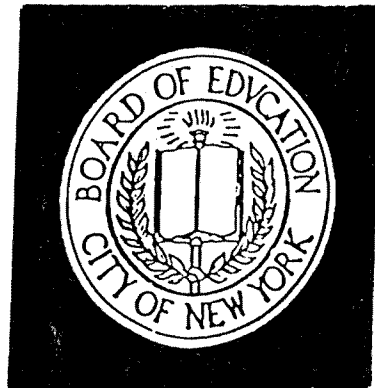


1984

R.S.P.

**ELECTRIC WORK &
LIGHTING FIXTURES
STANDARD
SPECIFICATIONS
TWENTY FIFTH EDITION**



P. BUCCELLATO

16-5.17.

**BOARD OF EDUCATION
CITY OF NEW YORK**

**DIVISION OF SCHOOL BUILDINGS
28-11 QUEENS PLAZA NORTH
LONG ISLAND CITY NEW YORK 11101**

11. 10

16-5.14 Concealed Conduits (Con't)

Where conduits cross expansion joints in floor slabs, special conduit expansion fittings shall be installed. A braided or solid copper bonding jumper allowing for at least 2 inches expansion in void between slabs, shall be attached to each end of conduit around fitting. Expansion fittings shall be type AX manufactured by OZ Manufacturing Company, Type XJ Series as manufactured by Appleton Electric Co. or equal approved by Underwriters' Laboratories.

Conduits shall NOT be installed in haunches of concrete beams, except where the Drawings indicate lighting fixtures are mounted on concrete beams, in which case the conduit connected to the lighting fixtures may be run in the haunch of the beam.

Conduits shall NOT be run through any part of the area of a concrete column except where the drawings indicate a lighting fixture or a switch mounted on the column, in which case, ONLY the conduits connected to fixture and switch shall be run through the column. Conduit shall be run at location selected by the Executive Director.

(b) Conduit in Concrete Slabs on Earth

The electrical contractor shall not run branch circuit conduits leading to motors, receptacles, switches, telephones, TV outlets etc. where they shall be installed in a floor slab, where that slab is in contact with the earth, unless otherwise shown on plans, directed in the specifications or with special written permission by the Executive Director's representative.

(c) Conduits in Fill Above Concrete Floor Slabs

Conduits may be installed in fill above the floor slab only when so required by the Drawings or if permitted by the Executive Director. Where conduits are required or permitted to be installed in fill above the floor slab, a clear space equal to the diameter of the largest conduit must be maintained between adjacent parallel conduits.

This Contractor shall consult the General Construction Drawings for the distance from the top of slab to the finished floor at all locations where conduits are to be installed.

This Contractor shall consult the General Construction Contractor and obtain from him the depth of floor at each location where the Drawings or Specifications require installation of conduit in floor.

16-5.14 Concealed Conduits (Con't)

Where top of finished floor is $2\frac{1}{2}$ inches above the concrete slab, no cross-overs of conduits will be permitted, nor shall top of conduits in fill project more than $1\frac{3}{4}$ inches above slab.

Where top of finished floor is $4\frac{1}{2}$ or $5\frac{1}{2}$ inches above the slab, conduits shall not project more than 3 inches above the slab. Where top of finished floor is 8 inches above the concrete slab top of conduits shall not project more than 5 inches above the concrete slab.

In rooms with wooden floors, conduits must be installed so as to minimize the cutting of the sleepers.

Conduits shall be fastened down in a manner approved by the Executive Director. Submit method of fastening for approval.

Where conduits are run parallel to walls or partitions, they shall be kept at least 18 inches away from finished wall or partitions unless otherwise dimensioned on Drawings or directed by the Executive Director.

Conduits installed in the fill of the auditorium floor shall be run in the aisle spaces only, so as not to interfere with ventilating equipment or fastening of auditorium seating equipment.

Conduits shall clear all concealed-in-floor door closers by three-inches. Consult General Construction Contractor for exact location of door closers.

Where metal deck construction with poured concrete slabs is the type of construction used on a project, the following restrictions shall apply, along with all other restrictions listed above.

- (1) All conduits shall be installed as shown on Standard Detail No. on Standard Detail Sheet No. E-3 (G Series).
- (2) All conduits shall be installed parallel to the direction of the span with no conduits in the rib.
- (3) One cross over shall be permitted in each panel. Panel is identified as the span between beams. The cross over shall be over a beam or immediately adjacent.
- (4) Additional wire mesh shall be placed over the cross-over by this contractor.

16-5.14 Concealed Conduits (Con't)

(d) Conduits to Outlet Boxes in Concrete Slabs

Where conduits to lighting fixtures, pull boxes, etc., are installed in reinforced concrete slabs, outlet boxes shall be sufficiently deep so that knockouts are above the reinforcing rods. The conduits to the boxes shall be installed in the slab above the reinforcing rods and shall enter side knockouts of the boxes perpendicularly.

After the conduit and outlet boxes have been installed, any openings through the slabs at the outlets, not provided for in the Specifications for General Construction, shall be filled with mortar, composed of at least one part cement and two parts sand.

(e) Conduits in Hung and Furred Ceiling

In hung ceilings the conduits must be run so as not to interfere with pipes or ducts. Groups of conduits shall be suspended above the hung ceiling upon separate hangers installed by this Contractor. Hangers will not be required for conduits to and between outlets of lighting fixtures located on or in hung ceilings or to wall switch.

Single conduits may be laid on and fastened to angle supports of the hung and furred ceilings.

(f) Conduits Run Overhead

Unless otherwise indicated on the Drawings horizontal conduits for branch lighting circuits, and to bells, buzzers, horns, telephones and loudspeakers shall be installed in the slab or in the hung and furred ceiling immediately above the story upon which the bell, buzzer, horn, telephone, loudspeaker, etc., is located.

(g) Conduits Under Wood Floors

Where conduits are required to be installed under a wood floor, conduits shall be run either in the space between the sleepers or in the fill under the sleepers. Where sleepers are set on floor slab and conduits must be run perpendicular to the sleepers, the sleeper may be notched only to the extent permitted by the Executive Director's representative at the building. Flooring shall not be notched under any condition.

16-5.14 Concealed Conduits (Con't)

(h) Covering of Conduits in Floor Fill

This Contractor's attention is called to the following paragraph of the specification for General Construction: "All pipes and conduits which will be in the floor fill, shall be tightly enclosed with Type B cement, mortar or nailing concrete, which shall be not less than $\frac{1}{4}$ inch thick and shall be allowed to set before the fill is laid".

16-5.15 Conduits for Motors

The electrical contractor prior to installing conduits for motors shall check location of motor connections with contractor furnishing motors and shall run conduits accordingly.

16-5.16 Auditorium, Assembly or Large Group Area Platform

The outlet boxes, in the Auditorium, Assembly or large Group Area Platforms, shall be installed flush with the face of the brick wall, where the walls of these areas are not plastered. Conduits shall be run concealed and vertical only. Horizontal conduits will not be permitted in this wall.

16-5.17 Painting

All exposed conduits and raceways in unfinished portions of the building, such as the cellar, etc., including boxes of all kinds, except those of motor control equipment, shall be painted. All exposed conduits and raceways including boxes in finished parts of the building shall be painted. In existing buildings all newly installed exposed conduits and raceways shall be painted. Painting shall consist of a prime coat and a finished coat, color as selected. Factory painting will be accepted as a prime coat.

16-5.18 Location of Outlets

Locations of outlets, etc., are indicated on the Drawings. The right is reserved to change the location of any outlet before same is permanently installed. Such changes shall be at the option of the Executive Director and shall be done without extra charge by the Contractor.

16-5.19 Conduits Ends

During the installation of conduits all unfinished runs of conduits, also conduit ends at light and power panelboard cabinets, shall be provided with T. & B. , Appleton, N.E.P. Co., or other equal capped bushings. Conduits at light and power panelboard cabinets shall remain capped until building is ready for the installation of conductors.

16-5.20 Short Radius Elbows

Short radius elbows shall be installed where indicated on the drawings. A short radius elbow shall consist of a T & B No. 470 series bushed elbow and floor coupling, Appleton, R & S., 1901 or other approved equal. The end of the coupling shall be flush with floor.

16-5.21 Drag Wire

A minimum No. 12 gauge galvanized drag wire shall be left in each blank conduit.

16-5.22 Conduit to Motors, Tables, Etc. in Shops and Other Rooms

Conduit runs to motors and starters unless otherwise indicated shall terminate as follows:

- (a) Conduits from panelboard to pull boxes adjacent to starters (in shops) shall be rigid, and installed concealed as indicated on Drawings. The pull boxes shall be equipped with extension collars and blank covers. Connections between extension collars and starters shall be exposed rigid conduits.
- (b) Conduits from starters to motor outlet boxes and "Start-Stop" push buttons of shop equipment shall be rigid or flexible (Greenfield) as selected by the Executive Director for the particular piece of equipment. Conduits shall be installed exposed, as directed by the Executive Director's representative at the school.

Motors with movable parts (such as drill presses) shall have flexible conduit connections.

16-5.22 Conduit to Motors, Tables, Etc. in Shops and Other Rooms (Con't)

(c) Where a table, bench, or other item of equipment is installed freestanding in a shop or other enclosure, unless indicated otherwise, electrical equipment mounted thereon shall be connected by this Contractor, in accordance with the following:

1. For free standing equipment, conduits shall terminate in a short radius elbow or coupling flush with floor, connected to a conduit nipple approximately 12" above floor and terminating in a junction box (4-in sq. min.) with blank cover.
2. Where conduits terminate at wall they shall terminate in flush wall boxes where possible and shall be equipped with capped extension collars.

In general, except otherwise noted, in existing buildings where equipment is away from walls, conduits shall be run on ceiling below and shall be terminated in junction box. Extend conduit through floor and terminate in coupling with brass plug flush with floor. When directed by the Executive Director, the plug shall be removed, and conduit shall be extended by this Contractor to electrical equipment (receptacles, switches, starters, motors, push-buttons, etc.). All connections shall be made by this Contractor.

16-5.23 Wiring and Electrical Equipment in Demountable Partitions (D.P.)

Raceway shall be installed to enter a D.P. from a vertical end of partition abutting the permanent structure or from the ceiling. It is forbidden to install raceway to enter through the bottom of the D.P. A flush outlet (junction box) shall be installed in the wall or ceiling of the permanent structure close to the D.P. and exterior to the finished surface of the D.P. and most convenient to facilitate wiring the D.P. The flush outlet boxes shall be provided with extension rings and blank plates. Surface metal raceway shall be extended from these outlets to the D.P. for connection to flexible armored conduit to be installed in the D.P. Raceway in the D.P. shall be limited to 3/4" nominal trade size. Coordinate the electrical work with the General Construction Contractor who will provide all openings for electrical raceway and outlet boxes in the D.P.

SECTION 16-6 OUTLET AND ENCLOSING BOXES

16-6.01 Scope

Unless otherwise indicated in the Specifications or on the Drawings, the Contractor for Electric Work shall furnish and install an outlet box appropriate for the purpose at each location where the Drawings require the installation of an item of electrical equipment which may or may not embody in its construction a means of conduit or raceway connection approved by the Executive Director.

All alterations, additions, removals, replacements, etc. of pull, junction, splice, outlet boxes, etc. and other related equipment of the conduit systems shall be made by this Contractor in accordance with the Drawings.

Where this Contractor selects and installs an item of equipment which requires either additional boxes, fittings, etc., or a modification of the conduit system indicated on the Drawings, such additional boxes, fittings, etc. shall be furnished and installed and such modifications shall be performed by this Contractor as part of this Contract and without extra compensation from the Board of Education. All modifications to conduit systems must be approved by the Executive Director before installation.

All outlet and enclosing boxes, and all steel or iron covers, doors, trims, etc. attached to the boxes shall be galvanized or rustproofed. Submit samples if requested.

All boxes shall be fastened in an approved manner, independent of the attached conduit.

All boxes set in plastered walls shall be provided with approved plaster "rings" or extension covers appropriate for the equipment.

Some partitions in Classrooms and certain other areas may be constructed of concrete block and a vinyl cork board surface. Outlets shall be installed flush with block and with square cornered covers extending to surface of finish. Consult General Contract Schedule of finishes for areas involved.

16-6.01 Scope (Con't)

Boxes installed in partitions and furring of lightweight concrete shall be set with bottom of box resting on top of the nearest block at approximate height indicated on the Drawings, except where exact height is necessary to avoid interference with structural, mechanical or other equipment. Boxes shall be of the standard gang type or the number of switches, receptacles, etc. to be installed. Each box shall be set back from surface of tile or other wainscot so that it can receive conduits. Back wall of block shall not be damaged. Switch and receptacle boxes shall be provided with an extension cover of proper size to accept electrical equipment, and depth so that equipment will be flush with face of wall. Extension cover shall have straight sides and square corners so that cut concrete block will abut snugly, without spaces between box and block. Switch, receptacle boxes, etc, shall be securely fastened in place by means of a flat metal strip or grouted in place.

All pull boxes, junction boxes, splice boxes, outlet boxes, etc., which are not covered by electrical equipment shall be provided with blank steel face plates, painted by this Contractor.

Where the drawings indicate existing boxes are to be re-used and present boxes are found to be defective or incorrectly sized or otherwise not suitable for the new equipment, new boxes shall be furnished and installed by this Contractor as a part of this contract.

All special boxes, such as enclosing boxes for telephones and fire signal equipment, mounting boxes for special clocks, clocks, panels, etc., shall be supplied by the manufacturer of the enclosed equipment.

16-6.02 Boxes for Lighting Fixtures

Ceiling outlets, except as hereinafter specified, shall be provided with octagonal pressed steel outlet boxes not less than 4-inches diameter.

Ceiling outlet boxes set in concrete shall be hot dipped galvanized and of a type especially constructed for concrete work. Boxes in concrete slab to which conduits are attached shall be deep enough so that conduits may be placed on top of reinforcing rods or mesh, and enter box through side knockouts.

16-6.02 Boxes for Lighting Fixtures (Con't)

Top cover of box shall be not less than 4-1/2 inches having malleable iron stud not less than 3/8-inch iron pipe size extending into box and having at least 6 threads. Arrow conduit and Fitting Company No. ACSS Type boxes or an approved equal will be acceptable.

Boxes set in concrete under beams shall be special and appropriate for the condition. Box holding fixture shall be clamped to beam in an approved manner.

Ceiling outlet boxes set in hung or furred ceiling shall be of a type suitable for such purpose. Boxes shall be deep enough so that conduits may be laid on angle iron supports of ceiling and enter sides of boxes with a minimum of bending and offset. For lightweight incandescent fixtures, each box shall be attached to rods or angle irons that are long enough to pass over and be securely fastened to adjacent angle irons.

Heavy fixtures (such as fluorescent, heavy incandescent, mercury vapor or other high pressure type fixtures) shall be supported directly from the building structure independent of the ceiling.

Each bracket for side wall lighting fixture, other than protected type fixture, shall be provided with a pressed steel outlet box suitable for the lighting fixture installed. Each outlet box shall be provided with a raised cover having a round or rectangular opening as required to suit the fixture. Cover shall be equipped with screw holes properly spaced as required for directly mounting fixture or strap to which fixture is attached. Where a fixture is to be mounted by means of a stud, the outlet box shall be provided with a stud as hereinbefore described.

Outlet boxes for protected type and vaporproof fixtures shall be limited to the following:

- (1) In ceilings, each box shall be round or square cast iron, or octagonal pressed steel, with FOUR threaded holes for mounting the fixture.
- (2) In walls, only SQUARE cast iron or pressed steel boxes, each equipped with FOUR threaded holes for supporting the fixture, shall be employed.

16-6.02 Boxes for Lighting Fixtures (Con't)

- (3) Surface mounted boxes in dry locations shall be of the cast iron or pressed steel type, each equipped with FOUR threaded holes for mounting fixture.
- (4) Boxes in or on outside walls or on fences, shall be cast aluminum or cast brass, each equipped with FOUR threaded holes for mounting fixture and threaded hubs for conduit connections.
- (5) Boxes for protected type wall fixtures shall be located 8-feet above finished floor (see Drawings). On stairs, boxes shall be not higher than 8-feet above landing level.
- (6) At each location where a ceiling is to have acoustical or other treatment, a special box, having sufficient depth to bring opening of box flush with the ceiling, shall be installed.

Where precast roof slabs occur, they shall not be drilled or marred in any way. Unless otherwise specified, lighting fixture supports shall be attached to 1-1/2" x 1-1/2" x 1/4" angle irons attached to structural steel which supports slab. Size of angle iron given is for spans which do not exceed 5'-0" and weights on support not exceeding 50-pounds. For greater spans or greater weight on support, consult Executive Director.

The Contractor for Electric Work shall submit one of each type of insert, hanger, etc., for approval, and he shall not install any means of supporting fluorescent lighting fixtures or heavy incandescent fixtures until permission from Executive Director has been granted. The Electrical Contractor shall cut the steel decking as required where metal inserts are required for metal decking.

16-6.03 Inserts

Supports which do not require circuit connections may be held by an approved slotted insert with non-turning nut to take 5/8-inch diameter, 18-thread, per inch pipe nipple, the approved equal of Central Iron Co., No. 100; C.H. Liefried Mfg. Co., No. 100; F.&S. Pipe Co., No. 180-Type A; Fee and Mason 185-Size 3; or approved equal by Glove Machine & Stamping Company. Bars thru inserts will not be required.

The Electrical Contractor shall cut the steel decking as required where metal inserts are required to metal decking.

16-6.03 Inserts (Con't)

A slotted insert with spring-nut combination, the equal of Steel City-Kindorf B-900-3", will also be acceptable.

16-6.04 Existing Outlet Boxes

Existing outlet boxes may be used for support of fluorescent and heavy incandescent fixtures only with written permission. Studs and other weight bearing parts of existing outlet boxes from which new lighting fixtures or other electrical equipment are to be suspended, shall be carefully inspected and weight tested (in accordance with directions of the Executive Director) by this Contractor to be certain that new equipment can be safely supported.

Suspension load test for supporting a four foot fluorescent fixture from an existing hung or furred ceiling shall consist of installing a fixture support as shown for "Typical Condition C", electrical standard detail 7E, F Series, and attach a convenient length of stem to the stud of the supporting bar. The bottom of the stem shall be fitted with a chain ring or harness for supporting the weight of two (2) 94 lb. bags of cement for 48 hours.

Assuming that each stem for a 4-foot fluorescent fixture should support *40 lbs., each end of the supporting bar in the hung ceiling should support 20 lbs. Safety practice suggests that a support exceed the load by four. Where the load is 40 the point of attachment to the bar should support 160 lbs. and each end of the supporting bar should support 80 lbs. Since the load test is an accelerated time test over 48 hours, I suggest that the test weight consist of two (2) cement bags weighing 188 lbs.

*The weight of a four foot fluorescent fixture varies from approximately 251 lbs. to 45 lbs. depending on the type of diffuser including glass lenses and construction variations. Although our types of fixtures generally range to 30 lbs, heavier fixtures may be installed in the future due to changes in layout and utilization of any number of the existing outlets for an alteration or modernization work.

16-6.05 Boxes for Switches

Pressed Steel switch boxes shall be furnished and installed for all switches indicated on the Drawings.

Switch boxes shall be mounted so that center of face plate will be approximately at height above floor indicated on Drawings.

All boxes set in plaster walls shall be provided with plaster "rings" or extension covers.

Each single flush mounted switch shall be provided with a 4-inch square box.

Where two or more flush switches are to be mounted at the same location, "gang" type boxes having the following minimum horizontal dimensions shall be provided:

Two-gang switch boxes	-	6-3/4 inches
Three-gang switch boxes	-	8-1/2 inches
Four-gang switch boxes	-	10-1/2 inches

Where more than four switches for control of lighting circuits are to be installed at the same location, a special box of appropriate size to contain the number of switches indicated on the Drawings shall be installed. Horizontal dimension of this box shall be not greater than 10-1/2 inches (4-gang). Depth of box shall be approximately 3-1/2 inches. The box shall be equipped with a center band wide enough to permit mounting and proper abutting of separate identical gang face plates.

In brick faced walls, and walls of enameled or glazed brick, light weight concrete block, wood, marble, tile or slate, install a standard box behind the facing or wainscot to receive conduit, and attach thereto a square corner extension cover similar to Arrow Conduit and Fittings 4-SC-51 series but of proper size to contain the number of switches indicated on the Drawings, and to bring switches flush with facing. Submit sample for approval before installation.

Switch Boxes shall be mounted in the following manner:

- (a) Each switch box adjacent to a door shall be rigidly attached to a steel door buck support, the approved equal of the type manufactured by the Arrow Conduit and Fittings Co.

16-6.05 Boxes for Switches (Con't)

- (b) At other locations, switch boxes shall be equipped with approved galvanized steel strap attached to the top or side of the box and embedded securely in the mortar between bricks, hollow tile or cinder block, etc. or attached to furring strips. Steel strap may be omitted where boxes can be rigidly grouted in place by mortar or by an equally approved method.

Switch boxes set exposed on exterior walls of buildings, fences, etc., shall be approved surface type cast aluminum; or other approved weather-proof boxes manufactured by Appleton Co.; Russell and Stoll; Crouse-Hinds Co.

These boxes shall be securely mounted to structure or fence, independent of conduit.

Boxes set exposed on interior walls of building shall be of the "FS or "FD" type or an approved pressed steel box the equal of Arrow No. SM 100.

Boxes for switches mounted in demountable partitions shall be of the narrow and shallow type so as to suit the partition being utilized.

16-6.06 Boxes for Receptacles

In general, the requirements for "Boxes for Switches" shall apply.

Certain modifications follow:

Outlet boxes for key or keyless lampholders shall be octagonal steel.

Outlet boxes for special receptacles in Kitchen, Dishwashing Room, Serving Units and other food preparation rooms, and for special receptacles in ships and special rooms shall be installed at approximate heights indicated on the drawings. The Contractor shall consult the Executive Director's Representative at the school and obtain final approved information before installing boxes in these rooms.

Outlet boxes for convenience outlets shall be installed in a vertical position, centered 18 inches above the floor unless otherwise indicated on drawings.

16-6.07 Combination Wall Boxes

Outlet boxes for combination wall outlets shall be not less than 2-gang and, unless otherwise indicated on the Drawings, shall be installed 5 feet above the floor.

Where receptacles are indicated at the same location as switches, they shall be installed together in a multiple gang box.

16-6.08 Interconnecting Boxes

Furnish and install interconnecting boxes at locations indicated on Drawings. Interconnecting boxes shall be set flush with finished wall, 9 feet from floor where possible; but not less than 3 inches from ceiling when ceiling is less than 9 feet above floor. Interconnecting boxes shall be constructed of No. 14 gauge sheet steel according to construction details of Drawing No. 752TR or 752R as indicated on drawings and/or as specified. Each interconnecting box shall be equipped with a steel door on approved hinges, closing against a rabbet on three sides. Door shall be equipped with a flush ring handle catch.

Interconnecting boxes shall be delivered to the job with a priming coat of white paint on all surfaces.

After installation the outside of door and trim will be painted by another Contractor to match the color of surroundings. The individual designation of the interconnecting box indicated on Drawings shall be stenciled on inside of door of each cabinet. Submit sample of catch of door.

Trims and doors MUST be completely installed by the time the General Construction Contractor starts painting walls.

16-6.09 Indicator Interconnecting Box

This box shall be in accordance with the above paragraph, but modified as indicated on Drawing No. 753N and in "Signal Systems" of the Specifications. Where the Drawings indicate the installation of an Auxiliary Program Signal System, Standard Detail Drawing No. 756A which includes an additional terminal strip (adjacent to relay) shall be used.

Dimensions of indicator interconnecting box shall be as indicated on the Drawings.

16-6.10 Boxes for Indicators

Shall be appropriate for surface mounting or flush mounting in the wall, as indicated on the Drawings. Unless otherwise noted on the Drawings, box for the indicator shall be set with center line approximately 6'-0" above the floor.

16-6.11 Boxes for Outside Push Buttons

Each push button shall be equipped with an appropriate box. Outlet for the push button installed on fence shall consist of a cast aluminum weatherproof box set in between the two flats in the upper part of fence. The front of box shall be flush with front of fence. Box shall be secured to fence by means of a strap iron formed about box and secured to fence and box by means of machine screws.

Outlet box for push button installed at entrance door shall be a galvanized "Handy Box" type approximately 4 x 3-1/8 x 1-7/8 inches deep with ears at the middle of the opposite ends. The Contractor for Electric Work shall give the Contractor for General Construction dimensions of openings to be cut in stone wall to accommodate these boxes.

16-6.12 Boxes for Buzzers, Horns and Bells

Furnish and install a pressed steel box for each buzzer, horn and bell indicated on the Drawings or specified. Each box and plaster ring or extension cover shall be supplied by the manufacturer of the buzzer, horn or bell, and approved by the Executive Director. Each box shall be of sufficient depth to accommodate the size rigid conduit indicated on the Drawings. Where a box must accommodate a large number of conductors or splices, the size of the box shall be appropriately increased to provide necessary volume. Buzzers, horns and bells shall be fastened to boxes by means of brass screws.

Horns mounted on the outside of the building, weatherproof cast aluminum or brass boxes, furnished by the manufacturer of the horn, shall be provided. Each box shall be equipped with a suitable boss (at the rear of the box) for conduit connection.

Box for buzzer on stage shall be set approximately 9 feet above the floor. Elsewhere in the building (including the corridors), boxes for buzzers, horns and bells shall be set with center of box approximately 9 feet - 6 inches above the floor (if structural conditions do not interfere). Where low ceiling (as in corridors) does not permit mounting this height, the box shall be set so that top of buzzer, horn or bell is approximately 2 inches below the ceiling. Boxes for horns in outside playyard shall be mounted with center of box as shown on drawings.

16-6.12 Boxes for Buzzers, Horns and Bells (Con't)

In the new Buildings, boxes for buzzers, horns and bells shall be flush mounted in partitions and walls within the building. Boxes for horns in playyards shall be flush mounted in exterior wall of building.

In general, for existing buildings where new buzzers, or horns replace bells, present outlet boxes, if suitable, may be used, but shall be equipped with adapter plate for mounting buzzer or horn. If the outlet boxes are unsuitable, new outlet boxes shall be installed for the buzzer or horn. New boxes shall be installed flush with wall surface.

16-6.13 Sound System (LS) Boxes

Furnish and install "L.S. Boxes" (pull boxes for the sound system) at location indicated on the Drawings. "L.S. Boxes" shall meet the requirements of interconnecting boxes previously specified, but contained equipment. Sizes of these boxes shall be as per drawing 752R unless otherwise indicated on the drawings or in the Amendments.

In the existing building where existing L.S. cables are to be cut and rerouted, suitable terminal strips shall be provided within the L.S. boxes.

16-6.14 Pull or Junction Boxes

Pull or Junction boxes shall be installed at locations indicated on the Drawings and wherever required for convenience of installation of conductors. Location of boxes in finished areas shall be subject to Executive Director's approval.

Where pull boxes are set flush in ceiling, this Contractor shall set boxes tru with finished ceiling. Large pull boxes flush in the ceiling, shall have removable section of cover, reduced in size. However, such covers shall be large enough to permit easy access for installing and pulling of conductors.

All boxes shall be fastened in an approved manner to the building structure independent of the conduits.

Covers of boxes shall be held by machine screws, and shall be in sections where the area of the cover exceeds 600 square inches or any dimension exceeds 24 inches.

16-6.14 Pull or Junction Boxes (Con't)

For large boxes suitable insulators or other approved devices shall be provided for supporting cables passing through so that the cables will not be unsupported for a distance-greater than three (3) feet.

The designation given on the Drawings shall be stenciled on each pull box, using letters and numbers of size as directed by the Executive Director. In finished areas stencil covers on the inside of cover and in unfinished areas stencil on the outside of cover.

16-6.15 Boxes (Floor Outlet)

Floor outlet boxes shall be adjustable type the equal of Russell and Stoll, G.E., or Thomas and Betts. Nozzle and attachment receptacle shall be approved equal of Russell and Stoll.

Where Library is equipped with a floor outlet (see Drawings), floor outlet shall be equipped with the following:

For electric power - An outlet the equal of Russell and Stoll No. 3000 Type but equipped with a three wire grounded receptacle. Furnish two plugs to fit receptacle and deliver plugs to school.

For telephone - An outlet the equal of Russell and Stoll No. 2630 Type Extension Set.

Boxes for motion picture projector - see paragraph 16-19.08T3.

16-6.16 Boxes for Proscenium Lights (Adjustable Type) and Border Lights

The electrical contractor shall install an 8" x 8" x 3" junction box for each proscenium light (adjustable type and each border light indicated on the drawings. An elbow shall be furnished on the side of the box and equipped with a cable grip support.

16-6.17 Boxes (Deep Type)

Boxes at location where spray glazed tile, brick tile, architectural terra cotta or other similar wall finishes are used in the construction of walls or partitions, special approved galvanized deep boxes shall be installed for protected type fixtures, switches, receptacles, program signal equipment, motor starters, fire signal stations and gongs, telephones or other devices requiring back boxes.

16-6.17 Boxes (Deep Type) (Con't)

Where protected type fixtures are installed in walls or partitions in which the above mentioned wall finishes are employed, square galvanized cast iron boxes (at least 3-1/2 inches deep), each with a round galvanized cast iron finishing ring 3/16-inches thick shall be used. Ring shall have a diameter of sufficient size to cover space between box and wall.

16-6.18 Box for Sidewalk Elevator Push Button Switch

When so indicated on the Drawings, furnish and install a cast aluminum box approximately 6 inch x 6 inch x 4 inch deep (outside dimensions) flush in outside wall (see General Construction Drawings for exact location). Box shall fit in without cutting brick face. Elevator push button switch will be installed by other parties. Opening of box shall be covered with a cast aluminum plate equipped with a rubber gasket. Box shall be equipped with a hinged door opening horizontally. A 511-S Standard Board of Education lock with satin chromium finish shall be set flush in door. Metal of box, plate and door shall be approximately 3/16" thick. Door shall close against a rabbet on three sides. Cast metal plate, door, hinges, etc., shall be made of aluminum with a satin finish. Exposed portions of the lock shall be chromium plated, with a satin finish. Box plate, door, etc., shall be as herein specified and the equal of Russell & Stoll C-4986 (modified), Beonell No. 31703 or the equal by Thomas and Betts. Detail drawings in quadruplicate, as approved by the Contractor installing elevator, shall be submitted for approval of the Executive Director immediately after the signing of this contract.

16-6.19 Outside Receptacle and Microphone Box

Furnish and install a flush, cast aluminum, weatherproof enclosing box (approximately 3/16 inch thick) with horizontal hinged cover and Board of Education lock No. 511-S with 47 key change. Box to house duplex grounded 120-volt receptacle on a GFI circuit, and duplex microphone receptacle, where indicated on drawings. Provide suitable barrier between receptacles. Submit drawing of box for approval.

SECTION 16-7, WIRING SYSTEMS

16-7.01 General

Control Wiring for Safety Devices for equipment where failure of operation will cause a hazard to life and property shall comply with Bulletin No. 8-1963 of the New York City Electrical Code. All safety devices, such as pressure controls, fire controls, relays, etc., shall have their electric switching mechanism connected to the underground conductor or conductors.

When an item of equipment is indicated on a floor plan and not shown on associated riser diagram or vice-versa, this Contractor shall provide said item and all required conduit and wiring connections for a complete system as a part of the contract.

16-7.02 Conductors

Install copper conductors indicated on the Drawings, herein specified, indicated on the Standard Detail Drawings, or required for the proper operation of the various systems specified. All connections shall be made complete, and all systems shall be energized and in proper operating condition on the date set by the Board of Education for opening of the School Building.

In certain electrical systems, the equipment furnished by one approved manufacturer may require different wiring than the equipment furnished by another manufacturer. The Drawings indicate the wiring required for the installation and proper operation of one of the systems specified. If this Contractor chooses to install an approved system requiring different wiring, any additional material or labor required to furnish and install the wiring for the new system shall be furnished by this Contractor as part of this Contract without extra cost to the Board of Education.

16-7.03 Manufacture

- (a) In new building and additions all conductors shall be made entirely of copper of 98% conductivity, free from splints, flaws, or other defects. Copper clad conductors are not acceptable. Except as otherwise specified, all conductors in new buildings No. 4 and larger shall be insulated with the highest grade moisture and heat resistant insulating compound type THW with minimum insulation thickness 3/64".

1607.03 Manufacture (con't)

- (b) In modernization and alteration work, the wiring shall be type "THWN" unless otherwise specified or indicated on the drawings. All conductors in these cables shall be made entirely of copper of 98% conductivity free from splints, flaws, or other defects. Copper clad conductors are not acceptable.
- (c) The exception to the above paragraphs shall be for conductors in conduit in contact with the earth, in slab contiguous to the earth, outside the building, and service feeders to Main Distribution Boards from Current Transformers. These conductors shall be type USE/RHW as hereinafter specified (Par. 16-7.06).
- (d) Conductors shall meet the requirements of the Underwriters Laboratories and the New York City Electrical Code and shall be of a type and manufacture which has the approval of the Bureau of Electrical Controls for the use to which they are being submitted. Evidence of such approval shall be supplied upon request of the Executive Director.
- (e) Type THW conductors shall have a thermoplastic polyvinyl chloride insulation for 600 volts, rated for 75 degrees C use and shall comply with A.S.T.M. specification D734 (latest edition) and I.P.C.E.A. and N.E.M.A. S-61-402 Sections 3.7 and 3.8 (latest edition).
- (f) Type THWN-75 Degrees C-THHN--90 Degrees C shall have a thermoplastic polyvinyl chloride insulation with nylon jacket, 600 volts, and shall comply with ASTM, IPCEA, NEMA S-61-402 (lates editions), and UL 83 specifications. This type of conductor shall be used as specified or called for on drawings.

16-7.04 Samples and Labeling

This contractor shall submit samples of each wire size for approval before installation.

Conductors shall be of an approved manufacturer and shall be delivered at the building in original packages or on reels, and shall have the tag of the manufacturer attached thereto, with stamp showing date of manufacture. Wire manufactured over one year prior to delivery at the building, will not be accepted.

16-7.05 600 Volt Conductors

Conductors for Light and Power, Exit Light, Clock, Sprinkler Alarm, and Fire Detection Systems shall have insulation of thickness equal to 600-volt conductors (THW-min. 3/64") as designated in the Electric Code of New York City.

16-7.05 600 Volt Conductors (con't)

The manufacturer's identification, permissible voltage, size of conductor, and type of installation on conductor shall be marked at intervals on the outside of the wire. The outer covering of all conductors for light and power, excepting fixtures and flexible cords shall have a distinguishing color in accordance with the following schedule:

Grounded Neutral Conductors and Secondary Service Grounding Conductors--White.

Phase Conductors--Blue-Phase "A", Black-Phase "B" and Red-Phase "C".

Interior Equipment and Conduit Grounding Conductors--Green.

Conductors larger than No. 10 shall be stranded.

16-7.06 Service Entrance Conductors

Underground or Overhead Electric Service Entrance Conductors shall consist of Underwriters Laboratory approved Type USE single conductors rated for 75 degrees temperature for use in dry or wet locations with RHW insulation. These conductors shall be either (1) the type with a heat and moisture rubber compound insulation with a neoprene sheath or (2) the type using a cross-linked polyethelene jacketed insulation (rated as USE) as manufactured by the Phelps Dodge Cable and Wire Company or the Triangle Conduit and Cable Company.

Cable shall be makred "Type USE-600V-75 Degrees C. Cable shall be capable of operating continuously at a temperature of 75 Degrees C in both wet and dry locations. Copper in these conductors shall be tinned where a type with a rubber compound insulation is furnished. The copper conductors need not be tinned where a polyethelene jacket type is furnished.

Cable shall meet the requirements of A.S.T.M.-D1679 and A.S.T.M. D752 specifications for the Rubber Insulated Type. The Cross-Linked Polyethelene Type shall meet all the requirements of Underwriters Laboratories Standards No. 854 and 44, NEMA Pub No. WC7 and IPCEA Publication No. S-66-524.

This type cable shall also be used for the following:

- (a) Installations between Service Switches and Main Distribution Centers.
- (b) Installations in Conduits in Contact with the earth.
- (c) Installations of Conduits in Concrete Slab in Contact with the earth.
- (d) Installation of Conduits on the exterior of the building.

16-7.07 High Tension Conductors

High tension conductors shall be employed on systems operating on potential greater than 600 volts but not exceeding 5000 volts. This Contractor shall submit to the Executive Director for approval, four copies of certified test data that the high tension conductors are suitable for the duty they shall perform and are acceptable to the Bureau of Electric Controls.

16-7.08 Signal System Conductors

Systems employing 50 Volts or Less--(Indicators Etc.)--Conductors, No. 16 gauge and smaller, for low voltage interior work, such as indicators etc., shall be single conductors type 'TF' with not less than 1/32-inch thermoplastic insulation, colored as required.

16-7.09 Fire Alarm Conductors

Conductors for "City Fire Alarm System" shall be installed as hereinafter specified in Section 16-14. These conductors shall meet the approval of the Fire Department. Submit samples for approval.

16-7.10 Fire Detection System Conductors

Conduits for the interior fire signal, heat detection, combination smoke and heat, sprinkler alarm system shall meet the approval of the Fire Department. Submit samples for approval.

16-7.11 Sound System and Television Distribution System Conductors

See their respective Sections.

16-7.12 Sizes

The minimum sizes of all conductors shall be No. 12 or as indicated on the Drawings and/or herein specified.

16-7.13 Splices and Tapes

(a) Splices

All splices shall be in accordance with requirements of the Electric Code and with accepted practice and good workmanship. The conductivity and physical strength of splices before the application of solder shall be equal to that of the unspliced conductor. All soldered splices shall be completely covered with molten solder to prevent corrosion; cold solder joints will not be acceptable.

16-7.13 Splices and Tapes (con't)

(a) Splices

Soldered splices shall be covered by the number of half lapped servings of rubber tape which are sufficient to produce an insulation resistance equal to or greater than the insulation resistance of the insulated conductor. Over the rubber tape, friction tape shall be applied.

In lieu of soldered splices (except for Sound and Fire Systems) mechanical splices using pressure tool (with pressure connectors, insulators, and locking rings) will be acceptable, such as Buchanan splice caps Cat. No. 2007 and No. 2014. Nylon insulators are approved, for operating temperatures up to 105 degrees C and for use in fluorescent fixtures.

Mechanical splices of Dycap Catalog No. 1218 using a pressure tool, Dycap No. SC12, will be acceptable for branch circuit and fixture wiring connections only.

Mechanical splices, made with insulated connectors not requiring a pressure tool as manufactured by 3-M Company, "Scotchlok", and Ideal "Wing-Nut" or "Super-Nut" Pressure types will also be acceptable for splicing of branch circuit conductors only.

(b) Tapes

All tapes for covering splices in wires, etc., shall comply with the following specifications:

Friction Tape--Friction tape shall comply with the latest specification of the A.S.T.M. and shall be so marked on each box.

Rubber Tape--Rubber tape shall comply with the latest specifications of the A.S.T.M. and shall be so marked on each box. Tape shall be 3/4-in, wide, 0.030 inch thick.

Plastic Tape--Plastic tape shall be 3/4 inch wide, 0.007 inch thick, the approved equal of 3-M "Scotch" No. 33 electrical tape.

Approved Tapes--Tapes meeting the above specifications as made by Paranite, G.E., Plymouth, U.S. Rubber, Clifton, Okonite, Manson, or equal, will be approved.

16-7.14 Pressure Lugs

In general, pressure lugs for distribution and panelboards (including Laboratory panels and Stage Switchboards) shall be U.L. approved and conform to the following:

- (a) Unless otherwise specified pressure lugs shall be of cast or formed 100% copper with pressure plate and hex or allen head screw of an approved type, such as burndy "QIKLUG" Type QA-B, "OZ"-XL line, or T. & B. "Locktite", Dossert "HL". Submit Samples for approval.
- (b) Lugs for #4 conductors and larger shall have at least 2 hole, NEMA drilling.
- (c) Lugs #6 conductors and smaller may have one (1) hole mounting. Where one (1) hole mounting is used approved means to prevent turning shall be provided.
- (d) The above paragraphs do not apply to terminals of standard approved circuit breakers, safety switches RC switches and motor controls or switch fuse units with integral lugs furnished by the manufacturer.
- (e) Main service switches however shall meet all above requirements.
- (f) Alternate

In lieu of the above specified lugs, the following alternate will be acceptable: Comparison connectors lugs of one piece, pure seamless copper tube terminals of proper sizes to fit cables. Lugs shall be attached to conductors by indent or crimp with proper mechanical or hydraulic tool supplied by manufacturer of respective lugs.

Where practicable allow sufficient slack for replacement of one lug per phase. Sub paragraphs b, c above, shall apply to these connectors. Burndy Hy lugs type YA or Thomas & Betts "Color Keyed" line will be approved.

- (g) Lugs used on a given piece of equipment shall be of the same type and manufacture.
- (h) Where wiring spaces of individual enclosures or gutter spaces of panelboards or switchboards, housing switches, circuit breakers, devices, etc., and/or where the terminal lugs provided are not adequate to properly accomodate or connect the conductors called for on drawings, the Contractor shall be bound as follows:

16-7.14 Pressure Lugs (con't)

Contractor shall replace or modify and/or adapt equipment to receive said conductors with approved auxiliary gutters, boxes, terminal lugs, cable traps, "in-line" connectors, etc., as required to suit conditions as a part of the contract. Approved "in-line" connectors are Dossert type HC, OZ type XW, T & B "Lock-Tite", or Burndy Type "QR" Qiklink.

The methods used to accomplish the above requirements shall be subject to the Executive Director's approval.

Cable ends shall not be filed or otherwise reduced by removing strands in order to fit terminal lugs.

16-7.15 Feeders

This contractor shall install all main feeder conductors, distribution feeder conductors and sub-feeder conductors required to supply current to Fire and Exit Light Cutout Panels, 24 Hour Panel, Meter Panels, panel-boards and other items of electrical equipment.

All feeder conductors that are installed in conduits buried in the earth, or in concrete slabs contiguous to the earth, or outside the building shall be Underwriters approved Type USE as described in paragraph 16-7.06.

Where the Drawings indicate, a feeder shall be connected to two or more panelboards, insulated gutter taps shall be employed.

Insulated gutter taps shall be the parallel type with insulating covers, as made by O.Z., Burndy, Nepco, Dossert "GTC".

Cable supports shall be installed in vertical runs as required. Cable support boxes shall be as specified for pull boxes. Approved cable supports shall be of proper type and size to prevent damage to insulation. Cable supports shall be the equal of "OZ" Manufacturing Co.

16-7.16 Branch Circuits

Install branch circuits required to supply electric current from the panelboards to the various lighting fixtures, receptacles or other electrical equipment indicated on the Drawings or Described in the Specifications.

16-7.16 Branch Circuits (con't)

Branch Circuits shall consist of single conductors of size No. 12 unless otherwise indicated on Drawings or Specifications.

The number of conductors in each conduit is indicated on the Drawings or in the Specifications.

Conductor insulation coloring shall be as hereinbefore specified for "600 Volt Conductors".

Circuit conductors shall be connected at the panelboards so that numbers adjacent to "home runs" on the Drawings, correspond to numbered buttons on switches or circuit breakers.

- (a) Conductors shall not be installed in conduits until the brown coat of plaster has been applied to walls and ceiling, and approval has been obtained from the Executive Director's representative.
- (b) Where the Drawings or Specifications require circuits to be installed in conduit in contact with the earth, or in slab contiguous to the earth, or outside the building (i.e., fence fixtures, bulletin boards, etc.). Type USE conductors, as described in paragraph 16-7.06, shall be installed from the junction box in the building to the terminating point of the exterior electrical equipment. Sufficient free wire shall be allowed at outlet boxes to permit splicing future connections, etc. All work shall be made waterproof and rain tight.
- (c) For entrance fence fixtures the conduit shall terminate in the outlet boxes provided in the fence by other parties, and the Type USE wire continued without splice inside the fence to fixture fitting at top.
- (d) For circuits to bulletin boards of the "free standing" type, the conduit shall enter at the bottom of the vertical pipe of the bulletin board and turn up as directed. The Type USE conductors shall continue up and through the bushing at the top of the bulletin board, connecting to lighting fixture.

In general, surface mounted fluorescent fixtures or incandescent fixtures aggregating 300 watts with enclosing diffuser and/or incandescent fixtures with 500 watts or above with open bottoms, shall be provided with branch circuit connections of a type to withstand temperatures encountered.

16-7.16 Branch Circuits (con't)

From each recessed fixture install a flexible conduit (between 4 to 6 feet Greenfield) with approved type of fixture wire, to a suitable junction box rigidly installed in hung ceiling within approximately 1-foot of opening with access from opening only. Box shall be set on end so cover will face opening. Where this method is used, branch circuit wire shall be used to and between junction boxes, switches and panels, etc.

One-half inch flexible conduit will be permitted between fixture and junction box for incandescent units and individually mounted 4 foot and 8 foot fluorescent units.

16-7.17 Relay Remote Control of Lighting Fixtures

Furnish, install and connect, where indicated on drawings, a complete remote relay control of lighting fixtures through the use of remote momentary contact switches or standard toggle switches, (alternate) then to relay cabinet so that various lighting fixtures can be controlled from locations indicated on drawings.

(a) Relay Cabinets

Relay Cabinet shall be flush mounted, galvanized sheet steel, primer finish with hinged outer door and 46 key lock. Relays shall be of the low-voltage remote control switching type, the equal of General Electric Standard type RR3 for 24 volt switch circuits. Relays shall be split-coil design, one half closes 120 V. line voltage circuit, the other opens it, with pigtail connections, UL listed 20 ampere rating. In addition provide a normally open auxiliary contact for low voltage pilot light. There shall be one (1) relay for each set of fixtures. Relay conductors shall be tagged in relay cabinet to indicate location of lights controlled.

Provide proper mounting frames and barriers in cabinet. Mount relays in frames with G.E. RA3 rubber grommet adapters.

(b) Switches

Remote control switches shall be normally open, single pole, double throw momentary contact type 30 amp., G.E.-5935-1.

(c) Transformer

Provide two (2) Edwards or equal Series 88, 120/24 volt fused secondary, 250 watt transformers connected through a D.P.D.T. toggle switch. Transformers may be mounted within or outside cabinet.

16-7.17 Relay Remote Control of Lighting Fixtures (con't)

Submit shop drawings of cabinet for approval.

Alternate

1. Relay Cabinet--Same as specified hereinbefore except the relays shall be the equal of Automatic Switch Co. type 116A-12, for 24 volt switch circuits.

Relays shall be single coil design closing a 120 volt line. Provide an auxiliary n/o contact for pilot lights.

Wiring between Relay Cabinet, and toggle switches shall be, as required, for the proper functioning of this system. Conduits shall be as shown on drawings.

2. Standard specified single pole toggle switches will be used in place of the aforementioned remote control switches.
3. Transformers, D.P.D.T. toggle switch and relay mounting with rubber grommets, to be as hereinbefore specified.

Submit drawings of the Control Cabinet for approval.

16-7.18 Astronomical Time Switch

The Electric Contractor shall furnish, install and connect Astronomical Time Switches where indicated on drawings. These switches shall be three pole, single throw when controlling three circuits.

When two circuits are to be controlled, the switch shall be a two pole, single throw.

Switch contacts shall be rated 40 amperes per pole at 277 volts. The time switch shall be 24 hour, Astronomic year.

The "ON" operation shall occur automatically at sunset, the "OFF" operation at sunrise.

The clock motor shall be a self-starting synchronous motor rated for 120 volts, 60 HZ, A.C.

Spring driven reserve shall be provided with sufficient capacity to operate time switch contacts at least 36 hours after power failure.

On restoration of power, spring driven reserve shall be automatically rewound.

Switch shall be Tork 7300 ZL for three pole or 7200 ZL for two pole, or the equal by Sangamo, Intermatic Register Company or the Paragon Electric Co.

16-7.46 Combination Outlets (con't)

	Receptacle	Switch
Arrow Hart	5261	RL-21-U
Allen Bradley	-----	600-Size C- Form 52 Open
Bryant	5251	-----
Hubbell	5261	-----
Pass & Seymour	5251	-----
Square "D"	-----	Class 2510-AD-2

(b) Pilot Lights for Combination Outlets

Except where otherwise indicated pilot light in combination outlets shall consist of a candelabra base receptacle Pass & Seymour 427, Hubbell No. 432, Arrow Hart 1720 or Bryant 427 with a ruby bullseye in face plate. With each combination outlet, two (1 spare) 120 volt, candelabra base, 3 watt (Lamp No. 3S6/5), lamps shall be furnished. Switches shall control pilot lights.

(c) Face Plates for Combination Outlets

Face plates shall be stainless steel and shall be finished in accordance with the paragraph on "Finishes of Receptacle Face Plates". All face plates shall be appropriately inscribed to indicate the equipment for which they are installed and the voltage at each receptacle. Appropriate abbreviations may be used. Submit for approval a sample face plate and a list of proposed inscription for all combination outlets.

16-7.47 Motion Picture Sound Receptacle (For 16 mm. motion picture machine sound circuits).

Male receptacle shall be the equal of Cannon p-2-36 with stainless steel plate and bridge so it will fit in a standard switch box. Female receptacle shall be the equal of Cannon P-2-35. Face plates shall be inscribed "16mm Sound" with lettering colored.

16-7.48 Extra Attachment Plugs

Furnish and deliver to the Custodian:

Ten (10) equal to Hubbell 5375, 3W, 20a, 125V. caps with "I-T" and U-shaped ground cord grip.

Twenty-Five (25) 3-wire 15 amp. 125V. cord grip caps. Hubbell 5264 or equal.

Ten (10) 4-wire 20 amp, 250V cord grip caps. Hubbell 7251 or equal.

16-7.49 Receptacle Face Plate Inscriptions

Face plates of all receptacles at or on Pupils Tables, Teachers Tables, Shop Tables, and Special receptacles in shops and special rooms shall be appropriately inscribed to indicate associated equipment, voltage, kind of current (A.C. or D.C.), etc.

Face plates of all receptacles which are to be used with appliances, machines and other special equipment such as Hot Plates, Sterilizers, Electric Irons, etc., shall be appropriately inscribed to indicate associated equipment. Where current is different from 120 volts, single-phase A.C., or where several voltages are available at a receptacle (as a four-pole receptacle) this face shall also be inscribed on the face plate.

Face plates of all receptacles used for special purposes shall be inscribed with purpose and use of receptacle.

This Contractor shall submit for approval a list of proposed inscriptions on receptacle face plates.

All inscriptions on receptacle face plates shall be deeply inscribed and the letters filled with black enamel. All inscriptions shall be deep enough to maintain filling material. Appropriate abbreviations may be used.

SECTION 16-8, MOTOR CONTROL EQUIPMENT

16-8.01 General

Unless otherwise indicated on the Drawings or in the Specification, motors or motor operated equipment (such as Shop Equipment, Heating Ventilating & Air Conditioning Equipment, Sanitary Equipment, Electric Elevators, etc.) will be installed by others.

Electrical Contractor shall provide necessary conduit and wiring, auxiliary starter contacts, etc., with proper interlocking connections to accomplish the operations called for on drawings or specified.

16-8.02 Motor Control

Control equipment shall be furnished and installed where and as indicated on Drawings. The type of control shall be as indicated on Drawings by the symbols as explained herein. Each unit of control equipment shall be contained in a separate cabinet and shall be interconnected.

Approximately 6 inches above each wall mounted starter in a finished part of the building, and in the Custodian's Workshop, a suitable box shall be installed flush in wall for terminating conduits. Box shall be provided with a suitable extension collar. Conduit shall be installed surface mounted on wall between the extension collar and the starter.

Each unit of control equipment set exposed, shall be fastened independently to the wall at not less than four points. All control equipment located on outside or damp walls shall be mounted at least 1/4 inch away from wall.

When indicated on Drawings or required by conditions, motor control equipment shall be installed on an approved rigidly constructed pedestal fastened to floor. Framing may consist of prefabricated steel channel or equivalent sections such as "Unistrut", "Kindorf" or "Power-Strut".

The arrangement and mounting of all control equipment shall be such, that the handle of the safety switch will be easily operable from the floor.

16-8.02 Motor Control (Con't)

On the front of cabinet of each unit of control equipment, there shall be installed a white core bakelite nameplate. Each nameplate shall have inscribed thereon in 1/4 inch high letters the name of the motor controlled with approved designation.

Manually operated control equipment shall have handles or push buttons 4-feet from floor, unless otherwise noted on drawings.

All motor control equipment shall be cleaned of all whitewash, stains, dirt, etc., before nameplates.

16-8.03 Motor Control Push Button Stations

All push button stations shall be of the momentary contact type unless otherwise specified or required.

Push button stations in unfinished areas may be of the surface mounted type.

Push button stations in finished areas shall be flush mounted with a type 302 Mfr. stainless steel face plate.

Push buttons shall be black for "Start" button and red for "Stop" button, and inscribed as such.

When stations are remotely mounted they shall be provided with a nameplate indicating the motor or device controlled.

Pilot lights shall be of the neon type 125 volt as hereinafter specified in this section.

Pilot light and push button shall be installed with a common face plate. Connections for all pilot lights shall be made on the "load side" of the motor starters, unless otherwise indicated on plans.

16-8.04 Safety Switches

When a safety switch symbol is indicated on Drawing in connection with control equipment symbol, furnish and install a Square "D" (80,000 Series), or Bull Dog, or other equal. Underwriters approved (NEMA General Purpose) safety switch of size indicated on drawings.

16-8.04 Safety Switches (Con't)

Unless otherwise indicated, safety switches shall be unfused, but if fuses are called for, fuse clips shall be provided to accommodate same. Safety switch shall have nameplate on front giving voltage, amperage and number of poles. Enclosure shall have baked gray enamel finish. Where voltages exceed 120/208 volts all safety switches shall be NEMA 2, heavy duty type.

16-8.05 Motor Starters

- (a) Furnish and install motor starters and auxiliary equipment of the type indicated, at locations indicated on the Drawings. All starters and auxiliary equipment shall be complete with proper thermal elements, and shall be completely wired and connected by this Contractor to perform the functions desired by the Executive Director.

Where the voltage supply at the building as specified on the Drawings or in the Amendments is 208 volts, all control equipment, having operating or holding coils, shall be designed for 208 volt operation.

Overload tripping devices of motor starters shall be designed to protect the motor against overload in each phase leg and be properly coordinated with branch circuit protective device on overload. **NAMEPLATE** full load current of the motor shall be used in designating the aforementioned thermal elements.

The covers of combination starter Symbols "B", "C", and "D" shall be so designed that the cover cannot be opened unless the switch is in the "OFF" position.

Wherever space limitations prevent the installation of combination starters, the equipment described may be installed in separate enclosures and properly interconnected.

Wherever an auxiliary automatic actuating apparatus (float switch, etc.) is indicated on the Drawings, the controlling starter shall be equipped with a "Hand-OFF-AUTOMATIC (H-O-A) switch connected as directed by the Executive Director to provide required control. "Start-Stop" buttons shall be omitted. The above requirement shall not apply to controls for air compressors.

16-8.05 Motor Starters (Con't)

Unless otherwise indicated on Drawings or Specified, Controllers for Air Compressors shall be provided without push buttons or selector switch and shall operate directly through pressure device.

Where motor operated equipment is controlled by remotely located push buttons (not within same enclosure) a set of push buttons for parallel operation shall also be provided at starter location.

Where a unit of shop equipment (such as a polisher), includes an exhauster, or where the Drawings or Specifications indicate that it is essential that two motors start simultaneously, a starter (with proper trip device to protect motor) shall be furnished and installed for each motor. However, only one "Start-Stop" switch shall be furnished and installed at locatin selected by the Executive Director. Starters shall be wired and connected so that "Start-Stop" switch shall actuate all starters; and so that tripping of any starter will stop all motors.

Where the Drawings indicate the use of fuses at a starter, the combination starter specified shall be equipped with a fused disconnect switch.

As the model and type numbers of starter equipment and auxiliary equipment frequently change, all starter and auxiliary equipment shall be the latest approved equivalent of the manufacturers' catalog designation listed in the specifications. Prior to installing starter equipment the Contractor shall present, for the Executive Director's approval, lists of starters and auxiliary equipment to be supplied. The list shall indicate the following: location of starters, name of equipment to which starter is connected, horsepower of motor, manufacturer's catalog designation given in specification, latest manufacturers designation of approved equipment (if a change has been made by the manufacturer), rating of starter (in amperes and horsepower), number of thermal units, (one for each phase leg) size of thermal units, rating of switch (in amperes and hosepower), rating and other pertinent data of all auxiliary equipment such as resistances, compensators, etc.

Unless otherwise called for or required for a particular usage, motor starters shall be NEMA General Purpose Type in metal enclosure.

The following describes the motor starter and auxiliary equipment indicated by symbol exponents "A", "B", "C", etc., on the Drawings:

16-7.45 Receptacles (con't)

- (c) The following 50 Ampere, 250 volt, AC, 3 wire, single receptacle located in Protection Booth, when indicated on drawings. Faceplate shall be inscribed "Follow Spot".

Arrow Hart.....5709
Hubbell.....7974-G
Pass & Seymour.....5950

- (d) The following 20 amp-120 volt single receptacle with polarized slots for line and "U" shaped ground slot are approved for use as receptacle outlets. The receptacle plates shall be engraved "Maint." Only when the receptacle is shown with "VC" subscript on the symbol.

General Electric.....4102-1
Hubbell.....5361
Leviton.....5801
Pass & Seymour.....5361
Slater.....S330

- (e) Four Wire grounded receptacles shall be 20 ampere, twist lock, with fourth terminal grounded to box and shall be equal to the following:

Arrow Hart.....6440
Hubbell.....7410BG
Leviton.....1520R

- (f) Floor and table pedestal with receptacles shall be the equal of Russell and Stoll type FO, screw mounting and equipped with the following approved receptacles.

Arrow Hart.....52525
Bryant.....5252
Hubbell.....5262
Pass & Seymour.....5250

- (g) Weather proof receptacle shall be a three wire, grounded, 20 ampere, 125 volt duplex receptacle. This receptacle shall be corrosion resistant, and have a corrosion resistant, weatherproof lift lid cover similar to Hubbell Catalog #52CM22 or an approved equal. The receptacle shall be the approved equal of Hubbell 53CM62.

16-7.45 Receptacles (con't)

(h) GFCI receptacle shall be utilized for exterior receptacles and temporary light and power receptacles when the circuit in which these receptacles are connected are not protected by a GFCI circuit breaker back at the panel. These GFCI receptacles shall be the approved equal of the following types:

3M.....GFI2701
 Arrow Hart.....1591F
 Pass & Seymour.....1591F

These receptacles are 15 ampere, 125 volt receptacles.

16-7.46 Combination Outlets

(a) The following shall explain the letters--'C' - 'H', etc., used on the Drawings in connection with symbol for a combination outlet:

Type "C"--A duplex 15 ampere-3 wire receptacle, a 20 ampere tumbler switch and a pilot light with a 3 gang face plate as follows:

	Receptacle	Switch	Pilot Light Receptacle
Arrow Hart	5252S	1991	T-1720 Red
Bryant	5252	4901	427
Hubbell	5262	1221	432
Pass & Seymour	5250	20AC1	427

Type "H" --Consists of a 4-wire, 20 amp. 250 volt receptacle; a double pole 20 ampere, 250 volt switch, connected to open the two (2) "hot" wires to the receptacle; a pilot light with a 3 gang face plate as follows:

Arrow Hart	7250G	1542	1720
Bryant	7250G	5862	427
Hubbell	7250G	9816	432
Pass & Seymour	7250G	20AC2	427

Type "L"--A flush mounted double pole motor starting switch with overload protection (similar to Allen Bradley No. 600, Size C, Form 52, open type or Arrow Hart No. RL-21-U) and a three wire receptacle with appropriate face plate. The switch shall control the receptacle, and the switch shall be equipped with heater coils of proper rating to protect motor of portable equipment which is being used.

16-7.42 Momentary Contact Switches (con't)

Components shall consist of momentary contact switches the product of Arrow-Hart (A-H), and switch plates and mountings the product of Mulberry Metal Products (MMP), or approved equals.

Symbol

- S^C (A-H) No. BP3 (N.C. red button), No. 8947-40082720 (N.O. key); (MMP) No. X278-DE-302SS (w) AYP 2-gang plate, two 7/8" round openings, and two pairs of No. AYP plate mounting straps. Engrave plate, as required.
- S^{2E} Same assembly as for S^C. See schedule above for plate engraving.
- S^E (A-H) No. BP3 (N.C. red button) in (MMP) single gang, No. X78-DE-302SS (w) AYP with 7/8" round opening, and one pair of No. AYP plate mounting straps. Engrave plate "Emergency Stop".

This Contractor shall be responsible for the complete assembly of the above components for the respective switch functions. The switches shall be rigidly secured to the finished faceplate. Threaded escutcheon rings securing the outside of the switch components shall be epoxied to deter loosening of the switch components.

16-7.43 Face Plates

Face plates for switches and receptacles shall be stainless steel type 302 (18% chrome, 8% nickel), non-magnetic with satin finish, and shall be not less than .035 inch thick.

Screws for all face plates shall be the following non-tamperable type finished to match the plate. Omit Phillips and/or Rosette type screws. Screws for each project shall be uniform throughout.

- (a) A spanner oval head screw the equal of Arrow-Hart No. 2529, General Electric, Sierra Electric Corp., or Mulberry.
- (b) A key slot head screw the equal of Arrow-Hart No. 2525, or Sierra Electric Corp.
- (c) Deliver to the Custodian a minimum of six (6) screw head keys for each project.

16-7.44 Marking of Switch Plates

All marking on switch plates shall be deeply inscribed to maintain coloring material. Letters shall be colored with black enamel. Submit sample for approval before installation.

Switches controlling equipment other than building lights (such as signals, motors, heating devices, cooling devices, machine appliances and similar electrical equipment) shall be appropriately inscribed to indicate the equipment controlled.

16-7.45 Receptacles

Furnish and install where indicated on Drawings, the required receptacles as indicated by the symbols. Face plates for receptacles shall meet general requirements as specified for switch face plates.

Where a receptacle is indicated at same location as a switch, both shall be installed under same face plate.

All receptacles of the same type throughout the building shall be the product of one manufacturer.

1. Three Wire (Grounded) Receptacles

(a) These receptacles shall be 15 ampere, 125 volts with parallel slots for line and "U" shaped ground slot.

Approved Receptacles are:	Single	Duplex
Arrow Hart.....	5251	52425
Bryant.....	5251	5252
Circle F.....	2514	2515
Eagle.....	817B	827-B
General Electric.....	4044-1	4090-1
Hubbell.....	5261	5262
	5292	5242-S
Leviton.....	5015	5014
Pass & Seymour.....	5251	524Z
	S-321	3200
Slater.....		

(b) The following receptacles in Pre-Kindergarten and Kindergarten rooms shall be safety duplex type-3 wire-U ground. Color of receptacles shall be gray in these rooms.

Arrow Hart.....	6352
Hubbell.....	5G62
Pass & Seymour.....	SG62

16-7.40 Framing of Riser Diagrams (con't)

This Contractor shall furnish and install corrected drawings of all the above mentioned riser diagrams. Riser diagrams shall be on cloth and shall be installed behind glass faces in approved wooden frames. Riser diagrams shall be installed where and as directed by the Executive Director.

The Board of Education will lend the latest tracings of riser diagrams for reproduction purposes.

16-7.41 Switches

Switches for control of fixtures using fluorescent or incandescent lamps shall be as follows:

LO AMP - 120/277 V. A.C. SWITCHES

	Tumbler (Single Pole)	Type (Three Way)	Lock (Single Pole)	Type (Three Way)
Arrow	1991	1993	1541-L	1543-L
Hart				
Bryant	4901	4903	-----	-----
Circle F	3421	3423	-----	-----
General Electric	5921-1	5923-1	-----	-----
Hubbell	1221	1223	9815-I	9943-L
	1121	1123	-----	-----
Leviton	5521	5523	1121-L	1123-L
Pass & Seymour	20AC1	20AC3	-----	-----
Slater	740-BR	743-BR	740-LBOE 720-LBOE	743-LBOE 723-LBOE

All switches of the same type shall be the product of one manufacturer. Keys for lock type switches shall be interchangeable where possible. Furnish one key with each switch.

Horsepower Rated Switches.

16-7.41 Switches (con't)

These switches are to be furnished and installed at locations indicated on drawings (kitchen equipment, motors, etc.). The following switches are for a maximum of 1 HP, 1 phase and 3 phase. The equal of Arrow-Hart will be acceptable.

Two Pole.....A-H #6808F
 Three Pole.....A-H #7810F

Dimmer Switches are to be the equal of G.E. #DI-61 UL, 600 watts, 120 volts, solid state.

16-7.42 Momentary Contact Switches

Momentary contact switches to control electrically operated mechanically held relay controlled automatic switches shall be quick make, quick break type as per schedule below. Deliver two (2) keys for each lock switch installed.

Symbol	Location	Function	Plate Engraved
S ^C	Lighting Panels for Auditorium Assembly Room Large Group Areas.	Lights On; Red Button, N.C. Lights Off Key, N.O.	Aud. Lts. ON-OFF
S ^C	Lighting Panel For other areas Connected to the above areas by Folding Partitions	Same as above	Lunch Lts. ON-OFF
s ^{2E}	Shops, at Panel	Motors on Key, N.O. Motors off Red Button N.C.	Power ON-OFF
s ^E	Shops, emerg. Stations	Motors off Red Button N.C.	Emerg. Stop
s ^B	Oil Burner	"Power On" Black Button N.O. "Power Off" Red Button N.C.	"Asco" Cat. No. 173A36 Burner with Pilot Lt. & Nameplate

16-7.35 Electric Football Scoreboard (con't)

(g) Guarantee

Two year guarantee against defects in material and workmanship. Factory exchange service for parts in warranty. Furnish copy of warranty and operating instructions and maintenance manual.

16-7.36 Wiring of Interior Dial Telephone System

The Wiring for telephone system shall be installed as indicated on drawing between the exchange unit, the various interconnecting boxes and the telephone instruments.

- (1) All cables shall be equal to General Cable Company Thermo-plastic Telephone Cable, and shall have not less than .015 inch polyethylene insulation on each copper conductor, conductors shall be paired (two or three wire as required) twisted and cabled in concentric layers or units, protected by a wrapped crepe paper belt and .040 inch thermoplastic jacket over-all.

Conductors shall be not less than No. 22 gauge copper, of number of lines required by the drawings. Cable conductors shall be color coded.

- (2) Twisted triplex or duplex (as required by the system installed) No. 22 gauge conductor or line wire to each telephone shall have a high grade thermoplastic covering the equal of "Geon" not less than .025 inch insulation, solid annealed, plain copper and color coded.
- (3) In lieu of the above a twisted color coded two or three wire line of not less than 22-gauge solid copper with a minimum .015 vinyl or thermoplastic insulation on each conductor and with an overall plastic jacket of not less than .025-inch thickness.

Cable when called for on drawings shall be terminated at the IB (Interconnecting Boxes) on double locknut type connection blocks complete with fanning strips and mounting brackets equal to Western Electric Type 30 Block and No. 102 Adapters and No. 15 fanning strip. Above terminal strips not required in local boxes where drawings do not indicate cable, however where a transition is made from cable to individual lines, terminal strips shall be provided.

16-7.36 Wiring of Interior Dial Telephone System (con't)

All fanning strips shall be stamped or stenciled to identify cable conductors. Terminal strips shall be provided for all lines in the main terminal box, except where terminals in exchange equipment are of such type, that conductors are readily disconnectable. In this case the terminal box shall be retained as a pull box. Where a 3 wire system is employed a 3 wire terminal block shall be used. Wiring for each individual station shall be tagged in the Interconnecting Boxes to identify the room associated with same. Tags shall be of red fibre, properly inscribed with black India Ink and shall be attached to telephone wiring in an approved manner. Submit sample of tag and method of attachment for approval before installation.

16-7.37 Coloring of Conductors

The outer jackets of all bell, telephone, indicator, lecturer's signal, principal's buzzer or any other signal system conductors shall be distinctly and separately colored.

16-7.38 Cabling of Conductors

All conductors in the interconnecting boxes, shall be properly grouped and neatly cabled. Each system shall be separate.

16-7.39 Tags on Spare Conductors

All spare conductors shall be tagged with red fibre tags. Markings on tags shall be as directed and inscribed legibly using black India Ink.

16-7.40 Framing of Riser Diagrams

Corrected (as built) Riser Diagrams for "LIGHT AND POWER", "SOUND SYSTEMS", "CLOCK SYSTEMS", "TELEVISION DISTRIBUTION SYSTEM", etc., shall be installed by this Contractor.

It is essential that framed riser diagrams show true field condition. Therefore, it shall be the obligation of the Contractor to carefully check each riser diagram and note all changes of conduit runs, location of equipment, conductor arrangements and connections.

16-7.34 Scoreboards (con't)

(d) Score Units

The numeral blocks for the score units shall be similar to those furnished for the clock. The stepping relays for the score numeral shall be housed in metal containers in the cabinet. The relays shall be of the plug-in type. Color of score numerals lamps, orange.

(e) Periods

The periods shall be indicated by 6" translucent colored disks numbered 1 to 4.

(f) Control Panel

The control panel shall be made of aluminum with 10 feet of flexible cord and heavy duty multi-pin connectors. Where two scoreboards are to be run simultaneously, panel shall be "dual control" each control in same phase and polarized.

Panel shall have heavy duty labeled switches to operate and reset clock and horn automatically, sound horn, advance or correct scores and period progressively. Furnish heavy duty multi-pin receptacles for wall or floor box mounting and PVC plastic insulated multi-conductor control cable to connect points with scoreboard.

(g) Horn

Provide loud 120-volt, buzzer-type vibrating horn, in each scoreboard to sound automatically at the end of periods, or at will by push button from the control panel.

(h) Guarantee

Guarantee to provide for 100 percent replacement of defective parts or workmanship for minimum of one year shall be furnished. Furnish copy of warranty together with operating instructions and maintenance manual.

16-7.35 Electric Football Scoreboard

(a) Scope

- (1) Furnish and install an electrical low voltage, remote controlled football scoreboard at the location shown Site Plan. Scoreboard shall show Home and Guests "Score", "Downs", "Quarter", "Time", "Yards to Go", and "Ball on". The scoreboard shall also be provided with the following optional features; 32" x 18'-0" presentation panel, dimmer control, horn and track conversion. Scoreboard shall be installed as per manufacturers recommendation.
- (2) Scoreboard shall be 8'-0" high by 18'-0" long (dimensions excluding presentation panel). It shall be All American Scoreboard No. F-718S or approved equal.

(b) Construction

Non-rusting 7" extruded aluminum case, .078 gauge, heli arc welded corners. Faceplates are 22 gauge, galvaneal with non-glare lacquered finish. Color is dark blue with white striping around border and timer.

(c) Numeral Units

Lighted numeral blocks shall be in banks of bulbs, four across and seven high each with aluminum reflectors. All bulbs shall be 15 watt frosted for daytime use of scoreboard. Time numerals shall be 28" high, all other shall be 22" high.

(d) Controls

Low voltage, remote control from field, press box or as shown on Drawing E-802. Control console shall be of metal and die formed plastic, with angled face and recessed mounted push button.

(e) Installation

Scoreboard shall be completely wired, ready to be mounted to two (8") structural steel eye beams as shown on architectural Drawing 101. Furnish grounding of scoreboard and structural supports with ground rods as required by the New York City Electrical Code. Control cable shall be supplied with the scoreboard, the exact length is to be determined by the Electrical Contractor.

(f) Power Supply

Scoreboard shall be wired for 120 volts, and having a maximum operating current of 34 amperes.

16-7.32 Wiring for Signal Systems (con't)

Install in each interconnecting box the required number of terminal blocks. Terminal blocks shall be Square "D" Class 9080 with type "CA" lugs or the equivalent by Allen Bradley or Buchanan. Channel mounting tracks shall be approximately 12 inches long. Install required number of lugs plus 10% spares or a minimum of twenty lugs whichever is the greater.

Signal system conductors entering interconnecting boxes need not be connected to terminal blocks, unless said conductors require tapping or splicing, in which case connections shall be made on terminal blocks.

Conductors in interconnecting box, not requiring connection to terminal blocks shall be suitably identified by attachment of red fibre tags properly inscribed with black India ink. Submit sample of tag with inscription and method of attachment before installation.

Furnish an approved marking strip on terminal block. Terminals on strip shall be inscribed with Arabic numerals. Install a directory frame on back of door of I.B. denoting locations of equipment connected to the various lugs on block with cross reference to Arabic numerals.

Directory shall be similar to that specified for panelboards.

16-7.33 Wiring of Indicator System

Copper conductors for the Indicator System shall be of number, size and arrangement indicated on the Drawings and on the Standard Detail Drawings.

Section plate, terminal plates, relays, etc., shall be installed in the Indicator Interconnecting Box in accordance with Drawing 753N, on the Standard Details.

Power supply shall be obtained from the Bell Transformer Board. Conductors to push buttons on fence shall be No. 14 neoprene covered and installed in a 3/4 inch conduit.

16-7.34 Scoreboards

Electrical Contractor shall furnish and install the following type scoreboards in High Schools.

1. Electrical Basketball Scoreboard

(a) Furnish and install on the walls of the Main Gymnasium, at height and location shown on drawings, and as hereinafter specified basketball scoreboard(s) complete with cabinets, control panel, multi-conductor control cable, conduit and wiring and angle-iron supports and brackets for wall mounting. The scoreboards shall be designed for sychronized operation from one control panel. Scoreboard shall be Nevco 60 FNT, or approved equal, designed for operation on 115V, AC, 15 amp service.

(b) Cabinet

The cabinet shall be constructed of aluminum alloy with fully enclosed back. All equipment shall be front accessible. Score blocks shall have numerals 13 inches high, with 7 lamps high and 4 lamps wide. The cabinet shall have panels with signs denoting "minutes", "seconds", "home", "visitors", "bonus". Signs shall be lighted from the rear and shall be of translucent plexiglas with white letters and black background. Cabinet shall be aluminum with dull black lacquer finish. Approximate dimensions of scoreboards to be 54" long, 60" high and 7-1/2" deep.

(c) Clock

The clock shall indicate the time remaining to play by four numeral blocks. Each numeral block shall be 13 inches high, with 7 lamps high and 4 lamps wide. Each block shall be provided with 28, 7-1/2 watt red lamps.

The clock mechanism shall be designed to read 0:00, ten minute movement, reading 9:59 after one second operation timed to diminish by seconds until reaching 0:00. Clock shall be quickly set from the control panel for any minute of play within the limits of the movement. The impulse mechanism shall be in the control panel. The clockpac including the stepping relays shall be housed in metal containers in the cabinet. The clockpac and relays shall be of the plug-in type.

16-7.29 Refrigeration and Freezer Walk-in Type (con't)

The Electrical Contractor shall provide a buzzer, red pilot light, flasher, and a 3 pole, double throw switch, control relay with a normally open and normally closed contact, in a flush mounted box with stainless steel face plate. Engrave face plate "HIGH TEMP ALARM".

If all devices are designed for 24 volts A.C. redirect 120 volt AC from 24 hour Panel to Bell Transformer Board (See Par. 16-9.18).

16-7.30 Gas Valves (Wiring)

- (a) Where Drawings indicate the use of gas valves, the gas valves will be installed by others.

This Contractor shall furnish and install all equipment (relays, push buttons, wire, conduit, etc.) for control of gas valves.

All conduits, boxes, couplings, etc., within the enclosure housing the gas valve shall be of the explosion proof type and shall be installed in accordance with Standard Detail Drawing No. 825. Sealing conduit fittings shall be filled with "Chico A" and "Chico X" fibre as indicated on Drawings and as directed.

Furnish and install a momentary contact switch operated relay and a rectifier in a steel cabinet. Panel shall be the approved equal of Automatic Switch Co., Bulletin 108-B-10C, 2 pole, normally open, 3 wire control. Rectifier shall be selenium type. The output shall be not less than the D.C. current necessary to operate and hold plunger without noise at rated D.C. voltage of gas valve. Electrical Contractor shall consult Plumbing and Drainage Contractor and obtain all necessary information regarding current, voltage, etc., and shall have rectifier and relay designed and made accordingly.

This model shall include the following features:

1. The diodes used in the rectifier bridge shall be transient voltage protected.
2. The relay shall provide automatic shut-off of gas supply in the event of voltage failure.

All equipment shall be enclosed in a flush galvanized steel cabinet, with door having approved hinges equipped with two or three Phillip's head screws through door and rabbet. Door and trim shall have a prime coat of white paint. Stencil the words "GAS VALVE RELAY" on inside of door of cabinet.

16-7.30 Gas Valves (Wiring) (con't)

(b) Momentary Contact Switch

Momentary Contact Switch for operation of each relay shall consist of combination of one normally-open, key-operated contact, and one normally-closed push button operated contact, the approved equal of Arrow-Hart No. BP3 (N.C. red button), No. 8947-400/82720 (N.O. Key); Mulberry Metal Products No. 2BDE-302SS, 2-gang plate, two 7/8" round openings, and 2 pairs of No. AYP plate mounting straps. Engrave plate, as specified. Assemble components as described as required.

The key-operated, normally-open contact shall control the circuit which opens the gas valve. The normally-closed, push-button operated contact shall control the circuit which closes the gas valve. See Standard Details--Latest Edition.

Faceplate shall be inscribed with the word "GAS VALVE CONTROL" at top of plate; and word "OPEN over keyhole; and "SHUT" over push button.

Furnish and deliver three keys for each momentary contact switch to the Custodian at the school.

16-7.31 Wiring of Automatic Controls

This Contractor shall furnish and install wiring and make all connections between motor starters and automatic controls, such as float switches, aquastats, pressure switches, etc., when these devices are furnished under other contracts.

Where the Drawings or Specifications require the Electric Contractor to furnish pressure switches or other control devices, he shall also install said devices and make all connections between these units and the equipment controlled.

16-7.32 Wiring for Signal Systems

Wiring of Program Signal System--Program Signalling shall be accomplished through the Sound System as described in Section 16-19 "Sound System".

Auxiliary Program Signal System shall be wired as indicated to accomplish signalling as described in Section 16-9 Signal Systems.

16-7.25 Wiring for Equipment in Kitchens or Warming Pantry (con't)

Install matching plug on all equipment to fit receptacle provided by others, for equipment having a portable cord attachment.

For all equipment, refer to Standard Detail Drawings, latest edition.

16-7.26 Dishwasher Unit

- (a) Others will install a dishwashing machine with various motors for pre-wash pump, wash pump, conveyor and an electric heater for wash tank. This equipment is dependent upon the type of machine installed by another contractor. Drawings will indicate the approximate horsepower, phases, voltage of motors and heaters.

This Contractor shall install a Control Panel consisting of motor starters, circuit breakers, contractors, switches, control buttons and indicating lights with all wiring required for this equipment, for the proper control and operation in accordance with the Standard Detail Drawings.

Internal wiring on the machine will be done by the manufacturer of the dishwashing unit, and brought to a terminal box; and the Contractor shall verify all connections, etc. with equipment manufacturer.

- (b) Booster Circulating Pump

Where the Drawings indicate a booster circulating pump it will be installed in connection with the dishwasher, the pump will be furnished and installed by others. The Contractor for Electrical Work shall perform all wiring in accordance with the Standard Detail Drawings, making all connections complete.

16-7.27 Refrigerated Cold Pan

The refrigerated cold pan, when installed, will be equipped by others with a motor operated compressor, switch with pilot light, temperature control equipment, etc.

The Contractor for Electric Work shall install the following:

- (a) A Disconnect switch at location indicated on the Drawings.
- (b) All conduits and conductors to interconnect all of the cold pan equipment (the disconnect switch, switches on cabinet, motor, pilot light, temperature control equipment, etc.).

16-7.28 Steam Jacketed Kettle

A steam jacketed kettle equipped with heater units, thermostat, and low water cutout, all completely wired and interconnected with conductors terminating in an outlet box on the equipment shall be furnished by others. A relay (for thermostatic control of power to kettle) will also be furnished by the Contractor furnishing the kettle.

The Contractor for Electric Work shall perform the following work:

- (a) Mount the relay on the wall at a location selected by the Executive Director.
- (b) The Contractor for Kitchen Equipment shall furnish a wiring diagram approved by the Executive Director.
- (c) Install at location indicated on the Drawings a 3-pole circuit breaker in a box covered by a flush plate, and make all connections complete.

16-7.29 Refrigeration and Freezer Walk-in Type

- (a) Where a Refrigerator and Freezer Walk-in Type is indicated on drawings, the Electrical Contractor shall furnish, install and make all connections complete as required by the Drawings and standard details applicable thereto in cooperation with the Contractor for Kitchen and Cafeteria equipment.

Where possible all work shall be installed concealed within insulated walls during fabrication.

In general all conduit shall be hot-dipped galvanized with cast iron boxes and with joints sealed for a vapor tight installation. All wiring within enclosures shall be U Use Type.

At all locations where conduit penetrates enclosing surfaces of refrigerator, this Contractor shall install an insulating bushing or nipple, length as required. Between nearest adjoining outlet boxes on both sides of insulating fitting, this Contractor shall install a No. 12 wire to serve as a grounding jumper across insulating fitting. Grounding jumper wire shall be connected to outlet boxes.

- (b) High Temperature Freezer Alarm

Where indicated, others will provide a high temperature contacting making device (Alarm Thermostat).

16-7.22 Elevator Wiring (Passenger-Freight-Dumbwaiters) Electric or Hydraulic (con't)

All power wiring beyond controller and all signal and control wiring will be part of elevator contract. All work shall be done in an approved manner in cooperation with elevator Contractors.

16-7.23 Oil Burner Equipment

(a) Remote Control Switch

The Electrical Contractor shall furnish and install, where indicated on drawings, an enclosed triple pole, 208 volt, 3 phase Automatic Switch Co., Bulletin No. 911-228DB, Zenith Elec. Series 6 MH or Russell Company RMS-X2 or other approved electrically operated and mechanically held relay controlled switch.

This remote control switch shall have a close differential voltage sensing relay to provide monitoring of control circuitry and for indication of low voltage conditions. The control circuitry shall be used, size as required, and operated at 120 volts, 60 HZ. All connection terminals on remote control switches shall be suitably marked, including line and load connections. Control circuit shall operate on 120 volts and reconnected so that switch will open on control circuit failure. Remotely controlled switch shall be provided with an open-close push button and pilot light, mounted in cover of switch box, and arranged to electrically open or reset the remotely controlled switch. Rating of switch shall be based on full connected load of heating equipment; and switch shall be adequate for the purpose employed and shall not overheat. Switch cabinet shall have hinged door and snap catch.

(b) Emergency Push Button Stations (Break Glass)

The Electrical Contractor shall furnish and install the number of normally closed push button type, momentary contact emergency switches. (A.S.C.O. No. 124S5 or approved equal) in order to operate this switch, where shown on drawings.

Emergency push button shall be arranged to open relay circuit when glass in cover of enclosure is broken, disconnecting all current from panelboard. Button of emergency switch shall be made of metal. Emergency switch shall be enclosed in heavy housing with glass and screw cover.

Housing shall be cast surface type for unfinished locations and cast or moulded flush type for finished locations. A hammer and chain or other device for breaking the glass shall be provided. Cover of enclosure shall have cast or engraved thereon in contrasting color the following large wording: "To Stop Oil Burners, Break Glass". Enclosure, hammer, etc., shall be enameled Fire Department red. The emergency switch shall be so wired that the switch will remain open and reset button remain ineffective until glass is replaced.

16-7.23 Oil Burner Equipment (con't)

Furnish total two (2) spare glass replacements for above stations and deliver to Custodian.

(c) Wiring

The Contractor's attention is called to the fact that he must furnish, install and connect the following:

All conduits and conductors between Push Button Emergency Switches and Remote Control Switch; between Heating Equipment Power Panelboard and each Oil Burner Control Panel, Pump and Heater Unit, Electric Suction (oil) Stub Heaters, Air Compressors and/or other equipment indicated on drawings.

16-7.24 Wiring of Vacuum Pumps

The Contractor for HVAC will install a vacuum pump unit completely wired and connected with all wiring terminating in a combination starter and safety switch. This Contractor shall install wiring to switches (by others) and make all connections complete.

16-7.25 Wiring for Equipment in Kitchens or Warming Pantry

All conduits, boxes, fittings, conductors, connections, etc., required to accomplish a finished installation shall be installed by this Contractor as a part of this Contract. Conductors from the panelboard shall NOT be installed until the equipment is permanently fastened into place.

In general all equipment will be delivered with internal wiring complete to a terminating junction box on equipment. Connections to equipment shall be performed in accordance with directions of the Executive Director's representative at the school. Any additional labor or material required to accomplish a complete and operating installation shall be supplied by the Contractor for Electric Work as a part of this Contract.

Dimensions of rising points of conduits, heights of switches and receptacles, etc., as indicated on the Electrical Drawings are approximate only and may vary for the equipment to be installed. Prior to installing electrical equipment in walls or floor of school, this Contractor shall consult the Executive Director's representatives at the school, and obtain exact information regarding the location of the rising point of each conduit, the height of each receptacle, switch, etc.

The Drawings indicate the approximate horsepower rating and number of phases of motors, power ratings of heaters, operating voltage, etc., for all equipment.

16-7.19 Motor Branch Circuit Wiring

Unless otherwise specified or indicated on the Drawings, motors will be furnished and installed by others. Horsepower ratings of motors will be as indicated and shall be polyphase unless otherwise noted.

Except where the Drawings or Specifications indicate otherwise, this Contractor shall install all wiring and conduits to all motors indicated on the Drawings. This Contractor shall also install all local switches, switch cabinets and controlling devices and shall make all connections to switches, controlling devices and motors complete.

Where the Drawings indicate the installation of Grinders or Polishing Units, or where motor driven equipment equipped with electric lighting reflectors are installed (in Shops, Custodian's Workshop, etc.) either by this Contractor or by other Contractors, the Contractor for Electric Work shall install proper and sufficient wiring and connections to provide a 120 volt circuit from the panelboard to each lamp. Where machine is equipped with an exhaust fan, lamps shall be connected to the load side of the starter for the exhaust fan.

Conductors in conduits terminating in "Short Radius Elbows" shall be installed when directed.

Unless otherwise indicated on the Drawings or in the Specifications, all conductors from panelboards to shop motors shall be installed by this Contractor, and all connections completely made. Unless otherwise indicated on drawings or specified, branch circuit wiring to motor operated shop equipment (except Laboratories etc.) shall terminate in junction boxes near equipment. Leave slack in junction boxes for splices and taping. Motor starting and control devices will be furnished and installed by others.

The Contractor shall obtain all wiring diagrams and other information furnished by the manufacturer of the machine.

Where wound rotor motors are installed, secondary conductors of required size shall be installed by this Contractor between the control equipment and the motor secondary.

Where Drawings indicate connections to solenoid operated valves, this Contractor shall install all conduits and conductors, and make all connections complete at the valves and starters. Solenoid valves shall be connected to the load side of the motor starter.

16-7.19 Motor Branch Circuit Wiring (con't)

Conductors used for push-buttons or other controlling devices may be #14 gauge copper.

Size of conductors, conduit, switches, fuse and/or circuit breaker trip ratings will be as indicated on Drawings.

16-7.20 Wiring for Motor Operated Partition

When an electrically operated partition is required the Electrical Contractor shall provide all necessary wiring and connections for the motor operated partition. Others will provide motor, motor controlling devices, limit switches, key operated switch, etc. This Contractor shall include mounting of any or all electrical devices not attached to equipment and shall provide all outlet boxes required by those devices.

16-7.21 Wiring of Metal & Electric Shop Disconnect (Wiring Booth)

Furnish and install at location indicated on drawing a 120/208 volt, 30 amperes, two (2) pole, safety switch, with solid neutral the equal of Square "D" No. D221.

Furnish and install a pull box, 8" high x 6" deep with hinged cover, 1/2" and 3/4" knock outs, with four (4) 15 amp. fused (Fusetrons) circuit cutout blocks, neutral type. This pullbox shall be located below the aforementioned safety switch and attached to the switch by a 3/4" x 10" long nipple connection.

16-7.22 Elevator Wiring (Passenger-Freight-Dumbwaiters) Electric or Hydraulic

When indicated on drawings, Electric Contractor shall provide power wiring terminating in main line disconnect switch at elevator control equipment. This Contractor shall locate this disconnect switch immediately adjacent to the door in the Elevator Control Room. This Contractor shall also extend power wiring from disconnect switch to terminals of elevator controller and shall furnish and install the following:

- (1) A 120 volt circuit to trailer cable outlet for car light (except sidewalk type).
- (2) A trailer cable outlet for building system telephone (where shown on drawings).
- (3) A light with a receptacle, controlled by a switch shall be located in the PIT.
- (4) A box (as described in Par. 16-6.19), located at sidewalk level, is to receive a receptacle by others for pushbutton control cable and from sidewalk box extend empty conduit, 3/4" in size, to box in shaft as directed. This shall be required installation when sidewalk type elevators are called for on plans.

16-8.05 Motor Starters (Con't)

Symbol "A"- This is a manual motor starting switch providing overload protection for a fractional horsepower single phase A.C. motor. Starter shall be mounted in a switchbox and shall be fitted with a suitable switchplate. In unfinished areas a type "FS" or an approved pressed steel box shall be used. Plates shall be engraved with the designation of the motor controlled.

Approved starters are: Allis-Chalmers--Class XMF, Furnace 10BAL, Cutler Hammer 9101, Klockner Moller PKZM, LTE-Class 211, Square D-2510, Federal Pacific Class 4003, Allan-Bradley.

Symbol "B"- (1/2-5HP)- An enclosed combination starter consisting of an unfused (unless otherwise called for)externally operated motor circuit switch and a triple-pole magnetic switch equipped with three thermal overload relays and a "Start" and a "Stop" push button station in the cover, providing overload and undervoltage protection.

Where a Sybmol "B" starter is indicated and a notation "WD" is affixed, the disconnect switch shall be omitted.

Approved starters are: Allis-Chalmers-Clas XCB-OB, XCN-OB-1; GE TYPE CR 208B, 208C; Furnace-Line 17-0, Line 17-1; Cutler Hammer-A30 BG (for 0 to 2 HP) A30CG (for 2 1/2 HP to 5 HP); Klockner-Mueller MC-41/FS/Z; ITE-Class A30; Federal Pacific-Class 4204, Square D-8538; Allan-Bradley.

Symbol "C" -(6-10 HP)-Enclosed combination starter, consisting of an unfused, externally operated motor circuit switch (rated 10 HP) and a triple-pole (50 ampere contactor), magnetic switch equipped with three thermal overload relays, barriers, and a "Start" and "Stop" push button station, providing undervoltage and overload protection.

Approved starters are: Allis-Chalmers-XCN-2B; GE-CR-208D; Furnace 17-2; Cutler Hammer-A30DG; Klockner Moeller-MZV-22/FS/Z; ITE-Class A30; Square D-8538, Size 2; Federal Pacific-Class 4204 (Size 1); Allan-Bradley.

16-8.05 Motor Starters (Con't)

Symbol "D"- (11-25 HP)-Enclosed combination starter consisting of an unfused externally operated motor circuit switch (rated 25 HP) and a triple-pole magnetic switch equipped with arc chutes, three thermal overload relays, and a "Start" and "Stop" push button station, providing undervoltage and overload protection.

Approved starters are: Allis-Chalmers-XCB-3B; GE-CR-208E; Furnace-17-3; Cutler Hammer-A30EG; Klockner Moeller-M3-22/FS/Z; ITE-Class A30; Square D-8538, Size 3; Federal Pacific-Class 4204, Size 2; Allan-Bradley.

Symbol "E"- Manually operated, reduced voltage, resistance motor starter, complete with "Safety Stop" push button, three thermal overload relays providing undervoltage and overload protection.

Approved Starters are: Allis-Chalmers-Class MRVA, Cutler Hammer-A600, Allan-Bradley.

Symbol "F" -An automatic reduced voltage auto-transformer motor starter. Where no other auxiliary actuating apparatus is to be installed, a "Start" and "Stop" push button station shall be installed, with automatic motor starter. This motor starter shall give overload protection, undervoltage protection where used with push button station, three thermal overload relays and undervoltage release where used with other auxiliary actuating apparatus (pressure regulator, float switch, etc.)

Approved starters are: Allis-Chalmers-Class RVA; Furnace-36 Class; Cutler Hammer-A 400; Klockner Moeller-AT/Z; Square D-Type 8606 or an approved equal; Allan-Bradley.

Symbol "J"- (26-40 HP)-A full voltage triple-pole magnetic switch equipped with arc chutes, thermal overload relays and a "Start" and "Stop" push button station.

Approved starters are: Allis-Chalmers- XL-4B, GE-CR-206F; Furnace Class 14; Cutler Hammer-A10FG; Klockner Moeller-DIL-6-22Z; Square D-8536 or an approved equal.

16-8.05 Motor Starters (Con't)

Symbol "K" - A manually operated, by lever or other approved means, manual starter with thermal overload relays, when overload will cause starter to open.

Approved starters are: Allis-Chalmers-XMI; Furnace-Class II-LVP; Cutler-Hammer-9115; Klockner Moeller (Nema Size 0, to 1 HP)-PKZM3 + H3, (Nema Size 1, 2 HP) - PKZM3 + H3; ITE Class C20; Square D-2510; Allan-Bradley.

Symbol "K" starter ratings shall be not less than the following:

<u>Poles</u>	<u>Nema Size</u>	<u>Max. Motor HP</u>	<u>Voltage</u>	<u>Phase</u>
2	0	1/2	115-120	1
2	0		208-220	1
3	0	1	208-220	3
3	1	2	208-220	3

Symbol "R" - The type R starters for shop equipment shall be similar to magnetic starters specified for motors of the same horsepower rating, except that separate "start-stop" push button stations shall be provided, and disconnect switches shall be omitted. Push button stations shall be approved equipment of the same manufacture as the starting equipment. Submit sample of push button for approval before installation.

Where the Drawings indicate a type "R" starter "in Shops and at other locations" controlling a single phase motor, starters shall be Allen-Bradley Magnetic Type, Bulletin 709-SP, GE-Type CR-200 line; Furnace-14 line, Cutler Hammer A10BG; Klockner Moeller DI L/Z; ITE-Class A20; Square D-8536.

Push buttons shall be installed on motor operated equipment, or on adjacent structure or equipment at location selected by the Executive Director and shall be within easy reach of the machine operator.

Type R starters unless otherwise noted shall be securely mounted on walls approximately 5'-0" above floor.

16-8.05 Motor Starters (Con't)

Symbol "RX" Whenever the symbol "RX" appears on the Drawings, the starter shall be type "R" as described above (with separate push button control mounted on machine) and shall include an externally operable disconnect switch as described for magnetic starters (Symbol B,C, or D) of the same horsepower. Starter and switch shall be in the same enclosure, except where space limitations prevent installation of cabinet.

Symbol "RP" Whenever the symbol "RP" appears on the drawings the starter shall be similar to type R except that start-stop buttons shall be in cover.

16-8.06 HVAC Blower Units

(a) Electrical Contractor shall provide connections thru a normally open auxiliary contact in motor starters, indicated on drawings, for ventilating equipment and their respective filter motor timer control to effect the following:

- (1) Filter motor to operate thru timer control when blower motor operates.
- (2) Thermostat to shut down blower motor. It shall be restarted by push button.
- (3) Solenoid valve for damper operation shall be connected to loadside of blower motor.

(b) Thermostats furnished and installed by others shall be connected by this Contractor to ventilating motors indicated on drawings. When these thermostats are energized they shall shut down their respective motors. They shall be restarted by starter push-button.

(c) Duct type Heat Detectors, and Smoke Detectors, furnished this Contractor and installed by the Heating & Ventilating Contractor, shall be wired by this Contractor. The operation of the detector shall shut down the ventilating motor. They shall be restarted by starter push button.

Heat Detector shall be an hermetically sealed stainless steel tube, with normally closed contacts, the approved equal of Fenwall #27120. Temperature rating shall be as required by the latest edition of the N.Y. City Building Code.

16-8.07 Mounting of Starters for Roof Motors

In general, roof fan motor circuit wiring is run to starters in grouped locations. Starters shall be mounted on a substantial steel framework where shown on Drawings.

When required, pilot light assemblies shall be the type manufactured by the Dialight Corporation No. 95408-931 with an 18,000 ohm built-in resistor for 125 volt circuits and with a 56,000 ohm built-in resistor for 250 volt circuits. Use an NE-51H 125 volt neon lamp in each unit. The complete unit shall be installed in a handy (utility) box nipped to the starter enclosure, or where sufficient space is available pilot light assembly may be installed in the covers of respective starters and connections made with No. 16 AWG flexible conductors.

16-8.08 Alternator for Motors

Wherever the Drawings indicate the use of an alternator in connection with motors (usually ejector pump or sump pump motors), this Contractor shall furnish and install an alternator meeting the following specifications:

Alternator shall be Square "D" Class 9039 Type PG alternator, Federal 820A00, or the approved equal by Allen-Bradley Co. or Westinghouse Electric Co., consisting of three magnetic contactors for 208 volts, 60 Hz, A.C., enclosed in a general purpose sheet steel case. Alternator shall be designed so that pumps shall be started alternately by the operation of the low level float switch. The closing of the high level float switch shall cause both pumps to operate simultaneously. The control circuits of the pump motor starters shall be kept electrically independent. Alternator and starters shall be wired in accordance with an approved manufacturers wiring diagram. Submit wiring diagram for approval before installation of alternator.

Alternator may combine motor starters, disconnects and alternator in common enclosure.

16-8.09 Starters for Warming Pantry Exhausters

This starter shall contain a control relay, 120 volt, 3 normally open contacts and shall be the approved equal of Square D, Class 8501. This relay shall operate in accordance with the drawings. Delete requirement for auxiliary contact shown on Standard Detail #825 for the control of solenoid operated main gas valve.

16-8.10 Motor Control Centers - Construction

Motor control centers shall be designed similar to Section 16-4.22, Panelboard Cabinet, of the standard specification. Control Centers shall be wall mounted, unless otherwise indicated on plans.

All devices, terminals and wiring shall be mounted inside cabinet, with single door construction. Pilot lights, start-stop push buttons, tumbler switches and levers for type "K" starters, open type, shall extend thru suitable cutouts on cabinet doors.

Nameplates shall be furnished and installed on the door for each tumbler switch, starter or start-stop push button with proper designations as indicated on plans.

The height of the motor control center shall be no more than 8'-0", not including pull box, from finished floor. A pull box shall be provided at the top of the control center. Pull box and method of supporting conductors shall be similar, as described for distribution board. A wiring trough shall be provided at the bottom of the control center.

Cabinets shall be painted a gray enamel.

SECTIONS 16-9, SIGNAL SYSTEMS

16-9.01 Furnish and install all Signalling and associated equipment indicated on the drawings and/or described in this section.

16-9.02 Raceways and Conductors

For conduits, boxes, fittings, etc., see Section 16-5, 16-6 for conductors see Section 16-7.

16-9.03 Buzzers

Buzzers shall be of the contactless, vibratory A.C. type, mounted on a sub-plate and arranged for mounting on a one or two-gang plaster cover which shall be mounted on a 4-inch square outlet box. Current consumption shall not exceed 500 milliamperes at 24 volts. Terminals of conductors within each buzzer shall be soldered to the screw type terminals by the buzzer manufacturer. Buzzer terminals shall be equipped with cup washers or wire retaining ears. Each buzzer shall be covered by an approved type 302 stainless steel excutcheon plate equipped with louvres or a dustproof wire grille or perforated plate. Face plates shall be finished as selected.

Acceptable Equipment--The following equipment is acceptable: Edwards Cat. No. 8983; Auth. No. 512-4 or the equal by Federal or other approved manufacturer.

16-9.04 Horns

All horns shall be of the contactless vibratory type, complete with appropriate back box, suitable for flush or surface mounting as required.

All horns mounted within the building shall have a sprayed finish on visible metal parts.

All horns shall be equipped with screw type terminals to which terminals of internal wires (of horn) shall be soldered by the manufacturer of the horn.

Horns shall be the equal of Federal 350, Edwards 370 or Auth 1350 for 24 volt AC operation. Each horn shall be furnished complete with approved grille and enclosure accessories.

16-9.04 Horns (Con't)

Horns in general shall be installed flush in new buildings and in new construction of existing buildings.

In alteration work where surface raceways are used a surface mounted housing shall be used.

Horns for mounting outside building (marked WP) shall be of weather proof design with cast aluminum housing.

16-9.05 Bells

When specifically required by the drawings or the Amendments install bells meeting the following specifications:

(a) Small Bells (4 and 6-inch).

Bells shall be the A.C. type and shall operate on 22-28 volts with a current consumption not exceeding 200 milli-amps. Terminals of all wires shall be soldered to their respective binding posts by the manufacturer of the bell. Bells shall be Edwards No. 8340, Auth, Federal or equal.

(b) Large Bells (10-inch and larger)

Larger bells shall operate on 22-28 volts alternating current with a current consumption not exceeding 500 milli-amps. Terminals of all wires shall be soldered to their respective binding posts by the manufacturer of the bell. Large bells shall be of the polarized type of Edwards, Auth or Federal or equal.

16-9.06 Custodian's Indicator System

Furnish and install the indicator equipment indicated on the Drawings and/or hereinafter listed, at locations indicated on the Drawings. Equipment shall be wired in accordance with Standard Detail Drawing 756B on Standard Detail Sheet E-1.

In the Custodian's Office:

One 8-drop (or more as required) indicator (flush mounted) unless otherwise indicated, with electric reset.

One push-button and two cut-off switches in three gang box.

16-9.06 Custodian's Indicator System (Con't)

In Boiler Room (Con't)

One buzzer, the equal of Auth No. 512-4 mounted near the indicator.

In Boiler Room:

One 8-drop (or more as required) indicator (flush or Surface Mounted) unless otherwise indicated, with electric reset.

Indicator interconnecting box bell control relay. See Drawing No. 753P for construction of box.

One horn as specified.

Provide engraved brass section plates with multiple hexagonal nut terminals in Indicator Interconnecting Box as indicated on Standard Detail Drawing 753P.

Indicators shall be the product of Auth or Edwards or other approved manufacturer.

16-9.07 Push-buttons at Entrances

Push-button plates at entrances shall be of solid bronze, mounted with rubber or Neoprene gasket and brass machine screws on the box hereinbefore specified. Push-button mechanism shall consist of an Arrow-Hart switch No. 3592 mounted on a bracket affixed to the back of the face plate. Heavy turned bronze operating plunger with pigskin ring gasket shall project through plate and actuate the push-button mechanism. Bottom plate shall be equal to Auth No. 120 or Edwards 8787A. Finish shall be as selected.

16-9.08 Sump or Ejector Connection

Where the Drawings or the Amendments indicate that a sump-pump and/or an ejector pump is installed in a school, the alarm float switch of the sump and/or ejector shall be connected to spare drop on the indicator panel to act as a high sump or high ejector alarm. Drops shall be appropriately marked "HIGH SUMP" or "HIGH EJECTOR".

Indicator drops operating on continuous ringing circuits such as sump or ejector alarms shall have a thermal time delay, rated at ten (10) seconds. This relay shall be as manufactured by Amperite No. 26C10T or equal.

16-9.09 Auxiliary Program Signal System

When required by the Drawings or the Amendments, certain bells of the Custodian's Indicator System and certain additional horns and/or bells indicated on the Drawings shall be connected to a group of momentary contact switches in General Office to act as an Auxiliary Program Signal System.

16-9.10 Push Buttons of Auxiliary Program Signal System

Install in the General Office at location indicated on the drawings, a group of momentary contact switches to operate horns, bells and buzzers at distributed locations throughout the building. The exact number of momentary contact switches to be installed are shown on the drawings. All momentary contact switches shall be of the heavy duty type capable of carrying at least 10 amperes.

Momentary contact switches shall be Cutler-Hammer Bulletin No. 10250 or equal by Arrow-Hart or Allen-Bradley. The number of open and closed contacts on each push button shall be appropriate for the function to be performed, as indicated by the wiring diagram on the Drawings. Buttons shall be black and shall be unmarked.

Switches shall be designed for installation in a suitable flush mounted box supplied by the manufacturer assembling the equipment. Boxes set in plaster walls shall be designed so that space between plaster and box will be covered by a face plate. Where number of switches is 4 or less, gang box shall be used; for more than 4 switches, use double tandem gang box.

One momentary contact switch shall operate all of the indicator horns and bells throughout the building through a relay in the Indicator interconnecting Box, regardless of the position of the Indicator Control Switches in the Custodian's Office (see wiring diagram). Relay shall be of sufficient size to carry maximum current through it. This momentary contact switch shall be equipped with two normally closed contacts and three normally open contacts and shall be connected as indicated on the wiring diagram and on Drawing No. 756B. All other momentary contact switches shall be equipped with two normally open contacts, and shall be connected to operate horns or buzzers in accordance with the wiring diagram.

Momentary contact switches shall be mounted in two horizontal rows on a sturdy brass plate (not less than 1/8" thick). Finish of face plate shall match program equipment. Plate shall be engraved as indicated on the Drawings to indicate location of buzzers and horns controlled by each momentary contact switch. In addition to the individual switch designations, the face plate shall be engraved with the words "Auxiliary Signal System". Letters shall be enameled.

16-9.11 Relay for Indicator Interconnecting Box

The relay which operates the bells in the corridors shall be the approved equal of Auth. No. R-55-H capable of carrying an inductive load of 12 amperes and non-inductive load of 30 amperes at the contacts.

16-9.12 Auditorium or Assembly Room Signal System

When indicated on the drawings or specified in the Amendments, furnish and install all equipment required to equip the Auditorium or Assembly Room with a signal system for the platform to the following areas:

Projection Area (room, alcove or rear of auditorium), Dressing or Cloak Rooms and Orchestra Area.

16-9.13 Lecturers Signal

In the Projection Area (room, alcove or rear of auditorium or assembly room) furnish and install the following equipment.

- (a) A buzzer complete with face plate shall be mounted and connected. Buzzer shall be the equal of Auth. No. 512-4, and face plate shall be inscribed "LECT. SIG." and shall be stainless steel.
- (b) A single-gang face plate upon which has been mounted a pilot light the equal of P & S No. 1377 complete with a 24-volt lamp and red jewel, and a three-way switch of the equal of Despard No. 1313. The switch shall be connected so that either lamp or buzzer may be connected to the button signaling equipment on the platform (as shown on drawings). Switch face plate shall be type 302 stainless steel and inscribed "LECT. SIG.", and "BUZ" and "LT" to designate whether buzzer or light is connected.
- (c) At the side of platform (as shown on drawings) install the following equipment:

An outlet box equipped with an Edwards 8235-A, Auth. BE-7003B or other approved combination wall plate and plug. A No. 18 gauge "Type SJ" flexible rubber covered cord, 35 feet long, connected to a wooden or metal pear-shaped shell push button and attachment plug to fit receptacle at platform shall be furnished. Face plate shall be stainless steel and inscribed "LECT. SIG".

16-9.14 Orchestra Signal

- (a) In vertical front of platform, furnish and install identical equipment to that described for Projection Area in paragraph 16-9.13, "Lecturers Signal system". Where space is too limited to permit use of atwo-gang face plate, buzzer may be mounted separately on a single gang stainless steel face plate. Face plate shall be inscribed "ORCH. SIG".
- (b) At the side of platform, furnish and install a Arrow-Hart, Catalog # B-1 unit or approved equal, mounted in stainless steel face plate. Face plate shall be inscribed "ORCH. SIG".

16-9.15 Cloak or Dressing Room Signal

When indicated on the Drawings, install the following equipment:

- (a) In each Cloak Room or Dressing Room at location indicated on Drawing, install an outlet type buzzer, Edwards 8983, Auth. No. 512-4 or an approved equal, consisting of a perforated stainless steel face plate with buzzer at the rear.
- (b) At side of platform furnish and install the required number of Arrow-Hart Catalog #B-1 units or approved equal to operate Cloak Room and Dressing Room buzzers. Push buttons shall be mounted in a stainless steel face plate. Face plate shall be engraved "CLOAK ROOM" or DRESS ROOM, as required.

16-9.16 Principal's Buzzers System

- (a) Principal's Office

At the location indicated on the drawings install a buzzer and a plug receptacle under a two or three gang, stainless steel face plate.

- (b) General Office

At the location indicated on drawings, furnish and install a convenience receptacle, buzzer, tranform and plug receptacle under a four gang stainless steel face plate.

16-9.16 Principal's Buzzer System (Con't)

The above equipment shall be the equal of the Auth Flushcall Line or Edwards Powacall. Transformer shall be Auth. no. 566 or Edwards No. 991 Powacall 10 volt. Buzzers shall be Auth No. 512-Edwards No. 661-10 volt. Plug receptacle shall be P & S Despard Polarized No. 1322, Arrow-Hart T-1322 or Cinch Jones # P-304-CCT. Convenience receptacle shall be P & S No. 5242, Arrow-Hart 5242 or approved equal.

- (c) Furnish two extension cords consisting of the following for each cord:

1 - P & S Polarized Plug No. 1323, Arrow-Hart No. T1323 or Cinch Jones S-304-AB.

1 - Auth. No. 106 or Edwards No. 200 - Weighted desk type push button and line cord consisting of 10 feet of No. 18 "SJ" flexible cord.

The buzzer in each office shall be connected to be operated from push button in other office.

16-9.17 Spare Equipment

Furnish two additional spare 24 volt lamps for each piece of equipment equipped with a 24 volt lamp.

16-9.18 Bell Transformer Board

Furnish and install a bell transformer board manufactured in accordance with Standard Detail Drawing No. 758, at location indicated on the Drawings. The minimum power rating of the transformer is 1000 watts. This rating shall be continuous at 24 volts. Where size of transformer is not indicated on drawings or in specifications, transformer shall have sufficient power output to simultaneously sound ALL bells, buzzers and horns of the system with a volume satisfactory to the Executive Director. All connections shall be made as indicated on Standard Detail Drawing No. 758.

Frames of transformers shall be grounded as directed. Lacquer shall be carefully removed from all contact points of current-carrying parts.

16-9.19 High Temperature Refrigerator and Freezer Alarm

The Electrical Contractor when indicated on drawing, shall provide a buzzer, red pilot light, flasher, and a 3 pole, double throw switch, control relay with a normally open and normally closed contact, in a flush mounted box with stainless steel face plate. Engrave face plate "HIGH TEMP ALARM".

Mode of Operation for Standard Detail Drawing #756-13 shall be as follows:

When the temperature rises the High Temperature Alarm Thermostat closes, the 3 pole double throw switch shall ring the corridor bells and activate the buzzer. When the 3 pole double throw switch is thrown to Position #2, the corridor bells shall stop ringing and the flasher, pilot light on the Freezer Alarm Panel is energized. When the temperature then drops to normal the Control Relay is deenergized which then shall activate the buzzer. This will indicate to the operator that the 3 pole double throw switch has to be returned into Position #1 for future operation.

SECTION 16-10, ELECTRIC CLOCK SYSTEMS

16-10.01 General

Furnish and install either of the following clock systems consisting of the items listed for each system. The choice of system shall be called for in the amendment or as shown on the drawings. The specification of each item follows below:

The two systems are as follows:

A. The Synchronous Motor Manual Corrective System (2 wire). This system shall consist of the following:

- (a) A program instrument embodying equipment hereinafter described, which when used in conjunction with the Sound System, will transmit throughout the building signals of pre-selected programs. Program instrument shall be connected directly to the 24-hour panel in the switchboard room for 120-volt AC operation. Submit shop drawings of this equipment for approval.
- (b) Electric Clocks (single motored non-corrective see item 16-10.05 below).
- (c) An electric time card recorder in General Office Area (see item 16-10.12).
- (d) Semi-Automatic Control Unit & Distribution Panel.
- (e) Electric Time Recorder in Warming Pantry of Intermediate School and High School-(see 16-10.04).
- (f) After the building is functioning as a school, the manufacturer shall send a competent representative to the school to instruct the school personnel in the operation, and make adjustments for the programs in accordance with the schedule furnished by the Executive Director.

B. The Synchronous Motor Self Corrective System (3-wire).

This system shall consist of the following:

- 1) Program Instrument/Master Clock with Panel. (See item 16-10.03).
- 2) Secondary clocks (single motored corrective type (See item 16-10.05).
- 3) Electric Time Recorder in General Office Area.
- 4) Electric Time Recorder in Warming Pantry of Intermediate School and High School.

16-10.01 General (Con't)

- 5) After the building is functioning as a school, the manufacturer shall send a competent representative to the school to instruct the school personnel in the operation and make adjustments for the programs in accordance with the schedule furnished by the Executive Director.

16-10.02 Program Instrument for Manual Corrective System

Program instrument shall be designed for semi-flush or flush mounting with suitable roughing box in new wall construction. Instrument shall be housed in a factory finished metal case with a visible minimum 6-inch pilot clock, with hinged cover and lock and with the hereinafter specified equipment.

The Amendments shall state the minimum number of program circuits required for each project, however, all programs shall be for 24 hours with a minimum of four programs.

- (a) A 120-volt heavy duty approved synchronous motor shall drive a revolving metal drum, disk time signal control, or an approved tape at a uniform speed without escapement or springs. Drums or disks shall contain removable pins or contact rollers in links of a ladder device which will close contacts to operate signal relays at any pre-selected minute of any hour of any school day.
- (b) Provide means for silencing of signals for Saturday and/or Sunday, or any twelve hour or longer period of any day.
- (c) Provide "Duration Ringing" contacts adjustable to permit contact from 3 to 10 seconds.
- (d) Provide relays or micro switches of heavy duty type, each controlling a separate external signaling circuit. These signaling circuits shall be connected by this Contractor to relays in the Sound Rack to produce audible program signals.

Provide 120/24 volt transformer for relay operation and for 24-volt supply for each circuit.

- (e) Program instrument shall be equipped with a disconnecting means for control of program device only.

16-10.02 Program Instrument for Manual Corrective System (Con't)

- (f) Provide signal cut-off and manual program push button for each circuit located on front of cabinet.
- (g) Program Instruments shall embody a minimum of six 24-hour programs. They shall be 24-hour duration with minute to minute selection.
- (h) Provide means for manually revolving program device.
- (i) Provide a program cross-connecting panel mounted in an accessible location within the case of the program instrument. The program cross-connecting panel shall be connected between the timing cylinder and program relays so that any relay can be connected to any section of the drum. The cross-connecting panel shall consist of an insulating bakelite panel approximately 1/4 of an inch thick. On one side of the panel shall be mounted copper or brass bars connected to the drum cylinder. The other side of panel shall be mounted copper or brass bars connected to the relay coils. Bars shall be approximately 1/4-inch wide by 1/8-inch thick and shall be so mounted on the insulating panel as to form a "criss-cross" pattern. Thumb screws shall be provided for interconnecting purposes.
- (j) Where setting of program requires a hand tool, proper hand tool shall be furnished with each clock and shall be affix to the inside of door so as to be available at all times for use in modification of program.
- (k) Program Instrument the equal of Edwards 2410 (4 or 6 programs), 2461-8(12 programs), Simplex Time Recorder 806 Type, Standard Electric Time Co. 105-685 (4 or 6 programs), 105-686 (12 programs) (Flexcron Series) or Acme 2510. Series, 2510 (4 program), 2520 (6 programs).

16-10.03 Program and Master Clock Instrument (Self Corrective System)

This equipment shall be designed for semi-flush or flush mounting with suitable roughing box in new wall construction. It shall be housed in a factory finished metal case with hinged cover and lock and with the hereinafter specified equipment. The program mechanism and master clock movement shall be an integral unit to assure synchronism and shall be timed and powered by an approved heavy-duty synchronous motor operating on 120 volts AC, 60 Hz..

16-10.03 Program and Master Clock Instrument (Self Corrective System) (Con't)

Program Instrument

- (a) A 120-volt heavy duty approved synchronous motor shall drive a revolving metal drum, disk time signal control, or an approved tape at a uniform speed without escapement or springs. Drums or disks shall contain removable pins or contact rollers in links of a ladder device which will close contacts to operate signal relays at any pre-selected minute of any hour of any school day.
- (b) Provide means for silencing of signals for Saturday and/or Sunday, or any twelve hour or longer period of any day.
- (c) Provide "Duration Ringing" contacts adjustable to permit contact from 3 to 10 seconds.
- (d) Provide relays or micro switches of heavy duty type, each controlling a separate external signaling circuit. These signaling circuits shall be connected by this Contractor to relays in the Sound Rack to produce audible program signals.
- (e) Program Instrument shall be equipped with a disconnecting means for control of program device only.
- (f) Provide signal cut-off and manual program push button for each circuit located on front of cabinet.
- (g) Program Instruments shall embody a minimum of six 24-hour programs. They shall be of 24-hour duration with minute to minute selection.
- (h) Provide means for manually revolving program device.
- (i) Provide a program cross-connecting panel mounted in an accessible location within the case of the program instrument. The program cross-connecting panel shall be connected between the timing cylinder and program relays so that any relay can be connected to any section of the drum. The cross-connecting panel shall consist of an insulating bakelite panel approximately 1/4 of an inch thick. On one side of the panel shall be mounted copper or brass bars connected to the drum cylinder. The other side of panel shall be mounted copper or brass bars connected to the relay coils. Bars shall be approximately 1/4-inch wide by 1/8-inch thick and shall be so mounted on the insulating panel as to form a "criss-cross" pattern. Thumb screws shall be provided for interconnecting purposes.

16-10.03 Program and Master Clock Instrument (Self Corrective System) (Con't)

- (j) Where setting of program requires a hand tool, proper hand tool shall be furnished with each clock and shall be affix to the inside of door so as to be available at all times for use in modifications of program.

Master Clock

- (a) It shall automatically control the operation of a minimum of 160 synchronous clocks. A clock extender panel shall be furnished and installed adjacent to the master clock where required for the 160 synchronous clocks.
- (b) It shall provide an automatic means for one (1) and twelve (12) hour time correction and synchronization for all clocks in the building.
- (c) In the event of a power outage of up to 12 hours, the system shall record the duration of the failure and, upon resumption of power, immediately reset all remote clocks to normal time at no less than 10 times normal rate. This shall be accomplished by energizing the second motor in each remote clock.
- (d) It shall provide a means to correct the clock system for daylight and standard time changes.
- (e) Master clock shall be mounted on front panel of the Program and Master Clock Instrument.

Acceptable Manufacturers

Program and Master Clock Instrument the approved equal of Edwards 2400 Series, or Standard Electric Time "Flexchron" will be acceptable.

16-10.04 Interconnecting Terminals for Low Voltage Conductors

Install a terminal strip suitable for connecting building conductors to conductors from Program Instrument. Program signaling conductors shall terminate on approved terminal strips.

16-10.05 Electric Clocks

- (a) Clock Motor shall have self starting synchronous single-motor of the G.E. Telechron "B" type or approved equal with the rotor hermetically sealed in an oil chamber in which special provision has been made for the self-lubrication of all bearings and shafts operating over 1 RPM through the use of capillary feed lubricating system. The sealed-in supply of high quality oil shall be adequate for long life performance of the clock. The clock motor shall start and shall operate synchronously at 80 per cent of rated voltage at room temperature. The sealed rotor unit shall be easily replaced without disconnecting any of the wiring.

Clock movement shall have all metal gear train of non-ferrous metals, no fiber or acrylic gears will be acceptable. A cover shall be provided to enclose these gears for protection against dust.

The movement of each clock shall incorporate means for individual time adjustment by a setting stem and reset knob which shall extend through top of case at the two o'clock position. This setting extension shall not be in mesh with driving mechanism of clock movement except when engaged for resetting time.

Clocks shall have a 12-inch white or aluminum dial with glass face and black arabic numerals. Clocks shall be surface type and shall have come equipped with 2'-0" of 3 conductor parallel cord and 3-wire grounded plug, all U.L. approved. The grounded wire shall be attached to a grounding screw secured to the movement mounting plate. The case of each clock shall be a metalized phenolic molding of chrome color, or of steel, with plated chrome finish, or of aluminum with satin aluminum finish.

Each clock shall come equipped by the clock manufacturer with a steel mounting bracket similar to sample in the Office of the Executive Director, or equal for the purpose intended. The bracket shall have a 14-24 Rd. Hd. steel machine screw secured in place at the top, and a tapered-point 6-32 Rd. Hd. steel machine screw threaded in place at the bottom. In addition, an approved locking bracket shall be provided at bottom of clock to prevent movement away from wall. Finish of mounting bracket and its screws shall be protective white nickel, or galvanized.

Bracket shall be fastened directly to the wall by means of toggle bolts or expansion shields as directed by the Executive Director's representative at the school.

16-10.05 Electric Clocks (Con't)

Clocks mounted above cross-corridor doors shall be installed so that center of clock shall be mid-way between top of door and ceiling. Edge of clock shall be approximately in line with vertical edge of door trim.

- (b) For work in new buildings, an approved three wire single (grounded) receptacle the equal of Hubbell 5251 shall be provided in flush outlet box at rear of clock. This outlet shall be on horizontal centerline of clock, but shall be set with center of outlet 3 1/2" either to left or right of vertical centerline of clock.
- (c) For service work in modernization projects a similar receptacle as described, in preceding paragraph shall be provided surface mounted alongside of the clock.
- (d) Clock for Auditorium shall be of the Skeleton Type, 15 inches in diameter, with hands and dial characters in Modern design finished black. The circular dial and center plate shall be finished satin aluminum. Hands and movement shall be supported by a flush mounted wall box supplied by manufacturer of clock. Electric connections in box shall be made by the use of a three (3) wire cord connector-midget size, the equal of Hubbell No. 7484 Connector Body and No. 7485 male cap. The grounded wire shall be attached to a grounding screw secured to the movement mounting plate.
- (e) Double-Face Mounting of Clock

Double face clocks may consist of two clocks facing in opposite directions, mounted on a special sturdy approved (submit sample) bracket, set out from wall or ceiling. Electric connections shall be made by using a Connector Body and male cap for each clock, the equal of Hubbell No. 7484 Connector Body and male cap for each clock, the equal of Hubbell 7484 connector body and 7485 male cap, both connecting in parallel and terminated for connection in wall or ceiling outlet box.

- (f) Current Interruption Indicator

Clocks shall be without current interruption indicators.

- (g) Sweep Second Hand

Clocks shall, in general, be equipped with sweep second hand.

16-10.05 Electric Clocks (Con't)

- (h) Wiring to Clocks shall be color coded black for hot leg, white for neutral, and green for ground wire. All clock risers shall be run from Clock Panel. A 120 volt A.C. circuit from 24-hour panel in switchboard room shall feed clock system. Timer Control shall be cut in on the hot leg of the feed for purpose of continuous clock operation and clock resetting as hereinafter described.

16-10.06 Electric Clocks

- (a) Clocks shall be dual motored and have a 12-inch white or aluminum dial, glass face, and black arabic numerals. The case of each clock shall be metal with plated chrome finish, or satin aluminum finish.

Clocks shall be surface or flush mounted as indicated on drawings. Manufacturer shall supply special box required for flush type clock.

Surface clock shall terminate in an approved 3 wire receptacle in box with faceplate. In addition a ground wire (green) shall be attached to a grounding screw secured to the movement plate and terminated in an approved manner on the outlet box.

Flush clock wiring shall terminate in approved male and female plug connectors. Grounding shall be provided by an approved means.

Each clock shall come equipped by the clock manufacturer with a steel mounting bracket or an approved equal for the purpose intended. In addition, an approved locking bracket shall be provided at bottom of clock to prevent movement away from wall. Finish of mounting bracket and its screws shall be protective white nickel, or galvanized steel. Bracket shall be fastened directly to the wall by means of toggle bolts or expansion shields as directed by the Executive Director's representative at the school.

Clocks mounted above cross-corridor doors shall be installed so that center of clock shall be mid-way between top of door and ceiling. Edge of clock shall be approximately in line with vertical edge of door trim.

- (b) Clocks for auditorium (Front and Rear) where indicated on drawings, shall be of the Skelton Type, 15 inches in diameter, with hands and dial characters in Modern design finished brass (satin finish). The square, 17" dial and center plate shall be finished bronze (satin finish). The above colors subject to the approval of the Executive Director. Hands and movement shall be supported by a flush mounted wall box supplied by manufacturer of clock. Contractor shall coordinate the installation of this clock with the Architectural Contractor.

16-10.06 Electric Clocks (Con't)

(c) Double-Face Mounting of Clock

Double face clocks may consist of two clocks facing in opposite directions, mounted on a special sturdy approved (submit sample) bracket, set out from wall or ceiling. Clocks shall be connected in parallel and terminated for connection in wall or ceiling box. Clocks shall have acrylic face plates as specified hereinafter.

(d) Sweep Second Hand

Clocks shall be equipped with sweep second hand.

16-10.07 Clock Panel (Manual Corrective System)

(a) Furnish and install a clock panel (par. 16-4.09) of No. 14 gauge steel, with a hinged cover, consisting of the required number of quicklag circuit breakers bussed together in a surface mounted cabinet. Note no more than 20 clocks shall be connected to one circuit breaker.

(b) To this clock panel nipple a Semi-Automatic control unit which shall consist of a metal cabinet with glassed door, lock and key. The cabinet shall contain a 6" pilot clock to indicate the clock system time for resetting purposes. This cabinet shall include a magnetically operated circuit interruption relay with neon lamp indicator to give clearly visible indication. The circuit interruption indicator shall be properly wired so that following any current interruption neon lamp will glow until reset has been operated. A 6" diameter reset timer control dial assembly capable of setting to shut the complete clock system off for any minute interval up to eleven hours and 59 minutes shall also be included in this cabinet. This control unit shall be capable of controlling up to 300 clock faces. Electric Time Company #202-SAC or equal will be acceptable.

(c) Clock resetting shall be accomplished by setting the reset timer control dial for the proper period of minutes and hours after which it will automatically resume operation of the entire clock system. Each clock shall incorporate means for individual time adjustment accessible from outside of case per detail specification under movements.

16-10.08 Clock Panel (Self Correcting System)

Furnish and install for clock distribution a code gauge steel box with a hinged cover consisting of four (4), 2 pole fuse blocks with 8 ampere cartridge fuses and neutral bar for four (4), 3 wire clock circuits. No more than 40 clocks shall be connected on a 3 wire, 2 pole circuit. Each circuit shall be protected by 8 ampere cartridge fuses.

16-10.09 Shatterproof Crystals

Clocks in the Gymnasium, Corridors and certain additional clocks, indicated on the Drawings, shall be equipped with convex shatterproof crystals meeting the following specifications:

Shatterproof virgin acrylic crystals shall be not less than 1/8" thick, formed with a minimum convex height of 1 1/4". Shatterproof crystals shall have a return lip amply secured in case to prevent crystal from falling from clock. Submit sample of shatterproof crystal for approval before installation.

16-10.10 Acceptable Manufacturers

Clocks shall have heavy duty single synchronous motors. Edwards #82400 Series, Standard Electric Time Co. 107 Series or approved equal will be acceptable. Manufacturer's catalog number shall represent a packaged 12" clock complete with mounting bracket as hereinbefore specified.

16-10.11 Guarantee

The clocks furnished shall be guaranteed free from defective material or workmanship for a period of one year.

16-10.12 Time Card Recorder

- (a) Card Time Recorder shall be G.E. Telechron Synchronous Motor operated, front printing type. Recorder shall operate on 120-volt-A.C. circuit from 24-hour panel in switchboard room. Recorder shall be the equal of Simplex Time Recorder--Type 8900 or Cincinnati Time Recorder--Model 5511N.

16-10.12 Time Card Recorder (Con't)

Time recorder shall be of the hand shift "IN" and "OUT", with 3 "IN" and 3 "OUT" (total 6) positions. Recorder shall be equipped with an automatic card shift from day to day and shall be suitable for semi-monthly time cards. Recorder shall be equipped with automatic ribbon feed and reverse mechanism.

At the rear of the recorder provide a 3/8" minimum approved grommet located so as to come within the outline of a 4-inch wall box in the back of the recorder and of suitable size to permit wires to pass through. Time recorder shall be equipped with a set of terminals for connection of supply conductors, and an approved disconnecting means (switch, connector, etc.) to open the current supply circuit. A No. 14 ground wire with copper lugs at both ends shall be used to ground the metal case of the recorder to the wall box.

The case of the time recorder shall be of steel and shall be equipped with a suitable tumbler type lock. Furnish and deliver two keys to the Principal of the school.

Time recorder shall be mounted with top 48 inches from the floor.

- (D) Furnish and install two metal card racks, each of proper size to accommodate the number of time cards required by this paragraph of the Amendments. One Rack shall be marked "IN" and the other "OUT". Each rack shall consist of the required number of individual metal units to accommodate the total number of cards. Each unit shall be approximately 32 1/2 inches high x 4 3/4 inches wide and shall hold 25 cards. Recorder Racks for General Office shall accommodate 175 time cards. Before installation submit for approval dimensional drawings in quadruplicate.

Cards shall be of the monthly type; 15 days on one side 16 days on the other, identical with sample in the office of the Executive Director. A sample card shall be submitted for approval. Furnish and deliver 3000 cards to the Principal of the school.

- (c) Time recorder and card racks shall be of color and finish as selected by the Executive Director to match or harmonize with the surroundings.

16-10.12 Time Card Recorder (Con't)

- (d)
1. The time card recorder date wheel shall be engraved so that the designated location code is printed above the date. The location code shall be engraved with upper and lower case letters or numerals as indicated elsewhere in this specification. The location code, date, hour and minute shall all print within the boundaries of the space provided on the time card.
 2. Time card recorders shall be the equal of Cincinnati Model 5511N or Simplex 8900 modified to conform to the above.

SECTION 16-11, INTERIOR TELEPHONE SYSTEM

(A) PRIMARY, INTERMEDIATE AND HIGH SCHOOLS (EXCEPTION FOR SMALL SCHOOLS)

16-11.01 General

Furnish and install an automatic dial type telephone system as shown on the drawings and hereinafter described. Exchange shall be either wall or floor mounted with built-in or externally mounted power supply.

16-11.02 Raceways and Conductors

Unless otherwise specified or noted conduits, conductors and boxes shall be in accordance with Sect. 16-5, Conduit & Raceway Systems and Sect. 16-7, Wiring Systems and/or with applicable detail drawings. Install a main terminal box at location indicated on drawings. All telephone distribution conduits shall terminate at this terminal box. Terminal box shall be No. 14 gauge galvanized steel, not less than 36 inches high by 24 inches wide by 4 inches deep with hinged door and snap catch. Terminal box shall be painted, color as selected and shall be stenciled as directed.

Terminal strips as specified shall be provided for full exchange capacity. (Exception see Par. 16-7.36).

Extend cable or telephone line wires in conduit from terminal box to exchange, allowing for flexible connection where necessary.

16-11.03 Exchange Unit

The exchange unit shall be of the all electronic solid state type. No electro-mechanical relays shall be permitted. Exchange shall automatically disconnect from the exchange any telephone which is taken off the hook and where dialing has not commenced within fifteen (15) SECONDS. Exchange shall also disconnect any telephone line which has been opened or shorted.

The telephone exchange shall be fully compatible to interconnect with N.Y. Telephone Company lines at some time in the future. It shall be furnished with all additional equipment so that the future addition of an "interconnect unit" will make certain chosen telephones capable of connecting with the N.Y. Telephone Company System. The instruments shall be chosen in the future at the time the interconnect unit is specified and installed.

16-11.03 Exchange Unit (Con't)

Exchange shall be solidly connected in an approved manner to the floor slab or wall slab. No wheels shall be mounted on the unit when permanently set in place.

All equipment shall for purposes of maintenance, be mounted at a height no lower than twenty four (24) inches above the finished floor.

Exchange shall be the approved equal of Telephone Sales & Service Comtrac Units.

16-11.04 Telephone Equipment

Telephone equipment shall be the equal of Automatic Electric Co. P-A-X, Kellogg Switchboard Co., Model KMG, Stromberg Carlson X-Y System, Strom Dialmaster System, Dukane Corp., Nippon Elect Pax, Modern Telephone Corp., fully automatic system.

Where the capacity of the system does not exceed forty (40) lines, the Kellogg Select-o-Phone, Strom Dial X, Modern Phone or DuKane Corp., fully automatic will be acceptable.

16-11.05 Power Supply

Power supply shall consist of a battery eliminator, providing not more than 50 volts, from a 110-125 volt, 60 HZ AC input. Power supply shall be of sufficient capacity to satisfactorily operate exchange equipment to the full capacity of the trunkage (Simultaneous Conversations) specified. Power Supply shall be Automatic Electric, Raytheon, Schavr Machine Company or an approved equal. Power Supply may be part of the exchange.

16-11.06 Capacity

The exchange shall be wired and equipped for not less than the number of lines and the minimum number of simultaneous conversations specified in Amendments.

In no case shall the quantity of lines, specified in the Amendments, be less than the amount of telephone instruments indicated on the drawings.

When two (2) exchanges are required to meet the specification, the first exchange shall be completely wired to its full capacity. The second exchange shall contain the remaining required lines.

16-11.06 Capacity (Con't)

Each exchange shall be independently capable of handling the minimum number of simultaneous conversations within its unit, plus the combination of exchanges shall be capable of each handling the amount of simultaneous conversations called for in the Amendments.

16-11.07 Characteristics

The following minimum operational requirements shall be complied with:

- (a) Each station shall be able to communicate with any other station, the connection being established by means of switching apparatus controlled by a calling dial mounted on the telephone.
- (b) Any two telephones shall be able to communicate without being interfered with by any other station.
- (c) Access to any station already in use shall be automatically prevented. When such access is attempted, a busy tone shall be automatically transmitted to the calling station.
- (d) Ringing of bells shall be automatic, except that for 40 lines or less, bells may be controlled from a button on the calling party's telephone.
- (e) The ringing of a bell at the station called shall be indicated to the receiver of the calling party.
- (f) The equipment shall be of such design that only a single two-copper conductor or three-copper conductor line shall be required between each telephone and the exchange unit.
- (g) Executive right of way or cut-in connections are not to be provided.
- (h) The system shall provide architectural dialing (Exact Room Numbers) where possible within the limitations of each approved system. This shall not eliminate the requirement for directories at each telephone instrument.

16-11.08 Telephones

All telephones shall be equipped with a standard calling dial consisting of a revolving disc having ten (10) finger holes under which shall be mounted a stationary enameled plate marked with numerals 1,2,3, etc., to 0 inclusive, in black on a white background. All telephones shall be of the self-contained type with anti-side tone characteristics, equipped with a bell ringer assembly and a retractable cord as approved by the Executive Director.

16-11.09 Dial Telephone-Desk Type

Desk telephones shall be of modern design, of light weight, and portable, the approved equal of Automatic Electric Company Type-80.

Each outlet for a desk type telephone shall consist of a 4-11/16" sq. box with a single gang switch cover. Install a standard telephone connection block mounted on a recessed "U" strap, fastened to the switch cover, and a one-gang standard telephone plate with grommets hole.

16-11.10 Dial Telephone-Handset Exposed

Surface mounted telephones of this type shall be of a design to match the desk telephones and suitable for wall mounting the approved equal of Automatic Electric Company, Type-90. Instrument shall be mounted over a 4" square box, center line + 4'-8" above finished floor.

16-11.11 Dial Telephone-Handset In Cabinet

Each telephone of this type that is to be mounted in a new cabinet, shall be either surface mounted or flush mounted or as indicated on drawings. Cabinet shall be constructed as per Standard Detail Drawing 775B with a flush ring catch in all areas of instruction. Catch shall be the approved equal of Corbin No. 15631. Telephones located in the Lobby or on the Platform or Stage shall be provided with a lock in lieu of a ring catch. Furnish and deliver two (2) keys to the Custodian for each locked wall box. Center-line of box shall be approximately 4'-6" above the floor. Telephone shall be the approved equal of Automatic Electric Company Type 90, Kellogg or Strom Communications.

16-11.12 Elevator Cab Telephone

Furnish and install a telephone the equal of Automatic Electric Co., Type 90, Kellogg or Strom Communications the General Construction Contractor will provide the box in the elevator and trailer cable to the box. Electrical Contractor shall make all necessary connections for the proper functioning of the telephone. This Contractor is cautioned to properly coordinate this installation with G.C. Contractor.

16-11.13 Loud Ringing Bell (Boiler Room)

Furnish and install in Boiler Room where indicated a loud ringing 6" bell of splash-proof construction, designed to operate with the telephone system selected.

16-11.14 Fault Signal

Where the exchange capacity exceeds 50 lines, furnish and install the following: On the telephone exchange unit and also in the Custodian's Office a buzzer and/or a signal light which will indicate by audible and/or visual means where there is a malfunction in the exchange unit. Provide necessary copper conductors and raceway to effect the foregoing. Install in the Custodian's Office a cut-off switch for controlling this buzzer and/or light.

16-11.15 Directories

For each telephone and for telephone exchange unit, furnish and install a printed or typewritten directory. Directory shall consist of a substantial aluminum back plate and frame approximately 5 1/2" x 8" with directory card and unbreakable non-inflammable transparent plastic face. Directories shall list the location of all telephones which can be dialed and their corresponding call numbers. The directory list shall be arranged in alphabetical order using official room or area designation. Where room numbers are necessary they shall be arranged numerically. Submit proposed directory and frame for approval. Rooms with desk type or surface type telephones, the back plate of the directory frame shall be fastened to the wall near the telephones, at location selected by the Executive Director. In rooms with recessed telephones the directories shall be fastened to the inside of the door of the flush mounted telephone box in such a manner as not to leave anything projecting on outside of door.

16-11.16 Drawings

Furnish one complete set of assembly drawings, circuit diagrams, adjustment sheets and all instructions necessary for the proper operation and servicing of equipment.

16-11.17 Installation and Guarantee

The Contractor shall install all equipment and turn the system over to the Board of Education in a first-class operating condition. The Contractor shall deliver to the Executive Director before the system is finally accepted, the following:

- (a) A certificate from the manufacturer of exchange stating that the system has been installed under their supervision and is satisfactory to them.
- (b) A written guarantee from the manufacturer of exchange guaranteeing Telephone equipment for a period of three years, during which time the manufacturer shall agree to keep equipment operating to the satisfaction of the Executive Director. This guarantee shall also include a statement that all parts requiring replacement or adjustment during the period of guarantee, will be replaced or adjusted by the manufacturer without cost to the Board of Education, where this replacement or adjustment is not made necessary by misuse or abuse by the Board of Education.

16-11.18 Optional-Inclusion of the Interior Telephone System as Part of the Sound System

On Primary, Intermediate, and Junior High School Projects, this contractor is permitted to include this Interior Telephone System as part of the Sound System. This shall apply only where the plans and specifications require him to provide separate Sound and Interior Telephone Systems. This contractor, at his option, may furnish and install separate Sound/Security and Interior Telephone Systems or a combined system. This option is not offered in the case of High School Projects. The combined system shall have the telephone exchange equipment specified above installed within in Central Control Rack of the Sound Systems. All performance requirements listed above shall apply to the combined system. This system shall be the equal of Rauland-Borg Telecenter I modified to meet the above specifications and the specifications of the Sound/Security System. This contractor shall furnish and install all additional conduit and wiring required to reroute all telephone lines from the telephone terminal box to the Central Control Rack if he should avail himself of this option.

This contractor may delete the interior telephones on each desk where an administrative telephone is specified if he should avail himself of this option. Only one phone in the General Office may be deleted in this arrangement. The Administrative Telephone shall be of a type capable of handling all the functions of a Telephone in the Interim Telephone System along with all its functions as part of the Sound/Security System.

(B) SMALL SCHOOLS (PRIMARY AND INTERMEDIATE)

16-11.20 General

Furnish, install and connect a telephone intercommunicating system only where this type of system is specifically called for on the plans or in the amendment. This shall be a 16 station system with selective ringing and eight (8) simultaneous conversations. This system shall be comparable to the TSL-16 Bogen Series, DuKane or an approved equal.

16-11.21 Equipment

(a) Interior Telephone (handset exposed)

ST-16 is a one ring button and fifteen (15) easy press station selector buttons telephone. The telephone is 9 1/2"w x 3 1/4"d and 3 1/2" high. This shall be similar to Bogen TSL-16, DuKane approved equal.

(b) Interior Telephone (Handset Concealed) (Lobby)

This telephone shall be the same as described in paragraph (a) with the exception that it shall be installed in a locked box. Dimensions of box shall be suitable, so as to house telephone described in paragraph (a). Box shall be similar to Std. Det. Dwg. #775B. Telephones are to be furnished and installed at locations indicated on drawings.

16-11.22 Elevator Cab Telephone

Furnish and install a telephone the equal of Bogen TSL-16, DuKane. The General Construction Contractor will provide the box in the elevator and trailer cable to the box. The Electrical Contractor shall only connect the phone to the General Office, Custodian's Office, Lobby and the Boiler Room. The phone shall be modified so that only these four areas will be shown and all the remaining buttons shall be blanked. Electrical Contractor shall make all necessary connections for the proper functioning of the telephone. This contractor shall also be cautioned to properly coordinate this installation with the G.C. Contractor.

16-11.23 Power Supply

STP-16 is the power supply required for each telephone system. Power drain is negligible when system is inactive. This power supply shall be placed in the central control rack of the Sound and Telephone Intercommunicating System.

This power supply shall be similar to Bogen PRS-16A, DuKane approved equal.

16-11.24 Conductors

Total number of unshielded conductors common to all phones shall be 3 more than the total number of phones in the system. A 16 station system will be interconnected with a 20 conductor unshielded cable, #22 wire (A.W.G.) Use parallel conductors, not twisted pairs.

(C) PRINCIPALS INTERCOM SYSTEM

16-11.30 General

Furnish and install a Principals Intercom System consisting of five executive intercom stations, with a priority over-ride for the Principals unit, terminal board and a power supply. Electrical Contractor shall furnish and install all associated conduit and wire required to provide a complete operating system.

16-11.31 Executive Intercom Stations

The Executive Intercom Stations shall selectively call and communicate with any other executive stations. The unit shall contain an integral amplifier and speaker with a permanent magnet cone. Once contract has been established between any two Executive Intercom Stations, interruption of contact shall only be by the Principal's unit, having priority over all other units. Each executive unit shall have a handset and cradle for private conversation. Cradle shall disconnect loudspeaker, upon lifting handset, and transfer voice communication to the handset. Each unit shall contain a soft audible signal for incoming calls and an incoming call light, a busy light and an inuse light.

"Listen-Talk" switch shall be pushbutton type or cross bar with palladium contacts. Units shall also contain a "Volume-On-Off" control for incoming calls. Housing shall be die cast metal with hammertone grey finish. Units shall be Executone, Inc. Model No. 111DH, desk unit, or equal.

16-11.32 Terminal Board

The terminal board shall be as described in Auditorium Intercom System, except it shall have 3 terminal blocks, Executone, Inc. Model J52.

16-11.33 Power Supply Unit

The power supply unit shall have a 120 volt A.C., 60 hertz input supply through 6 foot, 3 wire cord and plug and an output of 24 volt, D.C. well filtered supply. Unit shall contain an integral cartridge type fuse for D.C. current supply. Power supply shall also have a full wave silicon rectifier, choke and condensers. Housing shall be sturdy metal, for wall mounting and finished to match in appearance the terminal board. Unit shall be Executone, Inc. Model No. M217, or equal.

SECTION 16-12, PUBLIC TELEPHONE CONDUIT SYSTEM

16-12.01 Scope

- (a) The work under this Section shall consist of furnishing all labor, materials, equipment and appliances necessary and required to install all empty conduits, outlets, cabinets, etc., for the telephone system as required by the Drawings and specified herein.
- (b) The Contractor shall confer with representatives of the Telephone Company and shall make the installation conform with their regulations in every respect.

16-12.02 Service Conduits

For service into the building suitable service conduit of size, etc., indicated on the drawings shall be installed. Where telephone conduit is run up a pole (unless otherwise directed by the Telephone Company) it shall terminate 8 feet up in a threaded end and weather-proof cap satisfactory to the Telephone Company.

16-12.03 Interior Conduit System

- (a) Furnish, install and connect a complete empty conduit (including drag wire for one inch conduit or larger) system. "No instrument wire" for telephones, including all strip, junction, pull and outlet boxes from the point of service entrance to the various locations throughout the building ready for instruments and wiring.
- (b) For work within the building, conduit and boxes shall be galvanized and shall be of sizes as indicated on the Drawings.
- (c) Telephone strip boxes shall be built by a box manufacturer. Boxes shall be "Bent-up" and welded or riveted without angle frames. All boxes shall be No. 14 U.S.S. gauge minimum.
- (d) A door or doors shall open full width and height of the box and shall be hung on hinges, and shall be equipped with a ring catch.

16-12.04 Wall Outlets

- (a) Telephone outlet boxes 4-11/16" square, 2-1/8" deep, with single gange cover and 1/2" clear grommet in finish plate, shall be placed at the location shown on the drawings.
- (b) Where desk or hand type telephones are to be used, these outlets shall be placed 18" above the baseboard. Each outlet shall be provided with a telephone plate made of the same material and finish as specified for electric light switch and receptacle plates in the same room and have a bushed hole for cords. All boxes shall be set flush in wall.
- (c) Where wall type instruments are to be used, each outlet shall be centered 4'-9 1/2" above floor, and shall be equipped with a blank plate to cover the opening.
- (d) Where telephone booths are to be installed, the location and height of each outlet shall be as specified by the Telephone Company Public Coin Box Department and shall be provided with a standard telephone plate with a bushed hole. Where booths are supplied by the Telephone Company only one outlet each, for electric and telephone, is required for up to six booths in a bank.
- (e) Where the telephone booths are to be installed, this contractor shall furnish and install, a 120 volt outlet for electric light in the booth. This outlet shall be located at height specified by the Telephone Company Public Coin Box Department.

16-12.05 Floor Outlets

Standard under-floor outlets shall be provided where required and such outlets shall be equipped with a riser nipple when in service and with a removable water-proof flush type cover when not in use.

16-12.06 Grounding Conduit

- (a) A 3/4 inch empty conduit shall be installed from the grounding busbar to the telephone service entrance. Grounding connections shall be made as directed.
- (b) See Section 16-3 for grounding busbar connections, etc.

SECTION 16-13, CITY POLICE CALL SYSTEM

16-13.01 General

The Electrical Contractor shall provide facilities as required by the New York City Police Telephone Call System, where indicated on the drawings and as hereinafter specified.

The following types of installation are required, as indicated on the drawings.

16-13.02 Police Department Telephone Post

The Communications; Bureau of the Police Department shall select a street location for a proposed Police Telephone Post.

The Electrical Contractor shall furnish and install the concrete foundation for the post, the post standard and base and an astronomical clock in accordance with the drawings. The foundation shall be flush with the grade. Foundation shall contain two, 2 inch service conduit elbows, one for telephone wiring and one for 120 volt elbows, one for telephone wiring to the illuminated sign on the post. The elbows within the post will terminate 6" above the top of the foundation and the elbow at the opposite end will terminate at a level of 30" below grade.

The Police Department shall furnish an illuminated post sign which shall be picked up by the Electrical Contractor and deliver it to the school site. The Police Department will furnish and install the Police Telephone.

The Electrical Contractor shall install the illuminated sign on the post and the 120 volt wiring complete within the school and continued underground to the Police Department Post and make all connections complete within the post. The Electrical Contractor shall install the astronomical clock in the illuminated sign circuit wiring within the Switchboard Room at location indicated or directed. The conduits for Telephone and 120 volt wiring shall be connected to the respective elbows at the post foundation by the Electrical Contractor.

The Electrical Contractor shall telephone the Communications Bureau of the Police Department at 374-6792 at least 72 hours prior to installing the proposed work.

16-13.03 Street Lighting Standard

Where a Police Call Box is to be located on a B.G. & E. street lighting standard (an existing light standard or a new light standard), the Electrical Contractor will terminate and connect the 2" underground telephone service conduit in an elbow outside the foundation base. The elbow in the concrete base for a new or proposed lighting standard will be installed by the B.G. & E. The 120 volt supply and wiring to the illuminated sign is the responsibility of the B.G. & E.

The Electrical Contractor shall notify the Street Lighting Construction and Maintenance Division, by Telephone at 566-3936 and Police Department at 374-6792 at least 72 hours prior to the installation of the proposed work.

16-13.04 Wooden Utility Pole

Where a Police Call Box is to be located on a wooden utility pole, the Electrical Contractor will install two, 2" service conduits on the pole for telephone and 120 volt supply. These conduits shall be run 12" above the sidewalk grade alongside of pole and capped. The Electrical Contractor shall telephone the Communications Bureau of the Police Department at least 72 hours prior to installing the proposed work.

SECTION 16-14, CITY FIRE ALARM SYSTEM

16-14.01 Scope

PRIOR TO COMMENCING WORK, THE ELECTRICAL CONTRACTOR SHALL MAKE AN APPOINTMENT TO MEET THE ENGINEER OF THE DIVISION OF FIRE COMMUNICATIONS, F.D.N.Y. (TELEPHONE 566-1376) AND DISCUSS DETAILS INVOLVED IN THE INSTALLING OF FIRE ALARM EQUIPMENT DESCRIBED IN THESE SPECIFICATIONS AND DRAWINGS AND IN PREPARATIONS OF THE NECESSARY APPLICATIONS FOR PERMITS TO BE ISSUED BY THE BUREAU OF WATER SUPPLY AND THE DEPARTMENT OF HIGHWAYS IN THE BOROUGH AFFECTED, FOR THE NECESSARY WORK TO BE DONE IN STREETS OUTSIDE THE BUILDING.

The Contractor for Electric Work shall provide all material and labor to finish and install the following:

Within the Building.--A City Fire Alarm Signal Box, a service entrance junction box, with all connecting conduits and conductors indicated on the Drawings, or in the Specifications and required by the Fire Department.

Outside of the Building.--All conduits, ducts, manholes, poles, conductors, cables, lightning arrestors, terminal blocks, fittings, excavations, back filling, etc., indicated on the Drawings, or in the Specifications and required by the Fire Department to extend existing telegraph lines of the Fire Department to the service entrance junction box, unless Drawings or Specifications indicate that such equipment is "Existing".

All work shall be performed with the approval, direction to the complete satisfaction of the Executive Director and the Division of Fire Communications.

The Fire Department will make connections to their lines at the existing manhole, post, pole, box, etc.

16-14.02 Specifications and Drawings

The work indicated on the Drawings and in these Specifications is brief and mainly for estimating purposes.

16-14.02 Specifications and Drawings (Con't)

All equipment, appurtenances, and other material, and the performance of all work must be in conformance with detailed specifications and drawings of the Fire Department and must be completely acceptable to the Division of Fire Communications. Copies of these Standard Specifications and Drawings may be examined at 110-Church Street, 7th Floor, New York, New York.

The Contractor for Electric Work shall obtain from the Division of Fire Communications the latest editions of the detailed Drawings and Specifications which pertain to the work to be performed at the school. Included in the Drawings and Specifications to be obtained are:

(a) Specifications:

- (1) Cable (City of New York, Department of Purchase, Spec. No. 12-C-9:68. (Latest Revision).
- (2) Installation of underground conduit, manholes and posts (Division of Fire Communications, F.D.N.Y.)
- (3) Installation of Cable (Division Fire Communications, F.D.N.Y.)
- (4) Fire Alarm Installation (For Communications with the Fire Department) at Schools, Hospitals and Institutions.

(b) Drawings:

- (1) Manhole Cover and Frame (Division of Fire Communications Standard Drawing No. 140 with lock bar screw)
- (2) Manhole Construction, Post Setting, Subsidiary Connections (Division of Fire Communications Drawing No. 141). TYPE "A" CHAMBER SHALL BE INSTALLED UNLESS OTHERWISE SPECIFIED.
- (3) Pole Terminal Boxes and Appurtenances (Division of Fire Communications Standard Drawing No. 142 Series and No. 145 Series). (Latest Revision)
- (4) Typical Cable Installations--Drawing No.145 (series). (Latest Revision).

16-14.03 Permits, Fees, Etc.

Where conduits, manholes, etc., are to be installed in existing or proposed streets, the Contractor for Electric Work shall obtain and pay for all necessary permits required by the various Municipal Departments and Bureaus (see Par. 16-1.10--Ordinances, Permits Fees, Etc.," of the General Conditions). Permits for street openings shall be obtained through the Division of Sub Structures, Department of Highways, the Department of Water Supply, the Bureau of Electrical Controls, and in respective offices of the President of the Borough in which the school is being erected.

The Contractor shall present all such permits and accompanying data to the Division of Fire Communications for approval.

All such diagrams, data, permits, etc., shall then be presented to the Executive Director for final approval.

16-14.04 Interior Work

Furnish and install the City fire-alarm signal box, conduits, junction box and conductors, hereinafter described, at the locations indicated on Drawings, or as directed.

16-14.05 City Fire-Alarm Signal Box

The City fire alarm signal box consisting of mechanism, inner and outer shells, shall be furnished and installed at location indicated on the Drawings. The fire alarm mechanism shall be of the automatic grounding succession type, equal of Brown Bros. Mfg.Co., Break Glass Door, Interior Fire Alarm Box Model SP-177-1. The outer shell shall have a break-glass door. The box shall be equal in every respect to the sample box in the Office of the Director, Division of Fire Communications, or an approved equivalent. The box shall be delivered to the Brooklyn Fire Alarm Central Station, 35 Empire Blvd., Brooklyn for inspection and test. Upon completion of satisfactory tests and within five (5) days of due notice, the Contractor shall remove the box from the Central Station and install it at the School.

The mechanism shall be equipped with a code wheel cut to transmit the coded signal assigned to the building. The Executive Director will obtain from the Division of Fire Communications for the Contractor, the coded signal to be transmitted by the code wheel. The front of the outer shell door shall bear a number plate agreeing with the cut of the code wheel.

16-14.05 City Fire-Alarm Signal Box (Con't)

The box shall be secured to a one-inch thick wooden backboard, conforming to the shape of the outer shell of the box. The board shall be set on the terra cotta of the building wall (in recess, if provided--see General Construction Drawings) and secured to building wall in an approved manner, independent of the fire alarm box. The outer shell shall not come in contact with the finished surface of the recess. The board shall be painted red. The pull handle of the fire alarm box shall be not less than five feet three inches nor more than five feet ten inches from the floor.

The outlet box of the 3/4-inch conduit shall set flush with the wall at the back of the recess and position to conform to the entrance wire space of F.A. box procured for this installation. The backboard shall be cut out to conform to size and position of the outlet box.

The 3/4-inch Chase nipple and lock nut shall be installed in the rear of the outer shell of the fire alarm box to the outlet box in wall. Unused openings in shell of fire alarm box shall be closed with flat brass screw plugs.

Where the fire alarm box is surface mounted, the 3/4 inch conduit from the junction box shall be terminated in a pull box located below the fire alarm box. Solid or flexible conduit shall be installed between the pull box and existing hole in bottom of the fire alarm box.

Each City fire alarm box shall be equipped with not less than two SPARE "break glasses" placed in an approved holder mounted on the inside face of the door.

16-14.06 Conduits

A 3/4-inch conduit shall be installed between the fire alarm box and the junction box hereinafter described; and a one-half inch conduit between junction box or fire alarm box (which ever is closer) and the grounding connection. See Section 16-3 for ground of Fire Alarm System. The conduit shall be rigid, of mild steel, and shall bear the manufacturer's name or brand. It shall be equal to Sheraduct, Pittsburgh Standard, or approved equal.

16-14.06 Conduits (Con't)

At the point where the 3/4-inch and 1/2-inch conduits enter the junction box, approved insulated couplings (equal to OZ Electrical Manufacturing Co.) shall be installed so that the conduits are not electrically connected to the box. The insulated couplings in the 1/2" and 3/4" conduit shall be omitted when the installation described in last subparagraphs of 16-14.07 Service Junction Box is made.

Pull boxes in conduit runs shall be installed at locations selected by the Executive Director.

16-14.07 Service Junction Box

No. 12 U.S. gauge sheet steel junction box, as per Fire Department Standard drawing 142D, shall be installed near the service entrance, in an accessible location, approximately 7 1/2 feet above the finished floor and shimmed out approximately 1/4" from wall. This box shall NOT be installed in toilets, dressing rooms, locker rooms, or any room or other enclosures which of necessity would be locked or inaccessible; or in a location blocked by ducts, pipes or other equipment. This box shall be 12 x 12 x 6 inches and provided with a one piece door with approved hinges and a lock to fit the standard F.D. #2 key (T.B. 2658). The Fire Department will furnish and the Contractor shall install the lock on the Junction Box. The box shall be given two coats of black asphaltum paint, inside and outside, and the letters "F.D.N.Y." one to three inches in height shall be stenciled on the cover in red enamel. A bakelite terminal block, equal to Fahnestock No. 13B, 10 wire shall be furnished and installed in the junction box.

Where it is not practical to meet the above location requirements, the junction box shall be installed at a location other than the service entrance, and conforming to the remaining requirements. A pull box 12 x 12 x 6 inches shall then be installed on the wall at the conduit entrance into the building, a 1 1/2" galvanized mild steel rigid conduit shall be installed between the pull box and the junction box. An insulating coupling shall be installed in this conduit at its entrance into pull box.

16-14.08 Wiring

One No. 14 A.W.G. soft drawn solid duplex wire (or two wires) shall be installed by the Contractor for Electric Work between the fire alarm box and the junction box, utilizing the 3/4" conduit referred to in Par. 16-14.06 "Conduits".

One No. 14 A.W.G. solid single soft drawn wire shall be installed between the fire alarm box and the water main (see Section 16-3) utilizing the 3/4" conduit and the 1/2" conduit referred to in Par. 16-14.06 "Conduits".

The above wire shall be type "THW or THWN/THHN" as specified in Section 16-7 "Wiring Systems".

The No. 14 A.W.G. ground wire shall be connected to an approved pipe clamp or to the ground bus-bar attached to the water pipe at the point of entrance to the building and ahead of the main valve. Selection of the grounding location shall appear in the Amendment or on the Drawings, or shall be made by the Executive Director.

An approved metal marker, painted red and inscribed "Fire Alarm GRD", shall be fastened to the ground wire at the point of the ground connection. Submit marker for approval.

The No. 14 A.W.G. duplex wire shall be connected to the line terminals of the fire alarm box. The No. 14 A.W.G. single wire shall be connected to the ground terminal of the fire alarm box by means of a machine screw. All wiring shall be continuous in length, splices are not allowed.

16-14.09 Underground Work

Furnish and install underground work, conduits, conductors, manholes, etc. indicated in the specifications and on the Drawings to accomplish a complete electrical connection between the fire alarm box within the Building and the lines of the Fire Department.

Unless otherwise indicated on the Drawings or in the Schedule Specification, a 4(four) pair cable (See "Par. 16-14.22, Conductors [Fire Alarm]") shall be installed in conduit from the terminating point of the Fire Department's lines to the Fire Department service junction box within the building.

16-14.09 Underground Work (Con't)

The cable entering the service junction box shall be properly clamped, using plastic or plastic-coated clamps and the cable conductors soldered to the lugs of the terminal block. The cable conductors shall be laced and properly formed in the service junction box so as not to touch the sides or the back of the enclosure.

The installation of underground pipe and conduit and manholes shall be one continuous operation. In manholes, the cable shall be secured in place on cable supports, Joslyn Mfg. and Supply Co. Rack No. J-5125 and Hook No. J-5131 or length as specified equipped with Insulator No. J-5122 if specified by Fire Department or equal thereto all in accordance with Fire Department Standard Drawing No. 141.

Both cables are installed, this Contractor shall hermetically seal both ends of the cable to prevent moisture from entering into the core of the cable.

An approved type "Come Along" cable grip shall be used to pull in cable.

Where cable connections to fire alarm lines are made within a fire alarm post, the Contractor for Electric Work shall install cable in accordance with Fire Department Communications F.D.N.Y. Standard Specifications.

16-14.10 Notice

Duplicate notices in writing shall be sent to the Executive Director and to the Director of the Division of Fire Communications, Room 701 Municipal Bldg., Borough of Brooklyn, when underground work will begin. Should the Contractor fail to notify said parties, all and every pipe or conductor that may be covered shall be uncovered for inspection at the expense of the Contractor. Both notices shall be delivered at least 48 hours in advance (Saturdays, Sundays and holidays excepted).

16-14.11 Locations and Measurements

A diagram in duplicate shall be furnished to the Director of the Division of Fire Communications (of the Fire Department) giving exact locations and measurements of all work done in connection with the fire alarm circuits. Measurements to pipe or conduit shall show the depth from street grade, also distance from curb, etc. as approved by Department of Highways and Division of Sub-Structures.

After approval by the Fire Department, the diagram shall be submitted to the Executive Director for final approval.

16-14.12 Street Grade

Before starting the underground work, the Contractor shall submit to the Executive Director satisfactory drawings or written statements from the Department of Highways giving the proposed grade of the street or streets throughout the length of the underground work.

16-14.13 Trenches

All excavations for pipes or conduits shall be at a depth to leave a space of not less than 20 inches between the highest point of pipe, and surface of roadway, or the surface of sidewalk or lawn. Under roadways excavations shall be to a depth as required by the Fire Department. Excavations shall be of sufficient width to give at least 3 inches clear space on both sides of conduit. Trench when completed shall be straight and true between pole or manhole and entrance into the building. Where obstructions are encountered which would prevent the trench from running in the straight line, the trench shall be dug in accordance with directions of the Engineer of the Fire Department. Curves in conduit shall have a radius not less than 25 feet. All pipe shall be run so that rods may be pushed through without difficulty and so that pipe will pitch away from building. The trenches and other excavations spread in layers not over six inches deep and thoroughly tamped and wetted down. The surface of lawns and sidewalks shall be left in as good condition as before excavations were made.

Trenches shall not be back filled until conduits have been inspected by representatives of the Executive Director and of the Fire Department, and specified permission to fill trench has been given.

Manholes shall consist of a standard Fire Department roundhead cast-iron frame and cover, and concrete splicing chamber, of dimensions and constructed in accordance with the latest standard specifications and drawings of the Fire Department. A print of the Standard Fire Department manhole casting shall be obtained by the Contractor from the Division of Communications. Either precast or job formed manholes in accordance to Fire Department Specifications will be acceptable. Specifications and drawings may be examined at the Division of Fire Communications by the Contractor and intending bidders, to determine compliance with Fire Department Requirements.

Concrete for manholes shall be in accordance with Fire Department specifications, composed of one part of Portland cement, two parts of clean, sharp sand, and four parts of clean, hard, machine broken stone (not to exceed 3/4-inch on the longest side) mixed dry until thoroughly incorporated, properly wetted and tamped in place until the water flushes the surface. Layers of concrete shall not exceed 8-inches in depth; each layer shall be rammed but not set before the next is applied. All concrete shall be laid in plank frames where necessary, the bottom of the trenches having been previously well cleaned out and wetted and tamped level and firm. The making of concrete shall be by measure, consisting of boxes or barrels of a certain capacity; the same unit of measure shall be used for each part of the composition. Measurements by wheel barrow loads or by counting the shovel-fulls will not be allowed.

Manhole head casting shall be installed flush with the finished grade of street. Where streets have not been regulated and where the present grade is above the proposed grade, the concrete chamber of the manhole shall be built to conform with the proposed grade, having a brick chimney on which the head casting shall set at the present grade. The inside of the chimney shall be a minimum of 2 1/2 feet by 2 1/2 feet, or 2 1/2 feet in diameter (see Fire Department Drawing "Manhole Construction"). Steps shall be provided in the chimney, if so directed by the Fire Department Engineer.

Where a brick chimney is necessary, the Contractor shall advise the Executive Director and the Engineer of the Division of Fire Communications before back filling.

- (a) Conduit shall be plastic bonded steel conduit with an inside diameter as indicated on Drawings, and shall be approved, tested and guaranteed conduit of standard thickness and full weight equal to Rob Roy Industries or other approved manufacturer. The maker's name shall be rolled on each length of conduit, see Section 16-5.02, paragraph (d) Underground Service Conduits. Pipe shall be evenly cut, well reamed and all burrs completely removed. At the point of entrance into building and in the manhole, and in the post, conduit shall be sealed with oakum and approved sealing compound, the approved equal of B.S. Barnard & Co., to prevent water or gases from entering into building.

Sealing material shall extend 3 inches inside mouth of pipe. A No. 10 galvanized drag wire shall be left in pipe for pulling cable.

- (b) Care shall be exercised in installing conduit to keep it clear of contact with all foreign metallic structures, including the iron and steel reinforcing rods of the concrete foundation.

Where conduits must of necessity cross within 2 inches of other iron pipes of metal structure, pipes shall be protected by sleeves composed of one or more lengths of vitrified clay or sewer tile duct. Sleeves shall be installed in such manner as to permanently insulate and separate the conduits containing Fire Department conductors from the other pipes or structures. All joints in pipes shall be made in a substantial manner with standard couplings screwed up tight. Where it may be necessary to cut conduits, the inside edge shall be carefully reamed and cleaned in such manner that no burrs or other obstacles shall exist which might injure cables.

- (c) Where Drawings show conduits entering an existing manhole, the Contractor shall cut openings in the walls of manholes where directed by the Engineer of the Division of Fire Communications for entrance of pipes. All pipes shall be brought into manholes and terminated in the wall, a distance from the inner surface indicated on the Fire Department Drawing of "Manhole Construction". The walls shall be properly "pointed up" to the satisfaction of the Engineer of the Division of Fire Communications, after conduits are installed. The opening at the outer surface of the wall shall be filled with concrete around the conduits backfilling the trench. The opening in the wall of manholes shall be properly sealed by concrete to the satisfaction of the Engineer of the Division of Fire Communications.

16-14.15 Conduit (Con't)

- (d) Where Drawings show conduit terminating in posts, it shall be terminated in a 90 degree bend and extended by a pipe nipple to a point 3 inches above sidewalk level. The joint between the pipe and the bend shall be made by using a solid wrought iron sleeve at least 12 inches long. Sleeve shall fit completely over the conduit and bend and shall be completely covered by concrete.

The Contractor shall cut all necessary openings in walls of buildings for entrance of pipe at location indicated on the Drawings. All openings cut for the conduit entrance to buildings shall be properly sealed and surface "pointed up" to the satisfaction of the Executive Director. Where the surface of a painted wall has been disturbed, the Contractor shall repaint the wall and restore it to its original condition.

- (e) Pipe or conduit entering a building shall be pitched away from building toward manhole. Service conduits shall terminate in a junction box in building.

16-14.16 Damages from Blast

In all cases of blasting the stone shall be carefully covered with heavy timbers, so as to prevent the possibility of any damage or injury to property or persons. Any damage resulting directly or indirectly from such blasting shall be borne by the Contractor for Electric Work, and he shall hold the Board of Education entirely free from any actions or claims resulting from any injury of this kind.

16-14.17 Safety Obligations of the Contractor

In constructing underground work and doing other work required in the highways, the Contractor shall not unnecessarily interfere with traffic, and shall build such temporary bridges and place such guards as shall be acceptable to the authorities having jurisdiction and the Chief of the Division of Fire Communications. Before doing any work over, under or near railroad tracks and/or bus routes, pipe lines, duct lines or other sub-surface structures, the Contractor shall, at his expense, make such arrangements for properly removing or protecting them during the progress of the work as shall be satisfactory to the Executive Director, to the City department controlling them and to the Director of the Division of Fire

16-14.17 Safety Obligations of the Contractor (Con't)

Communications. Whenever it may be necessary to interfere with the service of any bus routes, and/or railroad, due notice shall be given the company by the Contractor. Damage to any structure occasioned in the prosecution of the work shall be immediately reported to the Executive Director or City Dept. having jurisdiction.

16-14.18 Sidewalk and Street Repairing

All gutters, curb, flag and street pavement which have been displaced during the progress of the work shall be reset in their former positions. Should any of the displaced material be broken or injured in any way this Contractor shall provide suitable new material at his own expense. All replaced material shall match present work in color and finish. Cement sidewalks shall be relaid in full squares. Only first class mechanics shall be employed in the repairing of strut after excavations. All stones, dirt and rubbish shall be removed and struts cleaned after street repairing is completed. This work shall be done to the satisfaction of the Department of Highways. The Contractor shall comply with all laws, ordinances and regulations by the city authorities relative to the use and maintenance of the public thoroughfares.

16-14.19 Overhead Lines--Scope

Furnish and install all overhead wiring, poles, wire and pipe up poles from underground, etc., when and where indicated on Drawings.

16-14.20 Underground to Overhead

Where the drawing shows the cable shall terminate on a pole, the following procedure shall prevail: A 2-inch plastic coated conduit or approved type "U" ground with conduit adapter size as per Division of Fire Communications drawing for the particular installation, shall be extended up the pole a distance of ten feet, avoiding the curb side of the pole. This conduit shall be attached to the underground conduit by means of a wrought iron or steel boiler sleeve and a 90 degree wrought iron bend. The sleeve shall fit snugly over the pipe and bend, and shall be completely covered with concrete. If this conduit does not readily drain into a manhole, a one-half inch hole, free of sharp edges, shall be made in the conduit at the lowest point to prevent the trapping and freezing of water.

16-14.20 Underground to Overhead (Con't)

A lead weather bell, cap or approved type split rubber cone shall be installed to cover the mouth of the iron conduit on the pole. If a lead weather bell is used it shall be beaten in tightly to the outer covering of the cable.

Where the bottom of the pole terminal box is installed at a height greater than 12 feet, the exposed cable above the iron conduit shall be enclosed in a two inch fibre conduit (equal to Orangeburg or Bernice). This fibre conduit shall rest on the lead weather bell, cap or split rubber cone over the mouth of the wrought iron conduit and terminate approximately two feet below the bottom of the pole terminal box. The open end of this fibre conduit shall be sealed with oakum and compound (equal to B.S. Barnard & Co.). Both iron and fibre conduits shall be properly secured to the pole with galvanized wrought iron straps, spaced at least every 24 inches and using 1/4" x 3" lag screws. The fibre conduit may be omitted on poles, which are the sole property of the New York Telephone Company.

The cable on the pole shall be terminated in an approved manner to a Fahnestock arrester Mounting Block No. 3B-90243, 8 or 10 Terminal Blocks, Latest Fire Department approved Model. This block shall be contained in a pole terminal box, built to F.D. Standard Drawing 142, Series Latest Revision. A No. 10 A.W.G. soft drawn copper wire, 1/2 inch galvanized rigid steel conduit, or approved type wood channel moulding, 7/16" x 7/8" x 8'0" shall be extended from the ground lug of the lightning arresters to an approved threaded sectional 6 foot, 1/2 inch copperweld ground rod, driven into the earth as directed. Where this rod does not produce a ground of less than 75 ohms, additional sections shall be added and the rod driven deeper into earth until the desired 75 ohms or less ground is obtained. The No. 10 A.W.G. ground wire shall be connected to the end of the rod with an approved clamp. The iron conduits and ground wire U-Guard moulding shall be painted black.

16-14.21 Poles

- (a) All new poles indicated on the Drawings, or in the Schedule Specification shall be furnished by this Contractor. Poles shall be creosote pressure treated, southern yellow pine or other approved. Poles shall be reasonably free from knots. Accepted standard specifications are ASA for poles, and AWPA 36C for treatment. Treatment shall be for 8 pounds final retention AWPA 36C, empty cell process.

16-14.21 Poles (Con't)

Pole shall be thirty-five (35) feet long, with a minimum top circumference of twenty-one (21) inches. Poles shall be set in ground to a depth of six (6) feet, and shall be set so that poles will stand perpendicular when the line is completed. Holes shall be dug large enough to admit the poles without stabbing or hewing, and shall be as large at the bottom as at the top. After the poles are placed in position, only one (1) shovel shall be used in filling the holes. Three (3) tampers shall be continuously employed to pack in the filling until the hole for each pole is completely filled. Where the ground shall be found soft and moist, the poles shall be set in a large barrel; the space between the barrel and the pole shall be filled with small stone and earth and shall be well tamped.

(b) Crossarms and Pins

Crossarms shall be three feet long (standard) thoroughly seasoned, straight grained pine, free from such sap wood and knots as would weaken same; crossarms shall be painted color of pole, and shall be fitted with two braces. The braces shall be attached to the crossarm by means of carriage bolts, which shall pass first through the arm and then through the brace. A round washer shall be placed under the head of the bolt. Crossarms shall be fitted with one and one-half (1 1/2) inch standard pins. Each pin shall be nailed in the crossarm with one six-penny nail, the nails shall be driven in straight through the middle of the side of the crossarm, a 5/8-inch hole shall be bored through the center of the grain at the time the crossarm is placed in position. Crossarms shall be placed in position with the braces facing away from the pole, and shall be attached to the pole by one crossarm bolt, which shall be long enough to pass through the pole and the crossarm without cutting out the back of the pole. The bolt shall be driven through the back of the pole, a square washer being placed under the head and a square washer shall be placed under the nut on the crossarm. The pair of crossarm braces shall be attached to the pole by means of one fether drive screw.

(c) Insulators

Insulators to which the conductors are secured shall be furnished and installed by this Contractor. Insulators shall be an approved single petticoat porcelain.

16-14.21 Poles (Con't)

(d) Joints

All joints in line conductors shall be made with double McIntyre sleeves and covered with not less than three (3) layers of 3/4-inch black Grimshaw, or other approved, tape. No joint shall be made in the line wire at a distance greater than two feet from a crossarm.

(e) Trimming Trees

In trimming trees. the Contractor shall pay the Inspector designated by the Commissioner of Parks to supervise the work for each and every day actually employed at the rate fixed by said Commissioner. All overhead lines shall be free from foliage and branches of any trees when completed.

16-14.22 Conductors--Interior Conductors

Fire Alarm interior conductors shall be No. 14 duplex (or two single No. 14 conductors). Ground wire shall be No. 14 with a green colored covering.

All interior conductors shall be types "THW or THWN/THHN" as specified in Section 16-7--"Wiring Systems".

16-14.23 Underground Conductors

The underground conductors shall be four (4) pair cable unless otherwise specified. The conductors shall be solid No. 16 A.W.G. The insulation and cable assembly shall meet the requirements of City of New York, Department of Purchase Cable Specification No. 12-C9:68. The fire alarm cable shall be properly terminated in the pole terminal box and in the service junction box, all in accordance with Fire Department cable installation specifications. The cable conductors shall be properly laced and or taped and formed so as not to touch the sides or back of the enclosure. The Contractor shall terminate the cable in the post terminal box in "dead" fire alarm posts. Where the cable enters a "Working Fire Alarm Post" the Contractor shall pull the cable up into the post leaving sufficient cable for proper terminating by others.

16-14.23 Underground Conductors (Con't)

The end of this cable must be hermetically sealed to prevent the entrance of moisture into the core of the cable. The Fire Department will make the splice to the "live" cable in the manhole. The Contractor shall leave sufficient cable in the manhole properly racked and positioned with the end hermetically sealed. Where directed, the cable shall be lubricated before pulling into ducts. Such lubricant shall be a thick solution of water and mild soap flakes (such as Lux or Ivory). The Contractor shall take every precaution by sealing the end of the cable prior to drawing into the ducts to preclude the entrance of moisture or water into the core of the cable.

All connections to lines of the Fire Department will be made by the Fire Department.

16-14.24 Overhead Aerial Line Conductors

Overhead aerial conductors shall be No. 10 A.W.G. hard drawn copper, uniform in diameter and free from flaws, scales and other imperfections. The conductor shall be solid, round and capable of withstanding a minimum of 505 lbs. before breaking and conforming to the requirements of A.S.T.M. Designation B-1, latest revision. The conductor shall be covered with a High Density Polyethylene insulation resistant to the weather, moisture, abrasion and so compounded as to have no injurious affect on the copper conductor conforming to the physical requirements of A.S.T.M. Designations D-1248, D-470, latest revisions. In lieu of the polyethylene covering, a polyvinyl chloride will be acceptable. The polyvinyl chloride shall conform to the physical requirements of A.S.T.M. Designations D-1047, D-470, latest revisions. Overhead conductors shall be manufactured in accordance with Fire Department Specifications No. 1.2 or 1.21, latest revisions.

16-14.25 Samples of Conductors

Samples of conductors shall be submitted to and approved by the Executive Director and the Fire Department Engineer before installation is made.

16-14.26 Tests and Acceptance

- (a) The Director of the Division of Fire Communications shall be notified 48 hours in advance of time of starting work so that a representative may be present.
- (b) The installation will be inspected and tested by the Division of Fire Communications to determine its compliance with these specifications before it is connected to the lines of the Fire Department. The contractor shall furnish the necessary manpower, the tools and materials required to aid the Fire Department Engineer in the testing and inspection of the cable installation.
- (c) The entire work shall be done to the complete satisfaction of the Director, Division of Fire Communications, F.D.N.Y.

SECTION 16-15, VISUAL FIRE SIGNAL INDICATOR SYSTEM

16-15.01 General

The Electrical Contractor shall furnish, install and connect equipment, conduit and wire for the installation of a Visual Fire Signal Indicator System in accordance with the specifications and drawings.

This system shall be an integral part of the Interior Fire Signal System and meet the approval of the Division of Fire Prevention of the New York City Fire Department.

16-15.02 Raceway and Conductors

For conduits, conductors, boxes, fittings, etc., see Section 16-5, 16-6, and 16-7.

Conductors shall meet the requirements of the Bureau of Fire Prevention. Unless otherwise noted by this Department, Type "RHW" or type "THW" will be acceptable.

16-15.03 Visual Fire Signal Indicator Cabinet

The electrical contractor shall furnish, install and connect a suitably sized cabinet which shall house contactors, relays, resistors, motor driven cams, etc.

Relays and Associated Equipment shall be provided so that the Visual Flashing Lights will Flash at a continuous pre-determined rate, minimum 4 flashes/second, not in the same sequence as the Fire Bell Code".

The flashing of lights shall commence with the initiation of an alarm condition, which shall occur by the pulling of a fire signal station, activation of a smoke or heat detector and activation of the sprinkler alarm system.

The flashing of these lights will continue until the reset button is pushed, at which time the system will be placed in readiness and capable of going into an alarm condition with the initiation of the next alarm.

16-15.03 Visual Fire Signal Indicator Cabinet (Con't)

The rate of flashing shall be steady and shall be adjusted and set in the field in accordance with the instructions from the Fire Department Inspection at the time of inspection.

Cabinet shall be painted red and stenciled "VISUAL FIRE SIGNAL INDICATOR CABINET".

16-15.04 Visual Fire Signal Indicator

Indicator is a wall mounted fixture, 120 volt, AC, with dual parallel connected lamps. Dual parallel connected lamps ensures continued illumination during alarm if one lamp should fail.

Fixture assembly is mounted on a brush finished, stainless steel plate. The translucent dome is hi-impact plastic, red or white letters so as to provide readability from any angle.

The dome shall be permanently secured to stainless steel plate. Dome may be epoxied to plate so as to prevent dome from being removed.

Fixture shall be mounted to a single gang surface mounted outlet box with suitably placed threaded holes to accept mounting of indicator face plate.

Box shall be a finished box as noted in the standard specifications for finished areas.

Fixture shall be similar to Johnsons catalog #SFA-12-6 or an approved equal.

Lamps shall be similar to Johnsons "001346" or "CMB-967-73 1/4" or an approved equal.

16-15.05 Manual Reset

A manual reset shall be furnished, installed and connected at a location adjacent to the fire signal board in a suitably sized steel cabinet with matching cover.

Manual reset shall be interwired with the fire signal board so as to reset the system to normal operation after clearing of the fire alarm.

16-15.06 Trouble Bells

A trouble bell shall be installed on a suitable galvanized steel back box above the fire signal control board.

Trouble bell shall be 4 inches in size and shall indicate trouble on the system, and shall be an approved type 110-125 volt bell giving a distinctive tone signal.

16-15.07 Silencer Switch and Pilot Light

Furnish and install, where shown on drawings, a double pole, double throw switch, the approved equal of Arrow-Hart No. 8660 and a 250 volt pilot light with ruby glass. This switch shall be in connection with the trouble bell of the fire signal board. The switch and pilot light shall be placed behind a stainless steel plate type 302 engraved "Silencer". The switch positions shall be engraved "T-bell" and "Light". Lettering shall be colored with red enamel. Silencer switch shall be connected in such a manner that the act of silencing the trouble bell, by the operation of the silencer switch, automatically transfers the trouble signal to the pilot light on the control board. When the trouble signal has been repaired, the trouble bell shall ring until the silencing switch has been reset to its normal position.

16-15.08 Auxiliary Fire Signal Control Box (Visual Fire Signal System)

The Electrical Contractor shall furnish and install two normally closed and two normally open contacts in a suitable metal enclosure with hinged door adjacent to the Fire Signal Control Board and run conduit and wire from the Board to the Visual Fire Signal Cutout and make all necessary connections. When the Fire Signal Control Board is alarmed the contacts shall close and the Visual Fire Signal System shall be activated.

SECTION 16-16 INTERIOR FIRE SIGNAL SYSTEM

16-16.01 General

Furnish and install all fire signal (Interior Fire Alarm) equipment indicated on the drawings or herein after described to equip the building with an approved interior fire signal system. All equipment that is furnished shall be presented to the Board of Standards and Appeals and approved by them for use in school buildings before fabrication in a school building.

16-16.02 Notice to Division of Fire Prevention of Fire Department

An advance written notice of when work will be started on the fire signal system shall be sent to the Division of Fire Prevention of the New York Fire Department, Municipal Building, Brooklyn, Room 1104. The Electrical Contractor shall obtain and file Form A-433 "Application for Electrical Inspection and Summary of Contract Equipment to be Installed" with the Division of Fire Prevention.

16-16.03 Raceways and Conductors

For conduit, boxes, fittings, etc., see Sections 16-5, 16-6, and 16-7.

Conductors shall meet the requirements of the Division of Fire Prevention. Submit sample of conductors for approval before installation.

16-16.04 Fire Signal System Wiring

- (a) Fire signal system conductors shall be installed, as indicated on the Drawings and as required to provide for the number of box circuits, gong circuits and punch register circuits indicated on the Drawings and in the Specifications. Separate conductors shall be provided for each circuit.

16-16.04 Fire Signal System Wiring (Con't)

- (a) Box circuit conductors and gong circuit conductors shall connect to the fire signal control board. Punch register conductors shall connect to the punch register control board. The punch register shall be on a separate circuit controlled by a relay in the punch register control board.

Braids of conductors shall be color coded as follows:

Box Circuits.....White
Gong Circuits.....Black
Punch Register Circuits.....Red

Conductors for box and punch registers circuits shall be No. 14 and No. 12 for gong circuits.

Punch register conductors shall connect to the punch register control board or the punch register modules or circuitry within the fire signal control board. The punch register shall be controlled by a relay within the punch register circuitry in the fire signal control board.

The schedule of wire colors shall be inserted on the riser diagram of this system. Riser diagram shall be framed and mounted at a location selected by the Executive Director.

- (b) Conductors between the fire signal control board, fire signal panel, and the Service Switch shall be installed as indicated on the Drawings and as directed.

For connections at fire signal panel, see detail wiring diagram on the Drawings. For special circuits to pilot lights of silencer switches in connection with the trouble bells see the Drawings.

- (c) The punch register, punch register control board, etc., shall be wired as indicated on the drawings and as directed.

Where punch register control is obtained from additional circuitry in the fire signal control board, the punch register shall be wired as directed by the manufacturers.

16-16.04 Fire Signal System Wiring (Con't)

- (d) Fire signal conductors shall be kept separate from all other wiring systems except at the service connection. Service connection shall be made as direct as possible.
- (e) A ground wire equal in size to the largest conductor used on the system, but not less than No. 10 A.W.G., attached to the control cabinet, shall be installed in 1/2" conduit and securely connected to the "grounding busbar" in the same manner as the other ground wires and conduits.
- (f) The normally closed push button (in general office) provided for fire drills shall be wired directly to the fire signal control board and shall permit the actuation of a single stroke of all gongs with each push of the button.
- (g) See Article 16-16.08(i) for alternate on station wiring and signalling.

16-16.05 Gongs

Furnish and install at each location indicated on Drawings, a single stroke gong. Gongs shall be of an approved type and manufacture.

Gongs shall be of the solenoid type having one moving part. The plunger shall be made octagonal in cross section, or other approved shape.

Gongs shall be designed for series operation from 110 to 125 volts alternating current. Gongs shall be mounted on the back boxes hereinbefore specified using four screws.

The gong shells shall be made of hot pressed steel, and unless otherwise shown on the drawings, shall be 10 inches in diameter, 2 inches deep and 1/8th of an inch thick, and shall weigh approximately four pounds.

Gong shells shall be of G.C. Reiter manufacture or approved equal.

Gong shells shall have a satin chromium finish.

Where Drawings indicate the letter "D" adjacent to a fire signal gong, the gong shell and sub-plate (including projection over gong shell) shall have a satin chromium finish; and manufacturers escutcheon plate shall be omitted.

16-16.05 Gongs (Con't)

Gongs shall be mounted with the centerline of the gong shell at least eight feet above the floor (or higher when so indicated on the plans). Where gongs must be mounted with their centerline below eight feet due to low ceiling construction, these gongs shall be set with the centerline of the shell at six inches below the ceiling.

Where gongs must be mounted with the centerline of the shell below eight feet, a guard shall be provided with the gong. This contractor shall consult the general construction drawings at the time of bid and the general construction contractor during construction to ascertain whether guards are required.

16-16.06 Guards

Unless otherwise specifically indicated on the Drawings, gongs in the Cloak Rooms, Play Yards, Gymnasias, Boys' Locker Rooms and Girls' Locker Rooms shall be equipped with guards. In addition, wherever the Drawings indicate gongs with guards, a guard shall also be installed.

Also, where the mounting of a gong must be set below eight feet, a gong shall be installed as part of this contract.

Guards shall be furnished and installed by this Contractor. Each guard shall be full cast iron or aluminum grid type, equal to guard manufactured by Acem Fire Alarm Co. Gong fastening bolt shall be extra length required to accommodate guard.

16-16.07 Boxes for Fire Signal Gongs

Install a suitable steel box for each fire signal indicated on the Drawings or Specifications. Box shall be supplied by the manufacturer of the fire signal equipment, and approved by the Executive Director.

Box shall be of sufficient depth to accommodate size of rigid conduit indicated on the Drawings and to accommodate conductors installed. In new buildings, boxes shall be set flush in partitions and walls. In existing buildings, boxes shall be surface mounted on partitions or walls unless otherwise indicated on the Drawings or in the Specifications.

16-16.07 Boxes for Fire Signal Gongs (Con't)

Boxes shall be rigidly fastened to the structure by means of approved supports independent of conduits. Gongs shall be fastened to boxes by means of brass machine screws.

Unless otherwise indicated on the drawings, gong boxes shall be mounted with the center of the box set at a height to permit the center of the gong shell to be 8'-0" above the floor. Where a mounting height of less than 8'-0" is unavoidable, a guard shall be provided over the gong.

16-16.08 Fire Signal Stations

Furnish and install a fire signal station at each location indicated on the Drawings.

- (a) Each fire signal station shall be the coded pull lever type with manually operated pull lever. Each station shall also be a double acting type requiring the opening of a door before an operating lever becomes available.

Each station shall have hinged inner and outer doors with the inner door locked and the outer door held closed by an approved catch or spring of substantial construction. Instructions for operating station shall appear on front of the outer door in cast raised letters.

- (b) Mechanism shall consist of a series of gears powered by a spring which, acting through an escapement, shall cause a coded wheel to rotate when the spring is "wound up" by manual operation of the lever. The mechanism shall be so designed that rotation of the coded wheel cannot be interfered with or stopped by manipulation of handle after lever has been pulled.

The gears and train plates of the fire signal station shall be made of commercial bronze or hard clock brass or any other material approved by the Board of Standards and Appeals, highly finished and lacquered. Gears and train plates shall be not less than 5/64" thick. Gears shall be cut, not stamped.

Where the Drawings or the Amendments indicate that a punch register shall be installed, each fire signal station shall be arranged to transmit a coded signal in addition to the standard evacuation signal.

16-16.08 Fire Signal Stations (Con't)

- (c) Individual punch register coded numbers shall be assigned and submitted for approval to the Executive Director. Following their approval by the Executive Director, they shall be submitted for approval to the Division of Fire Prevention by the Contractor, and shall be brought into conformance with their recommendations before adoption into the Punch Register System.
- (d) All contacts actuated by code wheels shall be in duplicate. Contacts shall be genuine coin silver mounted on phosphor bronze springs.
- (e) Each time a box lever is pulled through its entire arc, the following shall occur:
 - (1) Code wheels shall make four (4) complete revolutions.
 - (2) The contact transmitting the number "THREE" shall actuate the contacts of the circuit to the fire signal control board and produce four rounds of signal "THREE" at all fire gongs.
 - (3) The contact transmitting the individually assigned code number shall actuate the circuit to the punch register control board, and shall produce four rounds of the individual assigned code number on the tape of the punch register.
- (f) Each fire signal station shall be designed so that with the use of a removable test key it shall be possible to perform the following tests on the station:
 - (1) To test the box mechanism without transmitting the code to the gongs.
 - (2) To test the operation of the gongs and gong circuits from the station without operation of the station mechanism.
- (g) Six test keys with brass tags suitably labelled shall be furnished and delivered to the Custodian Engineer.

The two test positions shall be suitably marked. The test equipment shall have a spring return to the neutral positions so that it cannot be left in either test position.

16-16.08 Fire Signal Stations (Con't)

- (g) The station shall be capable of withstanding 1250 R.M.S. volts (or 1000 volts plus twice maximum operating voltage) between all live parts and the case for one minute.
- (h) The mechanism shall be set into a separate cast iron box or pressed steel box for surface mounting, and shall be set in a stamped steel box for semi-flush mounting. All cast parts shall have a baked enamel dull red finish and exposed edges shall be rounded.
- (i) Where the drawings call for the installation of a punch register, this contractor may furnish a single coded station along with a solid state Code 3 transmitter in the control panel and two conductors running to each station in lieu of a dual coded station and four conductors running to each station as specified above. In this alternate, the code wheel shall be cut to the punch register code and operation of this code shall activate the code transmitter in the panel to generate the Code 3 evacuation signal along with normal transmission of its signal to the punch register system. This shall not interfere with the required bell signal that must be transmitted with operation of the Smoke & Heat System or Sprinkler Alarm System. If the contractor chooses to use this alternate, the station must still be double acting with "Open Door, Pull Handle" type of operation. Where the drawings do not call for the installation of a punch register, the contractor must still furnish a single coded station with the gears cut for "Code 3" signal as specified above.

Where the symbol on the Drawings requires a "Fire Signal Station - Flush Mounted - with Special Box and Trim", the fire signal station shall be installed in accordance with Standard Detail Drawing No. 719 R. Trim shall have a bronze front of color and finish as selected by the Executive Director to match the adjacent metal work.

Fire Signal Stations shall be set so that the center line of the operating lever of station shall be 4 feet above finished floor. The Contractor for Electric Work shall report to the Executive Director any interference with wainscot, or other constructional or mechanical equipment.

16-16.09 Normally Closed Push Buttons.

Furnish and install a normally closed push button in the General Office at location indicated on Drawings.

The normally closed push button approved face plate.

16-16.09 Normally Closed Push Button (Con't)

Face plate shall have a finish to match the finish of receptacles in same enclosure. Face plate shall have a projecting ferrule around push button, shall be engraved "Fire Signal" and shall be mounted on the hereinbefore specified flush switch box set in partition at location shown on the drawings. Lettering on face plate shall be colored with red enamel. Push button shall be Auth Electric Co. No. BE-1596, Edwards Mfg. Co. No. 8105 equal.

16-16.10 Control

Single stroke gongs shall be operated from the normally closed push button and the fire signal stations indicated on the drawings.

Under normal conditions all single stroke gongs and the coils of the gong relays on the fire signal control board shall be connected in series on a closed supervisory circuit. Operation of the fire box circuit shall group the gongs into parallel operating circuits of not more than eight gongs each. An additional impedance shall be inserted in each gong circuit to limit the current to an approved value.

No more than twenty (20) fire signal stations shall be placed on one circuit. The contacts actuated by the gong signal code wheels of all fire signal stations, the contacts of the normally closed push button, the coils of the fire signal relays on the fire signal control board, and the milliammeter shall be connected on a closed supervisory circuit.

16-16.11 Fire Signal Control Board

Furnish and install, at a location indicated on the drawings, a fire signal control board for the manual fire signal system equipped to operate the number of gong circuits as indicated on the drawings and a minimum of two fan shutdown circuits which shall be as specified below.

The contractor shall furnish and install a "Code 3" code transmitter within the control panel if he chooses to avail himself of the alternate specified in item 16-16.08(i).

This board shall be capable of operating from the number of manual station circuits as indicated on the drawings, from the normally closed push button circuit, and from a signal actuation received from the sprinkler alarm control panel or any automatic fire signal system panel (smoke detection, heat detection, etc.). This fire signal control panel may be either of the 120 volt operating type as specified in items (a) to (c) and (k) to (p) below or of a low voltage modular type as specified in items (t) to (j) below.

16-16.11 Fire Signal Control Board (Con't)

Contractor shall obtain the approval of the Board of Standards and Appeals and the Fire Department Bureau of Fire Prevention on all equipment before fabrication for any particular job.

16-16.11 Fire Signal Control Board (Con't)

All boards shall be of the same manufacture as the fire gongs and shall be set in a painted metal cabinet of suitable gauge. Board shall be complete for service on 120/208 volts, 3 wire alternating current circuit, and shall be equipped with relays, indicating instruments for each supervisory circuits, automatic time limit cutout, relays, resistances, trouble bell connections, circuit terminal plates, etc., all as required by the building code of the City of New York, fire alarm rules of the Board of Standards and Appeals, and as approved by the Division of Fire Prevention of the Fire Department.

- (1) Boards of the 120 volt operating type-
These boards shall meet the following specifications:

- (a) Milliammeters shall be provided on the control board as follows:

For one gong circuit, provide one milliammeter.

For two or three gong circuits, provide two milliammeters.

For four gong circuits, provide three milliammeters.

For five to eight gong circuits, provide four milliammeters.

For nine to twelve gong circuits, provide five milliammeters.

For thirteen to sixteen gong circuits, provide six milliammeters.

The scales on all milliammeters shall be arranged to indicate "ON" when registering the normal supervisory current and "OFF" when registering 10 percent below the normal supervising current. In no case shall any marking be put on the glass face of the milliammeters.

Milliammeters shall be Hoyt, Westinghouse, Roller-Smith, Triplet or Weston manufacturer.

- (b) The relays and contactors on the control board shall be provided with genuine coin silver contacts not less than 1/4 of an inch in diameter. All contacts on relays shall be in duplicate, or shall have the equivalent in contact size and gap. All relays shall be quick acting and equipped with adjustable bronze freeze pins, or other approved means of preventing "freezing".

16-16.11 Fire Signal Control Board (Con't)

- (c) All control boards for two or more circuits shall be provided with contactor relays for actuating the gong circuits.
- (d) Control boards having four or more gong circuits shall be equipped with a 30- ampere, triple-pole, double-throw, closed circuit knife switch in each station circuit and in each gong circuit for isolating defective circuits. These switches shall be under electrical supervision.
- (e) Each station circuit, each gong circuit, each meter, each relay, each contactor, each resistor, each time limit device, each feeder wire and the trouble bell circuit shall be identified by an engraved beveled edge white-core bakelite name-plate 1/16-inch thick, Duralith or equal.
Submit sample nameplate for approval.
Nameplates shall be fastened to the control board in such a manner as to be easily read.

Boards of the low voltage operating modular type these boards shall conform to the following specifications:
- (f) The control board shall be of solid state design using various plug-in modules to provide the indicated (or required when there is no indication in the plans or specs. number of box and gong circuits. The system trouble bell shall sound if any of the modules are removed from the control panel.
- (g) All solid state control panels shall include one (1) milliammeter to register current through supervisory circuits.
- (h) All initiating circuits shall include an alarm light and a trouble light. Individual annunciation of trouble per circuit shall not necessarily cause that circuit to be inoperative.
- (i) All alarm signal modules shall be provided with fused outputs and an alarm light tapped transformers.

16-16.11 Fire Signal Control Board (Con't)

- (j) All alarm modules shall be fed a standard dismissal code of four rounds of three strokes. A Punch Register module shall be provided when a punch register is called for in the contract and no punch register control board is furnished. The punch register shall receive the assigned coded signal for each station.

Control Boards of either type shall conform to the following specifications:

- (k) A Grounding Lug shall be furnished and installed on the cabinet of the Control Board. Lug shall be of proper size and suitable for receiving grounding conductor.
- (l) A silencer switch shall be provided on the Control Board which shall be capable of silencing local buzzers within the board, separate trouble bells located immediately above the board, and remote trouble bells (when required by the plans) in other areas of the building. A suitable trouble light shall be located on the board to light when the trouble bells are silenced. All trouble bells shall ring when the trouble is cleared and the silencer switch has not been thrown back (Ring-Back Feature).
- (m) Alarms received from the Normally Closed Push Button shall only initiate a single stroke on the bells with each push of this button.
- (n) When an alarm is received from a manual pull station, all fans connected to the fan shutdown system shall be shut down.
When a signal is received from the Normally Closed Push Button, fans shall not be shut down.
- (o) A Wiring Diagram and card of instruction shall be inserted in a directory frame with a transparent plastic face and mounted on the inside of the cabinet door, all as specified in paragraph 16-4.32.
- (p) Working drawings (in quadruplicate) of the cabinet and board showing all circuits for gongs, relays, switches, cutout, resistors, meters, etc. shall be submitted for approval before manufacture.

16-16.12 Trouble Bells

A trouble bell shall be installed on a suitable galvanized steel back box above the fire signal control board.

Trouble bell shall be 4 inches in size and shall indicate trouble on the system, and shall be an approved type 110-125 volt bell giving a distinctive tone signal.

16-16.13 Silencer Switch and Pilot Light

Furnish and install, where shown on drawings, a double pole, double throw switch, the approved equal of Arrow-Hart No. 8660 and a 250 volt pilot light with ruby glass. This switch shall be in connection with the trouble bell of the fire signal board. The switch and pilot light shall be placed behind a stainless steel plate type 302 engraved "SILENCER". The switch positions shall be engraved "T. BELL" and "LIGHT". Lettering shall be colored with red enamel. Silencer switch shall be connected in such a manner that the act of silencing the trouble bell, by the operation of the silencer switch, automatically transfers the trouble signal to the pilot light on the control board.

When the trouble has been repaired, the trouble bell shall ring until the silencing switch has been reset to its normal position.

16-16.14 Fuse Cutout Panels

Install in the switchboard room, at a location indicated on drawings, the fuse cutout panels.

Panel shall be equipped with a fused cutout for connections of each circuit connected thereto (as indicated on the drawing or required by the system.) and at least two additional spare circuits. Each cutout shall be equipped with a silver sand, current limiting fuse of proper size for protection of connected wire.

(a) Exit & Emergency Light Panel

The exit & emergency light cutout panel shall be a column type panelboard circuit breaker type and shall be in accordance with paragraph 16-4.13 panelboards.

(b) Fire Signal Cutout Panel

- (1) Provide an individual cartridge fuse cutout with number of poles as required, and a removable neutral bar in fuse gap for each fire control system indicated on drawings (i.e., fire signal, sprinkler alarm, each smoke detection system, punch register, time stamp and heat detection system).
- (2) Compartments with partitions shall house respective individual fuse cutouts.
- (3) Each cutout shall bear a white-core bakelite identification nameplate.
- (4) Two (2) feeders (see drawings) shall be provided. One feeder for fire signal and the other looped to each of the aforementioned fire control systems. Modify wiring diagram accordingly.
- (5) The complete assembly shall meet code requirements and City Agency approval.

16-16.15 Punch Register Control Board

When so indicated on the drawings or in the amendments, furnish and install at a location indicated on the drawings a punch register control board as specified below. Where a low voltage modular type of fire signal control board is furnished, a punch register module meeting all the appropriate requirements of section 16-16.11 may be furnished within the fire signal control board.

A separate punch register control board shall meet the following specification:

The board shall be complete with transformer and copper oxide, selenium or other approved rectifier the equal of Rectox to supply direct current on a closed circuit to operate the punch register. The Board shall also be equipped with required relays, milliammeter, trouble bell connections, circuit terminals, etc., necessary to operate the punch register on closed circuit and to provide "Electrical Supervision", all as required and approved by the Division of Fire Prevention. Board shall be mounted in a sheet metal cabinet similar to that required for the fire signal control board. Cabinet shall have a suitable door equipped with a lock as described in Par. 16-4.31.

16-16.15 Punch Register Control Board (Con't)

Milliammeter shall be as specified for the fire signal control board. A wiring diagram shall be mounted on the inside of the cabinet door in a directory frame with transparent plastic face, all as specified in Par. 16-4.32 "Directories".

- (b) Working drawings (in quadruplicate) of the cabinet and board showing all circuits to relays, stations, punch register, trouble bells, etc., and giving the capacity of rectifier unit and transformer shall be submitted for approval before manufacture.
- (c) The Board shall be provided with a silencer switch and trouble light. The silencer switch shall be capable of silencing local buzzers, nearby trouble bells and remote trouble bells.
Trouble circuitry shall have a ring back feature to again ring trouble bells when trouble has been cleared and the silencer switch not reset.
Separate trouble bells, even where shown on the plans, shall not be required when the punch register is being powered from a module within the fire signal control board. In this case, trouble indication will be combined with the main fire signal control board trouble system.
- (d) The punch register control board on the punch register module in the fire signal control board shall deliver the assigned code to the punch register or to an alphanumeric printer.

16-16.16 Punch Register

When so indicated on the drawings or in the amendments furnish and install in the custodian's office at the location indicated on the drawings a punch register with time stamp, as specified in items (a) and (b) below. In lieu of a punch register, the contractor has the option of furnishing an alphanumeric printer with digital clock and all logic circuitry at the location shown for the punch register and as specified in item (c) below.

- (a) Punch register shall be of the slashing puncturing type using a one-inch tape and equipped with a "take-up" reel, and suitable for operation on a closed circuit using direct current. Punch register shall be installed where directed on a shelf described below. The "Excelsior" model punch register manufactured by the Gamewell Co., or an approved equal will be acceptable.

Furnish and deliver ten (10) extra tapes to the Custodian at the school.

A printed list of the code numbers for all stations indicating locations of fire signal boxes with respect to exits, stairs (not column numbers). Included in this list shall also be code numbers for the operation of the sprinkler alarm, stage exhaust operation (smoke detector system) and ventilating for shut-down (smoke detector system).

This list shall be mounted on the wall of the Custodian's office, where directed, behind a transparent non-breakable, non-inflammable plastic face set in aluminum frame. Submit list for approval before installation.

Install at location indicated on the Drawings a shelf for the Punch Register. Shelf shall be of suitable size and consist of not less than 1/2-inch ebony asbestos, lacquer finish, with rounded exterior edges and corners and suitable stainless steel edge molding. Install substantial mounting brackets to match, meeting the approval of the Executive Director.

- (b) Time Stamp

In addition to the Punch Register and Take Up Reel, install a Time Stamp to automatically record on the tape, date and hour with A.M. or P.M. designation, when the box circuit alarm is energized.

Provide all necessary contacts in Punch Register System to actuate the Time Stamp, when the box circuit alarm is energized.

16-16.16 Punch Register (Con't)

(b) Time Stamp

Provide an additional and separate 120 volt circuit with a 15 ampere fuse on the fire signal cutout panel for the operation of the time stamp.

Time stamp shall be the approved equal of Stromberg Company or Simplex Company, modified as required for proper functioning, will be acceptable.

- (c) Alphanumeric Printer shall be of a type capable of printing the appropriate number of the coded station that is activated along with the number of the station, the printer shall also print the month, day, year, and time, in minutes and seconds of each entry. The printer shall also make a coded identification of whether a manual or automatic device was activated separate from the number being printed. A Digital Clock shall be built into the printed which shows the year, month, day, hours, minutes and hundreths of a minute in digital numbers on the face of the unit. All logic and electronic circuitry required to decode the signals received from the fire signal control board module on the punch register control board shall be contained within the housing of this alphanumeric printer. This Contractor shall also furnish and install a suitable shelf on which to mount this printer at a location of approximately 5'-0" above the finished floor. Where the Contractor chooses to use this option, he shall provide all additional conduit and wiring as required by and what is shown on the plans for a punch register. All printers shall have the prior approval of the Board of Standards and Appeals of the City of New York.

16-16.17 Approved Equipment

Control Boards, fire signal stations, gongs, trouble bells, etc., manufactured by the Acme Fire Alarm Co., The Edwards Manufacturing Co., The Signal Engineering Company, Standard Electric Time Division of Johnson Control or other manufacturer in accordance with the above Specifications, in accordance with the rules of the Board of Standards and Appeals and approved by the Division of Fire Prevention of the New York City Fire Department will be acceptable.

16-16.18 Certification of Approval

The fire signal system as installed shall be in accordance with the rules of the Board of Standards and Appeals and shall be approved by the Division of Fire Prevention of the New York City Fire Department. A certificate of approval shall be obtained by the Contractor and delivered to the Executive Director before the work is finally accepted. The Contractor shall file application with the Fire Department for such certificate on completion of this work.

16-16.19 Rundown Bell

Electrical Contractor shall furnish, install and connect a 4-inch rundown bell above the heat detector control panel, combination smoke and heat detector control panel or sprinkler alarm control panel.

The bell shall be interwired with the code transmitter of each panel.

Contractor shall furnish, install and connect conduit and wire as shown on the drawings.

SECTION 16-17, SPRINKLER ALARM SYSTEM

16-17.01 General

When required by the Drawings or Amendments an approved Sprinkler Alarm System embodying all equipment indicated on the drawings and/or hereinafter specified shall be furnished and installed by this contractor. This system as installed shall be in accordance with the rules of the Board of Standards and Appeals and shall be approved by the Division of Fire Prevention of the New York City Fire Department. A certificate of approval shall be obtained by this Contractor and delivered to the Executive Director or his representative before the work is accepted.

16-17.02 Raceways and Conductors.

For conduits, conductors, boxes, fittings, etc., see Sections 16-5, 16-6, and 16-7.

Conductors shall meet the requirements of the Bureau of Fire Prevention. Submit sample of conductors for approval before installation.

16-17.03 Sprinkler Alarm Control Panel

Furnish and install, at the location indicated on the Drawings, an approved Closed Circuit Sprinkler Alarm Control Panel. This panel shall be either of the 120 volt operating type as specified below or of the low voltage modular type as specified in items (a) thru (e), and (h) thru (k), (a,b,c,d,e,h,i,j,k) below. Control panels shall be designed for operation from 120/208 volts (3 wire) alternating current service and shall continuously supervise all parts of the system by means of a supervisory current. Open circuit or a ground shall be indicated by means of indicating relays operating a trouble bell.

Panels of either type shall conform to the following:

- (a) A grounding, lug shall be furnished and installed on the cabinet of the Control Board. Lug shall be of proper size and suitable for receiving a grounding conductor.

16-17.03 Sprinkler Alarm Control Panel (Con't)

- (b) A silencer switch shall be provided on the Control Board which shall be capable of silencing local buzzers within the board, separate trouble bells located immediately above the board, and remote trouble bells (when required by the plans) in other areas of the building. A suitable trouble light shall be located on the board to light when the trouble bells are silenced. All trouble bells shall ring when the trouble is cleared and the silencer switch has not been thrown back (Ring-Back Feature).
- (c) A double acting code transmitter shall be furnished within the Control Board. One code wheel or circuit shall generate the normal dismissal code of a school building and shall be wired into the station circuitry of the Fire Signal Control Board.
The second code wheel or circuit shall generate a particular identifying code and shall be wired into the Punch Register Control Board. This second code wheel or circuit shall be a spare facility in those schools without a Punch Register. Where a mechanical or spring wound code transmitter is furnished an approved Run Down Bell shall be furnished and installed by this contractor, whether shown on the drawings or not, and wired with suitable conduit and wiring to the run-down contact on the Code transmitter.
- (d) Separate targets, or other approve identifying lights shall be provided for each water flow switch furnished in the building and for low pressure and low (or no) voltage on a booster pump set where a set has been furnished.
- (e) Activation of water flow switches and booster pump devices shall ring alarm bells at the panel and on the exterior of the building.

The Control Panel of the 120 volt operating type shall conform to the following:

- (f) The relays and contactors on the control board shall be provided with genuine coin silver contacts not less than 1/4 of an inch in diameter.
All contacts on relays shall be in duplicate, or shall have the equivalent in contact size and gap. All relays shall be quick-acting and equipped with adjustable bronze freeze pins, or other approved means of preventing "freezing".

16-17.03 Sprinkler Alarm Control Panel (Con't)

All control boards for two or more circuits shall be provided with contactor relays for actuating the gong circuits.

- (g) Control boards having four or more gong circuits shall be equipped with a 30 ampere, triple-pole double-throw, closed-circuit knife switch in each station circuit and in each gong circuit for isolating defective circuits. These switches shall be under electrical supervision.

The Control Panel of the Low Voltage Modular Type shall conform to the following:

- (h) The control board shall be of solid state design using various plug-in modules to provide the indicated (or required) when there is no indication in the plans or specs. number of water flow and booster alarm and gong circuits. The system trouble bell shall sound if any of the modules are removed from the control panel.
- (i) All solid state control panels shall include one milliammeter to register current through supervisory circuits.
- (j) All initiating circuits shall include an alarm light and a trouble light. Individual annunciation of trouble per circuit shall not necessarily cause that circuit to be inoperative.
- (k) All alarm signal modules shall be provided with fused outputs and an alarm light. Tapped transformers shall be capable of field modification to permit quick adjustment to circuit changes.

16-17.04 Bells

Furnish and install one 10-inch water flow alarm bell and a trouble bell adjacent to the control board and one 10-inch water flow alarm bell on the exterior of the school building at a location shown on the plans.

Immediately beneath this exterior bell furnish and install a suitable identifying placque as required by the Building Code of the City of New York wherever an exterior Sprinkler System Bell is to be furnished.

16-17.04 Bells (Con't)

Bells shall operate on 120 volts alternating current with a distinguishing tone. Bells shall be of the polarized type as manufactured by Edwards Mfg. Co., Auth Electric Co., Standard Electric Time Division of Johnson Controls or approved equal.

The terminals of all wires of bells be soldered to their respective binding posts in an approved manner.

16-17.05 Water Flow Valve

The water flow valve, indicated on the Drawings, will be furnished and installed by others.

The Electrical Contractor shall furnish and install the conduit and conductors to the water flow valve and complete all connections.

16-17.06 Silencer Switch and Pilot Light for Trouble Bell Circuit

Furnish and install, where shown on drawings, a double pole, double throw switch, the approved equal of Arrow Hart No. 8660 and a 250 volt pilot light with ruby glass. This switch shall be in connection with the trouble bell of the Fire Signal Board. The switch and pilot light shall be placed behind a stainless steel plate type 302 engraved ("SILENCER"). The switch positions shall be engraved "T-BELL" and "LIGHT".

Lettering shall be colored with red enamel. Silencer switch shall be connected in such a manner that the act of silencing the trouble bell, by the operation of the silencer switch, automatically transfers the trouble signal to the pilot light on the control board. When the trouble has been repaired, the trouble bell shall ring until the silencing switch has been reset to its normal position.

16-17.07 Sprinkler Booster Pump

Furnish and install, where indicated on drawings, a fused disconnect switch and a motor starter for the sprinkler booster pump. Switch, fuses and starter shall be of a size as specified and shown on the drawings.

Furnish a low pressure indicator and a no or low voltage indicator on the sprinkler alarm control panel. Furnish all required interconnecting wiring in rigid conduit to, and between current transformer cabinet, fused disconnect switch, motor starter, motor sprinkler alarm control panel and pressure switch. Pressure switch not in contract.

All work shall be in accordance with the rules of the New York City Fire Department, Building Department and all other agencies having jurisdiction.

16-17.08 Certificate of Approval

The sprinkler alarm equipment and installation shall meet with the approval of the Division of Fire Prevention of the New York City Fire Department. A certificate of approval shall be obtained by this contractor and delivered to the Executive Director before the work is accepted.

16-17.09 Acceptable Equipment

Equipment manufactured by the Acme Fire Alarm Co., Standard Electric Time Division of Johnson Controls, Inc., or approved equal which meets these specifications and is approved by the Fire Department of the City of New York will be acceptable.

SECTION 16-18, EMERGENCY LIGHTING SYSTEMS

16-18.01 General

Furnish and install as hereinafter specified when indicated on drawings one of the following systems:

- A) Emergency Battery Units - (6 volt or 12 volt)
- B) 115 Volt Emergency Lighting System
(Battery powered and charged emergency lighting system)

The emergency lighting systems, noted above, shall be interconnected with certain units of the exit light system as shown on exit and emergency light riser diagram.

All equipment shall be the product of one manufacturer. All units of the system shall be arranged for permanent rigid conduit connections.

16-18.02 Emergency Battery Units

Shall consist of a 40-ampere hour (5.5-6.0 volt) nickel cadmium battery, specifically designed for emergency lighting purposes. Unit shall contain a rectifier for constant trickle charge and an automatic device to provide up to 12 hours of fully automatic fast charge and operation. Fast charge shall be sufficient to return battery from full discharge to full charge in the time push button switch and a red neon pilot light to indicate the unit is ready for operation and properly functioning. Complete unit shall be housed in a compact case with hinged cover. Case shall have a corrosion resistant undercoat and an oven baked gray hammertone finish.

Unit shall be approved by and bear the label of Underwriter's Laboratory and shall be Lightalarms Model OSN6 or similar by Nicad (Nickel Cadmium Corp.) Dual Lite Co., Hobby Brown Corp., Electric Cord, or Electric Storage Battery Co. Model NA-40. Unit shall be mounted on a 14-gauge steel mounting platform finished to match unit.

16-18.03 Emergency Light Units

Where indicated shall be flush mounted universal swivel, 25-watt, 5-inch sealed beam floodlight with satin aluminum or satin chrome finished trim plate. These units shall be Lightalarms Model ELF605 or equal. Surface mounted units shall be Model ELF606 or equal. Where these units are installed in Gymnasium they shall be equipped with wire guard.

16-18.04 Spares

Deliver to Custodian 100 percent spare sealed beam units.

16-18.05 115 Volt Battery Powered and Charged Emergency Lighting System

A. General

This Contractor shall furnish and install a 115 volt, battery powered and charged emergency light system, when indicated on drawings, the approved equal of Lightalarms Model #CS115NC Series will be acceptable.

B. Battery and Charger Control Panel

1. Cabinet

This panel shall be in a cabinet, floor mounted, 18 gauge steel with undercoat finished in baked hammertone gray. The cabinet shall contain a 95 cell, 115 color nickel cadmium battery, charging equipment, meters, etc. and shall be adequately ventilated.

2. Charger

Charging shall be fully automatic 2-rate accomplished via a 100% solid state circuit having no relays or other moving parts. The high charge shall be initiated when the battery voltage falls to 104.5 volts, regardless of whether the AC supply has been lost. Charge shall continue until the battery reaches a voltage of 142.5 volts. The entire charger shall be current limited such that a float or trickle charge condition holding the battery at 122 volts. At that time the charger shall revert to the difference between the high-charge-current on a fully discharged and a fully charged battery does not vary more than 1 ampere. Current limiting shall also protect the charger in the event of a short circuit condition. The high charge shall be capable of recharging a discharged battery from 104.5 volts to 142.5 volts, within 12 hours.

3. Battery

Nickel cadmium battery shall be 95 cells and rated for 115 volt operation, and supplied with translucent plastic cells for viewing the electrolyte level. Electrolyte capacity is sufficient to provide a period of from 3 to 4 years without servicing. Battery shall be of sufficient capacity to carry the total load for 90 minutes to an end voltage of 1.1 volts per cell.

16-18.05 115 Volt Battery Powered and Charged Emergency Lighting System (Cont)

C. Transfer Panel

This panel shall provide instant emergency lighting in the event of a failure in normal service by automatically transferring to battery operated power. Panel shall consist of hermetically sealed mercury relays, operational relays, pilot light and test button. These components shall be mounted in a surface mounted cabinet, 20 gauge steel, with a corrosion resistant undercoat and baked gray hammertone finish with hinged door and snapcatch. Hermetically sealed mercury relays shall be 150 ampere.

The approved equal if Lightalarm PFP Series will be acceptable.

D. Emergency D.C. Circuit Breaker Panel

This panel shall be mounted in a surface mounted, 18 gauge steel cabinet finished in baked gray hammertone. Provide a hinged door with snapcatch over breakers. A phenolic back plate shall contain terminals, buzzer, pilot light silencing switch and circuit breaker connections. Number of circuits will be as indicated on drawings. The tripping of a circuit breaker will energize a buzzer and pilot light. Silencing switch "Off" position silences buzzer. When the breaker is reset, the buzzer will sound until the silencing switch is moved back to the "On" position. The approved equal of Lightalarm CBAP Series will be acceptable.

E. Battery Derangement Alarm Panel

This panel shall be mounted in a code gauge steel cabinet with a hinged door and an approved lock. Panel shall consist of a volt-meter, buzzers, relays, pilot lights and switches. Panel sounds an alarm on failure of battery or 120 A.C. alarm supply, battery voltage drops, charger stops, floating charge required adjustment, load fuse opens, system is in operation, open circuit occurs, electrolyte loss. The circuiting of this panel shall be solid state. Operation of silencer switch will be similar as herein before described for circuit breaker panel. The approved equal of Lightalarms XBAP Series will be acceptable.

F. Custodian's Alarm Panel

Where indicated on drawings, furnish and install, a remote alarm assembly consisting of the same audible and visual alarms with silencing switches as forementioned derangement panel. Mount this equipment in a standard flush four gang wall box with engraved .302 stainless steel plate. Unit shall be the approved equal of Lightalarms Model #LSR-2.

16-18.06 AC Standby System

- 1). Furnish and install and connect an AC Standby Power System with Nickel Cadmium Battery in accordance with these specifications and at location shown on drawing.

KVA rating, voltage input and voltage output shall be as specified in Amendments.

The AC Standby Power System shall have the following features unless otherwise noted in Amendments.

- a) Electrolyte Level Monitor and Alarm
- b) Output Circuit Breaker
- c) Remote AC/DC Monitor Alarm
- d) Remote Electrolyte Level Monitor

All mounting hardware, cabinetry, outlet and junction boxes, metal raceway and conductors necessary to complete this installation shall be furnished, installed and connected by the Electrical Contractor. Equipment shall be all of one manufacturer.

System shall be the approved equal of Light Alarms, Dual Lite, etc.

SECTION 16-19, SOUND, AND TEACHER-
ACTIVATED SECURITY SYSTEM

16-19.01 PERFORMANCE TESTS

Where this Contractor elects to furnish equipment on a particular project other than that specified in this section, he shall request approval of the Board of Education in writing and receive that approval, if granted, prior to submission of Shop Drawings on that particular project. The Contractor shall be required to submit these approval request sufficiently in advance so that the approval process will not delay the project. The Contractor or his supplier shall submit with his request technical data on the performance characteristics of the equipment being offered. This data shall certify that the performance of the equipment being offered meets the requirements of the specification and that the equipment being offered is equal to or better than that specified. The Board of Education may request that tests be conducted by the Contractor or his supplier, and may even require that these tests be conducted by an approved independent testing laboratory. Such tests shall be made under conditions which in the opinion of the Executive Director, simulate conditions of actual use in the school. This Contractor or his supplier shall include the costs of these tests and submissions as part of the contract where he first chooses to use this new equipment.

The data to be submitted shall include full and complete information regarding all performance characteristics which shall be deemed necessary and sufficient in the opinion of the Executive Director.

Where an Architect/Engineer of record amends these specification in a substantial manner on his particular project, the above requirements for performance tests shall apply except that the Contractor and his supplier shall submit for approval to that Architect/Engineer in lieu of the Board of Education and obtain approval from that Architect/Engineer of record.

16-19.02 GENERAL

A. Sound System

(a) Classroom Sound and Program System -

Furnish and install all items of equipment indicated on the Drawings or hereinafter specified,

or required to equip the building with a Classroom Sound System.

The Classroom Sound System shall be a three channel system which shall reproduce speech and music from radio, turntable and microphone at any or all loudspeakers over either of two main program channels. The third channel shall be an intercom channel which shall permit two way conversation between the rack or administrative telephones and each loudspeaker and shall permit listening-in at any area under the control of the area teacher by means of a privacy switch.

The Classroom Sound System shall also be designed to automatically reproduce at pre-selected loudspeakers a suitable tone for purposes of program signalling. Control of the Sound System for such program signalling shall be from the Program Instrument described in Section 16-10, "Electric Clock Equipment".

(b) Local Sound Systems -

When so indicated on the Drawings or in the Amendments, furnish and install all items of equipment indicated on the Drawings, described in the Specifications or required to equip the respective areas with the sound systems indicated:

1. An Auditorium Sound System - complete with local amplifier mounted in a cabinet at location shown on drawings.
2. A Cafeteria Sound System - complete with local amplifier mounted in a cabinet in the Cafeteria.
3. A Gymnasium Sound System for Each Gymnasium. This sound system shall be complete with a local amplifier mounted in a cabinet in each Gymnasium.
4. An Assembly Area Sound System - complete with local amplifier mounted in a cabinet in the Assembly Area.

THE AUDITORIUM, GYMNASIUM, CAFETERIA AND ASSEMBLY AREA SOUND SYSTEMS, shall reproduce speech and music from microphones and turntables through their respective loudspeakers, and each system shall be so interconnected with the classroom sound system that the auditorium, assembly area, gymnasium and cafeteria speakers may be fed from and controlled by the Central Control Rack and that program signalling from the Central Control Rack will be delivered to each speaker in each of these areas.

The Auditorium and Assembly Area Sound Systems shall also be so interconnected with the classroom sound system that the output of these systems may be fed into the classroom sound system through their respective amplifiers as hereinafter described.

All systems shall be capable of faithfully reproducing sound over the range of frequencies hereinafter described.

(d) General Requirements -

All equipment shall be complete in all respects with all connections made and shall operate in accordance with the specifications to the satisfaction of the Executive Director.

All equipment shall be designed for operation on the type of current and the voltage available at the building, which is usually from a nominal 120 volt, 60 Hz, single phase power source. This Contractor shall contact the Lighting Company, to determine the character of the current to be supplied and shall transmit this information to the manufacturer of the sound system so that the proper equipment will be supplied.

Extraneous noises developed by the system as installed in the building shall not be perceptible when the system is operating 6 db (sound volume) above the average operating volume level of the sound system.

The sound equipment shall be the product of approved manufacturers acceptable to the Executive Director.

Since dimensions of sound equipment vary for the different manufacturers, dimensions of all equipment shall be subject to the approval of the Executive Director. It shall be the obligation of this Contractor to verify space limitations before ordering equipment. The Contractor shall submit to the Executive Director a list of all equipment to be furnished, stating manufacture, type, special characteristics, dimensions, etc.

(d) Acceptable Manufacturers -

Acceptable manufacturers of sound equipment are Altec-Lansing Co., Rauland-Borg Co., Stromberg Carlson Co., Dukane Corporation and David Bogen Company. All equipment shall be the products of the aforementioned companies or the equal in performance of other manufacturers of sound equipment which meet the Specifications and are acceptable to the Executive Director.

B. Sound Motion Picture System.

Furnish and install all conduits, conductors, receptacles, etc., indicated on the Drawings, in the Specifications or required to provide a wiring system to be used for a 16 M.M. sound motion picture projector in the Auditorium or Assembly Area.

The projector will be furnished and installed by the Board of Education and is NOT part of this Contract.

C. INTERCOM AND TEACHER ACTIVATED SECURITY SYSTEM
ADMINISTRATIVE TELEPHONE COMMUNICATIONS SYSTEM

Furnish and install an Administrative Telephone Communication System incorporated with the intercom channel of the Classroom Sound System. This system shall have the following features and functions:

- (a) Direct dialing, two-way (via touch-tone push buttons) telephone communications between all administrative telephones; and between administrative telephones and intercom telephones, (where intercom telephones are part of this system).

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- (b) Direct dialing, two-way "amplified voice" communications between all administrative telephones and staff loudspeakers or staff telephones.
- (c) Automatic level control to assure a predetermined constant return-speech level.
- (d) Facilities for automatically sounding a warning tone signal over any loudspeaker selected for two-way "amplified voice" communication. The warning tone signal shall sound as soon as the station is selected and shall be automatically repeated at regular intervals for the duration of the call.
- (e) Capability for any administrative telephone to transfer a call from any administrative telephone, staff telephone, intercom telephone to another telephone, and to transfer calls from any loudspeaker station to any administrative telephone or intercom telephone.
- (f) Facilities for conference calls between administrative telephones and between administrative telephones and staff telephones (and loudspeakers) using any administrative telephone to establish the conference.
- (g) Facilities for the instantaneous distribution of emergency announcements simultaneously to all loudspeakers by dialing a predetermined code number. Emergency announcements originating at any administrative telephone shall have priority over all regular system functions (even if the audio-distribution center is turned off), and shall be transmitted at a predetermined level.
- (h) Built-in facilities for a minimum of ten (10) administrative telephones and two hundred (200) staff loudspeaker stations. At least four (4) of the administrative telephone locations shall be capable of visual displays.
- (i) Facilities for the origination of both "Normal" and "Priority" calls from any staff station. Normal call origination shall require only a momentary depression of the call-switch (or where telephones are used, by lifting the telephone from its cradle). This action shall sound a chime signal to alert personnel in the General Office to the call and

register the call on a digital display. Priority (Emergency) calls shall have precedence over all normal calls and shall be originated by "Flashing" the call origination switch (or flashing the telephone cradle switch).

- (j) Digital readout displays shall be provided with each administrative telephone (Maximum of four). The display system shall visually display in the order in which they are received, at least the first three (3) calls received and "Store" seven (7) more calls or a total of ten (10) in the memory circuit. Priority (Emergency) calls shall have precedence over all normal calls and shall be immediately displayed and identified by "Flashing" their number. The incoming call tone signal shall also sound repeatedly until the priority call is answered. The number that is flashed shall be the actual room numbers. (Architectural dialing).
- (k) Facilities for answering calls registered in the readout system in the order in which they are received by pressing a single "response" button.
- (l) A "busy" light on the face of each administrative telephone which lights whenever the system is busy.
- (m) Provisions for coded signalling from one administrative telephone to another administrative telephone.
- (n) Facilities to prevent monitoring of any staff station whose call origination switch is in the "private" mode.
- (o) Facilities for the use of staff telephones for communications without interruption of normal programming, or the distribution of time or alarm signals.
- (p) Facilities for the distribution of a program signal to selected speakers at specified time intervals. This action shall be controlled by the operation of a program clock, which may be external to this system or part of this system as specified.

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- (q) Provisions for sounding a momentary warning tone every ten (10) seconds when an administrative phone is picked up to supervise a conversation in progress.
- (r) Facilities for two-way communications between any staff loudspeaker and any other staff loudspeaker.
- (s) Ability to use any telephone as an "announcement microphone" permitting the telephone to be used for local sound reinforcement.
- (t) Facility for the distribution of alarm signals to all areas equipped with loudspeakers by pushbutton dialing of pre-determined code numbers. This is to be accomplished even if the audio distribution center is turned off. Three separate, distinct alarm signals shall be provided with each having a separate dial code number.
- (u) The Administrative Telephone Communications System shall be the equal of Rauland Telecenter III/Telecenter I or DuKane System 1200/PAX modified as required to meet the above listed performance features and functions.

D. APPROVAL BY UNDERWRITERS LABORATORIES, INC.

All amplifiers and radio tuners shall be approved by the Underwriters Laboratories Inc. and shall bear their seal of approval.

E. OPTIONAL INCLUSION OF INTERIOR (INTERCOM) TELEPHONE SYSTEM AS PART OF SOUND SYSTEM.

On Primary School, Intermediate School of Junior High School Projects, this Contractor is permitted to include the Interior (Intercom) Telephone System as part of this system where the contract plans and specifications require him to provide a separate Interior (Intercom) Telephone System. This Contractor at his option may furnish either separate Sound/Security and Interior Telephone Systems as specified or a combined system. This option is not offered in the case of High School Projects. The combined optional system shall have the following features in addition to those specified in A,B, and C above.

- (a) Interior (Intercom) dial telephones shall be capable of dialing and communicating with each administrative telephone and every other interior dial telephone automatically.
- (b) Interior (Intercom) dial telephones shall be capable of contacting staff stations (loudspeakers or telephones) through the administrative telephones.

- (c) System shall permit the same number of simultaneous separate conversations between Interior dial telephones as required of the Telephone Exchange Unit in Section 16-11. This total number shall be held to a maximum of ten and shall not include the conversation path furnished normally with the administrative telephone system.
- (d) All exchange equipment shall be included as part of the Central Control Rack and this Contractor shall furnish and install additional conduit and wiring as required to route all telephone lines from the Telephone Exchange Location to the Central Control Rack.
- (e) The exchange equipment in the Central Control Rack shall automatically disconnect from the exchange any telephone which is taken "off the hook" where dialing has not commenced within fifteen (15) seconds.
- (f) The Contractor shall omit the interior (intercom) telephone on all desks where one is installed adjacent to an administrative telephone and all "tel lines" to these omitted telephones. Only one telephone shall be omitted however in the General Office Area. This omission is permitted in this option since the administrative telephone at the same desk is capable of performing all the activities of the interior dial telephone.
- (g) The system shall be the approved equal of a modified Raulang-Borg combination of Telecenter I and Telecenter III, modified as required to meet all the above and hereafter requirements.

16-19.03 CENTRAL CONTROL RACK

A. General

Furnish and install a Central Control Rack at the location indicated on the drawings. The equipment hereinafter described shall be mounted in one, two or three cabinets as required, in an arrangement satisfactory to the Executive Director.

All equipment shall be rigidly supported by the steel framework of the cabinet in an approved manner. Method of mounting equipment shall be submitted for approval before fabrication of Central Control Rack.

B. Cabinet

Each cabinet shall be approximately 84" high x 22" wide x 15" deep. If another size is used, it shall be approved by the Executive Director. Top and sides of cabinet shall be of cold rolled steel not less than #16 gauge rigidly braced and reinforced throughout. Bottom shall be of steel not less than 12 gauge.

Panel mounting angle irons shall be not less than 3/16" thick, with mounting holes accurately drilled and tapped 12/24" thread on multiple 1¼"-1½" spacings. All screws for panel mounting, angle mounting, etc., shall be concealed by means of full length trim at corners, sides and front. Corner trims shall be rounded.

Rear of cabinet shall be equipped with a cold rolled steel door of same thickness as cabinet, containing suitable ventilating grilles at top and bottom. The door shall be hung from 3 sturdy, loose jointed steel hinges attached to flange at rear of cabinet. Door shall have bent up return edge and shall close against a concealed rabbet at top, bottom and side of door openings. Doors shall be equipped with an approved handle and a Yale 511-S lock with a #47 key change.

Rear door of cabinet in Sound Control Closet shall have approved combination handle and catch.

Equipment shall be either shelf-mounted or frame-mounted. Panel mounting of heavy equipment will not be permitted.

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Angle irons shall be installed in an approved manner to rigidly support heavy equipment not supported by shelves. Sufficient space shall be left at side and rear of shelves for installation of rack wiring.

Suitably rust-proofed and finished cold roll formed steel panels not less than 16 gauge, if properly braced, or aluminum panels not less than 1/8 inch thick, shall be secured to the front panel mounting angles by means of round oval head steel screws. Control equipment hereinafter described shall be mounted on panel front.

The bottom of the rack shall be equipped with suitable openings for admitting external circuit conductors. Any additional openings in sides of cabinet shall be neatly cut by this Contractor.

Cabinets and panels shall be spray painted with one coat of high bake oil primer and one smooth coat of slat gray enamel. Trim shall be of gray enamel to match.

Where the cabinet is installed in closet, a suitable L-shaped trim shall be provided to close the space between the rack and the door frame. Trim shall have a gray finish to match rack panel. Trim shall be fastened to front of rack and door frame. Trim shall be installed in accordance with directions of the Board of Education electrical representative at the school.

Where the Central Control Rack is installed in a framed opening of a wall, this contractor shall furnish and install a suitable L-shaped trim on both sides of the opening to close the space between the rack and the opening. This trim shall be specified above for a closet installation.

Where the Central Control Rack is required by the plans, specifications, or amendments to be installed in one cabinet in a closet and one cabinet is insufficient to house all components, this contractor shall offer alternate proposals for component arrangement to the engineer/architect of record for approval.

Components may be mouted in wall hung enclosures either within the closet or immediately outside the closet. All additional enclosures, conduit, wiring required by these alternate proposals shall be furnished and installed by this contractor as part of this contract.

C. Components: The Central Control Rack shall contain, but not be limited to the following:

(1) Central Switching Exchange—shall be similar to Rauland RT2002 and Tac 100 Expander or DuKane 9A1716 and expander panels or approved equal. Furnish and install a central switching exchange designed for use with dual-tone modulation type pushbutton dialing telephones. The exchange shall be an electronic switching type utilizing all solid state, logic and control circuits. It shall provide 3 wire balanced transmission complete with dial tone, ringing busy signal and conference call facilities. The exchange shall consist of the following components:

(a) Microprocessor Panel - This panel shall be completely solid state computer, capable of processing call information from Administrative Telephones and classroom and either completing the call or adding to the call waiting list. The processor shall maintain a call waiting list of up to 100 calls, and shall display the number of the first call on the list and the number of calls waiting on the list on digital readouts associated with Administrative Telephones.

(b) Autotrol Panel - This panel shall provide hands free, two way voice amplification between a telephone handset and a loudspeaker. All switching shall be done electronically, and the amplifier shall be rated at 15 watts with less than 5% distortion within the voice tailored frequency range. Pre-set level controls shall eliminate the need for either of the participants in the conversation to adjust a volume control.

(c) Multiplexer Panel - This panel shall monitor the classrooms stations to determine if a classroom is signalling a call, and to determine the level of the call, if one is present. When the multiplexer panel has decoded a call and determined the level

of the call to the waiting list. A typical time interval for checking all classroom stations in the system shall be 100 milliseconds.

- (d) Multifunction Panel - This panel shall provide tone generation at the direction of the Administrative Telephones, provide amplifier gathering for zone or All-Call paging at the direction of the microprocessor panel, and provide control signals to the selector switch banks for Time Program Signalling.

The exchange shall have the following features:

- (a) The central exchange shall have built in switching and control facilities for a minimum of one hundred (100) staff station lines and ten (10) administrative lines, plus facilities for accommodating a minimum of ten (10) special functions. The exchange shall be increased by the addition of an expander unit with provisions for an additional one hundred (100) staff station lines for a total of two hundred (200) lines.
- (b) The exchange shall also include a bi-directional voice controlled amplifier for two way communications between telephones and loudspeakers without the need of a talk-listen switch.
- (c) The exchange shall be capable of receiving, calls from one-hundred (100) stations and displaying their staff numbers on the associated digital displays.

These staff numbers shall be the actual room numbers.

- (d) The voice controlled amplifier shall have an output of at least 5 watt RMS and shall include a built in volume compressor so as to eliminate the need for volume controls and facilities for sounding tone signals over any loudspeaker selected for communication.
- (e) The incoming call circuitry shall be of the integrated circuit (IC) type using logic design for functions and memory.

- (f) The exchange shall also include all the circuitry required for operation of staff stations and the generation and distribution of signals and alarms.
- (g) It shall be of modular design utilizing plug-in printed circuit boards with support channels for each board. The boards will be UL approved.
- (h) The exchange shall be for rack mounting in any standard 19 inch rack and shall have a depth no greater than 13 inches and require no more than 14 inches of panel space.

(2) DC Regulated Power Supply

The power supply shall be DuKane, model 17A365 Rauland PSX30 or approved equal.

Power Supply shall furnish 24 volts D.C. at 3.2 amperes. The supply shall operate on 105 to 125 volts AC by use of primary transformer taps. The input shall be protected by a 2 ampere and a 3 ampere fuse.

The output shall be protected by an electronic fold back circuit and a 3.2 ampere resettable circuit breaker. The fold back circuit shall be self restoring when the overload or short condition is removed.

Power supply be 3½ inches high, 19 inches wide and 5½ inches deep.

Finish shall be light gray with black trim. External connections shall be screw terminals.

(3) AM-FM Tuner

The AM-FM tuner shall be a Rauland (SRX143) or approved equal, designed specifically for continuous duty service.

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It shall be completely solid-state, including transistors and integrated circuits for reduced power consumption and greater reliability and life expectancy. Tuners using tubes (which require frequent replacement), will not be accepted.

The AM portion shall have a tuning range of 540 to 1600 KHz, a sensitivity of at least 3 microvolts for 6 db signal-to-noise ratio, and an adjacent channel selectivity of at least 40 db. Image rejection, measured at 600 KHz shall be 96 db, and if rejection shall be at least 75 db. Image rejection, measured at 600 KHz shall be 96 db., and if rejection shall be least 75 db. The AM section shall include an antenna matching coil, and screw terminals shall be provided for connection of an external AM antenna.

The FM section shall have a tuning range of 88 to 108 MHz, with alternate channel selectivity of 75 db, a sensitivity of at least 1.5 microvolts for 20 db quieting, and a 6 db band-width of at least 400 KHz. Image rejection measured at 88 MHz shall be at least 90 db, and if rejection measured at 88 MHz shall be at least 81 db.. The tuner shall also incorporate a switchable muting circuit to quiet noise between stations on FM. Screw terminals for the connection of either a 75 or 300 ohm external antenna shall also be provided.

The FM frequency response shall be at least ± 2 db from 20 to 15,000 Hz, with distortion of less than 0.5% at rated output.

The tuner shall be equipped with an illuminated slide-rule dial employing a weighted flywheel and gear-driven tuning capacitor for smooth tuning. An illuminated peak tuning meter shall be provided for precise "on-station" adjustment of both AM and FM stations.

The tuner shall require no more than $3\frac{1}{2}$ inches high, 19 inches wide and shall be no more than 8" deep. The face panel shall be tinted brushed chrome with a wear-resistant protective top coat.

The tuner shall meet FCC radiation requirements and be listed by the Underwriters' Laboratories Re-examination Service.

The dial of the tuner shall be plainly marked by an easily distinguishable line at the proper tuning position for best reception of Radio Station WNYE, and this position shall be plainly labeled "WYNE".

(4) Channel 'A'

Control Panel - This panel provides a built in Panel microphone, all Room or Selected Room transmit buttons, remote emergency operation, remote volume control capability and automatic output level control. Panel shall be Rauland, Model MC1-200, DuKane Model #9A1665 or approved equal.

This panel shall be a visual flow panel with illuminated push buttons color keyed to the color coded operational guideline and shall be completely solid state.

Panel shall be 3½ inches high, 19 inches wide and 8 inches deep. Front Panel shall be finished with a gray, baked enamel with charcoal brown overlay bearing yellow operational guidelines.

Furnish and install an input expander panel with this control panel. Expander panel shall be DuKane, Catalog #2A65 or approved equal. Input selector buttons or 19 position selector switch shall be provided for each microphone input and Zero Level Input with at least 20% spare positions.

Pre Amplifier

A voltage pre amplifier shall be provided for each channel to provide voltage amplification for each of these separate and distinct channel. Each pre-amplifier shall be securely mounted on the Master Control Panel.

The program pre-amplifier shall have an output rating of 1.5 volts into 10,000 ohms at less than 1% distortion. from 40 to 15,000 hz. Frequency response shall be flat within ± 2 db over this range. Microphone inputs shall be 47K ohms unbalanced, convertible to balanced 150 ohms. Auxiliary inputs shall be 500K ohms unbalanced with a 0.25 volt sensitivity. A rear mounted treble control shall be provided. Pre-amplifier provides a minimum of five program inputs (two microphone, one tuner-player, two auxiliary) each selected by fluorescent color display push-button.

- (5) Channel 'B' Control Panel - This panel shall be completely solid state and shall provide automatic output level control. The panel shall be a visual flow panel with illuminated pushbuttons color keyed to the color coded operational guide-lines. This panel shall be used in conjunction with Channel A Master Control Panel.

Panel shall be 13/4 inches high, 19 inches wide and 8 inches deep. The front panel shall be finished with gray, baked enamel with charcoal brown overlay bearing green operational guide-lines.

Panel shall be Rauland, Model MCB-200, Du Kane model 9A1670 or approved equal.

Furnish and install an input expander panel with this control panel. Expander panel shall be DuKane, catalog #2A65 or approved equal. Input selector buttons or 19 position selector switch shall be provided for each microphone input and zero level input with at least 20% spare positions.

Pre Amplifier

A voltage pre amplifier shall be provided for each channel to provide voltage amplification for each of these separate and distinct channel. Each pre-amplifier shall be securely mounted on the Master Control Panel.

The program preamplifier shall have an output rating of 1.5 volts into 10,000 ohms at less than 1% distortion from 40 to 15,000 hz. Frequency response shall be flat within ± 2 db over this range. Microphone inputs shall be 47K ohms unbalanced, convertible to balanced 150 ohms. Auxiliary inputs shall be 500K ohms unbalanced with a 0.25 volt sensitivity. A rear mounted treble control shall be provided. Preamplifier provides a minimum of five program inputs (two microphone, one tuner-player, two auxiliary) each selected by fluroescent color display pushbutton.

(6) Speaker Selector Panel

- A. This panel shall contain twenty-five (25) two pole, four position switches that are color coded to match functions of Control Panels as follows:

Black (OFF); White (IC), Yellow (Channel A) and Green (Channel B).

This panel design shall allow the addition of annunciator facilities consisting of an annunciator lamp and receptacle for each selector switch mounted behind a full length designation strip.

The annunciator lamps shall be replaceable from the front panel without removing the panel. A receptacle associated with each switch shall permit adding plug-in relays as required for time signal distribution to individual areas as selected on the optional twelve (12) circuit cross connect board. It shall be possible to program the cross connect board from the front of the panel.

There shall be provisions to allow selection of individual speakers to the common bus to enable this bus to be used for IC application.

Panel shall be 3½ inches high, 19 inches wide and 9¼ inches deep.

Panel shall be DuKane, model 9A1436A, Rauland model #SWL425 or approved equal. The number of switches shall be as noted in the amendments.

- B. Furnish a Scanner Panel which shall provide control signals to the Selector Switch Speaker Panel to connect the correct station to the Multiplexer Panel, when a call signal is received from the Multiplexer Panel. Each switchbank panel shall be provided with a scanner panel.
- C. Furnish and install an approved cross-connect panel capable of delivering 3 (for Elementary or Primary Schools), 6 (for Junior High or Intermediate Schools), and 12 (for High Schools) programs with each speaker selector panel.

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(7) Control Panel For Local Sound System.

A local sound system is to be provided in the gymnasium, cafeteria and auditorium or assembly area where shown on plans or required by specs. A switch panel shall be provided on the rack, for each of these areas, and shall be provided with switches from the enclosure for the purpose of connecting the loudspeaker circuits in these areas to either Channel A or Channel B.

Switches shall be constructed so that provisions for actuating priority relays which shall disconnect the loudspeakers from the local amplifier and connect up to the Central Control Rack. Each local sound system switch shall be provided with an LED and shall be illuminated upon operation of the system. Panels for local sound system shall be suitably engraved for the various functions and location of equipment. Whereupon the areas noted above have additional functions such as convertible classrooms additional LED'S shall provide for each classroom on their respective panels.

(8) Power Amplifier - Total of Two (Channel A & Channel B).

Power amplifier shall employ silicon transistors exclusively and be capable of delivering an output (watts) as noted in the Amendments. Output shall be at less than 3 percent distortion 40 to 10,000 hertz.

Frequency response shall be 20 to 20,000 hertz 1 2db. Noise level shall be at least 75 db below rated output. Input shall be 1,000,000 ohms single ended. Rated output shall be obtained with 0.4 volt input. Balanced or single ended 25 volt and 70 volt outputs shall be available at a screw terminal strip. Output regulation shall be within 2 db from no load to full load. The amplifier shall supply auxiliary voltage of 28 volts DC, 50 milliamps maximum. An input level control shall be provided. The unit shall operate on 105-130 volts, 50-60 hertz and consume approximately 240 watts. The amplifier shall have protective circuits including a thermally operated relay and an automatically resetting electronic circuit to reduce dissipation under overload or short circuit conditions.

Amplifier shall be 8 3/4 inches high, 19 inches wide and 7 inches deep.

Finish shall be light gray baked enamel. Amplifier shall be DuKane 1A803, Rauland #TAX250 or approved equal.

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Power Amplifier - Con't

The minimum power required for each channel at the Central Control Rack to operate all of the speakers in the building (including speakers in the Auditorium, Gymnasia, and Cafeteria) at the same time on the same channel is given in the Amendments.

(9) Microphone, Tape and Phono Receptacle Input Panel.

Furnish and install on the front panel of the control rack two twist lock receptacles.

Hubbell 7582 or the equal by Bryant or Arrow-Hart for connecting a microphone or a turntable. Each receptacle shall be connected to a point on each input button or selector switch hereinbefore specified. (Receptacle shall have white core) bakelite name plates inscribed "Mic Phono".) A

Tape Recorder Receptacles. " " B

A tape recorder "playback" receptacle, the equal of Switchcraft #51 shall be panel mounted and connected to a position on each input selector switch. A network shall be provided to match the level and impedance of a zero level unbalanced output of a standard commercial tape recorder to the system.

A tape recorder "record" receptacle, the equal of Switchcraft #51 shall be panel mounted and connected to a three-position switch marked "CHAN-A-RADIO-CHAN-B". The switch shall be associated with resistors and/or a transformer to provide a zero level signal available at receptacle for recording from system. The switch shall provide a bridged signal from the output of the pre-amplifiers in the Channel A and Channel B positions, and when in the Radio position, shall provide a bridged signal directly from the radio tuner output.

Receptacles shall be suitably inscribed.

Provide (1) ten (10) foot interconnecting cable, with molded mating plugs for the above receptacles.

(10) Terminal Strips

At bottom rear of the Sound Control Cabinet provide approved terminal blocks with adequate metal or equivalent backing for terminating all incoming loudspeaker, microphone and turntable circuits to the rack.

(10) Terminal Strips - Con't

Terminal blocks for loudspeaker circuits shall be the approved equal of Jones No. 140-21.

Terminal blocks for microphone or turntable circuits shall be the approved equal of Western Electric No. WE L3A. Each block shall be equipped with 80 terminals. Terminals for microphone or turntable circuits shall be of the solder type only.

Furnish and install a directory on the inside of the door of the Rack Directory shall be identical with that supplied for lighting panelboards, and shall identify all circuits terminating at the terminal strips.

- (b) Grounding of the mesh shielding of all microphone and turntable conductors shall be accomplished by soldering the mesh shield of each pair of conductors to a separate point on the terminal block. All points on the terminal block to which mesh shields are connected shall be in the same vertical line, and shall be interconnected by a common conductor soldered at each point. This common ground conductor shall be connected to the ground terminal of the rack.
- (c) Grounding of uninsulated conductor of loudspeaker cable shall be accomplished in the following manner:
The screw terminals between each adjacent-pair of terminals (1 "LS" cable each pair) shall be used to connect the uninsulated ground wire of adjacent cables.
The ground terminals shall be tied together by a No. 18 tinned copper wire which in turn shall be grounded to frame of rack.
- (d) The terminal block to which the microphone and turntable circuits are connected shall be isolated from the terminal blocks to which loudspeaker lines are connected by means of a metal barrier.
- (e) F.M. and A.M. antenna transmission lines shall be connected to the same terminal block as the microphone and turntable lines.
- (f) In addition to the above terminal strips provide an additional terminal strip, the approved equal of Jones No. 142-4, for terminating the external 120 volt power circuits, and the 120 volt external pilot light. This terminal strip shall be separate and apart from all other terminal strips.

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(11) Blank Panels.

Blank panels shall be provided for spaces on the rack not needed for equipment.

(12) Finish.

The finish of all panels shall be gray, as hereinbefore specified with controls and switches to match or harmonize.

(13) Principal's Signal Button.

Mount in a convenient position on the rack a locking type push-button switch, the equal of A-H 86710-C. Adjacent to the switch mount a 6-volt lamp set in a miniature base socket (Drake or equal) and covered by a green jewel. This switch shall connect this lamp and the lamp in the Principal's Office with a 6-volt supply from a transformer connection to the AC power supply immediately after lock switch on AC power control panel. Inscribe push-button "PRIN. SIG."

(14) A.C. Power Wiring to Central Control Rack.

The power supply for the Central Control Rack shall consist of not less than two No. 10 wires in 3/4 inch conduit unless otherwise indicated on Drawings or directed. The power supply shall be furnished and installed by the Contractor for Electric Work. The manufacturer of the Central Control Rack shall provide wiring from the main switch on the A.C. Power Control Panel to the terminal strip for 120 volt power connection.

(15) Pull Box Central Control Rack..

The pull box adjacent to the Central Control Rack shall be of rigid construction, using steel sheets having a thickness not less than No. 14 gauge. Box shall be rigidly braced and firmly fastened to the ceiling of the floor below or adjacent to rack, as indicated on Drawings, so as not to vibrate. The cover shall be attached by monel metal machine screws.

Whenever this pull box is mounted over boilers or other heat producing equipment, the four vertical sides shall be lined with a heat insulating material the equal of Celotex or Fiberglass. Insulation shall be at least 1-inch thick.

(16) Sound Motion Picture Modification. (Schools WITHOUT Audit, or Assembly Area Sound Systems).

(a) General:

In addition to the functions previously described, the classroom sound system shall be designed to permit the Auditorium speakers to reproduce the output of a 16 mm sound projector operated within the Projector Closet. When a school is equipped with an Auditorium or Assembly Area Sound System this paragraph does not apply.

1. Matching Transformer:

A suitable impedance matching transformer shall be mounted where convenient within the Central Control Rack to match the impedance of the Auditorium speakers to the output impedance of the projector amplifier. Transformer shall have a rating equal to or in excess of the power output rating of the projector amplifier.

2. Relay:

Mounted within the Central Control Rack there shall be a relay, which when energized by a toggle switch located where shown on drawings, will permit the Auditorium speakers to be used by the projector amplifier when the

3. Auditorium Floor Pedestal.

When above mentioned switch is shown in Auditorium Floor a Cannon receptacle (male) and a two (2) pole key toggle (P & S No. 1312L or equal) shall be installed under one face plate and a microphone receptacle (Bryant No. 7582), or equal, in opposite face plate in a cast aluminum service fitting at location shown on Drawing. Outlets shall face side walls of auditorium. Face plate shall be properly inscribed.

4. Auditorium Pilot Light:

Mounted where suitable on a front panel of the Central Control Rack a Drake or equal miniature base socket and pilot lamp covered by a red jewel. Pilot light shall be wired to indicate when Auditorium speakers are being used by the movie projector.

(17) Keys.

All keys for Central Control and Program Racks shall be delivered to the Principal of the School and to no other person.

(18) Main Power Pilot Light Connection.

The 120-volt pilot light hereinafter described shall be connected through an approved 120-volt terminal strip at lower rear of the cabinet to the main power control switch for the Central Control Rack. Wiring within the cabinet shall be performed by the manufacturer of the Sound System.

(19) Program Signal Modification

- A) General - In addition to the functions previously described, the classroom sound system shall be designed to reproduce a sound signal automatically at loudspeakers for program signalling (time signal distribution).

Program signalling shall be controlled by a program instrument described in Section 16-10-

"ELECTRIC CLOCK EQUIPMENT".

The program signal shall be reproduced at all desired loudspeakers regardless of the setting of the individual speaker switch, the A.C. power switches or the main gain controls. A school equipped to operate on several programs (Paragraph Speaker Control Panel), the desired loudspeakers for any program shall be pre-selected by setting of the cross connect board.

B) Program Signal Equipment Required In School

1. Program Instrument.

The program instrument described in Section 17-10 "Electric Clock Equipment" shall be installed by the Contractor for Electric Work at location indicated on the Drawings. This Contractor shall furnish and install all necessary conduits and conductors to properly connect the time signal distribution equipment in the Central Control Rack to the Program Instrument. All work shall be performed according to directions from, and to the satisfaction of, the Executive Director.

16-19.03 CENTRAL CONTROL RACK (Con't)

(B) Program Signal Equipment Required in School - (Con't)

2. Relays.

Furnish and install relays which will accomplish the following program control. Relays shall be mounted in the Central Control Rack so as to be easily accessible when the rear door of the rack is open. Each relay shall have a name strip mounted adjacent to it to identify the circuit or device to which it is connected.

- (a) When the Program Instrument closes contacts or when the Program Signalling Pushbutton is depressed manually, all loudspeakers shall be disconnected from the output side of both power amplifiers (Channel A and Channel B), and shall be connected to the output of the alternator, regardless of the position of the room selector switches. Simultaneously, 120 volt A.C. power shall be connected to the input side of the alternator.
- (b) All relays except the relay which connects 120 volt A.C. Power to the Alternator shall be actuated by low voltage (less than 50 volts) A.C. or D.C. power.
- (c) Relays which are actuated by the Program Instrument, or by the All Ring Pushbutton shall be of the multi-contact type, positive acting, free from chatter, the equal of Ohmite type "GPRX" Relays.
- (d) The relay which connects 120 volts power to the input of the Alternator shall be the approved equal of Arrow-Hart 28300.
- (e) Relays shall operate with a low noise level which is not objectionable to the Executive Director.

Current Supply for Relays.

Relays may operate either on D.C. or A.C. Actuating of relays shall not interfere with operation of the Sound System.

Wherever DC relays are employed, a selenium oxide rectifier supplying suitable voltages (not over 50 volts) and current shall be provided and properly wired to supply DC power for field coils of the relays specified above.

Wherever AC relays are utilized, furnish, install and connect an approved transformer to produce suitable voltage (not over 50 volts) for relay operation.

3. Cross - Connect Panels.

Furnish and install suitable Cross-Connect Panels as part of the Speaker Selector Panel. These cross-connect panels shall permit selection of speakers on each programming circuit.

4. Transistorized Signal Generator.

Furnish and install a transistorized signal generator to produce an audible program signal where directed by the program circuitry. This generator shall be as specified below. In lieu of a separate generator, this contractor may use one of the tone signals generated by the Central Switching Exchange.

1. The input voltage shall be 115 to 135 V.A.C. at 60-Hz.
2. The power output shall not be less than 125% of Amplifier Rating and in any case shall not be less than 125-watts. The generator shall be capable of supplying this power for at least three minutes without undue heating.
3. A range of different output impedances shall be available including a 70-volt tap.
4. The output power regulation, when using any of the input or output taps shall be plus or minus 5% from a 20% to 100% load.
5. The output frequency shall be 400-Hz and shall have a square wave characteristic.
6. The output frequency regulation, when using any of the input or output taps shall be plus or minus 5% from a 20% to 100% load.
7. The generator shall have no moving parts.
8. The generator shall require no warm-up time and its output shall be available for instant usage after A.C. power to the unit is turned on.
9. The generator shall be adequately fused and shall not consume any standby power.
10. Construction of the generator chassis shall be rugged and adequate heat dissipating devices shall be utilized and shall be satisfactory to the Executive Director.
11. All connections shall be made by approved connections on the chassis.
12. Furnish and attach a suitable manufacturers' nameplate.
13. A neon light mounted on the front of the Cabinet shall indicate when generator is functioning.

16-19.04 POWER SUPPLY FOR PRIORITY RELAYS - (LOCAL AMPLIFIERS).

Where the Drawings require the installation of local sound systems in the Auditorium, Assembly Area, Cafeteria or Gymnasium, a suitable A.C. or D.C. power supply shall be provided to actuate relays (in the local amplifier cabinets) which disconnect loudspeakers in the enclosure from the local amplifier and connect these loudspeakers to the Central Control Rack. The operating voltage shall not exceed 50 volts, open circuit voltage.

16-19.05 A.C. POWER CONTROL.

(a) School Equipped with Audio Visual Center.

On a panel approximately $3\frac{1}{2}$ inches high, mounted approximately 4'-6" above the floor in the Central Control Rack, the following switches shall be installed:

1. Three-way lock switch and a 150 volt pilot as selected for connecting and disconnecting the main A.C. power supply of the entire rack. This switch shall be marked "Main Power Supply", and shall be operated by means of a key different from any other key used in the building. Furnish and deliver four keys to the Principal at the School.

The lock switch shall be operated by a Corbin type or Yale type key. Switch shall be approved equal of Arrow-Hart 1543-L Key shall be stamped "Sound Systems".

2. A toggle switch and a 150 volt pilot light for connecting and disconnecting A.C. power supply of Channel A amplifiers. This switch shall be marked "Power Supply --Channel A".
3. A toggle switch and a 150 volt pilot light for connecting and disconnecting A.C. power supply of Channel B amplifiers. This switch shall be marked "Power Supply--Channel B".

The above switches in (2) and (3) shall be identical with switches used in Class Rooms (see Par. 16-7.41 of this Specification).

16-19.05 A.C. POWER CONTROL - Con't

(b) School Equipped with Sound Control Closet.

In a school equipped with a Sound Control Closet, the lock switch and pilot light described above for controlling the main power supply to the Central Control Rack shall be located on the strike side of door of Sound Control Closet. Switch shall be equipped with a face plate matching other face plates in same enclosure and inscribed "SOUND SYSTEM".

16-19.06 CABINET PROTECTION

The Sound System manufacturer, at the time of delivery to the jobsite of the Central Control Rack or an Auditorium Cabinet or Console, shall provide this Contractor with canvas covers to protect this equipment during installation and connection of wiring. The canvas shall be of such weight as to withstand normal handling and to protect the metallic surfaces against abrasions and droplets of paint from soaking through. The covers shall be designed to restrict the entry of masonry dust and other alien particles to a minimum. The covers shall extend to within 1" of the floor, and shall be constructed to permit the lower 24" to be rolled up or otherwise raised allowing access to the terminal strips.

The covers shall be kept in place, except for necessary testing of the cabinet until all plastering, patching and painting in the vicinity is completed, and in no event

16-19.06 CABINET PROTECTION (Con't)

removed permanently until permission to this contractor has been granted by the Executive Director's representative. The covers shall remain the property of the Sound System manufacturer.

16-19.07 AUDITORIUM SYSTEM

Where shown on the drawings or called for in the specifications, this contractor shall furnish and install on Auditorium Sound System consisting of the following:

A. Amplifier Cabinet

A cabinet shall be mounted in a 14 gauge galvanized sheet steel cabinet set flush in wall, at a location noted on the drawings, in the auditorium. Cabinet shall be 4 inches deep, 20 inches (\pm) high and 16 inches in width.

Cabinet shall have a front trim and door, which shall be hinged type, and located at the bottom of the cabinet. Door shall hang vertically.

Amplifier cabinet door shall be equipped with a flush mounted lock with key change.

Trim shall be furnished with grilles for ventilation at top and bottom.

Cabinet shall be as specified.

Where amplifier is indicated as a surface type on wall, this cabinet and trim shall be modified for surface mounting.

Interconnect all apparatus within the cabinet.

Deliver four (4) keys to the Principal of the School.

B. Amplifier and Controls

This amplifier shall be/ solid state, employing silicon transistors and exclusively.

Amplifiers using tubes or germanium transistors, or amplifiers which are of the semi-flush type and protrude more than $\frac{1}{4}$ inch from the wall will not be accepted.

The amplifier shall deliver an audio output of 60 watts RMS at less than 3% distortion and have a peak output of 120 watts. Frequency response shall be flat from 20 to 20,000 cycles within ± 1 db, and output regulation shall be less than 2db from no load to full load.

The amplifier shall provide complete input and mixing facilities for four (4) low impedance microphone inputs either balanced or unbalanced, and two (2) auxiliary inputs.

16-19.07 AUDITORIUM SYSTEM (Con't)

B. Amplifier and Controls (Con't)

The microphone inputs shall have an overall gain of at least 113 db below rated output with all controls at rated gain. The noise level with all controls off shall be at least 80 db below rated output.

The amplifier shall be designed to operate continuously on line voltages of 105 to 130 volts, 60HZ AC, with a standby power consumption of no more than 30 watts. Power consumption at full output shall not exceed 150 watts.

The amplifier shall include at least two separate automatic protective circuits. One shall be a thermostatically controlled self-restoring circuit to prevent damage from prolonged overloads, exceedingly high line voltage, or other conditions that threaten damage. The other shall protect against extreme overloads, such as a shorted output line; This circuit shall automatically monitor the overload condition at one second intervals and automatically restore operation when the overload disappears.

Amplifiers which do not include protective circuits for the above conditions, or which rely upon fuses alone for protection, or in which the protective circuits are not self restoring, will not be accepted.

The amplifier shall be equipped with an appropriate number of output switches identified as to the location of speaker groups as shown on the drawings. Switch shall be the equal of Arrow-Hart #20905-FR.

In addition provide a switch and a double throw relay for each convertible classroom and auditorium that will enable each to receive sound from either the Central Control Rack or the auditorium Sound System.

Provide a pilot light for each to indicate when they are connected to Central Control Rack.

Furnish an independent power supply, maximum 50 volts, to energize relays and pilot light circuits for convertible classrooms and auditorium.

Acceptable amplifiers shall be Dukane 1A625, Rauland Z060X or approved equal.

C. Wiring Within Cabinet

The conductors which terminate at the amplifier input receptacles shall be equipped at one end with a suitable plug (Amphenol, Cannon, or an approved equal) to fit the receptacles on the amplifier chassis; and with U-type lugs the approved equal of Burndy YAV-14 HF type or Aviation Marine Products No. 33799 type or T. & B. "Stacon" at the other end for connection to terminal block. All other conductors shall be equipped at both ends with the U-type terminal lugs described above.

All U-type terminal lugs shall be equipped with up-turned ends to prevent lugs from slipping out from under screws.

All wire within cabinet shall be neatly cabled and attached to cabinet walls in a manner satisfactory to the Executive Director.

Provision shall be made in wiring of amplifier for connection to a cabinet 6 volt pilot light on the Central Control Rack.

D. Terminals

A 120 volt AC supply circuit from an adjacent panel-board shall be installed by this Contractor as indicated on the Drawings within the cabinet.

All conductors from loudspeakers and microphone receptacles shall terminate in U-type terminal lugs, Burndy YAV-14 HF type or Aviation Marine Products No. 33799 type or T. & B. "Stacon" (with up-turned ends). Microphone conductors shall be connected to an approved terminal block mounted within the cabinet. The terminal block shall be so constructed that terminal screws for adjacent conductors are separated by suitable insulated barriers. An identical terminal block shall be mounted within cabinet for loudspeaker conductors.

E. Control of Auditorium and Convertible Classroom Speakers from Central Control Rack

The auditorium loudspeakers shall be connected to a double-throw relay mounted within the cafeteria amplifier cabinet. Each convertible class-room loudspeaker circuit shall be connected to a double-throw relay mounted within the aforementioned Amplifier Cabinet.

16-19.07 AUDITORIUM SYSTEM (Con't)

E. Control of Auditorium and Convertible Classroom Speakers from Central Control Rack (Con't)

These relays shall be controlled by the switches mounted on the Auditorium Control Panel (Central Control Rack). The operation of these switches with signal lights shall be described as follows:

1. When the switch is in the "OFF" position, the Auditorium loudspeakers and/or convertible classrooms shall be connected to the output of the auditorium amplifier.
2. When the switch is thrown to "Channel A" or "Channel B" positions, the auditorium loudspeakers and/or convertible classrooms shall be connected to the output of the Central Control Rack.
3. The hereinafter specified signal lights for the auditorium amplifier shall be connected to the relay control circuits to indicate when the loudspeakers are connected to the output of the Central Control Rack.

Signal Light for Auditorium Amplifier.

In a convenient location on the amplifier (not on the front trim of the cabinet) mount a neon signal light, consisting of a miniature base socket covered by a white jewel. Light shall indicate when the auditorium and/or convertible classroom loudspeakers are connected to the Central Control Rack. Signal light shall have an inscription plate reading "Main Rack Control Indicator".

16-19.08 ASSEMBLY AREA SOUND SYSTEM

A. Amplifier Cabinet

Cabinet shall be mounted in a 14 gauge galvanized sheet steel cabinet set flush in wall, at a location noted on the drawings, in the Assembly Area.

Cabinet shall be 4 inches deep, 20 inches (\pm) high and 16 inches in width.

Cabinet shall have a front trim and door, which shall be hinged type, and located at the bottom of the cabinet. Door shall hang vertically.

Amplifier cabinet door shall be equipped with a flush mounted lock with key change.

Where amplifier is indicated on drawings or specified as a surface type of amplifier, this cabinet and trim shall be modified for surface mounting.

16-19.08 ASSEMBLY AREA SOUND SYSTEM (Con't)

A. Amplifier Cabinet

Trim shall be furnished with grilles for ventilation at top and bottom.

Cabinet shall be as specified.
Interconnect all apparatus within the cabinet.
Deliver four (4) keys to the Principal of the School.

B. Amplifier and Controls

This amplifier shall be/solid state, employing silicon transistors exclusively.

Amplifiers using tubes or germanium transistors, or amplifiers which are of the semi-flush type and protrude more than $\frac{1}{4}$ inch from the wall will not be accepted.

The amplifier shall deliver an audio output of 60 watts RMS at less than 3% distortion and have a peak output of 120 watts. Frequency response shall be flat from 20 to 20,000 cycles within ± 1 db, and output regulation shall be less than 2db from no load to full load.

The amplifier shall provide complete input and mixing facilities for four (4) low impedance microphone inputs either balanced or unbalanced, and two (2) auxiliary inputs.

The microphone inputs shall have an overall gain of at least 113db below rated output with all controls at rated gain. The noise level with all controls off shall be at least 80db below rated output.

The amplifier shall be designed to operate continuously on line voltages of 105 to 130 volts, 60HZ AC, with a standby power consumption of no more than 30 watts. Power consumption at full output shall not exceed 150 watts.

The amplifier shall include at least two separate automatic protective circuits. One shall be a thermostatically controlled self-restoring circuit to prevent damage from prolonged overloads, exceedingly high line voltage, or other conditions that threaten damage. The other shall protect against extreme overloads, such as a shorted output line, this circuit shall automatically monitor the overload condition at one second intervals and automatically restore operation when the overload disappears.

16-19.08 ASSEMBLY AREA SOUND SYSTEM (Con't)

B. Amplifier and Controls (Con't)

Amplifiers which do not include protective circuits for the above conditions, or which rely upon fuses alone for protection, or in which the protective circuits are not self-restoring, will not be accepted.

The amplifier shall be equipped with an appropriate number of output switches identified as to the location of speaker groups as shown on the drawings. Switch shall be the equal of Arrow-Hart #20905-FR.

In addition, provide a switch and a double throw relay for the Assembly Area enabling to receive sound from either the Central Control Rack or the Assembly Area Sound System.

Provide a pilot light for each to indicate when they are connected to Central Control Rack.

Furnish an independent power supply, maximum 50 volts, to energize relays and pilot light circuits for convertible classrooms and Assembly Area.

Acceptable amplifiers shall be Dukane 1A625, Rauland 2060X or approved equal.

C. Wiring Within Cabinet

The conductors which terminate at the amplifier input receptacles shall be equipped at one end with a suitable plug (Amphenol, Cannon, or an approved equal) to fit the receptacles on the amplifier chassis; and with U-type lugs the approved equal of Burndy YAV-14 HF type or Aviation Marine Products No. 33799 type or T. & B. "Stacon" at the other end for connection to terminal block. All other conductors shall be equipped at both ends with the U-type terminal lugs described above.

All U-type terminal lugs shall be equipped with up-turned ends to prevent lugs from slipping out from under screws.

All wire within cabinet shall be neatly cabled and attached to cabinet walls in a manner satisfactory to the Executive Director.

Provision shall be made in wiring of amplifier for connection to a 6 volt pilot light on the Central Control Rack.

16-19.08 ASSEMBLY AREA SOUND SYSTEM (Con't)

D. Terminals

A 120 volt AC supply circuit from an adjacent panelboard shall be installed by this Contractor as indicated on the Drawings within the cabinet.

All conductors from loudspeakers and microphone receptacles shall terminate in U-type terminal lugs, Burndy YAV-14 HF type or Aviation Marine Products No. 33799 type or T. & B. "Stacon" (with up-turned ends). Microphone conductors shall be connected to an approved terminal block mounted within the cabinet. The terminal block shall be so constructed that terminal screws for adjacent conductors are separated by suitable insulated barriers. An identical terminal block shall be mounted within cabinet for loudspeaker conductors.

E. Control of Assembly Area and Convertible Classroom Speakers from Central Control Rack

The Assembly Area loudspeakers shall be connected to a double-throw relay mounted within the Assembly Area Amplifier cabinet. Each convertible classroom loud speaker circuit shall be connected to a double-throw relay mounted within the aforementioned Amplifier Cabinet. These relays shall be controlled by the switches mounted on the Assembly Area Control Panel (Central Control Rack). The operation of these switches with signal lights shall be described as follows:

1. When the switch is in the "OFF" position, the Assembly Area loudspeakers and/or convertible classrooms shall be connected to the output of the Assembly Area amplifier.
2. When the switch is thrown to "Channel A" or "Channel B" positions, the Assembly Area loudspeakers and/or convertible classrooms shall be connected to the output of the Central Control Rack.
3. The hereinafter specified signal lights for the Assembly Area amplifier shall be connected to the relay control circuits to indicate when the loudspeakers are connected to the output of the Central Control Rack.

Signal Light for Assembly Area Amplifier

In a convenient location on the amplifier (not on the front trim of the cabinet) mount a neon signal light, consisting of a miniature base socket covered by a white jewel. Light shall

16-19.08 ASSEMBLY AREA SOUND SYSTEM (Con't)

- E. Control of Assembly Area and Convertible Classroom Speakers from Central Control Rack indicate when the Assembly Area and/or convertible classroom loudspeakers are connected to the Central Control Rack. Signal light shall have an inscription plate reading "Main Rack Control Indicator".

16-19.09 CAFETERIA SOUND SYSTEM

- A. Amplifier Cabinet

Cabinet shall be mounted in a 14 gauge galvanized sheet steel cabinet set flush in wall, at a location noted on the drawings in the cafeteria. Cabinet shall be 4 inches deep, 20 inches (+) high and 16 inches in width.

Cabinet shall have a front trim and door, which shall be hinged type, and located at the bottom of the cabinet. Door shall hang vertically. Amplifier cabinet door shall be equipped with a flush mounted lock with key change.

Trim shall be furnished with grilles for ventilation at top and bottom.

Where amplifier is indicated on drawings or specified as a surface type of amplifier, this cabinet and trim shall be modified for surface mounting.

Cabinet shall be as specified.

Interconnect all apparatus within the cabinet. Deliver four (4) keys to the Principal of School.

- B. Amplifier and Controls

This amplifier shall be solid/state, employing silicon transistors exclusively.

Amplifiers using tubes or germanium transistors, or amplifiers which are of the semi-flush type and protrude more than $\frac{1}{4}$ inch from the wall will not be accepted.

The amplifier shall deliver an audio output of 60 watts RMS at less than 3% distortion and have a peak output of 120 watts. Frequency response shall be flat from 20 to 20,000 cycles within \pm db, and output regulation shall be less than 2db from no load to full load.

16-19.09 CAFETERIA SOUND SYSTEM (Con't)

- B. The amplifier shall provide complete input and mixing facilities for four (4) low impedance microphone inputs either balanced or unbalanced, and two (2) auxiliary inputs.

The microphone inputs shall have an overall gain of at least 113db below rated output with all controls at rated gain. The noise level with all controls off shall be at least 80db below rated output.

The amplifier shall be designed to operate continuously on line voltages of 105 to 130 volts, 60HZ AC, with a standby power consumption of no more than 30 watts. Power consumption at full output shall not exceed 150 watts.

The amplifier shall include at least two separate automatic protective circuits. One shall be a thermostatically controlled self-restoring circuit to prevent damage from prolonged overloads, exceedingly high line voltage, or other conditions that threaten damage. The other shall protect against extreme overloads, such as a shorted output line; This circuit shall automatically monitor the overload condition at one second intervals and automatically restore operation when the overload disappears.

Amplifiers which do not include protective circuits for the above conditions, or which rely upon fuses alone for protection, or in which the protective circuits are not self restoring, will not be accepted.

The amplifier shall be equipped with an appropriate number of output switches identified as to the location of speaker groups as shown on the drawings. Switch shall be the equal of Arrow-Hart #20905-FR.

In addition provide a switch and a double throw relay for each convertible classroom and cafeteria that will enable each to receive sound from either the Central Control Rack or the Cafeteria Sound System.

Provide a pilot light for each to indicate when they are connected to Central Control Rack.

Furnish an independent power supply, maximum 50 volts, to energize relays and pilot light circuits for convertible classrooms and cafeteria.

Acceptable amplifiers shall be Dukane 1A625, Rauland 2060X or approved equal.

C. Wiring within Cabinet

The conductors which terminate at the amplifier input receptacles shall be equipped at one end with a suitable plug (Amphenol, Cannon, or an approved equal) to fit the receptacles on the amplifier chassis; and with U-type lugs the approved equal of Burndy YAV-14 HF type or Aviation Marine Products No. 33799 type or T. & B. "Stacon" at the other end for connection to terminal block. All other conductors shall be equipped at both ends with the U-type terminal lugs described above.

All U-type terminal lugs shall be equipped with up-turned ends to prevent lugs from slipping out from under screws.

All wire within cabinet shall be neatly cabled and attached to cabinet walls in a manner satisfactory to the Executive Director.

Provision shall be made in wiring of amplifier for connection to a 6 volt pilot light on the Central Control Rack.

D. Terminals

A 120 volt AC supply circuit from an adjacent panelboard shall be installed by this Contractor as indicated on the drawings.

All conductors from loudspeakers and microphone receptacles shall terminate in U-type terminal lugs, Burndy YAV-14 HF type or Aviation Marine Products No. 33799 type or T. & B. "Stacon" (with up-turned ends). Microphone conductors shall be connected to an approved terminal block mounted within the cabinet. The terminal block shall be so constructed that terminal screws for adjacent conductors are separated by suitable insulated barriers. An identical terminal block shall be mounted within cabinet for loudspeaker conductors.

E. Control of Cafeteria and Convertible Classroom Speakers From Central Control Rack

The cafeteria loudspeakers shall be connected to a double-throw relay mounted within the cafeteria amplifier cabinet. Each convertible classroom loudspeaker circuit shall be connected to a double-throw relay mounted within the aforementioned Amplifier Cabinet. These relays shall be

16-19.09 CAFETERIA SOUND SYSTEM (Con't)

E. Control of Cafeteria and Convertible Classroom Speakers from Central Control Rack - (Con't)

controlled by the switches mounted on the Cafeteria Control Panel (Central Control Rack). The operation of these switches with signal lights shall be described as follows:

1. When the switch is in the "OFF" position, the cafeteria loudspeakers and/or convertible classrooms shall be connected to the output of the cafeteria amplifier.
2. When the switch is thrown to "Channel A" or "Channel B" positions, the cafeteria loudspeakers and/or convertible classrooms shall be connected to the output of the Central Control Rack.
3. The hereinafter specified signal lights for the cafeteria amplifier shall be connected to the relay control circuits to indicate when the loudspeakers are connected to the output of the Central Control Rack.

Signal Light for Cafeteria Amplifier

In a convenient location on the amplifier (not on the front trim of the cabinet) mount a neon signal light, consisting of a miniature base socket covered by a white jewel. Light shall indicate when the cafeteria and/or convertible classroom loudspeakers are connected to the Central Control Rack. Signal light shall have an inscription plate reading "Main Rack Control Indicator".

16-19.10 GYMNASIUM SOUND SYSTEM (BOYS GYMNASIUM)

A. Amplifier Cabinet

Cabinet shall be mounted in a 14 gauge galvanized sheet steel cabinet set flush in wall, at a location noted on the drawings, in the boys gymnasium.

Cabinet shall be 4 inches deep, 20 inches (\pm) high and 16 inches in width.

Cabinet shall have a front trim and door, which shall be hinged type, and located at the bottom of the cabinet. Door shall hang vertically.

Where amplifier is indicated on drawings or specified as a surface type of amplifier, this cabinet and trim shall be modified for surface mounting.

16-19.10 GYMNASIUM SOUND SYSTEM (BOYS GYMNASIUM)

A. Amplifier Cabinet

Amplifier cabinet door shall be equipped with a flush mounted lock with key change.

Trim shall be furnished with grilles for ventilation at top and bottom.

Cabinet shall be as specified.

Interconnect all apparatus within the cabinet.
Deliver four (4) keys to the Principal of the School.

B. Amplifier and Controls

This amplifier shall be/solid state, employing silicon transistors exclusively.

Amplifiers using tubes or germanium transistors, or amplifiers which are of the semi-flush type and protrude more than $\frac{1}{4}$ inch from the wall will not be accepted.

The amplifier shall deliver an audio output of 60 watts RMS at less than 3% distortion and have a peak output of 120 watts. Frequency response shall be flat from 20 to 20,000 cycles within ± 1 db, and output regulation shall be less than 2db from no load to full load.

The amplifier shall provide complete input and mixing facilities for four (4) low impedance microphone inputs either balanced or unbalanced, and two (2) auxiliary inputs.

The microphone inputs shall have an overall gain of at least 113db below rated output with all controls at rated gain. The noise level with all controls off shall be at least 80db below rated output.

The amplifier shall be designed to operate continuously on line voltages of 105 to 130 volts, 60HZ AC, with a standby power consumption of no more than 30 watts. Power consumption at full output shall not exceed 150 watts.

The amplifier shall include at least two separate automatic protective circuits. One shall be a thermostatically controlled self-restoring circuit to prevent damage from prolonged overloads, exceedingly high line voltage, or other conditions that threaten damage. The other shall protect

16-19.10 GYMNASIUM SOUND SYSTEM(BOYS GYMNASIUM) Con't

B. Amplifier and Controls Con't

against extreme overloads, such as a shorted output line, this circuit shall automatically monitor the overload condition at one second intervals and automatically restore operation when the overload disappears.

Amplifiers which do not include protective circuits for the above conditions, or which rely upon fuses alone for protection, or in which the protective circuits are not self-restoring, will not be accepted.

The amplifier shall be equipped with an appropriate number of output switches identified as to the location of speaker groups as shown on the drawings. Switch shall be the equal of Arrow-Hart #20905-FR.

In addition provide a switch and a double throw relay for the Boys Gymnasium that will enable each to receive sound from either the Central Control Rack or the Boys Gymnasium Sound System.

In addition, and only where the Boys Gym and Girl's Gym are adjacent and separated with a folding partition, provide a switch to permit the connection of the Girl's Gym Speakers to the Boy's Gym Amplifier, when the folding partition is open and both Gyms are being used together for one function.

Provide a pilot light for each to indicate when they are connected to Central Control Rack.

Furnish an independent power supply, maximum 50 volts, to energized relays and pilot light circuits for convertible classrooms and Boys Gymnasium.

Acceptable amplifiers shall be DuKane 1A625 or Rauland 2060X or approved equal.

C. Wiring Within Cabinet

The conductors which terminate at the amplifier input receptacles shall be equipped at one end with a suitable plug (Amphenol, Cannon, or an approved equal) to fit the receptacles on the amplifier chassis; and with U-type or Aviation Marine Products No. 33799 type or T.&B. "Stacon" at the other end for connection to terminal block. All other conductors shall be equipped at both ends with the U-type terminal lugs described above.

All U-type terminal lugs shall be equipped with up-turned ends to prevent lugs from slipping out from under screws.

All wire within cabinet shall be neatly cabled and attached to cabinet walls in a manner satisfactory to the Executive Director.

GYMNASIUM SOUND SYSTEM (BOYS GYMNASIUM) Con't

C. Wiring within Cabinet (Con't)

Provision shall be made in wiring of amplifier for connection to a 6 volt pilot light on the Central Control Rack.

D. Terminals

A 120 volt AC supply circuit from an adjacent panelboard shall be installed by this Contractor as indicated on the Drawings within the cabinet.

All conductors from loudspeakers and microphone receptacles shall terminate in U-type terminal lugs, Burndy YAV-14 HF type or Aviation Marine Products No. 33799 type or T. & B. "Stacon" (with up-turned ends). Microphone conductors shall be connected to an approved terminal block mounted within the cabinet. The terminal block shall be so constructed that terminal screws for adjacent conductors are separated by suitable insulated barriers. An identical terminal block shall be mounted within cabinet for loudspeaker conductors.

E. Control of Boys' Gymnasium Speakers from Central Control Rack

The Boys Gymnasium loudspeakers shall be connected to a double throw relay mounted within the Boys Gymnasium amplifier cabinet. This relay shall be controlled by the switches mounted on the Boys Gymnasium Control Panel (Central Control Rack). The operation of these switches with signal lights shall be described as follows:

1. When the switch is in the "OFF" position, the Boys Gymnasium loudspeakers shall be connected to the output of the Boys Gymnasium amplifier.
2. When the switch is thrown to "Channel A" or "Channel B" positions, the Boys Gymnasium loudspeakers shall be connected to the output of the Central Control Rack.
3. The hereinafter specified signal lights for the Boys Gymnasium amplifier shall be connected to the relay control circuits to indicate when the loudspeakers are connected to the output of the Central Control Rack.

16-19.10 GYMNASIUM SOUND SYSTEM (Con't)

E. Control of Boys' Gymnasium Speakers from Central Control Rack

Signal Light for Cafeteria Amplifier

In a convenient location on the amplifier (not on the front trim of the cabinet) mount a neon signal light, consisting of a miniature base socket covered by a white jewel. Light shall indicate when the Boys Gymnasium loudspeakers are connected to the Central Control Rack. Signal light shall have an inscription plate reading "Main Rack Control Indicator".

16-19.11 GYMNASIUM SOUND SYSTEM (GIRLS GYMNASIUM)

A. Amplifier Cabinet

Cabinet shall be mounted in a 14 gauge galvanized sheet steel cabinet set flush in wall, at a location noted on the drawings, in the Girls Gymnasium.

Cabinet shall be 4 inches deep, 20 inches (+) high and 16 inches in width.

Cabinet shall have a front trim and door, which shall be hinged type, and located at the bottom of the cabinet. Door shall hang vertically.

Amplifier cabinet door shall be equipped with a flush mounted lock with key change.

Where amplifier is indicated on the drawings or specified as a surface type of amplifier, this cabinet and trim shall be modified for this surface mounting.

Trim shall be furnished with grilles for ventilation at top and bottom.

Cabinet shall be as specified.

Interconnect all apparatus within the cabinet.
Deliver four (4) keys to the Principal of the School.

B. Amplifier and Controls

This amplifier shall be /solid state, employing silicon transistors exclusively.

Amplifiers using tubes or germanium transistors, or amplifiers which are of the semi-flush type and protrude more than $\frac{1}{4}$ inch from the wall will not be accepted.

B. Amplifier and Controls (Con't)

The amplifier shall deliver an audio output of 60 watts RMS at less than 3% distortion and have a peak output of 120 watts. Frequency response shall be flat from 20 to 20,000 cycles within ± 1 db, and output regulation shall be less than 2db from no load to full load.

The amplifier shall provide complete input and mixing facilities for four (4) low impedance microphone inputs either balanced or unbalanced, and two (2) auxiliary inputs.

The microphone inputs shall have an overall gain of at least 113db below rated output with all controls at rated gain. The noise level with all controls off shall be at least 80 db below rated output.

The amplifier shall be designed to operate continuously on line voltages of 105 to 130 volts, 60HZ AC, with a standby power consumption of no more than 30 watts. Power consumption at full output shall not exceed 150 watts.

The amplifier shall include at least two separate automatic protective circuits. One shall be a thermostatically controlled self-restoring circuit to prevent damage from prolonged overloads, exceedingly high line voltage, or other conditions that threaten damage. The other shall protect against extreme overloads, such as a shorted output line; This circuit shall automatically monitor the overload condition at one second intervals and automatically restore operation when the overload disappears.

Amplifiers which do not include protective circuits for the above conditions, or which rely upon fuses alone for protection, or in which the protective circuits are not self-restoring, will not be accepted.

The amplifier shall be equipped with an appropriate number of output switches identified as to the location of speaker groups as shown on the drawings. Switch shall be the equal of Arrow-Hart #20905-FR.

In addition provide a switch and a double throw relays for the Girls Gymnasium to receive sound from either the Central Control Rack, the Girls Gymnasium Sound System or the Boys Gymnasium Sound System (Only where both Gyms are separated by a folding door).

16-19.11 GYMNASIUM SOUND SYSTEM (GIRLS GYMNASIUM) Con't

B. Amplifier and Controls (Con't)

Provide a pilot light to indicate when they are connected to Central Control Rack.

Furnish an independent power supply, maximum 50 volts, to energize relays and pilot light circuits for convertible classrooms and Girls Gymnasium.

Acceptable amplifiers shall be Dukane 1A625, Rauland 2060X or approved equal.

C. Wiring Within Cabinet

The conductors which terminate at the amplifier input receptacles shall be equipped at one end with a suitable plug (Amphenol, Cannon, or an approved equal) to fit the receptacles on the amplifier chassis; and with U-type lugs the approved equal of Burndy YAV-14 HF type or Aviation Marine Products No. 33799 type or T. & B. "Stacon" at the other end for connection to terminal block. All other conductors shall be equipped at both ends with the U-type terminal lugs described above.

All U-type terminal lugs shall be equipped with up-turned ends to prevent lugs from slipping out from under screws.

All wire within cabinet shall be neatly cabled and attached to cabinet walls in a manner satisfactory to the Executive Director.

Provision shall be made in wiring of amplifier for connection to a 6 volt pilot light on the Central Control Rack.

D. Terminals

A 120 volt AC supply circuit from an adjacent panelboard shall be installed by this Contractor as indicated on the Drawings.

All conductors from loudspeakers and microphone receptacles shall terminate in U-type terminal lugs, Burndy YAV-14 HF type or Aviation Marine Products No. 33799 type or T. & B. "Stacon" (with up-turned ends). Microphone conductors shall be connected to an approved terminal block mounted within the cabinet. The terminal block shall be so constructed that terminal screws for adjacent conductors are separated by suitable insulated barriers. An identical terminal block shall be mounted within cabinet for loudspeaker conductors.

16-19.11 GYMNASIUM SOUND SYSTEM (GIRLS GYMNASIUM) Con't

E. Control of Girls Gymnasium Speakers from Central Control Rack

The Girls Gymnasium loudspeakers shall be connected to a double throw relay mounted within the Girls Gymnasium amplifier cabinet. This relay shall be controlled by the switches mounted on the Girls Gymnasium Control Panel (Central Control Rack). The operation of these switches with signal lights shall be described as follows:

1. When the switch is in the "OFF" position, the Girls Gymnasium loudspeakers shall be connected to the output of the Girls Gymnasium amplifier.
2. When the switch is thrown to "Channel A" or "Channel B" positions, the Girls Gymnasium loudspeakers shall be connected to the output of the Central Control Rack.
3. The hereinafter specified signal lights for the Girls Gymnasium amplifier shall be connected to the relay control circuits to indicate when the loudspeakers are connected to the output of the Central Control Rack.

Signal Light for Girls Gymnasium Amplifier

In a convenient location on the amplifier (not on the front trim of the cabinet) mount a neon signal light, consisting of a miniature base socket covered by a white jewel. Light shall indicate when the Girls Gymnasium loudspeakers are connected to the Central Control Rack. Signal light shall have an inscription plate reading "Main Rack Control Indicator".

16-19.12 EMERGENCY SOUND ALARM SYSTEM

A. General

Furnish and install all items of equipment indicated on the drawings or hereinafter specified or required, to equip the building with an Emergency Sound Alarm System.

This system shall permit the office personnel to activate an alarm signal device which shall cause a distinctive tone to sound throughout the school corridors, Custodian's office, Fan Rooms and Boiler Room loudspeakers involved shall be transferred immediately to the alarm tone-amplifier output and a predetermined coded tone signal, set at a prefixed level shall sound throughout the areas assigned. A reset button shall be provided to deactivate the system

16-19.12 EMERGENCY SOUND ALARM SYSTEM (Con't)

B. Alarm Initiating Switches

On the office side of the counter in the General Office, where indicated on drawings, provide an A.H. #OBA-1 (Red) push button designed for momentary contact operation.

Provide a wall operated momentary contact push button switch, where shown, the equal of A.H. #OBA (Red) to be connected in parallel with counter switch. Switch plate shall be engraved "Emergency, Sound".

Provide a separately flush mounted reset button and neon pilot light where indicated with engraved plate. Operation of reset button shall deactivate the system and return all speakers to normal. Pilot shall indicate when alarm system is energized and ready for operation.

C. Control Cabinet

Furnish and install an amplifier cabinet at location indicated on the drawings. The equipment hereinafter described shall be mounted in the cabinet in a functional arrangement.

The cabinet shall be approximately 22" wide by 15 3/4" high by 13 1/2" deep and shall be constructed of No. 16 gauge cold rolled steel. The cabinet shall accommodate 14" of panel space and panels shall be recessed so that edges are not exposed. Cabinet shall have a pan type front door approximately 1 1/4" deep which shall be fitted with a Yale, Jr. No. 2446 lock.

Finish of cabinet and panels shall be as described in Par. 16-19.03-B.

Cabinet shall be mounted by means of mounting brackets manufactured by the cabinet manufacturer.

Cabinet shall be Premier Metal Products MDK-140 or approved equal.

At the Contractors option, the control equipment for the Emergency Alarm System may be mounted within the Central Control Rack where sufficient space is available and there is no overcrowding.

D. Coded Tone Signal Amplifier

The tone signal shall consist of five (5) repeating 750 Hz (frequency accuracy to within 5%) two second tone pulses occurring every two seconds, followed by a 30 second interval. Timing accuracy shall be within 10%. The tone signals shall start immediately upon actuation of the alarm initiation switch, and shall continue until the reset button is depressed.

D. Coded Tone Signal Amplifier

The coding and tone generator shall be an all solid state electronic unit containing no timing motors or thermal time delay tubes.

E. Power Amplifier

Amplifier shall be all solid state (transistorized) with an output capacity of 50 watts frequency response from 200 to 10,000 Hz \pm 3db; hum and noise 85db below rated output. Regulation, full load to no load, shall vary not more than 3 db. A constant voltage line output shall be provided. Amplifier input shall match output impedance of coding signal amplifier.

Provide a latching or holding type relay which shall be activated by the alarm initiation switch, and remain activated until released by the reset switch. The necessary speaker line transfer and amplifier power relays shall be operated by this holding relay. All relay coils shall operate on A.C. current.

Provide a master A.C. power disconnected lock switch in cover of cabinet.

F. Power Supply

Furnish an A.C. power supply of ample capacity to operate all control relays and associated equipment. Power supply control voltage shall not exceed 30 volts. Units shall isolate all associated components from A.C. line.

G. Terminal Strips

Control, speaker and A.C. power circuits shall be wired to Jones terminal strips of the proper size and capacity. Circuits of different levels shall be isolated as described in Par. 16-19.03-0 of the Standard.

H. Shop Drawings

Incorporate this system with Sound System submission.

16-19.13 LOUDSPEAKERS

A. General

Furnish and install a loudspeaker of type indicated at each location indicated on Drawings. Unless otherwise specified, the housing of each speaker shall have a finish of color as selected. Grille material and grille cloth (where employed) shall harmonize with the finish of the housing. Samples of finishes shall be submitted to approval.


The mounting of the loudspeakers in the Auditorium and Gymnasia shall be in accordance with directions of the Executive Director, with exact setting of loudspeakers determined after experiment at building.

All other loudspeakers shall be securely fastened to the wall.

All speakers located in TALK BACK/LISTEN IN areas shall be modified to perform in the required manner.

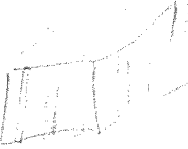
B. Mounting Height of Loudspeakers


See Drawings for mounting height of loudspeakers above finished floor and other mounting details.

 In general, unless otherwise noted, all necessary supporting members required to rigidly fasten speaker units to building structure in an approved manner shall be included as a part of this Contract.

 C. Guards

A guard shall be provided for each loudspeaker where the Drawings indicate such a guard shall be provided.

 The guard shall be rectangular in shape, built up of cadmium plated 3/8" x 1/8" half hard steel ribs and shall be securely fastened to the wall as directed.

 Guards shall be painted by this Contractor with one coat of lead, zinc and titanium paint and a second coat of aluminum or other paint as directed. Second coat shall be applied after guard is erected. Shop drawings showing construction details and method of mounting on wall shall be submitted for approval prior to manufacture.

D. Description of Loudspeakers

Type A Loudspeaker

- (a) Type A speakers shall be of the permanent field dynamic type with approved surface mounted housing. Speaker shall have a 5 watt nominal rating.

Speaker unit shall be 7 or 8 inches in diameter, of the cone type, employing "Alnico V" metal or ceramic magnet and shall have a frequency response of 30 to 15,000 hz. Provide a suitable multi-tap speaker matching transformer which will permit correct impedance matching of voice coil and system line impedances.

- (b) Housings

Housings shall be of an approved sloping front type, made of metal or wood as selected, approximately 15" H by 11" W by 7" D at top and 4" at the bottom. Housings shall be acoustically matched to the speaker units to provide the widest range of reproduced signals without cavity resonance.

- (c) Bracket

In new buildings, the manufacturer of the speaker shall supply the housing equipped with a mounting bracket capable of mounting the assembly to any standard, flush outlet box.

In existing buildings, boxes shall be omitted. Housing shall be mounted on a suitable plate which shall be mounted on the wall.

- (d) Acceptable Loudspeakers are RCA CR 5412C Assembly (RCA MI-12478, speaker unit, housing and transformer) or Stromberg Carlson RC-23/TR-B or approved equal by Altec-Lansing, DuKane Corp., David Bogen Company or Rauland-Borg Co.

Type A1 Loudspeaker

- (a) This high-fidelity speaker assembly shall consist of a cone type 8-inch diameter speaker and multi-tap transformer unit with a smooth response from 30 to 15,000 Hz. to a power handling capacity of 10-watts. Magnet weight 6.8-ounces of Alnico V or ceramic magnetic material with aluminum voice coil wire.

- (b) Housing

Components shall be set in a sloping front surface mounted furniture grade ½-inch plywood enclosure natural finish. Enclosure dimensions to approximate

16-19.13 LOUDSPEAKERS (Con't)

Type A1 Loudspeaker (Con't)

(b) Housing

12-inches high, 15-inches wide, 8½-inches deep on top and 5½-inches at bottom. Provide opening in back for access to flush outlet box with provisions for rigidly fastening speaker to wall or outlet box. Inside of box shall be lined with 1-inch insulating material. Provide a rectangular shadow box-frame with plastic grille for speaker opening.

Type D Loudspeaker

(a) These speakers shall be 15 inches in diameter and shall be of the coaxial duo-cone type. Frequency response shall be from 50 to 15,000 Hz within 6 db. Coverage angle shall be at least 90 degrees over the entire spectrum. Power handling capacity shall be at least 10 watts.

(b) Housings

Unless otherwise indicated on drawings or specified speakers shall be flush mounted in not less than ¾-inch plywood enclosures at location indicated.

Enclosures shall be hinged where necessary for access. Joints shall be glued and screwed air tight. Inside of box shall be lined with 1 inch aeracor or other approved insulating material. Inside and outside surfaces of enclosure shall be spray painted with one coat black enamel. Gap between enclosure and grille shall be covered with approved sound isolating material.

Grilles covering openings will be furnished by others. This Contractor shall install speakers at most favorable angle as recommended by sound system manufacturer and unless otherwise noted or specified shall provide all necessary bracing and/or supports to fasten units in an approved manner.

(c) Acceptable loudspeakers are RCA-LC1A, Stromberg-Carlson RF-475 or Altec-Lansing 605A, Electro-Voice Sentry II.

Type D-2 Loudspeaker

(a) This speaker shall contain five (5) high fidelity 8" cone type speaker mechanisms. Distribution angles shall be approximately 25° vertically and 80° horizontally. Frequency response shall be from 50 to 18,000 Hz with uniform response. Power handling capacity shall be 25 watts complex audio wave.

16-19.13 LOUDSPEAKERS (Con't)

Type D-2 Loudspeaker (Con't)

(b) Housing

These speakers shall have a semi-circular steel housing not less than 16-gauge, acoustically treated. Approximate dimensions are 44" high x 12" wide x 7" deep. Front of speaker shall have a plastic grille.

Provide brackets for flush mounting in recess (with finished grille by others).

- (c) Acceptable speakers are the approved equal of RCA loudspeaker assembly No. Cr5500C or Electro-Voice LR-4SA.

Type E Loudspeaker (For Outdoor Use, Playground, Corridor, etc.)

- (a) Type E Loudspeaker shall have a nominal rating of not less than 10 watts.

Loudspeakers shall be not more than five inches long; maximum diameter of horn shall be 7 inches.

Each loudspeaker mechanism shall be of the permanent magnet type using "Alnico V" metal. Each loudspeaker shall be equipped with a marine type non-vibrating metal re-entrant baffle, completely weatherproof and raintight, and designed for outdoor use. Baffle shall have a distribution angle not less than 45 degrees horizontally and vertically. Speaker shall be equipped with a low frequency cut-off for clarity of speech and signal reproduction. The construction of the speaker shall be dark gray or other approved subdued color. If so directed by the Executive Director, this Contractor shall paint loudspeaker and connected conduit, boxes, fittings, etc., to match surroundings.

Speaker shall be equipped with a suitable multi-tap transformer of at least 10 watts rating which will permit correct impedance matchings of voice coil and system line impedances.

- (b) Mounting of Loudspeaker. The loudspeaker shall be mounted as directed, at location indicated on Drawings, by means of at least three expansion bolts or other approved non-rusting fasteners. Conduits and conductors shall be connected in accordance with directions from the Executive Director. From the weatherproof box, lead covered two-conductor wire shall be run to speaker, and connected as directed.

16-19.13 LOUDSPEAKERS (Con't)

Type E Loudspeaker (For Outdoor Use, Playground, etc.). (Con't)

- (c) Acceptable loudspeakers are RCA MI-6317-D/12371A miniature marine type, Stromberg Carlson RS-16 or equal by Altec Lansing, DuKane Corp., Racon or Atlas.

Type "E" Loudspeaker for Use in Corridors--Mounting

Type E loudspeaker as hereinafter modified, shall be used in corridors, where indicated. This unit shall be separately mounted on a 90° angle bracket so that the axis of the loudspeaker is parallel with the wall to which it is attached. In some instances, as explained below, the speaker will be mounted on a 135° angle bracket so that the speaker axis will be set at 45° with respect to the wall. The transformer for this unit shall be installed in a flush wall multi-gang box. The cover for the wall box may be a standard multi gang faceplate with a bushed hole for a cable loop between the transformer and the loudspeaker, or one side of the angle mounting bracket may also be used to cover the wall box opening and be secured to the wall box. In the latter method, include a bushed hole through the bracket for the wiring loop.

The angle iron mounting bracket shall be No. 14 gauge, cold rolled steel, and finished to match the loudspeaker. The diameter of the loudspeaker at its base shall be the minimum size for both legs of the mounting angle except where on leg of the angle must be increased to overlap the wall box opening.

At certain locations, where two corridors intersect at right angles, provide a 135° angle bracket, where indicated. The centerline of this speaker shall coincide with the centerlines of other equipment, such as a bell, gong, or horn in the general area.

Type E-1 Loudspeaker

This speaker when called for shall be of the double re-entrant type capable of handling 25-watts of audio program material. The driver unit and built-in transformer shall be suitably protected in a weatherproof spun aluminum housing which may be removed for service. The horn shall have a sturdy aluminum base integrally cast with the tone arm. Bell and reflex reflector shall be exponentially spun of heavy gauge aluminum. A mounting arm and malleable iron flange for mounting to a flat surface. A wing nut shall lock the horn in any desired vertical position.

16-19.13 LOUDSPEAKERS (Con't)

Type E-1 Loudspeaker (Con't)

Overall assembly shall be approximately 12½" long x 9" diameter. Frequency response shall be 350-8500 Hz. Built-in transformer shall be equipped with suitable impedance taps to be compatible with values used on other speaker assemblies. Axial sensitivity shall be at least 108-db with 1-watt input measured at 4-feet at 2500 Hz.

Each speaker shall be furnished with a piece of neoprene sheathed cord, 2 No. 16 conductors for flexible connection to the LS Cable in the weatherproof box outlet shown on the plans.

Neoprene sheathed cord shall be sufficiently long for connection to loudspeaker cable as directed and as specified.

Speaker shall be RCA MI-38452, Electro-Voice PA3ORT, or an approved equal by Stromberg Carlson DuKane Corporation, Racon RO-25T, or Atlas AP-30T.

Type E-2 Loudspeaker

This speaker shall be of the double re-entrant type capable of handling 30-watts of audio program material. Frequency response shall be from 80-10,000 Hz. Axial sensitivity shall be at least 117-db with 1-watt input measured at 3 feet. Transformer shall be equipped with suitable impedance taps to be compatible with values used on other speaker assemblies. Speaker shall be furnished with a neoprene sheathed cord, two No. 18 conductors, of sufficient length to permit a flexible connection to the loudspeaker cable in weatherproof outlet box as shown on the drawing.

Horn shall be ruggedly constructed of heavy gauge aluminum spinning and/or castings. Bell shall have an exponential expansion rate. Throat of horn shall have appropriate female threading to receive drive unit. Horn shall be provided with malleable cast iron bracket for mounting and orientation. Bracket shall attach to a standard ¼" pipe fitting. Provide wing nut for locating horn in desired position.

Horn driver unit shall be encased in an approved weatherproof enclosure. Top of this enclosure shall be provided with appropriate male threading for connection of driver unit to horn.

Length of assembled unit shall be approximately 23-inches. Bell diameter of horn shall be approximately 20½-inches.

Horn driver unit shall be the equal of RCA MI-14851.
Horn shall be the equal of RCA MI-12482.



16-19.13 LOUDSPEAKERS (Con't)

Type F Loudspeaker

- (a) Loudspeakers--The loudspeaker shall consist of the "Type A" loudspeaker hereinbefore described, without the housing, mounted on a suitable plywood baffle. The speaker and baffle shall be installed in the box hereinafter described, in accordance with the directions of the Executive Director.
- (b) Box--A suitable metal box supplied by the Manufacturer of the Sound System shall be furnished by this Contractor and installed as directed, flush in the wall, at location indicated on the Drawings.
- (c) Grille--This Contractor shall furnish an approved steel grille, Harrington-King "Style S" (56% Openings) or approved equal, at least 1/8 inch thick, of proper dimensions to cover the box hereinbefore described, and to overlap the finished wall surface by at least 1/2 inch on all sides of the box. This Contractor shall install the grille in such a manner as to completely cover and protect speaker mechanism. Grille shall have a plastic mesh fastened to the back to render grille pencil proof. Grille will be painted by other Contractor.

Type FS Loudspeaker

These speakers are similar to type F speakers described above, except units shall be designed for surface mounting. Furnish a sturdy wood frame around box to meet edge of grille. Frame and grille shall be finished in matching color.

 Type F-1 Loudspeaker (Flush Wall Type) 

- (a) The loudspeaker shall consist of the "Type A" loudspeaker hereinbefore described, without the housing, mounted on a plaque. The speaker and plaque shall be installed in the box hereinafter described, in accordance with the direction of the Executive Director.
- (b) Box.
A suitable galvanized steel box supplied by the Manufacturer of the Sound System shall be furnished by this Contractor and installed as directed, flush in the wall, at location indicated on the Drawings.

(c) Plaque.

This Contractor shall furnish an approved steel plaque and grille combination of proper dimensions to overlap the finished wall surface by at least $\frac{1}{2}$ " on all sides of the box. Plaque shall be made of No. 20 gauge steel with bevelled edges. Center cut-out for speaker shall be backed by a No. 20 gauge steel grille of "cross-moire" design. Both grille and plaque shall have a baked enamel finish, suitable if necessary, for repainting to match wall by other Contractor.

Type F-2 Loudspeaker.

These loudspeakers shall consist of a "Type A" unit herein- before described except as follows--Speaker shall be mounted on a $\frac{3}{8}$ -inch painted plywood plaque fastened to lips of an enclosing metal box. Box shall be not less than 16 gauge galvanized steel and approximately 10 x 12 x 4 inches. ↘

Assembly shall be mounted approximately $\frac{1}{4}$ of an inch above upper surface of removable section of perforated metal pan ceiling where indicated. Acoustical material shall be omitted at speaker locations. Speaker boxes shall be supported by substantial steel straps to the structure in an approved manner by this Contractor.

An approved marker will be inserted in metal pans by others at speaker locations for identification and maintenance.

→ Type J Loudspeaker. ← 8" LUNCHROOMS

Each type J loudspeaker were indicated on Drawings shall be a flush ceiling assembly designed for ceiling mounting. Assembly shall consist of an acoustically treated cylindrical metal housing, mounting frame, cone type "A" speaker mechanism with transformer and air duct type metal grille designed to provide maximum sound diffusion. Depth of assembly shall be $10\frac{1}{4}$ " with diameter of grille $10\frac{1}{8}$ ". Diameter of metal housing shall be 8". Weight of unit shall not exceed 10 lbs. Ceiling loudspeaker assembly shall be RCA CR 3443-A, or an approved equal.

Type K Loudspeaker.


At each location when shown on the drawings, provide and install a surface mounted ceiling speaker assembly consisting of a cone speaker similar to Type-A assembly mounted in a spun aluminum housing.

16-19.13 LOUDSPEAKERS (Con't)

Housing shall be approximately 15-inches diameter and 5-1/8 inches deep, constructed of not less than 16 gauge aluminum. Speaker openings shall be protected by a substantial cross-moire grille material. Speaker unit shall be surrounded by sound-absorbing material.

Housing shall be provided with heavy gauge circular back plate for fastening speaker to ceiling outlet box by means of 4-rust proofed machine screws. Assembly shall be finished in a baked enamel of color selected by the Executive Director.

Speaker assembly shall be RCA type CR-2944 or equal.

 "Type-M" Loudspeaker.

This loudspeaker assembly shall be designed for surface ceiling mounting and shall consist of a type-A loudspeaker unit, a spun aluminum housing and a circular backplate for mounting.

The housing shall have a diameter of 13½" and a depth of 4¼" and shall be constructed of not less than 18-gauge aluminum. Speaker openings shall be protected by a cold rolled steel grille not less than 20-gauge.

The housing shall contain integral reinforcing rings and shall be sprayed with undercoating and lined with patched jute to prevent mechanical and acoustical resonances. The housing shall be finished satin brushed aluminum.

The housing shall be provided with a heavy gauge circular back plate for fastening speaker to ceiling outlet box by means of 4-rust proofed machine screws.

Housing shall be Soundolier type-260 or approved equal.

Type R Loudspeaker.

This loudspeaker assembly shall be designed for flush ceiling mounting and shall consist of a type A loudspeaker, a one piece stamped metal grille, a plywood sub-baffle and a galvanized steel backbox.

The grille shall be made of #18 gauge cold rolled steel and shall have an opening consisting of louvres arranged in 8" square pattern. Louvres of a circular configuration will not be acceptable. Louvres shall have an angle of 45 degrees.

16-19.13

LOUDSPEAKERS (Con't)

The edge of the grille shall be chamfered to a depth of 3/16". Overall dimensions shall be 12½" x 12½". Color of the grille shall be as selected by the Executive Director.

The sub-baffle shall be made of ¼" thick plywood and shall be finished in dull black so as to be inconspicuous.

The backbox shall be made of #16 gauge galvanized steel, and shall be 11-3/8" x 113/8" x 6". Box shall be acoustically treated to eliminate metallic resonance.

Square flush type ceiling loudspeaker assembly shall be RCA CR-8050A, or approved equal.

Type RS Loudspeaker.

This speaker shall be similar to type R speaker described above, except unit shall be designed for surface mounting.

Box shall be 12½" x 12½" x 6" and shall be made of #16 gauge cold rolled steel with a zinc chromate primer. Box shall be finished to match color of grille.

Square surface type ceiling loudspeaker assembly shall be RC CR-8050B, or approved equal.

16-19.14

PRIVACY/CALL-IN SWITCH

Furnish and install at locations in each room or area where indicated on the plans or called for in the specifications a triple action Privacy/Call-In Switch, on a wall at 5'-6' above the finished floor. Where new wall construction is involved, this switch shall be mounted in a flush single gang box with suitably engraved face plate. Where the switch is to be mounted on an existing wall, a suitable single gang, surface type Wiremold box shall be furnished with suitably engraved faceplate. Where new wall construction is involved, wiring shall be run to this switch in conduit buried in the wall. Existing wall construction shall require that incoming wiring be installed in surface metal raceway unless otherwise indicated.

This Privacy/Call-In Switch shall have three positions labeled "Privacy", "Normal", and "Call". The switch shall generally return to the "Normal" mode when not called upon to activate either of the other two modes.

This switch may take the form of separate buttons for each mode, the form of a three position rocker switch, or any other approved form. This switch shall be heavy-duty and vandal resistant and shall be furnished with a nameplate on which the three modes shall be engraved. The cover plate shall be designed to accept a locking cover if the Board of Education shall choose to specify such a cover at some time in the future. All exposed screws shall be spanner head type.

This switch shall accomplish the following functions:

- (1) Activation of the switch into the "Normal" position or mode shall permit two-way conversation between the staff loudspeaker in the room and the Central Control Rack and shall also permit the Central Control Rack to listen-in to the room while the switch is in this mode. The Central Control Rack shall also be capable of signalling the room and delivering normal audio program material to the room.
- (2) Activation of the switch into the "Call" mode or position shall be momentary in duration with spring return to "Normal" on release of the switch. This activation shall signal the Central Control Rack and its Administrative Telephones. Flashing of the switch two or more times shall indicate an emergency or priority call to the Central Control Rack.
- (3) Activation of the switch into the "Privacy" position or mode shall be a maintained type of action. The switch shall remain in this position until released. This activation shall prevent any listening-in by the Central Control Rack or any two-way conversation between the Central Control Rack and the staff loudspeaker involved. Activation into this mode however shall not prevent the Central Control Rack from signalling the staff loudspeaker or from delivering normal audio program material.

This switch shall be Dukane 9A1745, Rauland 0510 or the approved equal.

16-19.15 Telephones

General

- (a) General-The electrical contractor shall furnish and install telephones at locations noted on the drawings.

All outlet boxes, mounting hardware shall be furnished and installed by the electrical contractor. Description of the type of telephones to be utilized are noted in the paragraphs that follow.

- (b) Administrative Telephone

Furnish and install administrative telephones where indicated on the drawings.

All administrative telephones shall be furnished with digital display built in or attached to the telephone. All telephones shall be push button, touch tone type providing two wire balanced transmission complete with dial tone, ringing, busy signal, and digital readout.

All phones shall be desk type with suitable extension to a nearby wall outlet.

All phones shall be capable of performing all functions outlined in this specification.

All administrative telephones shall be the approved equal of Rauland ACS-33D, DuKane, Model 7A995 or an approved equal.

- (d) Staff Telephones

- (1) Wall type - Handset exposed.

Furnish and install a telephone handset designed for wall mounting. It shall include a flush mounting plate for the telephone to be mounted in a cradle.

The unit shall measure 2-3/4" wide, 9-1/8" high and approximately 3" deep. The mounting plate shall be standard single gauge, stainless steel. The telephone unit shall be similar to Bogen HS5R, DuKane 9A680/7A540 or an approved equal.

- (2) Wall type - Handset enclosed in cabinet.

Furnish and install a telephone handset designed for wall mounting. It shall include a flush mounting plate for the telephone to be mounted in a cradle. The unit shall measure 2-3/4" wide, 9-1/8" high and approximately 3" deep. The mounting plate shall be standard single gauge, stainless steel. The telephone unit shall be similar to DuKane 9A680/7A540 or an approved equal.

16-19.15 TELEPHONES (Con't)

These staff telephones shall be installed in a cabinet to be furnished and installed by this contractor. See Standard Detail Sheet E-2, Series F Dwg. 775A for details of cabinet.

(d) Elevator Telephone

Furnish and install a telephone, similar to staff telephone, located in the elevator cab. The General Construction Contractor will provide the box in the elevator and trailer cable to the box. This contractor shall make all necessary connections for the proper functioning of the telephone.

The Electrical Contractor is cautioned to properly coordinate this installation with the General Construction Contractor, and to provide a telephone instrument that will fit into the cabinet furnished in the Elevator Cab.

16-19.16 LOCAL VOLUME CONTROLS

(1) Volume Controls for Speaker Circuits

(a) General

Furnish and install a volume control at each location indicated on the drawings.

(b) Volume Control

Volume Control shall consist of a single T-pad variable resistance network and shall be of the non-shut-off type.

Volume Controls shall have sufficient power capacity to carry currents of the circuits they control and shall be the approved equal of Daven power attenuators. The attenuation in the last position of the control shall not exceed between 12 to 16 db.

Each Volume Control shall be connected, as indicated on drawings to control loudspeakers in the respective enclosure.

(c) Box and Trim

Box of Volume Control shall be constructed from No. 14 gauge steel and shall be of ample size to contain T-pad network described above. Box shall be flush mounted as indicated on the Drawings.

16-19.16 LOCAL VOLUME CONTROLS (Con't)

(c) Box and Trim (Con't)

Trim of box shall be of No. 14 gauge steel finished to match adjacent metal. Trim shall contain a piano hinged door equipped with lock, Yale Jr. No. 2446 or an approved equal. Completely close all openings around inside control plate. No wires shall be visible or accessible.

The words "Loudspeaker Volume" shall be inscribed on face of trim.

(d) Where required on drawings, install in volume control box, additional control switches, Arrow-Hart No. 20905FR, or equal, for local control of loudspeakers. Switches shall have properly inscribed nameplate.

(2) Volume/Mixing Controls for Amplifiers

Furnish and install at location indicated on the Drawings, a remote microphone mixing control Stromberg-Carlson RV-1009-6 or approved equal. Control shall be designed to operate with a pre-amplifier mixer in a manner as hereinbefore specified. It shall consist of five variable units which shall individually control the gain of the of the five inputs, and one master variable unit to control the gain of the five inputs as a unit. The control units shall be mounted in a suitable flush box with a piano hinged cover and an approved lock. Furnish two keys for lock to the Principal at the school. Cover shall be No. 14 gauge steel finished satin chromium. Face of trim shall be inscribed "Loudspeaker Volume".

Each control shall be inscribed to agree with inscription on corresponding control of pre-amplifier in amplifier cabinet.

(3) Special Mixing Control (Music Room-Band Practice Rm.).

Provide and install at each of the locations shown in the Bank Practice and Music Rooms, a box, internal plate and trim meeting previous specifications. Plate shall contain two (2) broadcast quality microphone attenuators of the ladder type, with detent knob mechanism in 2 db steps with a total of about 20 db, and an insulated type earphone jack. Attenuators shall be as made by Daven. Earphone jack shall be as made by Switchcraft. Jack shall be connected to an L.S. cable run separately (to the C.C.R.) from the L.S. cable feeding the speakers in the room. The attenuators shall have their outputs mixed and fed back to the C.C.R. as one (1) microphone circuit. Each Special Mixing Control is to be furnished with one (1) Brush BA-200 or approved equal crystal element headset equipped with plug to match earphone jack.

(4) Principal's & General Office Sound Control.

Furnish and install an L-Pad volume control and a selector switch for the Principal's Loudspeaker, and a signal light on the face plate of a flush mounted 3-gang box at location indicated on Drawings. The volume control and selector switch shall be so connected two circuits (one from each channel) from the Central.

16-19.16

LOCAL VOLUME CONTROLS (Con't)

Control Rack that the loudspeaker can be connected to either channel and the sound volume adjusted, all independent of the Central Control Rack. The signal light shall be a 6-volt lamp set in a miniature base socket (Drake or equal) and covered by a green jewel. This shall be connected to the push button on the Central Control Rack.

Faceplate finish shall be as selected by the Executive Director to match adjacent metal. Inscribe faceplate as indicated on Drawings.

16-19.17

MICROPHONES

A. General

The Amendments indicate the number of microphones of each type which are to be furnished by this Contractor. Microphones shall be delivered to the Principal of the school.

All microphones shall be of the dynamic type. Each microphone shall be equipped with a dustproof screen which shall harmonize with the microphone finish. Each microphone shall be equipped with a swivel attachment for mounting on a stand.

Microphones shall be of the low impedance type, suitable to the impedance of the voltage amplifiers with which they are used.

Microphones and stands shall have a finish acceptable to the Executive Director. Submit for approval a sample of each type of microphone and each type of stand.

B. Announce Type Microphone (Offices Only)

This type of microphone shall be exceptionally rugged of the omni-directional dynamic type. The frequency response shall be from 60 to 11,000 Hz. The output level shall be not less than -55 db with zero db equalling 1 mw./10 dynes/cm². Impedance shall be 150-250 ohms balanced. Cable length attached to microphone shall be not less than 15 feet with Hubbell No. 7567 plug on end.

Acceptable Announce Type microphones are RCA MI-12039A, Stromberg Carlson MD-37AS, Electro-Voice 630-LO-Z, Turner 251 or equal.

16-19.17 MICROPHONES (Con't)

- C. General Purpose Type - (Playrooms, Lunchrooms, Gyms, Auditoriums, Lecture Halls, etc.)

This type of microphone shall be a cardioid dynamic type with uniform frequency response from 60 to 15,000 Hz. Output level for 150 ohm impedance shall be -57 db with 0 db equalling 1-mw/10 dynes/cm², EIA sensitivity rating shall be -151 db for 150 ohm impedance. Provide with a bass-tilt switch offering a choice of 0,5 or 10 db attenuation at 100 Hz. Electro-Voice 674-LO-Z, Turner S-500, Shure or equal will be acceptable.

- D. Play Yard Type (Outside)

This microphone shall be an omnidirectional, dynamic type with a magnetic shield to prevent dust and magnetic particles from diaphragm. Uniform response from 70 to 10,000 Hz, output level 61 db with 0 db equalling 1 mw/10 dynes/cm², EIA sensitivity rating shall be -155 db. Provide lavalier neck assembly to hold microphone. Electro-Voice 647A-LO-Z, Turner #220A, Shure #570, or equal will be acceptable.

Cable length attached to this microphone shall be not less than 15 feet. Supply one (1) microphone extension cable minimum 25 feet long of Belden No. 8428 or equal, heavy duty, rubber covered, shielded microphone cable, with Hubbell 7567 three-pole twist lock plug at one end and Hubbell No. 7555 three-wire twist lock cord connector on other end.

Furnish and install a flush mounted cast aluminum box (par. 16-6.20) of this specification, to house a Hubbell 7580 receptacle for Play Yard microphone.

- E. Stands

- (a) The microphone in the Principal's Office shall be attached to a substantially constructed table stand approximately 8" high with built-in microphone switch. Microphone switch shall be of the long leaf anti-capacity type and permit push-to-talk or lock-to-talk operation. Switch contacts shall not be grounded to frame of stand.

Acceptable small stands are RCA MI-6427, Electro-Voice 418-S or approved equal.

16 -19.17 MICROPHONES (Con't)

- (b) All microphones other than those for Play Yard and for Principal's Office shall be permanently fastened to substantially constructed stands which are adjustable in height from 36 inches to 66 inches above the floor.

Acceptable large stands are RCS MI-4068-D, Atlas MS-20 or approved equal.

- (c) Furnish and install on the Reading Stand, furnished under another contract, a flexible microphone stand. The flexible stand shall consist of a flange 1¼" in diameter fastened through the level surface of the reading stand by means of chrome plated button head machine screws, lockwashers and nuts, on the left hand side, rear. The stem of the stand shall be approximately 5/8 inch in diameter and 19 inches long, constructed of coiled, chrome plated steel to give "gooseneck" flexibility. One end of the gooseneck shall be threaded for insertion into flange base and the other end threaded to fit the "General Purpose Type" microphone normally used on the floor stand provided for all Auditoriums. No microphone shall be supplied with this stand.

F. Microphone Cables

Each microphone shall have 25 feet of approved 2 conductor rubber covered shielded cable, cut on job as directed to suit conditions. Each microphone cable shall be equipped with a 3-conductor polarized plug the equal of Hubbell 7567, Bryant or A-H.

16-19.18 PORTABLE TURNTABLE

Furnish and deliver to the Principal at the school one (1) portable record player meeting the following specifications:

The record player shall be a portable unit complete with fittings to permit operation with the school sound system. The case shall be ruggedly constructed of 3/8" thick wood and neatly covered with leatherette.

The top cover shall be hinged and made removable. Cover shall include a positioning device to keep turntable in position while being carried. The eight corners shall be provided with brass reinforcing corner peices. Four brass feet shall be provided to protect the lower surface while the case is in a stored position. Four rubber feet shall protect the lower surface while the case is in the horizontal playing position. The cover shall fasten to the case by means of two brass latching devices. The motor board shall be constructed of ½" plywood that is flocked to match the flocking on the turntable. Case shall be provided with suitable hinged, molded plastic carrying handle.

The turntable shall permit playing of standard lateral cut records at speeds of 78,45 and 33-1/3 RPM. The turntable shall be lathe-turned and balanced, made of laboratory tested aluminum casting. Turntable shaft shall be hardened, ground and polished. The motor shall be of the induction type designed for smooth, quiet, vibration-free operation, fitted with a Lamitex motor pulley. Means shall be provided to make speed changes instantaneously without stopping turntable or removing disc. Noise level shall be 30 db below average recording level.

The tone arm shall be capable of playing either standard groove or microgroove recordings. Tone arm shall be curved cast aluminum arm of light weight construction. It shall be provided with stand possessing locking feature when not in use. Cartridge shall be of the turn-over type employing ceramic unit. Frequency response shall be essentially flat on an Orthocoustic characteristic to within plus or minus 2 db from 30 to 12,000 Hz. Cartridge shall be provided with a 1-mil diamond stylus and a 3-mil sapphire stylus. Impedance of unit shall be appropriately redacted to match the impedance of the sound system input, using pads and isolation transformers to provide a balanced signal source. Output level shall be equal to microphone output level under normal usage.

A volume control shall be mounted on the motor board to permit control of the volume of reproduction. Control shall be provided with suitable escutcheon.

16-19.18 PORTABLE TURNTABLE (Con't)

A three-wire "SJ" type power cable shall be provided with unit, cable being eight feet long and terminated in a cord grip plug, the equal of Hubbell No. 5264. One wire shall ground the frame of the motor.

Portable record player shall be provided with an eight foot signal cable terminated in a Hubbell No. 7567 twist lock plug. Cable shall be of rubber covered two conductor shielded cable equivalent to the microphone cables used in the school. The shield shall be connected to the third pole of the plug.

Acceptable record players are RCA Model CR-4829-3SA, Bogen Model 1004, Lenco L-75, or an approved equal by Stromberg Carlson Company.

16-19.19 WIRING

- (a) Furnish and install all conduits, conductors, boxes receptacles, etc. indicated on the Drawings, herein specified, or required for the proper operation of the sound systems. All conduits and conductors, unless otherwise herein specified or indicated on the Drawings, shall meet the requirements of Sections 16-5, 16-6, and 16-7 of the Standard and Amendments.

- (b) "Intercom Cable" to Provacy/Call-in Switch shall be a four conductor copper cable and shall consist of two number 20 AWG stranded twisted pair shielded, and two number 20 AWG stranded conductor unshielded.

Cable shall have aluminum-polyester shield over two conductors, 20 AWG stranded tinned copper drain wire, polyethylene insulated conductors cabled, chrome vinyl jacket.

Cable shall be Belden, catalog # 8722 or approved equal.

Submit sample of conductor for approval.

- (c) "Loudspeaker Cable" shall be a four conductor, number 20 AWG, copper cable and shall consist of two number 20 AWG stranded twisted pair shielded and two number 20 AWG stranded conductor unshielded. This cable shall be called an "LS Cable" on the drawings.

Cable shall have aluminum- polyester shield, number 20 AWG, stranded, tinned copper drain wire, polyethylene insulated conductors cabled, chrome vinyl jacket. Cable shall be Belden, catalog # 8722 or approved equal.

Submit sample of cable for approval.

16-19.19 WIRING (Con't)

- (d) "Administrative Cable"--Administrative telephone cable shall be twenty five (25) pair, number 22 AWG conductor cable. Cable shall have tinned copper conductors vinyl insulated, chrome vinyl jacket.

Cable shall be Belden, Catalog # 9434 or approved equal.

Submit sample of cable for approval.

- (e) "Mic Cable" - Microphone (MIC) cable shall consist of number eighteen (18) twisted, two conductor cable. Each conductor shall be made up of 16 number 30 tinned copper strands. Both conductors shall be insulated with a minimum of 1/64 inch plastic material having the dielectric and physical properties of "GEON". The two conductors shall be color coded.

The outside covering shall have 4 ends #34 tinned copper mesh shielding, 16 to 18 picks per inch. The mesh braid shall give a minimum of 80% shielding. An approved aluminum polyester shield, with no 20 AWG copper drain wire will be acceptable as an equal. The cable shall have a bare number 20 solid tinned copper conductor within the shield to act as a grounding conductor. This solid conductor shall be connected to the lug and the shield butted and taped back.

Cable shall be RCA CR-18B or approved equal.

Submit sample of conductor for approval.

All microphone cables (MIC CABLES) shall be equipped at the microphone receptacle end with approved U-type solder lugs.

At the Central Control Rack, microphone cables shall be soldered in an approved neat and workmanlike manner to the terminals of the terminal block for microphone conductors.

WIRING (Con't)

- (e) At the outlying amplifiers, the ends of microphone cables shall be neat, workmanlike and soldered in an approved manner by skilled solderers. Soldering shall be performed without leaving unnecessary lumps, excessive residue of soldering paste, or displaying the characteristics of any other sub-standard soldering methods.
- (f) All Sound System and Intercom System conductors to and between the Central Rack and associated components such as outlying amplifiers, all loudspeakers, all microphone receptacles, all privacy switches, all types of telephones, etc. shall be installed in one continuous length between the terminals of these units and shall be free from splices or other breaks.

Interconnecting terminals as hereinafter specified may be used only at terminals of loudspeakers, telephones, privacy switches, amplifiers, microphone receptacles, or where directed.

Submit sample of cable for approval.

- (g) All loudspeaker cables (L.S. cables) shall be terminated in the following manner.
1. The ends connected to the terminals of the Central Control Rack or the local amplifiers shall be equipped with a Burndy YAV-14-HF solderless U-type lugs, T.&B. "Sta-Kon" Connectors or an approved equal.
 2. The end connected to the loudspeaker transformer leads shall be neatly soldered and taped where such loudspeakers are not equipped with terminal strips. Where loudspeakers are equipped with terminal strips, the ends of "LS Cables" shall be equipped with U-type solderless lugs described above.

WIRING (Con't)

3. Where two or more loudspeakers are on the same circuit, "LS Cables" shall be soldered neatly to the terminals of the loudspeaker transformers to form a "loop" circuit. Where loudspeakers are equipped with terminal strips, stacking U-type terminal lugs, the equal of Burndy type, shall be employed.
 4. Unused leads of taps of loudspeaker matching transformers shall each be separately taped to insulate the conductors from each other and from the grounded parts of the equipment.
- (h) All connections of wiring within the Central Control Rack to terminal blocks shall be performed by the manufacturer of the Central Control Rack.
- (l) All connections of conductors entering the Central Control Rack to the terminal blocks shall be performed by the Contractor for Electric Work.
- (j) From a nearby water pipe, a ground wire of size indicated on the Drawings shall be installed in conduit and attached to the frame of the central control cabinet. Ground connection at water pipe shall be by means of a Thomas and Betts 3670 line, Appleton, Crouse-Hinds or other approved ground fitting.
- (k) All connections shall be made under the direct supervision of the manufacturer's representative. Connections shall not be made until the contractor and the manufacturer's representative have explained to the Executive Director's representative the procedure to be followed.

MICROPHONE RECEPTACLES

Microphone receptacles shall be three pole, each with a separate screw terminal. Ground terminal shall not be connected to yoke. Microphone receptacles shall be the approved equal of Hubbell 7582 (single) and Hubbell 7580 (duplex). A stainless steel face plate type 302 .035 inch thick and finished to match other face plates in same enclosure, shall be provided for each receptacle. Each face plate shall be inscribed "PHONO-MIC-1", "PHONO-MIC-2", etc.

16 -19.20 MICROPHONE RECEPTACLES (Con't)

Certain face plates shall have additional inscriptions as hereinafter noted:

1. In a school equipped with an Auditorium or Assembly Sound System, each microphone receptacle in stage front and rear wall of the Auditorium or Assembly platform which is connected to the pre-amplifier, shall be identified as to input number on the pre-amplifier. Additional inscription shall be "Aud. Amp. Input 1"; "Aud. Amp. Input 2"; "Aud. Amp. Input 3"; "Aud. Amp. Input 4", as appropriate to the receptacle.
2. In all schools the face plate of each receptacle in the auditorium, assembly, gymnasium, and cafeteria, which is connected to the Central Control Rack, shall bear the additional inscription "Cent. Cont. Rack".

16 -19.21 ANTENNA FOR RADIO RECEPTION

NOTE: When a school is being equipped with a Television Distribution System the Antenna, Mast and Transmission line herein specified shall be omitted from the Sound System as it will be included as a part of the Television System.

(a) General

Furnish and install when indicated on Drawings, an antenna suitable for receiving radio programs on the frequencies from 550 to 1600 kc and from 88 to 108 mc and meeting the following specifications. All parts of the antenna system indicated on the Drawings or herein described shall be furnished and installed by the Contractor for Electric Work.

(b) Mast

The mast shall consist of 1½" quadruplicate wrought iron pipe fastened as indicated the Drawings. All iron parts in connection with masts (including guides, brackets, bolts, etc.) shall be hot dipped galvanized. These parts shall be thoroughly cleaned of grease with gasoline or turpentine. After drying, they shall be given one coat of copper sulphate (6 oz. to each gallon of water), then painted one coat of red lead and two coats of lead and zinc and titanium paint, color as directed. The final coat shall be applied after erection.

ANTENNA FOR RADIO RECEPTION (Con't)

(c) Antenna

On top of the mast, where indicated on the Drawings, install a horizontal dipole antenna as directed. Antenna shall be tuned to 88 ma for FM and from 550-1600 KC on AM and shall consist of two 5/16" diameter tubular aluminum rods each securely inserted in an approved insulator. Insulator containing rods shall be securely fastened to pipe mast, as directed. Submit sample of insulator and dipole rod for approval before installation. Insulator shall have spark type lightning arrestor that is grounded to mast on installation.

(d) Transmission Line

The transmission line from the dipole shall be installed through the weatherhead and conduits, as directed, to the tuner previously specified. The transmission line shall be type RG-6/U, Belden cable # 8228P or an approved equal. This cable shall be #18 AWG (solid), with a cellular polyethylene insulation and a white, black, light beige vinyl jacket and duofoil + drain shield.

The transmission lines shall be supported from the mast in accordance with the details shown on the Drawings. Where transmission line enters the weatherhead install weatherproof glands equal to the sample in the Office of the Executive Director.

PILOT LIGHTS (120 VOLT)

In connection with the Central Control Rack and with each of the local amplifiers required by the Drawings or Specifications, there shall be furnished and installed where and as indicated on the Drawings, a pilot light (Type L-94P or L-94PG), equipped with a 15 watt lamp. Each pilot light shall be connected so as to be illuminated when the main power switch of the unit is in the "ON" position. Glass covering shall be white opalescent.

16-19.23 EQUIPMENT FOR MOTION PICTURE PROJECTOR

A sound motion picture projector will be supplied by the Board of Education. The Contractor for Electric Work shall supply the following:

1. A Female plug (Cannon No. P-2-CG-11) to fit the M.P. Sound Receptacle (Cannon No. P-2-36) where indicated for Auditorium and/or Assembly Area usage.
2. A three pole plug to fit the power receptacle where indicated for Auditorium and/or Assembly Area usage.

When directed by the Executive Director, this Contractor shall connect the above plugs to the appropriate cords of the sound motion picture equipment.

16-19.24 DRAWINGS

Before manufacture of the sound equipment, and all associated equipment, there shall be submitted for approval a complete wiring diagram (in quadruplicate) and dimensional and descriptive drawings of all equipment. Drawings of the Central Control Rack (classroom system) and outlying amplifiers and cabinets shall indicate the location of the panels and equipment, and shall provide full descriptive details of all equipment including methods of mounting equipment, wiring details, etc.

16-19.25 SUPERVISION AND CERTIFICATION

The installation of the sound equipment, and wiring, shall be performed under the supervision of the manufacturer's engineer.

When the installation is completed, it shall be given an overall performance test for the Executive Director's representative. The overall test shall include but not necessarily be limited to the following individual test:

Central Control Rack--Audio Tests

- A. Loudspeaker Circuits -- Transmission of audio signals at normal levels over each loudspeaker circuit for determination of proper loudspeaker volume and operation, and for the purpose of checking actual room numbers vs. the room numbers on the room switch escutcheons.

SUPERVISION AND CERTIFICATION (Con't)

- B. Input Circuits -- Transmission of audio signals at normal levels over each input circuit for determination of circuit continuity and for checking designations on input selector switches.
- C. All-Call Switch -- Checking for proper operation of this switch on both channels; also for exclusion of loudspeakers not be controlled by same.
- D. Load Test -- Checking for proper system operation when the entire loudspeaker load is applied to either channel.
- E. Remote Volume Controls -- In primary schools, the loudspeaker volume controls in the Auditorium or Assembly Area, Cafeteria and Gymnasium shall be checked for proper operation.
- F. Local System Selector Switches -- In schools, the switches for control of the loudspeakers in the rooms having local systems shall be checked for priority control. All pilot lamps shall be checked.
- G. Sound Motion Picture Connection -- In primary schools, the complete circuitry of this feature shall be checked with a movie projector or equivalent amplifier device, especially noting proper operation with time signal and Auditorium switch priorities.

Central Control Rack -- Program Signal Tests

- H. Automatic Control, All Schools -- Automatic and manual ring feature of the Program Instrument shall be checked.
- I. Manual Control, Primary School -- The "All-Ring" control shall be tested.
- J. Manual Control, Intermediate or High Schools -- Each circuit shall be tested for proper operation using the manual ring feature.

Auditorium Sound System

- K. Intermediate Schools -- Tests A, B and C above shall be performed on this system. In addition, the remote volume control, the Auditorium Monitor Switch and the priority of Central Control Rack shall all be checked. The Movie

16-19.25 SUPERVISION AND CERTIFICATION (Con't)

- K. Connection circuit shall be tested using a movie projector or equivalent amplifier device. Tape recorder playback and recorder receptacles shall be tested.
- L. High Schools -- All tests outlined in L. above shall be conducted on this system. All additional features and controls shall be tested; among these shall be the Talk-Playback Switch, "On-Air" fixture controls, monitor speaker controls, headset and headset controls, etc. The tape recorder, which may actually be located in the Central Control Rack, shall be tested by the making and playing back of a tape obtained from the output of both the Central Control Rack and the Auditorium System.

Gymnasium Sound Systems

- M. Input Circuits -- The two input circuits of each Gymnasium amplifier shall be tested from all microphone receptacles.
- N. Output Control -- In the event one amplifier can operate all the loudspeakers in both halves of a split gym, the switch permitting this control shall be tested.

Cafeteria Sound System

- O. Input Circuits -- Repeat the test outlined in M. above.
- P. Output Circuits -- In the event there are switches for control of loudspeakers to avoid acoustic feedback, they shall be tested for proper operation, and checked to determine that priority control of the Central Control Rack obtains with the switches in the OFF position. Switches for control of loudspeakers in Convertible Classrooms shall be tested.

Emergency Sound Alarm

Test the momentary contact buttons in General Office. Check reset button and pilot light for deactivation of system.

16-19.26 OMISSIONS

These specifications do not enumerate all the details of fittings and accessory equipment required for proper operation of the systems herein described. It is understood that all necessary and required equipment shall be supplied complete by the Contractor without extra compensation even though not specifically mentioned herein.

16-19.27 INSTRUCTIONS

- (a) The Contractor shall arrange with the manufacturers of the equipment to instruct persons designated by the Principal of the school, in the proper operation and care of the sound equipment.
- (b) An approved schematic wiring diagram showing the interconnections between the various units of the sound equipment shall be mounted behind a transparent, non-breakable, non-inflammable plastic face, set in a suitable wooden frame and fastened by machine screws to the inside of rear door of the Central Control Rack.
- (c) A complete schematic diagram (in triplicate) of the sound & intercom equipment, as installed, showing all connections to units and parts thereof, both internal and external, shall be delivered to the Executive Director.
- (d) A set of simple operating instructions for operation and care of the sound equipment shall be mounted at a location selected by the Executive Director.

16-19.28 NOTIFICATION OF CHANGES OF EQUIPMENT

When inspecting or supervising the installation of equipment, manufacturer's representative shall be accompanied at all times by the Executive Director's representative. In order to make the necessary arrangements, the Executive Director shall be notified at least 48 hours in advance of the time the manufacturer's representative plans to visit the School.

Any changes of equipment shall be made only with the written permission of the Executive Director.

16-19.28 NOTIFICATION OF CHANGES OF EQUIPMENT (Con't)

Changes in location of equipment may be made with the permission of the Executive Director's electrical representative at the School. However, a written memorandum of these changes of location shall be forwarded to the Office of the Executive Director.

All changes of location of equipment (including pull boxes, conduit runs, wire sizes, etc.) shall be incorporated in the framed Sound System & Intercommunication Riser diagram installed in the School.

SECTION 16-20, MISCELLANEOUS ELECTRIC EQUIPMENT

16-20.01 Blackboard Eraser Cleaner

(A) Electrical Rating and Motor

Rating shall be 115-volts. Power input during cleaning operation at 115-volts. Power input during cleaning operation at 115-volts AC shall be approximately 600 watts. Motor shall be universal type mounted in unit and steel plated, No. 12 MSG to motor housing. Motor shall contain sealed ball bearings requiring no oiling. Approximate horsepower shall be 1/2 HP and shall be approximately 18,500 RPMS under load.

Motor shall not be exposed during normal operation or when changing bag or filters, but shall be accessible only by removal of side end cover. It shall be possible to replace motor or switch or associate wiring without removing unit from the wall.

(B) Wiring, Connections, Control

Power connections shall be made to a terminal block outside the motor compartment and housing in the rear of the unit. The 120-volt power supply shall be connected through a motor starting switch.

Control shall be via an approved toggle type switch (Cutler-Hammer rated 10 amp. 250 V, AC/15 amp, 125 V, AC/ 3/4 HP 250 V AC) located to the right of the upper deck lid.

(C) Housing and Mounting

Housing shall not exceed 7 1/2" x 8" x 15 3/4" and shall be constructed of integrated backing, with laminated metal skin, finished in dark grey enamel with cast metal 5/64 in minimum thickness end plates. Each plate shall have eight ventilation openings (5/32" x 5 1/4" long).

16-20.01 Blackboard Eraser Cleaner (Con't)

(C) Housing and Mounting (Con't)

Four or more mounting holes shall be provided on bottom of housing. Cleaner shall be mounted as directed using two triangular mounting brackets made of the purpose using four bolts through the brackets and the wall. Bolts and/or fastening devices used shall be long enough to accure unit to the wall. Eraser cleaner shall b e positioned on mounting bracket in relation to wall or mounting in such a manner as to provide 1/2" space between wall and unit with the deck lid in the up position.

Deck lid shall be of cast metal 5/64 in minimum thickness, secured via and approved spanner head fastener or other security type device to prevent anyone other than authorized personnel from gaining access to the cloth bag, sponge filter or internal assembly.

(D) Cleaning Apparatus

Proper cleaning action shall be obtained without the use of any brush or other motor driven parts on the outside of the unit. Cleaning shall be accomplished by the use of three strings of thermoplastic rollers which will vibrate and impact clean the eraser as air is drawn through the openings between them. Cleaning apparatus shall be designed so as to eliminate any possible injury to operator even should he come in contact with the beater bars.

(E) Suction and Filtration

Suction shall be provided via 1/4 HP motor as previously described. Fan and all other motor component parts shall be scaled using a perforated steel screen No. 21 MSG.

Filtration shall be accomplished in two stages:

First state - A high grade cloth filtering bag equipped with an extruded rubber gasket to seal properly to deck lid.

Second Stage - Heavy duty slow burning polyurethane absorbent filter.

An additional sponge filter and cloth filter bag shall be provided with each eraser cleaner.

Blackboard eraser cleaners shall be the approved equal of the Chieftain II Model 505 (Agent: John Berkheimer, Blackboard Resurfacing Company. 50 N. 7th St., Bangor, PA, Area Code 215/588-0965).

16-20.02 Tool Grinder

Furnish and install at location (usually in the Custodian's Work Shop) indicated on the Drawings or where directed, one floor-mounted pedestal type tool grinder of the ball-bearing type, equipped with one medium and one fine carborundum grinding wheel, guards which fully enclose wheel (except for grinding area), two (2) safety glass eye shields, two (2) adjustable tool rests and all regular equipment. Grinding wheels shall be 7 inches in diameter, and shall have a 3/4-inch face. Tool grinders shall be installed complete, adjusted and ready for operation.

The tool grinder shall be equipped with a 1/3 horsepower, 208 volt, 60-cycle, three phase induction motor. Motor shall be of the highest grade and shall meet the requirements of N.E.M.A. Motors of Allis Chalmers, Century, Crocker Wheeler, General Electric, Westinghouse, Wagner or approved equal will be accepted.

The wiring to starter and motor shall be installed in rigid conduit, except that a short section of flexible conduit shall be used for final motor connection. An approved junction box shall be inserted between rigid and flexible conduits.

The tool grinder shall be equipped with two (one over each wheel) illuminated, shatterproof eye shields, complete with holders, safety glass, lamps, etc. Sockets of lamps shall be connected in parallel on a 120 volt circuit from the 3 phase, 4 wire, 120/208 volt circuit (this Contractor shall install the fourth wire from the panel to the grinder). Lamp circuit shall be connected so that is energized whenever motor is energized. Furnish and deliver to the Custodian six (6) additional lamps for replacement purpose.

Shields shall be "Flud Lite No. 600" of the Stanley Electrical Tool Co., or the approved equal supplied by Cincinnati Electrical Tool Co., or other equal.

Switch and flexible cords shall be omitted from motors where such equipment is an ordinarily standard part. Motor housings shall be suitably modified in a manner approved by the Executive Director so that a wall mounted starter and flexible conduit can be used.

Tool grinders shall comply with the Industrial Code of the New York State Department of Labor.

The following tool grinders or other approved equal which comply with these specifications will be acceptable: James Clark Jr. Electric Co., Cincinnati Electrical Tool Co. Type PBA., Stanley 697.

16-20.03 Kilns

(a) General

Furnish install complete electric kilns at locations indicated on Drawings. Each kiln shall be complete with auxiliaries, furniture, etc., and shall be completely wired and connected, and left ready to operate.

Each kiln and operating equipment shall be approved and acceptable to the Bureau of Electrical Controls.

Prior to fabrication of equipment, this Contractor shall submit to the Executive Director for approval, shop drawings showing dimensions of kilns, and detailed wiring and pertinent technical data of all auxiliary equipment.

Before delivery and installation the kiln, or a duplicate, shall be made available for inspection by a duly appointed representative of the Board of Education.

Equipment shall be arranged for conduit connections, and conductors or kiln and/or within kiln (except elements) shall be asbestos covered, type-SA.

A representative of the manufacturer of the kiln shall instruct a person designated by the Principal of the school in the proper operation of the kiln.

A complete set of instructions shall be furnished in the simplest terms, describing the operation and maintenance of the kiln. The Contractor shall arrange for the kiln to be tested at the school by a Board of Education representative before final acceptance is given.

Each electric kiln shall have a nameplate securely attached thereto, located for ease of reading. Nameplate shall indicate manufacturer, trade mark or other identification symbol, together with non-erasable markings giving current, operating voltage, wattage, maximum operation temperature, and date of installation. Kiln should also be provided with metal plate securely fastened to front of kiln door with 2-inch high letters in red spelling word "DANGER".

16-20.03 Kilns (Con't)

Electrical Binding Posts for all heating elements as specified in the following specifications shall be made of brass or of any other suitable material approved for this use by the Board of Education. Manufacturer must submit evidence of at least five years' experience that all newly submitted binding posts will be maintenance free and tend toward easy replacement of heating elements to which they are connected.

Kilns of the American Art Clay Company; Kilns, Inc., Harper Electric Furnace Corp., N.Y., Stewart Clay Company, N.Y., meeting these specifications will be acceptable.

- (b) Large Electric Kiln-Size 18" x 18" x 18".

Each Kiln shall be constructed in accordance with the following specifications.

- (1) Kiln Casing

The kiln casing shall be constructed of cold rolled galvanized steel sheet of not less than sixteen gauge which shall be used for the rear wall, side walls, top and bottom sections. Eleven gauge cold rolled steel shall be employed for the front section of the kiln and the door. The rear pan, forming the rear wall, shall fit within the side walls and bottom piece and shall be formed as a pan with not less than one-and-a-half inches for a lip. The front pan, eleven gauge steel, shall be made as a pan with one-and-a-half inch lip to fit within the side walls, rear wall, and the bottom of the kiln. The top pan shall fit over the side walls, rear wall, and front section and shall extend for one-and-a-half inches over these areas. This pan shall be formed by making a running weld at the corners and such weld shall be ground smoothly to a finished surface. These sections of metal shall be secured by means of continuous welding or not less than twelve sheet metal screws to each area being secure. All rough edges at junctions of metal sections shall be ground smooth. Other methods of construction will be considered upon submission for approval. The metal shall be treated on the interior with two coats of acid-resistant coating. Each section of metal shall further be lined with not less than one-eighth inch "Fibrefax" or approved insulation. "Fibrefax" shall be secured by means of heat-resistant adhesive applied to the inner coated surface of each metal surface except the lips of the pans.

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(2) Kiln Door and Firing Chamber

Shall be plug type, hinged, refractory backed (with a total thickness of not less than 6 inches), door shall be constructed of not less than 11 gauge, cold rolled steel, provided with a minimum of one latch. Door shall be hung on two approved heavy cast iron or bronze, plated, pintle type hinges measuring approximately 4 1/2 inches long by 2" wide overall and approximately 1/2" thick with at least 1/2" dia. by 1 1/2" long pin in a 1" housing and securely fastened to kiln with heavy plated bolts. The latch shall be cast iron or bronze with plated sliding eccentric headed steel bolt or approved cam action type latch for olding door tight against front of kiln. The latch shall be provided with means for locking the door with a padlock. Hinges shall be mounted on face of front panel immediately adjacent to door and shall connect between door and front panel.

Door shall be equipped with handle constructed of not less than 1/2" diameter stainless steel rod or chrome plated steel tubing extending the full height of door, securely fastened to top and bottom with a minimum of two cap screws and lock-washers at each location. Handle shall be capable of being opened a minimum of 120 degrees without sag andd shall be so secured that the front pan does not bulge or pull away from the kiln when the door is fully opened or locked in position. Door shall be mounted on the right or left as specified on the Schedule Specification.

Kiln shall encase a firing chamber of approx. 18" wide x 18" high x 18" deep or approved dimensions to give a volume of not less than 5,670 cu. in. Firing chamber and door shall be lined with K-26 refractory insulating brick, backed up by K-20 insulating brick. The bricks shall be laid on a 2 1/2" surface and shall be backed with 4 1/2" laid on the 4 1/2" surface of K-20. Refractory insulating brick shall have not less than 2600 degree fahrenheit rating and shall be such as made by A.P. Green, Babcock and Wilcox, Harbison Walker, Johns Manville or other approved equal.

Outside of kiln casing shall not exceed 225°F after 8 hours of operation.

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(3) Kiln Cabinet Steel Stand

Stand shall be of angle iron construction with top angles not less than 2" x 2" x 1/8", size diagonally braced at back area on both sides. Legs shall be of angle iron of same size as top angles or of tubular steel or approved diameter to carry load. Stand shall be of proper height to locate center of kiln heating chamber approximately 4 feet above floor level. At floor, bottom ends of leg shall be connected by angle irons (not less than 2" x 2" x 1/8" size) to properly distribute weight of kiln and not damage floor surface. Stand shall be equipped with horizontal angle iron braces not less than 1" x 1" x 1/8" size at two points, 5 inches and 17 inches from floor on which shall be fastened heavy steel plates to provide stand with one No. 18 gauge steel shelf. Stand shall be fully enclosed with No. 18 gauge cold rolled steel, equipped with hinged door and snap catch. One piece construction for combined kiln and stand shall be acceptable in lieu of two piece construction specified above. Cabinet stand shall be painted with two coats of gray heat resisting and rust resisting paint, hammertone finish.

(4) Heating Elements

Kiln shall be equipped with three (3) heating elements made up of Kanthal A-1 metal coils and shall be of sufficient length to produce a temperature in firing chamber of approximately 2350 degrees fahrenheit under normal working conditions. Elements shall be fully enclosed or set in open grooves cut into refractory lining of firing chamber in the two sides, rear door or two sides and bottom and shall be secured in place by pins, porcelain or ceramic channels. Leads from porcelain tubes of proper size to take leads and these porcelain tubes shall be packed with rock wool to prevent passage of heat from firing chamber to outer terminal junction box. Rod type heating elements shall be acceptable. Heating elements shall be designed to operate on three phase, four wire, 208 volt, 60 cycle, alternating current supply from building service. Heating elements shall be made of Kanthal A-1 wire such as made by Fire Clay Co.; Jeliff Mfg. Co.; Haskins Chromel Co.

(5) Kiln Junction Box

Kiln shall be equipped with an approved type terminal junction box in which shall be installed a panel board of heat resisting non-conductor material on which shall be mounted the required electrical binding posts to take heating elements, leads, etc. Binding posts shall be of brass and all interior and exterior electrical connections shall terminate at these binding posts.

(6) Auxiliary Equipment, Controls, etc.

Each kiln shall be equipped with the following equipment with all interconnections made complete and ready to operate:

- a. Kiln shall be equipped with a 60 ampere, three pole unfused disconnect switch for operation on 208 volt, 60 cycle, 3 phase Alternating Current, such as type A as made by A & H, Square "D" Bull Dog or other approved equal, mounted on exterior of kiln casing or cabinet. Where the current per phase does not exceed 25 Amps. a 30 ampere switch the equal of A-H 7810 will be acceptable.
- b. Kiln shall be equipped with three (3) approved rotary or toggle switches each of which shall control one of the heating elements and each element switch shall be provided with its own pilot light in series showing current on or off element.
- c. Thermocouple: Kiln shall be equipped with an approved chrome-alumel thermocouple such as Wheelco No. CA-SC-19F or approved equal with a 12" long by 1/2 inch diameter standard drawn nickel of similar high temperature alloy protecting tube and adjustable flange and equipped with Wheelco 46-400 chrome-alumel No. 14 gauge (stranded) asbestos covered lead wire.
- d. Kiln shall be equipped with an approved indicating and limiting pyrometer or controller calibrated to 2500 degree Fahrenheit, such as Wheelco "Limitrol" Model No. 741-P or other approved equal. Controller shall be designed to operate through a three pole contactor. If current per phase exceeds 25 Amps. a 3 pole, 60 ampere contactor the equal of Automatic Switch Co., Bulletin 1034, shall be furnished. However, if current is less than 25 Amps., a 30 ampere contactor will be accepted. Magnetic Coil of such contactor shall be designed to operate on 120 volt, 60 cycle alternating current and controller shall be designed to automatically cut off the power to kiln through the contactor when any predetermined temperature within the range has been reached.

Controller shall be calibrated for operation with thermocouple and lead wire hereinbefore specified. Controller shall be equipped with a means of opening power circuit to kiln, when thermocouple circuit is broken (i.e., shall have T.C. and T.C.B. leads).

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d. Controllers such as Model No. 741-P, made by Wheelco Instrument Co., Brown Instrument Co.; Model JL such as made by West Instrument Company or approved equal will be accepted. Controller shall be equipped with a means of limiting the maximum setting of the limiting operating mechanism so that it will be impossible to heat kiln above the safe maximum temperature of the kiln heating elements as prescribed by the manufacturer of kiln. Controller shall be mounted on the kiln heating elements as prescribed by the manufacturer of kiln. Controller shall be mounted on kiln with spacers to provide air space between controller and kiln casing. Controller shall be further insulated by a panel composed of two pieces of 1/8 inch thick transite board separated by a one (1) inch thick 85% magnesia block or other equal insulation. Panels shall be sufficient size to overlap sides and back of controller by one inch. Furnish electrically operated, manual reset, synchronous motor operated interval timer enclosed in a metal box equipped with a lock. Box with enclosed timer shall be mounted on kiln and wired into control circuit to automatically cut-off current supply to kiln when predetermined time setting has elapsed. Timer such as Model No. RS-12H made by Industrial Timer Corp.; Model No. 2409 made by Paragon Elec. Co., or an approved equal will be accepted.

e. Kiln shall be equipped with manufacturer's name plate which should provide all electrical data giving rating, current, voltage, etc. Kiln should also be provided with a proper size plate securely fastened to front of Kiln door with 2 inch high letters in red spelling word "DANGER".

(6) Kiln Rating

Kiln shall have a max. rating of 10.0 KW. Kiln shall be designed to reach maximum temperature of 2350° in not more than 6 hours.

(7) Kilns such as American Art Clay Co., Model No. AH-10; Harper Electricl Furnace Corp., Model No. SIC151821-SF; Kilns, Inc., Model No. N4 or approved equal, conforming to the above specifications, will be accepted.

(8) Kiln Supplies, etc.

Each kiln shall be furnished with the following additional supplies:

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Seventy-two (72) assorted refractory porcelain posts.
Seventy-two (72) assorted refractory stilts.
Five (5) lbs. kilnwash.
1 box cones type .05.
1 box cones type .06.
6 full size (16" x 16") or 12 half size (8" x 16")
silicon carbide shelves.

(9) Kilns shall be assembled with all their electric connections by the Contractor who shall arrange for a competent person to demonstrate and operate kiln after electric service has been connected to kiln. Test shall be made with an authorized person assigned by the Executive Director Office of School Buildings of the Board of Education to prove that apparatus is complete and in good operating condition. Manufacturer of kiln shall furnish either an instruction book or a typewritten set of instructions.

(c) Small Electric Kiln - Size 11" x 11" x 11".

(1) Electric Kiln shall be constructed of 16 gauge minimum cold rolled steel welded casing, enclosing a refractory lined firing chamber or muffle, of 11 inch by 11 inch size, complete for mounting on steel stand unless specified or shown on drawings as bench mounted. Front door shall be side hinged and made of steel similar to kiln casing. Door shall be hung with an extended plate with steel hinges welded to steel door plate and kiln casing side. Door shall fit tightly into recessed front wall of kiln and shall be equipped with two (2) approved latches for holding door tight against front of kiln. Door shall be equipped with front sight peep hole of approved size.

(2) Muffle lining shall be not less than 4 1/2 inches thick consisting of insulation on sides, bottom and top of 2 1/2 inch thick refractory block capable of withstanding 2,000 degree Fahrenheit without failure, and 2 inches insulation made of Mica powder or magnesia block. Door insulation shall be not less than 4 1/2 inches thick consisting of solid refractory block capable of withstanding 2,000 degrees Fahrenheit without failure. Refractory block shall be such as made by Babcock Wilcox Armstrong, Harbison-Walker, Johns-Manville, or other approved refractory block.

- (3) Heating elements shall be made of nickel-chromium or "Kanthal" metal wire set in open grooves of muffle on not less than four (4) sides of muffle, two (2) side walls, rear wall and front door.

Elements shall terminate at posts in side terminal box. Kiln shall be equipped with a switch to control current to elements for three conditions of heating, such as low, medium and high and also offpositions. Element wire shall be of metal specified such as made by the Driver-Harris Corp.; Jeliff Mfg. Co. or Hoskins Chromel Co., or other approved equal.

Kiln shall be also be equipped with a manual reset interval timer enclosed in a metal box equipped with a lock. Box with enclosed timer shall be mounted on kiln. Timer such as Model No. RS-12H made by Industrial Timer Corp.; Mark Timer made by Rodale Manufacturing Company or approved equal will be accepted.

- (4) Kiln shall be equipped with an approved pyrometric cone heat shut off device such as the "Kiln-gard" unit, which can be used up to 2,000 degrees Fahrenheit. Kiln-Gard unit shall be properly wired into circuit for control of current supply to heating elements of kiln.
- (5) Kiln shall be equipped with an approved pyrometer complete with thermocouple made of Chromel Alumel metals for indication of temperatures within firing chamber. Pyrometer shall be securely fastened to kiln in location for ease of reading.
- (6) Unless kiln is specified or shown on the Drawings as bench mounted, it shall be provided with a welded steel floor stand of size to fit base of kiln casing. Kiln stand shall be equipped with a steel shelf of No. 12 gauge steel plate with four edges turned up for attaching and enclosing shelf plate. When kiln is specified or shown on the drawings as bench mounted, provide a vented false bottom with flanges for mounting on bench top.
- (7) Kiln and stand or false bottom shall be given two (2) coats of approved heat resisting gray paints.

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- (8) Kiln shall be completely assembled on steel stand or false bottom and shall be of size and construction as specified.
- (9) Kiln such as Model No. 6 made by Norman Ceramics; or Steward Clay Co., or other approved equal conforming to the above specifications, will be accepted.
- (10) Each kiln shall be furnished with the following supplies of approved quality:
 - Two (2) boxes small pyrometric cones.
 - Two (20) silicon carbide shelves to fit firing chamber.
 - Sixteen (16) assorted refractory posts.
 - One (1) gross of assorted refractory silts.
 - Three (3) pounds of kiln wash.
 - One (1) repair kit consisting of six (6) nichrome splice coils, one (1) ounce of nichromate paste, one (1) test light and three (3) dozen nichrome pins.
- (11) Kiln shall be rated at 1.6KW, 115V, A.C., and shall be permanently connected to its Source of Supply. Install an unfused disconnect switch the equal of AH 6808.
- (12) Kiln shall have nameplate securely attached thereto, located for ease of reading. Nameplate shall indicate manufacturer, trade mark or other identification symbol, together with nonerasable markings giving current, operating voltage, wattage, maximum operating temperature and date of installation. Kiln shall also be provided with a metal plate securely fastened to front of kiln door with 2-inch high letters in red spelling word "DANGER".

16-20.03 Kilns (Con't)

(13) After installation, Contractor shall arrange for a competent person to demonstrate proper operation of the kiln. Test shall be made with an authorized person assigned by the Executive Director, Office of School Buildings of the Board of Education, to prove that the apparatus is complete and in good operating condition. Manufacturers of kiln shall furnish a complete set of printed or typewritten kiln operating instructions.

(14) Kiln shall be constructed in compliance with and approved by the N.Y.C. Bureau of Electrical Controls and the N.Y.C. Electrical Code.

(d) Enameling Kiln--Size 8" x 10" x 4"

1. Each electric enameling kiln shall be constructed in compliance with the rules and regulations of the New York City Electric Code and the Bureau of Electrical Controls of the City of New York. Any electric kiln which does not meet the above requirements will not be approved for purchase and use in any of the New York City school buildings.
2. Each electric enameling kiln shall have a metal name plate securely attached thereto, located for ease of reading. Name plate shall indicate manufacturer, trademark or other identification symbol, together with non-erasible markings, giving current, operating voltage, wattage, maximum operating temperature, and serial number. Kiln shall be rated at 2.5KW, single phase, 3 wire, 120/208V, 60 cycles.
3. Kiln shall be provided with legs or other means of allowing air to circulate, under the kiln. Space under kiln shall be a minimum of two inches.
4. Kiln Casing

The electric enameling kiln shall be constructed of minimum #16 gauge cold rolled sheet steel casing.

Kiln and legs shall be given two (2) coats of approved heat and rust resisting gray paint, hammertone finish.

16-20.03 Kilns (Con't)

5. Insulation

The firing chamber refractory block shall be entirely encased with insulating material to a thickness of not less than 2 1/2" between refractory block and the sheet steel casing. Approved insulating materials shall be mica pellets; 85% magnesia block or other approved equal.

6. Firing Chamber

The firing chamber shall be a minimum of 8" x 10" x 4" and cubic content of approximately 320 cu. in. It shall be constructed of insulating refractory block not less than 2 1/2" in thickness and capable of withstanding a temperature of 2300°F without failure, such as manufactured by A.P. Green Co., Babcock-Walcox, Harbison-Walker, Johns-Manville, or other approved equal.

7. Door

Kiln shall be front loading type (side swinging) equipped with a hinged front door constructed of sheet steel of not less than 16 gauge, enclosing refractory material equal in quality and thickness to that of firing chamber. Door shall be hung on approved continuous steel hinge, securely fastened to door and kiln casing. Door shall fit tightly into front opening of kiln and shall be equipped with peephole approved magnetic door catch or other approved device for holding door tight against front of kiln. Door shall be furnished with a handle that remains cool during firing operations.

8. Heating Elements

Kiln shall be equipped with heating elements made of approved metal wire coils such as "Kanthal" A-1, Nichrome V, Chromel A, or other approved equal. Elements shall be of sufficient length and resistance to reach a temperature of at least 1,550°F. under normal working conditions within thirty minutes. Elements shall be renewable without disassembling of kiln. Leads from elements of firing chamber shall be drawn through kiln wall in porcelain tubes of length equal to wall thickness of kiln. Porcelain tubes shall be packed with rock wool after elements have been drawn through tubes. This rock wool is required to prevent passage and loss of heat from interior of firing chamber of element terminal junction box. Heating elements shall be of the above specified wire such as manufactured by the Driver-Harris Corp., Jeliff Mfg. Co. or other approved equal.

10. Terminal Junction Box

Kiln shall be equipped with an approved junction panel box for leads from heating elements mounted for ease of access for checking, repairs, etc. Box shall be furnished with a panel of heat resistant non-conductor material mounted on insulators. On this panel of junction box shall be mounted the required number of electrical binding posts for elements terminal leads and electrical circuit connections. Binding posts shall be made of brass and all interior and exterior electrical connections shall terminate at these binding posts. This terminal junction box shall be furnished with an approved cover.

11. Kiln shall be provided with an approved pyrometer, thermocouple, and approved limiting control such as "Kiln-trol" as manufactured by Kiln-guard Co., or equal. An input Regulator the equal of "INF" by Robert Shaw will be accepted in lieu of "Kiln-trol".
12. A 2 pole unfused 30 amp. type main disconnect switch the equal of A-H 6808.
13. Furnish one (1) pound kiln wash and 12 assorted triangular bars to reset trivetts.
14. The Electrical Contractor shall furnish a sturdy angle iron stand (1 1/2" x 1 1/2" x 3/16" angles). Height of stand to be approximately thirty (30) inches. A shelf (16 ga.) to be provided at approximately 18 inches from floor, stand to be bolted to the floor. Kiln shall be installed, complete and ready to operate on the stand.

SECTION 16-21, LIGHTING FIXTURES

The Contractor for Electric Work shall be responsible for the safe and proper support of each lighting fixture. He shall furnish and install all items of equipment (hangers, rods, inserts, boxes, brackets, yokes, channels, frames, etc.) required to adequately and safely support each lighting fixture in a manner acceptable to the Executive Director.

16-21.01 General

- (a) All lighting fixtures shall conform to or exceed the requirements of the Electric Code of the City of New York. A sample of each type shall be submitted for inspection to the Board of Education (for standard B of E type fixtures) or to the private architect/engineer of record (for non-standard type fixtures). The above requirements may be waived and installed. Lighting fixtures shall bear the Underwriters label of approval.
- (b) Shop drawings of fixtures will be submitted to the Executive Director (for contracts and specifications originated within the Division of School Buildings) or to the Architect or Engineer of record (for contracts developed by private Architects or Engineers for the Board of Education). If not previously approved and prior to fabrication, detailed drawings of fixtures shall be submitted for approval as listed above for shop-drawings.
- (c) Furnish and install a lighting fixture at each location shown on drawings of the type indicated by symbol or other notation. If the type is not specifically noted on drawings, the Contractor shall provide without cost a fixture of the same type called for under a similar condition elsewhere on the drawings as determined by the Executive Director.

Contractor shall examine the drawings and familiarize himself with location and conditions under which each type of lighting fixture is to be installed, so that details of construction will best suit mounting conditions and/or obstructions at the job.

Where the contract does not contain drawings, the contractor shall furnish and install all lighting fixtures required by the specifications under these same conditions.

16-21.01 General (Con't)

Where manufacturers catalog numbers are specified or drawings indicate a particular type, a fixture of the same general design of good quality and workmanship which meets all applicable requirements of the Specification will be considered.

- (e) The Contractor is required to protect fixtures from damage during installation of same and up to time of acceptance by the Board of Education and any broken fixtures, glassware, plastics, lamps, etc., must be replaced by the Contractor with new parts, without any additional expense to the Board of Education.

16-21.02 Stems and Hickeys

Stems for typical fixtures shall consist of steel pipe not less than 3/8 inch (Iron Pipe Size) having a wall thickness of not less than .091 inches, or of aluminum pipe of equal mechanical strength. Stems shall be not less than 6 inches long with a cut thread. Pipe stems at fixture end shall have a length of threads of approximately 1 1/2" for fixture alignment.

Protected type fixtures in general shall be provided with 1/2 inch (Iron Pipe Size) pipe stems.

A swivel or aligner joint shall be provided for all pendant fixtures to fit 3/8 inch malleable iron hickey.

16-21.03 Holders and Spun Work

All shells, canopies or other spun parts shall be not less than No. 20 gauge unless otherwise specified with a reasonable tolerance allowed for finishing.

All screw type globe holders shall be reinforced so that screws shall have a bearing of at least four full threads. Screws holding glassware and/or plastics shall have check nuts or equivalent.

Globe holders shall be not less than 6 inches in diameter unless otherwise specified. Screwless safety type globe holders are acceptable.

16-21.04 Joints

Wherever joints require soldering they shall be brazed or welded. No soft soldering on any portion of metal work will be permitted. Joints shall be concealed as far as practicable by close fitting. Screw joints shall be given an application of heated cement before installation.

16-21.05 Sockets-Lampholders

Except for fluorescent tubes, lampholders in general shall be of porcelain or bakelite with a 660 watt rating.

- (a) Lampholders approved for use in fluorescent fixtures may be the type providing for screw-type wire terminal connections, or the type of socket provided with attached leads, or the type permitted push-in and locking connection of the ballast wiring, the approved equal of Bryant or Leviton. The sockets shall be secured to an approved separate mounting plate for simplified replacement of socket and wiring leads. Sockets shall be held to the plate by means of screw/nut arrangement or any other approved means that will prevent any motion of the socket on the plate either with the fixture end cap on or off. The plate shall be attached to the fixture body by means of screw/nut arrangement or any other approved means that will insure solid mounting and support of the lampholders.
- (b) Sockets in fixtures with incandescent lamps of 200 watt size or smaller shall be of the medium base type. Sockets in fixtures equipped with 300 watt lamps may be of the medium or mogul base types, unless otherwise noted. Lamp sizes of 500 watts or larger shall be equipped with mogul base sockets.
- (c) Bakelite sockets shall have the screw shell secured in place with two brass rivets and heavy brass washers, or with two brass screws with ends peaned over, or shall have the screw shell secured by being integrally molded in as a part of the socket body. Bakelite sockets shall be the equal of Kulka, or Russell & Stoll.
- (d) The terminal screws of all sockets shall be staked by peaning over ends of screws, or by other suitable means, so that they cannot be readily removed.

16-21.06 Wiring and Connections

- (a) Each fixture shall be completely wired in an approved manner in accordance with requirements of the Electrical Code of the City of New York.
- (b) The joints at the outlets shall be connected mechanically using approved pressure type insulated connectors. The insulation shall completely cover the bare copper ends of both wires in the splice, and shall be mechanically tight.
- (c) Wires within fluorescent fixtures, wiring between the ceiling outlet boxes and the fixture, and all wiring between fixtures in a continuous row shall have a minimum size of Note; be insulated for 1,000 volts, and rated at 90° C minimum. This wiring shall be of a type approved by the Advisory Board for fluorescent fixture wire and meeting the above requirements.

16-21.07 Miscellaneous

- (a) Self threading or sheet metal screws and nuts will not be accepted.
- (b) Porcelain enamel reflectors shall meet R.L.M. standards.
- (c) Fixture and/or parts, such as finishing plates and trims for recessed fixtures, shall not be installed until all plastering and painting that may mar finish has been completed.
- (d) Where fluorescent fixtures with glass and/or plastic enclosures are called for and these fixtures are not specifically fixtures using frameless diffusers, the diffuser shall be fastened in frame, to fixture body by means of approved hinges or hinging device. When in closed position hinged frame shall be held by captive screws, or by welded rivets which enter into openings in the frame, or by other approved means.
- (e) Fixtures to be installed outside of Building shall be equipped with weatherproof gaskets and fixtures shall be thoroughly grounded to conduit system.
- (f) All metal not corrosive resisting, shall be galvanized or treated to prevent corrosion after fabrication.

16-21.07 Miscellaneous (Con't)

- (g) In general, glass and/or plastic diffusers shall be fastened in a hinged frame. Snap-in or lift out type construction will not be accepted.
- (h) A frameless diffuser shall be satisfactorily secured to the fixture housing by safety chains or an approved equivalent means to prevent the diffuser from dangling or falling.
- (i) All lighting fixtures (either incandescent, fluorescent, or H.I.D. type) furnished in a gymnasium, playroom, or lunch-playroom shall be furnished with an approved guard whether or not it is called for on the plans or specifications. Guards around surface-type fluorescent fixtures shall be separately mounted to the ceiling. Guards on incandescent or H.I.D. fixtures shall be chained to the fixture which, in turn, is chained to a supporting ballast assembly (where applicable) and finally to the ceiling in an approved manner.

16-21.08 Fluorescent Fixtures-General

Fluorescent fixtures shall be designed with not less than No. 20 gauge metal unless otherwise specified or required for adequate rigidity and with the specified diffusers fastened in approved hinged frames (except baffle type louvers and frameless diffusers) with captive screws or approved equivalent.

Ballast covers, however may be 22 Gauge if required for spring retention.

Lighting distribution data and curves from an Independent Testing Agency shall be furnished by this contractor for all fluorescent lighting fixtures and submitted to the Board of Education (for standard B of E fixtures) or the Architect/Engineer of record for approval. This requirement may be waived where such data is already on file with the Architect/Engineer of record.

- (a) Diffusers and Louvers

The following type diffusers (louvers, shields, lens, etc.) shall apply to all fluorescent fixtures. These letters shall follow the fixture type specified on the Drawings (e.g. F-4-ME).

16-21.08 Fluorescent Fixtures-General (Con't)

(a) Diffusers and Louvers (Con't)

Type "ME"-Metal egg crate louver. Cell type aluminum of .025 inch minimum thickness. Cell size shall be either 1/2 inch by 1/2 inch by 1/2 inch high giving a cut-off angle of 45 degrees by 45 degrees, or 3/4 inch by 3/4 inch by 1/2 inch high giving a cut-off of 35 degrees. Louvre finish shall be baked white enamel.

Type "PL"-Virgin acrylic plastic male or female prismatic lens (conical or hexagonal).

Type "GL"-Prismatic Glass.

Type "PME"-Parabolic metal egg crate louver. Same as "ME" except this louver shall be parabolic.

Type "GS"-Glass drop dish type. Furnish in alba type glass.

Type "PS"-Virgin acrylic plastic drop dish type. This diffuser shall be white translucent.

Type "GLG"-Prismatic Glass with Gasket around all openings of fixture to prevent grease fumes from entering fixture.

Type "PLG"-Same as Type PL with Gasket around all openings of fixture, lens, or side lites to prevent grease fumes from entering fixture.

(b) Plastics

Fluorescent type fixtures with plastic diffusers or lenses shall be, in general, the extruded or injected type molded from 100% clear virgin acrylic powders.

The Plastic product shall be approved by the Advisory Board of the Bureau of Electrical Controls;

The over-all plastic thickness of the diffuser or lens shall be a minimum of 0.125" \pm 0.005". The minimum thickness of plastic from the surface of the smooth side to the base of the conical or hexagonal prism shall be .060". Ribbed diffusers shall be .080" from the base to smooth side.

16-21.08 Fluorescent Fixtures-General (Con't)

- (b) The V-rib, or lens pattern, etc., related to the position of the plastic in the lighting fixture shall appear on the outside of the diffuser or lens unless the design of a lens prescribes that the reverse be followed, then the lens pattern, etc., may appear on the inside face of the plastic panel.

- (c) Mounting (Surface).

Where fluorescent fixtures are surface mounted a minimum of one-half (1/2) inch air space shall be maintained between top of fixture and ceiling surface by an approved means. No openings on fixture or outlet box will be acceptable.

- (d) Mounting (Pendant).

Where fixtures are mounted in a continuous row, fixtures eight feet in length, shall have stems placed within 2'-0" of each end. Stems shall be spaced symmetrically. A fixture, four feet or three feet in length, placed in the row, shall have a stem connected to center fixture.

Individual fixtures, four feet in length, shall have two stems placed approximately 3-inches from each end, or shall have dual stems and a single canopy.

Each stem shall have a brass or steel swivel or other self-aligning device of type approved by the Executive Director. The entire fixture mounting (hickey, aligner, swivel, stem, etc.) shall be submitted to and approved by the Executive Director before installation.

A malleable iron bushing shall be placed at fixture end of stem through which wire passes.

A pendant support using an approved sliding clevis bracket which firmly grips an indentation in rigid sides of the wiring channel will be acceptable.

- (e) Ballast

All fluorescent fixtures shall be furnished with only one lamp ballast (for one lamp fixture), or one two lamp ballast for two lamp fixture or one of each (for a three lamp fixture).

16-21.08 Fluorescent Fixtures General (Con't)

1. Fixtures calling for lamps 36 inches in length or longer shall have approved rapid start, series sequence, two lamp type (or appropriate single lamp type), high power factor (approx. 90%) energy conserving 125 volts, ballast CBM certified by ETL for quiet operation. Where lamps are 48" in length, ballasts shall be of the reduced wattage type equal to Universal 446-1-SHL-TC-P, advance tube fixtures, ballasts equal to the above for their reduced wattages shall be used. When reduced wattage ballasts are available for 36 inch lamps, they shall be similarly furnished and installed by this contractor.
2. Fixtures calling for lamps 24-inches in length shall have approved slimline, series sequence two lamp type (or appropriate single lamp type), approximately 90% power factor 110-125 volts, ballast CBM certified by ETL for quiet operation.
3. Fixtures calling for lamps less than 24 inches in length shall have approved trigger start, series sequence two lamp type (or appropriate single lamp type), high power factor 110-125 volts, ballasts CBM certified by ETL for quiet operation.
4. Fixtures calling for lamps 72" or 96" in length shall be furnished with two 36" lamps or 48" lamps in tandem and the appropriate increased number of ballasts as described in item (1) above.
5. Fixtures specifically calling for Slimline lamps shall be furnished with approved watt reducer ballasts the equal of Universal 806-SLH-TC-P (for two (2) 72", 84" or 96" lamps). When a similar reduced wattage ballast is available for one lamp fixture or for 24", 36", or 48" lamps it shall be furnished and installed by this contractor as part of his contract. Ballasts for control of lamps in one housing or fixture unit shall not control lamps of an adjoining unit, except where specified or for continuous cove lighting and only if the unit with the ballast is properly identified. This requirement shall apply to all fluorescent lamp fixtures unless otherwise indicated on the plans or in the specifications for purposes of multiple switching and control. In three tube fixtures (three lamps in cross-section), the inner lamp shall be wired to a one-lamp ballast and the outer lamps (one to each side of the inner lamp) to a two-lamp ballast. Removal of the inner lamp shall not adversely affect the operation of the lighting fixture.

16-21.08 Fluorescent Fixtures-General (Con't)

6. Ballast shall be a class P thermally protected type and shall be protected with a suitable protector that will open the power supply circuit to the ballasts before temperatures exceed limits as mentioned in the New York City Electrical Code. Ballasts and fixtures shall adhere to all the requirements of Paragraph B30-119.1 of the revised Article 14 of the New York City Electrical Code.
7. All ballasts shall be "Energy Conserving" low loss types which shall provide full lamp lighting output with reduced input wattage. Ballast shall be of a high power factor (Approx. 90%). The maximum allowable full lamp lighting input power for 120 volts, 48 inch rapid start lamps (two lamp operation) shall be 86 watts. Ballast code number shall be RS-4. Ballasts for 2 lamp 48"RS lamps shall be Universal, Catalog #446-L-SLH-7c-p, Advance 1Z-2S40-1-7p or an approved equal. All other ballasts for other size lamps and for single lamp fixtures shall be of a similar type where such a type exists on the market.
8. Ballasts of Advance Company, General Electric Company, Universal Manufacturing Company, or Jefferson company meeting the above requirements will be acceptable.

(f) Spares

Deliver to the Custodian one (1) spare ballast for each twenty (20) ballasts or starters of each type, but not less than one.


16-21.09 Fixture Supports

- (a) In general the method of supporting the various types of fixtures shall be discussed with the Executive Director's representative before installation in order to coordinate requirements of the Standard Details and Specifications with field conditions, shop drawings, the General Construction Contract, etc.
- (b) The Contractor for Electric Work shall furnish plaster stop frames for all recessed or semi-recessed fixtures to be located in plaster suspended ceilings or furred ceilings. He shall deliver these frames to the General Construction Contractor for installation by that Contractor.

16-21.09 Fixture Supports (Con't)

- (b) The Contractor for Electric Work shall coordinate the exact location of each frame with the Contractor for General Construction in order to assure that the installation shall be as designed and presented in the plans and specifications.
- (c) All Mercury Vapor Fixtures, fluorescent fixtures three feet in length or greater, or heavy incandescent fixtures shall not be supported directly from a suspended ceiling or the immediate hardware for a suspended ceiling (furring strips, inverted tees, Z-Bar Clips, etc.) from which the ceiling itself hangs. These types of fixtures shall be supported from the intermediate structural support system for the ceiling which consists of the 1 1/4" running bars of black iron, where such structure (stone concrete slab or steel). Additional running bars, where furnished by the Contractor for General Construction for support of recessed fixtures, shall be utilized by this Contractor for the support of his fixture. Where no additional running bars have been furnished, this Contractor shall support weight of his fixture from the main running bars (black iron) or from the structural steel or concrete by means of inserts, hanging rods, Kindorf or Unistruct channels, all furnished and installed by him as required. Lateral support of the fixture to prevent it from swinging must be provided by this Contractor and may be obtained from the running bars (black iron) or from the ceiling hardware. Surface mounted or pendant fixtures of these types, mounted on new suspended ceiling shall be supported by running approved straps, bars, or channels from the top of the ceiling outlet box to the black iron where it exists or to the structural steel or concrete. Surface mounted or pendant fixtures installed on an existing suspended ceiling shall be supported as shown on Drawing 525R on Standard Detail Sheet E-7 Series "F".
- (d) Recessed fixtures shall all be provided with a suitable flange trim to cover the opening, whether a plaster stop frame is used or not. In cases where inverted tees are used for support of the ceiling, the recess fixture shall be designed so that the tee will form the overall trim and cover the opening between ceiling and fixture.

16-21.09 Fixture Supports (Con't)

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- (e) The Contractor for Electric Work shall coordinate closely with the Contractor for General Construction on all work involved with recessed fixtures, giving him the size and location of all openings, and advising him where additional running bars (black iron) are needed and are the obligation of the G.C. Contractor. He shall constantly check to see if all openings are correct.

16-21.10 Existing Buildings

- (a) Canopies on Surface Mounted Outlet Boxes.

Where lighting fixtures are mounted upon surface-mounted outlet boxes in surface mounted conduit runs, this Contractor shall furnish and install a fixture canopy sufficiently deep to permit exposed conduits to pass through. Canopy shall have proper openings cut by fixture manufacturer through which conduits may pass. Submit sample of canopy for approval before installation.

Canopy may be in two parts fastened together in an approved manner.

- (b) Adapters

Where new lighting fixtures are to be mounted on existing outlet boxes and mounting holes are not in proper position, suitable adapter or extension collars shall be provided.

- (c) Repairs

Where fixtures are removed and are to be re-installed at the same or another location, this contractor shall repair or replace damaged or worn sockets, wiring, glassware, etc. and shall clean fixture bodies and reflector. This shall be defined as "Refurbishing a Fixture".

- (d) Capped Outlets

Where drawings indicate a capped outlet, Contractor shall install a blank face painted to match surroundings.

- (e) Removed Fixtures

Where the drawings or specifications call for the Contractor to remove an existing fixture, this contractor shall also install a suitable blank face plate on the exposed outlet box.

16-21.10 Existing Buildings (Con't)

(e) Removed Fixtures (Con't)

If the outlet box is to be used in the extension of branch circuit wiring, this contractor shall furnish and install a suitable extension collar that may be required to receive surface raceway.

16-21.11 Glassware

- (a) Blown or sheet glassware shall be translucent with smooth even interior and exterior surface, free from all defects and uniform in tone.
- (b) Blown glass enclosing bowls shall be of shapes and sizes indicated on drawings or specified. Bowls shall be of a homogeneous texture approximately white and shall have a light output of at least 80 percent of lamp output. Bowls shall be so manufactured that there will be a fairly even distribution throughout the entire surface and in no case shall filament of a lighted lamp be visible when placed at light center.
- (c) Annealing of glass shall be in accordance with the best practice as determined by method of test and definition stated in ASTM C336-54T. For rolled glass, residual stress shall not exceed 600 p.s.i., measured perpendicular to the rolled surface with a Friedel polarimeter. For translucent glass, cracking or breaking shall not occur if glass is abraded over entire surface with 150 grit carborundum and then soaked in water for one hour.

The Executive Director shall be furnished with a warranty from the manufacturer certifying that the glassware has been annealed, or tempered when required, and is composed of materials that meet the standard of quality proven to be acceptable for the particular application of the glassware as used in the fixture.

16-21.12 Spare Glassware and/or Plastic

- (a) The Contractor shall furnish 10% extra glassware and/or plastic shields, diffusers, panels and plastic parts but not less than one of each type and size.

16-21.12 Spare Glassware and/or Plastic (Con't)

- (b) This glassware and/or these plastics shall be delivered to the Custodian of the Building with an itemized list and a receipt taken, certifying that these spare parts have been delivered securely packed and received in acceptable condition.

16-21.13 Fixture Schedule

Contractor for Electric Work shall submit for approval a list showing areas in which lighting fixtures are located, type of fixture, lamp wattage, finish, height of reflector above floor, etc. A separate line shall be allowed on the list for lighting fixtures having different lamp wattage, finish, or other features, even though lighting fixtures may be of same type or in same enclosure.

A copy of the schedule of fixtures (all sheets), corrected to actual conditions at final installation, and indicating lamp wattages actually installed shall be delivered to the Custodian at the School on completion of work. Corrected copies of this schedule shall also be sent to Chief of School Custodians, 28-11 Queens Plaza North, L.I. City, Bureau of Supplies, 44-36 Vernon Blvd. L.I. City, and the local borough office at the Bureau of Electric Controls.

16-21.14 Fixture Finishes

- (a) In general, Class Room fluorescent fixtures shall be finished in baked white enamel.
- (b) Recessed fixtures unless otherwise specified shall be finished white enamel in a white ceiling and satin aluminum in metal pan ceiling.
- (c) Protected type fixtures shall be finished satin aluminum or may have a cadmium finish for unfinished areas.
- (d) Fixtures outside building shall have an anodized finish.
- (e) The finish of all ighting fixtures not described in the specifications shall be selected by the Executive Director. Prior to manufacture of these fixtures, the Contractor shall request the proper finish from the Executive Director.

16-21.15 Mounting Height

Fixtures shall be hung in accordance with the mounting heights indicated on drawings. Mounting heights are usually given in terms of the distance between the finished floor and the bottom of the globe, reflector, or diffuser.

16-21.16 Lamps

(a) General

Incandescent, fluorescent, mercury vapor, metal halide and high pressure sodium lamps for all fixtures shall be furnished and installed by this Contractor. Quantity of lamps will be as indicated on drawings and in the specifications. Quantity of rapid start lamps shall be as required by the drawings, specifications and fixture length.

(b) Incandescent

Lamps shall be inside frosted. Lamps of 200 watt size or smaller shall be of the medium base type. Fixtures equipped with 300 watt lamps may be of the medium or mogul base types, unless otherwise noted. Lamp sizes of 500 watts or larger shall be equipped with mogul bases.

(c) Fluorescent

Lamps for rapid start and trigger start shall be T-12, Warm white, 425 ma., medium bi-pin. Three foot and four foot rapid start lamps shall be the 25 watt or 35 watt energy conservation lamp in lieu of the 30 or 40 watt lamp.

Slimline lamps shall be T-12, warm white, 425ma single pin. Four foot and eight foot slimline lamps shall be the 30 watt and 60 watt energy conservation lamp in lieu of the 40 or 75 watt lamp.

(d) Mercury Vapor or Metal Hallide

Lamps shall be the Saft-T-Vapor lamp type similar to Dur-O-Test, Luxor & Westinghouse safety life guard mercury lamps, are designed to conform to the "American National Standard Institute", Standard entitled: ANSI C78,1330-1976, Specification for Mercury Lamps with Integral Means for Extinguishing the Arc after the Outer Envelope is broken.

16-21.16 Lamps (Con't)

(e) Lamps shall be American made, the standard product of Champion Lamp Co., General Electric Lamp Co., Sylvania Electric Co., Westinghouse Lamp Co.

(f) Spares

In addition to original lamps specified furnish spare lamps in original carton, packaged and labeled and delivered to Custodian as follows:

Furnish one spare lamp for every ten (10) of each type and size, but not less than one (1) of each.

16-21.17 Borderlights

(a) Reflector

Furnish and install the number of Borderlights indicated on the Drawings or in the Amendments. Borderlights shall be of the individual reflector type, each borderlight shall be designed for 100-watt lamps of number required by the Drawings. Lamps shall be mounted on 6-inch centers. The length of each borderlight shall be as indicated on the Drawings. Borderlights shall be constructed from No. 20 gauge galvanized sheet steel, with outside painted 2 coats of black paint. Each borderlight shall be wired for 3 colors (red, amber and blue) with No. 12 slow burning wire soldered to receptacles and compounded. Each borderlight shall be wired for the number of circuits indicated on the Drawings. Each circuit shall be controlled by a separate switch. Each third lamp receptacle shall be connected to the same circuit.

Borderlights using reflector lamps in lieu of standard incandescent lamps with individual reflectors shall be considered for approval if lamp wattage is maintained and all other specification requirements adhered to.

Each receptacle shall be equipped with an Alzak or other approved anodic process finished aluminum reflector. Reflectors shall be provided with natural colored non-diffusing, convex, heat resisting glass roundels (approximately 5-5/8 inches in diameter) to provide the required amber, red and blue colors. Each glass roundel shall be supported by a "Universal" holder or approved hinged door.

16-21.17 Borderlights (Con't)

Borderlight shall be complete with scenery guards and with chain hangers fastened to a 1 1/2 inch wrought iron pipe batten in an approved manner. Submit drawing of fastening for approval.

Pipe batten of each borderlight shall be of such length as to cover entire length of borderlight, and at the same time to permit the ropes from overhead sheaves to hang vertically. Exact length of pipe batten shall be determined after inspection of building, and shall be approved by the Executive Director. Borderlights shall be suspended by means of wire rope installed by others.

Borderlights shall be provided with No. 12 borderlight cable to provide the number of circuits required by the Drawings. Cable shall contain an additional conductor for grounding the borderlight as directed. Borderlight cable shall be fastened to the elbow from the junction box in ceiling by means of a suitable clamp; to the wire cable support by a cradle (Kliegl 636 or Century #3251); and to pipe batten by a clamp (Kliegl No. 635 or Century #3250). Between the junction box and the cradle sufficient free cable shall be allowed and installed so as to permit the borderlight cable to travel to its lower limit without putting a strain on the junction box and to form a loop when the borderlight is at its upper limit.

(b) Control

The switch controls shall consist of eight (8) switches; one for each spotlight; located where indicated on drawings. The switch plate shall be engraved "PINK" across the top, and the horizontal row of four switch toggles directly below this shall be engraved "1,2,3,4" corresponding in order to the four pink spotlights controlled. Similarly, the switch plate shall be engraved "BLUE" across the bottom, and the other row of four switch toggles immediately above shall be engraved "1,2,3,4" corresponding in order to the other bank of four blue spotlights.

(c) Spotlight

Each spotlight shall be compact lightweight construction; fitted with a first surface ellipsoidal specular Alzak aluminum or other approved anodic process metal mirror reflector; one 6" diameter Pyrex heat resisting condensing lens of stepped design; positive screw adjustment for the exact positioning of lamp filament.

16-21.17 Borderlights (Con't)

Lamp wiring shall be No. 14 type "AF" carried through 4'-0" of flexible conduit to polarized 20 AMP. 3 pole plug Pass & Seymour 7311, Arrow-Hart 7311, hubbell 7311 or equal. Four 20 AMP. female receptacles, Pass & Seymour 7310, Hubbell 7310B, Arrow-Hart 7310B or approved equal shall be set in a plugging box located approximately one (1) foot behind spotlights.

Spotlights shall be mounted in an approved manner as indicated on the Drawings. This Contractor shall furnish and install the mounting frame, hinged ceiling plate and or pipe betten and all mounting and supporting equipment indicated on the Drawing. Ceiling plate where required shall be painted to match surroundings.

A 20-gauge, galvanized 1/2-inch wire mesh shall be spot-welded by the manufacturing to the ceiling cone or where this is impossible to the front of each spotlight to prevent galss from falling on audience in event of breakage.

Each spotlight shall be provided with two (one spare) quartz-iodine projector lamps. Eight of the sixteen lamps to be furnished are to be spares. A sheet metal box with hinged cover shall be provided for the eight spare lamps.

Unless otherwise indicated on the Drawings or in the Specifications spotlight equipment shall be Kliegl No. DL-1365E, Century 1490, Lightalarm Cat. 755, or Lighting and Electronics.

The Contractor for Electric Work shall furnish the Contractor for General Construction with all pertinent data concerning spotlight mounting including exact dimensions of clear opening required to produce proper lighting of stage.

The Kliegl Bros. No. 610 (made for 100-watt lamps), Lighting and Electronics, Century Mfg. Co., No. 411, Lightalarms Series 601 or other approved manufacturer meeting these specifications will be accepted. Submit detailed drawings (in quadruplicate) for approval before manufacture.

Eighteen (6 of each color) spare roundels shall be furnished and delivered to the Custodian.

The Contractor for Electric Work shall supply all necessary electrical equipment in connection with the Borderlight.

16-21.17 Borderlights (Con't)

This Contractor shall furnish and install a 1 1/2" wrought iron pipe batten with each borderlight. Pipe batten shall be of such length as to cover the entire length of the borderlight. This Contractor shall support these borderlight pipe battens from the ceiling slab (by use of inserts), or from ceiling structural steel, or from the miscellaneous steel members on the ceiling when provided. This Contractor shall provide a minimum of 3 points of support with support at both ends of the batten and at least every 20 feet. Location and mounting height of this permanently fixed batten shall be as directed by the Executive Director. On school projects, where adjustment devices (winches, ropes from overhead sheaves, etc.) are furnished by other Contractors, for the lowering and raising of borderlights, this Contractor shall coordinate fully with these other Contractors, provide pipe batten of correct length to permit correct operation of the total installation, provide extra length on the flexible cable connection as required, all as directed by the Executive Director's representative.

16-21.18 Spotlights

1. Type INC-5, Spotlights for Auditorium Stage Lighting (New Building)

(a) General

When required by the Drawings or the Amendments, furnish and install in the auditorium ceiling, where indicated on the Drawings, two batteries (four to a battery), quartz-iodine, wattage as indicated, color spotlights, set up to light the stage.

Each battery shall be equipped with heat resisting glass color filters of a light shade. One battery of four spotlights shall have light pink color filters; the other battery of four spotlights shall have light blue color filters.

Furnish and deliver to the Custodian an additional set of four glass color filters for use with the aforementioned spotlights.

After installation the spotlight projectors shall be adjusted by the Contractor under the supervision of the manufacturer's representative. This adjustment shall be made in the presence of and to the satisfaction of the Executive Director's representative.

16-21.18 Spotlights (Con't)

2. Spotlights (Modernization)

Type 8979-3S - This fixture is a surface mounted three (3) lamp border light unit with three (3) 500 watt, Par. 64 lamps.

Surface mounted strips shall have color caps with clear and colored glass roundels.

Eight (9 of each color) spare roundels shall be furnished and delivered to the Custodian.

Colors shall be similar to Hub Electric, catalog #8979-3, surface mounted unit.

16-21.19 Proscenium Arch Reflector (Stationary Type).

When required by the Drawings or the Amendments, furnish and install a Proscenium Arch Reflector (Stationary Type). Reflector shall be in accordance with Standard Detail Drawing No. M-93.

Each reflector shall be mounted at a height and location selected by the Executive Director to produce proper lighting of the platform. Selection of height will be made only after all valances, border drops, etc., have been completely installed.

Where the mounting height of reflector requires that reflector be suspended from overhead structure, suspension shall be accomplished by means of double chains. Each chain shall form a "V" between reflector housing and ceiling, as indicated on the Standard Detail Drawing. Each reflector shall be suspended by the number of chains indicated on the Electrical Drawings. However, not fewer than four (4) chains shall be used to support each reflector. Each chain shall be fastened to a ceiling angle clip (angle clips provided by others) by means of an approved adjustable steel clamp. Each chain shall be composed of welded steel links. Chains and clamps shall be cadmium plated.

16-21.20 Description of Fixtures

The following fixture manufacturers will be approved, provided all applicable paragraphs of specifications including required modifications are conformed with: McPhilben Manufacturing Co., Simes Co., Frink-Westinghouse Corp., Garcy, Neo-Ray, Curtis-Electro, Gotham, Gruber Lighting Co., Lighting Products, Inc., Holophane, Kenbert Lighting Industries, Beaux Arts Lighting Co., Russell & Stoll, Appleton, Kent-Eastern Lighting Products, and Thomas Industries.

16-21.20 Description of Fixtures (Con't)

(a) Incandescent Fixtures

Type A

Boiler gauge fixture consisting of two adjustable pipes, not less than 3/8" inside diameter and 18" long, a porcelain enamel; steel angle reflector, a pipe clamp for mounting, a swivel clamp for adjusting, and a socket. Provide two-conductor flexible cord of sufficient length to reach outlet box in boiler room ceiling. Fixture the equal of Simes Company 43780, McPhilben Company 77/3107 or Beaux Arts No. A-1000 will be acceptable.

Type 141

Surface mounted fixture consisting of a shallow bowl porcelain enamel steel reflector, reflector holder and a medium base lamp receptacle. Reflector holder shall be of 20 gauge spun brass or 16 gauge spun aluminum or polished cast aluminum, finish to be as selected. Holder shall be approximately 6" diameter. Fixture the equal of Simes 43816, McPhilben Company 77/1317 or Beaux Arts 1141 will be acceptable.

Type 143A

Pendant fixture consisting of a canopy, swivel connector, stem, reflector husk, medium base socket and a porcelain enameled steel reflector. Canopy and husk shall be of 20 gauge brass or 16 gauge aluminum. Husk rim shall be for 2 1/4" reflectors. Fixture the approved equal of Simes Co. 43823 or McPhilben Co. 77/1276 will be acceptable.

Protected Type Fixture--Type 2430 and 2432.

Each fixture shall have a cast aluminum base and fixture body, porcelain receptacle, screw-on type globe with rubber gasket, and a heavy round half hard cast aluminum guard and gasket. Each fixture shall be of sufficient size to accommodate a 100 watt lamp.

Each protected type fixture shall be fastened firmly and securely to a special four hole outlet box by means of four (4) brass or monel metal machine screws. Bracket type protected type fixtures shall be provided with SQUARE outlet boxes; round or octagonal outlet boxes will NOT be acceptable. Each protected type fixture shall be provided with a rubber gasket between box and the fixture.

Fixtures shall be the equal of Russell and Stoll, Simes or Appleton.

16-21.20 Description of Fixtures (Con't)

Vaportight Fixture--(Pendant Type)

Type 6369A

This fixture shall have 1/2 inch cadmium plated pipe stems, and shall be equipped with approved swivel aligners the equal of Benjamin No. 3369.

Fixture shall be supported by means of a hickey, or an approved strap, or FOUR threaded screws from a special box with FOUR threaded holes. Submit sample of fixture and box with method of mounting.

Fixtures shall be the equal of Russell and Stoll No. 6369A for 100 watt, and No. 6104A for 150/200 watts.

Type 6104A

Same fixture as described above, with the exception the wattage lamp size shall be 150-200 watts.

Vaportight Fixtures--Ceiling Type

Type 6330A

Fixture shall be the equal of Russell & Stoll, Catalog #6330A or approved equal. Lamp wattage shall be 100 watts.

Type 617A

Same as Type 6630A with exception lamp wattage size is 150-200 watts.

Type LHG Keyless Lampholders (Keyless Receptacles).

Keyless lampholders (keyless receptacles) shall consist of a Pass and Seymour No. 457; Hubbell No. 457; Arrow-Hart No. 9309; Bryant No. 174; or approved equal. complete with galvanized outlet box cover of proper size and design for outlet box installed. Each keyless lampholder shall be equipped with an approved heavy wire guard the approved equal of Benjamin No. 1400 fastened to cover.

Type LHPC Pull Chain Lampholders (Pull Chain Receptacles).

Pull chain lampholders (pull chain and receptacles) shall be of the porcelain type, and approved equal of Hubbell No. 830; Pass and Seymour No. AL-848; or Bryant No. 4275.

16-21.20 Description of Fixtures (Con't)

Drop Cord Pendants--Type DC and DCR

- (a) Drop Cord pendants shall consist of No. 18 Type "SJO" flexible cord passing through a cord grip the equal of Arrow-Hart No. 112, Appleton No. 8441, Hubbell No. 112 or equal, in cover of outlet boxes, and medium brace pull chain or key sockets. Sockets shall hang 6'-6" from floor to bottom of sockets.

Threaded catch type sockets shall have a 250 watt rating and equipped with cord grip caps. Sockets shall be held to the cap by two (2) screws. Sockets shall be Hubbell (Body No. 3984--Cap No. 3983), Bryant (Body No. 4710--Cap No. LG), Arrow-Hart (Body No. PA--Cap No. 962), S.E. (Body No. GE 2703--Cap No. GE 2794), or Pass and Seymour (Body No. 0-26--Cap No. O-PY).

- (b) Cone Reflectors

Drop cord pendants shall be equipped with 8 inch diameter deep cone reflector at specific locations noted on drawings.

Type RDC--Similar to Type DC with the exception that this type shall terminate in a Hubbell #5374 connector body with a "U" shaped ground. Furnish a Type

"SJO" flexible cord with three, number 18 conductors for this type.

Type 4344

Cast aluminum wall bracket, for wattage specified, tapered opal glass globe, threaded neck and gasket with guard, satin aluminum finish and anodized for outside building the equal of McPhilben 43-line or Simes. Fixture shall be vaportight.

Type 4340

Similar to fixture above, exception that fixture shall be furnished with a guard.

Type 3-10

Cast aluminum, satin anodized ceiling unit. Unit shall be cylinder-shaped, approximately ten inches high with an open baffle and an R-40, 300 watt flood lamp or 150 watt spot lamp as shown on drawings. Fixture shall be the equal of McPhilben 3 line.

16-21.20 Description of Fixtures

Type 68.

Shallow Square Recessed Ceiling Unit. Cast aluminum concealed hinged face plate with "A" Flat glass or lens, "B" Square lensed bowl, "C" Square opal bowl as indicated for lamp size selected No. 18 gauge treated steel or aluminum housing baked white enamel interior with spun aluminum reflector. For concrete pour, housing shall be No. 16 gauge hot dipped galvanized steel. Porcelain socket on removable wire-way. Frame shall be held by self centering captive screw and finished satin aluminum and anodized if installed outside. Fixture the equal of McPhilben 68 line, or Simes 44785 will be accepted.

Type SC397 - A surface mounted cylindrical downlite with a 8 1/2" clear alzak aluminum reflector.

Lamp shall be 75 watt, R-30 medium base, or

Housing shall be precision formed 14 gauge aluminum.

Wire shall be #14 Af wire.

Finish of fixture shall be baked semi-matte white.

Fixture shall be Omega Lighting, Catalog #SC-397 or approved equal.

Fixture shall be furnished with wire guard mounted on ceiling.

Fixture shall be furnished with spotlight or floodlight. Type of lamp shall be noted on drawing.

Type SL - Furnish and install, at location indicated on drawing, in dark room a pendant type safelight. Furnish canopy with bushed hole. Canopy shall include hardware to hold chains which support safelight and shall be attached to outlet box. A three (3) conductor flexible cord shall be directly connected to outlet box and supported by a cord grip. Connect a three (3) conductor grounding plug to the other end of the cord.

Safelight receptacle shall be replaced by three conductor plug and safelight housing shall be connected to ground prong of receptacle.

Safelight shall be the equal of Kodak Utility Safelight Lamp Model (C) with Series OA filter and 15 watt bulb.

Type 3737 - A surface mounted, vandalproof, 100 watt lamp lighting fixture diffuser shall be molded clear lexan with inner and outer prisms.

Diffuser is fastened to chassis with one tamperproof screw.

16-21.20 Description of Fixtures

Chasis is constructed of 14 gauge steel with four mounting screws.

Fixture shall be Tork, Catalog #6530 or approved equal.

Type 43-90 - A surface mounted incandescent lighting fixture with guard. Fixture shall be completely enclosed and gasketed for weather-tight and vapor tight applications.

Backplate shall be precision cast aluminum with two hinge hooks for support of pin hinges. Finish shall be matte aluminum.

Hinged trim shall be rugged precision aluminum, high tensile strength alloy, corrosion resistant, minimum wall thickness 1/8 inch. trim is hinged to backplate. Finish shall be satin aluminum.

Reflector shall be semi-specular, anodized aluminum.

Light control shall be a prismatic refractor.

Protective guard and trim is one piece casting.

Fixture shall be furnished with 2-100 watt lamp.

Fixture shall be furnished with finishing collar P-1679 When utilized in Modernization work.

Fixture shall be McPhilben, Catalog #43-90 or approved equal.

Type 43971- A recessed flush step light.

Cast aluminum, louvre frame with not less than 16 gauge steel housing with procelain angle sockets for 2-25 watt lamps wired for separate circuits.

Fixture shall be Simes, Catalog number 43971 or approved equal.

Type 606-A surface mounted indoor emergency lighting fixture with a Par 36, 25 watt lamp for a 12 volt system. Housing shall be constructed of with torsion spring frame trim shall be completely gasketed and lamp shall be able to be adjusted in two planes to 45 degrees.

Fixture shall be 8 3/4 inches in diameter and 4 inches deep.

Finish shall be white enamel.

Fixture shall be Light Alarms Electronics Corp, Catalog #ELF606 or approved equal.

Type 606G-Shall be similar to Type 606, But furnished and installed with aguard.

(b) Exit Light Fixtures

NOTE: Types M-81, M-91, 152E, and 40 Series. Panels specified for these Exit Light Fixtures shall be phosphorescent panels which comply in all particulars with Local Law No. 16 of the City of New York, approved by the Mayor on February 21, 1967.

Evidence shall be submitted with shop drawings to indicate that the phosphorescent panels to be furnished have been approved by the Board of Standards and Appeals.

Type M-91.

Edge Lit Ceiling Exit Signs. Cast aluminum construction hinged access door invisible glass fasteners. Inscription panel 3/16" phosphorescent glass with carved 6" red letters separated by white metal divider. Signs shall be single or double faced, no arrow, one way arrow to two way arrow as noted for two, 8 watt, T-5 fluor. lamps and finished satin aluminum. Signs shall be McPhilben 45 series, or Simes 45241.

Where exit fixture type numbers M-81A, B, C & D, or M-91-A, B, C & D are marked "Modified-See Spec." on electric drawings, then the modification shall consist of the following:

The plate shall be 18" in width instead of 14" as shown on Standard Detail, and a numeral as designated on the Electric Drawings shall be etched on plate following the word "Exit"; numeral shall be 8" high.

Type M-81.

Similar to above except for pendant suspension.

Type 152E.

Recessed exit sign consisting of an 18 gauge galvanized steel back box having cast aluminum fixed trim and hinged door with non-rusting hinge pin. Exit panel shall have the word "EXIT" in 8" high letters on a white opal phosphorescent glass background. Fixture shall have two, 8 watt, T-5 fluorescent lamps. Finish of fixture to be as selected.

Exit sign fixtures marked "modified with an exit numeral," the modification shall consist the designated exit numeral etched on glass panel following the word Exit.

When the subscript "EM" is attached to the symbol of plans modify this fixture by adding the appropriate socket for use on 6 volt or 12 volt emergency light system as indicated on the emergency light riser.

16-21.20 Description of Fixtures (Con't)

(b) Exit Light Fixtures (Con't)

Fixture the equal of McPhilben Co. 54-8H or Simes Company 43802 will be acceptable.

Type 152-EG-Similar to fixture above, with the exception that it shall be furnished with a guard.

Type 40C.

Surface mounted, single faced exit sign. Housing shall consist of aluminum or treated steel. Access door shall be suitably hinged at top and shall contain 3/16" phosphorescent glass panel, with white background, having red letters, 8" high (unless otherwise indicated) etched on panel. Provide directional arrow, one way arrow, two way arrow or no arrow as called for on drawings. Fixtures shall have two, 8 watt T-5 fluorescent lamps. Provide suitable guard when called for. Finish shall be satin aluminum. Fixtures the equal of McPhilben 40 line, Simes, Gruber or Garcy will be acceptable.

Where the fixture types (40C or 40X) are noted "Modified-See Spec." on electric drawings, the modification shall consist of the following: A numeral designating Exit Number as shown on drawings shall be etched on phosphorescent glass panel following the word "Exit". Lettering and numeral shall be 6-inches high.

Type 40X

Same as type 40C, except outlet box is for surface mounting. Provide collar, depth as required, to match fixture housing. See Standard Detail Drawing.

Type 40W-WC.

Similar to type 40C, except, it shall be double faced and either wall (W) or ceiling (WC) mounted.

Type 40 TW-TC.

Two (2) type 40C fixtures mounted perpendicular as indicated on drawings. "TW" shall be wall mounted--"TC" shall be ceiling mounted.

16-21.20 Description of Fixtures (Con't)

(b) Exit Light Fixtures (Con't)

Type L-94P

Round exit sign incorporating a metal housing (approximately 5 inches in diameter and 2 1/4 inches deep with a plate at rear for attachment to outlet box), an approved medium base lamp receptacle recessed into opening in plate, and approved rounded holding collar.

Housing, rear plate and rounded holding collar shall be No. 20 gauge spun brass or copper, or of No. 16-gauge spun aluminum, or of cast aluminum. Finish of exposed metal parts shall be satin chrome for brass or copper, or satin aluminum lacquered for aluminum.

Outlet box shall be 2-1/8" deep, flush or surface mounted as indicated on Drawings. Surface mounted box shall be hidden by a collar matching fixture.

Roundel shall be convex white opalescent glass, approximately 4 1/2" in diameter, prismatic inside and smooth outside. Roundel shall be secured to holding collar by means of a steel bezel ring.

Acceptable fixtures are McPhilben No. 77/3110; Simes No. 43827; or an approved equal conforming to this specification.

Type L-94-PG- Similar to Type L-94-P with exception that fixture shall be furnished with guard.

Type 50B- Similar to Type 40C with exception that the following lettering "Dark Room In Use" shall be substituted for "EXIT".

(c) Fluorescent Fixtures

Type F3P

Rectangular fluorescent luminaire with open top for pendant mounting with metal sides and a cell type aluminum louvre of .025 minimum thickness with a cell size of 1/2 inch by 1/2 inch by 1/2 inch high giving a cut off angle of 45 degrees by 45 degrees, or a cell size of 3/4 inch by 3/4 inch by 1/2 inch high giving a cutoff of 35 degrees by 35 degrees will be acceptable. Louvres shall be permanently interlocked for rigidity, and set in a hinged frame with self-retaining thumb screws, or in another approved manner.

16-21.20 Description of Fixtures (Con't)

(c) Fluorescent Fixtures (Con't)

Finish of louvre and fixture body shall be baked white enamel. Fixture body shall be not less than 20-gauge cold-rolled treated steel, with welded joints. Louvre panels shall have a reflectivity of not less than 88 percent. Fixture shall have rigid stem, swivel and canopy.

Type F-3S.

Same as above except for surface mounting, except with top reflector and translucent virgin acrylic sides.

Type F-3S-GYM.

Rectangular fluorescent luminaire with top reflector, for surface mounting with glass sides and a cell type aluminum louvre of .025 minimum thickness with a cell size of 1/2 inch by 1/2 inch by 1/2 inch high giving a cutoff of angle of 45 degrees by 45 degrees, or a cell size of 3/4 inch by 3/4 inch by 1/2 inch high giving a cutoff of 35 degrees by 35 degrees will be acceptable. Louvres shall be permanently interlocked for rigidity, and set in a hinged frame with self-retaining thumb screws, or in another approved manner. Finish of louvre and fixture body shall be baked white enamel. Fixture body shall be not less than 20-gauge cold-rolled treated steel, with welded joints. Louvre panels shall have a reflectivity of not less than 88 percent. Fixture shall have rigid stem, swivel and canopy. Fixture shall have approved wire guard separately supported from ceiling and hinged.

Type F-4.

Recessed troffer with a baked white enamel reflector. Housing shall be a minimum 20 gauge bonderized sheet steel. This fixture shall have a flanged trim to cover ceiling openings. The trim shall be finished in baked white enamel for plaster or acoustic tile ceilings and in satin aluminum for metal pan ceilings, unless otherwise noted. The equal of McPhilben 51 line, Neo-Ray, Kent-Eastern Lighting Products or equal will be acceptable.

16-21.20 Description of Fixtures (Con't)

(c) Fluorescent Fixtures (Con't)

Type F-5-P (Pendant), F-5-S (Surface)

Fluorescent fixture shall be of a generally rectangular shaped enclosed, complete or partial wrap-around acrylic prismatic diffuser. Fixture shall not exceed 12 inches in width for two (2) lamps (in cross-section) or not less than 10 1/2 inches and approx. 3 1/2 inches in depth.

Diffuser shall consist of a male conical or hexagonal prismatic acrylic lens, minimum 85% reflectance shaped to redirect some illumination on ceiling.

Housing shall be not less than 20 gauge die formed cold rolled steel rigidly braced with approved raceway cover, protectively coated and finished white enamel.

End plates shall be minimum 18 gauge cold rolled steel or equivalent.

Diffuser shall be adequately supported on all sides and provided with concealed hinges or chains for relamping that can be disconnected if desired.

All joints shall be electrically welded or by other approved method. Self tapping screws or sheet metal nuts of any type will not be approved.

Fixture shall be completely wired and connected.

Ballasts shall be selected or mounted so that they will not produce excessive temperature rise nor objectionable hum.

Distribution curves certified by E.T.L. for initial design of fixture shall be submitted for approval.

Pendant fixtures shall have an approved swivel aligner and 3/8 inch steel (iron pipe size) stem.

It should be possible to replace lamp holders without removing or unnecessarily dismantling fixture.

16-21.20 Description of Fixtures (Con't)

(c) Fluorescent Fixtures (Con't)

Type 367S--(Surface)

Fixture shall have a ribbed, clear, virgin acrylic plastic diffuser in an approved hinged frame held by two knurled captive screws. In lieu of a conventional pin-hinge, other forms of hinging devices which are demonstrated as practicable and secure will be acceptable, provided that in each such case there shall be at least one (1) knurled captive screw for securing the frame against accidental opening. Housing shall be 20 gauge minimum treated steel with end plates welded in place. Finish shall be baked white enamel unless otherwise specified.

Plastic diffuser shall be approximately 4 ft. in length. The virgin acrylic ribbed, clear plastic diffuser, shall meet the requirements of paragraph 16-21.08 (b) of this specification.

The plastic shall be non-color selective, and the over-all light output of the lighting fixture equipped with plastic shall be no less than 75% of the light output of the same fixture without plastic diffusing.

The plastic diffuser shall provide either diffusion or refraction of light or a combination of both, modifying or controlling the transmitted light.

The transverse candlepower distribution curve of the plastic diffuser when used in this lighting fixture with lamps specified, shall be such that the main light output subtends a total angle of not less than 90 degrees, or not less than 45 degrees symmetrically disposed to each side of the nadir.

Before purchase or fabrication of the fixtures or plastic diffuser the contractor shall submit for approval to the Executive Director shop drawings and a candlepower distribution curve prepared by an independent laboratory.

The fixture shall be the equal of Kent-Eastern 367S, McPhilben, or Neo-Ray.

Type 367P

Same as above modified for pendant mounting with dual stems and single canopy.

16-21.20 Description of Fixtures (Con't)

(c) Fluorescent Fixtures (Con't)

Type 8000R

Fluorescent Light Strip (with reflector). For continuous or individual units of 18-24-36 and 48 inch length with end plates and couplings as required. Heavy gauge treated steel channels and covers, beaded for rigidity and alignment. Wired with lamps, sockets and ballasts in accordance with standard specifications and amendments. Furnish complete with asymmetric type reflector unless otherwise noted. Finish baked white enamel of high reflectivity and durability.

Type 8000

Similar to above, except without reflector.

Gauge galvanized sheet steel with reflector. Diffuser shall be prismatic virgin acrylic. Finish to be baked white enamel. McPhilben 18-12 line or equal will be acceptable.

Type DB Fixtures

Fluorescent Display Board Reflector, consisting of a hood-shaped No. 18 gauge brass or No. 16 gauge aluminum housing, or No. 22 gauge stainless steel, containing a single row of one or more fluorescent tubes as called for on Electrical Drawings. Housing shall have a curved contour (baked white enamel interior) to properly reflect light downward to evenly illuminate display board which extends 30" below fixture. This contractor shall consult General Construction Contractor for exact location and size of display board, and shall install a Gem type outlet box flush in wall (with long dimension horizontal) at top and at center of frame. Reflector housing shall be fastened to wall by means of 3/16" toggle or anchor bolts' at least one bolt shall be used for each linear foot (or fraction thereof) of housing length.

Housing shall be approximately 3 1/2" high, shall project from wall a maximum of 6 1/2". The Contractor shall take exact dimensions of display board at the building.

Top and sides of housing shall incorporate combined ballast and wiring trough, separated from lamps by removable 20-gauge galvanized sheet steel lamp holder plates (finished in baked white enamel).

16-21.20 Description of Fixtures (Con't)

(c) Fluorescent Fixtures (Con't)

Lamp holders, ballasts, starters, and internal wiring shall be in accordance with above paragraph.

Acceptable fixtures are McPhilben Mfg. Company No. 18-17 (without glass); Gotham Lighting Corporation No. 2202 (without glass); Simes Company No. 43173; Beaux Arts No. Q1615, or approved equal conforming to this specification.

Type 37-60

A 20 inch long, two tube, wall mounted fluorescent lighting fixture. Housing shall be heavy gauge aluminum, with satin aluminum finish. Diffuser shall be extruded, ribbed, white acrylic. Fixture shall contain a convenience outlet. Lamps shall be 15 watts each, T-8 type. Pull chain shall be furnished where noted on drawing. Fixture shall be McPhilben, Catalog #37-66ATHPF or approved equal.

Type 367W

A two tube, four foot long fluorescent fixture. Lamps are 34 watt energy conservation type. Ballasts shall be energy conservation low loss type. Housing, end plates and ballast cover are die formed of 20 gauge, cold rolled steel. Diffuser is high transmission acrylic, of the snap in type. Finish shall be baked white enamel. Fixture shall be Neo Ray, Catalog # 3367W or an approved equal.

Type 88-19

Furnish and install, at a location shown on drawings, a low energy 19 watt circline vandalproof, fluorescent lighting element. Lens shall be retained by one tamperproof screw and integral tabs. Housing shall be die formed 14 gauge steel, finished in baked white enamel. Ballast shall be preheat, low power factor core, coil and starter. Power shall be for 120 volt AC. Fixture shall be similar to LIGHTRON, catalog #VPF-88-19C or approved equal.

16-21.20 Description of Fixtures (Con't)

(c) Fluorescent Fixtures (Con't)

Type F-7-P

Pendant fluorescent fixture of a generally rectangular shape with a wrap-around diffuser. Normal dimensions shall be four (4) feet in length and/or eight (8) feet in length by approximately 12 inches in width and 5 inches in depth. Four-foot fixture shall contain three (3) lamps in cross-section and eight-foot fixture shall contain six (6) lamps (three lamps in cross-section in each of two four-foot units in tandem).

Diffuser shall consist of a male conical or hexagonal wrap-around prismatic virgin acrylic lens, minimum 85% reflectance shaped to redirect some illumination on ceiling. Lens shall be either extruded or injection molded, but only one type shall be furnished for all fixtures. Diffuser shall be adequately supported on all sides and provided with concealed hinges or chains for relamping which can be disconnected if desired.

Housing shall be not less than 20-gauge die formed cold rolled steel rigidly braced with approved raceway cover; protectively coated and finished in baked white enamel. All joints shall be electrically welded or by other approved method. Self tapping screws or sheet metal nuts of any type will not be approved. Pendant fixtures shall have an approved swivel aligner with a 3/8 inch (iron pipe size) stem.

All ballasts shall be of the Class P thermally protected type and shall adhere to all requirements of the New York City Electrical Code. Ballast types for each three lamp fixture shall be either for one (1) single and one (1) two-lamp operation or for one (1) three lamp operation, but only one type shall be furnished for all fixtures.

Fixtures shall be the approved equal of Continental Lighting Products, No. 8100-340RS (4 ft.) No. 8100-6408T (8 ft.) McPhilben Lighting, Keene Lighting Corp.

16-21.20 Description of Fixtures (Con't)

(c) Fluorescent Fixtures (Con't)

Type F-7-S

Surface mounted fixture of a generally rectangular shape with a wrap around diffuser. This fixture shall be similar to the type F-7-P specified, except that this fixture shall be surface mounted. Fixtures shall be the approved equal of Continental Lighting Products No. 8100-340RS (4 ft.) No. 8100-6408T (8 ft.), McPhilben Lighting, Keene Lighting Corp.

Type 8PI

Furnish and install, at location shown on drawing a four foot, single tube (34 watt rapid start lamp) with a clear acrylic, one piece refractor.

Fixture shall be for surface or pendant mounting.

Finish shall be baked white enamel.

Housing shall be 20 gauge die formed steel.

Fixture shall be similar to Miller Co., Catalog #DA-1101-04 or approved equal.

Type 8P

Same as type 8PI, with exception fixture shall be a two tube fluorescent fixture.

Type 8PC

Same as type 8PI and 8P with exception fixture shall be for chain mounting.

(d) High Pressure Sodium

All high pressure sodium lamps shall have color rendition factor of 70 or better.

16-21.20 Description of Fixtures (Con't)

(d) High Pressure Sodium (Con't)

Type 22B

Fixture shall be a 11 inch x 11 inch square with a 70 watt high pressure sodium lamp.

Diffuser shall be a clear prismatic polycarbonate type.

Fixture shall be for flat wall mounting.

Fixture shall be supplied with tamperproof screws.

Fixture shall be McPhilben, Catalog #22B3162JB or approved equal.

Type WP-417CG

A wall mounted luminaire consisting of a contoured, anodized aluminum a symmetric reflector, molded prismatic thermal shock-resistant glass refractor, integral hid ballast housed within a weatherproof, die cast aluminum housing.

The unit shall have a hidden cast aluminum pressure latch to open and close the hinged door. There shall be a safety chain attached between the housing and door.

Fixture shall be 14 1/4 inches long by 6 7/16 inches in depth.

Fixture shall be furnished with a cast aluminum guard.

Fixture shall have a bronze finish.

The integral ballast shall operate a 70 watt HPS Lamp.

Fixture shall have tamperproof hardware.

Fixture shall be Johns Manville, Catalog #419-120-0108-TP-BZS or approved equal.

Type 200

Fixture shall be a stem mounted high pressure sodium lamp unit furnished complete with a 150 watt high pressure sodium lamp.

Unit shall consist of a self contained high power factor constant wattage ballast completely wired with approved reflector and guard.

Wire guard shall be heavy duty with center opening for relamping.

Reflector shall be prismatic glass with a spun aluminum cover or a number 14-gauge aluminum elliptical specular alzak reflector.

Where subscript "Q" is noted on drawings, a 120 volt, 250 watt quartz lamp shall be built into reflector lamp shall be the equal of General Electric Q250CL/DC. During a power failure quartz lamp shall be energized until HPS lamp restrikes.

System shall be Abolite Ltg. Inc., "Sentinal Series", Holophane or Wide Lt. Corp.

16-21.20 Description of Fixtures (Con't)

(d) High Pressure Sodium

Type 300

Same as type 200, with the exception that the integral ballast shall operate a 250 watt, HPS lamp.

Type 200S

A surface mounted high pressure sodium fixture furnished with a 150 watt high pressure sodium lamp, approved guard with center opening for relamping.

Unit shall consist of a self contained high power factor constant wattage ballast completely wired with approved reflector & guard. Ballast shall be remote of fixture.

Housing shall be cast aluminum or 14 gauge galvanized steel plate with Ellipsoidal semi specular aluminum or prismatic glass reflector. Where subscript "Q" is noted on drawing, a 120 volt, 250 watt Quartz Lamp shall be built into reflector lamp shall be the equal of General Electric Q 250CL/dc. During a power failure quartz lamp shall be energized until high pressure sodium lamp restrikes.

System shall be Apolite Ltg. Inc., Holophane or Wide Lt. Corp. or approved equal.

Type 300S - Same as Type 200S, with the exception that the integral ballast shall operate a 250 watt HPS lamp.

Type HPS-4-

This fixture shall contain a 400 watt high pressure sodium lamp with an Alzak Aluminum reflector and heat impact resistant tile glass.

Fixture features a die cast aluminum housing poor and integral slipfitter. All hardware is stainless steel or plated.

Fixture shall have a vandal resistant shield. Ballast shall be a hinged and readily removable ballast assembly.

Fixture shall be Crouse Hinds, Catalog # MVD-4LEC-120 VS or approved equal.

Finish shall be dark bronze thermo set acrylic enamel.

16-21.20 Description of Fixtures (Con't)

(d) High Pressure Sodium (Con't)

Type HPS-10

Same as type HPS-4 with exception that the ballast shall operate a 1000 watt high pressure sodium (HPS) lamp.

Type 15B

This fixture shall be a high pressure sodium lighting fixture with a shallow symmetric prismatic G-6477 light control.

Lamp shall be as noted on the drawing.

Fixture shall be constructed of cast aluminum with integral ballast compartment. Fully enclosed and gasketed, suitable for wet locations.

Housing shall be cast aluminum, 3/16 inch wall thickness of corrosion resistant alloy. Finish shall be satin aluminum.

Reflector shall be die formed specular Alzak.

Face plate shall be cast aluminum provided with drop hinges, gasketed to housing and secured with two Philips head captive screws, satin aluminum anodized finish. Furnish faceplate with guard.

Ballast shall be constant wattage, high power factor, 180°C. Class 'N' auto transformer type, standard 120 volt primary.

Fixture shall be for ceiling mounting.

Fixture shall be McPhilben, Catalog #15B-170 or approved equal.

SECTION 16-22 TELEVISION DISTRIBUTION SYSTEM

16-22.01 Scope

- (a) Furnish all materials, equipment, labor and services required for the complete installation of a master antenna television system, as herein specified that will permit plug connection of EIA standard television receivers at designated locations to provide the best signal obtainable for over the air, internal closed circuit television and associated audio reception.

Neither receivers, cameras or modulators are to be furnished as a part of this contract.

- (b) All basic equipment described herein or that may be required whether specified or not shall be the product of a manufacturer or manufacturers of established reputation and experience who shall have produced similar apparatus for a reasonable period of time and who shall be able to refer to similar installations now rendering satisfactory service.
- (c) The Contractor shall show satisfactory evidence upon request that he maintains a fully equipped, fully staffed service organization capable of furnishing satisfactory inspection and service to the system, including standard replacement parts. Contractor shall be prepared to offer a service contract for the maintenance of this system after the guarantee period.
- (d) The Contractor shall provide two sets of operating instructions, schematic circuit diagrams, a complete set of "as built" drawings, service manual and other information necessary for proper installation, maintenance, and operation of the system.
- (e) The Contractor shall construct the system following best engineering techniques for continuous 24 hour operation in accordance with applicable codes and safety precautions.
- (f) Four copies or as required of the shop and/or working drawings with basic information on equipment shall be submitted for approval.

As part of the submission, complete system layout drawings shall be included. The system drawings shall be comprised of the Head End Block Diagram and the Distribution System. Each piece of equipment shall be labeled as to its function and model number. Each coaxial cable run shall be labeled as to its function and type number. Splitter types and locations shall be clearly denoted.

16-22.01 Scope (Con't)

- (g) All equipment including wiring, cabling, and outlets furnished and installed under these specifications shall be guaranteed for a period of one year from the date of final acceptance thereof against all electrical or mechanical defects or failures except that which can be proved to have been caused by misuse. All service and parts shall be provided during the first year by the Contractor or his designated agent.
- (h) Jerrold, Blonder-Tongue, RCA & JFD are acceptable equipment manufacturers.
- (i) The following drawings are an integral part of these specifications:
 - 1. Basic T.V. System, Functional Diagram.
 - 2. T.V. System, Outlet Box Details.
 - 3. T.V. Distribution System Riser Diagram.

16-22.02 Omissions

As it is not practical to enumerate in these specifications all the details of fittings and accessory equipment required for proper operation of the system herein described, it is understood that they will be supplied by the Contractor without extra compensation.

All fittings, pads, terminations, filters, wave traps, etc., needed to provide the best performance possible at the present state of the art shall be supplied at no additional cost.

16-22.03 Specific Functions

- (a) The system shall consist of single channel antennae for each specified TV channel to be received, feeding the proper amplifying and distributing equipment to permit simple connection of EIA standard television receivers. Transmission of the composite television (video and audio) signals throughout the School shall be accomplished by means of a single coaxial cable system.

16-22.03 Specific Functions (Con't)

- (b) Amplifiers with integral power supplies, Booster-in line amplifiers and such similar devices shall be designed for 115-125 volt, 60 cycle, A.C. operation. The system and all equipment shall be designed and rated for 24 hours a day continuous operation.

Booster in-line amplifiers, where required for UHF signal, shall be designed for DC operation along the line with appropriate 120 volt power supplies located in the Distribution Equipment Housing.

- (c) The system shall deliver all NTSC color and monochrome signals without degradation at a minimum picture carrier level of 2,600 microvolts per channel. The sound carrier levels shall not be less than 20db or not more than 6db of the picture carriers across 75 ohms at each receiver outlet.
- (d) The over-all system shall exhibit a VSWR of less than 1.4. The system design and components shall allow for future extensions, addition, or modifications without increasing the system VSWR.

16-22.04 System Operation

System as designed shall provide the following functions:

- (a) Distribute local VHF television channels 4 and 13 picture and sound carriers to all TV outlets.
- (b) Distribute local UHF television channels 25 and 31 picture and sound carriers to all TV outlets on normal channel frequency.
- (c) Provide for audio information exchange from any TV outlet to any other TV outlet and TV distribution equipment.

16-22.05 Antenna

- (a) The Contractor shall provide antenna equipment hereinafter specified and as indicated on drawings. Antenna masts shall be mounted as indicated on drawings, by means of brackets. All openings for this mounting shall be properly water-proofed. Antenna shall be mounted to best suit conditions at the building location using a calibrated field strength meter and a T.V. set.

16-22.05 Antenna (Con't)

- (b) Install individual and separate rugged Yagi antennae of not less than 5 elements for each specified TV channel, mounted on whichever mast best suits conditions. No more than 1 LO-band antenna shall be mounted on each mast. Each VHF Yagi antenna shall be cut to the specified TV channel and matched to coaxial lead-in cable. Antenna output impedance shall be 75 ohms.
- (c) All antenna elements shall be aluminum tubing of one piece construction, reinforced at center and closed at the ends to prevent whistling. Each element shall be secured to the boom by conforming brackets and aluminum screws.
- (d) Masts shall be minimum 1 1/4" diameter, X-heavy hot dipped galvanized wrought iron approximately 10 feet long. Mast mount hardware shall be specially treated to prevent corrosion. The open ends of each mast shall be capped with a plastic cap or equivalent. There shall be television cables, quantity as indicated on drawings, plus AM-FM transmission line, ground wire, preamp wiring provided from the antennae, through weather head and lead-in conduits, to top floor pull box and from pull box to head-end amplifiers and AM-FM transmission line to Sound System and ground wire. All lead-in connections shall be coated with weatherproofing compound. The entire structure shall be grounded as called for on drawings. Lead-in cables shall be attached to masts and supporting structure at approximately 12-inch intervals to prevent sway.

Cabling and tying antenna lead-in cables to antenna masts, and to the bulkhead may be accomplished by the use of the Thomas & Betts "Ty-Rap Method". The "Ty-Rap Method" shall utilize approved lengths of Ty-Rap nylon cable ties and clamps for outside use installed in accordance with the manufacturer's instructions.

- (e) Provide a horizontal dipole AM-FM antenna, Taco Turnstile or approved equal, or an appropriate mast for the Sound System.

16-22.06 Distribution System

- (a) The coaxial cable from the antennae to the main amplifiers shall be type RG-11U for the UHF and VHF channels and RG-6U for the AM-fm band. The coaxial cable from the head-end amplifiers to the TV IB boxes (trunk lines) shall be type RG-11U foam. Center conductors shall be solid copper. Copper weld will not be acceptable.

16-22.06 Distribution System (Con't)

- (b) The coaxial cable from the head-end splitters or TV IB boxes to the end of the receiver's outlet lines (feeder lines) shall be RG-6U foam coaxial cable. Center conductors shall be solid copper. Copper weld will not be acceptable.
- (c) Coaxial cables shall be run in continuous lengths except for termination in TV-IB boxes or Rack and no splices or splitters shall be permitted in any conduit run or pull box. Cables shall be installed to avoid sharp bends or physical distortion.
- (d) The attenuation vs. frequency characteristic of installed cable shall not vary more than 1db from the specifications set forth by the cable manufacturer.
- (e) The Contractor shall secure from the coaxial cable manufacturer and submit to the Board of Education, not less than three copies of certification of compliance with the cable specification contained herein.
- (f) Audio cable shall consist of single tinned copper mesh shielding with insulating jacket enclosing two No. 18 thermoplastic insulated twisted pair conductors.
- (g) All cables terminating at amplifiers or splitters shall be tagged as to function and destination.
- (h) All coaxial cables shall be manufactured within the nine months' period preceding installation. Submit sample for approval. All coaxial cables used in this system shall have a nominal characteristic impedance of 75 ohms throughout the entire frequency spectrum utilized in this system. Each reel of cable shall meet the requirements of MIL specifications.
- (i) Cables shall be tagged in all boxes and panels of this system. Tags shall be white with black lettering giving designation.
- (j) The RG-11U cable shall be #14 AWG (solid) with cellular polyethylene insulation with a black vinyl jacket and duo-foil + drain shield. The RG-11U shall be Belden-Cable 9230P or approved equal.
The RG-6U cable shall be #18 (solid), with a cellular polyethylene insulation and a white, black, light beige vinyl jacket and duo-foil + drain shield.

16-22.07 TV Distribution Rack

Provide a sturdy, enclosed, ventilated, steel rack cabinet approximately 19-22" wide x 15" deep x 7'0" high with adequate shelves, brackets, etc., to support and connect the amplifiers, splitters, various components and termination devices, etc. Provide approved snap catch and lock on front hinged door. Space shall be provided for the addition of eight (8) future head-end amplifiers, band pass filters, RF modulators, etc., and associated wiring at a later date. Cabinet shall be dipped in iron phosphate and finished with silver-gray Hammertone baked-on enamel. The rack cabinet shall be located where noted on the drawings. Provide six (6) one-inch knockouts on each exposed side.

Switch and pilot for control of power where not shown elsewhere on drawings, shall be included on rack.

Provide 3 wire grounded receptacle plug-in strip for 120 volt power supply to components, the equal of Wiremold 200 series.

Install a service label on the rack, in full view and clearly identify the name of the fabricator of the equipment, and instructions for making service calls (address, and telephone).

16-22.08 Head-End Amplifiers

- (a) Each amplifier shall contain its individual supply (see also Par. 16-22.11) and AGC Control for each unit. The amplifiers shall be engineered such that the failure of any rectifier, power supply or component of solid state circuitry will affect but one channel throughout the system.
- (b) "Each amplifier shall be of solid state design. Tube type amplifiers shall not be acceptable".

Each amplifier shall have Gain - not less than 35 db (2 through 82).

2 outputs - minimum of four (4) volts RMS at each of two (2) outputs at a maximum of 1% IM distortion. (1/2 db sync. comp.). Two (2) volt RMS Amplifiers for the UHF channels with additional Booster Amplifiers down the line, will be acceptable where no four (4) volt UHF channel amplifier is available from the same manufacturer.

Each amplifier shall be of such a design that it is completely independent and interchangeable with a replacement unit.

16-22.09 "UHF In-line Booster Amplifiers and Power Supply".

Provide a UHF In-line Amplifier with solid state, two (2) transistor UHF broadband amplifiers designed for reamplification use in UHF-VHF all channel MA TV systems. Specifications required for this item is as follows:

- Gain.....14 db (typical)
- Cable Compensation.....0 db at 470MHZ, + 3 db at 806 MHZ
- Amplified Bandpass.....470-890 MHZ (Ch 14-83)
- Thru Bandpass.....12-216 (Sub Ch-13) at 2 db insertion
- Maximum Input.....34 mv per channel (+30.5 dbm V) for just perceptible
- Interference
- Input Return Loss.....15 db (Typical)

The UHF in-line amplifiers are installed in a distribution line at the pint where TV set signals drop to odb mV and the line signal is +17 to +22 db mV nd the line signal is +17 to +22 db mV. Flat response and low VHF insertion loss permit cascading more than 10 units.

Booster Amplifiers shall be capable of permitting a VHF (sub-channel or Regular Channel) signal to be fed from an outlet box to the TV distribution equipment in the multi-media room. These amplifiers shall be located in TV-IB boxes or if needed provide addition TV-IB boxes in rooms along the line, if additional boosters are needed.

The UHF In-line Amplifiers shall be similar to Blonder-Tongue Mighty Mite S. or an approved equal.

The Power requirements shall have the specifications as follows:

Minus 21 VDC, 12MA, up to 16 amplifiers. This shall be similar to Blonder-Tongue Model 4555 or an approved equal.

16-22.10 Preamplifiers

- (a) Preamplifiers for VHF and UHF shall be used as required. Preamplifiers for mast mounting shall be of the solid state design, of rugged construction and weather-proof. Where preamplifiers are mounted inside building they may be either solid state or tube type. Each Preamp shall have its own Power Supply (See Par. 16-22.11) so that any component failure will affect but one channel.
- (b) Each Preamplifier shall meet or exceed the following parameters:

	VHF	UHF (Ch. 25 & 31 only)
GAIN:	20 db	13 db
Band Pass:	6 mc \pm 3/8 db	Ch. 14 to 56 \pm 1 1/4db
Noise Figure		
VHF--Lo	4 db max.	
UHF Band		10 db max.
VHF--Hi	5.5 db max.	
Output Capability:	100,000 uv. min. @ 75 ohms	5,000 uv. min. @ 75 ohms
VSWR Input	Typical 1.4	Typical 2.5
Input Connection	75 ohms	300 ohms
Output Connection:	75 ohms	75 ohms
Mounting	Mast	Mast
Finish	Anodized Aluminum	Anodized Aluminum
Operating Temperature Range	-40°F. to +140°F.--40°F. to +140°F.	

16-22.11 Power Supplies

- (a) A common power supply for each group of components (e.g. amplifiers, UHF in-line booster amplifier, pre-amplifiers) will be acceptable in lieu of individual power supplies called for in the above spec. items. Wherever a common supply is furnished, a spare power supply with an approved quick changeover feature shall be provided for each group of components.
- (b) Each component supplied from a common power supply shall be separately fused.

16-22.12 Line Splitter and Mixer

- (a) Line splitters shall have a flat frequency response over the entire operating band from 18 mc to 890 mc. The unit shall be of the hybrid design with a 75 ohm match on all inputs and outputs and a VSWR of not more than 1.4. Output isolation shall be not less than 16.0 db (VHF) and a 11.5 db (UHF).
- (b) The two way splitter shall have a signal loss not more than 3.7 db (VHF) and 4.0 db (UHF). The four way splitter shall have a signal loss not more than 6.2 db (VHF) and 6.7 (UHF). All unused outputs on the splitters shall be terminated with 75 ohm capacitive type termination.
- (c) Frequency filter networks shall be used for mixing Hi and Lo VHF bands and UHF bands and for dividing VHF, UHF and future sub-channel frequencies. These filters shall have a minimum of 30 db rejection between bands at its designated output terminals. Maximum insertion loss shall not exceed 1 db on any VHF or sub-channel band. The unput and output impedance shall be 75 ohms with a VSWR of 1.5 or better.

16-22.13 Power Line Filters

The 120-volt power supply line to the TV Distribution Rack shall be equipped with a power line filter. Provide an RF filter having at least 60 db of isolation between power line input and output. Blonder-Tongue or equal. Locate filter in TV Distribution Rack.

16-22.14 Wall Box and Receiver Outlets

- (a) Receiver outlets in building shall be equipped with a surface or recessed wall box as per Standard Detail No. 850. The wall box shall incorporate lockable cover to prevent vandalism. The door shall be secured with an approved tumbler type lock, to be accessible only with a key. Each locking door shall be furnished with two (2) keys.
- (b) The wall box shall incorporate and meet the following requirements:
 - 1. Allow and permit access for cable and plug connection to the TV outlet receptacle when door is closed and locked.
 - 2. Be made to afford complete outlet terminal inaccessibility when the door is closed and locked.
 - 3. Allow simultaneous access to all outlets when door is open.
 - 4. Contain a permanent and properly marked plate on which the TV and audio fittings are located.
 - 5. Termination circuits provided in each of these items shall be modified to provide 75 ohm capacitive type, designed to prevent short circuit of the direct current supply to the Booster-in-Line Amplifier.
- (c) The wall box outlets shall be divided into the following categories:
 - 1. TV receiver outlet.
 - 2. TV camera outlet.
 - 3. Audio Outlet.
- (d) TV Receiver and Camera Outlet
 - 1. The outlet shall consist of a double isolation network feeding two (2) coaxial type screw terminals. The connectors shall be of dissimilar types, and therefore not interchangeable. The receiver connector shall be of the G-61 type or equal. The camera connector shall be the SO-239 type or equal.

16-22.14 Wall Box and Receiver Outlets (Con't)

2. The isolation network shall be of the Back-Matched type design, using Hi quality torroidal ferrite transformer circuits. Back-Match VSWR shall be 1.4 or less. Provision shall be incorporated in the network to prevent 60-cycles A.C. or D.C. feedback into the feeders or trunk lines. The combined isolation network through line loss shall not exceed .7 db within a frequency range of 18 to 216 mc. The minimum isolation value between any output and the feeder line shall not be less than 17 db. The isolation between output terminals shall not be less than 34 db at frequencies between 18 and 216 mc.

The isolation network shall be so designed that a short circuit, open circuit, or a defective TV receiver will not affect the operation of any other TV receiver connected to the system. The origination isolation network shall be capable of passing a sub-channel origination program without adding visible ghosting, smear to any other frequencies.

- (e) Audio intercom outlet shall be the 3-circuit (sleeve-tip-ring) type connector for quick connection
- (f) A complement of plugs and cables shall be supplied with each school system as follows and delivered to custodian.
 1. Furnish and install (12) 12-foot RG 6/U cables with G-59 and suitable TV set fittings at respective ends. The TV set fitting shall be designed to deliver UHF signals to the VHF connection on a TV set smf IHF signals to the UHF connection on a TV set Y-type of connection.
 2. Furnish six (6) male PL-259 plugs for camera input connectors. Plugs shall be designed to accept RG-59U foam coaxial cable. Plugs shall be brass, silver plated for lower loss contact and long life when subjected to corrosive conditions.
- (g) Hinged door and frame of box shall be finish painted by manufacturer as selected. Provide means of installing door and frame after wall painting by others. Protect receptacle connectors during painting process.
- (h) Furnish a complete same outlet box with component devices for approval before installation.

16-22.14 Wall Box and Receiver Outlets (Con't)

- (i) Outlets shall be left "live" and ready for receiver plug-in with all required devices provided.
- (j) Receptacle outlet plate shall be stainless steel, type 302, as specified in paragraph 16-7.43 of this Standard.

16-22.15 Site Survey

- (a) After contract award and prior to submission of equipment the school site shall be surveyed to determine the probable quality of TV reception.
- (b) If it is determined that this site is located in a marginal TV reception area, an antenna field survey shall be performed at no additional cost to the Board of Education.
- (c) The Antenna survey shall be made with a field strength meter, Yagi antennae and a TV set.

If the survey shows that high quality TV pictures cannot be received off the antenna structure as called for in the specifications, a report shall be included with the submission. This report shall include:

1. Type and size of recommended antenna structure.
2. Recommended location of structure.
3. New type of antenna that may be required.
4. Other equipment that may be necessary for best reception.

16-22.16 Equipment Approved

This Contract shall submit the following listed items for approval:

- a) Preamplifiers.
- b) Amplifiers.
- c) UHF In-Line Booster Amplifiers.
- d) Splitters and Mixers.
- e) Wall Outlet Complete.

16-22.16 Equipment Approved (Con't)

- f) One-foot sample coaxial and Audio cable.
- g) Power Supplies.
- h) Connectors.
- i) Antennae.

16-22.17 Performance Tests

- (a) Prior to purchasing the equipment herein specified, this Contractor shall submit for approval data on items listed a,b,c,d and i above, from an approved laboratory not connected with the manufacturer of the equipment. The data shall certify that the performance of the equipment to be installed meets the requirements of the specification, and that the equipment installed is equal to, or better than that specified. Such tests shall be made under conditions which, in the opinion of the Engineer, simulate conditions of actual use in the school.
- (b) The data to be submitted shall include full and complete information, regarding all performance characteristics, which shall be deemed necessary and sufficient in the opinion of the Executive Director.

16-22.18 Final Test Procedure

- (a) On completion of the installation the sub-contractor supplying this equipment shall provide a qualified technician with a calibrated field strength meter and a television receiver to show the quality of reception and verify signal strength requirements at each outlet.
- (b) All cameras, modulators, receivers and other equipment needed for final tests and demonstrations shall be supplied by the sub-contractor at no cost to the Board of Education.
- (c) The intercom system shall be checked out with a set of power phones.

16-22.19 Guarantee

- (a) The Electrical Contractor shall present before final payment for this system a certified statement by the TV manufacturer or his agent that he has generally supervised the installation and test of the system on completion of the work. That he will warrant the system for one year after date of acceptance by adjusting or replacing defective material, workmanship or equipment including wind damage to antennae.

- (b) Supply two (2) sets of complete operating instructions plus one day of class instruction at the school, for persons designated to operate system.

SECTION 16-23, METAL AND ELECTRIC SHOP ANTENNA SYSTEMS

16-23.01 General

Furnish and install all items of equipment indicated on the drawings and hereinafter specified, as required to equip the Metal and Electric Shop.

The system shall consist of the following antennas:

- (a) A television antenna provided under Section 16-22 for receiving VHF AND UHF television channels and FM radio stations.
- (b) An amateur antenna capable of transmitting and receiving on the two meter amateur radio bands.
- (c) A multi-brand antenna system capable of receiving the ten, fifteen, twenty, forty and eighty meter bands.

16-23.02 Antenna--General

All antennas shall be supported and mounted as indicated on the drawings.

(a) Television Antenna

Use television antenna provided under Section 16-22 Television Distribution System.

(b) Amateur Radio Antenna

The amateur antenna shall consist of a 2-meter 4-bay vertical Antenna mounted on a free standing Jay Pole. The antenna system is identified as Hy-Gain Model No. SJ2s4. This antenna shall be mounted in accordance with manufacturer's instructions for omni-directional performance.

(c) Multi-Band Radio Antenna

The multi-band radio antenna shall be a doublet antenna 52 ohm impedance, containing integral solid state traps and shall be constructed of copper-clad steel wire elements and shall be Hy-Gain Model No. 5BDQ or approved equal.

16-23.03 Antennae Location and Arrangement

In general, the antennas described above shall be mounted in accordance with the following limitations:

(a) Television Antenna

Shall be provided under Section 16-22--TV Distribution System.

(b) Amateur Radio Antenna, Jay-pole shall be free standing or attached to bulkhead.

(c) Multi-Band Radio Antenna, shall be supported from two (2) masts, which may be either free-standing or attached to a stair bulkhead. These masts shall have a separation of approximately ninety-five (95) feet and shall be not less than ten (10) feet high. The center point of this antenna shall be not less than seven (7) feet above the roof level.

16-23.04 Terminations

Radio-frequency signals from the various antennae shall be delivered to receptacles, specified below, mounted in two (2) separate 4 11/16 inch square, extra-deep, boxes with engraved face-plates. Box for TV outlet shall be as specified in paragraph 16-22.14. These boxes shall be located on the wall, behind a work table in the Metal and Electric Shop, as indicated on the drawings. The center-line of the receptacles shall be three (3) feet, six (6) inches above the finished floor. Receptacles shall be separated from each other by not less than one (1) foot, six (6) inches.

Receptacles

(a) For the television antenna outlet, furnish and install as specified in paragraph 16-22.14

(b) For the amateur radio antenna system, install an Amphenol SO-239A coaxial receptacle and connect lead-in cable. Furnish three (3) mating plugs as above with 83-185 adapters.

(c) For the multi-band radio antenna system, install an Amphenol SO-239A coaxial receptacle and connect lead-in cable. Furnish three (3) mating plugs as above but without adapters.

Deliver all plugs and adapters to Custodian.

16-23.05 Cable

The lead in cables for the hereinbefore specified antenna systems shall be installed in conduit as indicated on the drawings. All cables shall be manufactured less than six (6) months before installation. The cable for the amateur radio and the multi-band antenna systems shall be RG-8U foam. These cables shall be supported from the masts by suitable stand-off insulators.

SECTION 16-24, LANGUAGE LABORATORY EQUIPMENT

16-24.01 Scope

The Electric Contractor shall furnish and install, as indicated on the Drawings and as herein specified, a complete Language Laboratory, including an instructor's Control Console, Modular Student Positions, wiring, microphones, recorders, head sets and other accessory items in the quantities specified.

The Contractor shall provide a complete and fully operative system, consisting of the number and type of Student Positions, indicated on the drawings and called for in this Specification.

16-24.02 Manufacturer

All equipment and interconnecting cable, described herein, shall be supplied as a complete system by a single manufacturer of established reputation and experience.

Accessory equipment supplied but not produced by the principal manufacturer, shall carry his full recommendation for the service specified, and shall be guaranteed by him to fully meet these specifications.

16-24.03 Drawings

Before manufacture of the electronic equipment and all associated equipment, the Contractor shall submit for approval a complete wiring diagram (in quadruplicate) and dimensional and descriptive drawings of all equipment. Drawings of control console and booth equipment shall indicate the locations of tape deck, amplifiers, etc., and shall provide full descriptive details of all equipment including methods of mounting equipment, wiring details, etc.

16-24.04 Supervision

- (a) The installation of the laboratory equipment, and wiring shall be performed under the supervision of the manufacturer's or his authorized agent's engineer. Before payment will be made for the equipment and its installation, this Contractor shall present to the Executive Director a written statement from the manufacturer of the equipment or his authorized agent that all equipment has been properly installed, and is operating in a manner satisfactory to the manufacturer.

16-24.04 Supervision (Con't)

- (a) This Contractor shall submit the name of the manufacturer's or his authorized agent's engineer, including business address and telephone number, before the installation is started.
- (b) At the time the installation is completed and ready for operation, the Contractor shall notify the Board of Education in writing and make arrangements for complete testing of the equipment. A qualified representative of the manufacturer or his agent shall be present to demonstrate that all equipment complies with the specifications in the presence of Board of Education assigned representatives. The Contractor shall provide all essential testing equipment.

16-24.05 Omission

These specifications may not enumerate all details and accessory equipment required for proper operation of the system, herein required. It is understood that all equipment and installation material required to accomplish the functional objectives, herein specified, shall be supplied complete by the Contractor without extra compensation even though not specifically mentioned herein or shown on the drawings.

16-24.06 Approval by Underwriter Laboratories, Inc.

All amplifiers, tape transports and phonograph shall be approved by the Underwriter's Laboratories, Inc. and shall bear a seal of approval.

16-24.07 Servicing and Maintenance

The manufacturer and/or his authorized agent shall show satisfactory evidence that he maintains a fully equipped service organization stocked with factory approved replacement parts within the Metropolitan Area of New York, and is capable of adequately servicing the specified equipment.

16-24.08 Guarantee

A written guarantee from the manufacturer or his authorized agent, guaranteeing the Language Laboratory equipment herein specified for a period of one year duringf which time the manufacturer and/or his authorized agent shall agree to keep this equipment operating to the satisfaction of the Executive Director. This guarantee shall, also, include a statement that all parts requiring replacement or adjustment during the period of guarantee will be replaced or adjusted by the manufacturer and/or his agent without cost to the Board of Education. The guarantee period shall start from date of final acceptance for a period of one year.

16-24.09 Language Laboratory Equipment

Definitions-- A row is to be considered as running from the teachers console back (one student behind another).

A student multi-purpose table shall be considered to have two (2) student positions, except, when seven rows are specified, then the odd table shall consist of a single student position.

(a) Teachers' Console shall include the following:

1. One (1) Console--Califone LC 255--NY standard console desk or equal 2 drawer cabinet shall have locking cover drawers and doors.
2. Two (2)--Master Tape Playback/Program Source Califone LP 923T or equal.
3. One (1)--Master Tape Recorder/Program Source Califone LP 912T or equal.
4. One (1)--Master Phonograph/Program Source Califone LP 924T or equal.
5. One (1)--Teacher Control Teachers Amplifier Monitor Panel Califone LS 219-30B.
6. Six (6) Student Switch Panels for 6 rows with 6 student positions (total--36 positions), Califone IS 220-6 or equal. Provide seven (7) switch panels in schools with 7 rows of 5 student positions (total--35 positions). See drawings for proper installation.

16-24.09 Language Laboratory Equipment (Con't)

(a) Teachers' Console shall include the following: (Con't)

7. One (1)--A.C. Power Panel for lab. with student recorders. Califone LS 227 with switch for solenoid release.
8. One (1) Teachers' Amplifier Califone TA-30 or equal.
9. Console installed Student Audio-Active Amplifier with microphone and program volume controls. Quantity dependent on number of student positions. Califone SA-31 or equal.
10. One (1) Teachers' boom microphone headset combination-Califone AKG-K58 ruggedized model or equal with 8' to 10' cable, rubber ear pads and dual flat plugs.
11. One (1) Centralized Power Supply, 15 amperes. Califone PS-30 or equal.
12. One (1) Master program distribution panel Califone PM-10 or equal.
13. One (1) Off/On Power Panel for entire lab. Califone LS 218 or equal, modified for solenoid lock switch only if unit LS-227 is not used.
14. Switches of student panels shall conform to student position layout.

(b) Student positions shall include the following:

1. A total of thirty-six (36) student positions shall be provided unless otherwise indicated on drawings.
2. All student positions shall have identical furniture capable of receiving student recording equipment. Student furniture shall be multi-purpose tables MPC-63-A as manufactured by Micro-Precision Corp., B'klyn, N.Y. or equal. These student tables shall be equipped with approved electronic latches.
3. The student positions with single type receptacles, as indicated on drawings, shall be provided with a cassette recorder, Califone Model LP 904SR.

16-24.09 Language Laboratory Equipment (Con't)

4. The remaining student positions shall be provided with the necessary boom microphone-headset combination with required connectors for audio-active operations. The amplifiers for these positions shall be located at the console.
5. All student positions (recording and non-recording) shall be provided with boom microphone-headset combination--Califone AKG-K58 (ruggedized model), with 5' cables, rubber ear pads, and flat plugs.

All student and console equipment shall be installed in a satisfactory manner with the entire system functioning in accordance with published Califone specifications for frequency response and distortion. Crosstalk figure for the entire system shall be better than--45 db.

16-24.10 Equipment Specifications

- (a) LC255--Console with cover and lock. Console constructed of oil walnut. Counter surface and sides covered with Pionite. Dimensions 39"H x 62"L. Counter surface 62" x 16".
- (b) LP923-TA--Console master tape playback all solid state, featuring modular plug-in, designed for tape playback only, this unit plays up to 7" reels at 3 3/4 and 7 1/2 IPS. This unit has 3 digit counter for accurate tape position indication, 6 pole wave wound motor for heavy duty drive, single Fast Forward/Rewind/Play Control, tone control for equalizing audio, Pause/Edit lever, and a professional VU meter to set playback. Frequency range: ± 30 db, 50-12,500 Hz, Signal-to-Noise Ratio: 50 db, Wow & Flutter: .2% RMS, Total Harmonic Distortion: 3%, Speeds: 3 3/4 and 7 1/2 IPS.
- (c) LP912TA--Identical with LP 923T except it is a monaural recorder with selector switch for "Student-Teacher" record. Operates on 110 volts, 60 cycles, AC input 50 watts. Frequency range: ± 3 db, 50-12,500 Hz, Signal to Noise Ratio: 50 db, Wow & Flutter: .2% RMS, Total Harmonic Distortion: 3%, Speeds 3 3/4 and 7 1/2 IPS.
- (d) LP924TA--Variable speed turntable built for heavy duty. Transcription size for playing up to 16" records. Die cast rugged Pickup Arm with plug-in cartridge and adjustable (3 to 12 grams) stylus. Cue master automatic arm control--pre-sets "Repeat" cues, floating motor deck, heavy machined aluminum turntable with non-slip pad and built-in 45 RPM hub, VU meter, and high quantity amplifier with tone control. Operates on 110 volts, 60 cycles, frequency range: ± 3 db, 50-12,500 Hz, Signal to Noise Ratio: 50 db, Total Harmonic Distortion: 3%, Speeds: Variable from 16 to 84 RPM.

16-24.10 Equipment Specifications (Con't)

- (e) LP904S-4 Cassette tape recorder solid state triplex tape recorder with automatic AGC-control. Master program may be recorded on upper track while students record on lower track. One lever for Record/Play/Stop; another for Rewind and Fast Forward. Separate volume controls, call switch, record indicator light, 3-digit resettable tape counter, and Pause/Edit lever. This recorder can be mounted vertical or horizontal has two tape speeds--3 3/4 and 7 1/2 IPS, will accomodate up to 7" reels. Operates on 115 volts, 50 watts, 60 Hz, frequency response: 50 to 12,500 Hz \pm 3 db, Wow & Flutter: less than .18% RMS, Signal to Noise Ratio: 50 db, Total Harmonic Distortion: 3%.
- (f) SA-31B--Transistorized student amplifier with microphone and program volume controls on the printed circuit board. Power requirements 12 to 24 volts DC, 15 MA, frequency response 30 to 15,000 Hz \pm 1 db, distortion: 1% @ 0 db output. S/N ratio 65 db. Printed circuit board shall be epoxy type with edge mounted contactors for plug-in installation.

Amplifier shall be located in Teachers' Console.

Input and output circuits shall be suitable for AKG-K58 microphone and headphone units.

NOTE: Overall listening level at the student headphones shall be controlled by a suitable 360° type potentiometer in the headphone circuit and located in the respective "MPC-63A" student position.

- (g) LS-219-30--Console instructor panel with dual pack for teacher's headphone and microphone. Two (2) auxiliary program inputs; VU meter for indicating sound level of program, auxiliary program, or instructor microphone; program monitor selector and group call switch; all call switch; microphone switch; instructor headphone level control; two (2) observer headphone outlets.
- (h) LS-220-6--Designed for those laboratory systems based on multiple of station groupings as shown. Has master selector switch with eleven (11) positions, ten (10) for master selection, and one (1) for teacher's "All-Call". Has highest quality key switches for communication or recording of student. Any key set to right of center allows teacher to record individual student on console recorder. Any key set to left of center allows teacher to monitor student's activity.

16-24.10 Equipment Specifications (Con't)

- (h) To speak to student being monitored, teacher presses button next to student's key to mute individual master while allowing panel provides connectors to next adjacent panel, and plugs into distribution panel for easy installation. Circuits shall permit any number of switches to be put into same position (right or left) (multiplied) without throwing system into oscillation of change in levels.
- (i) IS-218--AC switch panel, complete with master AC switch, pilot light and auxiliary AC switch, and Momentary Contact for controlling 120 volts electric latches on student positions.
- (j) AKG-K58 Headphone--Frequency range 20-25,000 Hz, average power requirement 0.312 milliwatts at a level of 250 millivolts, delivering 95 db spl. per earphone. Both earphones shall be equipped with rubber ear pads. Maximum undistorted continuous acoustic output 127 db spl. per earphone with an input level of 6 volts at 180 milliwatts, with a total harmonic distortion of less than 2% (20-25,000 Hz). Translation efficiency 2 milliwatts input at 630 millivolts will produce 106 db spl. Total harmonic distortion throughout entire range 1% or less at 2 millivolts input. Total impedance 150 ohms + 20% throughout entire range. (Both earphones connected in series). Microphone--Frequency range 100--12,000 Hz. Impedance 290 ohms. Sensitivity 0.1 millivolt per microbar. Average output for speech at 5 cm distance 0.2-1 millivolts. Average discrimination against undesired noise from a distance of more than 30 cm for speech at 5 cm distance ranging from 37 db at low frequencies to 15 db at the high frequency end, 22 db at 1,000 Hz. Headphone shall be provided with rubber ear pads and dual flat plugs. Headphone shall be ruggedized model, which includes construction and components that prevent unauthorized disassembly.

16-24.11 Wiring

All wiring shall be done in accordance with manufacturer's diagrams and recommendations, and must conform to the New York City Electrical Code.

The Contractor for Electric Work shall furnish and install the following electrical and electronic circuitry including all necessary wires, cables, plugs, jacks, connectors, etc. in addition to other equipment and material which is specified herein.

16-24.11 Wiring (Con't)

- (a) Behind Student Positions provide a three wire grounded system in metal raceway. Raceway to incorporate a three-wire grounded receptacle (the equal of Hubbell No. 5284), generally at end student position, inside table, for plug-in attachment of tape recorder (see drawings).
- (b) At console, furnish and install necessary wiring with plug-in attachment to the outlet box (120 volts) at the console.
- (c) The required signal circuits and low voltage (less than 50 volts) power supply circuits to each Student Position shall consist of shielded cables terminating at each Student Position of shielded cables terminating at each Student Position in suitable plug-in type connections as required by Student's Equipment. Termination shall be properly coded and polarized.
- (d) Signal and power supply (less than 50 volts) wiring from Control Console to each Student Position shall be made by this Contractor for Electric Work, via boxes and conduits, etc., installed by this Contractor. Signal and power supply connections shall be in accordance with good audio practice as specified by the equipment manufacturer.
- (e) Signal and power supply circuits to all Student Positions shall be properly protected from physical damage.
- (f) Shielded cable shall be used for all microphone, turn table, and tape unit signal circuits, and program lines.
- (g) Approved terminal strips and approved cable (or wire) connectors or lugs shall be used, where required by the equipment manufacturer for the system wiring installation.
- (h) All wire within Control Console shall be neatly cabled and attached as required in a manner satisfactory to the Executive Director.
- (i) The term "metal raceway" as used herein, shall include rigid conduits, flexible conduits (Greenfield) metal duct or troughing. Armored cable (BX) shall not be used.

16-24.11 Wiring (Con't)

- (j) Provide a standard 2 conductor phono jack (receptacle), the equal of Switchcraft, Part #21 or 11, at rear student position, where indicated on drawings. Conductors shall be connected to teachers' auxiliary jack circuit on the console. Provide load resistor, attenuation circuit, etc. at console for sound circuit of a motion picture projector.

This phone jack shall enable students to hear the sound of a motion picture projector through their headphones.

16-24.12 Fuse Protection

- (a) The main fuses for the power supply shall be located in the console.
- (b) Individual units (amplifiers and tape deck electronics) shall be provided with fuses.
- (c) Fuses shall be provided in the power lines between the console and the student positions. These fuses shall be located in the console.
- (d) All chasis, metal tables, and exposed metal surfaces shall be grounded.

16-24.13 Spare Parts

Furnish one complete set of spare fuses for all equipment installed.

Four (4) spare AKF-K58 microphone headset units.

SECTION 16-25, POWER PACK UNITS

16-25.0 General

- (A) Furnish, install and connect complete self-contained power supply units, flush mounted in apron of laboratory tables together with other accessories, as shown on plans and as specified herein.
- (B) All required accessory materials - whether detailed herein or not - shall be supplied so that the final arrangement will leave the system in a completely satisfactory operating condition and shall meet the performance characteristics outlined herein.
- (C) Schematic wiring diagrams, detailed working drawings (shop drawings) and lists of specific materials shall be submitted for formal approval preceding fabrication and each complete panel shall be available at factory for inspection prior to shipment to job site.
- (D) The manufacturer of these power supply units shall furnish six (6) copies of instructions in booklet form complete with schematic wiring diagrams, explaining the operation of each power supply unit and accessories.
- (E) A schematic wiring diagram showing all components and wiring of each unit shall be mounted on the inside of the panel.
- (F) Approved manufacturers of the assembled power panels are as noted below or approved equal:
 - (1) Standard Electric Time Co., Springfield, Mass.
 - (2) Hampden Engineering Corp., East Longmeadow, Mass.
 - (3) Ariel Davis Mfg. Co., Salt Lake City, Utah.
 - (4) Superior Electric Co., Bristol, Conn.

16-25.02 Construction

- (A) Each unit shall consist of an outer housing designed to facilitate table mounting and a cabinet or box to house the power supply components. Control equipment and output receptacles for the power supplies shall be located on the face of this cabinet. The components cabinet shall be mounted within the outer housing with fastening devices not accessible from the front, and shall be provided with two pull handles and drawer slides to allow for easy removal for servicing. Slides shall be provided with a positive stop so that the cabinet cannot be withdrawn in one motion. The stop mechanism shall be such that simultaneous release of the stop, while lifting the cabinet from the housing, shall not be necessary. Stop mechanism shall not require resetting when the cabinet is reinstalled.
- (B) The front of the entire unit shall be covered by a door, hinged at the top, which shall be retractable when in the open position so that the cover will be protected and will be out of the way. The cover shall be provided with a suitable handle and keyed lock. All units are to be keyed alike, using a Corbin 15751XC25 lock and key #30. The overall dimensions shall not exceed 24" wide x 12" high x 22" deep. Units shall be constructed of steel having a minimum thickness of #14 gauge.
- (C) The outer housing shall have an overlapping flange, in front, of sufficient width to cover the cutout in the furniture in which the unit is mounted. Threaded studs shall be welded to the rear of the flange, in each corner, for use in bolting the unit to the table without bolt heads being visible or accessible from the front. An adjustable brace shall be provided to support the rear portion of the housing from the internal table structure and from the floor.
- (D) The component cabinet shall be ventilated, for purposes of heat dissipation, across the full top and rear. Ventilating shall be by means of perforated metal having openings no larger than 1/8" and having an open area of not less than 50%.

16-25.03 Finish

- (A) All metal surfaces shall be deburred and buffed to remove scratches. Prior to final finishing the units shall be degreased in a vapor bath.
- (B) Surfaces, both interior and exterior, shall be primed with a rust inhibiting zinc chromate primer followed by two coats of Atlas SY111-64 grey texture paint. After finishing the paint shall be over cured to provide a smooth, durable surface.

16-25.04 Components

- (A) All components not specifically mentioned, shall be of the best commercial quality available. Other parts shall be as specified in the following paragraphs.
- (B) Variable auto-transformers, for use as voltage control devices, shall be Underwriters' Laboratories, Inc., approved. Dials furnished with these units shall be calibrated from 0-10.
- (C) Circuit Breakers, for protection of the various power supplies, shall be the fully magnetic type suitably rated. No fuses shall be required or used for this purpose.
- (D) Pilot light assemblies shall be of a tamperproof design, removable only from the rear. Lamp circuits shall incorporate a series resistance so as to provide a minimum lamp life of 10,000 hours.
- (E) Rectifiers shall be the silicon diode type connected in a full wave bridge circuit and mounted on properly proportioned heat sinks for convection cooling. Cells shall be capable of operating continuously at full-rated current in the ambient temperature of 50°C.
- (F) Transformers shall be double wound, isolating type, conforming in all respects to NEMA standards for specialty transformers. After winding, transformers shall be vacuum impregnated with coil varnish and baked. The assembled transformers shall have a moisture and corrosion resistant coating. Filter reactors shall be of similar construction.

16-25.05 Wiring

- (A) All wiring connections between power supply components shall be made with type TW thermoplastic wire meeting requirements of IPCEA and METRA standards and shall be Underwriters' Laboratories, Inc., listed for 90°C. in air. Wire sizes shall comply with the National Electrical Code. All wiring shall be neatly cabled and laced.
- (B) A four foot, 3 conductor, #12 neoprene insulated power cord shall be attached to the component cabinet for 120 v. AC power-input connections. This cord shall be provided with a strain relief when it passes through the cabinet. A 3 wire, 20 ampere, grounding type cord cap shall be provided on the end of the cord for connection to a suitable 120 v. AC outlet located in the laboratory tables.

16-25.06 Power Supplies

- (A) All power supplies shall be completely self-contained within the component cabinet, and shall be available for simultaneous use at full capacity. On the front panel face shall be located all controls, circuit breakers, pilot lights and output receptacles. All component items on this panel shall be identified by means of 1/8" thick, 5 ply white core engraved legend plates attached to the panel by non-removable means. All equipment on the control panel shall be counted to the panel in such a way that mounting screws cannot be tampered with.
- (B) The following items shall be provided on the control panel for each voltage supply: variable autotransformer (variable supplies only), output circuit breaker, pilot light and output receptacles.
 - (1) Output receptacles for fixed 120 VAC supplies shall consist of two, convenience outlets, 3 wire grounding type, rated at 15 amperes.
 - (2) Output receptacles for all other supplies shall consist of four single pole, 25 ampere, socket receptacles connected in pairs so as to allow two loads to be connected simultaneously to each supply.
 - (3) Output receptacles shall be located on the upper portion of the equipment panel.
- (C) Variable voltage supplies shall be variable from 0 to full rated output voltage with a full load current rating of 15 amperes.
 - (1) Variable DC supply at instructor's unit shall have an output ripple not exceeding 1% RMS. Regulation shall not vary more than 9% at 120 volts and full rated load. Variable DC supply at students' units shall have an output ripple not exceeding 1% RMS. Regulation shall not vary more than 9% at 30 volts and full rated load.
 - (2) Variable AC supplies may have one side of the line common to the building service neutral. AC output is to be an undistorted sine wave at all voltage settings.
- (D) Fixed 6.3 volt supplies shall be isolated from ground and shall have a full load output of 10 amperes.

16-25.07 Patch Cords (Con't)

- (4) One half of the cords shall be furnished with red insulating handles, the other half have black handles.
- (B) For fixed 120 volt AC supplies provide two 3 wire, male grounding type cord caps, of the metal armoured type having a positive cord grip. Rating shall be 15 amperes.
- (C) For ground connection furnish one cord having a banana plug with a green insulating handle on one end and an alligator clip with green insulator on the opposite end.

16-25.08 Instructor Unit (X-1)

These units shall be equipped with the following voltage supplies:

- 0-120v. AC variable - 10A
- 0-120v. DC variable - 10A with 9% regulation at 120v., and 1% RMS maximum ripple.
- 6.3v. AC fixed - - 10A
- 120v. AC fixed - 15A

16-25.09 Illuminated Meter Panel (X-3).

- (A) Illuminated meter panel, X-3 shall be semi-flush, wall-mounted type, where indicated on Drawing. The equipment shall be manufactured by Hampden Engineering Corp., or approved equal.
- (B) The cabinet shall be approximately 50" wide, 16" high and 10" deep at top and 9" deep at bottom, providing a sloping meter sheet steel. The assembly shall be furnished grey Hammertone. The front meter panel shall be 11 gauge steel and each of the four meters shall be flush mounted on a separate hinged door.
- (C) Across the width of the cabinet, located above the meters, provide a fluorescent lighting fixture complete with lamp and hood. The ballast and any accessory lamp equipment required shall be installed within the cabinet.

16-25.06 Power Supplies (Con't)

- (E) Fixed 120 volt AC supplies shall be derived from the building service and shall be rated at 15 amperes.
- (F) Building ground connections shall consist of two 75 ampere binding posts.
- (G) All output receptacles shall be color coded for purposes of terminal identification.
 - (1) Variable 120 volt DC Output coded black, negative and red positive.
 - (2) Variable 30 volt DC output coded brown, negative and maroon positive.
 - (3) Variable 120 volt AC output coded black, line and white neutral.
 - (4) Fixed 6.3 volt AC output coded mint.
 - (5) Fixed 120 volt AC output receptacles.
 - (6) Building ground binding posts coded green.

16-25.07 Patch Cords

- (A) Each power supply of each unit having single pole output receptacles shall be furnished with a pair of patch cords for use in making connections to experimental equipment.
 - (1) Patch cords shall be approximately four feet long and shall utilize #16 super flexible neoprene insulated wire approximately 3/16" outside diameter.
 - (2) Connector on one end of each cord shall be a 25 ampere single pole plug with insulated handle to mate with the supply output receptacles.
 - (3) Connector on opposite end of each cord shall be a solid copper springclip having a four inch long limp rubber insulator which shall incorporate a two inch long, tapered flexure section to minimize wire breakage due to flexure being concentrated at the wire entry point.

16-25.09 Illuminated Meter Panel (X-3) (Con't)

(D) The meter cabinet shall include:

- (1) One (1) rectifier-type AC ammeter, scale 0-15 amperes, Westinghouse Type KC-26.
- (2) One (1) rectifier-type AC voltmeter, double scale 0-75 and 0-150 volts, Westinghouse Type KC-26.
- (3) One (1) DC voltmeter, double scale 0-75 and 0-150 volts, Westinghouse Type KX-26.
- (4) One (1) DC ammeter, scale 0-15 amperes, Westinghouse type KX-26, complete with calibrated leads of a length to conveniently reach the meter connection panel.

(E) All wiring within the cabinet shall be #12 conductors and all wires, except for calibrated ammeter leads, requiring outside connection shall terminate at a terminal block. Any excess length of calibrated ammeter lead shall be neatly coiled and securely fastened within the meter cabinet.

16-25.10 Meter Connection Panel (X-4)

(A) Meter connection panel X-4 shall be mounted in the demonstration table where indicated on Drawing.

The equipment shall be as manufactured by Hampden Engineering Corp., or approved equal. The cabinet shall be approximately 22" wide, 12" high and 10" deep, fabricated from 16 gauge steel, finished grey "Hammertone". The cabinet shall be equipped with a bottom hinged front door fitted with a New York City lock No. 511S, key 47. Furnish two keys for each lock. A set of two angle-iron members shall be provided to facilitate mounting the cabinet in the table.

(B) The operating panel shall be accessible through the front hinged door. The front control panel shall be satin brush finished aluminum 3/16" thick, with the apparatus designation engraved in its surface. The following equipment shall be mounted on the panel and shall be accessible to the instructor:

- (1) Three (3) pin-style receptacles for DC voltmeters; red caps for positive termination and black caps for negative.

16-25.10 Meter Connection (X-4) Con't)

- (2) Two (2) receptacles, one pin style and one socket style, for DC ammeter; blue cap for positive termination and green cap for negative.
 - (3) Three (3) pin style receptacles for AC Voltmeter; yellow caps for one side of line and white cap for other side.
 - (4) Two receptacles, one pin style and one socket style for AC ammeter; light blue cap for one side of line and orange cap for other side.
 - (5) Two (2) push-to-read ammeter switches; one for AC ammeter and one for DC ammeter.
 - (6) One (1) tumbler switch for fluorescent lamp used to illuminate the demonstration meters. A red lens indicating lamp shall be provided to show fluorescent lamp is energized.
- (C) The receptacles shall be 50 ampere capacity. Type KR-5S socket style and Type HR-5P pin style. All receptacles shall be color coded. All plug and receptacle pin parts shall be fabricated from high-quality bronze having conductivity of 200% of brass and a tensile strength 150% of brass.
- (D) With the meter connection panel provide four single-conductor cord sets each 6 feet long, made up of #14 extra-flexible wire having a Type HP-5S socket type plug on one end and an insulated type HC-2 spring clip on the other end. Also provide two cords as described above, except equipped with Type HP-5P plugs instead of the HP-5S socket plug.
- (E) Within the cabinet the following apparatus shall be securely mounted and wired with #12 conductors to the receptacles and outgoing connection terminal block:
- (1) One (1) meter shunt for the DC ammeter rated 15 ampere.

16-25.11 Guarantee

After installation, the manufacturer of the laboratory power supply units and the accessory materials thereof, shall provide the services of a factory trained engineer to inspect each unit, instruct school personnel in its operation and provide written guarantee for not less than one (1) year, after acceptance, against all mechanical and electrical defects with free service for the same period.

16-25.12 Approved Shop Drawings

The Electrical Contractor shall furnish the General Contractor with manufacturer's approved shop drawings complete with details and dimensions required to install units into equipment or tables.

SECTION 16-26, SECURITY SYSTEM

16-26.01 GENERAL

- (a) The Electrical Contractor shall furnish, install all items of equipment indicated on drawings, or hereinafter specified to equip the building with an ultrasonic security system, along with associated conduit, wire outlet boxes and mounting hardware.
- (b) The Contractor shall submit engineered drawings of the proposed layout.

16-26.02 MULTI-ZONE CONTROL PANEL

- (a) This multi-zone unit consists of one circuit board and four processing circuit boards enclosed on one control cabinet. The front of the cabinet shall contain a windowed front which shall give the status of transmitter and receiver lines, AC power, client controlled walk test and relay annunciation, all with the cabinet locked and secured.

Each circuit board shall represent a zone, for a total of five zones per unit. This unit shall be 5Z-2001-L system, Sontrix or an approved equal.

- (b) The circuit board shall be the ASP-2001-L, Sontrix Mfg. Co., or an approved equal. ASP-2001-L contains the following features:
 - 1) Built-in annunciator
 - 2) Line supervision
 - 3) System is secured through the end of line resistors or transducer and transceiver lines.
 - 4) Protection against system tampering during the systems "ON" and "OFF" periods.
 - 5) Transducer line fault indicating lights show which line has been tampered with.
 - 6) A 15 second timed Sonalert indicated loss of AC power.
 - 7) Reset button, inside locked cabinet, will not reset the system until the fault has been corrected.
- (c) The multi-zone unit which contains in addition to the circuit board, four processing boards which contain the following features:
 - 1) Each processing board has a double set of relay contacts. The second set can be used to activate a "Lock Up" Annunciator Panel. Each board has its own latching annunciator and all are reset by the button on the circuit board.

SECTION 16-26 SECURITY SYSTEM (Con't)

- 2) Each board has both receiver and transmitter terminals. The transmitter is routed internally to each section. This makes multiple transmitter runs easier by providing more terminals. It also permits soning of the line supervision.
- 3) Each board has both transmitter and receiver line supervision.
- 4) Each processing board shall be the equal of Sontrix, Model 5Z-2001-L or an approved equal.

16-26.03 MASTER CONTROL PANEL

Master control panel shall consist of one Ademco 1023 main relay panel complete with rechargeable power supply and (2) Ademco 1034 four zone expander units with switches numbered 1 to 8.

Master panel shall have alarm device outputs. Each zone of zone expander shall have a separate output. Panel shall be modified as required to include the following:

- 1) Automatic mechanical counter which shall register the number of times the system is triggered into alarm condition. The counter shall be non-resettable and have a minimum of three digits and be visible when the panel door is closed.
- 2) N.O. dry contacts (normally open).
- 3) 12 volt power supply for operation of alarm devices.
- 4) Three (3) spare keys for control panel.

16-26.04 REMOTE SWITCH

Type A Remote Switch to be the equal of Ademco, Catalogue 246 with two-wire remote station adapter equal to Ademco Catalogue 245 installed in relay control panel.

16-26.05 DIGITAL COMMUNICATOR

Digital communicator shall be capable of being utilized as a slave or eight-zone control panel and capable of dialing out on two separate phone lines. Communicator shall have eight (8) distinct alarm channels and separate and distinct codes for opening and closing. Digital communicator shall simultaneously transmit multiple alarms with priority override.

SECTION 16-26 SECURITY SYSTEM (Con't)

16-26.05 DIGITAL COMMUNICATOR (Con't)

Unit shall be able to transmit four messages in less than three seconds, have a separate and distinct signal for handshake and acknowledge and be equipped with telephone line seizure and low battery signal. Communicator shall have option of transmitting four-digit location code and be capable of being programmed to transmit status at predetermined time. Communicator shall be Varitech model V380 or approved equal with optional listening capability, compatible with Varitech Model V301 digital receiver and receivers by Ademco, Sescoa or Silent Knight. Contractor shall make arrangements through school and school district for installation of Telephone Co. RJ31X telephone jack for connection of communicator. All costs relative to installation of telephone jack shall be paid by this contractor.

16-26.06 TRANSFORMERS AND POWER SUPPLIES

Transformers and power supplies for relay control panel, ultrasonic panel, digital communicators and alarm devices shall be installed in a hinged metal box at location specified. Unless otherwise specified, transformer for ultrasonic panel shall be 120V/16VAC, 20 VA and transformer for digital communicator shall be 120V/16VAC, 20 VA. All other transformers and power supplies shall be as specified elsewhere in this specification. Contractor may at his option install multi-voltage transformer of sufficient rating complete with fused terminal strip for power to each panel and alarm device.

16-26.07 TRANSCEIVER

Transceiver is a wall mounted unit with adjustable transducers within the unit so as to be able to adapt to any environmental situation.

Sensitivity of the unit may be checked by the built-in walk test LED, the walk test LED also monitors the AC power connection since it will not light if the AC fails.

Unit is powered from a low voltage plug-in transformer. The unit will automatically switch to a built-in rechargeable battery in the event of a power failure. Standby time is 12 hours.

SECTION 16-26 SECURITY SYSTEM (Con't)

16-26.07 TRANSCEIVER (Con't)

Long Range Transceiver shall be Ademco, Catalog #TR-66 or approved equal. (6'x70')

Broad range transceiver shall be Ademco, Catalog #TR-6 or approved equal.(35'x25')

16-26.08 "BLASTER" ELECTRONIC SIREN

Unit shall consist of a speaker and tamper switches in cabinet plus driver module.

Unit shall be 12 volt powered and furnished with an automatic alarm cut off which shall cut off "BLASTER" in 15 minutes after alarm.

Speakers are weather resistant.

Unit shall be Ademco, Catalog #717 or approved equal.

16-26.09 ELECTRONIC HOWLER SIREN

This device shall be weather resistant 12 volt electronic Howler siren in outdoor box and complete with driver module as per Ademco Catalog #711-712 or approved equal.

16-26.10 STROBE LIGHT

Alarm device shall be flashing strobe light, 1,000,000 CP, clear, 60 per minute flash rate operable on 12 volt D.C., surface mounted type, weatherproof, device shall be Ademco, catalog #711 or approved equal.

16-26.11 DIGITAL KEYPAD (KEYLESS) ARMING AND DISARMING

Digital keypad shall be mounted in a surface mounted box with a key lock drop, at location shown.

Digital keypad is a two component system consisting of a keypad and adapter. Adapter shall be located in the control panel.

Digital keypad shall be Ademco, Catalog #215 or approved equal.

Adapter shall be Ademco, Catalog #216 or approved equal.

SECTION 16-26 SECURITY SYSTEM (CON'T)

16-26.12 WIRING INSTALLATION

- a) Lateral runs of low voltage wires and shielded cable shall be installed concealed in ALL areas of hung ceilings.
- b) Later runs in rooms and areas without hung ceilings except as otherwise specified, shall be installed in rigid metal conduit.
- c) All vertical wiring and wiring in lobbies, stairwells, entrances, vestibules or on exterior of building shall be installed in raceway. Raceway or exterior of building shall be ½" rigid conduit. Surface metal raceway and rigid conduit installations shall conform to the requirements of the Electrical Standard.
- d) All wiring at locations, where asbestos ceilings or walls have been encapsulated, shall be installed in raceway along wall just below ceiling line. Sensing units in these locations shall be installed, mounted on wall below ceiling. Wiring and sensors specified for areas with encapsulated asbestos walls shall be installed so as not to penetrate the asbestos material.

16-26.13 TYPES OF WIRING

- a) Wiring specified hereinafter as "No. 18 twisted pair", shall be unshielded #18 AWG, copper, vinyl insulated twisted pair, vinyl jacket. U.L. listed, Belden Trade No. 8461 or approved equal.
- b) Wiring specified hereinafter as "shielded cable" shall be shield type 18 AWG, copper, vinyl insulated twisted pair, aluminum polyester-shield, turned copper drain wire, vinyl jacket, U.L. Listed, Belden Trade No. 8760 or approved equal.

16-26.14 OPERATION

Upon completion of all installation and wiring, the new alarm system shall be capable of performing as follows:

- (1) With a remote control station and/or master control panel in the oof or day position and all sensors in respective zones in closed position, white light on remote switch or access light on control panel shall be lit. An open in any of the sensors shall extinguish the lights.

SECTION 16-26 SECURITY SYSTEM (CON'T)

16-26.14 OPERATION (CON'T)

- (2) OFF switch on ultrasonic control panel shall render all transmitters inoperative.
- (3) When the switch on the ultrasonic control panel is in the Test position, motion detected in area of transmitter and receiver shall cause the audible device and light on the remote conalert unit to operate. No other alarm devices or central station shall operate.
- (4) Zone switches on relay control panel shall be capable of placing sensors in respective area in the "secure" and "access" position.
- (5) Turning the remote switch and/or main relay control panel switch, on and off, shall activate the digital communicator and transmit closed and open signals respectively.
- (6) When the ultrasonic control panel is in the "on" position, the ultrasonic sensors in the closed position and the remote switch or relay panel switch is turned to the "on" position, the system is now in the "armed" condition.
- (7) The alarm devices that are activated shall operate for not less than three (3) nor more than fifteen (15) minutes. After that time, the system shall reset as if all transmitters, receivers, transceivers and sensors are in the closed position by "armed" against further instructions. An open in any of the sensing devices shall cause the system to again go into alarm.
- (8) For exiting from the building, the zones connected into the entrance/exit delay module shall not be capable of initiating an alarm until the specified time period after the remote switch has been turned to the "on" position. Movement detected by other motion detectors or sensors shall initiate an alarm immediately during the delay period. The delayed zones shall be "armed" to detect intruders after the delay period has ended.

SECTION 16-26 SECURITY SYSTEM (CON'T)

16-26.14 OPERATION (CON'T)

- (9) For entrance to the building: Entering the building at locations that result in movement in the presence of motion detectors or opening sensor before the remote control station is turned to the "off" position shall cause an immediate alarm condition. Entering the building at a location that "breaks" the delayed zone shall immediately activate the mini-howler. However, operation of the remaining alarm devices and digital communicator shall be delayed for a specified time period. If the remote switch is not turned on the "off" position before the delay period has ended the alarm devices and digital communicator shall be activated.

16-26.15 CENTRAL STATION CONNECTION BOX

The Electrical Contractor shall furnish, install and connect two normally open contacts in a separate outlet box which shall be located adjacent to the multi-zone control panel.

The Electrical Contractor shall furnish, install and connect four, number 14 conductors in conduit from the multi-zone panel to this outlet box.

16-26.16 PERFORMANCE TESTS

- (a) Prior to purchasing the equipment herein specified, this Contractor shall submit for approval data on items listed above, from an approved testing laboratory not connected with the manufacture of the equipment. The data shall certify that the performance of the equipment to be installed meets the requirements of the specification, and that the equipment, installed is equal to, or better than that specified. Such tests shall be made under conditions which, in the opinion of the Engineer, simulate conditions of actual use in the school.
- (b) The data to be submitted shall include full and complete information, regarding all performance characteristics, which shall be deemed necessary and sufficient in the operation of the Executive Director.

SECTION 16-26 SECURITY SYSTEM (CON'T)

16-26.17 SERVICE DATA

- (a) Furnish and deliver seven (7) copies of the following maintenance and service information.
 - 1) Detailed Riser Diagram showing wiring, relays, control panels, transmitters, receivers, magnetic contact switches, etc., with locations indicated.
 - 2) Complete service manual showing operating maintenance and troubleshooting procedures of new security system.
- (b) The four (4) copies shall be distributed as follows:
 - (1) Two (2) copies to the School Custodian Engineer.
 - (2) Four (4) copies to the N.Y.C. Board of Education.
 - (3) One (1) copy to N.Y.C. Board of Education, Bureau of School Building Security, Room 201, 49 Flatbush Avenue Extension, Brooklyn, N.Y. 11201.
- (c) Submit two (2) copies of printed procedures for operation of the total system and detailed riser diagram showing wiring, relay location of equipment to Custodian, Area Office and Bureau of School Building Security, Room 210, 49 Flatbush Avenue Extension, Brooklyn, N.Y. 11201.
- (d) Furnish a written guarantee for security system for a period of one (1) year. During this period the contractor shall keep a system operating properly, replace parts and make adjustments as required at no cost to the Board of Education, except where this work is the result of obvious misuse or vandalism. Guarantee period shall start from date of final acceptance.
- (e) Receipts for spare keys, instructions, manuals, etc., signed by the custodian and the written guarantee shall be submitted with final payment requests.

16-26.18 SYSTEM TEST

- (a) The Contractor shall upon completion of the system adjust sensitivity of detectors so as to provide a system operating at maximum capability and effectiveness.
- (b) The owner may direct, at such time, that the Contractor perform an operating test for approval. The equipment shall be demonstrated to operate in accordance with the requirements of these specifications.

SECTION 16-26 SECURITY SYSTEM (CON'T)

16-26.19 GUARANTEE

The Electrical Contractor shall present before final payment for this system a certified statement by the manufacturer or his agent that he has generally supervised the installation and the test of the system on completion of the work. That he will warrant the system for one year after date of acceptance by adjusting or replacing defective material, workmanship or equipment.

SECTION 16-27, HEAT DETECTION SYSTEM

16-27.01 General

Furnish, install and connect a supervised means to automatically shut down recirculating air system requiring a heat detector when a fire and/or sprinkler system service the same area is in an alarm condition. The system shall be electrically supervised against wiring derangements in the detection and control panel circuitry such that an open will give an audible trouble indication at the associated fire or sprinkler alarm panel. The system will consist of one or more supervised rate compensation detectors, mounted as required in the supply and return ducts, shutdown control panels in the fan rooms and interconnection wiring to the fire or sprinkler alarm control panel.

This system shall meet all the requirements of the Department of Buildings and all agencies having jurisdiction.

All equipment used in this system shall be approved for such use by the Board of Standards and Appeals.

16-27.02 Raceway and Conductors

Conduits used for this system shall be as required in Section 16-5. Aluminum conduit shall not be used for this system. Conductors shall be type THW or RHW.

16-27.03 Heat Detectors

Duct Type Heat Detector furnished by this Contractor and installed by the Heating and Ventilating Contractor, shall be wired by this Contractor as indicated on drawings.

Heat Detector shall be an hermetically sealed stainless steel tube, with normally open contacts, the approved equal of Fenwall #27121. Temperature rating shall be as required by the Heating & Ventilating Contractor.

16-27.04 Heat Detector Control Panels

The Heat Detector Control Panels shall consist of an alarm and supervisory relay, fire alarm tie relay, two (2) fuses, and necessary terminals properly labeled. All equipment shall be fastened to an ebony asbestos panel and mounted in a cabinet.

16-27.04 Heat Detector Control Panels (con't)

Cabinet shall be constructed of code gauge, galvanized sheet steel with hinged door. Finish of cabinet shall be as selected. The door shall be labeled "HEAT DETECTOR CONTROL PANEL". Furnish lock and keys similar to lock and keys for Fire Signal Control Board. The panel shall be the approved equal of Fire Controls FCU-4MN (4 circuit type) or FCU-2MN (2 circuit type). The panel shall be provided with an approved code transmitter (single acting normally or double acting where a punch register is provided) which will deliver a dismissal signal to the building through the Fire Signal Control Board.

16-27.05 Trouble Bells, Alarm Bells and Silencer Switch

(a) Where indicated on drawings furnish, install and connect 6 inch trouble bells, 8 inch alarm bells and a double pole, double throw silencer switch and pilot light. Bells shall operate on 120 volt, alternating current and shall have distinguishing tones. Silencer switch and pilot light shall be the same as that specified in Par. 16-16.13 and operate in the same manner.

(b) Rundown Bell - See Par. 16-17.10

16-27.06 Operation

(1) An actuated Heat Detector shall effect the following:

- (a) The associated fans (as noted on drawings) for the specified detector will shut down.
- (b) Bells, and visual indicators of the Heat Detection System will operate.
- (c) The above operation as affected by one Detector is also likely to be repeated by other detectors located in the same atmosphere.

Visual indicators and nameplates shall be placed on the door of the control panel.

(2) Operation of a manual alarm on the fire signal system shall shut down all fans connected to the Heat Detection System.

(3) Operating the normally closed test button of the fire signal system in the General Office shall not affect the fans connected to the Heat Detection System.

16-27.06 Operation (con't)

(4) Punch Register will indicate the operation of a detector through a dual code transmitter in the Heat Detector Control Panel.

(This is for Intermediate School Installation).

(5) The fire signal will sound throughout the building.

16-27.07 Installation

The installation of the foregoing equipment shall be performed under the supervision of the manufacturer of said equipment.

16-27.08 Tests

After the completion of installation of foregoing equipment each heat detector unit shall be tested to determine proper functioning as required by the drawings and/or specifications.

These tests shall be made by this Contractor under the Supervision of equipment manufacturer. Tests shall be conducted in the presence of Executive Director's representative and adjustments made as required for satisfactory operation.

SECTION 16-28, SMOKE AND HEAT DETECTION SYSTEM

16-28.01 General

Furnish and install Smoke and Heat Detection Signal and associated equipment indicated on the drawings and/or herein specified and/or required to equip the building with a closed circuit, supervised Smoke and Heat Detection System meeting the requirements of the Department of Buildings and all agencies having jurisdiction. All equipment used in this system shall be approved for such use by the Board of Standards and Appeals.

16-28.02 Raceway and Conductors

Conduits used for this system shall be as required in 16-5. Aluminum conduit shall not be used for this system. Conductors shall be type THW or RHW.

16-28.03 Space Type Smoke Detectors

These smoke detectors shall be for surface mounting at designated locations. These detectors shall be complete with detector chamber, sensitivity control, radium source, etc. These detector units shall be the equal of Acme No. 190, Pyrotronics, Inc. #DIS-5B.

16-28.04 Duct Type Smoke Detectors

These smoke detectors shall be for mounting on ducts. Detectors shall be complete with outlet box, pick up tubes, sensitivity control, sampling chamber and tubes, radium source, etc. Detector shall be the equal of Acme Air Duct Assembly Unit No. 170DA, Pyrotronics, Inc. #DIA-5. Detector unit shown on drawings shall be delivered by this Contractor to the Heating and Ventilating Contractor who will install same at designated location. The Electrical Contractor shall make all wiring connections.

16-28.05 Heat Detectors

See Section 16-27, Heat Detection System, Paragraph 16-27.03.

16-28.06 Combination Smoke and Heat Detector Control Panel

- (a) Smoke and Heat Detector Control Panel shall consist of fire indicating equipment, and fan control relay equipment in a unit enclosure.

Control Panel shall provide zone indication for each smoke detector unit connected to the panel. Provide in panel the required number and type of relays to separately perform the required operations. Visual indicator's and nameplates shall be placed on the door of the control panel. The visual indicators shall be for each detector being fed from the control panel. Panel shall be constructed of code gauge, galvanized sheet steel. Finish of panel shall be as selected.

Provide lock and keys similar to lock and keys for Fire Signal Control Panel. On the panel provide an approved Code Transmitter (single acting normally double acting where a punch register system is provided, which will deliver a dismissal signal to the building through the Fire Signal Control Board.

- (b) Trouble Bells, Alarm Bells and Silencer Switch.

Smoke Detector Control Panel shall be provided with a 6" trouble bell, an 8" alarm bell and a double throw silencer switch and pilot light. Silencer switch and pilot light shall be the same as that specified in Par. 16-16.13 of this Standard. Bells shall operate on 120 volts, alternating current and shall have distinguishing tones. Silencer Switch shall be connected in such a manner that the act of silencing trouble bell, by the operation of the silencer switch, automatically transfers the trouble signal to the pilot light on the control board. When the trouble has been repaired, the trouble bell shall ring until the silencing switch has been reset to its normal position.

- (c) Rundown Bell - See Par. 16-17.10.

16-28.07 Operation

- (a) Operation of the Heat Detectors shall be the same as shown on Section 16-27, Heat Detection System, Paragraph 16-27.06.
- (b) Each smoke detector unit shall be capable of detecting smoke and the invisible products of combustion. An actuated detector shall effect the following:
- (1) The associated fans for the specific zone will be shut down.
 - (2) The fire signal gongs, throughout the building will sound through the action of a code transmitter (double-acting if there is a Punch Register in System).

16-28.07 Operation (con't)

- (3) The punch register will indicate this operation through a code transmitter in the Detector Panel. A Run-down Bell shall be furnished on all code transmitters.
- (4) The alarm bell and visual indicators on the Combination Heat and Smoke Detector Control Panel will operate.
- (5) The detector in the duct shall be connected thru a Combination Heat and Smoke Detector Control Panel. On sensing operation, it will shut down the indicated blower and exhaustor motor starters and perform the functions described in paragraphs 1,2,3, and 4 above. They shall be manually restarted by a starter push button when detector is reset.
- (6) The operation of a fire signal station shall shut down the ventilating motors under the supervision of the smoke detection system. The detector panel shall be connected with the fire signal control board through normally closed auxiliary alarm contacts in the Fire Signal Panel.

The Fire Signal System shall be arranged so that the ventilating motors shall not shut down when the normally closed button in the General Office is operated. If a fire signal station is pulled, the normal operation of all fire gong ensues.

16-28.08 Installation

The installation of the foregoing equipment shall be performed under the supervision of the manufacturer of said equipment.

16-28.09 Tests

After the completion of installation of foregoing equipment each smoke detector unit shall be tested to determine proper functioning as required by the drawings and/or specifications.

These tests shall be made by this Contractor under the supervision of equipment manufacturer. Tests shall be conducted in the presence of Executive Director's representative and adjustment made as required for satisfactory operation.

SECTION 16-29, ATHLETIC FIELD SOUND SYSTEM

16-29.01 Scope

Electrical Contractor shall furnish, install an athletic field sound system as shown on drawings and with all associated equipment, conduit, wire, boxes, mounting hardware, etc.

1. This system shall be a single channel unit, providing for the reproduction and distribution of a microphone program.
2. The system power amplifier shall provide a 70 volt output to the Horn Assembly as specified hereinafter.

16-29.02 Raceway

For conduits, boxes, fittings, etc., see Section 16-5, Conduit & Raceway Systems and Section 16-6 Outlet and Enclosing Boxes.

16-29.03 Conductors

The Electrical Contractor furnish and install Belden Cable #8760 or approved equal for inputs (MIC) and outputs (LS) for Athletic Field Sound System.

16-29.04 Surface Sound Cabinet

This cabinet shall be constructed of 16 ga. C.R.S. Back and front sections are one piece construction with angle braces at each corner. All seams and mitres shall be electric welded and ground smooth. Center cabinet shall be strengthened with 16 ga. braces at each corner. Removable pin hinges for easy assembly and hinges are to be bolted to cabinet section for greater strength. Knockouts and internal louvers are required similar to Soundolier. Center section and rear section are to be secured with one-quarter turn camlocks and alignment pins. Front section shall be complete with cylinder lock. Finish to be grey hammertone over a phosphate coating. This cabinet shall be similar to DuKane Model #300-26 or an approved equal.

16-29.05 Mixer Amplifier

The mixer amplifier shall be a solid-state, 100% silicon device, self-powered, and rack mountable. The mixer amplifier shall have a frequency response of 20-20,000 HZ, \pm 1db. Distortion shall be less than 0.5% at + 28 DBM, 20 to 20,000 HZ. Rated output of + 28DBM transformer isolated for 150/600 ohms, balances or single ended. Controls and indicators shall be as follows: Five input levels, one master, one bass and one treble each 3 db per step to \pm 15 db, one monitor, one output switch, one power switch, 1 vu range, five speech filters. (\pm 10 db at 100 hz.).

The mixer amplifier shall be similar to DuKane Model 2A75B or an approved equal.

Associated Equipment shall be DuKane Model #438-206 Remote Control Assembly or an approved equal.

16-29.06 Crossover Network

The crossover network shall be capable of providing two standard bands of 20-500 HZ and 50-20,000 HZ. The distortion over the range of 20-20,000 HZ shall be less than .5% T.H.D. with noise down 70 db. The input impedance shall be 600 ohms. The crossover shall be designated to operate into a load impedance of 10,000 ohms or higher. The attenuation beyond the crossover shall exhibit negligible insertion loss. It shall operate on (+) and (-) 22.5 volts D.C. at 50 miliamperes. The unit shall measure 19" wide by 3 1/2" high by 10" deep for mounting in a standard 10" rack. This unit shall be DuKane Model 99A555 or an approved equal.

16-29.07 Power Amplifier (Two Required)

The amplifier shall employ silicon transistors exclusively and be capable of delivering 100 watts (rms) output at less than 1 1/2% distortion 30 to 20,000 HZ. The frequency response shall be 20 to 20,000 HZ + 1 db. Noise level shall be at least 80 db below rated output. Input shall be 100,000 ohms single ended. Rated output shall be obtained with 0.4 volt input. Balanced or single ended 25 volt, 50 volt and 70 volt outputs shall be available at a screw terminal strip. Output regulation shall be within 1 db from no load to full load.

16-29.07 Power Amplifier (Two Required) (Con't)

The amplifier shall supply auxiliary voltage of 28 volts DC, 50 maximum. An input level control shall be provided. The unit shall operate on 105-130 volts, 50-60 HZ, and consume approximately 300 watts. The amplifier shall have a protective circuits including a thermally operated relay and an automatically resetting electronic circuit to reduce dissipation under overload or short circuit conditions. The amplifier shall be 8 3/4" high, 19" wide, 7" deep finished in light grey baked enamel. Weight shall not exceed 36 pounds.

Horns shall be circuited to respective amplifiers to permit equal distribution of power consumption.

This amplifier shall be similar to DuKane Model #1A 911 or an approved equal.

16-29.08 Matching Transformer (70.7 Volt Line)

This transformer shall provide taps of 50, 32, 25 and 16 watts. Secondary taps shall be 25, 16, 12.5, 8, 6.25, 4 ohms. Insertion loss shall not be more than 0.5 db. Frequency response shall be 30 to 15,000 HZ and distortion less than 1%. The transformer shall be provided with 12" color coded leads on both primary and secondary windings. The dimensions shall be 4' x 4" x 4 1/2" and the weight 9 pounds.

This transformer shall be similar to DuKane Model #710-3084 or an approved equal.

16-29.09 Horns

The Multicell Horn shall be similar to Altec Lansing #203B, or an approved equal.

The cutoff frequency shall be 220 HZ. The cells shall be weatherproof. The cell mouth opening shall be 8" x 8". The acoustic distribution shall be approximately 20 degrees per cell. Finish shall be matte black.

Associated equipment shall be Altec Lansing #291-16 Loudspeaker drivers or an approved equal; Throats, Altec Lansing #30162 or approved equal.

These horns shall be mounted on the poles at a point shown on the plans.

16-29.10 High Frequency Drivers

Power capacity for High Frequency Drivers shall be forty watts. The frequency range shall be 500 to 12,000 HZ. The sound pressure level shall be 115 db. The edge wound, aluminum ribbon voice coil shall be 1 3/4" diameter with an impedance of 250 ohms. The magnetic structure shall produce no stray fields and provide a flux density of (19,000) gauss in the voice coil gap. The driver shall be (5 3/4" diameter) and 3 13/16" high with horn throat diameter one (1) inch.

The High Frequency Driver shall be similar to Altec-Lansing #291-16, or an approved equal.

16-29.11 Monitor Speaker Panel

- (1) A "Type A" loudspeaker (without housing), shall be flush mounted on the panel and shall be covered with an approved grille. Loudspeaker shall be connected to the monitor switch of the Mixer Amplifier. This shall be the monitor speaker for the sound cabinet.
- 2) Also on this panel there shall be one (1) AH & H 1282 key switch, engraved "Main Sound Power" and one (1) Drake #75 receptacle w/230v G.E. bulb. This switch shall be wired so that when turned on the Mixer Amplifier will be powered.

16-29.12 Input Panel

This panel shall contain two (2) Cannon XLR-3-13 receptacles for input connection. These receptacles shall be engraved MIC, 4 and "PHONO". They shall be connected to separate inputs, available on the Mixer Amplifier.

16-29.13 Control Cabinets

The Electrical Contractor shall at locations shown on the drawings, furnish and install a weatherproof cabinet. Cabinet shall be constructed of 16 gauge cold rolled steel (CRS) with hinged door and key lock. Cabinets shall contain remote control plate containing the following items:

16-29.13 Control Cabinets (Con't)

Control Cabinet

- (1) A single pole, duplex 20A, 120 volt AC, GFI receptacle.
- (2) One Cannon XLR-5.31 receptacle, engraved "MIC 1".
- (3) Zero Level.
- (4) Two sound powered telephone receptacles.
- (5) One combination switch and microphone volume control, engraved "MIC 1 VOLUME".

These items shall be mounted on a plate which shall be screw mounted in steel weatherproof cabinet, size as required.

These weatherproof cabinet shall have a hinged door which shall open from left to right. It shall have a Yale No. 511S or Eagle 03101 lock, key change number 47 (No. 9 key). Ten (10) keys shall be supplied with each lock.

The Electrical Contractor shall furnish and install and connect a weatherproof control cabinet securely mounted on an angle iron frame welded to the handrail existing scorers control box located in the bleachers.

Angle iron shall be 3" by 3" by 1 1/2" and embedded in a concrete base.

16-29.14 Microphone (Four Required)

- (a) Provide three Shure 545S microphones with wind Screens as per Standard Spec., with 50 foot cable and Hubbell connector.
- (b) Provide one desk stand as per standard spec.

16-29.15 Instructions

- (a) The Contractor shall arrange with the manufacturers of the equipment to instruct persons designated by the Principal of School, in the proper operation and care of the sound equipment.

16-29.15 Instructions (Con't)

- (b) An approved schematic wiring diagram and component wiring diagram shall be provided along with written operating instructions. Three (3) copies shall be delivered to the Principal.

16-29.16 Guarantee

The Electrical Contractor shall present before final payment for this system a certified statement by the Sound manufacturer or his agent that he has generally supervised the installation and test of the system on completion of the work; that he will warrant the system for one (1) year after date of acceptance by adjusting or replacing defective material, workmanship or equipment.

SECTION 16-30, SOUND POWERED TELEPHONE SYSTEM

16-30.01 General

Furnish and install and connect sound powered telephone system with all equipment, conduit, wire, boxes and mounting hardware.

System shall be installed in accordance with drawings and as noted on drawings.

Porta phones shall be as manufactured by Coaching Aids, Box 506, Cod Belly Lane, Wakefield, R.I., 02880 or approved equal.

16-30.02 Raceway

For conduits, boxes, fittings, etc., see Section 16-5 Conduit & Raceway Systems and Section 16-6 Outlet and Enclosing boxes.

16-30.03 Conductors

The Electrical Contractor shall furnish and install conductors for sound powered telephone system which shall be Belden, Cable #8760 or approved equal.

16-30.04 Equipment

Furnish and deliver two model C-4 Offense/Defense Style "S" Porta Phones complete with eight headsets and four 100 foot male to female extension cords with reel assembly. Two-ten (10) foot extension cords male to male.

16-30.05 Receptacles

Furnish and install sound powered receptacles at location shown on drawings. Receptacles shall be Anphonol 91PC4F or an approved equal.

16-30.06 Weatherproof Box for Sound Powered Receptacles

The Electrical Contractor shall furnish and install sound powered receptacles in a suitable sized weatherproof cabinet, min. size 6" x 6" x 6" with hinged door and key lock at location shown on drawing for these receptacles. Box shall be mounted on an angle iron frame. Door shall be properly gasketed. Key lock shall be as described in paragraph 16-4.51.

END OF SPECIFICATIONS

DATED: OCTOBER, 1983
CITY OF NEW YORK
L.J.MANDARINO
JA

NICHOLAS E. BORG
EXECUTIVE DIRECTOR
DIVISION OF
SCHOOL BUILDINGS
OFFICE OF DESIGN &
CONSTRUCTION

ALPHABETICAL INDEX TO STANDARD SPECIFICATIONS
 FOR ELECTRIC WORK AND LIGHTING FIXTURES
 25TH EDITION
 OFFICE OF DESIGN & CONSTRUCTION
 OFFICE OF SCHOOL BUILDINGS
 BOARD OF EDUCATION, N.Y.C.

NOTE: This table is for convenience only and
 is not binding as a part of the contract.

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Water Flow Alarm Bell (Sprinkler Alarm).....	16-17.04
Water Flow Water Valve (Sprinkler Alarm System).....	16-17.05
Weatherproof box for Sound Powered Receptacles.....	16-30.06
Wiring and Connections (Light Fixtures).....	16-21.06
Wiring (City Fire Alarm System).....	16-14.08
Wiring Connections for Temporary Drainage And Power Equipment.....	16- 2.21
Wiring for Bd. of Ed. Field Office and Workmans Toilet.....	16- 2.13
Wiring for Equipment in Kitchens, or Warming Pantry.....	16- 7.25
Wiring for Floor Sanding and Terrazzo Finishing Machines.....	16- 2.19
Wiring for Gas Valves.....	16- 7.30
Wiring for Language Lab.....	16-24.11
Wiring for Signal Systems.....	16- 7.32
Wiring for Sound System.....	16-19.19
Administrative Cable.....	16-19.19(d)
Intercom Cable.....	16-19.19(b)
Loudspeaker Cable.....	16-19.19(c)
MIC Cable.....	16-19.19(e)
Wiring from T.L. & P. Distribution Center (Inside the Building).....	16- 2.15
Wiring Installation (Security System).....	16-25.12
Wiring (Power Pack Unit).....	16-25.05
Wiring of Automatic Controls.....	16- 7.31
Wiring of Indicator System.....	16- 7.33
Wiring of Interior Telephone System.....	16- 7.36
Wiring of Language Lab. Equip.....	16-24.11
Wiring of Metal & Elec. Shop Disc.....	16- 7.21
Wiring of Motor Operated Partition.....	16- 7.20
Wiring of Vacuum Pumps.....	16- 7.24
Wiring Pipe Threading Machines.....	16- 2.20
Wiring to Oil Burner Equipment.(T.L. & P.).....	16- 2.22
Wiring System (General).....	16- 7.01
Wooden Utility Pole.....	16-13.04
Work During School Session.....	16- 1.27
Work in Connection with Present Buildings.....	16- 1.70