" VERTICAL CLEARANCE ZONE. EXCESS CLEARANCES ARE TO BE DETERMINED BASED UPON APPLICABLE CRITERIA FOR SUPERELEVATION, CENTER AND END EXCESSES GIVEN IN THE NYCTA STRUCTURAL DESIGN GUIDELINES.

LEGEND:

- - - - - - - - - - LINING LINE OF PERSONNEL CLEARANCE AREA.

A DIVISION

NEW YORK CITY TRANSIT AUTHORITY
PERSONNEL CLEARANCE FOR A DIVISION (RT) SUBWAY LINES

DATES
SEPTEMBER 1990

DIAGRAM NO.
PC-III A
CASE III B
WALLS WITHOUT NICHES, WITH 3RD RAIL

NOTE 'A': 6'-41/2" EXCESS CLEARANCE DIMENSION IS TO BE MEASURED AT THE TOP OF THE 6'-6" VERTICAL CLEARANCE ZONE. EXCESS CLEARANCES ARE TO BE DETERMINED BASED UPON APPLICABLE CRITERIA FOR SUPERELEVATION, CENTER AND EDGE EXCEEDANCES GIVEN IN THE NYCTA STRUCTURAL DESIGN GUIDELINES.

LEGEND:

LIMITING LINE OF PERSONNEL CLEARANCE AREA.
CASE III
AT WALLS WITHOUT NICHES

NOTE "A": 7'-0" + EXCESS CLEARANCE DIMENSION IS TO BE MEASURED AT THE TOP OF THE 6'-6" VERTICAL CLEARANCE ZONE. EXCESS CLEARANCES ARE TO BE DETERMINED BASED UPON THE APPROPRIATE CRITERIA FOR SUPERELEVATION, CENTER AND END EXCESSES GIVEN IN THE NYCTA STRUCTURAL DESIGN GUIDELINES.

LEGEND:

LIMITING LINE OF PERSONNEL CLEARANCE AREA.

NEW YORK CITY TRANSIT AUTHORITY
PERSONNEL CLEARANCE FOR B DIVISION (IND & BMT) SUBWAY LINES

DATE: SEPTEMBER, 1990
DIAGRAM NO. PC-III
NOTE "A": T'-0' EXCESS CLEARANCE DIMENSION IS TO BE MEASURED AT THE TOP OF THE 0'-0" VERTICAL CLEARANCE ZONE. EXCESS CLEARANCES ARE TO BE DETERMINED BASED UPON THE APPROPRIATE CRITERIA FOR SUPERELEVATION, CENTER AND END EXCESSES GIVEN IN THE NYCTA STRUCTURAL DESIGN GUIDELINES.

NOTE "B": A CLEAR UP SPACE FOR PERSONNEL, CONSISTING OF AT LEAST ONE TWO FOOT SIX INCH WIDE SAFETY NICHES OR CLEAR OPENING BETWEEN COLUMNS, MUST BE PROVIDED WITHIN A LENGTH OF ANY THREE CONSECUTIVE BAYS OR 6 FEET.

LEGEND:

NEW YORK CITY TRANSIT AUTHORITY.

PERSONNEL CLEARANCE FOR B DIVISION (IND & BMT) SUBWAY LINES

DATE: SEPTEMBER 1990

DIAGRAM NO: PC-II
CASE I
AT SIDEWALL WITH HIGH DUCT BENCH

NOTE: 1. 7'-0" + EXCESS CLEARANCE DIMENSION IS TO BE MEASURED AT THE TOP OF THE 6'-6" VERTICAL CLEARANCE ZONE. EXCESS CLEARANCES ARE TO BE DETERMINED BASED UPON THE APPROPRIATE CRITERIA FOR SUPERELEVATION, CENTER AND END EXCESSES GIVEN IN THE NYCTA STRUCTURAL DESIGN GUIDELINES.

LEGEND:
--- LIMITING LINE OF PERSONNEL CLEARANCE AREA.
SECTION 10F
NO-CLEARANCE SIGNS

10F1.0 GENERAL REQUIREMENTS.

10F1.1 SCOPE.

(a) Furnish all labor, materials, tools and equipment, and perform all operations necessary to install fiberglass signs and markers for the demarcation of areas of restricted, no-clearance conditions as indicated in the Contract Documents.

(b) Where construction along a trackway is not in accordance with the Contract Documents, the Contractor shall survey the trackways for no-clearance conditions. The survey shall be based on the PERSONNEL CLEARANCE diagrams and the Contractor shall locate the no-clearance condition by station and offset from the center-line of track.

The Contractor shall furnish and install no-clearance signs and markers wherever a secure, level, unobstructed clear-up space is not available.

Before any construction or any other action which causes a no-clearance condition based on the PERSONNEL CLEARANCE diagrams, the Contractor shall furnish and install no-clearance signs and markers. The Contractor shall remove signs and markers which were installed for temporary no-clearance conditions when the condition has been corrected.

Where the Contractor's activities remove or obstruct existing no-clearance signs, the Contractor shall install temporary no-clearance signs as directed.

(c) The Contractor shall give 30 day notice to the Engineer before installing, removing or obstructing any no-clearance signs and markers. The notice shall state the locations and areas covered by the signs.

10F1.2 SUBMITTALS:

For Approval

(a) Manufacturer’s product data, Material Safety Data Sheets, installation methods.

(b) Sample of material. Sample shall be the same thickness as specified in this section.

For Information:

(a) Compliance with ASTM, NEMA and UL standards
10F2.0 MATERIALS.

10F2.1 DESCRIPTION.

(a) Sign material shall be 0.093 in. thick laminated fiberglass Glastic Grade 1130, as manufactured by the Glastic Co., Modualite, or approved equal, and shall consist of a continuous strand fiberglass mat reinforced inorganic mineral filled, thermoset unsaturated polyester laminate.

(B) No-clearance signs shall conform to the current 29 CFR 1910, Specifications for Accident Prevention Signs and Tags.

(C) No-clearance signs shall be mineral filled, continuous strand roving fiberglass mat reinforced, thermoset polyester resin laminate. The reinforcements and the resin used in the laminate shall provide the impact strength required and the service conditions of chemical resistance and electrical insulating properties, as well as temperature, weather (ultraviolet light) and water resistance. Physical and performance property requirements shall be achieved by using resin modifiers and/or selective additives.

10F2.2 DIMENSIONS.

No-clearance sign dimensions shall be subject to the following requirements:

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Tolerances:</td>
<td></td>
</tr>
<tr>
<td>Length</td>
<td>plus or minus 1/16 inch</td>
</tr>
<tr>
<td>Width</td>
<td>plus or minus 1/16 inch</td>
</tr>
<tr>
<td>Thickness</td>
<td>plus or minus 0.009 inch</td>
</tr>
<tr>
<td>2. Warp</td>
<td>1.5 percent, Maximum</td>
</tr>
</tbody>
</table>

10F2.3 PHYSICAL PROPERTIES.

(a) No-clearance signs shall conform to the requirements of the National Electrical Manufacturer’s Association (NEMA) Specification U-1-1983, Grade GPO-3, Polyester Glass Mat Sheet Laminates, except as specified:

<table>
<thead>
<tr>
<th>Property</th>
<th>Test</th>
<th>Value</th>
<th>Note(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impact Strength, ft-lb/ln.</td>
<td>ASTM D-256</td>
<td>6.0, Minimum</td>
<td></td>
</tr>
<tr>
<td>Dielectric Breakdown Voltage, V</td>
<td>ASTM D-149</td>
<td>10^4, Minimum</td>
<td>(1)</td>
</tr>
<tr>
<td>Water Absorption, percent</td>
<td>ASTM D-570</td>
<td>0.2, Maximum</td>
<td></td>
</tr>
<tr>
<td>Flame Resistance</td>
<td>UL94</td>
<td>V-0, Minimum</td>
<td></td>
</tr>
<tr>
<td>Average Extent of Burning, cm</td>
<td>ASTM D-568</td>
<td>2.0, Maximum</td>
<td>(2)</td>
</tr>
<tr>
<td>Average Time of Burning, sec.</td>
<td>ASTM D-568</td>
<td>5.0, Maximum</td>
<td>(2)</td>
</tr>
<tr>
<td>Ignition Temperature, °F</td>
<td>ASTM D1929</td>
<td>103, Maximum</td>
<td>(3)</td>
</tr>
<tr>
<td>Specific Optical Smoke Density</td>
<td>ASTM D-662</td>
<td>200, Maximum</td>
<td>(4)</td>
</tr>
</tbody>
</table>
Note(s)

1. Sample thickness shall be the sign thickness.
2. Burning characteristics shall not produce dripping of flaming particles.
3. Indicated temperature shall not flash ignite sample.
4. Within 4 minutes after start of test.

(b) No-clearance sign smoke toxicity, of gases emitted or produced, when tested in accordance with the current Defense Documentation Center Report Number AD297457, Procedure and Analytical Method for Determining Toxic Gases Produced by Synthetic Compounds, shall not exceed the following values:

<table>
<thead>
<tr>
<th>Gases</th>
<th>Maximum Quantities (Parts Per Million)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon Dioxide</td>
<td>10,000</td>
</tr>
<tr>
<td>Carbon Monoxide</td>
<td>1,000</td>
</tr>
<tr>
<td>Ammonia</td>
<td>500</td>
</tr>
<tr>
<td>Aldehydes</td>
<td>30</td>
</tr>
<tr>
<td>Cyanides</td>
<td>10</td>
</tr>
<tr>
<td>Oxides of Nitrogen</td>
<td>100</td>
</tr>
<tr>
<td>Hydrogen Chloride</td>
<td>10</td>
</tr>
<tr>
<td>Hydrogen Bromide</td>
<td>10</td>
</tr>
<tr>
<td>Hydrogen Sulfide</td>
<td>10</td>
</tr>
<tr>
<td>Vinyl Chloride</td>
<td>10</td>
</tr>
<tr>
<td>Nitrogen Dioxide</td>
<td>10</td>
</tr>
</tbody>
</table>

10F2.4 FABRICATION.

(a) No-clearance signs shall be produced by the internal casting process incorporating an image bearing material embedded between two layers of fiberglass resin laminate and polyester resin substrate. The signs shall be cast, baked and cured into a single solid laminate. All cut sign edges shall receive a resin coating.

(b) No-clearance sign image bearing material shall be a carrier sheet produced by the silk screen or lithography process.

Sign shall show no variations in color when subjected to the standard tests for durability and staining.

10F3.0 CONSTRUCTION METHODS.

10F3.1 SIGNS INSCRIPTION.
The inscriptions on the signs shall be "DANGER NO CLEARANCE". The letters shall be red on a white background. Markers shall have alternating red and white diagonal stripes as shown on the Contract Drawings.

10F3.2 INSTALLATION.

The signs and markers shall be fastened on the walls indicated on the Contract Drawings and where the Engineer deems the clearances to be insufficient. The Contractor shall clean the surfaces to receive signs and markers of all loose material before installation.

10F3.3 FASTENERS.

Signs shall be installed on the existing concrete structure with 2" long, 1/4" diameter all-steel round head RAWL LOK/BOLT (Catalogue No. 5210) masonry anchor bolts as manufactured by the Rawlplug Company, or approved equal. The hole size shall be 1/4" in diameter and shall not exceed 2" in depth. The 5/32" diameter Ramset powder-accurated fasteners shall be used on masonry surfaces only for positioning signs. Signs shall be installed on existing steel structure with 5.32" shank diameter 3/4" shank length drive pins (Catalogue No. 2226) as manufactured by Ramset, or approved equal. Drive pins shall be furnished with suitable plastic washers.

10F4.0 MEASUREMENT AND PAYMENT.

10F4.1 PAYMENT.

The cost of the fiberglass signs is deemed to be included in the lump sum price stipulated in ITEM 13A.1. The Contractor shall base his bid on providing 400 lineal feet of "DANGER NO CLEARANCE" markers. Payment for any additional or lesser quality, if required, will be made to the Contractor as provided in Chapter 4 CHANGES TO THE CONTRACT.
RECEPTACLE REQUIREMENT:

All station areas and rooms shall be provided with the convenience receptacles, in compliance with NYC Electrical Code, NEC and as per NYC Transit Authority requirements outlined below. All receptacles shall be mounted 18” above finished floor (AFF) unless otherwise indicated on drawing at the location of receptacle or in symbol list.

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="Symbol" /></td>
<td>SPECIAL PLATFORM AND MEZZANINE RECEPTACLE 30A., 125VAC 3 WIRE GROUNDING TWIST LOCK, CORROSION RESISTANT HUBBEL NO. CAT. NO. 60CM63 POWER OUTLET WITH ADAPTER PLATE CAT. NO. 60CM75 FOR MOUNTING 60CM63 TO F.S. BOX AND ADAPTER CAT. NO. 31CM29 TO CONVERT 30A., 125V, 3 WIRE TWIST LOCK TO 20A., 125V STRAIGHT BLADE, MOUNTED 84” AFF N COLUMN WEB OR AS INDICATED</td>
</tr>
<tr>
<td><img src="image2" alt="Symbol" /></td>
<td>GFCI DупLEX RECEPTACLE, 20 AMP, 120VAC, PASS AND SEYMOUR CAT. NO. 2091-SHG MOUNTED FLUSH OR IN TYPE &quot;FD&quot; BOX.</td>
</tr>
<tr>
<td><img src="image3" alt="Symbol" /></td>
<td>SINGLE RECEPTACLE, 20A, PASS AND SEYMOUR CAT. NO. 9301-HG FOR 125VAC OR CAT. NO. 9801-HG FOR 250VAC MOUNTED FLUSH OR IN TYPE &quot;FD&quot; BOX.</td>
</tr>
<tr>
<td><img src="image4" alt="Symbol" /></td>
<td>DUПLEX RECEPTACLE, 20 AMP, 125VAC, PASS AND SEYMOUR CAT. NO. 9300-HG MOUNTED FLUSH OR IN TYPE &quot;FD&quot; BOX.</td>
</tr>
</tbody>
</table>

1. Platform shall be provided with special receptacle mounted 84” AFF and installed in column web at every 90’, or as indicated and alternately wired between normal and reserve services.
2. Control areas, mezzanines and long passageways shall be provided with special receptacle mounted 84” AFF installed in column web at every 45’ or as indicated and wired between phases or normal and reserve services as applicable.
3. Provide attention ground fault receptacle with designation for mounting height and/or abbreviation as indicated below at the location of receptacle shown on drawing:

<table>
<thead>
<tr>
<th>LOCATION</th>
<th>DESIGNATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Employee's toilet room - Next to mirror (near sink)</td>
<td>54”</td>
</tr>
<tr>
<td>b) Employee's locker room - Water cooler (dedicated wired)</td>
<td>WC</td>
</tr>
<tr>
<td>c) Refuse room</td>
<td>72”</td>
</tr>
<tr>
<td>d) Cleaner/Scrubber room</td>
<td></td>
</tr>
<tr>
<td>e) Wall Hydrant (hose-bib) - Column web mounted</td>
<td>84”, H1</td>
</tr>
<tr>
<td>f) Wall Hydrant (hose-bib) - Recessed mounted</td>
<td>H2*</td>
</tr>
</tbody>
</table>

4. Station manager’s room shall be provided with an additional single receptacle mounted near to the air conditioning unit, dedicated wired, and must be designated with "AC". The electrical rating and mounting height shall be coordinated with mechanical drawing.
5. Receptacle is not required in public toilet room and beyond the end of canopies.
6. Circuit breaker for the receptacle shall be rated minimum 20 Amperes or as required.
7. Each receptacle circuit shall have separate neutral wire independent of lighting circuits.

*When the wall hydrant receptacle is recessed mounted on the tile wall, next to the wall hydrant, it shall be provided with Pass and Seymour cat #WP-26L stainless steel weatherproof wall plate.
LIGHTING SWITCH REQUIREMENT:

All station rooms shall be provided with a local light switch for controlling lighting fixtures in compliance with NYC Electrical Code, NEC and as per NYC Transit Authority requirement outlined below. All switches shall be mounted 48" above finished floor (AFF) and opposite side of hinge door unless otherwise indicated on drawing at the location of switch or symbol list.

<table>
<thead>
<tr>
<th>S</th>
<th>TOGGLE SWITCH, 30A, 120-277VAC, 1P, PASS AND SEYMOUR CAT. NO. 30AC1 MOUNTED IN CROUSE HINDS &quot;FD&quot; BOX.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sₖ</td>
<td>KEY OPERATED SWITCH, 20A, 120VAC, 120-277V, 1P, PASS AND SEYMOUR CAT. NO. 20AC1-L MOUNTED IN CROUSE HINDS &quot;FD&quot; BOX.</td>
</tr>
<tr>
<td>S₃</td>
<td>THREE WAY SWITCH, 30A, 120-277V, 1P, PASS AND SEYMOUR CAT. NO. 30AC3 MOUNTED IN CROUSE HINDS &quot;FD&quot; BOX.</td>
</tr>
<tr>
<td>S₃ₖ</td>
<td>THREE WAY KEY OPERATED SWITCH, 20A, 120-277V, 1P, PASS AND SEYMOUR CAT. NO. 20AC3-L MOUNTED IN CROUSE HINDS &quot;FD&quot; BOX.</td>
</tr>
<tr>
<td>Sₕ</td>
<td>HEATER SWITCH OR FAN SWITCH, 30A, 120-277V, 2P, PASS AND SEYMOUR CAT. NO. 30AC2 MOUNTED IN CROUSE HINDS &quot;FD&quot; BOX.</td>
</tr>
</tbody>
</table>

1. All rooms with one entrance door shall be provided with toggle switch, 30A, 120-277VAC, 1P, Pass and Seymour cat #30 AC1.

2. Public toilet rooms shall be provided with a key operated switch, 20A, 120VAC, 120-277VAC, 1P, Pass and Seymour cat #20 AC1-L.

3. All rooms with two distinct entrance doors (from passageway or corridor) shall be provided with three way switch, 20A, 120-277VAC, 1P, Pass and Seymour cat #30 AC3.

4. Employee’s corridor, from one external entrance or two external entrances to the said corridor, shall be provided with key operated or three way key operated switch respectively.

5. For type of light switch in rooms, where ventilation fan is required, refer to Exhibit-L, titled "Wiring Diagram for Fan Control."

6. All lighting fixtures in passenger accessible areas such as platforms, control areas, passageways shall be switched from the lighting panel.

7. All DC lighting fixtures shall be switched from the DC lighting panel.